



Curriculum vitae et studiorum

**DR CHRISTIAN ALBERTI**

**DDS, MSC, CDT, MDT, FIAOMS, FACOMS, FAAOMS**

PROFESSORE A CONTRATTO  
**DI CHIRURGIA ORALE PEDIATRICA E DELL'ETÀ EVOLUTIVA**

DIPLOMA DI SPECIALISTA  
**IN CHIRURGIA ORALE**

FELLOW  
**INTERNATIONAL ASSOCIATION OF ORAL AND MAXILLOFACIAL SURGEONS**

FELLOW  
**AMERICAN ASSOCIATION OF ORAL AND MAXILLOFACIAL SURGERY**

FELLOW  
**AMERICAN COLLEGE OF ORAL AND MAXILLOFACIAL SURGEONS**

SOCIO ATTIVO  
**DELLA SOCIETÀ ITALIANA DI CHIRURGIA ODONTOSTOMATOLOGICA**

DIPLOMA DI MASTER UNIVERSITARIO DI 2° LIVELLO  
**IN IMPLANTOLOGIA ZIGOMATICA**

DIPLOMA DI MASTER UNIVERSITARIO DI 2° LIVELLO  
**IN ODONTOIATRIA DIGITALE**

DIPLOMA DI MASTER UNIVERSITARIO DI 2° LIVELLO  
**IN CHIRURGIA ORTOGNATICA E DELLE MALFORMAZIONI CRANIO-FACCIALI**

DIPLOMA DI MASTER UNIVERSITARIO DI 2° LIVELLO  
**IN CHIRURGIA RICOSTRUTTIVA E IMPLANTOLOGICA DEI MASCELLARI**

DIPLOMA DI MASTER UNIVERSITARIO DI 2° LIVELLO  
**IN IMPLANTOPROTESI**

DIPLOMA DI PERFEZIONAMENTO UNIVERSITARIO  
**IN TRAUMATOLOGIA DENTALE**

DIPLOMA DI PERFEZIONAMENTO UNIVERSITARIO  
**IN POSTUROLOGIA CLINICA**

DIPLÔME D'UNIVERSITÉ  
**IN ANATOMIA CHIRURGICA ED IMPLANTOLOGIA**

DIPLOMA DI ALTA FORMAZIONE UNIVERSITARIA  
**IN CHIRURGIA PRE-IMPLANTOLOGICA NELLA RIABILITAZIONE  
ESTETICA DELLE GRAVI ATROFIE DEI MASCELLARI**





---

## **INDICE**

### **2. Curriculum vitae**

- 2. Informazioni generali e professionali
- 3. Titoli di Studio
- 9. Esperienze Professionali
- 10. Lettere di Presentazione e Ringraziamento
- 11. Relatore e Moderatore a Congressi Nazionali e Internazionali
- 15. Socio Ordinario di Società Scientifiche Nazionali e Internazionali
- 15. Abbonato a riviste scientifiche
- 15. Tesi e suoi contenuti pubblicati nelle riviste Internazionali

### **16. Diplomi**

### **22. Frontespizi tesi**

### **26. Abstract delle Pubblicazioni**

### **29. Pubblicazioni**

### **289. Attività corsistica e congressuale**

### **350. Certificazioni Universitarie**

### **388. Lettere di Presentazione e Ringraziamento**



## Informazioni generali e professionali

<b>Nome e Cognome:</b>	Christian Alberti
<b>Indirizzo dello Studio:</b>	Via Zanchetta 5, 36027, Rosà, Vicenza, Italia
<b>Telefono dello Studio:</b>	+39 0424 858991 / +39 393 868 3873 / +39 375 6911253
<b>E-mail personale:</b>	studiodentisticoalberti@gmail.com
<b>E-mail dello Studio:</b>	info@albertistudio.it - amministrazione@albertistudio.it studiodentisticoalberti@pec.it
<b>Sito internet:</b>	www.albertistudio.it
<b>Cittadinanza:</b>	Italiana
<b>Data e Luogo di nascita:</b>	15/09/1979, Bassano del Grappa, Vicenza, Italia
<b>Titoli Accademici Internazionali:</b>	DDS, MSc, CDT, MDT, FIAOMS, FACOMS, FAAOMS Associate Fellow of Foundation for Oral Rehabilitation, -FOR- Active Member of the European Association of Osseointegration, -EAO- Associate Fellow of the International Association of Oral and Maxillo Facial Surgeon -IAOMS- Fellow American Association of Oral and Maxillo Facial Furgery -FAAOMS- Fellow American College of Oral and Maxillo Facial Surgeons -FACOMS- Socio Attivo della Società Italiana di Chirurgia Odontostomatognatica www.scopus.com - Scopus author identifier: 57222015713
<b>Madrelingua:</b>	Italiana
<b>Lingue conosciute:</b>	Inglese, Francese



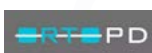


## Titoli di Studio



Dall' Anno Accademico 2020

**Professore a Contratto - Adjunt Professor**  
**Titolare dell'insegnamento di CHIRURGIA ORALE PEDIATRICA E DELL'ETÀ EVOLUTIVA**  
**PL004563-PL004564, MED28, CFU: 2**



Università degli Studi di Padova  
 Scuola di Medicina e Chirurgia  
 Dipartimento di Neuroscienze  
 Scuola di Specializzazione in Odontoiatria Pediatrica  
 Direttore: **Prof. Antonio Gracco**, DDS



Oral and maxillofacial surgeons:  
 The experts in face, mouth and jaw surgery

Dal 2023

**Fellow American Association of Oral and Maxillofacial Surgery**



Dal 2023

**Fellow American College of Oral and Maxillofacial Surgeons Facoms**



International Association of  
 Oral and Maxillofacial Surgeons

**Official member fellow International Association of Oral and Maxillofacial Surgeons**



UNIVERSITÀ DI PISA

a.a. 2022-2023 - cmu 2

**Diploma di Master Universitario di II° Livello**  
**In Implantologia Zigomatica**

Università degli Studi di Pisa  
 Facoltà di Medicina e Chirurgia  
 Direttore: **Prof. Antonio Barone**, MD, DDS  
 Voto finale: 110 su 110 e lode  
 CFU: 60

Tesi di Master Universitario di II° Livello in Implantologia Zigomatica:

**Pianificazione e trattamento chirurgico-protetico del paziente totalmente edentulo associato ad atrofia estrema vertico-trasversale grave del mascellare superiore: approccio digitale tridimensionale versus approccio analogico standard.**

**Relatore: Prof. Antonio Barone**, MD, DDS



a.a. 2022-2023 - cmu 2

**Diploma di Master Universitario di II° Livello**  
**In Odontoiatria digitale**

Università degli Studi di Brescia  
 Facoltà di Medicina e Chirurgia  
 Direttore: **Prof. Antonio Cerutti**, MD, DDS  
 Voto finale: 110 su 110 e lode  
 CFU: 60

Tesi di Master Universitario di II° Livello in Odontoiatria Digitale:

**Valutazione analitica, morfologica e morfometrica dell'anatomia facciale di superficie tramite tecnologia computerizzata. Utilizzo dei sistemi di scansione tridimensionale computer-assistiti per la riproduzione 3D dei tessuti molli del viso.**

**Relatori: Prof. Antonio Cerutti**, MD, DDS

**Dr. Nicola Barabanti**, DDS

## Titoli di Studio



a.a 2019-2022

### Diploma di Specialista in Chirurgia Orale



Università degli Studi di Verona  
 Scuola di Specializzazione in Chirurgia Orale  
 Facoltà di Medicina e Chirurgia  
 Dipartimento di Scienze Chirurgiche, Odontostomatologiche e Materno-Infantili  
 Clinica Odontoiatrica e di Chirurgia Maxillo-Facciale  
 Azienda Ospedaliero Universitaria Integrata di Verona  
 Unità Operativa Autonoma di Odontoiatria e Chirurgia Maxillo-Facciale  
 Centro di riferimento regionale per la ricostruzione microchirurgica  
 del distretto cranio-maxillo-facciale  
 Direttore: **Prof. Pier Francesco Nocini**, MD, DDS  
 Cattedra di Chirurgia Orale  
 Scuola di Specializzazione in Chirurgia Orale  
 Direttore: **Prof. Massimo Albanese**, MD, DDS  
 Cattedra di Chirurgia Maxillo-Facciale  
 Voto finale: 70/70 e lode  
 CFU: 180  
 Tesi di specializzazione, tipologia sperimentale:  
**Analisi dell'occlusione transizionale nelle procedure Surgery-first.**  
**Valutazione morfologica e morfometrica tridimensionale.**  
 Relatore: **Prof. Massimo Albanese**, MD, DDS  
 Correlatore: **Prof. Redento Peretta**, MD, DDS  
 Direttore: **Prof. Pier Francesco Nocini**, MD, DDS



a.a. 2018-2019 - cmu 2

### Diploma di Master Universitario di II° livello in Chirurgia Ortognatica e delle Malformazioni Cranio-Facciali

Università degli Studi di Torino  
 Facoltà di Medicina e Chirurgia - Dipartimento di Scienze Chirurgiche  
 Azienda Ospedaliera-Universitaria Ospedale Molinette - Città della Salute e della Scienza di Torino  
 Scuola di Specializzazione in Chirurgia Maxillo-Facciale  
 Cattedra di Chirurgia Maxillo-Facciale  
 Direttore: **Prof. Guglielmo Ramieri**, MD, DDS  
 Voto finale: 110/110 e lode, dignità di stampa della tesi e menzione  
 CFU: 60  
 Tesi di Master Universitario di II° livello in Chirurgia Ortognatica  
 e delle malformazioni Cranio-Facciali  
**Pianificazione computerizzata 3d dell'occlusione post-chirurgica nelle procedure Surgery-First**  
 Relatori: **Prof. Guglielmo Ramieri**, MD, DDS; **Prof. Giovanni Gerbino**, MD, DDS  
 Correlatori: **Prof. Redento Peretta**, MD, DDS; **Prof. Antonio Gracco**, DDS

## Titoli di Studio



a.a. 2016-2017

### Certificate of Advanced Surgical Implant Training Program

New York University at Buffalo, USA  
 School of Dental Medicine  
 Department of Oral and Maxillofacial Surgery  
 Director: **Prof. Richard Hall**, MD, DMD,  
 Chair and Head Department of Oral and Maxillofacial Surgery  
 New York University at Buffalo, USA



a.a. 2015-2016 - cmu 2

### Diploma di Master Universitario di II° livello in Chirurgia Ricostruttiva ed Implantologica dei mascellari

Università degli Studi di Firenze  
 Facoltà di Medicina e Chirurgia - Dipartimento di Chirurgia e Medicina Traslazionale  
 Azienda Ospedaliero-Universitaria Careggi  
 Centro Ortopedico-Traumatologico Careggi - Cattedra di Chirurgia Maxillo-facciale  
 Direttore: **Prof. Roberto Bertolai**, MD, DDS  
 Voto finale: 110/110 e lode  
 CFU: 69

Tesi di Master Universitario di II° livello in Chirurgia Ricostruttiva ed Implantologica dei mascellari:

#### **La Riabilitazione Implantoprotesica fissa del mascellare edentulo ed atrofico a funzione immediata: opzione terapeutiche e performance a confronto**

Relatore: **Prof. Roberto Bertolai**, MD, DDS  
 Correlatore: **Dott. Carlo Alessandro Aversa**, MD, DDS



a.a. 2013-2014 - cmu 2

### Diploma di Master Universitario di II° livello in Implantoprotesi

Università degli Studi di Genova  
 Facoltà di Medicina e Chirurgia  
 Azienda Ospedaliero-Universitaria IRCCS San Martino-IST  
 Istituto Nazionale per la Ricerca sul Cancro  
 Ospedale San Martino, Genova  
 Dipartimento di Scienze e Tecnologie Biofisiche, Mediche ed Odontostomatologiche, -DISTBIMO-  
 Sezione di Clinica Odontostomatologica  
 Servizio di Protesi ed Implantoprotesi  
 Cattedra di Riabilitazione Protesica ed Implantoprotesica  
 Direttore: **Prof. Paolo Pera**, MD, DDS  
 Voto finale: 110/110  
 CFU: 60

Tesi di Master Universitario di II° livello in Implantoprotesi:

#### **“La Ricostruzione tridimensionale del volto con tecnica laser: metodologia operativa ed analisi preliminare dei risultati”**

Relatore: **Prof. Paolo Pera**, MD, DDS  
 Correlatore: **Prof.ssa Maria Menini**, DDS, PHD

## Titoli di Studio



a.a. 2013-2014

### Diploma Universitario in Anatomia Chirurgica ed Implantologia

Università degli Studi Jacques Lisfranc, Lione, Francia  
 Università degli Studi Jean Monnet, Saint-Étienne, Francia  
 Facoltà di Medicina e Chirurgia - Dipartimento di Scienze, Tecnologia e Salute  
 Laboratorio di Anatomia Micro e Macroscopica  
 Associazione Universitaria di Anatomia ed Implantologia  
 Direttore: **Prof. André Morin, Prof. Robert Gauthier, Prof. Jean Marie Prades**  
 Tesi di Diploma Universitario in Anatomia Chirurgica ed Implantologia:

**“Columbus Bridge Protocol: riabilitazione Implantoprotesica fissa del mascellare edentulo a funzione immediata: Biomechanically Advanced Prosthesis”**

Relatore: **Prof. Robert Gauthier**, MD, DDS



Chirurgia  
Maxillofacciale



Padova

a.a. 2012-2013

### Diploma di Alta Formazione Universitaria in Chirurgia Pre-implantologica nella riabilitazione estetica delle gravi atrofie dei mascellari

Università degli Studi di Padova - Facoltà di Medicina e Chirurgia  
 Dipartimento di Neuroscienze, Psichiatriche, Sensoriali, Ricostruttive e Riabilitative  
 Dipartimento di Specialità Medico-Chirurgiche  
 Direttore: **Prof. Domenico d'Avella**, MD  
 Sezione di Clinica Odontoiatrica  
 Cattedra di Chirurgia Maxillo-facciale  
 Unità Operativa Complessa di Chirurgia Maxillo-facciale  
 Direttore: **Prof. Giuseppe Ferronato**, MD, DDS  
 CFU: 8



a.a. 2010-2011

### Diploma di Perfezionamento Universitario in Traumatologia Dentale

Università degli Studi di Verona - Facoltà di Medicina e Chirurgia  
 Dipartimento di Scienze Morfologico-Biomediche e Chirurgiche  
 Sezione di Clinica Odontoiatrica e Chirurgia Maxillo-facciale  
 Cattedra di Odontoiatria Conservatrice e Traumatologia Dentale  
 Direttore: **Prof. Pierfrancesco Nocini**, MD, DDS  
 Titolare: **Prof. Giacomo Cavalleri**, MD, DDS  
 CFU: 10



UNIMORE  
UNIVERSITÀ DEGLI STUDI DI  
MODENA E REGGIO EMILIA

a.a. 2006-2007

### Diploma di Perfezionamento Universitario in Posturologia Clinica

Università degli Studi di Modena e Reggio Emilia  
 Facoltà di Medicina e Chirurgia  
 Dipartimento di Neuroscienze  
 Cattedra di Chirurgia Maxillo-facciale  
 Unità Operativa Complessa di Odontoiatria e Chirurgia Maxillo-facciale  
 Direttore: **Prof. Ugo Consolo**, MD, DDS  
 CFU: 10

## Titoli di Studio



Chirurgia  
Maxillofacciale



Padova

a.a. 2004-2005

### Laurea Magistrale a ciclo unico in Odontoiatria e Protesi Dentaria

Sostenendo anche tutti gli esami complementari non obbligatori in corso di studio  
Università degli Studi di Padova  
voto: 102/110

### Tesi di Laurea sperimentale e progetto di ricerca CPDT-033371, approvato e finanziato dall'Università degli Studi di Padova

Indirizzo: Chirurgia Maxillo-facciale  
Inizio del progetto: Ottobre 2000, 1° anno di Studi Universitari

**“La Ricostruzione tridimensionale del volto in Chirurgia Ortognatica. Comparazione di tre metodi non invasivi di riproduzione tridimensionale dei tessuti molli della faccia: performance a confronto e necessità future in Chirurgia Ortognatica”**

Relatori: **Prof. Giuseppe Ferronato**, MD, DDS, Chirurgia Maxillo-facciale, Università degli Studi di Padova  
**Prof. Redento Peretta**, MD, DDS, PHD, IBO, Ortodonzia Pre-chirurgica, Università degli Studi di Padova

Correlatori: **Prof. Gianmaria Concheri**, DAUR-LIN, Università degli Studi di Padova  
**Prof. Virgilio Ferruccio Ferrario**, MD, LAFAS-FARC, Università degli Studi di Milano

Collaboratori: **Dott. Pierfrancesco Galzignato**, MD, DDS, Chirurgia Maxillo-facciale, Università degli Studi di Padova  
**Ing. Roberto Meneghello**, DAUR-LIN, Università degli Studi di Padova  
**Ing. Daniele Comelli**, DAUR-LIN, Università degli Studi di Padova



a.a. 2004-2005

Seconda Sessione, Novembre 2005

### Diploma di Stato di Abilitazione alla Professione di Odontoiatra

Università degli Studi di Padova

2006

**Iscrizione all'Albo dei Medici-Chirurghi e degli Odontoiatri Provincia di Vicenza n° 00741**

a.s. 1997-1998

### Diploma di abilitazione all'esercizio della professione di Odontotecnico

a.s. 1997-1998

### Diploma di Maturità Professionale per Odontotecnico

Indirizzo: Chirurgia Orale e Maxillo-facciale

Tesi di Maturità:

**Chirurgia ricostruttiva cranio-maxillo-facciale e dell'articolazione temporo-mandibolare**

a.s. 1995-1996

### Diploma di qualifica per Operatore Meccanico Odontotecnico

## Esperienze Professionali

**14.257 Ore certificate di Assistenza Clinica e Chirurgia Ospedaliera**  
**8.180 Interventi chirurgici come primo, secondo e terzo operatore in regime di Sala Operatoria, Day-Surgery e Day-Hospital (a maggio 2024 compreso)**

**Dal settembre 2020 a Febbraio 2022**

**Specializzando in Chirurgia Orale Unità Operativa Dipartimentale di Odontoiatria e Chirurgia Maxillo-Facciale**

Azienda Ospedaliera Usl 7 "San Bassiano", Bassano del Grappa

Direttore: **Dr. Michele Garofolin**, MD, DDS



**Dal 2019 a Febbraio 2022**

**Tutor di Chirurgia Orale presso la Scuola di Specializzazione in Chirurgia Orale**

Università degli Studi di Verona

Direttore: **Prof. Massimo Albanese**, MD, DDS



**Dal 2010 ad oggi**

**Frequentatore Volontario per lo studio e l'applicazione della Metodologia Operativa di Riabilitazione Implantoprotesica a Carico e Funzione Immediata "Columbus Bridge Protocol"**

Clinica Dentale "Valle Belbo", Santo Stefano Belbo, Cuneo, Italia

Direttore: **Prof. Tiziano Tealdo**, DDS, MSC, CDT

**Dal 2010 ad oggi**

**Frequentatore Volontario per lo studio e l'applicazione della Metodologia Operativa di Riabilitazione Implantoprotesica a Carico e Funzione Immediata "Columbus Bridge Protocol"**

Università degli Studi di Genova

Facoltà di Medicina e Chirurgia

Servizio e Cattedra di Riabilitazione Protesica ed Implantoprotesi

Direttore: **Prof. Paolo Pera**, MD, DDS

**Dal 2010 al 2014**

**Frequentatore Volontario per lo studio e l'approfondimento delle Tecniche Chirurgico-Protesiche di Riabilitazione Protesica a Carico Immediato**

Centro Odontostomatologico "San Luigi", Pavia, Italia

Direttore: **Dott. Gioacchino Cannizzaro**, MD, DDS

**Ottobre 2000-Agosto 2009**

**Frequentatore Volontario per Assistenza Clinico-Chirurgica e di Sala Operatoria**

Unità Operativa Complessa di Odontoiatria e Chirurgia Maxillo-facciale

Direttore: **Dott. Paolo Toscano**, MD, DDS

ASL n°3 Bassano del Grappa, Ospedale "San Bassiano"



**Dal 1999 al 2007**

**Frequentatore Volontario**

Studio di Odontoiatria e Chirurgia Maxillo-facciale del **Prof. Giuseppe Ferronato**

e del **Prof. Redento Peretta** Padova, Italia

**Dal 1999 al 2007**

**Frequentatore Volontario**

Studio di Ortodonzia ed Ortodonzia Pre-Chirurgica del **Prof. Redento Peretta** Vicenza, Italia

**Dal 1999 al 2007**

**Frequentatore Volontario**

Cattedra di Chirurgia Maxillo-facciale

Unità Operativa Complessa di Chirurgia Maxillo-facciale

Azienda Ospedaliero-Universitaria di Padova - Policlinico Universitario di Padova

Direttore: **Prof. Giuseppe Ferronato**, MD, DDS



## Esperienze Professionali

Da Agosto 2009 a Gennaio 2014

### Titolare di Borsa di Studio

**Vincitore di Concorso Pubblico per titoli ed esami di Borsa di Studio per la Struttura Semplice Dipartimentale di Odontoiatria e Chirurgia Maxillo-facciale**

ASL n°3 Bassano del Grappa, Ospedale "San Bassiano"

Dipartimento di Chirurgia Specialistica

Direttore: **Dott.ssa Simonetta Morselli**, MD



1998

**Vincitore per titoli ed esami di Borsa di Studio come partecipante al Corso Tecnico-Pratico di aggiornamento e formazione di perfezionamento "Attacchi Dentali e Metallurgia"**

Ditta Cendres & Metaux, Milano, Italia

1997

**Vincitore per titoli ed esami di Borsa di Studio come partecipante al corso tecnico-pratico di aggiornamento e formazione di perfezionamento "Fusione e Precisione"**

Centro di Formazione Odontoiatrica "Degussa Ag Geschäftsbereich Dental"

Ditta Degussa Defradental, Verona, Italia

Direttore: **Andrea Maleci**, CDT

**Partecipazione a 999 Corsi e Congressi di aggiornamento nazionali ed Internazionali**

- Vedi allegati in stampa conformi agli originali -

## Lettere di Presentazione e Ringraziamento

- Vedi allegati conformi agli originali -

1. **Lettera di presentazione del Prof. Giuseppe Ferronato**  
Cattedra ed U.O.C. di Chirurgia Maxillo-facciale, Università degli Studi di Padova
2. **Lettera di presentazione del Prof. Redento Peretta**  
Ortodonzia Pre-Chirurgica ed Ortopedia Dento-Maxillo-facciale,  
Università degli Studi di Padova
3. **Lettera di presentazione del Prof. Paolo Pera**  
Cattedra di Riabilitazione Protesica ed Implantoprotesi,  
Università degli Studi di Genova
4. **Lettera di presentazione della Dott.ssa Simonetta Morselli**  
Direttore Dipartimento Chirurgia Specialistica,  
Ospedale ed Azienda Sanitaria n°3 di Bassano del Grappa, Vicenza
5. **Lettera di presentazione del Prof. Roberto Bertolai**  
Cattedra ed U.O.C. di Chirurgia Maxillo-facciale, Università degli Studi Firenze



6. **Lettera di presentazione del Prof. Giovanni Gerbino**  
S.c. Chirurgia Maxillo-facciale, A.O.U. Città della Salute e della Scienza di Torino, Università degli Studi di Torino
7. **Lettera di presentazione del Prof. Guglielmo Ramieri**  
Direttore di S.C. Chirurgia Maxillo-facciale, A.O.U. Città della Salute e della Scienza di Torino, Università degli Studi di Torino
8. **Lettera di ringraziamento del sig. Renato Minuzzo**  
agli operatori del reparto Maxillo-facciale, ULSS 3
9. **Lettera di presentazione del Prof. Paolo Pera** professore emerito Università degli Studi di Genova, Cattedra di Implantoprotesi
10. **Lettera di presentazione del Prof. Roberto Pistilli**  
Unità operativa complessa di Chirurgia Maxillo-Facciale, Ospedale S. Camillo Forlanini, Roma
11. **Lettera di presentazione del Prof. Antonio Barone**  
Direttore di S.C. Di Odontoiatria e Chirurgia Orale, Università degli studi di Pisa

## Relatore e Moderatore a Congressi Nazionali e Internazionali

1. **Relatore al 5° Forum Internazionale sulla Metodica “Columbus Bridge Protocol”**  
8-9 Novembre 2013, Santo Stefano Belbo, Cuneo, Italia
2. **Relatore al 6° Forum Internazionale sulla Metodica “Columbus Bridge Protocol”**  
7-8 Novembre 2014, Santo Stefano Belbo, Cuneo, Italia
3. **Relatore al 7° Forum Internazionale sulla Metodica “Columbus Bridge Protocol”**  
6-7 Novembre 2015, Santo Stefano Belbo, Cuneo, Italia
4. **Relatore al 8° Forum Internazionale sulla Metodica “Columbus Bridge Protocol”**  
27-28-29 Ottobre 2016, Santo Stefano Belbo, Cuneo, Italia
5. **Moderatore al Congresso, Tour di Primavera Biomax 3I Zimmer**  
“La Costante Centralità del Paziente Implantare nell’evoluzione dell’era digitale”  
01 Aprile 2017, Falsia Portopiccolo, Trieste, Italia
6. **Moderatore al 20° Congresso Internazionale di Implantologia Biomax 3I Zimmer**  
“Innovazioni e Tecnologia Semplificano Laterapia Implantare”  
12-13-14 Ottobre 2017, Palazzo della Gran Guardia, Verona, Italia
7. **Relatore al 9° Forum Internazionale sulla Metodica “Columbus Bridge Protocol”**  
27-28 Ottobre 2017, Santo Stefano Belbo, Cuneo, Italia
8. **Relatore al Congresso Nazionale**  
“Protocolli e tecnologie innovative al servizio del paziente implantare di oggi”  
17 Febbraio 2018, Vicenza, Italia
9. **Moderatore al 21° Congresso Internazionale di Terapia Implantare, Biomax 3I**  
“L’integrazione tra il biotipo ed il sociotipo odontoiatrico:  
anamnesi, procedure e indicatori di successo del paziente implantare”  
4-6 Ottobre 2018, Verona, Italia
10. **Relatore al 10° Forum Internazionale sulla Metodica “Columbus Bridge Protocol”**  
26 - 27 Ottobre 2018, Santo Stefano Belbo, Cuneo, Italia
11. **Moderatore al Congresso, Tour di Primavera Biomax 3I Zimmer**  
“Il nuovo Rinascimento odontoiatrico italiano:  
Terapie canoniche, digitali e non invasive ad uso quotidiano”  
29-30 Marzo 2019, Roma, Italia



- 12. Co-Relatore alla Tesi di Laurea in Igiene Dentale - Università degli Studi di Padova**  
**Titolo: "Protocollo di gestione e di mantenimento delle riabilitazioni Full-Arch Immediate Bridge in igiene orale: studio analitico e stato dell'arte"**  
Laureanda: Eleonora Rabito, Voto finale: 110/110 e Lode, Anno Accademico: 2018-2019
- 13. Relatore all' 11° Congresso Nazionale sulla Metodica "Columbus Bridge Protocol"**  
**"Il CBP come unica alternativa nel recupero morfo-funzionale dei pazienti con fallimenti implantoprotesici causati da low cost e del turismo dentale "**  
25-26 Ottobre 2019, Santo Stefano Belbo, Cuneo, Italia
- 14. Relatore Clinico presso la Scuola di Specializzazione in Odontoiatria Pediatrica.**  
**Università degli Studi di Padova. Direttore: Prof. Antonio Gracco**  
2 Marzo 2020, Padova, Italia
- 15. Relatore al Congresso Nazionale Biomax 3I:**  
**"Il supporto digitale nelle moderne riabilitazioni implantari: previsualizzazione, finalizzazione protesica, carico immediato con qualità ossea limitata "**  
18 Aprile 2020, Vicenza, Italia
- 16. Relatore al 1° Forum del Tealdo Total Face Academy**  
**Columbus Bridge Protocol e Digital Dentistry**  
**"Procedure diagnostiche, operative e sviluppi futuri per l'odontoiatria e per l'odontotecnico"**  
6 Novembre 2020, Santo Stefano Belbo, Cuneo, Italia
- 17. Relatore Clinico presso la Scuola di Specializzazione in Odontoiatria Pediatrica**  
**"Chirurgia Orale Pediatrica: approccio al paziente, problematiche diagnostiche e chirurgiche"**  
**Università degli Studi di Padova. Direttore: Prof. Antonio Gracco**  
2 Marzo 2021, Padova, Italia
- 18. Relatore al Congresso Nazionale dei Docenti di Odontoiatria, presentazione del poster**  
**Teledentistry for the early detection of oral lesions: a lesson from the COVID-19 pandemic**  
14 Aprile 2021, Milano, Italia
- 19. Relatore al Master Universitario di 2° livello in Implantoprotesi**  
17 Aprile 2021, Genova, Italia
- 20. Relatore al Congresso Nazionale dei Docenti di Odontoiatria, presentazione del poster**  
**Teledentistry for the early detection of oral lesions: a lesson from the COVID-19 pandemic**  
27 Aprile 2021, Milano, Italia
- 21. Relatore al Congresso Nazionale della Società Italiana di Chirurgia Orale**  
**Tooth-Derived bone obtained from tooth transformer as graft material: a literature review**  
10 Luglio 2021, Roma, Italia
- 22. Relatore al Congresso Nazionale della Società Italiana di Chirurgia Orale**  
**Tooth-Derived bone obtained from tooth transformer as graft material: a literature review - parte 2**  
10 Luglio 2021, Roma, Italia
- 23. Relatore al Congresso Nazionale della Società Italiana di Chirurgia Orale**  
**Implantologia zigomatica iuxta sinusale: la tecnica chirurgica**  
10 Luglio 2021, Roma, Italia
- 24. Relatore al Congresso Nazionale della Società Italiana di Chirurgia Orale**  
**Flusso di lavoro digitale nella riabilitazione del quadrante edentulo e atrofico**  
10 Luglio 2021, Roma, Italia
- 25. Relatore al Congresso Nazionale della Società Italiana di Chirurgia Orale**  
**Trattamento non chirurgico della mucosite peri-implantare tramite strumentazione manuale associata all'utilizzo di un agente antisettico con proprietà igroscopiche**  
10 Luglio 2021, Roma, Italia

- 26. Relatore al Primo Corso di Dissezione Anatomica “One Day Full Immersion: corso teorico pratico su preparato anatomico, tecniche di chirurgia avanzate nel paziente atrofico con impianti extra orali”**  
04 Settembre 2021, Verona, Italia
- 27. Relatore Clinico presso la Scuola di Specializzazione in Odontoiatria Pediatrica. Università degli Studi di Padova. Direttore: Prof. Antonio Gracco**  
2 Novembre 2021, Padova, Italia
- 28. Relatore al Corso Base Chirurgico Protesico: “Il Columbus Bridge nell’evoluzione digitale”**  
18-19 Febbraio 2022, Santo Stefano Belbo, Cuneo, Italia
- 29. Relatore al Corso Avanzato Chirurgico Protesico: “Il Columbus Bridge nel paziente atrofico”**  
18-19 Marzo 2022, Santo Stefano Belbo, Cuneo, Italia
- 30. Relatore al Corso chirurgico-protesico  
“Advanced prosthetic surgical course: digital dentistry, immediate loading and zygomatic implants”**  
5-6-7 Ottobre 2021, Santo Stefano Belbo, Cuneo, Italia
- 31. Relatore al Congresso Nazionale della Società Italiana di Chirurgia Orale  
“Ortodonzia chirurgicamente assistita (piezosurgery): studio in vivo pre-clinico e clinico”**  
23-24-25 Settembre 2021, Gubbio, Italia
- 32. Relatore al Congresso Internazionale di Terapia Implantare 3i  
“Corretto inquadramento delle atrofie severe del mascellare superiore e possibili alternative terapeutiche”**  
22 Ottobre 2021, Verona, Italia
- 33. Relatore al Webinar “La riabilitazione con carico immediato del mascellare superiore”**  
27 Ottobre 2021, Vicenza, Italia
- 34. Relatore al Congresso ANDI Piemonte Sezione di Cuneo “Le atrofie ossee: tecniche a confronto”**  
19 Febbraio 2022, Cuneo, Italia
- 35. Relatore clinico presso la Scuola di Specializzazione in Odontoiatria Pediatrica, Università degli Studi di Padova  
“La chirurgia orale pediatrica: corretto inquadramento clinico e chirurgico”**  
1 Marzo 2022, Padova, Italia
- 36. Relatore al Webinar “Columbus Bridge Protocol: le basi del successo del trattamento di carico immediato”**  
9 Marzo 2022, Vicenza, Italia
- 37. Relatore al Corso di perfezionamento in implantoprotesi computer-assistita  
“Riabilitazione dei pazienti atrofici senza innesti ossei: flusso digitale dalla diagnosi estetica alla riabilitazione full-arch”**  
Università Cattolica del Sacro Cuore, Policlinico Agostino Gemelli,  
Cattedra di Chirurgia Maxillo-Facciale  
11 Marzo 2022, Roma, Italia
- 38. Relatore al Congresso Internazionale di Terapia Implantare 3i  
“Le attuali aspettative estetiche e riabilitative del paziente adulto”**  
22-23-24 Settembre 2022, Verona, Italia
- 39. Relatore al Corso di Chirurgia Implantare Avanzata “Il Columbus Bridge Protocol nel paziente atrofico”**  
6-7-8 Ottobre 2022, Santo Stefano Belbo, Cuneo, Italia
- 40. Relatore alla Scuola di Specializzazione in Odontoiatria Pediatrica**  
2 Novembre 2022, Padova, Italia

41. **Relatore al Corso di Dissezione anatomica e Chirurgia Implantare su preparato anatomico**  
5 Novembre 2022, Iclo, Verona, Italia
42. **Relatore al 1° Forum del Tealdo Total Face Academy “Ulteriori opzioni di trattamento del mascellare atrofico”**  
15 Novembre 2022, Santo Stefano Belbo, Cuneo, Italia
43. **Relatore alla Scuola di Specializzazione in Odontoiatria Pediatrica**  
29 Novembre 2022, Padova, Italia
44. **Relatore al Corso Internazionale Chirurgico-Protesico “Columbus Bridge Protocol: two full days live course”**  
27-28 Gennaio 2023, Alba, Cuneo, Italia
45. **Relatore alla Scuola di Specializzazione in Odontoiatria Pediatrica**  
23 Febbraio 2023, Padova, Italia
46. **Relatore al Corso Chirurgico-Pediatrico “Strategie di trattamento del paziente con dentatura terminale: come trattare con efficacia e sicurezza una nuova fascia di pazienti nella propria pratica clinica”**  
17-18 Marzo 2023 Alba, Cuneo, Italia
47. **Relatore al Corso Chirurgico-Protesico “Il Columbus Bridge Protocol nel paziente atrofico e nei ritrattamenti”**  
27-28 Ottobre 2023, Alba, Cuneo, Italia
48. **Relatore al Congresso Nazionale “Memorial Pino Ferronato”**  
4 Marzo 2023, Vicenza, Italia
49. **Relatore al Corso di dissezione anatomica su preparato cadaverico e chirurgia implantare avanzata**  
5 Maggio 2023, ICLO, Verona, Italia
50. **Relatore al Congresso Nazionale di implantologia avanzata**  
12-13 Maggio 2023, Cosenza, Reggio Calabria, Italia
51. **Relatore al Congresso Internazionale di Terapia Implantare “3i biomax”  
Il ripristino delle funzioni oro-facciali**  
5-6-7 Ottobre 2023, Verona, Italia
52. **Relatore al corso chirurgico-protesico “Il Columbus Bridge nel paziente atrofico e nei ritrattamenti”**  
27-28 Ottobre 2023, Alba, Italia
53. **Relatore presso la scuola di specializzazione in odontoiatria pediatrica, Università degli studi di Padova**  
8 Novembre 2023, Padova, Italia
54. **Relatore al congresso nazionale “Il cambio di paradigma in campo odontoiatrico”**  
17 Novembre 2023, Padova, Italia
55. **Relatore con congresso internazionale ellenico di chirurgia orale e maxillo-facciale:  
“Aesthetic and functional reconstruction of the mouth jaws and face”**  
26-27 Gennaio 2024, Atene, Grecia
56. **Relatore per le attività consorsistiche del gruppo columbus bridge: “L’evoluzione del trattamento dalla chirurgia al digitale. La formazione indispensabile per ogni odontoiatra”**  
5 Febbraio 2024, Vicenza, Italia
57. **Relatore al corso internazionale Zimvie-Biomax: “Immediate loading on full arch: a valuable option”**  
16-17 Febbraio 2024, Alba, Italia
58. **Relatore al corso chirurgico-protesico: strategia di trattamento del paziente con dentatura terminale**  
22-23 Marzo 2024, Alba, Italia
59. **Relatore al corso nazionale di dissezione anatomica su cadavere “One day full immersion:  
protocolli chirurgici e protesici nel paziente atrofico con impianti orale ed extraorali”**  
18 Maggio 2024, Verona, Iclo, Italia

**60. Relatore al Congresso Internazionale di Terapia Implantare Zimvie.biomax 3i**

10-11-12 Ottobre 2024, Verona, Italia

**61. Relatore al Corso Nazionale Avanzato Chirurgico-Protesico: "Il Columbus Bridge nel paziente atrofico e nei ritrattamenti"**

18-19 Ottobre 2024, Alba, Italia

**Socio di Società  
Scientifiche Nazionali e Internazionali**

Socio Ordinario dell'Accademia Italiana di Odontoiatria Protesica  
 Socio Attivo della Società Italiana di Chirurgia Odontostomatologica  
 Associate Fellow of Foundation for Oral Rehabilitation  
 Active Member of the European Association of Osseointegration  
 Socio Ordinario di Dentist 4  
 Socio Ordinario di Slow Dentist  
 Socio Ordinario Italian Academy of Osseointegration  
 Socio Ordinario della Società Italiana di Chirurgia Orale Pediatrica  
 Socio Ordinario della Società Internazionale di Chirurgia Orale e Maxillofacciale  
 Fellow American Association of Oral and Maxillofacial Surgery  
 Fellow American College of Oral and Maxillofacial Surgeons

**AIOP**  
**SIDCO**  
**FOR**  
**EAO**  
**D4**  
  
**IAO**  
**APOS**  
**IAOMS**  
**FAAOMS**  
**FACOMS**

**Abbonato a riviste scientifiche**

1. European Journal of Oral Implantology
2. Journal of Oral and Maxillofacial Implants
3. Journal of Prosthetic Dentistry

**Tesi e suoi contenuti pubblicati nelle riviste Internazionali***1. PROG. ORTHOD:***"A3 - Dimensional Facial Morpho-dynamic database in the development of a prediction model in Orthognathic Surgery"**

Department of Maxillofacial Surgery, University of Padua

*2. BR. J. ORAL MAXILLOFACIAL SURG:***"Three-dimensional Facial Morphometry in skeletal class III patients. A non-invasive study of soft-tissue changes before and after Orthognathic Surgery"**

Functional Anatomy Research Center - FARC -, Laboratorio di Anatomia Funzionale dell'apparato stomatognatico - LAFAS - Dipartimento di Morfologia Umana, Università degli Studi di Milano

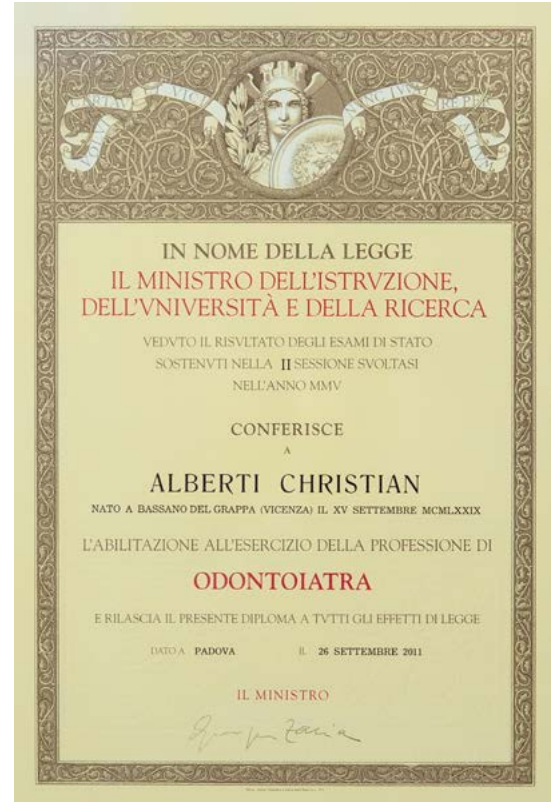
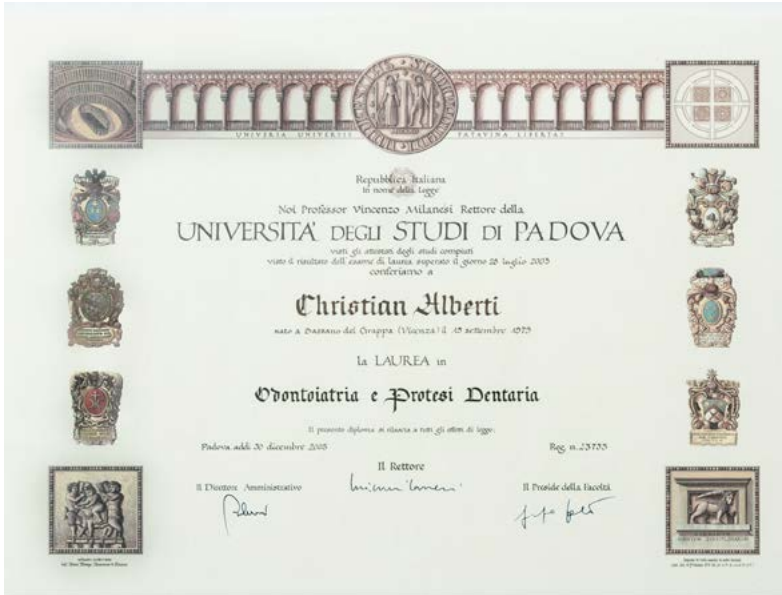
*3. J. PLAST. RECONSTR. AESTHET. SURG:***"Soft tissue facial volumes and shape in skeletal class III patients before and after Orthognathic Surgery treatment"**

Functional Anatomy Research Center - FARC -, Laboratorio di Anatomia Funzionale dell'apparato stomatognatico - LAFAS - Dipartimento di Morfologia Umana, Università degli Studi di Milano

*4. XIV CONGRESSO NAZIONALE DELLA SOCIETÀ ITALIANA DI CHIRURGIA MAXILLO-FACCIALE, SICMF, PARMA, 09-11 GIUGNO 2005:***"Valutazione morfometrica tridimensionale del volto pre e post Chirurgia Ortognatica: Landmarks vs Surface Analysys"**



## Diplomi





**ORDINE PROVINCIALE DEI MEDICI CHIRURGHI  
E DEGLI ODONTOIATRI DI VICENZA**

OGGETTO: Riconoscimento della Professionalità.

Egr. Dott. Alberti Christian  
e-mail: [studio.dentisticoalberti@gmail.com](mailto:studio.dentisticoalberti@gmail.com)

Egregio Dott. Alberti,  
in riscontro alla Sua istanza del 19 agosto u.s., prot. n. 3820, vista la regolarità della documentazione presentata a corredo della richiesta, si esprime parere favorevole alla pubblicazione della professionalità in Chirurgia Odontostomatologica (riconoscimento della Professionalità - art. 1 comma 4, Legge n° 175/92).

Cordiali saluti.

IL PRESIDENTE  
Dott. Michele Valente

SM/psn

Contrà Paolo Lioy n° 13 - 36100 VICENZA - Tel. 0444 326714 - 0444 543084 - Fax 0444/546552  
Codice Fiscale n. 80097250144 E-mail: [ordine@medicivicenza.org](mailto:ordine@medicivicenza.org) Site Web: [www.medicivicenza.org](http://www.medicivicenza.org)

**UNIVERSITÀ DEGLI STUDI DI GENOVA**

Reg. n. 4306

In nome della legge  
Noi Prof. Giacomo Deferrari  
 Rettore dell'Università degli Studi di Genova

Ve'uto il Decreto Ministeriale 22 ottobre 2004, n. 270 art. 3 comma 9  
Ve'uto il risultato della prova finale superata in questa Università il giorno 20 Settembre 2014 da

**Alberti Christian**

Nato a Bassano del Grappa (Vicenza) il 15 Settembre 1979

gli conferiamo il

**Master Universitario di II livello in  
IMPLANTOPROTESI**

Il presente diploma viene rilasciato a tutti gli effetti di legge.  
Dal palazzo dell'Università di Genova, 10 Dicembre 2014

Il Rettore (Giacomo Deferrari)  
Il Presidente del Collegio dei Docenti (Paolo Peres)

Il Direttore Generale (Stefano Gatti)

Impresso in Italia su carta a regola d'arte, grazie autorizzate dall'Università di Genova n. 001026 del 2 maggio 2014

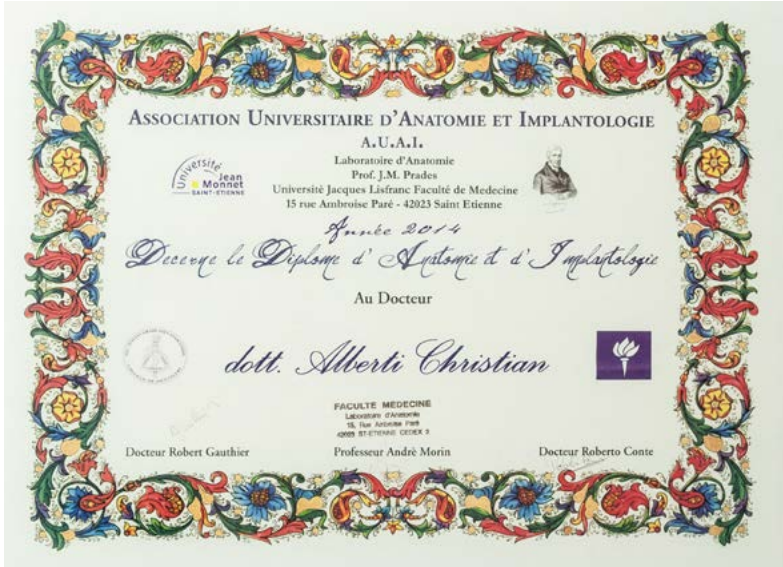
**Università degli Studi di Torino**  
Si attesta che

**Christian Alberti**  
Nato a Bassano del Grappa (Vicenza) il giorno 15 Settembre 1979  
Ha conseguito in data 28 Febbraio 2019 Cum Laude  
Il Master di 2° Livello in  
**Chirurgia Ortognatica e delle  
Malformazioni Cranio - Facciali**

Esatto a Torino il giorno 2 Aprile 2019  
Il Rettore  
La Direzione Generale

Impresso in Italia su carta a regola d'arte, grazie autorizzate dall'Università di Genova n. 001026 del 2 maggio 2014

## Diplomi





  
**Ministero della Salute**  
DIREZIONE GENERALE DELLE PROFESSIONI SANITARIE E DELLE RISORSE UMANE DEL SERVIZIO SANITARIO NAZIONALE  
UFFICIO 4

DGPROF/4/2022/339

**ATTESTATO**

A richiesta dell'interessata e per gli usi consentiti dalla Legge,  
dalla documentazione agli atti di questo Ministero, risulta che :  
**ALBERTI CHRISTIAN** nato a Bassano Del Grappa il 15/09/1979  
ha conseguito in data 23/02/2022 dopo un corso della durata legale di anni tre,  
**IL DIPLOMA DI SPECIALISTA IN**  
**CHIRURGIA ORALE**  
presso l'Università degli Studi di  
**VERONA**

Ministero della Salute  
DGPROF  
0019070-P-05/04/2022  
1.3.4. /2022/339  


Il suddetto titolo soddisfa i requisiti di formazione di cui all' articolo 35 della Direttiva 2005/36/CE del 7 settembre 2005 e corrisponde al titolo indicato nell'Allegato V "Riconoscimento in base al coordinamento delle condizioni minime di formazione" di cui al punto 5.3.3 "Titoli di formazione di dentista specialista" della succitata Direttiva.

Roma, **29 MAR 2022**  
AM

IL DIRETTORE GENERALE  
Dott.ssa Rossana Uggetti  




**International Association of  
Oral and Maxillofacial Surgeons**



To Whom All these presents may come greeting,  
Be it known that the International Association of Oral & Maxillofacial Surgeons  
has approved and Accepted  
**Dr. Alberti Christian**  
As a  
**Fellow**

These letters being their testimonial that he has met the standards  
and qualifications and was granted the rights of Fellow

Original Date of Issue  
The 26th of April  
Two Thousand and Twenty Two

  
Dr. Scott Ferguson  
Dr. Scott Nair  
Dr. Alexander Mattson  
Dr. Mark Zemanek  
Dr. Mitchell Shorack

Annual General Meeting  
Executive Director

**SIdC**  
SOCIETÀ ITALIANA DI CHIRURGIA  
ODONTOSTOMATOLOGICA

Si certifica che  
**Christian Alberti**  
possedendo i requisiti richiesti, è nominato  
**SOCIO ATTIVO**

Presidente SIdC  


Commissione Soci Attivi  
Gastano Marenzi  


Bardolino, 20 ottobre 2022

  
**REPUBBLICA ITALIANA**  
UNIVERSITÀ DEGLI STUDI DI VERONA 

IL RETTORE

VISTO CHE IL DOTT. CHRISTIAN ALBERTI NATO A BASSANO DEL GRAPPA (VICENZA) IL GIORNO 15 SETTEMBRE 1979 HA COMPIUTO GLI STUDI NELLA SCUOLA DI SPECIALIZZAZIONE IN CHIRURGIA ORALE SUPERANDO L'ESAME FINALE DI DIPLOMA IL GIORNO 23 FEBBRAIO 2022, A NORMA DELLE VIGENTI DISPOSIZIONI LEGISLATIVE IN MATERIA E DELLO STATUTO DI QUESTA UNIVERSITÀ, GLI CONFERISCE IL PRESENTE

**DIPLOMA DI SPECIALISTA**  
IN  
**CHIRURGIA ORALE**

AFFINCHÉ POSSA AVVALERSI AD OGNI EFFETTO DI LEGGE, DATO A VERONA, ADDÌ 31 DEL MESE DI MARZO DELL'ANNO MMXXII.

IL RETTORE  
PIETRO BOCCHI  


IL DIRETTORE GENERALE  
FEDERICO GALDI  


Regione di Basilicata in sede ordinaria  
Aut. Regione della Basilicata - 1942/2017 n. 2001

Regione di Basilicata in sede straordinaria  
Aut. Regione della Basilicata - 1942/2017 n. 2001


**American College of  
Oral and Maxillofacial Surgeons**

*Be it known that by virtue of the authority vested,  
the Regents hereby confer upon*

**Christian Alberti**  
International Associate

*As testimony of meritorious achievement and contributions  
In the field of Oral and Maxillofacial Surgery*

*On the Sixteenth Day of February  
Two Thousand and Twenty-Three.*

  
**Allen Paul J. Jankovic**  
ACOMS President

**ACOMS**  
THE AMERICAN COLLEGE OF ORAL AND MAXILLOFACIAL SURGEONS  
SURGICAL EXCELLENCE THROUGH EDUCATION


# Diplomi





## Frontespizi tesi

I.P.I.A. " FEDELE LAMPERTICO "



VIA GG. TRISSINO, 30 - 36100, VICENZA

.....

ESAME DI MATURITÀ

**CHRISTIAN ALBERTI**

**CHIRURGIA RICOSTRUTTIVA  
CRANIO-MAXILLO-FACCIALE  
E DELL'ARTICOLAZIONE  
TEMPORO-MANDIBOLARE**

**ANNO SCOLASTICO: 1997-1998      CLASSE 5ª ODONT SEZ.B**



**UNIVERSITÀ DEGLI STUDI DI PADOVA**

FACOLTÀ DI MEDICINA E CHIRURGIA  
CORSO DI LAUREA IN ODONTOIATRIA E PROTESI DENTARIA  
DIPARTIMENTO DI SPECIALITÀ MEDICO-CHIRURGICHE  
ISTITUTO DI CLINICA ODONTOIATRICA  
CATTEDRA DI CHIRURGIA MAXILLO-FACCIALE  
AZIENDA OSPEDALIERA UNIVERSITARIA DI PADOVA  
UNITÀ OPERATIVA COMPLESSA DI CHIRURGIA MAXILLO-FACCIALE  
SCUOLA DI SPECIALIZZAZIONE IN CHIRURGIA MAXILLO-FACCIALE  
DIRETTORE: PROF. GIUSEPPE FERRONATO

**TESI DI LAUREA SPERIMENTALE**  
PROGETTO DI RICERCA CPDT-033071 APPROVATO E FINANZIATO  
DALL'UNIVERSITÀ DEGLI STUDI DI PADOVA

**LA RICOSTRUZIONE TRIDIMENSIONALE DEL VOLTO IN CHIRURGIA ORTOGNATICA.  
COMPARAZIONE DI TRE METODI NON INVASIVI DI RIPRODUZIONE TRIDIMENSIONALE  
DEI TESSUTI MOLLI DELLA FACCIA:  
PERFORMANCE A CONFRONTO E NECESSITÀ FUTURE IN CHIRURGIA ORTOGNATICA**


RELATORE: CHIAI MO PROF. GIUSEPPE FERRONATO  
PROF. REBENTO PERETTA

CORRELATORE: CHIAI MO PROF. GIAN MARIA CINCIGI  
CHIAI MO PROF. VECCHIO F. FEBBARO

COLLABORATORE: DR. PIER FRANCESCO GALZIGNATO  
ING. DANIELE COMELLI  
ING. ROBERTO MONTAGHELLI

LAUREANDO: ALBERTI CHRISTIAN

ANNO ACCADEMICO 2004-2005



Università degli Studi di Genova  
*Scuola di Scienze Mediche e Farmaceutiche*



**Master Universitario di II livello in Implantoprotesi**  
Presidente: Prof. Paolo Pera

**LA RICOSTRUZIONE TRIDIMENSIONALE DEL VOLTO  
CON TECNICA LASER:  
METODOLOGIA OPERATIVA ED  
ANALISI PRELIMINARE DEI RISULTATI**

Candidato: **CHRISTIAN ALBERTI**

Relatore: **PROF. PAOLO PERA**  
Correlatore: **PROF. MARIA MENINI**

Anno Accademico 2013-2014

**Université "Jean Monnet" Saint Etienne**


Faculté de Médecine Jacques Lisfranc  
Laboratoire d'Anatomie  
15, Rue Ambroise Paré, 42, Saint Etienne  
Année 2013-2014

**DIPLOME UNIVERSITAIRE D'ANATOMIE APPLIQUÉE A L'IMPLANTOLOGIE**

Mémoire Présenté par  
Mr le Docteur Christian ALBERTI  
Titre du Mémoire:

**COLUMBUS BRIDGE PROTOCOL™ :**  
**RIABILITAZIONE IMPLANTOPROTESICA FISSA DEL MASCELLARE  
EDENTULO A FUNZIONE IMMEDIATA  
-BIOMECHANICALLY ADVANCED PROSTHESIS-**

Directeur du Mémoire:  
Mr Le Docteur Robert Prof. GAUTHIER



**UNIVERSITÀ DEGLI STUDI FIRENZE**

UNIVERSITÀ DEGLI STUDI DI FIRENZE  
FACOLTÀ DI MEDICINA E CHIRURGIA  
DIPARTIMENTO DI CHIRURGIA E MEDICINA TRASLAZIONALE  
CENTRO TRAUMATOLOGICO ORTOPEDICO CAREGGI  
CATTEDRA DI CHIRURGIA MAXILLO-FACCIALE  
MASTER UNIVERSITARIO DI II° LIVELLO IN  
CHIRURGIA RICOSTRUTTIVA ED IMPLANTOLOGICA DEI MASCELLARI  
DIRETTORE: PROF. ROBERTO BERTOLAI

TESI DI MASTER UNIVERSITARIO DI II° LIVELLO IN  
CHIRURGIA RICOSTRUTTIVA ED IMPLANTOLOGICA DEI MASCELLARI

**LA RIABILITAZIONE IMPLANTOPROTESICA FISSA DEL MASCELLARE  
ED ENTUL O ED ATROFICO A FUNZIONE IMMEDIATA:  
OPZIONI TERAPEUTICHE E PERFORMANCE A CONFRONTO**

**RELATORI:** PROF. ROBERTO BERTOLAI  
DR. CARLO ALESSANDRO AVERSA

**CANDIDATO:** DR. CHRISTIAN ALBERTI

ANNO ACCADEMICO: 2015-2016



**UNIVERSITÀ DEGLI STUDI DI TORINO**

Facoltà di Medicina e Chirurgia  
Dipartimento di Scienze Chirurgiche  
Lingotto School of Dental Medicine  
Azienda Ospedaliero - Universitaria Molinette, Torino  
Città della Scienza e della Salute di Torino  
Cattedra ed U.O.C. di Chirurgia Maxillo-Facciale  
Scuola di Specializzazione in Chirurgia Maxillo-Facciale  
Master Universitario di II Livello in Chirurgia Ortognatica e delle Malformazioni Cranio-Facciali  
Direttore: Prof. Guglielmo Ramieri, MD, DDS

Tesi di Master Sperimentale

**Pianificazione Computerizzata 3D  
dell'Occlusione Post-Chirurgica  
nelle Procedure Surgery First**

**Relatori:** Prof. Guglielmo Ramieri, MD, DDS  
Prof. Giovanni Gerbino, MD, DDS

**Correlatori:** Prof. Redento Peretta, MD, DDS, PhD, IBO  
Prof. Antonio L. Gracco, DDS

**Masterizzando:** Dr. Christian Alberti, DDS, MSc, CDT, MDT

**UNIVERSITÀ DI VERONA**  
SCUOLA DI MEDICINA E CHIRURGIA  
Scuola di Specializzazione in Chirurgia Orale


Direttore: Prof. Massimo Albanese

**TESI DI SPECIALIZZAZIONE**  
Analisi dell'Occlusione Transizionale  
nelle Procedure Surgery-First.  
Valutazione Morfologica  
e Morfometrica Tridimensionale.

Relatore: Prof. Massimo Albanese  
Correlatore: Dott. Redento Peretta

Medico Specializzando  
Dott. Christian Alberti

ANNO ACCADEMICO 2019 - 2020



Università degli Studi di Brescia  
Scuola di Medicina e Chirurgia  
Dipartimento di Specialità Medico-Chirurgiche, Scienze Radiologiche e Sanità Pubblica  
Azienda Ospedaliero Universitaria Spedali Civili di Brescia  
Master Universitario di II Livello in Odontoiatria Digitale  
Coordinatore: Prof. Antonio Cerutti  
Scuola di Management ed Educazione Avanzata

Tesi Sperimentale di Master Universitario di II Livello in Odontoiatria Digitale

Valutazione analitica, morfologica e morfometrica  
dell'anatomia facciale di superficie tramite tecnologia computerizzata.  
Utilizzo dei sistemi di scansione tridimensionale computer-assistiti  
per la riproduzione 3D dei tessuti molli del viso.

Relatore: Prof. Antonio Cerutti

Masterizzando:  
Dr. Christian Alberti  
Matricola n. 740305



Università degli Studi di Brescia  
Scuola di Medicina e Chirurgia

Dipartimento di Specialità Medico-Chirurgiche, Scienze Radiologiche e Sanità Pubblica  
Azienda Ospedaliero Universitaria Spedali Civili di Brescia  
Master Universitario di II Livello in Odontoiatria Digitale  
Coordinatore: Prof. Antonio Cerutti  
Scuola di Management ed Educazione Avanzata



Tesi Sperimentale di Master Universitario di II Livello in Odontoiatria Digitale

Valutazione analitica, morfologica e morfometrica  
dell'anatomia facciale di superficie tramite tecnologia computerizzata.  
Utilizzo dei sistemi di scansione tridimensionale computer-assistiti  
per la riproduzione 3D dei tessuti molli del viso.

Relatore: Prof. Antonio Cerutti

Masterizzando:  
Dr. Christian Alberti  
Matricola n. 740305



UNIVERSITÀ DI PISA

Scuola di Medicina e Chirurgia  
Dipartimento di Patologia Chirurgica, Medica, Molecolare  
e dell'Area Critica  
Master Universitario di II Livello in Implantologia Zigomatica  
Direttore: Prof. Antonio Barone

Tesi Sperimentale di Master Universitario di II Livello in Implantologia Zigomatica

Pianificazione e trattamento chirurgico-protetico del paziente totalmente edentulo  
associato ad atrofia estrema vertico-trasversale grave del mascellare superiore:  
approccio digitale tridimensionale versus approccio analogico standard.

Relatori:  
Prof. Antonio Barone  
Dr. Andrea Tedesco

Masterizzando:  
Dr. Christian Alberti  
Matricola n. 668176





## Abstract delle Pubblicazioni

### 1 Prog Orthod. 2008; 9(2): 8-19.

#### **A 3-Dimensional Facial Morpho-Dynamic Database in the development of a prediction model in Orthognathic Surgery.**

Peretta R., Concheri G., Comelli D., Meneghello R., Galzignato P.F., Ferronato G.

Author information

1 Dep. of Maxillofacial Surgery, University of Padova, Italy

#### Abstract

##### **Background:**

Current methodologies in the prevision of post-surgical features of the face in orthognathic surgery are mainly 2-D.

An improvement is certainly given by the introduction of CT, but its acceptance is controversial due to its high biological cost. As an alternative, in this study an effective procedure for the construction of a 3-D textured digital model of the face and dental arches of patients with dentofacial malformations using a 3-D laser scanner at no biological cost is presented.

##### **Methods:**

A 3-D Laser scanner Konica-Minolta VIVID 910 is used to obtain multiple scans from different perspectives of the face of patients with dentofacial malocclusions requiring orthognathic surgery. These multiple views are then recombined, integrating also the maxillary and mandibular arch plaster casts, to obtain the 3-D textured model of the face and occlusion with minimal error.

##### **Results:**

A viable methodology was identified for the face and occlusal modeling of orthognathic patients and validated in a test case, confirming its effectiveness: the 3-D model created accurately describes the actual features of the patient's face; the proposed methodology can be easily applied in the Clinical routine to accurately record the steps of the surgical treatment and to perform accurate anthropometric analyses of the facial morphology, and thus constitute the necessary database for the development of previsional tools in orthognathic surgery.

##### **Conclusions:**

The proposed method is effective in recording all the morphological facial features of patients with dentofacial malformations, to develop a facial modification database and tools for virtual surgery.

### 2 Br J Oral Maxillofac Surgery 2007 Mar;45(2): 138-44. Epub 2006 Feb 17.

#### **Three-dimensional facial morphometry in skeletal Class III patients. A non-invasive study of soft-tissue changes before and after Orthognathic Surgery.**

Sforza C., Peretta R., Grandi G., Ferronato G., Ferrario V.F.

Author information

1 Functional Anatomy Research Center (FARC), Laboratorio di Anatomia Funzionale dell'Apparato Stomatognatico (LAFAS), Dipartimento di Morfologia Umana, via Mangiagalli 31, Università degli Studi di Milano I-20133 Milano, Italy. farc@unimi.it; Cattedra ed U.O.C. di Chirurgia Maxillo-facciale, Università degli Studi di Padova, Direttore: Prof. Giuseppe Ferronato.

#### Abstract

Nine patients aged between 18 and 35 years who had severe skeletal Class III malocclusion and moderate-to-severe mandibular asymmetry, were assessed by a non-invasive, landmark-based, three-dimensional system before and after mandibular reduction by sagittal split osteotomy and LeFort I maxillary advancement. The three-dimensional coordinates of 50 facial soft tissue landmarks were collected, and a series of anthropometric measurements was calculated and compared with reference values from 240 healthy subjects of similar sex, age, and ethnic group. Patients were more asymmetrical than normal subjects before the operations, particularly in the gonion. Postoperatively, total and lateral asymmetry was considerably reduced. The three-dimensional approach was a valuable complementary diagnostic aid that enabled quantitative evaluation of the final soft-tissue results without invasive procedures.



### 3 J Oral Maxillofac Surg. 2008 Apr;66(4):691-8. doi: 10.1016/j.joms.2007.06.645.

#### Soft tissue facial planes and masticatory muscle function in skeletal Class III patients before and after orthognathic surgery treatment.

Sforza C., Peretta R., Grandi G., Ferronato G., Ferrario V.F.

##### Abstract

##### Purpose:

To noninvasively assess the facial soft tissues and masticatory muscle function before and after orthognathic surgery.

##### Patients and Methods:

Eight patients aged 18 to 36 years, all with a skeletal Class III and mandibular asymmetry, were assessed both before (on average, 2 months) and after (on average, 10.5 months) surgical Intervention (mandibular reduction by sagittal split osteotomy and Le Fort I maxillary advancement). From the 3-dimensional coordinates of soft tissue facial landmarks, the inclination of facial planes was calculated. Surface electromyography of the masticatory muscles was performed and indices of muscular activity computed. Data were compared with reference values collected in healthy subjects of the same gender, age, and ethnic group.

##### Results:

Before surgery, facial planes were significantly less horizontal (frontal plane) than in the reference subjects ( $P < .05$ ). The sagittal projection of the mandibular plane was more inclined relative to the norm ( $P < .001$ ). During teeth clenching, all indices of standardized muscular symmetry, torque, and activity ( $P < .05$ ) were smaller than the reference values. After surgical treatment, the inclinations of facial planes became more homogenous ( $P < .05$ ). The inclination of the frontal and sagittal planes came next to the reference values, but still differed significantly in the patients ( $P < .05$ ). The mean symmetry index of masseter muscle, torque coefficient, and pooled muscle activity increased, but the patient values remained significantly under the reference values ( $P < .05$ ).

##### Conclusion:

The morphologic and functional approach used in this study proved useful as a complementary diagnostic aid, enabling quantitative evaluation of the final results of surgery, without submitting the patients to invasive procedures.

### 4 J Plast Reconstr Aesthet Surg. 2007;60(2): 130-8. Epub 2006 Sep 7.

#### Soft tissue facial volumes and shape in skeletal Class III patients before and after Orthognathic Surgery treatment.

Sforza C., Peretta R., Grandi G., Ferronato G., Ferrario VF.

##### Author information

1 Functional Anatomy Research Center, Laboratorio di Anatomia Funzionale dell'Apparato Stomatognatico, Dipartimento di Morfologia Umana, Facoltà di Medicina e Chirurgia, Università degli Studi di Milano, Milano, Italy. chiara.sforza@unimi.it; Cattedra ed U.O.C. di Chirurgia Maxillo-facciale, Università degli Studi di Padova, Direttore: Prof. Giuseppe Ferronato.

##### Abstract

##### Background:

To obtain the best surgical results in orthognathic surgery, treatment planning and the evaluation of results should be performed on measurable three-dimensional reproductions of the face of the patients, and compared to reference subjects.

##### Methods:

Seven women aged 18-35 years, all with a skeletal Class III and mandibular asymmetry, were assessed both before (on average, 2 months) and after (on average, 10.7 months) surgical Intervention (mandibular reduction by sagittal split osteotomy and LeFort I maxillary advancement). the three-dimensional coordinates of 50 soft tissue facial landmarks (face, eyes, nose, mouth and lips, ears) were collected with a noninvasive, electromagnetic digitizer; facial volumes were estimated, and compared to reference values collected in 87 healthy women of the same age and ethnic group. Inter-individual modifications in facial shape were also assessed.

##### Results:

Before surgery the patients had smaller faces than the reference women, with larger lower lips and noses. a large within-group variability was found. Surgical treatment significantly reduced total facial volume and mandibular volume, increased total and upper lip volumes (Student's t test,  $p < 0.05$ ), and made all values more homogenous within the group. Shape differences were significantly larger before than after surgery. on average, right side gonion was the landmark that moved the most, closely followed by menton, while the tragi and ala nasi moved the least. the three-dimensional approach used in this study enabled quantitative evaluation of the final soft tissue results of surgery, without submitting the patients to invasive procedures.



## 5

## Valutazione morfometrica tridimensionale del volto pre e post chirurgia ortognatica: landmarks versus surface analysis

R. Peretta\*, G.M. Concheri\*\*, D. Comelli\*\*, R. Meneghello\*\*, P.F. Galzignato\* e G. Ferronato\*

*\*Cattedra e U.O.C. di Chirurgia Maxillo-Facciale, \*\*D.A.U.R., Dipartimento Ingegneria Industriale, Università degli Studi, Padova*

### Riassunto

La ricostruzione virtuale del viso dei pazienti disgnatici offre al chirurgo facciale la possibilità teorica di utilizzarla a scopo clinico per formulare una diagnosi, programmare una terapia e verificare la prognosi estetica delle manovre chirurgiche programmate. La riproduzione del viso per punti antropometrici ha la sua massima utilità nel momento della diagnosi. Sono disponibili infatti valori di normalità con i quali confrontare le dimensioni facciali dei pazienti e identificare le zone di disequilibrio facciale. La riproduzione dell'intera superficie facciale offre possibilità aggiuntive. Oltre all'identificazione virtuale dei landmarks sulla superficie del viso è possibile una fine analisi delle caratteristiche dei tessuti molli facciali in termini di size, shape and location. Il razionale terapeutico consiste nel programmare una variazione di forma e di posizione dei tessuti duri del paziente allo scopo di ottenere una corretta occlusione e una piacevole estetica facciale. Questa possibilità teorica diventerà realtà solo se sarà realizzato un database di casi trattati dal quale estrapolare un modello di comportamento dei tessuti molli in risposta alla variazione dei tessuti duri. La scansione laser del viso sembra lo strumento più adeguato per poterlo realizzare

### Introduzione

La prognosi estetica dei trattamenti chirurgici è possibile solo disponendo di un database di pazienti operati che ci consenta di stabilire un modello



di comportamento dei tessuti molli relativo allo spostamento dei tessuti duri di supporto alle procedure di chirurgia virtuale. La realizzazione di database di queste caratteristiche necessita di mezzi di riproduzione della geometria facciale eticamente e biologicamente accettabili per i pazienti ed efficaci per il clinico. A questo scopo sono state testate tre procedure di riproduzione tridimensionale facciale non invasive (3DNIP) e messe a confronto. La prima 3DNIP (Landmarks) consiste in una penna elettronica da appoggiare al viso del paziente e un sistema di rilevamento delle coordinate tridimensionali di 50 punti antropometrici digitalizzati in sequenza prestabilita <sup>(1)</sup>. La seconda 3DNIP (Facial Mask) consiste nella riproduzione del viso mediante impronta e colatura di una maschera in gesso e successiva scansione della superficie con un digitalizzatore a braccio meccanico. La terza 3DNIP (Laser Scan) consiste nella riproduzione diretta del viso del paziente mediante scansione con uno scanner laser eseguita prima e dopo chirurgia <sup>(2)</sup>.

## **Materiali e metodi**

Sono stati selezionati in modalità random 18 pazienti affetti da malocclusioni dento-scheletriche che dovevano essere sottoposti a chirurgia ortognatica, il cui tipo di malocclusione era del tutto casuale. Questo gruppo è stato suddiviso in tre sottogruppi. I primi sei sono stati studiati con metodo morfometrico utilizzato dal gruppo di ricerca del LAFAS (Laboratorio di Anatomia Funzionale dell'Apparato Stomatognatico) dell'Istituto di Scienze Morfologiche dell'Università di Milano, conosciuto in letteratura come 3DMFA (three dimensional morphometric facial analysis) <sup>(3)</sup>. Ogni singolo paziente viene studiato marcando sul viso cinquanta punti antropometrici, con la testa bloccata da un craniostato applicato ad una sedia. Un digitalizzatore con penna elettronica e tavoletta ricevente (3Draw, Pholemus Inc, Colchester, VT.) registra le coordinate spaziali di ogni singolo punto. I secondi sei sono stati studiati con riproduzione della superficie facciale mediante impronta del viso che richiedendo accuratezza, necessita di una intelaiatura di fili in acciaio modellati direttamente sul viso del paziente oppure di una garza termoplastica che funga da "cucchiaino individuale" per il materiale da impronta. Da questa viene ricavata una maschera in gesso da scansionare <sup>(4)</sup> con digitalizzatore a contatto di tipo meccanico (Microscribe G2, Immersion Corporation, San José, CA, USA.). L'informazione spaziale è costituita da curve per punti interpolati tipo NURBS gestite da un programma di disegno tridimensionale Rhinoceros. Gli ultimi sei sono stati studiati dall'equipe di disegno industriale della Facoltà di Ingegneria dell'Università di Padova scansionando direttamente il viso con uno scanner laser Minolta, scansionando più viste, lateralmente e frontalmente, e sovrapponendole allo scopo di ottenere una immagine completa e coerente del viso. Il segnale di ingresso è costituito da punti che descrivono



Parma, 9-11 giugno, 2005

181

una vista parziale del volto, dai quali può essere ricavata una superficie sfaccettata. Le tre procedure di riproduzione facciale descritte sono state ripetute per ogni paziente dopo sei mesi circa dall'intervento in corrispondenza della fine del trattamento ortodontico attivo e l'inizio della contenzione. Di ogni metodo impiegato è stato valutato il costo in termini di investimento economico iniziale necessario per l'acquisto dello scanner e del software necessario alla gestione dell'immagine; il tempo medio necessario per la realizzazione del modello facciale a partire dalla preparazione del paziente sino alla fine della processazione dei dati acquisiti. Nella fase di pre-processing è stata valutata l'informazione fornita dalla differente modalità di scansione in termini di natura del dato acquisito (landmarks, curve NURBS, superficie mesh) quantità di punti e dettaglio.

## Risultati

L'informazione fornita dalla metodica Landmarks è di tipo puntiforme: fornisce la posizione spaziale di un punto scelto come rappresentativo della struttura che si vuole studiare, ovvero in altri termini una buona informazione sulla location ma nessuna informazione in termini di shape and size della parte del viso rappresentata. La valutazione diagnostica per landmarks consente una valutazione accurata della normalità, secondo statistica, della posizione spaziale dei punti antropometrici analizzati. L'esiguità dei punti, tuttavia, non consente un'analisi della dimensione e della configurazione delle parti del viso, ad esempio delle curvature delle superfici. La riproduzione con maschera è una metodica non applicabile in quanto troppo onerosa in termini di tempo e troppo poco precisa: l'informazione fornita dalla riproduzione per maschera e scansione laser sono concettualmente equiparabili fornendo la possibilità di una valutazione quantitativa più ricca in termini di location, shape and size di ogni parte del viso potendo utilizzare landmarks, curve di sezione, aree e volumi compresi tra superfici. La terza procedura di riproduzione facciale prevede la scansione diretta senza contatto della superficie facciale mediante uno scanner laser. Sulla superficie rappresentata da una mesh di piccoli triangoli, similmente alla superficie da curve, possono essere individuati punti antropometrici di interesse clinico, possono essere determinate curve di intersezione con piani di sezione, aree di zone definite e volumi compresi tra superfici. Contemporaneamente alla scansione lo scanner fotografa il viso del paziente e riallinea i pixel dell'immagine con la superficie corrispondente. L'immagine fotografica del viso è dunque utilizzata come texture della mesh con un effetto fotorealistico finale di grande utilità clinica. L'errore di riproduzione è molto basso nella riproduzione per scansione laser. Possiamo quindi concludere che il contenuto informativo nel modello fornito dalle tre metodiche è rispettivamente basso, medio e alto.



## Conclusioni

La rappresentazione con cinquanta landmarks e un sistema di registrazione elettronica delle coordinate spaziale di ogni singolo punto è un sistema economico, veloce e con una curva di apprendimento sufficientemente breve. La maggiore utilità di questo sistema è diagnostica perché è disponibile un database di visi normali <sup>(5)</sup> con il quale è possibile confrontare le misure del paziente in esame ed avere quindi un criterio statistico, cioè quantitativo, di valutazione delle caratteristiche patologiche che si desiderano correggere. La tecnica indiretta utilizzata è quella dell'impronta facciale, la riproduzione mediante maschera di gesso e successiva scansione mediante braccio meccanico. La qualità della riproduzione è buona ma con tempi di lavoro eccessivi per un uso routinario. La riproduzione diretta mediante scansione laser del viso ha mostrato la massima qualità e velocità nella riproduzione facciale con un solo handicap rappresentato dall'alto costo iniziale dello scanner. L'utilizzo clinico è ancora limitato alla valutazione delle variazioni pre-post chirurgia a causa della mancanza di un database di riferimento in fase diagnostica.

## Bibliografia

- 1- Ferrario VF, Sforza C, Poggio CE, Cova M, Tartaglia G. Preliminary evaluation of an electromagnetic three-dimensional digitizer in facial anthropometry. *Cleft Palate Craniofacial J* 1998;32:9-15.
- 2- Moss JP, McCance AM, Frigth WR, Linney AD, James DR. A three-dimensional soft tissue analysis of fifteen patients with Class II, division 1 malocclusions after bimaxillary surgery. *Am J Orthod Dentofacial Orthop* 1994;105:430-7.
- 3- Ferrario VF, Sforza C, Schmitz JH, Santoro F. Three-dimensional facial morphometric assessment of soft tissue changes after orthognathic surgery. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 1999 Nov;88(5):549-56.
- 4- Ayoub A, Garrahy A, Hood C, White J, Bock M, Siebert JP, Spencers R, Ray A. Validation of a Vision Based, Three-Dimensional Facial Imaging System. *Cleft Palate- Craniofacial Journal*, September 2003, Vol.40 No.5:523-529.
- 5- Ferrario VF, Sforza C, Poggio CE, Schmitz JH. Soft-tissue facial morphometry from 6 years to adulthood: a three dimensional growth study using a new modeling technique. *Plastic Reconstr Surg* 1999;103:768-78.

## 6 Classificazione e revisione della letteratura nella chirurgia dei terzi molari

### 1° Incontro Nazionale delle Scuole di Specializzazione in Chirurgia Orale

D. Donadello, C. Alberti, G. Causarano, G. Capocasale - Università degli Studi di Verona - Clinica odontoiatrica e di chirurgia maxillo-facciale

Scuola di specializzazione in chirurgia orale - Direttore: Prof. Massimo Albanese - Modena, Venerdì 07 giugno 2019

#### Healing of hard tissues post surgical extraction of the lower third molar: comparison between two different extraction methods. Retrospective study of 300 patients and literature review

Manfrin F., Donadello D., Bertossi D., Alberti C., Albanese M.

Department of Surgery, Dentistry, Paediatrics and Gynecology, University of Verona, Italy

**Aim:** The aim of this study was to focus on the healing process of hard tissues in post surgical extraction sites of lower third molars in healthy patients.

**Methods:** A group of 300 patients was treated by two different surgeons (respectively 150 the first and 150 the second), each of whom followed his own standardized surgical protocol. Basic differences were: the first operator did not administer antibiotic prophylaxis and the surgical phase was conducted with significant use of water-rotating instruments, while the second operator provided the use of the antibiotic prophylaxis and a significant use of the lever, despite minimal use of water-based rotary instruments. All other points of the two surgical extraction protocols were similar.

**Results:** The percentages of delayed healing, alveolitis, osteitis and osteomyelitis of the two groups were compared and a higher percentage of complications was recorded with the First operator than the Second one (14.09% versus 12.08%). From this analysis, subgroups of the population were created based on the risk factors related to the patient most involved in these complications, such as sex, age, smoking and oral contraceptives assumption. The respective percentages of complications were calculated and the data were compared with literature, showing that: the influence of sex and age, despite having obtained conflicting results between the two cohorts, is supported by literature and may be relevant or not. Regarding smokers and women who take contraceptives, in both cohorts a higher percentage of complications was obtained as clearly supported by literature. Once the smoking and contraceptives were defined as two evident risk factors for healing complications, these patients were removed from the initial pools and the complication rates were recalculated for both groups, showing a marked difference of complication rate: 12.75% versus 7.25%. Regarding the surgical protocols, a literature review showed that there is no statistically significant difference on the use of antibiotic prophylaxis in healthy patients to reduce the percentage of hard tissue complications; while the duration of the surgery, in particular the time spent in osteotomy, seems to increase the risk of complications referred to the hard tissues healing. On opposite, the extractions operated with a marked use of the lever (cohort 2) presented a high rate of temporary impairment of sensory function of the NAI and of the lingual nerve as secondary outcome.

**Conclusions:** The following study allows to conclude that smoking and oral contraceptive are risk factors for the healing of hard tissues that increases the possibility of complications by 2.8 times the first and 1.75 times the second; temperature increase generated by prolonged osteotomy procedure influences the healing capacity of hard tissues after an extraction; the use of strong pressure with the lever increases the risk of temporary paresthesia.

## 7 Relazione tra le complicanze postoperatorie dell'estrazione dei terzi molari e l'età del paziente: revisione della letteratura

### 1° Incontro Nazionale delle Scuole di Specializzazione in Chirurgia Orale

G. Capocasale, C. Alberti, G. Causarano, D. Donadello - Università degli Studi di Verona - Clinica odontoiatrica e di chirurgia maxillo-facciale - Scuola di specializzazione in chirurgia orale - Direttore: Prof. Massimo Albanese - Modena, Sabato 08 giugno 2019

### NobelGuide™ pilot surgical template: retrospective study on 15 consecutive cases

Dario Donadello, Alberto Rossetto, Alessandro Rizzini, Christian Alberti, Massimo Albanese

Department of Surgery, Dentistry, Paediatrics and Gynaecology, University of Verona, Verona, Italy

**Aim:** Technological and computer development for guided implantology has enabled the introduction of programs that allow clinicians to plan implant insertion with beneficial prosthetic emergence and produce surgical templates to guide inserting the pilot drill only. Pilot Drill Template implantology is a turning point between flapless surgery and traditional surgery while maintaining the computer guidance in using the first pilot drill and having a direct view of bone tissue. The aim of this study was to evaluate patients who are candidates for the pilot template, thus partially edentulous.

**Methods:** For each patient a dental impression and a diagnostic wax-up of the areas to be rehabilitated were performed. They were then scanned via Nobel Procera® scanner, and the images were imported into the NobelClinician® software. The SmartFusion algorithm allows the automatic matching of the data deriving from the scan of the stone model with the DICOM files of the patient's CT scan. A pilot drill template was virtually created; it includes the housing of 2 mm diameter bushings for each implant position. After local anesthesia, the surgical template was fitted on the present teeth, and the Guided Twist Drill

Ø 2.0 × (10+) 7-18 mm was used, with a fixed stop at the predetermined length. Once the guided milling was performed, the template was removed, a crestal incision was made, a mucoperiosteal flap was raised and the implant site was prepared according to Nobel Biocare® protocols. A total of 32 implants were placed using 14 surgical templates in 14 partially edentulous patients. Only one patient was excluded from surgery for the inadequate vestibulo-lingual bone thickness.

**Results:** Patients' average age is 49 years (21-64 years). 9 patients are females (60%) 6 males (40%); they were rehabilitated respectively with 22 (68.75%) and 10 implants (31.25%). 7 rehabilitations were performed on the maxilla (21 implants), and 8 on the jaw (11 implants). The average number of implants placed per patient is 2.286. In 12.5% of cases implants were placed at the incisive level, in 3.12% at the canine level, in 25% at the premolars level and in 59.38% at the molars level. The average length of the 32 implants inserted is 11.19 to 1.10 mm. The average diameter of the 32 implants inserted is 3.82 to 0.29 mm. Of the 32 implants inserted, 6 are Nobel Active® (19%), 7 are Speedy Groovy (22%) and 19 are the Brånemark System® MK III (59%). Of the 32 holes performed with the Guided Twist Drill, 12 were reprepared with the first

Ø 2.0 drill to have a better anatomical and prosthetic position. In 2 cases the therapeutical pathway was modified in the vestibulo-palatal sense, 6 in the mesio-distal sense and 4 in both vestibulo-palatal and mesio-distal senses. In 4 the implant length was changed, in 3 the diameter, in 3 the type, in 6 diameter-length, in 1 type-diameter, in 5 type-length-diameter and in 10 no changes were made.

**Conclusions:** The advantages of this technique are: a lower loss of keratinized mucosa, the direct vision of bone tissue, a reduction of the degree of bone overheating and a less bulky bushing than the Fully Guided protocols, the possibility of reviewing the planning during surgery with implant parameter changing. Pilot Drill Implant Template implantology is a compromise between flapless and traditional surgery, with the aims of maintaining the advantages of both techniques, overcoming their different limits.

### 8 Incisional biopsy examination to diagnose oral potentially malignant disorders and oral squamous cell carcinoma: report of 100 cases

Giorgia Capocasale, Martina Peretti, Francesca Zotti, Andrea Fior, Christian Alberti, Massimo Albanese

Department of Surgery, Dentistry, Paediatric and Gynecology, University of Verona, Verona, Italy

**Aim:** Oral squamous cell carcinoma (OSCC) is the most common oral and maxillofacial malignancy. If detected at an early stage, survival from oral cancer is higher than 90% at 5 years. OSCC is very often preceded by oral "potentially malignant disorders"; in 2005, the World Health Organization recommended the use of the term oral "potentially malignant disorders" (PMDs) instead of precancerous lesions, having greater potential for malignant transformation than other oral lesions. In these cases, often, patients presented widespread disorders in different sites of the oral cavity and for this they obviously require an incisional biopsy. Indeed, currently, the "gold standard" for the diagnosis of PMDs or OSCC involves three initial steps: a visual recognition of macroscopic features, selection of the most representative sites for biopsy, and histomorphology examination. So the limitations are: the choice of the site, the tendency of PMDs towards field cancerization, artifacts or insufficient tissue, intra- and interobserver variability. Also, patients should be followed-up at regular intervals. Currently, follow-up intervals are not evidence-based and are entirely based on clinicians' subjective assessment of clinical appearance and reported dysplasia in the specimens. The aim of this retrospective study was to determine the accuracy of incisional biopsy examination to diagnose PMDs or OSCC, also during follow-up.



**Methods:** This retrospective review included a sample 100 patients referred to the Department of Surgery, of Dentistry, Paediatric and Gynecology, University of Verona, during the period from 2007 to 2017, who presented the following oral lesions: leukoplakia (idiopathic or due to smoking), erythroplakia, oral lichen planus, and who also were subjected to incisional biopsy. All data as demographics, habits (smoking and alcohol) and clinical features of the lesions (site, clinical features, morphology and color) were collected in a dataset. For each patient the clinical diagnosis formulated during the first visit was also recorded. The photographic records were collected in order to record not only the clinical features of the lesion, but also for the purpose of recording the site in which biopsy sampling was performed. Simple visual examination is accompanied with adjunctive techniques as toluidine blue for subjective interpretation of dysplastic changes.

**Results:** Considering the period from 2007 to 2017, 100 patients involved in the study were: 57 females and 43 males; their age range was 27-86 years. The majority of the lesions (n=31) appeared clinically as plaque, 23 were erosive lesions, 30 were papular/reticular, 8 were mixed plaque and erosive lesions, and 8 were ulcerative lesions. The pathological diagnosis identified the presence of 51 cases of Oral Lichen planus, 31 cases of oral leukoplakia, 10 cases of Proliferative verrucous leukoplakia and 8 cases of erythroleukoplakia. No cases were found with insufficient tissue provided in the biopsy specimen or sampling error. Also, during follow-up period, 21 patients were subjected to incisional biopsy (also with toluidine blue); so, 9 cases of OSCC were diagnosed: in 5 cases patients' first diagnosis were oral lichen planus, in 4 cases were erythroleukoplakia.

**Conclusions:** The data collected indicated a diagnostic concordance with final pathologic results of incisional oral biopsy. The clinical knowledge (in association with the use of adjunctive techniques as toluidine blue), the quality of the samples sent to the pathologists and the communications between oral surgeon and pathologist are important for a correct and timely diagnosis of PMDs or OSCC.

## 9 Short implant: new horizon in Oral Surgery

Causarano G., Alberti C., Marostegan M., Donadello D., Capocasale G.  
Department of Surgery, Dentistry, Paediatrics and Gynecology,  
University of Verona, Italy

### AIM:

To evaluate the survival and success of short and super-short implants in prosthetic restorations, whether with immediate or delayed loading. In this article there are no principles of sectoral exclusion of prosthetic restorations and all types of implants on the market and present in the literature are considered (13 articles in total).

### METHODS:

In literature there are numerous articles concerning short and super short implants. In this review, articles from the last 15 years were considered and of these only those free from regenerative or reconstructive techniques were selected.

Short implants were considered according to the following inclusion scheme:

- 1 implant placement in the patient's native bone only, whether maxillary and / or mandibular;
- 2 exclusion of incremental techniques with auto, hetero and homologous bone grafts;
- 3 positioning with flapless versus open technique;
- 4 immediate versus deferred loading;
- 5 implant placement in total maxillary atrophy;
- 6 implant placement after post-reclamation healing;
- 7 implants positioned in various types of skeletal atrophy according to the Kennedy classification;
- 8 definitive restoration with metal-ceramic, composite and/or zirconia crowns;
- 9 connection of the internal and/or external abutment;
- 10 variations in the type of implant surface by macro and micro-structure;
- 11 screw connection according to torque standards with dynamometric selection;
- 12 distinction between fixed and/or removable prosthesis.

Of all the articles present in the literature, 11 publications that meet the requirements have been selected.

**RESULTS:**

4,334 short implants in a total of 1.932 patients were evaluated and considered, without significant percentage changes in gender or age. Implant placement was performed equally at both maxillary and mandibular levels without significant statistical variation with regard to the surgical positioning technique. In the study, the implants considered have a length between 5 mm and 8.5 mm and a standard diameter ranging between 3.75 mm and 4 mm. From the data obtained we were able to trace only 104 short implants attributable to rough surfaces and 176 implants with machined surfaces. The articles examined consider a variable survival follow-up between 3 years and 16 years. From the data obtained and with a weighted statistical average, the survival rate after masticatory loading, both immediate and delayed, was 96.4%. This percentage indicates an excellent implant survival at 5 years with a stable maintenance of the peri implant bone peaks. No significant data emerged regarding the final prosthetic type of the crowns positioned on the implants at the end of the treatment. Furthermore, there are no data indicating with which torque method the definitive prosthetic abutments were screwed.

**CONCLUSIONS:**

The results obtained show that short implants are an excellent fixed implant-prosthetic resolution in cases of sectorial and vertical-transverse bone atrophy, with an excellent success rate of definitive prosthetic rehabilitation therapy. However, there are currently no significant results regarding the association between platform switching and short implants. There is also no unambiguous and accepted classification on which is, definitively, the maximum length threshold to define what is now called "short implant".

*Bibliografia*

. Splinted and unsplinted short implants in mandibles: a retrospective evaluation with 5 to 16 years of follow up.

. Ronnie Goené, Carlo Bianchesi, Markus Hüerzeler, Tiziano Testori, Mithriadade Davarpanah, Ziad Jalbout

Performance of short implants in partial restorations: 3 years follow up of osseointegrated implants

Implants dentistry.

. Pietro Felice, Roberto Pistilli, Carlo Barausse, Anna Trullenque-Eriksson, Marco Esposito

Short implants as an alternative to crestal sinus lift: a 1 year multicentre randomized controlled trial

Eur j. Oral implantol.

## 10 Effects of the sander bite jumping appliance in patients with class ii malocclusion before growth peak

P. Faccioni, D. De Santis, S. Sinigaglia, M. Zarantonello, F. Zotti, P. Pancera, A. Iurlaro, M. Finotti, M. Marchiori, S. Bazzanella, C. Alberti, A. Zangani, G. Capocasale, D. Donadello, F. Faccioni and P. F. Nocini

**Sander bite jumping appliance (BJA) is a functional appliance used to correct Class II malocclusion in growing patients. The aim of this study was to identify the dento-skeletal effects in patients treated with BJA before growth peak and to compare these effects with the ones obtained in a similar group treated with the Andresen activator (AA). Twenty subjects with class II relationship of the skeletal bases and cervical vertebrae maturation stage 1 or 2 were enrolled in the study and treated with BJA. This group were compared to 14 subjects treated with AA. Cephalometric analyses were carried out using landmarks derived from the analyses of Pancherz, Ricketts, Tweed and Steiner. After treatment with BJA Pg/OLp increase was  $7.40 \pm 3.81$  mm ( $P < 0.001$ ); Pg/OLp+Co/OLp significantly heightened from T0 to T1 (T0:  $82.20 \pm 4.65$  mm vs T1:  $89.62 \pm 4.27$ ,  $P < 0.001$ ). Overjet (is/OLp - ii/OLp) significantly decreased from T0 to T1 (T0:  $7.40 \pm 2.31$  mm vs T1:  $3.05 \pm 1.34$  mm,  $P < 0.001$ ). Molar relationship improved passing from  $1.46 \pm 1.68$  mm at T0 to  $-3.56 \pm 2.04$  mm at T1 ( $P < 0.001$ ). No statistically significant differences were found between BJA and AA groups at T0 and T1. BJA treatment determined a Class II malocclusion correction in all patients. The correction of molar relationship was mainly due to the increase in mandibular length; the correction of the overjet was due to the increase in mandibular length, to the slight pro-inclination of the lower incisors and the mild retro-inclination of the upper incisors. No significant differences were found in effectiveness between BJA and AA.**

Class II malocclusion affect one third of the Italian children (1). Several factors may contribute to the development of Class II malocclusion including skeletal pattern, soft tissues, dental factors and vicious habits. Animal studies showed that a forward positioning of the mandible increased condylar growth (2-3). The functional orthopedic appliances determine an advanced mandibular position by stretching the external pterygoid muscles: which favours mandibular growth (4). Sander bite jumping appliance (BJA) is one of the most used functional orthopedic appliances: the main characteristic of this device is represented by two prongs embedded in the upper plate and positioned to form an angle of  $60^\circ$  with the occlusal plane. These force the patient to posture the mandible

forward (5). In most studies related to the functional orthopedic treatment of Class II malocclusion, the therapy is performed during the patient's growth peak (6). In our experience the treatment performed before growth peak can be beneficial because children are more cooperative than adolescents (7). The objectives of the study were: to identify the skeletal and dentoalveolar effects in patients treated with BJA before growth peak; to compare these effects with the ones obtained in a similar group treated with the Andresen Activator (AA).

**MATERIALS AND METHODS:**

Twenty patients (11 males and 9 females; mean age: 10.2±1.6 years before treatment, T0) with the following characteristics were enrolled: bilateral class II molar relationship; overjet ± 5mm; class II skeletal relationship (ANB >4°); mandibular retrusion (SNB <78°); CS1 or CS2 cervical vertebral maturation stage according to Baccetti et al. (8). The exclusion criteria were genetic or endocrine diseases that could affect the treatment; previous orthodontic treatments; skeletal abnormalities (9). The documentation included: study models, extraoral and intraoral photographs, orthopantomography, lateral cephalograms before (T0) and after (T1) treatment. Class II malocclusion was diagnosed through clinical examination, lateral photographs, lateral cephalogram and Frankel maneuver at T0 (10-11). Patients were treated with BJA for a mean period of 12.2±2.3 months and were instructed to wear the appliance for at least 14 hours/day (12). At the end of the treatment dento-skeletal variables on the cephalometric traces of the initial (T0) and final (T1) lateral cephalograms were measured with Dolphin Imaging 11.7 software. Parameters derived from Steiner, Tweed, Ricketts, Pancherz and McNamara cephalometric analyses were measured to gather all the measurement variables often used in the literature (Table I) (13). The obtained data were compared with those of our previous study performed on 14 patients (7 males and 7 females) with Class II malocclusion treated with AA before the growth peak (7). The statistical analysis was performed using STATA software. Mean and standard deviation (SD) were calculated for all cephalometric variables at T0 and at T1. Paired t test was performed for the evaluation of the dento-skeletal changes that occurred during treatment with BJA. Unpaired t test was performed to compare the efficacy of BJA and AA. The p-value was considered statistically significant if less than 0.001.

**RESULTS:**

Skeletal and dentoalveolar measurements at T0 and T1 and their relative changes over time are reported in Table II. Pg/OLp and Pg/OLp+Co/OLp were significantly higher after BJA treatment (D Pg/OLp: 7.40±3.81 mm, P<0.001; D Pg/OLp+Co/OLp: 8.92±8.67 mm, P<0.001). Overjet (is/OLp - ii/OLp) significantly decreased from T0 to T1 (T0: 7.40±2.31 mm vs T1: 3.05±1.34 mm, P<0.001). Molar relationship improved passing from 1.46±1.68 mm at T0 to -3.56±2.04 mm at T1 (P<0.001). The dento-skeletal effects of BJA patients

**Table I.** Skeletal and dentoalveolar variables.

Variable	Unit of measurement	Description
is/OLp-ii/OLp	mm	Overjet
ms/OLp-mi/OLp	mm	Molar relationship
A/OLp	mm	Position of the maxillary base
Pg/OLp	mm	Position of the mandibular base
Co/OLp	mm	Position of the condylar head
Pg/OLp+Co/OLp	mm	Sagittal mandibular length
Co-Gn	mm	Total mandibular length
is/OLp-A/OLp	mm	Position of the upper central incisor in the maxilla
ii/OLp-Pg/OLp	mm	Position of the lower central incisor in the mandible
ms/OLp-A/OLp	mm	Position of the upper permanent first molar in the maxilla
mi/OLp-Pg/OLp	mm	Position of the lower permanent first molar in the mandible
SNA	°	Antero-posterior positioning of maxilla in relation to cranial base
SNB	°	Antero-posterior positioning of mandible in relation to cranial base
ANB	°	Relative position of the maxilla to mandible
IMPA (LI_MP)	°	Incisor Mandibular Plane Angle
FMA (LI_FH)	°	Frankfort-Mandibular Incisor Angle
FMA (MP_FH)	°	Frankfort-Mandibular plane Angle
UI_LN	°	Inclination of maxillary incisor to anterior cranial base
UI_LI	°	Interincisal angle

were compared to those of a group treated with AA. No statistically significant differences were found between BJA and AA groups at T0 and T1 (Table III). Both appliances were effective in correcting overjet and molar relationship. AA determined a greater retraction of the upper incisors (AA D is/OLp - A/OLp: -1.75±3.18 mm vs BJA D is/OLp - A/OLp: 0.10±2.62 mm) and a slight advancement of the lower incisors (AA D ii/OLp - Pg/OLp: -0.22±2.69 mm vs BJA D ii/OLp - Pg/OLp: 0.16±1.77 mm). The dental correction of overjet in BJA and AA groups was 47.4% and 6.1% respectively. In BJA group, the maxillary molars moved distally 1.30±2.79 mm, while they tended to move mesially (0.98±2.92 mm) in AA group. AA determined a greater mesialization of the first lower molars (AA D mi/OLp - Pg/OLp:

1.91±8.47 mm vs BJA D mi/OLp - Pg/OLp: 0.57±3.21 mm). The dental correction of molar relationship was 37.8% in BJA group and 20.1% in AA group. Sagittal mandibular length increased slightly more in BJA group (BJA D Pg/OLp+Co/OLp: 8.92±8.67 mm vs AA D Pg/OLp+Co/OLp: 7.25±4.47 mm), whereas AA determined a slightly greater increase in total mandibular length (BJA D Co-Gn: 9.21±8.57 mm vs AA D Co-Gn: 10.06±5.35 mm). SNA increased slightly in BJA group (0.77±1.11°), whereas it decreased in AA one (-1.49±3.43°). BJA determined a greater increase in SNB than AA (BJA D SNB: 2.52±2.41° vs AA D SNB: 0.82±2.69°).

**Table II.** Cephalometric values at T0 and T1 expressed as mean  $\pm$  standard deviation. Significant values are in bold.

Measurements	T0 (mean $\pm$ SD)	T1 (mean $\pm$ SD)	$\Delta$ T1-T0 (mean $\pm$ SD)	P-value
is/OLp-ii/OLp	7.40 $\pm$ 2.31	3.05 $\pm$ 1.34	-4.27 $\pm$ 2.05	<b>&lt;0.001</b>
ms/OLp-mi/OLp	1.46 $\pm$ 1.68	-3.56 $\pm$ 2.04	-4.95 $\pm$ 1.96	<b>&lt;0.001</b>
A/OLp	73.42 $\pm$ 3.67	77.63 $\pm$ 4.58	4.21 $\pm$ 4.12	0.011
Pg/OLp	77.15 $\pm$ 5.06	84.55 $\pm$ 4.33	7.40 $\pm$ 3.81	<b>&lt;0.001</b>
Co/OLp	5.14 $\pm$ 1.83	5.09 $\pm$ 3.36	-0.05 $\pm$ 2.82	0.956
Pg/OLp+Co/OLp	82.20 $\pm$ 4.65	89.62 $\pm$ 4.27	8.92 $\pm$ 8.67	<b>&lt;0.001</b>
Co-Gn	96.32 $\pm$ 5.26	105.53 $\pm$ 5.03	9.21 $\pm$ 8.57	0.008
is/OLp-A/OLp	9.66 $\pm$ 1.91	9.66 $\pm$ 0.1	0.10 $\pm$ 2.62	1
ii/OLp-Pg/OLp	-3.06 $\pm$ 4.04	-2.07 $\pm$ 2.92	0.16 $\pm$ 1.77	0.589
ms/OLp-A/OLp	-21.03 $\pm$ 1.33	-22.38 $\pm$ 2.51	-1.30 $\pm$ 2.79	0.164
mi/OLp-Pg/OLp	-27.7 $\pm$ 3.66	-27.79 $\pm$ 2.72	0.57 $\pm$ 3.21	0.787
SNA	80.05 $\pm$ 3.90	80.82 $\pm$ 4.05	0.77 $\pm$ 1.11	0.056
SNB	73.43 $\pm$ 3.38	75.95 $\pm$ 4.64	2.52 $\pm$ 2.41	0.009
ANB	6.62 $\pm$ 1.78	4.96 $\pm$ 2.42	-1.66 $\pm$ 1.33	0.003
MPA	94.16 $\pm$ 6.38	97.96 $\pm$ 4.71	3.44 $\pm$ 5.82	0.094
L1_FH	59.90 $\pm$ 7.56	55.64 $\pm$ 6.07	-4.26 $\pm$ 5.88	0.048
MP_FH	25.66 $\pm$ 4.26	27.06 $\pm$ 4.55	1.40 $\pm$ 2.06	0.059
U1_SN	106.20 $\pm$ 10.15	101.23 $\pm$ 9.06	-4.97 $\pm$ 5.23	0.015
U1_LI	123.73 $\pm$ 11.98	124.45 $\pm$ 13.47	3.48 $\pm$ 12.23	0.392

**Table III.** Comparison of cephalometric values between BJA group and AA group at T0 and T1.

Measurements	BJA (n=20)	T0 (mean $\pm$ SD)	T0 p-value	T1 (mean $\pm$ SD)	$\Delta$ T1-T0 (mean $\pm$ SD)	T1 p-value
is/OLp-ii/OLp	BJA	7.40 $\pm$ 2.31	0.319	3.05 $\pm$ 1.34	-4.27 $\pm$ 2.05	0.416
	AA	8.21 $\pm$ 2.37		3.39 $\pm$ 0.57	-4.16 $\pm$ 2.21	
ms/OLp-mi/OLp	BJA	1.46 $\pm$ 1.68	0.378	-3.56 $\pm$ 2.04	-4.95 $\pm$ 1.96	0.190
	AA	2.12 $\pm$ 1.79		-2.50 $\pm$ 1.72	-4.62 $\pm$ 2.34	
A/OLp	BJA	73.42 $\pm$ 3.67	0.709	77.63 $\pm$ 4.58	4.21 $\pm$ 4.12	0.252
	AA	75.74 $\pm$ 15.31		76.81 $\pm$ 5.99	1.07 $\pm$ 13.63	
Pg/OLp	BJA	77.15 $\pm$ 5.06	0.011	84.55 $\pm$ 4.33	7.40 $\pm$ 3.81	0.677
	AA	78.02 $\pm$ 5.99		85.84 $\pm$ 8.91	7.82 $\pm$ 9.95	
Co/OLp	BJA	5.14 $\pm$ 1.83	0.668	5.09 $\pm$ 3.36	-0.05 $\pm$ 2.82	0.872
	AA	4.49 $\pm$ 2.45		4.00 $\pm$ 1.75	-0.49 $\pm$ 2.48	
Pg/OLp + Co/OLp	BJA	82.20 $\pm$ 4.65	0.557	89.62 $\pm$ 4.27	8.92 $\pm$ 8.67	0.644
	AA	83.97 $\pm$ 6.63		90.92 $\pm$ 7.97	7.25 $\pm$ 4.47	
Co-Gn	BJA	96.32 $\pm$ 5.26	0.959	105.53 $\pm$ 5.03	9.21 $\pm$ 8.57	0.407
	AA	96.47 $\pm$ 7.96		106.53 $\pm$ 7.59	10.06 $\pm$ 5.35	
is/OLp-A/OLp	BJA	9.66 $\pm$ 1.91	0.581	9.66 $\pm$ 0.1	0.10 $\pm$ 2.62	0.621
	AA	10.07 $\pm$ 1.82		9.11 $\pm$ 1.85	-1.75 $\pm$ 3.18	
ii/OLp-Pg/OLp	BJA	-3.06 $\pm$ 4.04	0.483	-2.07 $\pm$ 2.92	0.16 $\pm$ 1.77	0.364
	AA	-4.35 $\pm$ 4.49		-4.33 $\pm$ 2.92	-0.22 $\pm$ 2.69	
ms/OLp-A/OLp	BJA	-21.03 $\pm$ 1.33	0.537	-22.38 $\pm$ 2.51	-1.30 $\pm$ 2.79	0.978
	AA	-21.56 $\pm$ 2.91		-22.41 $\pm$ 3.36	0.98 $\pm$ 6.92	
mi/OLp-Pg/OLp	BJA	-27.7 $\pm$ 3.66	0.813	-27.79 $\pm$ 2.72	0.57 $\pm$ 3.21	0.956
	AA	-28.07 $\pm$ 3.69		-27.89 $\pm$ 4.88	1.91 $\pm$ 8.47	
SNA	BJA	80.05 $\pm$ 3.90	0.230	80.82 $\pm$ 4.05	0.77 $\pm$ 1.11	0.971
	AA	81.9 $\pm$ 4.20		80.76 $\pm$ 3.68	-1.49 $\pm$ 3.43	
SNB	BJA	73.43 $\pm$ 3.38	0.046	75.95 $\pm$ 4.64	2.52 $\pm$ 2.41	0.284
	AA	76.8 $\pm$ 4.51		77.91 $\pm$ 3.26	0.82 $\pm$ 2.69	
ANB	BJA	6.62 $\pm$ 1.78	0.099	4.96 $\pm$ 2.42	-1.66 $\pm$ 1.33	0.021
	AA	5.1 $\pm$ 2.10		2.87 $\pm$ 1.61	-2.26 $\pm$ 2.54	
MPA	BJA	94.16 $\pm$ 6.38	0.917	97.96 $\pm$ 4.71	3.44 $\pm$ 5.82	0.713
	AA	98.53 $\pm$ 11.36		98.65 $\pm$ 7.92	4.07 $\pm$ 6.53	
L1_FH	BJA	59.90 $\pm$ 7.56	0.718	55.64 $\pm$ 6.07	-4.26 $\pm$ 5.88	0.321
	AA	61.44 $\pm$ 11.49		58.25 $\pm$ 6.15	-3.18 $\pm$ 7.65	
MP_FH	BJA	25.66 $\pm$ 4.26	0.179	27.06 $\pm$ 4.55	1.40 $\pm$ 2.06	0.079
	AA	23.30 $\pm$ 3.7		22.89 $\pm$ 5.11	0.41 $\pm$ 3.81	
U1_SN	BJA	106.20 $\pm$ 10.15	0.472	101.23 $\pm$ 9.06	-4.97 $\pm$ 5.23	0.171
	AA	109.11 $\pm$ 8.85		105.81 $\pm$ 5.17	-3.30 $\pm$ 6.50	
U1_LI	BJA	123.73 $\pm$ 11.98	0.855	124.45 $\pm$ 13.47	3.48 $\pm$ 12.23	0.587
	AA	123.52 $\pm$ 9.11		122.8 $\pm$ 9.16	0.09 $\pm$ 7.27	

**DISCUSSION:**

Functional orthopedic treatment is effective in correcting Class II malocclusion in children aged 8-10 years (14-15). According to Martina et al. (5), BJA produced a significant increase in mandibular growth, improving overjet and molar relationship. Nucera et al. reported that functional orthopedic appliances produced a slight narrowing of the maxilla without a significant change of its inclination (16). On the contrary, we noticed that neither BJA nor AA inhibited the sagittal and transverse maxillary growth during the observational period. According to Illing et al. (11) SNA did not change significantly between T0 and T1 (P=0.056). The relationship between the significant increase in maxillary length and the slight increase in SNA angle was explained by the fact that BJA determined the growth of the maxilla by rotating it backward. In fact, U1\_SN decreased from T0 to T1 (D U1\_SN: -4.97 $\pm$ 5.23 $^{\circ}$ ; P=0.015). Since no dental variations were observed, we can state that the maxillary growth direction was slightly directed downward and backward. Regarding the mandible, there was a significant increase in the mandibular base position after BJA and AA treatments (BJA D Pg/OLp: 7.40 $\pm$ 3.81 mm, P<0.001 vs AA D Pg/OLp: 7.82 $\pm$ 9.95 mm, P<0.001). The total mandibular

length increase (D Co-Gn: 9.21 $\pm$ 8.57 mm; P=0.008) was very similar to that recorded by Giuntini et al. (17) in subjects treated with Twin-Block (TB) during the growth peak (9.4 $\pm$ 3.1 mm; P<0.001). We noticed similar Co-Gn increase between BJA (9.21 $\pm$ 8.57 mm) and AA groups (10.06 $\pm$ 5.35 mm): these increments were greater than those reported by Tulloch et al. (3.69 $\pm$ 1.47 mm; P<0.001) (18). Sagittal mandibular length (Pg/OLp+Co/OLp) showed a mean increase of 8.92 $\pm$ 8.67 mm (P<0.001). We can state that BJA significantly influenced the mandibular growth more than TB (5.30 $\pm$ 3.60 mm) in the study of Baysal et Uysal (19). This is attributable to the BJA prongs which maintain the mandibular protrusion both day and night (20-26). In fact, it is important that the patients wear the appliance especially during the sleep because there is an increased bone turnover overnight (27-33). Although less marked than in Martina et al. (5), the increase in basal bone was significant as it represented 93.9% of the molar relationship correction. ANB decreased of -1.66 $\pm$ 1.33 $^{\circ}$  (P=0.003). According to Schaefer (34) and Baysal (19), the functional orthopedic treatment with removable appliances leads to a significantly greater increase in the anterior repositioning of the mandible than using fixed appliances. Condylar head position did not change (-0.05 $\pm$ 2.82 mm, P=0.956) during treatment with BJA: the mandible was not anteropositioned and the correction of Class II malocclusion occurred mainly thanks to an increase in mandibular length. Therefore, molar relationship correction was more skeletal than dental. Vertical skeletal variables did not change significantly in BJA group. This was probably related to the prongs of BJA, which prevented the clockwise rotation of the jaws (5). The overjet reduction was 4.27 $\pm$ 2.05 mm (P<0.001) in BJA group: this result was superimposable to the correction occurred in AA group (4.95 $\pm$ 1.96 mm; P<0.001). The dental correction of overjet (given by the retroclination of the upper incisors and the proclination of the lower incisors) represented only 6.1% of the total correction, indicating a significant skeletal growth of the mandible. The slight increase of is/OLp-A/OLp (0.10 $\pm$ 2.62 mm) and ii/OLp-Pg/OLp (0.16 $\pm$ 1.77 mm) indicated that displacement of the maxillary and mandibular incisors was not significant (P=0.621 and P=0.364). Molar relationship correction was significant between T0 and T1 (4.95 $\pm$ 1.96 mm, P<0.001). The distalization of the maxillary

first molar was moderate ( $1.30 \pm 2.79$  mm;  $P=0.164$ ) and the mesialization of the mandibular first molar was mild ( $0.57 \pm 3.21$ ;  $P=0.787$ ): this indicated that the dental molar relationship correction was 37.8%, whereas the skeletal one was 62.2% in BJA group. Therefore, Class I occlusion was obtained thanks to an effective increase in mandibular length. IMPA was  $3.44 \pm 5.82^\circ$  ( $P=0.094$ ). Several Authors (35-50) reported statistically significant differences regarding the proclination of the lower incisors by comparing the group with removable functional orthopedic appliances to a control group. In our study we did not find this significant proclination; this could be due to the acrylic coverage of the lower anterior teeth (5). BJA treatment determined a Class I occlusion in all patients. The correction of molar relationship was mainly due to the increase in mandibular length rather than to the distalization of the maxillary first molars and the mesialization of the mandibular ones; the correction of the overjet was due to the increase in mandibular length, to the slight proclination of the lower incisors and the mild retroinclination of the upper incisors. BJA did not determine a significant clockwise rotation of the jaws with effects on the divergence. No significant differences were found in effectiveness between BJA and AA.

## REFERENCES

- Perillo L, Masucci C, Ferro F, Apicella D, Baccetti T. Prevalence of orthodontic treatment need in southern Italian schoolchildren. *Eur J Orthod* 2010; 32(1):49-53.
- McNamara Jr JA, Hinton RJ, Hoffman DL. Histologic analysis of temporomandibular joint adaptation to protrusive function in young adult rhesus monkeys (Macaca mulatta). *Am J Orthod* 1982; 82:288-98.
- Proff P, Gedrange T, Franke R, Schubert H, Fanghänel J, Miede B, Harzer W. Histological and histomorphometric investigation of the condilar cartilage of juvenile pigs after anterior mandibular displacement. *Ann Anat* 2007; 189:269-75.
- Cozza P, Baccetti T, Franchi L, De Toffol L, McNamara Jr JA. Mandibular changes produced by functional appliances in class II malocclusion: a systematic review. *Am J Orthod Dentofacial Orthop* 2006; 129:599.e1-599.e12.
- Martina R, Cioffi I, Galeotti A, et al. Efficacy of the Sander bite-jumping appliance in growing patients with mandibular retrusion: a randomized controlled trial. *Orthod Craniofac Res* 2013; 16(2):116-26.
- Perinetti G, Primožič J, Franchi L, Contardo L. Treatment Effects of Removable Functional Appliances in Pre-Pubertal and Pubertal Class II Patients: A Systematic Review and Meta-Analysis of Controlled Studies. *PLoS One* 2015; 10(10):e0141198.
- Faccioni P, De Santis D, Luciano U, et al. Efficacy of the Andresen activator before peak growth in class II patients. *J Biol Regul Homeost Agents* 2019; 33(S1):1-7.
- Baccetti T, Franchi L, McNamara Jr JA. The cervical vertebral maturation (CVM) method for the assessment of optimal treatment timing in dentofacial orthopedics. *Semin Orthod* 2005; 11:119-29.
- De Santis D, Sinigaglia S, Faccioni P, et al. Syndromes associated with dental agenesis. *Minerva Stomatol* 2019; 68(1):42-56.
- Martina R, D'Antò V, Chiodini P, et al. Reproducibility of the assessment of the Frankel manoeuvre for the evaluation of sagittal skeletal discrepancies in Class II individuals. *Eur J Orthod* 2016; 38(4):409-13.
- Illing HM, Morris DO, Lee RT. A prospective evaluation of Bass, Bionator and Twin-Block appliances. Part I-The hard tissues. *Eur J Orthod* 1998; 20(5):501-16.
- Faccioni P, De Santis D, Sinigaglia S, Pancera P, Faccioni F, Nocini PF. Short-term "in vivo" study on cellular DNA damage induced by acrylic Andresen activator in oral mucosa cells. *Orthod Craniofac Res* 2019; 22(3):208-12.
- Proffit WR, Sarver DM, Ackerman JL. Diagnosi ortodontica: approccio clinico ai problemi ortodontici. In *Ortodonzia moderna*. WR. Proffit, H.W. Fields, D.M. Sarver, ed. Edra Masson. Milano 2013; 192-202.
- Keeling SD, Wheeler TT, King GJ, et al. Anteroposterior skeletal and dental changes after early Class II treatment with bionators and headgear. *Am J Orthod Dentofacial Orthop* 1998; 113(1):40-50.
- O'Brien K, Wright J, Conboy F, et al. Effectiveness of early orthodontic treatment with the Twin-block appliance: a multicenter, randomized, controlled trial. Part 1: Dental and skeletal effects. *Am J Orthod Dentofacial Orthop* 2003; 124(3):234-43.
- Nucera R, Lo Giudice A, Rustico L, Matarese G, Papadopoulos MA, Cordasco G. Effectiveness of orthodontic treatment with functional appliances on maxillary growth in the short term: A systematic review and meta-analysis. *Am J Orthod Dentofacial Orthop* 2016; 149(5):600-11.
- Giuntini V, Vangelisti A, Masucci C, Defraia E, McNamara JA Jr, Franchi L. Treatment effects produced by the Twin-block appliance vs the Forsus Fatigue Resistant Device in growing Class II patients. *Angle Orthod* 2015; 85(5):784-9.
- Tulloch JF, Phillips C, Koch G, Proffit WR. The effect of early intervention on skeletal pattern in Class II malocclusion: a randomized clinical trial. *Am J Orthod Dentofacial Orthop* 1997; 111(4):391-400.
- Baysal A, Uysal T. Dentoskeletal effects of Twin Block and Herbst appliances in patients with Class II division 1 mandibular retrognathia. *Eur J Orthod* 2014; 36(2):164-72.
- Sander FG. Mouth opening and its influencing through the SII appliance during the night. *J Orofac Orthop* 2001; 62(2):133-45.
- De Santis D, Gelpi F, Castellani R, et al. Bi-layered collagen nano-structured membrane prototype collagen matrix CM-10826 for oral soft tissue regeneration: an in vivo ultrastructural study on 13 patients. *J Biol Regul Homeost Agents* 2019; 33(S1):29-41.
- Santis D, Menchini Fabris GB, Lotti J, et al. Bi-layered collagen nano-structured membrane prototype collagen matrix 10826® for soft tissue regeneration in rabbits: an in vivo ultra-structural study of the early healing phase. *J Biol Regul Homeost Agents* 2017; 31(S2):91-7.
- Nocini PF, Menchini Fabris GB, Gelpi F, et al. Treatment of skin defects with growth factors and biodegradable collagen carrier: histological evaluation in animal model. *J Biol Regul Homeost Agents* 2017; 31(S2):1-13.
- De Santis D, Cucchi A, Rigoni G, Longhi C, Nocini PF. Relationship Between Primary Stability and Crestal Bone Loss of Implants Placed with High Insertion Torque: A 3-Year Prospective Study. *Int J Oral Maxillofac Implants* 2016; 31(5):1126-34.
- De Santis D, Graziani P, Castellani R, et al. A New Radiologic Protocol and a New Occlusal Radiographic Index for Computer-Guided Implant Surgery. *J Craniofac Surg* 2016; 27(5):e506-10.
- Covani U, Marconcini S, Ferrini F, Gelpi F, Finotti M, Barone A, de Santis D. Post traumatic use of dental implants immediately after tooth extraction: clinical study. *J Craniofac Surg* 2014; 25(3):796-8.
- Yamada S, Saeki S, Takahashi I, Igarashi K, Shinoda H, Mitani H. Diurnal variation in the response of the mandible to orthopedic force. *J Dent Res* 2002; 81(10):711-5.
- Nocini PF, Castellani R, Zanotti G, Gelpi F, Covani U, Marconcini S, de Santis D. Extensive keratinized tissue augmentation during implant rehabilitation after Le Fort I osteotomy: using a new porcine collagen membrane (Mucoderm). *J Craniofac Surg* 2014; 25(3):799-803.
- Nocini PF, Castellani R, Zanotti G, Bertossi D, Luciano U, De Santis D. The use of computer-guided flapless dental implant surgery (NobelGuide) and immediate function to support a fixed full-arch prosthesis in fresh-frozen homologous patients with bone grafts. *J Craniofac Surg* 2013; 24(6):e551-8.
- De Santis D, Cucchi A, Rigoni G, Longhi C. Short implants with oxidized surface in posterior areas of atrophic jaws: 3- to 5-year results of a multicenter study. *Clin Implant Dent Relat Res* 2015; 17(3):442-52.
- Nocini PF, De Santis D, Morandini B, Procacci P. A dental implant in the infratemporal fossa: case report. *Int J Oral Maxillofac Implants* 2013; 28(4):e195-7.
- Nocini PF, Albanese M, Castellani R, Zanotti G, Canton L, Bissolotti G, De Santis D. Application of the "All-on-Four" concept and guided surgery in a mandible treated with a free vascularized fibula flap. *J Craniofac Surg* 2012; 23(6):e628-31.
- De Santis D, Cucchi A, de Gemmis A, Nocini PF. New collagen matrix to avoid the reduction of keratinized tissue during guided bone regeneration in postextraction sites. *J Craniofac Surg* 2012; 23(3):e186-9.
- Schaefer AT, McNamara JA Jr, Franchi L, Baccetti T. A cephalometric comparison of treatment with the Twin-block and stainless-steel crown Herbst appliances followed by fixed appliance therapy. *Am J Orthod Dentofacial Orthop* 2004; 126(1):7-15.
- Lund DI, Sandler PJ. The effects of Twin Blocks: a prospective controlled study. *Am J Orthod Dentofacial Orthop* 1998; 113(1):104-10.
- Tümer N, Gültan AS. Comparison of the effects of monoblock and twin-block appliances on the skeletal and dentoalveolar structures. *Am J Orthod Dentofacial Orthop* 1999; 116(4):460-8.



37. Nocini PF, Zanotti G, Castellani R, Grasso S, Cristofaro MG, De Santis D. Bi-layered collagen nano-structured membrane prototype (collagen matrix 10826(®)) for oral soft tissue regeneration: an "in vitro" study. *Clin Oral Implants Res* 2013; 24(6):612-7.
38. De Santis D, Trevisiol L, D'Agostino A, Cucchi A, De Gemmis A, Nocini PF. Guided bone regeneration with autogenous block grafts applied to Le Fort I osteotomy for treatment of severely resorbed maxillae: a 4- to 6-year prospective study. *Clin Oral Implants Res* 2012; 23(1):60-9.
39. De Santis D, Cucchi A, Longhi C, Vincenzo B. Short threaded implants with an oxidized surface to restore posterior teeth: 1- to 3-year results of a prospective study. *Int J Oral Maxillofac Implants* 2011; 26(2):393-403.
40. De Santis D, Malchiodi L, Cucchi A, Canton LC, Trevisiol L, Nocini PF. Computer-assisted surgery: double surgical guides for immediate loading of implants in maxillary postextractive sites. *J Craniofac Surg* 2010; 21(6):1781-5.
41. De Santis D, Canton LC, Cucchi A, Zanotti G, Pistoia E, Nocini PF. Computer-assisted surgery in the lower jaw: double surgical guide for immediately loaded implants in postextractive sites-technical notes and a case report. *J Oral Implantol* 2010; 36(1):61-8.
42. Bertossi D, Giampaoli G, Verner I, Pirayesh A, Nocini R, Nocini P. Complications and management after a nonsurgical rhinoplasty: A literature review. *Dermatol Ther* 2019; 32(4):e12978.
43. De Santis D, Sinigaglia S, Pancera P, et al. An overview of socket preservation. *Biol Regul Homeost Agents* 2019; 33:55-9.
44. De Santis D, Sinigaglia S, Pancera P, et al. An overview of guided bone regeneration. *J Biol Regul Homeost Agents* 2019; 33:49-53.
45. Gerszewski C, Topolski F, Correr GM, Gomes RAP, Morais ND, Moro A. Dentoalveolar Evaluation of Lower Incisors by CBCT after Treatment with Herbst Appliance. *Braz Dent J*. 2018; 29(6):562-8.
46. Robiony M, Lazzarotto A, Nocini R, Costa F, Sembronio S, Franz L. Piezosurgery: Ten Years' Experience of Percutaneous Osteotomies in Rhinoplasty. *J Oral Maxillofac Surg* 2019; 77(6):1237-44.
47. Zhurakivska K, Maiorano E, Nocini R, Mignogna MD, Favia G, Troiano G, Arena C, Caponio VCA, Lo Muzio L. Necrotizing sialometaplasia can hide the presence of salivary gland tumors: A case series. *Oral Dis* 2019; 25(4):1084-90.
48. Bertossi D, Nocini R, Luciano U, et al. Piezoelectric surgery inserts vs conventional bur: a clinical investigation. *J Biol Regul Homeost Agents* 2018; 32(2):15-19.
49. Bertossi D, Botti G, Gualdi A, Fundarà P, Nocini R, Pirayesh A, van der Lei B. Effectiveness, Longevity, and Complications of Facelift by Barbed Suture Insertion. *Aesthet Surg J* 2019; 39(3):241-7.
50. Toth LR, McNamara JA Jr. Treatment effects produced by the twin-block appliance and the FR-2 appliance of Fränkel compared with an untreated Class II sample. *Am J Orthod Dentofacial Orthop* 1999; 116(6):597-609.

## 11 Platelet rich plasma grafting technique combined with trans-sinus post-extractive implants placement in the posterior maxilla: a technical report and brief literature review

F. Gelpi<sup>1</sup>, D. De Santis<sup>1</sup>, U. Luciano<sup>1</sup>, A. Bertajola<sup>2</sup>, F. Bernardello<sup>2</sup>, T. Zambotti<sup>1</sup>, G. Causarano<sup>1</sup>, M. Zarantonello<sup>3</sup>, A. Iurlaro<sup>1</sup>, A. Poscolere<sup>1</sup>, N. Modena<sup>1</sup>, F. Zotti<sup>1</sup>, C. Alberti<sup>1</sup>, A. Zangani<sup>1</sup>, G. Capocasale<sup>1</sup>, D. Donadello<sup>1</sup>, P. Faccioni<sup>1</sup> and M. Finotti<sup>4</sup>

<sup>1</sup>Section of Oral and Maxillofacial Surgery, Department of Surgical Sciences, Dentistry, Gynecology and Pediatrics, University of Verona, Italy;

<sup>2</sup>Free practitioner in Verona, Italy; <sup>3</sup>Free practitioner in Rovigo, Italy; <sup>4</sup>Free practitioner in Padua, Italy

**The atrophic posterior ridges are usually characterized by poor bone quality and quantity: this situation requires the use of bone regenerative techniques. Other alternative surgical approaches are investigated. Nowadays the use of trans-sinus implants offers some advantages due to its feasibility. Today, bone grafting may be practical, but depends on many factors, such as the type of bone graft used (autogenous, alloplastic, or xenograft), host response, age of the patient, various complications associated with grafting procedures, infection, and, most importantly, the time spent while the grafted material matures and is taken up by the bone. So, this case report describes the feasibility of an alternative surgical technique associated to PRP (Platelet Rich Plasma).**

The atrophic posterior ridges are usually characterized by poor bone quality and quantity: this situation requires the use of bone regenerative techniques which range from very simple ones to more complex and investigative as osteo distraction (1) or free vascularized fibula flap (2). Other alternative surgical approaches are investigated such as PRP (Platelet Rich Plasma) combined with implants. Nowadays the use of tilted implants offers some advantages due to its feasibility. Today, bone grafting may be practical, but depends on many factors, such as the type of bone graft used (autogenous, alloplastic, or xenograft) (3), quality and quantity of keratinized tissue (4-6), host response, age of the patient, various complications associated with grafting procedures, infection (7-9), unusual clinical anatomy (10), rare condition (11-20) or and, most importantly, the time spent while the grafted material matures and is taken up by the bone. On the other hand all it needs for using PRP is a blood sample from the person who is undergoing the surgery; that means a higher and better compliance by patients, less procedures, less morbidity, shorter rehabilitation times and costs. Usually, an atrophic posterior area is characterized by poor bone quality and quantity: this situation requires the use of bone regenerative techniques using or not computer-support (21), such as sinus lifts or short implant insertion (22-23), or bone regeneration with vertical/horizontal crestal onlay grafts. (24-25) Today, bone grafting may be practical, but depends on many factors, such as the type of bone graft used (autogenous, alloplastic, or xenograft) (3), feature of keratinized tissue (4,6,26), inter arch space (27), host response, age of the patient, various complications associated with grafting procedures, infection (7), and, most importantly, the time spent while the grafted material matures and is taken up by the bone. One review revealed that there are few studies providing data on the success rates of dental implants placed in onlay graft augmented ridges and demonstrated, on average, poor methodological quality (28).

A reasonable method to bypass few issues previously mentioned is the PRP (Platelet Rich Plasma) that is an autologous high concentrate of human platelets enclosed in a small volume of plasma (approximately 60% of the same amount of blood) thanks to

the elimination of water, buffy coat made by leukocytes, erythrocytes and other low molecular weight substances (29). Within it, various growth factors are kept active (PDGFs, TGFbs, VEGF, EGF) as well as cellular adhesion proteins (fibrin, fibronectin and vitronectin) with osteoconductive activity (30). PRP consequently has the capacity to implement the normal processes of cell differentiation and replication, to stimulate neo angiogenesis, to product a greater quantity of collagen and therefore a greater neoformation of mature bone tissue and a better healing of wounds (31).

Moreover, the placement of an angulated implant, which avoids both invasive procedures (like a sinus lift) and bone augmentation procedures (32), may be a viable treatment option (33). However, some alternative techniques can also be used, such as implant placement in front of the sinus, or in the intra sinus septa, or palatal to the sinus. Thus, the same amount of bone may allow the insertion of two implants: one axial and another tilted to support a three-element prosthetic fixed unit without a cantilever (34-35). Here, we describe a case report of a maxillary immediate fixed rehabilitation, with axial and tilted transinusal implants supported in the fresh-post extractive sockets combined with PRP technique.

**MATERIAL AND METHODS:**

An 84-year-old woman was referred to our private clinic (Centro Medico Vesalio, V. Sorio, Padova, Italy) for rehabilitation of her upper left maxilla. Her medical history revealed only one previous episode of ischemia. Clinical observation revealed some caries-destroyed teeth and missing teeth in the upper left maxilla (Fig. 1-3).

Given this clinical situation, a minimally invasive implant surgery was suggested to the patient to avoid bone regenerative techniques,



Fig. 1. Frontal aspect of the caries destroyed teeth.



Fig. 2. Lateral and occlusal aspect of the caries destroyed teeth.

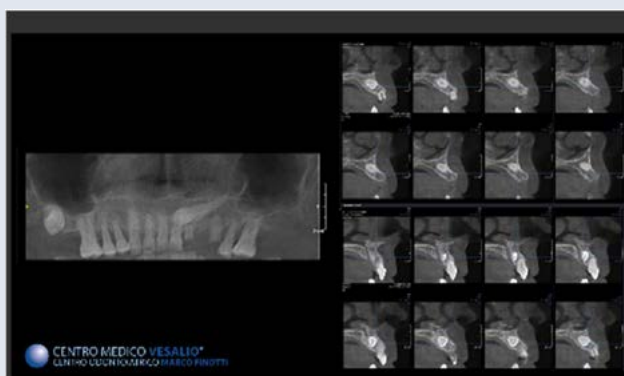


Fig. 3. First screen shot of the previous CBCT exam.



Fig. 4. Radiological check before implant placement: the multi corticalism of the drill can be appreciated.

such as a sinus lift (Fig. 4) Thus, tilted implant placement was planned to support an immediate fixed three-unit element prosthesis to restore her upper maxilla. Her treatment goals were to re-establish lost function and esthetics with a fixed prosthesis to minimize the period without teeth and to avoid removable prosthesis. The patient was carefully informed about the possible treatment options: sinus floor elevation with delayed implant placement and prosthetic restoration, or an immediate fixed prosthesis supported by one axial implant and one tilted posterior implant. The patient chose the second option and signed an informed consent form.

After local anesthesia had been administered, a mucoperiosteal flap was raised, exposing the facial bone of the left maxilla. After teeth extraction, starting from the area of the first molar, the implant site was prepared with a 30° mesial inclination passing in front of the sinus cavity and proceeding in the apical portion of the bone, anterior to the sinus (Fig. 5). A tilted implant was inserted (Win6 BioSaFin, Milan, Italy; 15 mm long and 3.8 mm in diameter). Another couple of Win6 BioSaFin fixture (15 mm long and 4.5 mm in diameter) was inserted axially in the socket of the canine and first premolar. Both implants reached a final insertion torque higher than 40 Ncm (Fig. 6).

Then, two 30° multi-unit abutments (MUA) were connected over the posterior and anterior implants (Fig. 7-9). All the grafted Bio-Oss (Geistlich Biomaterial), used to fill up the bone sockets, was subsequently covered by a reinforced membrane and the above mentioned PRP



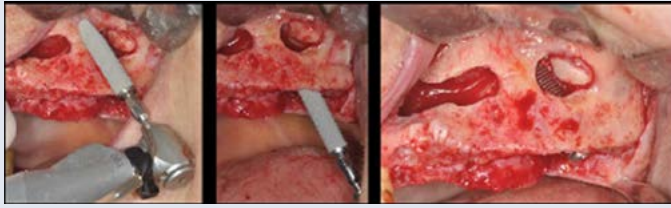


Fig. 5. Surgical orientation of the transinus tilted implant.



Fig. 6. The final phase of implants placement.

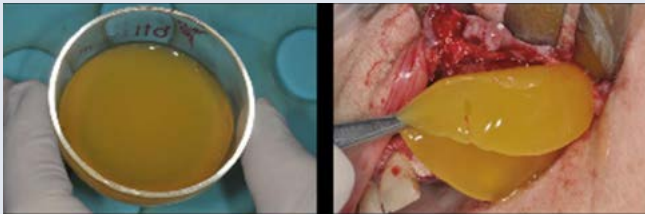


Fig. 6. The final phase of implants placement.

the tilted implants and 0.92 mm for the axial implants. Thus, it was concluded that this surgical approach was a valid and practical alternative to a sinus lift in the rehabilitation of the atrophic maxilla. Moreover, in 2005 Calandriello conducted a study of 18 patients, treated with 60 implants supporting fixed partial/total prostheses, and reported a 96.7% success rate (mixed) and bone resorption values of 0.82 mm for axial implants and 0.34 mm for tilted implants (38). No significant difference was found between axial and tilted



Fig. 7. The PRP graft placement.



Fig. 8. Lateral aspect after PRP grafting.



Fig. 9. Frontal and occlusal aspect of the interim screws retained prosthesis.

implants regarding the implant-related prevalence of peri-implant mucositis, peri-implantitis, or implant loss (39). Lekholm reported that a 14 mm distance between the canine bone and the distal implant allowed for rehabilitation of an atrophic maxilla with one axial and one tilted implant without a prosthetic cantilever (40).

graft (PRGF-Endoret Dental technique following the BTI System Protocol).

After the surgery, a three-unit composite resin interim prosthesis was relined with Combo Lign Bredent (Bz, Italy) and connected to two temporary abutments. Slight contacts in maximum intercuspation were registered and any lateral excursions were removed (Fig. 10-12).

#### RESULTS:

Here, we present a technique for the immediate fixed restoration of the posterior maxilla in an elderly patient requiring surgical treatment of reduced duration. Mattsson first reported the concept of tilted implants in oral surgery to support a full-arch fixed prosthesis in patients affected by severe maxillary atrophy (36). In 2001, Aparicio applied this concept to rehabilitation, through a fixed implant-supported prosthesis of the posterior maxilla as an alternative to a sinus lift (37). In total, 25 patients received 101 implants: 59 axial implants and 42 tilted implants. After 5 years of follow-up, the success rate was 95.2% for tilted implants and 91.3% for orthogonal implants.

The marginal bone loss was, on average, 1.21 mm for the tilted implants and 0.92 mm for the axial implants. The use of longer implants increases the bone-implant contact (BIC) in a low-quality bone region; moreover, it allows the cortical bone to be reached with increased primary stability (41) and, consequently, it is possible to install an immediate load fixed implant-supported prosthesis. In our case, we decided to use a tilted distal implant in the mesial-palatal direction to take advantage of the native bone. Thus, we used two 15-mm long fixtures to reach more cortical bone.

The tilted implant impacted against the mesial sinus cortical margin with its distal surface, such that 'bicorticalism' was achieved, thereby improving primary stability and permitting an immediate load (42). The only risk in this procedure depends

on the flexibility of the bone, which could be subjected to excessive stress due to the prosthetic components (43-47). The use of an immediate loaded full-arch prosthesis, supported by two mesial axial implants and two distal tilted implants, is a viable rehabilitation

option, considering the lower rate of peri-implant mucositis and peri-implantitis compared with that reported in the literature (39). Since their first use by Marx in 1998 PRP have been utilized in pre-prosthetic oral surgery for atrophic maxillae rehabilitation using axial and/or tilted implants in association with autologous bone grafting or alloplastic biomaterial (such as coral hydroxyapatite) (29,

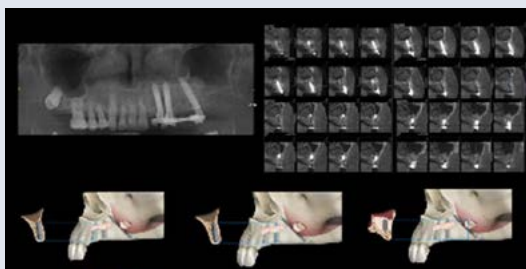


Fig. 10. Graphic representation of the planned treatment.



Fig. 11. Frontal aspect of final screws retained prosthetic restoration and the image of angled MUA.



Fig. 12. Occlusal and radiological aspect of the final screws retained prosthetic restoration.

offers several advantages:

- Stability even with minimum bone volume: longer implants can be used with minimum bone volume to increase BIC and reduce the requirement for vertical bone regeneration.
- Cortical anchorage may be achieved through longer fixtures (18, 20, 25-mm long).
- Good clinical results.
- Stimulation of neo angiogenesis, secretion of collagen, neoformation of mature bone tissue (31).
- Better healing of wounds (31).
- Avoids invasive bone regenerative techniques.
- Can be performed in patients with various systemic conditions that are often contraindications for bone grafting
- Angulations allow implant placements that avoid anatomical structures.
- There is a biomechanical advantage to using tilted distal implants rather than distal cantilever units (54).
- Reduction of the length of cantilevers without performing bone grafting or sinus lifting (55).
- Effective and safe alternative to maxillary sinus floor augmentation procedures and to a pneumatized maxillary sinus (33).
- Distally tilted implants induced better loading transmission than vertical implants (56).
- Excellent prognosis in the short-to-medium term as well as over the long term (57).
- Higher and better compliance by patients.
- Less procedures, less morbidity.
- Shorter rehabilitation times and costs.

However, the technique also has some disadvantages. First, it assumes that the surgeon has biomechanical knowledge and experience in the management of prosthetic immediate loading and is a higher sensitivity surgery. There are several other considerations that should be kept in mind when using this approach: the use of angulated implants should remain confined to situations of favorable bone quality (preferably greater than D3) and angulated implants should only be placed after suitable three-dimensional planning. Greater inclinations of the implants ( $>30^\circ$ ) lead to increased force at the implant-bone and implantabutment interfaces. Thus, extreme angulation should be avoided. We suggest an inclination between  $15^\circ$  and  $30^\circ$  (10). Cavallaro and Greenstein, after evaluating the proportion of survival and complications (biological and technical) associated with tilted abutment-supported prostheses showed

48) and with sinus lift elevation (29, 49-50). The greatest advantages of using PRP with coral hydroxyapatite are that the new bone formation processes are equivalent to those obtained with autologous bone grafting (golden standard) (29, 51).

A systematic review of literature has been published recently focused on RCT and CCT studies using PRP in all fields connected to implant dentistry including sinus floor augmentation, socket preservation, ridge augmentation or peri-implantitis.

The aim was to evaluate the current knowledge with respect to the clinical indications of PRP on soft tissue healing and bone regeneration with respect to implant placement (52). PRP was found to provide a higher bone width, higher bone density, and less

marginal bone resorption at 9 and 12 months (53). With all the information listed above, the idea was born to experiment the utility of PRP in the insertion of axial and tilted transinusual implants. This technique

that increased abutment inclination creates a greater amount of tension on the prosthesis and the surrounding bone. However, the increased tension was not associated with any significant reduction in the longevity of the prosthesis. Moreover, it was not associated with any increase in the incidence of fixation screw loosening (58). A trigonometric ratio was developed to estimate the two-dimensional safe distance between a tilted implant and an adjacent vertical implant. The distance or length between the fixtures can be determined by multiplying the known length of each implant by a constant derived from the sine of the insertion angle. In edentulous maxillae, if the inter-implant distance is increased, the load distribution will be better (59-69).

Moreover, we used an internal hexagonal connection, which offers better force dissipation. The cortical preparation is also reduced due to abutment placement: this helps with the primary stability. In addition, the internal hexagonal connection may be more coronal, which could lead to a reduction in the micro leakage of bacteria (3,12,14-15,70-71). Prosthetically, the internal hexagonal connection has some procedural disadvantages, but it offers a better implant abutment seal, fewer prosthetic complications due to lower pin fixation stress and, finally, the possibility of a better prosthetic finalization of the abutment (16-20, 72-75). Last but not least we should underline that the production of PRP must be carried out by specialized and approved laboratories (76); and also it could be considered expensive using in private practice (quick estimates on web account for spending between 300 and 600 USD).

## DISCUSSION

The surgical approach described here is sensitive and useful in patients with atrophic ridges. Long-term studies are required to evaluate its success rate in terms of load distribution, marginal bone loss around the implant, and prosthesis survival, although currently many practitioners are treating patients with this technique. Generally, we can state that rehabilitation using tilted implants combined with PRP offers many advantages versus the use of bone grafts (onlays, sinus lift) and short implants. This type of surgery is faster, safer, more predictable, less expensive and invasive, and allows the application of an immediate load protocol when primary stability is achieved. This case report shows the feasibility of the technique in achieving clinical success, as well as surgeon and patient satisfaction.

## REFERENCES

- Bertelè G, Mercanti M, Stella F, Albanese M, De Santis D. Osteodistraction in the craniofacial region. *Minerva Stomatol* 2005; 54(4):179-98.
- Nocini PF, Albanese M, Castellani R, Zanotti G, Canton L, Bissolotti G, De Santis D. Application of the "All-on-Four" concept and guided surgery in a mandible treated with a free vascularized fibula flap. *J Craniofac Surg* 2012; 23(6):e628-31.
- De Santis D, Trevisiol L, D'Agostino A, Cucchi A, De Gemmis A, Nocini PF. Guided bone regeneration with autogenous block grafts applied to Le Fort I osteotomy for treatment of severely resorbed maxillae: a 4- to 6-year prospective study. *Clin Oral Implants Res* 2012; 23(1):60-9.
- De Santis D, Cucchi A, de Gemmis A, Nocini Pier F. New collagen matrix to avoid the reduction of keratinized tissue during guided bone regeneration in postextraction sites. *J Craniofac Surg* 2012; 23(3):e186-9.
- Bertossi D, Favero V, Albanese M, et al. Peripheral ameloblastoma of the upper gingiva; report of case and literature review. *J Clin Exp Dent* 2014; 1(6):2.
- Nocini PF, Castellani R, Zanotti G, Gelpi F, Covani U, Marconcini S, de Santis D. Extensive keratinized tissue augmentation during implant rehabilitation after Le Fort I osteotomy: using a new porcine collagen membrane (Mucoderm). *J Craniofac Surg* 2014; 25(3):799-803.
- Bertossi D, Barone A, Iurlaro A, Marconcini S, De Santis D, Finotti M, Procacci P. Odontogenic Orofacial Infections. *J Craniofac Surg* 2017; 28(1):197-202.
- Hammel JM, Fischel J. Dental Emergencies. *Emerg Med Clin North Am* 2019; 37(1):81-93.
- De Santis D, Pancera P, Luciano U, et al. Evaluation of bacterial flora composition on teeth and periodontal tissues in patients in treatment with rapid palatal expander. *J Biol Regul Homeost Agents* 2018; 32(S.2):31-36.
- Bertossi D, Procacci P, Aquilini SE, Bollero R, De Santis D, Nocini PF. An unusual case of third molar displaced into the infratemporal fossa. *Minerva Stomatol* 2013; 6:11.
- Galzignato P, Trevisiol L, D'itri L, et al. Aneurysmal bone cyst of the nasal bone: case report. *Minerva Stomatol* 2013; 62:65-70.
- Bertossi D, Giampaoli G, Verner I, Pirayesh A, Nocini R, Nocini P. Complications and management after a nonsurgical rhinoplasty: A literature review. *Dermatol Ther* 2019; 32(4):e12978.
- De Santis D, Sinigaglia S, Pancera P, et al. An overview of socket preservation. *J Biol Regul Homeost Agents* 2019; 33:55-59.
- De Santis D, Sinigaglia S, Pancera P, et al. An overview of guided bone regeneration. *J Biol Regul Homeost Agents* 2019; 33:49-53.
- Fenerty S, Shaw W, Verma R, Syed AB, Kuklani R, Yang J, Ali S. Florid cemento-osseous dysplasia: review of an uncommon fibro-osseous lesion of the jaw with important clinical implications. *Skeletal Radiol* 2017;46(5):581-90.
- Robiony M, Lazzarotto A, Nocini R, Costa F, Sembronio S, Franz L. Piezosurgery: Ten Years' Experience of Percutaneous Osteotomies in Rhinoplasty. *J Oral Maxillofac Surg* 2019; 77(6):1237-44.
- Zhurakivska K, Maiorano E, Nocini R, et al. Necrotizing sialometaplasia can hide the presence of salivary gland tumors: A case series. *Oral Dis* 2019; 25(4):1084-90.
- Bertossi D, Nocini R, Luciano U, et al. Piezoelectric surgery inserts vs conventional burst: a clinical investigation. *J Biol Regul Homeost Agents* 2018; 32(2):15-19.
- Bertossi D, Botti G, Gualdi A, Fundarà P, Nocini R, Pirayesh A, van der Lei B. Effectiveness, Longevity, and Complications of Facelift by Barbed Suture Insertion. *Aesthet Surg J* 2019; 39(3):241-7.
- Bertossi D, Farronato G, Picozzi V, et al. Treatment of multiple ankylosed teeth using a piezoelectric device. *J Clin Orthod* 2013; 47(11):656-60.
- De Santis D, Malchiodi L, Cucchi A, Canton LC, Trevisiol L, Nocini PF. Computer-assisted surgery: double surgical guides for immediate loading of implants in maxillary postextractive sites. *J Craniofac Surg* 2010; 21(6):1781-5.
- De Santis D, Cucchi A, Rigoni G, Longhi C. Short implants with oxidized surface in posterior areas of atrophic jaws: 3- to 5-year results of a multicenter study. *Clin Implant Dent Relat Res* 2015; 17(3):442-52.
- Cruz RS, Lemos CAA, Batista VES, Oliveira HFFE, Gomes JML, Pellizzer EP, Verri FR. Short implants versus longer implants with maxillary sinus lift. A systematic review and meta-analysis. *Braz Oral Res* 2018; 32:e86.
- Aloy-Prósper A, Peñarrocha-Oltra D, Peñarrocha- Diago M, Peñarrocha-Diago M. The outcome of intraoral onlay block bone grafts on alveolar ridge augmentations: a systematic review. *Med Oral Patol Oral Cir Bucal* 2015; 20(2):e251-8.
- Bertossi D, Lucchese A, Albanese M, et al. Piezosurgery versus conventional osteotomy in orthognathic surgery: A paradigm shift in treatment. *J Craniofac Surg* 2013; 24(5):1763-6.
- De Santis D, Gerosa R, Graziani PF, et al. Lingual frenectomy: a comparison between the conventional surgical and laser procedure. *Minerva Stomatol* 2013; 62:45-53.
- De Santis D, Graziani P, Castellani R, et al. A New Radiologic Protocol and a New Occlusal Radiographic Index for Computer-Guided Implant Surgery. *J Craniofac Surg* 2016; 27(5):e506-10.
- Clementini M, Morlupi A, Agrestini C, Ottria L. Success rate of dental implants inserted in autologous bone graft regenerated areas: a systematic review. *Oral Implantol* 2011; 4(3-4): 3-10.
- Nocini PF, Chiarini L, De Santis. *Trattato di chirurgia pre-protetica e ingegneria tissutale*. PF Nocini, ed. Martina. Bologna 2005; 323-30.
- Marx RE. Platelet Rich Plasma: evidence to support its use. *J Oral Maxillofac Surg* 2004; 62:489-496.



31. Kasperk CH, ergedal JE, Mohan S, Long DL, Lau KH, Baylink DJ. Interactions of growth factors present in bone matrix with bone cells: effect on DNA synthesis and alkaline phosphatase. *Growth Factors* 1990; 3(2):147-58.
32. Bertossi D, Albanese M, Turra M, Favero V, Nocini PF, Lucchese A. Combined rhinoplasty and genioplasty: Long-term follow-up. *JAMA Facial Plast Surg* 2013; 15(3):192-7.
33. Lim TJ, Csillag A, Irinakis T, Nokiani A, Wiebe CB. Intentional Angulation of an Implant to Avoid a Pneumatized Maxillary Sinus: A Case Report. *J Can Dent Assoc* 2004; 70(3):164-68.
34. Agliardi EL, Romeo D, Wenger A, Gastaldi G, Gherlone E. Immediate rehabilitation of the posterior maxilla with extensive sinus pneumatization with one axial and one trans-sinus tilted implant: a 3 year clinical report and a classification. *J Prosthet Dent* 2015; 113(3):163-8.
35. Balshi TJ, Wolfinger GJ, Balshi SF. 2nd Analysis of 356 pterygomaxillary implants in edentulous arches for fixed prosthesis anchorage. *Int J maxillo Implants* 1992; 14:398-406.
36. Mattsson T, Köndell PA, Gynther GW, Fredholm U, Bolin A. Implant treatment without bone grafting in severely resorbed edentulous maxillae. *J Oral Maxillofac Surg* 1999; 57(3):281-7.
37. Aparicio C, Perales P, Rangert B. Tilted implants as an alternative to maxillary sinus grafting: A clinical, radiologic, and periosteal study. *Clinical Implant Dentistry and Related Research* 2001; 3(1):39-49.
38. Calandriello R, Tomatis M. Simplified treatment of the atrophic posterior maxilla via immediate/early function and tilted implants: A prospective 1-year clinical study. *Clin Implant Dent Relat Res* 2005; 7:51-12.
39. Cavalli N, Corbella S, Taschieri S, Francetti L. Prevalence of Peri-Implant Mucositis and Peri-Implantitis in Patients Treated with a Combination of Axial and Tilted Implants Supporting a Complete Fixed Denture. *Scientific World Journal* 2015; 5:1-8.
40. Lekholm U. The surgical site. In Lindhe J, Karring T, Lang NP, editors. *Clinical periodontology and implant dentistry*, 4th ed. Copenhagen Blackwell Munksgaard 2003; 856.
41. De Santis D, Cucchi A, Rigoni G, Longhi C, Nocini PF. Relationship between primary stability and crestal bone loss of implants placed with high insertion torque: A 3-Year Prospective Study. *Int J Oral Maxillofac Implants* 2016; 31(5):1126-34.
42. Barone A, Toti P, Bertossi D, et al. Gene expression of human mesenchymal stem cells cultured on titanium dental implant surfaces. *J Craniofac Surg* 2016; 27(3):712-7.
43. Pozzi A, Sannino G, Barlattani A. Minimally invasive treatment of the atrophic posterior maxilla: a proof-of-concept prospective study with a follow-up of between 36 and 54 months. *J Prosthet Dent* 2012; 108(5):286-97.
44. Fortin Y, Sullivan RM, Rangert BR. The Marius implant bridge: surgical and prosthetic rehabilitation for the completely edentulous upper jaw with moderate to severe resorption: a 5-year retrospective clinical study. *Clin Implant Dent Relat Res* 2002; 4(2):69-77.
45. Widmann G, Bale RJ. Accuracy in computer-aided implant surgery: a review. *Int J Oral Maxillofac Implants* 2006; 21(2):305-1.
46. De Santis D, Malchiodi L, Cucchi A, Canton LC, Trevisiol L, Nocini PF. Computer-assisted surgery: double surgical guides for immediate loading of implants in maxillary postextractive sites. *J Craniofac Surg* 2010; 21(6):1781-5.
47. De Santis D, Canton LC, Cucchi A, Zanotti G, Pistoia E, Nocini PF. Computer-assisted surgery in the lower jaw: double surgical guide for immediately loaded implants in postextractive sites-technical notes and a case report. *J Oral Implantol* 2010; 36(1):61-8.
48. Nocini PF, De Santis D. Nuove prospettive in impianto-protesi e in chirurgia rigenerativa. *ed.Qe. Milano* 2010; 235-43
49. Lemos CA, Mello CC, dos Santo DM, Verri FR, Goiato MC, Pellizzer EP. Effects of platelet rich plasma in association with bone grafts in maxillary sinus augmentation: A systematic review and meta-analysis. *International Journal of Oral and Maxillofacial Surgery* 2016; 45(4):517-25.
50. Pocater A, Caruso S, Bernardi S, Scagnoli L, Continenza MA, Gatto R. Effectiveness of platelet rich plasma as an adjunctive material to bone graft: A systematic review and meta-analysis of randomized controlled clinical trials. *International Journal of Oral and Maxillofacial Surgery* 2016; 45(8):1027-34.
51. Tong DC, Rioux K, Drangsholt M, Beirne OR. A review of survival rates for implants in placed in grafted maxillary sinuses using meta-analysis. *Int J Oral Maxillofac Implants* 1998; 13:175-182.
52. Stahl A, Strauss FJ, Gruber R. The use of platelet-rich plasma to enhance the outcomes of implant therapy: A systematic review. *Clin Oral Implants Research* 2018; 29(18):20-36.
53. ArRejaie A, Al Harbi F, Alagl AS, Hassan KS. Platelet rich plasma gel combined with bovine derived xenograft for the treatment of dehiscence around immediately placed conventionally loaded dental implants in humans: Cone beam computed tomography and three-dimensional image evaluation. *International Journal of Oral and Maxillofacial Implants* 2016; 31(2):431-8.
54. Zampelis A, Rangert B, Heijl L. Tilting of splinted implants for improved prosthodontic support: A two-dimensional finite element analysis. *J Prosthet Dent* 2007; 97(6):S35-43.
55. Iglesia MA. Anteriorly tilted implants in maxillary tuberosity: Avoiding the maxillary sinus. *CPOI* 2012; 3(1):6-16.
56. Baggi L, Pastore S, Di Girolamo M, Vairo G. Implant-bone load transfer mechanisms in complete arch prostheses supported by four implants: A three-dimensional finite element approach. *J Prosthet Dent* 2013; 109(1):9-21.
57. Rosen A, Gynther G. Implant treatment without bone grafting in edentulous severely resorbed maxillae: A long-term follow-up study. *Journal of Oral and Maxillofacial Surgery* 2007; 65(5):1010-6.
58. Cavallaro J Jr, Greenstein G. Angled implant abutments: A practical application of available knowledge. *J Am Dent Assoc* 2011; 142(2):150-8.
59. Geramipناه F, Sadighpour L. Estimation of the safe distance between the implant and an adjacent tilted implant using trigonometry. *Journal of Oral Implantology* 2012; 38(3):289-90.
60. Wentaschek S, Lehmann K, Behneke N, Scheller H. Changes of the polygonal area of prosthesis support by tilted implants. Poster presented at: Aesthetic regeneration versus functional rehabilitation – Is there a contradiction? SKY Meeting 2012; Munich, Germany.
61. De Santis D, Trevisiol L, Cucchi A, Canton LC, Nocini PF. Zygomatic and maxillary implants inserted by means of computer-assisted surgery in a patient with a cleft palate. *J Craniofac Surg* 2010; 21(3):858-62.
62. Nocini PF, Castellani R, Zanotti G, Bertossi D, Luciano U, De Santis D. The use of computer-guided flapless dental implant surgery (NobelGuide) and immediate function to support a fixed full-arch prosthesis in fresh-frozen homologous patients with bone grafts. *J Craniofac Surg* 2013; 24(6):551-8.
63. Nocini PF, Zanotti G, Castellani R, Grasso S, Cristofaro MG, De Santis D. Bi-layered collagen nano-structured membrane prototype (collagen matrix 10826®) for oral soft tissue regeneration: an "in vitro" study. *Clin Oral Implants Res* 2013; 24(6):612-17.
64. Di Alberti L, Tamborino F, Lo Muzio L, et al. Calcium sulfate barrier for regeneration of human bone defects. 3 years randomized controlled study. *Minerva Stomatol* 2013; 6:11.
65. De Santis D, Gelpi F, Castellani R, et al. Bi-layered collagen nano-structured membrane prototype collagen matrix CM-10826 for oral soft tissue regeneration: an in vivo ultrastructural study on 13 patients. *J Biol Regul Homeost Agents* 2019; 33(5.1):29-41.
66. Nocini PF, Menchini Fabris GB, Gelpi F, et al. Treatment of skin defects with growth factors and biodegradable collagen carrier: histological evaluation in animal model. *J Biol Regul Homeost Agents* 2017; 31(5.2):1-13.
67. De Santis D, Menchini Fabris GB, Lotti J, et al. Bi-layered collagen nano-structured membrane prototype collagen matrix 10826® for soft tissue regeneration in rabbits: an in vivo ultra-structural study of the early healing phase. *J Biol Regul Homeost Agents* 2017; 31(5.2):91-97.
68. Khatami AH, Smith CR. "All-on-Four" immediate function concept and clinical report of treatment of an edentulous mandible with a fixed complete denture and milled titanium framework. *J Prosthodont* 2008; 17(1):47-51.
69. Di Alberti L, Di Alberti C, Donini F, et al. Clinical and mechanical evaluation of screw-retained implant-supported zirconia restorations. A 36 months prospective clinical study. *Minerva Stomatol* 2013; 6:11.
70. De Santis D, Pancera P, Luciano U, et al. Short-term in vivo evaluation of cellular DNA damage induced by fixed orthodontic appliances. *J Biol Regul Homeost Agents*. 2018; 32(25.2):75-80.
71. Lucchese A, Gherlone E, Portelli M and Bertossi D. Tooth orthodontic movement after maxillofacial surgery. *Eur J Inflamm* 2012; 10(2):227-31.
72. Zotti F, Albanese M, Rodella LF, Nocini PF. Platelet rich plasma treatment of temporomandibular joint dysfunctions: narrative review. *Int J Mol Sci* 2019; 20(2):277.
73. Borsani E, Bonazza V, Buffoli B, et al. Beneficial Effects of Concentrated Growth Factors and Resveratrol on Human Osteoblasts In Vitro Treated with Bisphosphonates. *Biomed Res Int* 2018.
74. Bertossi D, Robiony M, Lazzarotto A, Giampaoli G, Nocini R, Nocini PF. Nonsurgical redefinition of the chin and jawline of younger adults with a hyaluronic acid filler: results evaluated with a grid system Approach. *Aesthet Surg J* 2020.
75. Marconcini S, Giammarinaro E, Covani U, Mijiritsky E, Vela X, Rodriguez X. The effect of tapered abutments on marginal bone level: a retrospective cohort study. *J Clin Med* 2019; 8(9):1305.
76. Marconcini S, Giammarinaro E, Toti P, Alfonsi F, Covani U, Barone A. Longitudinal analysis in the effect of insertion torque on delayed single implants: a 3 years randomized clinical study. *Clin Implant Dent Relat Res* 2018; 20(3):322-32.

## 12 New trends in adjunctive treatment and diagnosis in Medication-related osteonecrosis of the jaw: A 10-year review

D. De Santis<sup>1</sup>, F. Gelpi<sup>1</sup>, U. Luciano<sup>1</sup>, M. Zarantonello<sup>2</sup>, A. Poscolere<sup>1</sup>, N. Modena<sup>1</sup>, P. Faccioni<sup>1</sup>, G. Causarano<sup>1</sup>, M. Finotti<sup>3</sup>, F. Zotti<sup>1</sup>, M. Magi<sup>1</sup>, A. Iurlaro<sup>1</sup>, P.F. Nocini<sup>1</sup>, C. Alberti<sup>1</sup>, A. Zangani<sup>1</sup>, G. Capocasale<sup>1</sup>, D. Donadello<sup>1</sup>, R. Nocini<sup>1</sup> and F. Bernardello<sup>4</sup>

<sup>1</sup>Section of Oral and Maxillofacial Surgery, Department of Surgical Sciences, Dentistry, Gynecology and Pediatrics, University of Verona, Italy;

<sup>2</sup>Free practitioner in Rovigo, Italy; <sup>3</sup>Free practitioner in Padua, Italy; <sup>4</sup>Free practitioner in Verona, Italy

**Medication-related osteonecrosis of the jaw (MRONJ) is a major disease under study for over the last twenty years. Different classifications have been proposed and many therapies for the different stages have been applied. The evolution of treatments lead to an increasingly conservative approach. Numerous adjuvant treatments have been proposed in the last decade. All these complementary treatments have been proposed mainly to resolve or reduce the painful stress, predominantly caused by bacterial infection, simplifying the wound healing process and improving patients' compliance. Nowadays "secondary" treatments, such as autologous platelet concentrates (APCs, more specifically PRP, PRGF or PRF), hyperbaric oxygen (HBO), Auto/tetracycline fluorescence-guided bone surgery (AF-GBS/TF-GBS), medical drugs like teriparatide or the combination between pentoxifylline and tocopherol, fluorodeoxyglucose positron emission tomography (FDG-PET), laser and/or low-laser therapy and ozone therapy are more or less well documented and known considering their clinical effectiveness. The aim of the present review is the evaluation of the quantity and quality of scientific studies concerning this specific topic.**

At the beginning of 19th century first scientific publications appeared concerning serious pathologies, named "possy jaw", involving the upper and lower maxillary bone structures in specialized workers in the extraction and/or processing phosphorus (miners and workers in factories used to manufacture matches) (1). Originally noted as early as 2002 (2) the condition was first described in detail in 2003 when Marx et al. (3) published the first paper in which this pathology became known internationally and will be called Osteonecrosis of the Jaw (ONJ). A few years later it highlighted a very high incidence of this pathology (compared to the healthy population) in patients treated for various needs (e.g. osteoporosis, Paget disease, bone metastases, osteopetrosis, multiple myeloma) with bisphosphonates or undergo to radiation therapy. This correlation led scientific community to coin respectively the term Bisphosphonate-Related Osteonecrosis of the Jaws (BRONJ) and Osteo Radionecrosis of the Jaw (ORNJ). Furthermore, recent studies showed as other drugs categories (monoclonal antibody with anti-resorptive activity, anti-angiogenic drugs (anti-VEGF), tyrosin-Kinasi inhibitors, mTOR inhibitors) can cause the same disease, leading to a modification of the previous acronym in Medication-Related Osteonecrosis of the Jaws (MRONJ) by the American Association of Oral and Maxillofacial Surgeons (AAOMS) (4-5).

The MRONJ refers to a condition characterized by exposure of bone in the mandible or maxilla persisting for more than 8 weeks in a patient treated or in treatment with bisphosphonates with negative history of radiation therapy to the jaws (3-6). Diagnostic criteria for MRONJ were developed based on the pharmacological history as well as clinical and radiographic features (7). The MRONJ staging system, developed in 2006 by Ruggiero et al. and subsequently update in 2104 by AAOMS (4-5), is reported in Table I.

The classification in a specific stage cannot ignore an extreme accurate intra and extra oral clinical examination and an evaluation with radiographic supports (8); orthopantomography is the first level radiographic diagnostic support, followed by Computerized Tomography (CT) and Cone-Beam CT (CBCT); to obtain high-quality tomographic images, that exhibits a higher resolution in the alveolar bone and the jawbones (9); Magnetic Resonance Imaging (MRI) can be very useful (10-11). Recently the single-photon emission computed tomography (SPECT) has been used for localization of physiological changes in the bone and it appears to be sensitive but not specific (11).

In the assessment of osteoporosis' severity (and consequently the dosage, type and method of administration of the BPs), a quantitative haematic evaluation of two protein markers was introduced: P1NP (procollagen type 1 amino-terminal propeptide) and CTX (cross-linked C-telopeptide of type I collagen). These two parameters are measured before the start of therapy at time 0 and at 3 months, allowing to promptly verify the validity of the therapy and adherence to the treatment (12-13). Other widely used means in index calibration of osteoporosis and osteopenia's therapy with BPs are DEXA scan (dual energy x-ray absorptiometry) which yields to BMD (bone mineral density) values (14-16).

Although there are still no clear guidelines or a unique clinical protocol totally shared by the international scientific community, some operative strategies in osteonecrosis' case are worldwide shared by numerous clinicians. Summarizing in literature are reported: preferred conservative, endodontic maintenance therapies and extreme care of professional and home oral hygiene, avoiding traumatic interventions such as toilet or surgical curettage if possible, less extensive surgeries as possible, avoiding any traumatization for the surrounding structures, intra-operative disinfection with saline solution, accurate management of soft tissues without stress or tension, elimination of sharp edges, closure by first intention with eventual flap passivation, double-layer suture, use of mouthwash

and painkillers after surgeries, coverage or double antibiotic coverage variable from 10 days before to 7 days after, weekly follow up. In absence of anamnestic allergy, the first-choice antibiotics are clavulanate amoxicillin and metronidazole (4, 14, 17-23). Aim of the present literature review is the evaluation of the possible utility of adjunctive therapies in the treatment and diagnosis of MRONJ.

**Table I.** MRONJ staging system as updated by AAOMS in 2014.

Stage	Clinical findings
<i>At-risk category</i>	No apparent necrotic bone in patients who have been treated with either oral or IV bisphosphonates
<i>Stage 0</i>	No clinical evidence of necrotic bone, but non-specific clinical findings, radiographic changes, and symptoms
<i>Stage 1</i>	Exposed and necrotic bone, or fistulae that probes to the bone in patients who are asymptomatic and have no evidence of infection
<i>Stage 2</i>	Exposed and necrotic bone, or fistulae that probes to the bone, associated with infection as evidenced by pain and erythema in the region of the exposed bone, with or without purulent drainage
<i>Stage 3</i>	Exposed and necrotic bone or a fistula that probes to bone in patients with pain, infection, and one or more of the following: exposed and necrotic bone extending beyond the region of alveolar bone (i.e., inferior border and ramus in the mandible, maxillary sinus, and zygoma in the maxilla) resulting in pathologic fracture, extraoral fistula, oral-antral/oral-nasal communication or osteolysis extending to the inferior border of the mandible of sinus floor

## MATERIALS AND METHODS

This review study followed the PRISMA statement guidelines (24) and was conducted to analyze all publications related to adjunctive treatments on MRONJ therapy. Focused questions: what are today's additional treatments in the therapy of MRONJ? How many and what types of studies have been conducted on these treatments in the past 10 years? In the light of these data, could a first assessment be made of how much they are known and used in clinical practice by the scientific community?

Information sources: an electronic research was performed through MEDLINE (PubMed) databases. In addition, in order to further increase the number of eligible articles and not to skip potentially relevant publications, an analysis of the reference list of the main literature reviews and studies performed on the topic of interest was carried out. Search strategy: the electronic search was conducted by three independent examiners to minimize reviewer biases, applying the following filters: human studies, date of publication starting 01/01/2010 up to the time of the search (April 2020), and articles exclusively published in English. The first search strategy made use of the following terms: "adjunctive treatment MRONJ" or "adjunctive therapy MRONJ" or "adjunctive treatment ONJ" or "adjunctive therapy ONJ" or "adjunctive treatment BRONJ" or "adjunctive therapy BRONJ".

The first screening directly made on PubMed identified 75 papers, 54 on humans, 53 written in English, 48 published from 1st January 2020, 24 removing the duplicates and by a cross-checking in the different categories (in order to eliminate further duplications) the final result was 20 eligible papers (see Table II).

After removing duplicate and checking their pertinence, the total of evaluable publications was 18 (25-42). All the papers were analyzed by reading the abstract or, if it was not clear or incomplete, the full text. Nine complementary/additional treatments to usual therapy in osteonecrosis of the jaws were identified (see Table III). The adjunctive treatments are:

- APCs (Autologous Platelet Concentrates or hemoderivates, i.e. PRP, PRGF or PRF).
- HBO (Hyperbaric Oxygen).
- AF-GBS/TF-GBS (Auto/Fluorescence-guided bone surgery; Tetracycline/Fluorescence-guided bone surgery).
- Antimicrobial photodynamic therapy.
- Teriparatide.
- FDG-PET (Fluorodeoxyglucose Positron Emission Tomography).
- Pentoxifylline/Tocopherol.
- Laser and/or low-laser therapy.
- Ozone (O<sub>3</sub>).

The second step in screening was performed by searching for all 9 correlation items, as previously searched, with the terms "treatment", "MRONJ", "ONJ" and "BRONJ" (Table IV). For a better research about the term "APCs" it has been further divided into 3 subgroups (PRF, PRP and PRGF) (Table V).

### Eligibility criteria

The following inclusion and exclusion criteria were applied to carry out the study selection. Inclusion criteria:

- All kind of publication: Randomized-controlled clinical trials (RCT), Clinical trials (CT); Review (R); Longitudinal study (LS); Retrospective study (RS); Pilot study (PS); Case series (CS) and Case report (CR).
- “in vivo” studies, on humans.
- Date of publications from 01.01.2010.
- Original language English.
- Close relevance to MRONJ therapy (this point was discussed by examiners and accepted only if all 3-examiner agreed).
- Exclusion criteria:
  - “In vitro” studies.
  - Animal studies.
  - Retrospective studies, case reports, case series, and systematic reviews.
  - Date of publication before 01.01.2010.
  - All original language, not in English.

Categories*	n° articles	on human	in English	from 1.1.2010	Total sectorial papers**	Total eligible papers
Atr MRONJ	10	6	6	6	6	20
Ath MRONJ	10	6	6	6		
Atr ONJ	10	8	8	5	5	
Ath ONJ	9	6	5	5		
Atr BRONJ	18	14	14	13	13	
Ath BRONJ	18	14	14	13		

Atr= Adjunctive Treatment; Ath= Adjunctive Therapy; MRONJ= Medicament-Related Osteonecrosis of the Jaw; ONJ= Osteonecrosis of the Jaw; BRONJ= Bisphosphonate-Related Osteonecrosis of the Jaw.

Study selection: titles deriving from the research previously highlighted have been reviewed (identification) by three examiners. In case of disagreement, the three reviewers discussed each case jointly, to get to a final decision concerning inclusion or exclusion. The potentially useful articles through the analysis of the title were only then selected for a deeper investigation by firstly reading the abstract. In the examination of abstract (screening), attention was paid to assess the

compliance of the study with the inclusion criteria. The selected studies were downloaded in digital or paper version and submitted to the reading of the full text (eligibility). With this procedure only articles that conformed to the aforementioned criteria were included (included).

The data extraction was performed filling in a table (see Table V) with complementary treatments' name, typology of the study (RCT, CT, R, LS, RS, PS, CS, CR), total number of publication, number of discarded publication (not closely inherent for the purpose of the current study), total useful number of publication. Quality assessment. The following parameters were adopted for the evaluation of risk of bias: random sequence generation and allocation concealment (selection bias), blinding of participants and personnel (performance bias), blinding of outcome assessment (detection bias), incomplete outcome data (attrition bias), selective reporting (reporting bias), and other possible reasons for bias. Once these articles have been selected, they were further checked according to the same inclusion and exclusion criteria motioned above.

## RESULTS

All results are summarized in Table VI and Fig. 3. First of all, in Fig. 1 the observation on how the number of articles concerning the 8 additional treatments under consideration in decreasing order are: laser therapy (twenty-three), teriparatide (twenty two), APCs (twenty), hyperbaric oxygen therapy (thirteen), ozone therapy (twelve), use of pentoxicylline/tocopherol (five), AF-GBS/TF-GBS (four) and FDG-PET (three). This data has the function of understanding passively through publications number whether a treatment has been taken into general scientific community consideration in order of its potential effectiveness.

From this point of view, data can be split into 4 different groups: the first one includes just the laser therapy which is better known and used than other additional treatment in MRONJ. The second one is made of teriparatide and APCs, the third one, progressively less utilized and mentioned in literature, are hyperbaric oxygen and ozone therapy. The last one, the fourth, highlights less known and used procedures to the current state of art in complementary therapy of MRONJ such as pentoxifylline/tocopherol medical drugs, whereas AF-GBS/TF-GBS is used as an aid in the pre-intra surgical phase and FDG-PET in diagnostic phase. Studies such as reviews and case reports (respectively 29 and 18) are more numerous than clinical trials, case series, retrospective studies, longitudinal studies, randomized clinical trials and pilot studies (respectively 9, 9, 7, 4, 2, 2) (Fig. 2).



## DISCUSSION

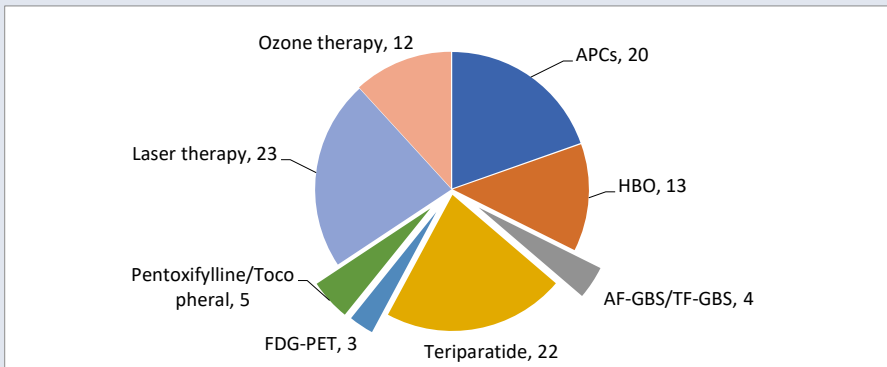
Despite progress in the prevention of BRONJ, a specific widely accepted and utilized treatment protocol to manage MRONJ is still missing, as the literature shows (43-48). Summarizing, the MRONJ treatments are referable to surgical and non-surgical treatments (49-60). In the past, surgical treatments were reserved only for advanced stages of BRONJ, but since 2012, the Italian Society of Oral and Maxillofacial Surgery (SICMF) and the Italian Society of Oral Pathology and Medicine (SIPMO) recommended conservative surgery in lesions belonging to stages 1 and 2. In this regard, from our study we evidenced as, in recent years, an attempt to increasingly adopt a “conservative” approach has been made. Most of the analyzed studies introduced the use of therapy defined as “additional” in association with surgery.

Specifically, additional therapy is referred to as non-invasive treatments, such as cycles of local or systemic antibacterial therapy combined or not, to low level laser therapy, ozone therapy (O<sub>3</sub>), HBO (Hyperbaric Oxygen therapy), the use of APCs APCs (Autologous Platelet Concentrates, such as PRP, PRGF or PRF), AF-GBS/TF-GBS (Auto/Fluorescence-guided bone surgery, Tetracycline/Fluorescence-guided bone surgery), Teriparatide, FDG-PET (Fluorodeoxyglucose Positron Emission Tomography) and the administration of

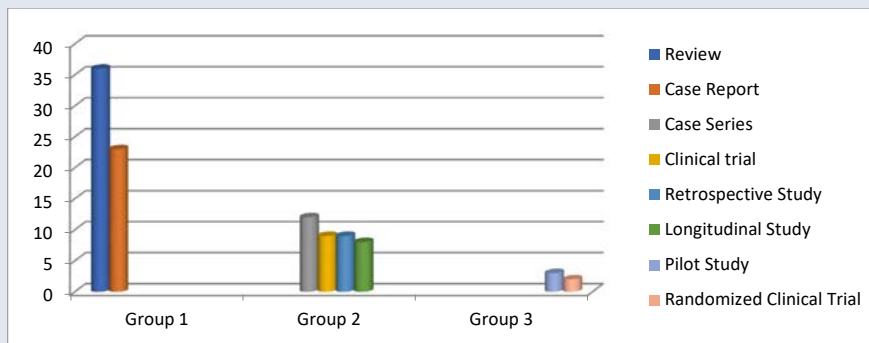
**Table III.** *Adjunctive treatments in relation of the selected paper.*

Authors	Paper's Title	Adjunctive treatments							
		1	2	3	4	5	6	7	8
Poli PP et al. (2019) (25)	Adjunctive application of antimicrobial photodynamic therapy in the prevention of medication-related osteonecrosis of the jaw following dentoalveolar surgery: A case series.								
Quaisi M et al. (2017) (26)	Bone Margin Analysis for Osteonecrosis and Osteomyelitis of the Jaws.								
Beth-Tasdogan NH et al. (2017) (27)	Interventions for managing medication-related osteonecrosis of the jaw.								
Jung J et al. (2017) (28)	Short-Term Teriparatide and Recombinant Human Bone Morphogenetic Protein-2 for Regenerative Approach to Medication-Related Osteonecrosis of the Jaw: A Preliminary Study.								
Fleisher KE et al. (2016) (29)	Does Fluorodeoxyglucose Positron Emission Tomography With Computed Tomography Facilitate Treatment of Medication-Related Osteonecrosis of the Jaw?								
Owosho AA et al. (2016) (30)	Pentoxifylline and tocopherol in the management of cancer patients with medication-related osteonecrosis of the jaw: an observational retrospective study of initial case series.								
Silva LF et al. (2016) (31)	Surgical management of bisphosphonate-related osteonecrosis of the jaws: literature review.								
Rollason V et al (2016) (32)	Interventions for treating bisphosphonate-related osteonecrosis of the jaw (BRONJ).								
Anitua E et al.(2016) (33)	PRGF exerts a cytoprotective role in zoledronic acid-treated oral cells.								
Goodday RH. (2015) (34)	Preventive Strategies for Patients at Risk of Medication-related Osteonecrosis of the Jaw.								
Fliefel R et al. (2015) (35)	Treatment strategies and outcomes of bisphosphonate-related osteonecrosis of the jaw (BRONJ) with characterization of patients: a systematic review.								
Del Fabbro M et al. (2015) (36)	Autologous platelet concentrates for bisphosphonate-related osteonecrosis of the jaw treatment and prevention. A systematic review of the literature.								
Altay MA et al. (2014) (37)	Low-level laser therapy supported surgical treatment of bisphosphonate related osteonecrosis of jaws: a retrospective analysis of 11 cases.								
Ohbayashi Y et al. (2013) (38)	Adjunct teriparatide therapy with monitoring of bone turnover markers and bone scintigraphy for bisphosphonate-related osteonecrosis of the jaw.								
Kwon YD et al. (2012) (39)	Short-term teriparatide therapy as an adjunctive modality for bisphosphonate-related osteonecrosis of the jaws.								
Freiberger JJ et al. (2012) (40)	What is the role of hyperbaric oxygen in the management of bisphosphonate-related osteonecrosis of the jaw: a randomized controlled trial of hyperbaric oxygen as an adjunct to surgery and antibiotics.								
Lee JJ et al. (2011) (41)	Successful treatment of advanced bisphosphonate-related osteonecrosis of the mandible with adjunctive teriparatide therapy.								
Kan B et al. (2011) (42)	Low-level laser therapy supported teeth extractions of two patients receiving IV zoledronate.								

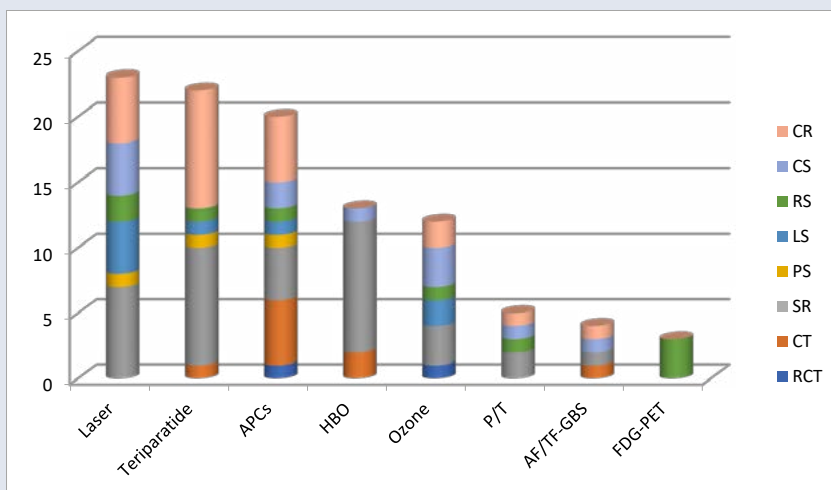
*LTh = Laser Therapy; T = Teriparatide; APCs = Autologous Platelet Concentrates or hemoderivates, i.e. PRP, PRGF or PRF; HBO = Hyperbaric Oxygen; O<sub>3</sub> = Ozone therapy; P/T = Pentoxifylline/Tocopherol; AF-GBS/TF-GBS = Auto/Fluorescence-guided bone surgery - Tetracycline/Fluorescence-guided bone surgery; FDG-PET = Fluorodeoxyglucose Positron Emission Tomography.*



**Fig. 1.** “Cake” graphic underlines which adjunctive individual category treatment are well known by scientific community (Laser therapy, APCs and Teriparatide) and which ones are less notorious (FDG-PET, AF-GBS/TF-GBS, use of Pentoxifylline/Tocopheral).



**Fig. 2.** Numerical distribution of publication by their typology. Group 1: high quantitative; Group 2: medium quantitative; Group 3: low quantitative.



**Fig. 3.** Results distribution obtained for the 8 adjunctive/complementary treatments for MRONJ therapy and relative quantification by typology of publications.

**Table IV.**

	RCT	CT	SR	PS	LS	RS	CS	CR	Total	Dis-card	Total useful
Laser and/or low-laser therapy	0	0	7	1	4	2	4	5	58	35	23
Teriparatide	0	1	9	1	1	1	0	9	23	1	22
APCs	1	5	4	1	1	1	2	5	21	1	20
HBO	0	2	10	0	0	0	1	0	14	1	13
Ozone therapy	1	0	3	0	2	1	3	2	13	1	12
Pentoxifylline/Tocopherol	0	0	2	0	0	1	1	1	6	1	5
AF-GBS/TF-GBS	0	1	1	0	0	0	1	1	4	0	4
FDG-PET	0	0	0	0	0	3	0	0	34	31	3
<b>Summary</b>	<b>2</b>	<b>9</b>	<b>36</b>	<b>3</b>	<b>8</b>	<b>9</b>	<b>12</b>	<b>23</b>	<b>173</b>	<b>71</b>	<b>102</b>

HBO=Hyperbaric Oxygen therapy; AF-GBS/TF-GBS=Auto/Fluorescence-guided bone surgery; Tetracycline/Fluorescence-guided bone surgery; PDG-ET=Fluorodeoxyglucose Positron Emission Tomography.

Pentoxifylline/Tocopherol. The present study evidence that the most cited additional treatment in the literature is represented by the laser therapy, followed by administration of Teriparatide. The reported clinical outcomes in BRONJ/ONJ/ MRONJ treatments with additional therapies have been shown promising if compared to conventional surgery alone. For example, Vescovi et al. highlighted as the use of laser devices in MRONJ surgery represents a valid therapeutic option and enables the minimally invasive treatment of the early stages of the disease (61). With limits of the eligible study number, the analysis showed how most of the authors pointed out how these additional therapies are not substitutes of existing procedures, but they might be considered as a fundamental pre and/or post-operative steps to improve clinical outcomes and patient's life quality. A wider number of further prospective and retrospective studies, with a larger patients' samples, are needed to confirm this statement to better define the clinical effect of adjunctive therapies in MRONJ.

**Table V.**

APCs		n° papers	total individual papers	With no duplicates	Total (PRF+PRP+PRGF)	Total (PRF+PRP+PRGF) without duplicates
PRF	tr.MRONJ	5	14	11	26	21
	tr.ONJ	2				
	tr.BRONJ	7				
PRP	tr.MRONJ	1	8	6		
	tr.ONJ	2				
	tr.BRONJ	5				
PRGF	tr.MRONJ	3	11	9		
	tr.ONJ	1				
	tr.BRONJ	7				

APCs= Autologous Platelet Concentrates; PRF=Platelet-Rich Fibrin; PRP=Platelet-Rich Plasma; PRGF= Platelet-Rich in in Growth Factors.

**Table VI.**

	RCT	CT	SR	PS	LS	RS	CS	CR	Total	Dis-card	Total useful
Laser and/or low-laser therapy	0	0	7	1	4	2	4	5	58	35	23
Teriparatide	0	1	9	1	1	1	0	9	23	1	22
APCs	1	5	4	1	1	1	2	5	21	1	20
HBO	0	2	10	0	0	0	1	0	14	1	13
Ozone therapy	1	0	3	0	2	1	3	2	13	1	12
Pentoxifylline/Tocopherol	0	0	2	0	0	1	1	1	6	1	5
AF-GBS/TF-GBS	0	1	1	0	0	0	1	1	4	0	4
FDG-PET	0	0	0	0	0	3	0	0	34	31	3
<b>Summary</b>	<b>2</b>	<b>9</b>	<b>36</b>	<b>3</b>	<b>8</b>	<b>9</b>	<b>12</b>	<b>23</b>	<b>173</b>	<b>71</b>	<b>102</b>

RCT=Randomized Clinical Trial; CT=Clinical Trial; SR=Systematic Review; PS=Pilot Study; LS=Longitudinal Study; RS=Retrospective Study; CS=Case Series; CR=Case Report.

## REFERENCES

- Dearden WF. Fragilitas ossium amongst workers in Lucifer match factories. *Br Med J* 1899; 2:270-271.
- Marx RE. Osteoradionecrosis. A new concept of its pathology. *J Oral Maxillofac Surg* 1983; 41:283-288.
- Marx RE, Stern DS. Oral and Maxillofacial Pathology: A rationale for diagnosis and treatment. RE Marx, ed. Quintessence. Chicago 2002; 36-38.
- Ruggiero SL. Bisphosphonate-related osteonecrosis of the jaw (BRONJ): initial discovery and subsequent development. *J Oral Maxillofac Surg* 2009; 67:13-8.
- Ruggiero SL, Dodson TB, Fantasia J, Goodday R, Aghaloo T, Mehrotra B, O'Ryan F: American Association of Oral and Maxillofacial Surgeons position paper on medication-related osteonecrosis of the jaw - 2014 update. *J Oral Maxillofac Surg* 2014; 72:1938-56.
- Ruggiero SL, Dodson TB, Assael LA, Landesberg R, Marx RE, Mehrotra B (Task Force on Bisphosphonate-Related Osteonecrosis of the Jaws, American Association of Oral and Maxillofacial Surgeons position paper on bisphosphonate-related osteonecrosis of the jaw - 2009 update. *Aust Endod J* 2009; 35:119-30.
- AlDhalaan NA, BaQais A, Ahmad AO. Medication-related Osteonecrosis of the Jaw: A Review. *Cureus* 2020; 12(2):e6944.
- Stockmann P, Hinkmann FM, Lell MM, Fenner M, Vairaktaris E, Neukam FW, Nkenke E. Panoramic Radiograph, computed tomography or magnetic resonance imaging. Which imaging technique should be preferred in bisphosphonate-associated osteonecrosis of the jaw? A prospective clinical study. *Clin Oral Investig* 2010; 14:311-7.
- Shimamoto H, Grogan TR, Tsujimoto T, et al. Does CBCT alter the diagnostic thinking efficacy, management and prognosis of patients with suspected Stage 0 medication-related osteonecrosis of the jaws? *Dentomaxillofac Radiol* 2018; 47:20170290.
- Tsuchimochi M, Kurabayashi T: Symposium: imaging modalities for drug-related osteonecrosis of the jaw, role of imaging in drug-related osteonecrosis of the jaw: An upto-date review (secondary publication). *Jpn Dent Sci Rev* 2011; 55:1-4.
- Morag Y, Morag-Hezroni M, Jamadar DA, Ward BB, Jacobson JA, Zwetckhenbaum SR, Helman J. Bisphosphonate-related osteonecrosis of the jaw: a pictorial review. *Radiographics* 2009; 29:1971-84.
- Diez-Perez A, Naylor KE, Abrahamsen B, Agnusdei D, Brandi ML, Cooper C, Dennison E, Eriksen EF, et al. Adherence Working Group of the International Osteoporosis Foundation and the European Calcified Tissue Society. International Osteoporosis Foundation and European Calcified Tissue Society Working Group. Recommendations for the screening of adherence to oral bisphosphonates. *Osteoporos Int* 2017; 28(3):767-74.
- Naylor KE, Jacques RM, Paggiosi M, et al. Response of Bone Turnover Markers to Three Oral Bisphosphonate Therapies in Postmenopausal Osteoporosis: The TRIO Study. *Osteoporos Int* 2016; 27(1):21-31.
- Marx RE. Oral and intravenous bisphosphonate-induced osteonecrosis of the jaw. RE Marx, ed. Quintessence. Chicago 2011; 29-34.
- Naylor KE, Bradburn M, Paggiosi MA, et al. Effects of discontinuing oral bisphosphonate treatments for postmenopausal osteoporosis on bone turnover markers and bone density. *Osteoporos Int* 2018; 29(6):1407-17.
- Szalay EA. Bisphosphonate use in children with pediatric osteoporosis and other bone conditions. *J Pediatr Rehabil Med* 2014; 7(2):125-32.
- Hasegawa T, Kawakita A, Ueda N, et al. A multicenter retrospective study of the risk factors associated with medication-related osteonecrosis of the jaw after tooth extraction in patients receiving oral bisphosphonate therapy: can primary wound closure and a drug holiday really prevent MRONJ? *Osteoporos Int* 2017; 28(8):2465-73.
- Beth-Tasdogan NH, Mayer B, Hussein H, Zolk O. Interventions for managing medication-related osteonecrosis of the jaw. *Cochrane Database Syst Rev* 2017; 10(10):CD012432.
- Spanou A, Nelson K, Ermer MA, Steybe D, Poxleitner P, Voss PJ. Primary wound closure and perioperative antibiotic therapy for prevention of bisphosphonate-related osteonecrosis of the jaw after tooth extraction. *Quintessence Int* 2020; 51(3):220-8.
- Voss PJ, Steybe D, Poxleitner P, et al. Osteonecrosis of the jaw in patients transitioning from bisphosphonates to denosumab treatment for osteoporosis. *Odontology* 2018; 106(4):469-80.
- Mücke T, Deppe H, Hein J, et al. Prevention of bisphosphonate-related osteonecrosis of the jaws in patients with prostate cancer treated with zoledronic acid - A prospective study over 6 years. *J Craniomaxillofac Surg* 2016; 44(10):1689-93.
- Otto S, Pautke C, Van den Wyngaert T, Niepel D, Schiødt M. Medication-related osteonecrosis of the jaw: Prevention, diagnosis and management in patients with cancer and bone metastases. *Cancer Treat Rev* 2018; 69:177-87.
- Nicolatou-Galitis O, Schiødt M, Mendes RA, et al. Medication-related osteonecrosis of the jaw: definition and best practice for prevention, diagnosis, and treatment. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2019; 127(2):117-35.
- Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *Int J Surg* 2010; 8(5):336-41.
- Poli PP, Souza FÁ, Ferrario S, Maiorana C. Adjunctive application of antimicrobial photodynamic therapy in the prevention of medication-related osteonecrosis of the jaw following dentoalveolar surgery: A case series. *Photodiagnosis Photodyn Ther* 2019; 27:117-23.
- Qaisi M, Montague L. Bone Margin Analysis for Osteonecrosis and Osteomyelitis of the Jaws. *Oral Maxillofac Surg Clin North Am* 2017; 29(3):301-13.
- Beth-Tasdogan NH, Mayer B, Hussein H, Zolk O. Interventions for managing medication-related osteonecrosis of the jaw. *Cochrane Database Syst Rev* 2017; 10(10):CD012432.
- Jung J, Yoo HY, Kim GT, Lee JW, Lee YA, Kim DY, Kwon YD. Short-Term Teriparatide and Recombinant Human Bone Morphogenetic Protein-2 for Regenerative Approach to Medication-Related Osteonecrosis of the Jaw: A Preliminary Study. *J Bone Miner Res* 2017; 32(12):2445-52.
- Fleisher KE, Pham S, Raad RA, et al. Does Fluorodeoxyglucose Positron Emission Tomography with Computed Tomography Facilitate Treatment of Medication-Related Osteonecrosis of the Jaw? *J Oral Maxillofac Surg* 2016; 74(5):945-58.
- Owosho AA, Estilo CL, Hury JM, Yom SK. Pentoxifylline and tocopherol in the management of cancer patients with medication-related osteonecrosis of the jaw: an observational retrospective study of initial case series. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2016; 122(4):455-9.
- Silva LF, Curra C, Munerato MS, Deantoni CC, Matsumoto MA, Cardoso CL, Curi MM. Surgical management of bisphosphonate-related osteonecrosis of the jaws: literature review. *Oral Maxillofac Surg* 2016; 20(1):9-17.
- Rollason V, Laverrière A, MacDonald LC, Walsh T, Tramèr MR, Vogt-Ferrier NB. Interventions for treating bisphosphonate-related osteonecrosis of the jaw (BRONJ). *Cochrane Database Syst Rev* 2016; 2(2):CD008455.
- Anitua E, Zalduendo M, Troya M, Orive G. PRGF exerts a cytoprotective role in zoledronic acid-treated oral cells. *Clin Oral Investig* 2016; 20(3):513-21.
- Goodday RH. Preventive Strategies for Patients at Risk of Medication-related Osteonecrosis of the Jaw. *Oral Maxillofac Surg Clin North Am* 2015; 27(4):527-36.
- Fliefel R, Tröltzsch M, Kühnisch J, Ehrenfeld M, Otto S. Treatment strategies and outcomes of bisphosphonate-related osteonecrosis of the jaw (BRONJ) with characterization of patients: a systematic review. *Int J Oral Maxillofac Surg* 2015; 44(5):568-85.
- Del Fabbro M, Gallesio G, Mozzati M. Autologous platelet concentrates for bisphosphonate-related osteonecrosis of the jaw treatment and prevention. A systematic review of the literature. *Eur J Cancer* 2015; 51(1):62-74.
- Altay MA, Tasar F, Tosun E, Kan B. Low-level laser therapy supported surgical treatment of bisphosphonate related osteonecrosis of jaws: a retrospective analysis of 11 cases. *Photomed Laser Surg* 2014; 32(8):468-75.
- Ohbayashi Y, Miyake M, Sawai F, Minami Y, Iwasaki A, Matsui Y. Adjunct teriparatide therapy with monitoring of bone turnover markers and bone scintigraphy for bisphosphonate-related osteonecrosis of the jaw. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2013; 115(4):e31-7.
- Kwon YD, Lee DW, Choi BI, Lee JW, Kim DY. Short-term teriparatide therapy as an adjunctive modality for bisphosphonate-related osteonecrosis of the jaws. *Osteoporos Int* 2012; 23(11):2721-5.
- Freiberger JJ, Padilla-Burgos R, McGraw T, et al. What is the role of hyperbaric oxygen in the management of bisphosphonate-related osteonecrosis of the jaw: a randomized controlled trial of hyperbaric oxygen as an adjunct to surgery and antibiotics. *J Oral Maxillofac Surg* 2012; 70(7):1573-83.
- Lee JJ, Cheng SJ, Jeng JH, Chiang CP, Lau HP, Kok SH. Successful treatment of advanced bisphosphonate-related osteonecrosis of the mandible with adjunctive teriparatide therapy. *Head Neck* 2011; 33(9):1366-71.
- Kan B, Altay MA, Tasar F, Akova M. Low-level laser therapy supported teeth extractions of two patients receiving IV zoledronate. *Lasers Med Sci* 2011; 26(5):569-75.
- Di Fede O, Panzarella V, Mauceri R, Fusco V, Bedogni A, Lo Muzio L, et al. The Dental Management of Patients at Risk of Medication-Related Osteonecrosis of the Jaw: New Paradigm of Primary Prevention. *Biomed Res Int* 2018; 2018:2684924.
- Ristow O, Otto S, Troeltzsch M, Hohlweg-Majert B, Pautke C. Treatment perspectives for medication-related osteonecrosis of the jaw (MRONJ). *J Craniomaxillofac Surg* 2015; 43(2):290-3.
- Petrovic M, Jelovac DB, Antic S, et al. Medication-Related Osteonecrosis of the Jaws: Two Center Retrospective Cohort Studies. *Biomed Res Int* 2019; 2019:8345309.
- Ramaglia L, Guida A, Iorio-Siciliano V, Cuzzo A, Blasi A, Sculean A. Stage-

specific therapeutic strategies of medication-related osteonecrosis of the jaws: a systematic review and meta-analysis of the drug suspension protocol. *Clin Oral Investig* 2018; 22(2):597-615.

47. Borsani E, Bonazza V, Buffoli B, et al. Beneficial Effects of Concentrated Growth Factors and Resveratrol on Human Osteoblasts in Vitro Treated with Bisphosphonates. *Biomed Res Int* 2018.
48. Gaudin E, Seidel L, Bacevic M, Rompen E, Lambert F. Occurrence and risk indicators of medication-related osteonecrosis of the jaw after dental extraction: a systematic review and meta-analysis. *J Clin Periodontol* 2015; 42(10):922-32.
49. Ramaglia L, Agostino Guida A, Iorio-Siciliano V, Cuzzo A, Blasi A, Sculean A. Stage-specific Therapeutic Strategies of Medication-Related Osteonecrosis of the Jaws: A Systematic Review and Meta-Analysis of the Drug Suspension Protocol. *Clin Oral Investig* 2018; 22(2):597-615.
50. Momesso GAC, De Souza Batista FR, Alves de Sousa C, et al. Successful Use of Lower-Level Laser Therapy in the Treatment of Medication-Related Osteonecrosis of the Jaw. *J Lasers Med Sci Fall* 2017; 8(4):201-3.
51. Bertossi D, Giampaoli G, Verner I, Pirayesh A, Nocini R, Nocini P. Complications and management after a nonsurgical rhinoplasty: A literature review. *Dermatol Ther* 2019; 32(4):e12978.
52. De Santis D, Sinigaglia S, Pancera P, et al. An overview of socket preservation. *J Biol Regul Homeost Agents* 2019; 33:55-9.
53. De Santis D, Sinigaglia S, Pancera P, et al. An overview of guided bone regeneration. *J Biol Regul Homeost Agents* 2019; 33:49-53.
54. De Santis D, Gelpi F, Castellani R, et al. Bi-layered collagen nano-structured membrane prototype collagen matrix CM-10826 for oral soft tissue regeneration: an in vivo ultrastructural study on 13 patients. *J Biol Regul Homeost Agents* 2019; 33:29-41.
55. Robiony M, Lazzarotto A, Nocini R, Costa F, Sembroni S, Franz L. Piezosurgery: Ten Years' Experience of Percutaneous Osteotomies in Rhinoplasty. *J Oral Maxillofac Surg* 2019; 77(6):1237-44.
56. Zhurakivska K, Maiorano E, Nocini R, et al. Necrotizing sialometaplasia can hide the presence of salivary gland tumors: A case series. *Oral Dis* 2019; 25(4):1084-90.
57. Bertossi D, Nocini R, Luciano U, et al. Piezoelectric surgery inserts vs conventional burst: a clinical investigation. *J Biol Regul Homeost Agents* 2018; 32(2):15-19.
58. Bertossi D, Botti G, Gualdi A, Fundarà P, Nocini R, Pirayesh A, van der Lei B. Effectiveness, Longevity and Complications of Facelift by Barbed Suture Insertion. *Aesthet Surg J* 2019; 39(3):241-7.
59. Mauceri R, Panzarella V, Maniscalco L, et al. Conservative Surgical Treatment of Bisphosphonate-Related Osteonecrosis of the Jaw with Er,Cr:YSGG Laser and Platelet-Rich Plasma: A Longitudinal Study. *Biomed Res Int* 2018; 2018:3982540.
60. Albanese M, Zotti F, Capocasale G, Bonetti S, Lonardi F, Nocini PF. Conservative non-surgical management in medication related osteonecrosis of the jaw: A retrospective study. *Clin Exp Dent Res* 2020; 1-7.
61. Vescovi P, Giovannacci I, Merigo E, Meleti M, Manfredi M, Fornaini C, Nammour S. Tooth extractions in high-risk patients under bisphosphonate therapy and previously affected with osteonecrosis of the jaws: surgical protocol supported by low-level laser therapy. *J Craniofac Surg* 2015; 26(3):696-9.

### 13 The use of computer-guided flapless dental implant surgery (Nobel guide®) and immediate function to support a fixed full-arch prosthesis in fresh frozen homologous bone grafted patients: a retrospective cohort study with 5 to 8-year follow-up

D. De Santis<sup>1</sup>, F. Gelpi<sup>1</sup>, T. Zambotti<sup>1</sup>, A. Rossetto<sup>1</sup>, U. Luciano<sup>1</sup>, F. Zotti<sup>1</sup>, A. Iurlaro<sup>1</sup>, M. Zarantonello<sup>2</sup>, M. Finotti<sup>3</sup>, C. Alberti<sup>1</sup>, A. Zangani<sup>1</sup>, G. Capocasale<sup>1</sup>, D. Donadello<sup>1</sup>, P. Faccioni<sup>1</sup> and P.F. Nocini<sup>1</sup>

<sup>1</sup>University of Verona - Department of Dentistry and Maternal-Infantile Surgical Sciences; <sup>2</sup>Free practitioners in Rovigo, Italy; <sup>3</sup>Free practitioners in Padua, Italy

The introduction of computer-assisted and guided surgery has radically improved the possibility of using all available bone for implant support, reducing the need for extensive grafting procedures and allowing for better implant placement and restoration. Moreover, fresh frozen homologous bone (FFB) grafts have shown good osteoconductive properties and biocompatibility with results comparable to autologous bone patients. The purpose of this retrospective cohort study was to evaluate the survival and the success rate of implants and related fixed full arch prosthesis at the 5 to 8 years follow-up when performed with immediate function using a flapless surgical procedure and computer-aided technology (NobelGuide®, Nobel Biocare® AB, Goteborg, Sweden) in patients previously treated with FFB grafts; treated at the University of Verona with the NobelGuide® system from January 2007 to December 2012 with at least 5 years follow-up were reviewed. Survival implants and survival prosthesis' percentage reached 95% in a 5 to 8-year period. This study indicates that patients previously augmented with FFB graft for maxillary or mandibular bone atrophy can be safely treated with implant supported prosthesis based on the NobelGuide® protocol, with the aid of computer-generated guide.

The introduction of computer-assisted and guided surgery has radically improved the possibility of using all available bone for implant support, reducing the need of extensive grafting procedures and allowing for better implant placement and restoration, both in grafted and nongrafted sites (1). Indeed, now it is possible to make use of all the available osseous volume during the planning

and the surgical phase. This approach allows an accurate placement of implants using a flapless technique under the guidance of a surgical template, generated from the preoperative virtual planning of the implant. In this way, precise implant installation is possible through a thick layer of soft tissues, having the drills and the implants guided by a computer-generated surgical guide.

The planning is also useful to avoid obstacles or structures in the reconstructed bone such as screws, osteotomy sites and discontinuity of bone segments (2). This technique has shown to be as successful as traditional implant surgery with flap access (3-5).

Moreover, the beneficial effect of flapless surgery without exposure of the periosteum may minimize bone resorption (6-19).

However, a major prerequisite for a restoration driven implant surgery remains the availability of bone of adequate length and width, suitable for the proper placement of implants of sufficient length. Physiological resorption of the alveolar processes of the maxillary bones can lead to insufficient bone volume, especially in patients who have been edentulous for a long period of time, making it virtually impossible to place implants (20). Several solutions have been proposed to obviate bone volume deficiency (2, 21-26). The endpoint of most of these techniques is the augmentation of available bone volume with onlay and inlay grafts (27-28).

Recently the use of fresh frozen homologous bone (FFB) grafts have shown good osteoconductive properties and biocompatibility with results comparable to those of autologous bone but with a reduced morbidity, lower surgical risk and shorter operative time (29) without modification of the traditional techniques (30-31). Histological studies have confirmed these results, showing the presence of new bone and osteoclast activity 4 months after grafting, with 80% mature bone observed after 12 months (32). FFB grafts resulted in volumes of bone similar to those obtained with autologous bone grafts, however the amount of residual bone particles seems to be greater, which may indicate a slower remodeling process (33).

FFB is a widely used substitute for autologous bone especially in large reconstructions when block grafts are indicated (34). The behavior of FFB when used in combination with computer guided implant surgery is still not well understood, as studies are absent in the literature. Due to the extended regenerations of the jaws FFB was the first choice and it was used even in the sites where it was not necessary to reduce the differences between the grafted sites. The purpose of this retrospective cohort study was to evaluate the survival and the success rate of implants and related fixed full arch prosthesis at the 5 to 8 year follow-up when performed with immediate function using a flapless surgical procedure and computer-aided technology (NobelGuide®, Nobel Biocare® AB, Goteborg, Sweden) in patients previously treated with FFB grafts.

## MATERIALS AND METHODS

**Inclusion criteria:** clinical charts of patients with edentulous arches treated at the University of Verona with the NobelGuide® system from January 2007 to December 2012 with at least 5 years follow-up were reviewed. Patients' medical history and clinical data were collected, together with panoramic radiographs and CT scans. The inclusion criteria used were the following: medical history negative for pathologies generally contraindicating implant surgery (35-38), initial edentulism and previous pre-prosthetic surgery with application of fresh frozen bone grafts to restore a sufficient bone volume for implant rehabilitation of the jaws (Fig. 1-3). In particular, pre-prosthetic surgical treatment should have been carried out by the following techniques: ridge preservation with filling of the extraction sockets with FFB bone chips (A) (39) posterior bilateral maxillary sinus augmentation with lateral window with bone chips (B) (40-42) together with anterior maxillary bone block veneer surrounded by bone chips (C) (43-44) Le Fort I osteotomy with inlay technique of Keller (D) (29). In addition, all implant/prosthetic treatment and follow-up should have been carried out according to the NobelGuide® protocol (1). All the surgeries were performed by the same operator.

**Grafting material:** the material used in the pre-prosthetic surgical treatment was FFB. The FFB, obtained from the Veneto Tissue Bank in Treviso (Italy), is a mineralized, non-irradiated and only disinfected, frozen homologous bone. The bone harvesting was obtained from the anterior and posterior iliac crest, in the first 12 hours after donor death. The bone was then disinfected, for at least 72 hours at -4°C, in a polychemotherapeutic solution. The sample was then subdivided into cortico-medullary blocks or morcellized, packed in double sterile casing, and frozen at -80°C (45). **Surgical procedure:** six months after FFB grafts, if plates or osteosynthesis screw were used, these were removed and a temporary total or partial removable acrylic resin prosthesis was made.

NobelGuide® procedure has been described previously for dentate and edentulous patients (46-50). Based on computer planning a fixed metal-acrylic resin complete denture was constructed prior to the implant surgery and was immediately adapted and inserted after surgery. The technician inserted several gutta-percha markers (Hygienic, Coltène/Whaledent Inc. Mahwah, NJ, USA) in small holes with the diameter of 1.5 mm made in the prosthesis, as indicated by the NobelGuide® protocol. The markers are necessary to the software (Procera® or NobelClinician®, Nobel Biocare® AB, Goteborg, Sweden) for coupling two CT scans: one of the patients and one of the prosthesis. Once the modifications on the denture were complete, it was possible to send the patient to a radiological centre where a double CT scan was carried out: one of the patients wearing the prosthesis/radiological guide, correctly inserted, and one of the prosthesis alone. After 3D reconstruction of the CT images in the software, the Procera® or NobelClinician® software allowed us to plan the implant virtually according to the desired prosthetic result (Fig. 4-5). The surgical operations were performed under local/regional anesthesia. The implants used were Brånemark System MKIII® (MKIII), Brånemark System Groovy® (Groovy) e





**Fig. 1.** Initial frontal aspect view of a female patient treated with our surgical technique.



**Fig. 2.** Upper complete edentulism in the same patient.



**Fig. 3.** Lower detrimental oral condition in the same patient.

NobelSpeedy Groovy® (NobelSpeedy) (Nobel Biocare® AB, Goteborg, Sweden) with an oxidized surface (TiUnite®, Nobel Biocare® AB, Goteborg, Sweden). Once the template was stabilized using a surgical index and three anchor pins, the flapless implants were inserted, according to the drill sequence specific for the type of implant planned. The template was then removed and the correct position of the implants was checked and temporary abutments were screwed in place.

The prosthodontist relined a prefabricated provisional fixed metal-acrylic complete denture, including the temporary abutments in the prosthesis with resin and made it functional by adjusting occlusal contacts. One gram of amoxicillin/clavulanate (GlaxoSmithKline plc., Brentford, Middlesex, United Kingdom) every twelve hours for 6 days was prescribed.

The patients were then dismissed. Sutures were removed after 15 days and the patients were given oral hygiene instructions. The main follow-up appointments were delivery of the final fixed prosthesis (6-12 months), professional oral hygiene every 6 months, and regular control once a year to maintain good oral health and monitor the absence of complications and compliance with oral hygiene instructions. A radiographic evaluation (orthopantomogram or periapical radiograph of the implants) was performed each year. Clinical assessment. Implant survival was considered if these conditions were satisfied (from Malò 2007 modified) (51):

1. Presence of the implant as planned in the NobelGuide® treatment plan after surgery and during follow-up.
2. Clinical stability of the implant in the surrounding peri-implant bone at follow-up (bridge removed and implants individually checked).
3. Satisfactory function without any discomfort to the patient at follow-up.
4. No suppuration or infection present at follow-up.
5. No radiolucent areas around the implants at follow-up.

Implant success defined in the scientific literature as the absence of infectious complications affecting peri-implant soft and hard tissues and the absence of more than 2 mm of peri-implant bone loss (PBL) (52-58) was considered. It was also recorded implants Pocket

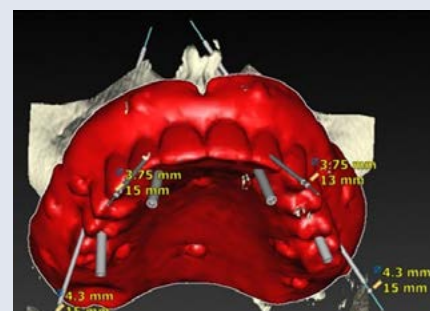
Probing Depth (PPD), soft tissue dehiscence, Mombelli Plaque Index (mPI) and the Mucosal Plaque Score (59-61). Survival of the prosthesis was considered if all these conditions were met immediately after surgery and during the follow-up:

1. Presence in the mouth of the original prosthesis (in-situ criterion) (62).
2. Presence of at least all the anterior teeth (for aesthetics) and two posterior occlusal units (premolar/molar) for function (59) as planned in the NobelGuide® treatment plan. Clinical assessments were performed from two calibrated operators.

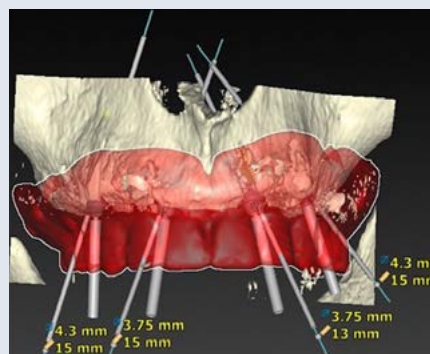
Statistical analysis: the nominal and ordinal variables were tested with Fisher's Exact Test to evaluate association of implant failures due to diabetes or smoking. Peri implants parameter variables clinically and radiologically recorded were described using an Average and Standard Deviation. Bone loss Level (PBL) analysis was performed using Spearman rank to evaluate correlation between keratinized tissue width (67) and bone loss.

The Kruskal-Wallis Test was used to evaluate if the bone loss amount was correlated to the graft type or implants type. The Wilcoxon Mann-Whitney Test was used to evaluate the different bone loss amount surrounding tilted implants or straight ones. We decided to use non parameters Test because PBL variable resulted asymmetrically distributed; moreover the Shapiro-France tests and Shapiro-Wilk are highly significant ( $p < 0.001$ ), suggesting a marked deviation from normality, and also was found a certain instability of variance between the groups in the study.

A possible correlation between keratinized mucosa width and plaque index, bleeding



**Fig. 4.** First screen shot from the digital planning with Nobel Guide Software.



**Fig. 5.** Second screen shot from the digital planning with Nobel Guide Software.



index and probing depth values was made using the Spearman test. The Wilcoxon-Mann-Whitney test was used to highlight differences between the maxillary torque and mandibular torque and maxillary and mandibular bone loss level. The significance for all tests was set at a p-value less than 0.05 (=5%).

## RESULTS

Characterization of the population: a total of 45 patients met the criteria of inclusion, receiving a total of 239 implants. NobelSpeedy was inserted significantly more in the maxilla compared to MK III and Groovy ( $p < 0.001$ ). The patients' follow-up ranged from 5 to 8 years (mean 69 months). (Fig. 6-8) The median age was 64 (interquartile range: 59-69) years (minimum 43, maximum 78 years), 9 patients were male (20%) and received 35 implants, 36 were females (80%) and received 204 implants. The median number of implants per prosthesis was 4 (range 4-6). A total of 54 full arch prosthesis were made, 34 in the maxilla and 20 in the mandible. Three patients (6.7%) were smokers (considered as current exposure to smoking at intake) and received a total of 17 implants.



**Fig. 6.** Final frontal view after double full arch fixed implants prosthetic restoration.



**Fig. 7.** Upper view at 5 years follow up.



**Fig. 8.** Mandibular aspect at 5 years follow

up. The mean PBL was 1.86 (dev. St.  $\pm 1.24$  range 1.55-2.3). Bone resorption was considerably higher ( $p < 0.001$ ) in the maxilla. PBL was significantly influenced by different grafting procedures ( $p < 0.01$ ), and by different type of fixture ( $p < 0.01$ ) (Fig. 9).

### Soft tissues

The mean PPD was 2.12mm (dev. St.  $\pm 1.04$  range 1-6). The mean mPI was 0.74 (dev. St.  $\pm 0.74$  range 0-3). The mean mBI was 0.43 (dev. St.  $\pm 0.55$  range 0-2). The mean soft tissue dehiscence around fixtures was 0.35mm (dev. St.  $\pm 0.86$  range 0-5). The average MPS was 1.15 (dev. St.  $\pm 0.38$  range 0-3). The mean width of KT was 1.23mm (dev. St.  $\pm 1.05$  range 0-4) but did not present a significative correlation with mBI, mPI, MPS ( $p > 0.01$ ).

### Prosthesis survival

One out of 20 (5%) mandibular full arch fixed metal-acrylic prosthesis failed during the follow-up. Otherwise in the 34 maxillary full arch fixed prosthesis there was not failures. As for implant failure, the low number of prosthetic failures precluded a detailed analysis of risk factors.

### Miscellaneous complications

One patient experienced a fracture of the surgical stent in the mandible which was repaired during the surgery. The position of 2 implants in another patient was slightly aberrant from the planned position, resulting in a minor vestibular bone dehiscence at implant placement. The complication did not preclude achievement of sufficient



**Fig. 9.** An example of radiological follow-up with periodontal parameters evaluation such as Perimplant Bone Loss.

torque, implant integration and a favorable emergence profile for the final prosthesis.

One patient had the fracture of maxillary bone during implant surgery. There was the failure of five implants also, which had been removed and after a 6 month rigid fixation, it was possible to go on with the procedure and deliver a fixed prosthesis to the patient. In the other patients, who had the failure of a single implant, it was possible to maintain the fixed restoration removing the failed implant and inserting another one. There was one prosthetic failure in one patient, who did not accept the restoration. In one patient there was the fracture of a resin tooth of the prosthesis. Three implants (1%) had a positive diagnosis for periimplantitis. A total of 13 implants failed (5%). Table I, Table II, Table III, Table IV and Table V.

**DISCUSSION**

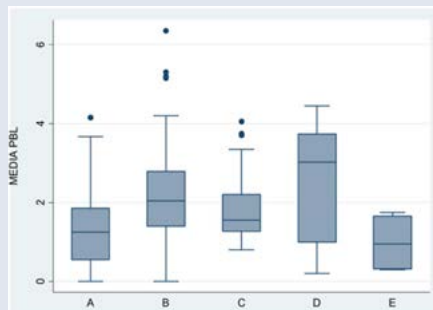
The cumulative survival rate was 95%. Implant success rate was 85%, 20 implants (8%) did not show signs of inflammation or suppuration but had a PBL value higher than those reported in the success criteria also those were not classified successful. Three implants (1%) had a positive diagnosis for periimplantitis. During the 5 to 8-year follow-up 13 failures (5%) were detected. The low number of failures precluded a detailed analysis of risk factors. Failures had a tendency to be more frequent in the maxilla (3.3%) than in the mandible (2.1%), 8 failures in the maxilla happened in the first years after NobelGuide® surgery, while 5 failures in the mandible happened 4 at 5 years and 1 after 6 years (1). During the follow-up, implants placed in smokers were more likely to fail than implants placed in non-smokers (28.5% vs 3.6%). The lower survival rate of implants placed in smokers has been well documented in the literature (62). In our study survival of implants placed in reconstructed bone with FFB was comparable to those obtained with autologous

bone grafts (64), FFB grafts (65) and NobelGuide® treatment on native (1), or fibula reconstructed bone (66). In fact, it has been shown that the use of various dentoalveolar bone grafting procedures to reconstruct deficient implant recipient sites are not an independent risk factor for implant failure (68). Peri-implant soft tissues had been investigated, particularly mBI, mPI and MPS

**Table I.** Survival and Success rate.

<b>TOTAL IMPLANTS</b>	<b>239</b>	<b>100%</b>
Failed	13	5%
Survived	226	95%
Periimplantitis	3	1%
PBL > success criteria	20	8%
Success	203	85%

**Table II.** Periimplant Bone Loss.



are index to identify different degrees of soft tissue inflammation and condition allowing the clinician to evaluate the need of additional treatments. The values of these index showed an average good condition of soft tissues around implants, which is fundamental for the long-term maintenance of full arch prosthesis implant supported. Peri-implant Bone Loss was evaluated at 1 year and at 5 years after implants load. At 1 year the average PBL values were of  $0.66 \pm 0.65$ mm while at follow up of  $1.86 \pm 1.24$ mm, these data agree with success criteria (51). Bone resorption resulted higher in the upper jaw (58), this is due to the lower quality and minor density of the of maxillary bone. In literature it is even reported a higher risk of failure of implants positioned in the maxilla (69-73).

In this study, it has also been evaluated the Keratinized Tissue (KT) width around dental implants, as a matter of fact this is a variable of emergent interest in implant therapy. In literature there are discordant results about the possible relations between KT and implant health, in our study there was not a significative relationship between

**Table III.** Periimplant Bone Loss.

GRAFTS	MEAN	SD	MIN	MAX
A	1.36	1.11	0	4.15
B	2.26	1.35	0	6.35
C	1.89	0.86	0.8	4.05
D	2.48	1.54	0.2	4.45
E	0.99	0.78	0.3	1.75

**Table IV.** Keratinized Tissue.

PPD	Media ± DS (mm)	Range interqu.	MIN	MAX
Mesial	2.12±1.04	2-3	1	6
Vestibular	1.80±0.93	2-2	1	7
Distal	2.18±1.03	2-3	1	6
Pal/ling	1.85±0.87	2-2	1	6

**Table V.** *mPI and MPS.*

Recession	(mm)	Range interqu.	MIN	MAX
Vestibular	0.35±0.86	0-0	0	5
Pal/ling	0.36±0.28	0-0	0	3

**Table VI.** *mPI and MPS.*

	Media ± DS	Range interqu.	MIN	MAX
mPI	0.74±0.74	1-1	0	3
MPS	1.15±0.38	1-1	0	3

Keratinized tissue width surrounding implants and PBL. Implant position did not condition significantly PBL, particularly tilted implants compared to straight did not showed a meaningful major PBL (74-75).

The type of implant and the different grafting procedure influenced significantly bone resorption. Speedy Groovy manifested a higher resorption but this data must be argued because those implants had been used mainly in the maxilla. MK III Groovy showed a lower bone resorption than Speedy Groovy and MK III. The grafting procedures with a significantly greater PBL were sinus lift and Le Fort I inlay still for the same reason of lower quality of maxillary bone. Initial torque level at implant placement was not related to implant failure. Furthermore, torque level may not be a proper measurement of implant primary stability.

In one patient 5 implants failed because of fracture of the basal bone at implant placement. The reason for this is still unclear but it may have speculated that the presence of a surgical stent in an atrophic maxilla may transfer the stress exerted by the implants on basal bone. This, together with the fact that no fracture of grafted bone surrounding the implant occurred in our patients, may indicate that complex implant/surrounding bone is safely stabilized by the stent, but the resulting stress may be exerted outside the ferrule of the stent. One patient experienced a fracture of the surgical stent in the mandible which was repaired during the surgery. Fracture of the surgical stent has already been described as a possible complication which can be related to insufficient thickness or imperfect fitting of the stent in relation to the amount of stress generated by implant insertion (76). In another patient the position of 2 implants deviated slightly from the planned position. This complication did not preclude achievement of sufficient torque, implant integration and a favorable emergence profile for the final prosthesis.

An individual error can occur at each step of the guided surgery protocol, starting from the radiographic guide to the placement of the implant leading to incorrect implant placement (9,77-78). Particularly stereolithographic surgical guide stents have the potential to be dissimilar from the original scan denture. The ISO threshold setting in the conversion software is a very sensitive component of the production process (79-81). The only prosthetic failure occurred in one patient who did not accept the restoration, also it was removed and substituted with a mobile device. In one patient there was the fracture of a resin tooth of the full arch fixed prosthesis, hence the prosthesis was repaired through the substitution of the broken tooth. Based on the results of our retrospective study, we can conclude that:

1. Survival of implants was high, reaching 95% in a 5 to 8-year period.
2. Survival of the prosthesis was high reaching 95% in a 5 to 8-year period.
3. Factors significantly related to failure of the implants were smoking.
4. Factors significantly related to PBL were implant position (maxillary or mandibular), type of implant and graft procedure.
5. A higher torque level at implant insertion did not correspond to a lower risk of implant failure.

This study indicates that patients previously augmented with FFB graft for maxillary or mandibular bone atrophy can be safely treated with implant supported prosthesis based on the NobelGuide® protocol, with the aid of computergenerated guide. This procedure may be a promising treatment option, offering several advantages to both clinicians and patients, while keeping the same degree of predictability in terms of torque levels, survival and success of the implants and the prosthesis compared with conventional treatment. However, in our study the low number of implants and prosthetic failures precluded a detailed analyses of risk factors associated to these failures. Before drawing any general conclusion, the benefit of the procedure should be further evaluated by prospective clinical trials where the possible endpoints of the treatment should be more thoroughly evaluated and compared with conventional protocols on the same study population.

## REFERENCES

1. Malo P, de Araujo Nobre M, Lopes A. The use of computer-guided flapless implant surgery and four implants placed in FTimmediate function to support a fixed denture: preliminary results after a mean follow-up period of thirteen months. *J Prosthet Dent* 2007; 97:26-34.
2. Nocini PF, Albanese M, Castellani R, et al. Application of the "All-on-Four" Concept and Guided Surgery in a Mandible Treated with a Free Vascularized Fibula Flap. *J Craniofac Surg* 2012; 23:628-31.
3. Balshi SF, Wolfinger GJ, Balshi TJ. A prospective study of immediate functional loading, following the Teeth in a Day protocol: a case series of 55 consecutive edentulous maxillas. *Clin Implant Dent Relat Res* 2005; 7:24-31.
4. Balshi SF, Wolfinger GJ, Balshi TJ. Surgical planning and prosthesis construction using computer technology and medical imaging for immediate loading of implants in the pterygomaxillary region. *Int J Periodontics Restorative Dent* 2006; 26:239-47.

5. Van Steenberghe D, Glauser R, Blomback U, et al. A computed tomographic scan-derived customized surgical template and fixed prosthesis for flapless surgery and immediate loading of implants in fully edentulous maxillae: a prospective multicenter study. *Clin Implant Dent Relat Res* 2005; 7:111-20.
6. Fickl S, Kepschull M, Schupbach P, et al. Bone loss after full-thickness and partial-thickness flap elevation. *J Clin Periodontol* 2011; 38:157-62.
7. Lee JH, Kim MJ, Choi WS, et al. Concomitant reconstruction of mandibular basal and alveolar bone with a free fibular flap. *Int J Oral Maxillofac Surg* 2004; 33:150-6.
8. Nocini PF, De Santis D, Morandini B, Procacci P. A dental implant in the infratemporal fossa: case report. *Int J Oral Maxillofac Implants* 2013; 28(4):e195-7.
9. Al-Juboori MJ, Bin Abdulrahman S, Jassan A. Comparison of flapless and conventional flap and the effect on crestal bone resorption during a 12-week healing period. *Dent Implantol Update* 2012; 23(2):9-16.
10. Bertossi D, Giampaoli G, Verner I, Pirayesh A, Nocini R, Nocini P. Complications and management after a nonsurgical rhinoplasty: A literature review. *Dermatol Ther*. 2019; 32(4):e12978.
11. De Santis D, Sinigaglia S, Pancera P, et al. An overview of socket preservation. *J Biol Regul Homeost Agents*. 2019; 33:55-9.
12. De Santis D, Sinigaglia S, Pancera P, et al. An overview of guided bone regeneration. *J Biol Regul Homeost Agents* 2019; 33:49-53.
13. De Santis D, Gelpi F, Castellani R, et al. Bi-layered collagen nano-structured membrane prototype collagen matrix CM-10826 for oral soft tissue regeneration: an in vivo ultrastructural study on 13 patients. *J Biol Regul Homeost Agents* 2019; 33:29-41.
14. Robiony M, Lazzarotto A, Nocini R, Costa F, Sembronio S, Franz L. Piezosurgery: Ten Years' Experience of Percutaneous Osteotomies in Rhinoplasty. *J Oral Maxillofac Surg* 2019; 77(6):1237-44.
15. Zhurakivska K, Maiorano E, Nocini R, et al. Necrotizing sialometaplasia can hide the presence of salivary gland tumors: A case series. *Oral Dis* 2019; 25(4):1084-90.
16. Bertossi D, Nocini R, Luciano U, et al. Piezoelectric surgery inserts vs conventional burst: a clinical investigation. *J Biol Regul Homeost Agents* 2018; 32(2):15-19.
17. Bertossi D, Botti G, Gualdi A, Fundarà P, Nocini R, Pirayesh A, van der Lei B. Effectiveness, Longevity, and Complications of Facelift by Barbed Suture Insertion. *Aesthet Surg J* 2019; 39(3):241-7.
18. Bertossi D, Lucchese A, Albanese M, et al. Piezosurgery versus conventional osteotomy in orthognathic surgery: A paradigm shift in treatment. *J Craniofac Surg* 2013; 24(5):1763-6.
19. Albanese M, Zotti F, Lanaro L. Fresh-frozen homologous bone in sinus lifting histological and radiological analysis. *Minerva Stomatol* 2019; 68(5):226-235.
20. Tallgren A. The continuing reduction of the residual alveolar ridges in complete denture wearers: a mixed-longitudinal study covering 25 years. *J Prosthet Dent* 1972; 27:120-32.
21. Bertele G, Mercanti M, Stella F, et al. Osteodistraction in the craniofacial region. *Minerva Stomatol* 2005; 54:179-98.
22. Raviv E, Turcotte A, Harel-Raviv M. Short dental implants in reduced alveolar bone height. *Quintessence Int* 2010; 41:575-9.
23. De Santis D, Trevisiol L, D'Agostino A, et al. Guided bone regeneration with autogenous block grafts applied to Le Fort I osteotomy for treatment of severely resorbed maxillae: a 4- to 6-year prospective study. *Clin Implant Dent Relat Res* 2015; 17(3):442-52.
24. De Santis D, Cucchi A, Rigoni G, et al. Short implants with oxidized surface in posterior areas of atrophic jaws: 3- to 5-year results of a multicenter study. *Clin Implant Dent Relat Res* 2015; 17:3:442-52.
25. Nocini PF, De Santis D, Ferrari F, et al. A customized distraction device for alveolar ridge augmentation and alignment of ankylosed teeth. *Int J Oral Maxillofac Implants* 2004; 19:133-44.
26. De Santis D, Trevisiol L, Cucchi A, et al. Zygomatic and maxillary implants inserted by means of computer-assisted surgery in a patient with a cleft palate. *J Craniofac Surg* 2010; 21:858-62.
27. Felice P, Marchetti C, Iezzi G, et al. Vertical ridge augmentation of the atrophic posterior mandible with interpositional block grafts: bone from the iliac crest vs. bovine anorganic bone. Clinical and histological results up to one year after loading from a randomized-controlled clinical trial. *Clin Oral Implants Res* 2009; 20:1386-93.
28. Perry RT. Ascending ramus offered as alternate harvest site for onlay bone grafting. *Dent Implantol Update* 1997; 8:21-4.
29. Nocini PF, Bertossi D, Albanese M, et al. Severe maxillary atrophy treatment with Le Fort I, allografts, and implant-supported prosthetic rehabilitation. *J Craniofac Surg* 2011; 22:2247-54.
30. Accetturi E, Germani KB, Cavalca D. Reconstruction of bone defects in the maxilla and mandibula through the use of frozen human bone. *Transplant Proc* 2002; 34:531-3.
31. Viscioni A, Franco M, Rigo L, et al. Retrospective study of standard-diameter implants inserted into allografts. *J Oral Maxillofac Surg* 2009; 67:387-93.
32. Viscioni A, Dalla Rosa J, Paolin A, et al. Fresh-frozen bone: case series of a new grafting material for sinus lift and immediate implants. *J Ir Dent Assoc* 2010; 56:186-91.
33. Pelegrine AA, Sorgi da Costa CE, Sendyk WR, et al. The comparative analysis of homologous fresh frozen bone and autogenous bone graft associated or not with autogenous bone marrow, in rabbit calvaria: a clinical and histomorphometric study. *Cell Tissue Bank* 2011; 12:171-84.
34. Deluiz D, Oliveira L, Fletcher P, et al. Fresh-Frozen Bone Allografts in Maxillary Alveolar Augmentation: Analysis of Complications, Adverse Outcomes, and Implant Survival. *J Periodontol* 2016; 87(11):1261-7.
35. Lekolm U, Zarb GA. Patient selection and preparation. In *Tissue-integrated prostheses: osseointegration in clinical dentistry*. P.I. Branemar, G.A. Zarb, T. Albrektsson, ed. Quintessence. Chicago 1985; 211-32.
36. De Santis D, Cucchi A, Rigoni G, Longhi C, Nocini PF. Relationship Between Primary Stability and Crestal Bone Loss of Implants Placed with High Insertion Torque: A 3-Year Prospective Study. *Int J Oral Maxillofac Implants* 2016; 31(5):1126-34.
37. Nocini PF, Castellani R, Zanotti G, Gelpi F, Covani U, Marconcini S, de Santis D. Extensive keratinized tissue augmentation during implant rehabilitation after Le Fort I osteotomy: using a new porcine collagen membrane (Mucoderm). *J Craniofac Surg* 2014; 25(3):799-803.
38. Vissink A, Spijkervet F, Raghoobar GM. The medically compromised patient: Are dental implants a feasible option? *Oral Dis* 2018; 24(1-2):253-60.
39. Araujo MG, Lindhe J. Socket grafting with the use of autologous bone: an experimental study in the dog. *Clin Oral Implants Res* 2011; 22:9-13.
40. Acocella A, Bertolai R, Nissan J, et al. Clinical, histological and histomorphometrical study of maxillary sinus augmentation using corticocancellous fresh frozen bone chips. *J Craniofac Surg* 2011; 39:192-9.
41. Danesh-Sani SA, Wallace SS, Movahed A, El Chaar ES, Cho SC, Khouly I, Testori T. Maxillary Sinus Grafting with Biphasic Bone Ceramic or Autogenous Bone: Clinical, Histologic, and Histomorphometric Results From a Randomized Controlled Clinical Trial. *Implant Dent* 2016; 25(5):588-93.
42. Barone A, Varanini P, Orlando B, et al. Deep-frozen allogeneic onlay bone grafts for reconstruction of atrophic maxillary alveolar ridges: a preliminary study. *J Oral Maxillofac Surg* 2009; 67:1300-6 30.
43. Contar CM, Sarot JR, Bordini J Jr, et al. Maxillary ridge augmentation with fresh-frozen bone allografts. *J Oral Maxillofac Surg* 2009; 67:1280-5.
44. Carinci F, Brunelli G, Zollino I, et al. Mandibles grafted with fresh-frozen bone: an evaluation of implant outcome. *Implant Dent* 2009; 18:86-95.
45. De Santis D, Malchiodi L, Cucchi A, et al. Computer-assisted surgery: double surgical guides for immediate loading of implants in maxillary postextractive sites. *J Craniofac Surg* 2010; 21:1781-5.
46. De Santis D, Canton LC, Cucchi A, et al. Computer-assisted surgery in the lower jaw: double surgical guide for immediately loaded implants in postextractive sites-technical notes and a case report. *J Oral Implantol* 2010; 36(1):61-8.
47. Nocini PF, Castellani R, Zanotti G, et al. The use of computer-guided flapless dental implant surgery (NobelGuide) and immediate function to support a fixed full-arch prosthesis in fresh-frozen homologous patients with bone grafts. *J Craniofac Surg* 2013; 24:551-8.
48. Barone A, Toti P, Bertossi D, et al. Gene Expression of Human Mesenchymal Stem Cells Cultured on Titanium Dental Implant Surfaces. *J Craniofac Surg* 2016; 27(3):712-7.
49. Alves CC, Correia AR, Neves M. Immediate implants and immediate loading in periodontally compromised patients-a 3-year prospective clinical study. *Int J Periodontics Restorative Dent* 2010; 30(5):447-55.
50. Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants: a review and proposed criteria of success. *Int J Oral Maxillofac Implants* 1986; 1:11-25.
51. Misch CE, Perel ML, Wang HL, et al. Implant success, survival, and failure: the International Congress of Oral Implantologists (ICOI) Pisa Consensus Conference. *Implant Dent* 2008; 17:5-15.
52. Mombelli, A, Lang, N.P. Clinical parameters for the evaluation of dental implants. *Periodontology* 2000; 4:81-86.
53. Mombelli, A, van Osten, MAC, Schurch E, et al. The microbiota associated with successful or failing osseointegrated titanium implants. *Oral Microbiology and Immunology* 1987; 2:145-51.
54. Covani U, Marconcini S, Ferrini F, Gelpi F, Finotti M, Barone A, de Santis D. Post-traumatic use of dental implants immediately after tooth extraction: clinical study. *J Craniofac Surg* 2014; 25(3):796-8.
55. De Santis D, Graziani P, Castellani R, et al. A New Radiologic Protocol and a New Occlusal Radiographic Index for Computer-Guided Implant Surgery. *J Craniofac Surg* 2016; 27(5):e506-10.
56. Nocini PF, Zanotti G, Castellani R, Grasso S, Cristofaro MG, De Santis D: Bi-



- layered collagen nano-structured membrane prototype (collagen matrix 10826®) for oral soft tissue regeneration: an "in vitro" study. *Clin Oral Implants Res* 2013; 24(6):612-7.
57. Bertossi D, Albanese M, Turra M, Favero V, Nocini PF, Lucchese A. Combined rhinoplasty and genioplasty: Long-term follow-up. *JAMA Facial Plast Surg* 2013; 15(3):192-7.
  58. De Santis D, Cucchi A, Longhi C, Vincenzo B. Short threaded implants with an oxidized surface to restore posterior teeth: 1- to 3-year results of a prospective study. *Int J Oral Maxillofac Implants* 2011; 26(2):393-403.
  59. Henriksen BM, Ambjarnsen E, Axell T. Evaluation of a mucosal-plaque index (MPS) designed to assess oral care in groups of elderly SCD. *Special Care in Dentistry* 1999; 19:154-7.
  60. Frisch E, Ziebolz D, Rinke S. Long-term results of implant-supported overdentures retained by double crowns: a practice-based retrospective study after minimally 10 years follow-up. *Clin Oral Implants Res* 2013; 24:1281-7.
  61. Liddel G, Klineberg I. Patient-related risk factors for implant therapy. A critique of pertinent literature. *Aust Dent J* 2011; 56:417-26.
  62. Aghaloo TL, Moy PK. Which hard tissue augmentation techniques are the most successful in furnishing bony support for implant placement? *Int J Oral Maxillofac Implants* 2007; 22:49-70.
  63. De Riu G, Meloni SM, Pisano M, et al. Computed tomography-guided implant surgery for dental rehabilitation in mandible reconstructed with a fibular free flap: description of the technique. *Br J Oral Maxillofac Surg* 2012; 50:30-5.
  64. Woo VV, Chuang SK, Daher S, et al. Dentoalveolar reconstructive procedures as a risk factor for implant failure. *J Oral Maxillofac Surg* 2004; 62:773-80.
  65. Patzelt SB, Bahat O, Reynolds MA et al. The All-on- Four treatment concept: a systematic review. *Clin Implant Dent Relat Res* 2014; 16:836-55.
  66. Leonhardt A, Gröndahl K, Bergstrom C et al. Long-term follow-up of osseointegrated titanium implants using clinical, radiographic and microbiological parameters. *Clinical Oral Implants Research* 2002; 13:127-32.
  67. Nocini PF, Zanotti G, Castellani R, Grasso S, Cristofaro MG, De Santis D. Bi-layered collagen nano-structured membrane prototype [collagen matrix 10826®] for oral soft tissue regeneration: an "in vitro" study. *Clin Oral Implants Res* 2013; 24(6):612-7.
  68. Del Fabbro, M. Bellini, C. M. Romeo, D et al. Tilted Implants for the Rehabilitation of Edentulous Jaws: A Systematic Review. *Clin Implant Dent Relat Res* 2012; 14:612- 21.
  69. Friberg B, Jemt T, Lekholm U. Early failures of 4641 consecutively placed Brånemark dental implants. A study from stage one surgery to connection of the completed prostheses. *Int J Oral Maxillofac Implants* 1991; 6:142-6.
  70. Jemt T, Hager P. Early Complete Failures of Fixed Implant-Supported Prostheses in the Edentulous Maxilla: A 3-Year Analysis of 17 Consecutive Cluster Failure Patients. *Clin Implant Dent Relat Res* 2006; 8:77-86.
  71. Cavalli N, Barbaro B, Spasari D. Tilted implants for full-arch rehabilitations in completely edentulous maxilla: a retrospective study. *Int Journal of Dentistry* 2012; 2012:180379.
  72. Francetti L, Romeo D, Corbella S, et al. Bone Level Changes Around Axial and Tilted Implants in Full-Arch Fixed Immediate Restorations. Interim Results of a Prospective Study. *Clin Implant Dent Relat Res* 2012; 5:646-54.
  73. Merli M, Bernardelli F, Esposito M. Computer-guided flapless placement of immediately loaded dental implants in the edentulous maxilla: a pilot prospective case series. *Eur J Oral Implantol* 2008; 1:61-9.
  74. Vercruyssen M, Jacobs R, Van Assche N, et al. The use of CT scan-based planning for oral rehabilitation by means of implants and its transfer to the surgical field: a critical review on accuracy. *J Oral Rehabil* 2008; 35:454-74.
  75. Nocini PF, Zanotti G, Castellani R et al. Bi-layered collagen nano-structured membrane prototype (collagen matrix 10826®) for oral soft tissue regeneration: an "in vitro" study. *Clin Oral Implants Res* 2013; 24(6):612-7.
  76. Di Alberti L, Tamborrino F, Lo Muzio L et al. Calcium sulfate barrier for regeneration of human bone defects. 3 years randomized controlled study. *Minerva Stomatol* 2013; 11.
  77. Di Alberti L, Di Alberti C, Donini F et al. Clinical and mechanical evaluation of screw-retained implant-supported zirconia restorations. A 36 months prospective clinical study. *Minerva Stomatol* 2013; 11.
  78. Stumpel U. Deformation of stereolithographically produced surgical guides: an observational case series report. *Clin Implant Dent Relat Res* 2012; 14:442-53.
  79. Bertossi D, Albanese M, Malchiodi L, et al. Surgical alar base management with a personal technique: the tightening alar base suture. *Arch Facial Plast Surg* 2007; 9(4):248-51.
  80. Bertossi D, Barone A, Iurlaro A, Marconcini S, De Santis D, Finotti M, Procacci P. Odontogenic Orofacial Infections. *J Craniofac Surg* 2017; 28(1):197-202.
  81. De Santis D, Pancera P, Luciano U, et al. Evaluation of bacterial flora composition on teeth and periodontal tissues in patients in treatment with rapid palatal expander. *J Biol Regul Homeost Agents* 2018; 32(S2):31-6.

## 14 Ketamine in dentistry: a useful way for non-compliant pediatric patients

Marinello<sup>1</sup>, G. Zanotti<sup>2</sup>, A. Spinelli<sup>1</sup>, M. Zarantonello<sup>3</sup>, D. De Santis<sup>4</sup>, F. Zotti<sup>4</sup>, A. Iurlaro<sup>1</sup>, C. Alberti<sup>1</sup>, A. Zangani<sup>1</sup>, G. Capocasale<sup>1</sup>, A. Bertajola<sup>2</sup>, D. Donadello<sup>1</sup> and M. Finotti<sup>1</sup>

<sup>1</sup>Free practitioner in Padua, <sup>2</sup>Free practitioner in Verona, Italy; <sup>3</sup>Free practitioner in Rovigo, Italy; <sup>4</sup>University of Verona-Surgical Science, Dentistry, Gynecology and Pediatrics Department, Verona, Italy

**The infant, like the young un-cooperative or odontophobic patient, constitute the most complex type of patient to be treated and it is frequent in modern society. The treatment of these patients is necessary to resolve the infectious-antalgic urgency and subsequently to build the patient/doctor relationship for continuing general dental care. Conscious sedation is the only way to approach this type of patient. Where therapeutic success with traditional sedation techniques is not achieved, as frequently happens in these patients, sedation with ketamine is the extreme ratio for the purpose of effective resolution of the dental problem, obviously carried out within facilities authorized for these anesthesiological modalities such as private outpatient surgery structures where, when necessary, it is possible to carry out the treatments also under general anesthesia as well as with ketamine.**

Today, despite the fact, that instructions for having good oral health appear traditionally rooted in everyone's life and that the latter are remembered daily through the media, dentistry is still faced with pathologies, even serious ones, in patients of pediatric age (1-3). From 1960 into the years of 2000, the development of the concept of prevention, the evolution of auxiliary technologies and the introduction of toothpaste pastes containing fluorine led to a reduction in the prevalence of carious disease in the population, especially among pediatric patients (4-6). Since the entry into the new millennium, however, the frenetic high speed social globalization without real integration and the establishment of a relative-individualistic culture society oriented to total liberalism have led to the reduction of knowledge and respect for the instructions necessary for maintaining a good oral health mentioned above (7, 8).

Specifically, first, the result of recent ethnic, economic and demographic changes has led to an average impoverished population, superficially educated and consequently apprehensive. Therefore, a worsening oral health conditions was generated, detected as



the prevalence of carious pathology is greater in the population segment with reduced economic possibilities (5, 7, 8). Furthermore, secondly, the huge educational differences on an ethnic basis, the lowering of the demographic rate and the exaggerated amount of information provided by the media unfiltered by educational “campaigns” led to a confused and anxious parenting class that transmits the fear of pain to children by generating a reduction in tolerance capacity, even if minimal (9).

The treatment of the pedodontic patient, paradoxically, is therefore nowadays more difficult to deal with; even though the psychological approach techniques are well known (9). This category of patients, moreover, has often had negative experiences that may be due to an emergency intervention following a trauma or to some carelessness and/or lightness due to inexperience. These events generate a real phobia in the small patient, with a consequent refusal to dental care and a tendency to reject any general figure in medical field (3, 10-11). The phobic pedodontic patient (3, 10-11) is a type of patient with whom it now becomes necessary to relate and to be able to aid in case of:

- need to resolve acute pain symptoms;
- need to preserve or restore correct chewing function;
- need to preserve the deciduous teeth in order to reduce orthodontic problems (12-13) by obtaining a physiological exchange;
- need to restore social aesthetics (14-24).

The treatment in the cases mentioned above will be possible, only with the aid of sedation (25-27) on the infant patient as well as on the phobic pedodontic (3), caused by his lack of collaboration. In the same way, the natural maturation of the psychological profile should not be neglected but, in agreement with the parents, also possibly supported with the help of psychotherapy. In fact, the choice of sedation, with ketamine (28), born from the desire to be able to rebuild a relationship with the infant, preserving the integrity of his teeth from caries and his psyche from phobias. The progressive reduction of the use of the sedative aid until the complete elimination of it must be the goal reachable, at the same time as the growth of the patient’s psychological profile, in order to avoid all possible side effects (25-29) linked to the execution of the procedure and to repetition of itself.

## MATERIALS AND METHODS

Ketamin. Backgrounds (29):

- in 1962 it was synthesized for the first time by Calvin Stevens;
- in 1963 it was patented;
- in 1965 it was defined by the term “dissociative anesthetic” by Edward Domino;
- in 1969, ketamine hydrochloride became available with a prescription under the name Ketalor®.

Pharmacological nodes (30): sedation with ketamine is called “dissociative anesthesia” characterized by catatonia, amnesia and analgesia without real loss of consciousness. The drug is a chemically related ARY cyclohexylamine phencyclidine (PCP), a drug frequently used and abused for its psychoactive properties. The mechanism of action of ketamine can involve blocking the membrane effects of glutamic acid, an excitatory neurotransmitter, at the level of the NMDA receptor subtype (N-methyl-D-aspartate). Ketamine, a highly lipophilic drug, is rapidly distributed in highly vascularized organs, including the brain, and is subsequently redistributed in less perfused tissues, with simultaneous liver metabolism and both urinary and biliary excretion.



**Fig. 1.** Vein cannulation.



**Fig. 2.** Lateral patient position to promote swallowing reflexes.



**Fig. 3.** Operator position based on the patient’s mandatory position.

In addition to being a powerful analgesic, ketamine is the only intravenous anesthetic that usually produces cardiovascular stimulation. Heart rate, blood pressure and cardiac output have generally increased significantly. The peak of these effects occurs in 2-4 minutes after intravenous injection and the return to normal levels occurs in 10-20 minutes. Furthermore, ketamine produces cardiovascular stimulation by excitation of the central sympathetic nervous system, probably by inhibiting the reuptake of norepinephrine at the level of the sympathetic nerve endings. Increases to adrenaline

and norepinephrine plasma levels occur as early as 2 minutes after intravenous administration of ketamine and return to normal levels after 15 minutes, significantly increasing brain blood flow, brain oxygen consumption and intracranial pressure.

Finally, in most patients, ketamine slightly decreases the respiratory rate for 2-3 minutes while allowing the maintenance of the muscular tone and the reflexions of the upper airways. Although it is a desirable anesthetic, the use of ketamine is associated with disorientation, sensory and perceptual illusions and vivid dreams that follow anesthesia, effects that are called "emergence phenomena". Diazepam 0.2-0.3 mg / kg intravenously, 5 minutes before the administration of Ketamine, reduces the incidence of these phenomena.

Dissociative Sedation Technique with ketamine: the technique in question must be performed by an anesthesiologist in a protected environment (24, 28), as we usually carry out in our extra-hospital surgery facility, which has the appropriate authorization and organization to perform general anesthesia indeed. It is indicated in children up to about 6 years with a body weight of 25/30 kg in which milder techniques such as those that use nitrous oxide and/or benzodiazepines have failed. It initially involves an intramuscular injection of a single solution of ketamine 5mg/kg and midazolam 0.1mg/kg. Then the above injection generates the baby falling asleep in 60-90 seconds and allows the intravenous infusion of ketamine 5mg/kg / h (Fig. 1).

Finally, the association of propofol 1-2mg /kg/h reduces the percentage of postoperative vomiting. The laryngo-pharyngeal reflexes of the infant remain intact, therefore even in the presence of liquids in the mouth, swallowing occurs physiologically, protecting the airways spontaneously. For greater safety, the child is positioned on his side and under constant aspiration of his physiological secretions (Fig. 2-3). The sialorrhea produced would be antagonizable with atropine, which however is not administered because the vasoconstrictor is already present in local anesthetic and in ketamine therefore would result in a very constant high heart rate. We recommend 45/90 minutes as maximum intervention duration, thus generating an "anesthesiological tail" of approximately 90 minutes. The "anesthesiological tail" is proportional to the quantity of ketamine administered. Saturation and heart rate should be monitored until awakening (Fig. 4-5).

In conclusion, a safety medication of betamethasone 1.5mg is administered intravenously. Respect for these indications allows the child to be released serene and without short-term memory. Upon awakening of the patient, parents should be informed that nystagmus, diplopia and vomiting can, although not frequently, be present and have no pathological significance by spontaneously regressing and that feeding can be quickly resumed even if with caution.

## RESULTS

Ketamine is an effective agent for conscious sedation in pediatric emergencies, with minimal adverse effects and sequelae compared to traditional agents such as benzodiazepines, opioids and hypnotic sedatives. The choice, at the pediatric dental level, stems from the fact that today it is still the only inductor injectable by the intramuscular route and this makes it easier to administer in the infant patient as in the dental phobophobic patient (28). The importance of ketamine in pediatric dentistry is linked to the fact that it leads to relative cardiovascular stability and has limited effects on the respiratory system: in fact it maintains intact the laryngo-pharyngeal reflexes and therefore, even in the presence of liquids in the mouth, allows swallowing physiological by spontaneously protecting the airways (31).

In general, the above-mentioned pharmacological characteristics avoid hospitalization, prevent pain and reduce the discomfort for the pediatric patient while specifically allow to carry out any dental intervention also with the help of the rubber dam, since the infant manages physiologically to control salivary flow. In the post-operative course, the use of ketamine can lead to transient visual disturbances, nausea and vomiting, while side effects are frequent especially in psychiatric patients: realistic dreams, hallucinations, floating sensation, delirium, agitation, dysphoria. Prophylactically associated administration of benzodiazepines (Midazolam) reduces the mentioned phenomena ensuring post-operative retrograde amnesia, useful to reduce the discomfort of the pediatric patient (32).

## DISCUSSION

Summarizing, ketamine compared to other categories of drugs commonly used (33-36) determines dissociative sedation leading the patient to a catalytic state characterized by deep analgesia and amnesia with the maintenance of airway protection reflexes, spontaneous breathing, and cardiopulmonary stability. It is therefore excellent for sedation



Fig. 4. Syringe pump for constant infusion.



Fig. 5. Parameter monitoring.

to perform short dental procedures, which would lead to negative pain and emotional aftermath in the pediatric dental phobia patient or in more invasive procedures (37-45). The resolution, through ketamine, of the dental infectious-antalgic urgency will allow the approach to the phobic pedodontic patient (28).

Subsequently, it will be possible to reconstruct the “patient/doctor” relationship, to completely overcome the phobia, through progressive pre-treatment psychological therapies and positive dental experiences gradually less supported by the sedative aid (46). In conclusion, ketamine is an effective agent for the conscious sedation of uncooperative pediatric patients and represents the last alternative to an intervention performed under general anesthesia. The comparison with other sedation techniques has no value, as the choice of ketamine must only take place when success has not been achieved through other modalities (33-36). Ketamine must be used by an anesthesiologist with experience in the pediatric field.

REFERENCES

1. Hall-Scullin E, Whitehead H, Milsom K, Tickle M, Su TL, Walsh TJ. Longitudinal Study of Caries Development from Childhood to Adolescence. *Dent Res* 2017; 96(7):762-7.
2. Frazão P. Epidemiology of dental caries: when structure and context matter. *Braz. oral res* 2012 (26).
3. Arhakis A, Athanasiadou E, Vlachou C. Social and Psychological Aspects of Dental Trauma, Behavior Management of Young Patients Who Have Suffered Dental Trauma. *Open Dent J* 2017; 11:41-7.
4. Kalsbeek H. Caries prevention in a historical perspective. *Food. Ned Tijdschr Tandheelkd N* 2018; 125(3):139-43.
5. Kalsbeek H. Caries prevention in historical perspective. Social factors. *Ned Tijdschr Tandheelkd* 2018; 125(11):571-6.
6. Kalsbeek H. Caries prevention in historical perspective. Oral hygiene. *Ned Tijdschr Tandheelkd* 2018; 125(1):11-14.
7. Hobdell MH. Economic globalization and oral health. *Oral disease* 2001; 7(3):137-43.
8. Bekemans L. Culture versus globalisation in Europe: actual tension or possible dialogue? *Building Towers. Perspectives on Globalisation* 2002; 191-211.
9. Cianetti S, Lombardo G, Lupatelli E, Rossi G, Abraha I, Pagano S, Paglia L. Dental caries, parents' educational level, family income and dental service attendance among children in Italy. *Eur J Paediatr Dent* 2017; 18(1):15-18.
10. D'Alessandro G, Alkhamis N, Mattarozzi K, Mazzetti M, Piana GJ. Fear of dental pain in Italian children: child personality traits and parental dental fear. *Public Health Dent* 2016; 76(3):179-83.
11. Barreto KA, Dos Prazeres LD, Lima DS, Soares FC, Redivivo RM, da Franca C, Colares V. Factors associated with dental anxiety in Brazilian children during the first transitional period of the mixed dentition. *Eur Arch Paediatr Dent* 2017; 18(1):39-43.
12. De Santis D, Pancera P, Luciano U, et al. Evaluation of bacterial flora composition on teeth and periodontal tissues in patients in treatment with rapid palatal expander. *J Biol Regul Homeost Agents* 2018; 32(Suppl. 2):31-36.
13. De Santis D, Pancera P, Luciano U, et al. Short-term in vivo evaluation of cellular DNA damage induced by fixed orthodontic appliances. *J Biol Regul Homeost Agents* 2018; 32(2 Suppl. 2):75-80.
14. Nocini PF, Castellani R, Zanotti G, Gelpi F, Covani U, Marconcini S, de Santis D. Extensive keratinized tissue augmentation during implant rehabilitation after Le Fort I osteotomy: using a new porcine collagen membrane (Mucoderm). *J Craniofac Surg* 2014; 25(3):799-803.
15. Barone A, Toti P, Bertossi D, et al. Gene Expression of Human Mesenchymal Stem Cells Cultured on Titanium Dental Implant Surfaces. *J Craniofac Surg* 2016; 27(3):712-7.
16. Bertossi D, Giampaoli G, Verner I, Pirayesh A, Nocini R, Nocini P. Complications and management after a nonsurgical rhinoplasty: A literature review. *Dermatol Ther* 2019; 32(4):e12978.
17. De Santis D, Sinigaglia S, Pancera P, Faccioni P, Portelli M, Luciano U, Cosola S, Penarrocha D, et al. An overview of socket preservation. *J Biol Regul Homeost Agents* 2019; 33:55-59.
18. De Santis D, Sinigaglia S, Pancera P, et al. An overview of guided bone regeneration. *J Biol Regul Homeost Agents* 2019; 33:49-53.
19. De Santis D, Gelpi F, Castellani R, et al. Bi-layered collagen nano-structured membrane prototype collagen matrix CM-10826 for oral soft tissue regeneration: an in vivo ultrastructural study on 13 patients. *J Biol Regul Homeost Agents* 2019; 33:29-41.
20. Robiony M, Lazzarotto A, Nocini R, Costa F, Sembronio S, Franz L. Piezosurgery: Ten Years' Experience of Percutaneous Osteotomies in Rhinoplasty. *J Oral Maxillofac Surg* 2019; 77(6):1237-44.
21. Zhurakovska K, Maiorano E, Nocini R, et al. Necrotizing sialometaplasia can hide the presence of salivary gland tumors: A case series. *Oral Dis* 2019; 25(4):1084-90.
22. Bertossi D, Nocini R, Luciano U, et al. Piezoelectric surgery inserts vs conventional burst: a clinical investigation. *J Biol Regul Homeost Agents* 2018; 32(2):15-19.
23. Bertossi D, Botti G, Gualdi A, Fundarà P, Nocini R, Pirayesh A, van der Lei B. Effectiveness, Longevity, and Complications of Facelift by Barbed Suture Insertion. *Aesthet Surg J* 2019; 39(3):241-7.
24. Nocini PF, Zanotti G, Castellani R, Grasso S, Cristofaro MG, De Santis D: Bi-layered collagen nano-structured membrane prototype (collagen matrix 10826®) for oral soft tissue regeneration: an “in vitro” study. *Clin Oral Implant Res* 2013; 24(6):612-7.
25. Attri JP, Sharan R, Makkar V, Gupta KK, Khetarpal R, Kataria AP. Conscious Sedation: Emerging Trends in Pediatric Dentistry. *Anesth. Essays Res* 2017; 11(2):277-81.
26. Coté CJ, Wilson S. Guidelines for Monitoring and Management of Pediatric Patients Before, During, and After Sedation for Diagnostic and Therapeutic Procedures. *Pediatr Dent* 2019; 41(4):259-60.
27. Bertossi D, Barone A, Iurlaro A, Marconcini S, De Santis D, Finotti M, Procacci P. Odontogenic Orofacial Infections. *J Craniofac Surg* 2017; 28(1):197-202.
28. Mistry RB, Nahata MC. Ketamine for conscious sedation in pediatric emergency care. *Pharmacotherapy* 2005; 25(8):1104-11.
29. Li L, Vlissides P. Ketamine: 50 Years of Modulating the Mind. *Front Hum Neurosci* 2016; 10:612.
30. Katzung BG. *Clinic and General Pharmacology*. B.G. Katzung, A.J. Trevor, ed. Piccin. Padova 2001; 445-460.
31. Oh S, Kingsley K. Efficacy of Ketamine in Pediatric Sedation Dentistry: A Systematic Review. *Compend Contin Educ Dent* 2018; 39(5):1-4.
32. Gomes HS, Miranda AR, Viana KA, Batista AC, Costa PS, Daher A, Machado GC, Sado-Filho J, et al. Intranasal sedation using ketamine and midazolam for pediatric dental treatment (NASO): study protocol for a randomized controlled trial. *Trials* 2017; 18(1):172.
33. Livingstone MJ, Groenewald CB, Rabbitts JA, Palermo TM. Codeine use among children in the United States: a nationally representative study from 1996 to 2013. *Paediatr. Anaesth* 2017; 27(1):19-27.
34. McCormack L, Chen JW, Trapp L, Job A. A comparison of sedation-related events for two multiagent oral sedation regimens in pediatric dental patients. *Pediatr Dent* 2014; 36(4):302-8.
35. Mehran M, Ansari G, Vahid Golpayegani M, Shayeghi S, Shafiei L. Comparison of sedative effects of oral midazolam/chloral hydrate and midazolam/promethazine in pediatric dentistry. *J Dent Res Dent Clin Dent Prospects* 2018; 12(3):221-6.
36. Kim J, Kim S, Lee DW, Ryu DS. The alternative of oral sedation for pediatric dental care. *J. Dent. Anesth. Pain. Med* 2015; 15(1):1-4.
37. De Santis D, Trevisiol L, D'Agostino A, Cucchi A, De Gemmis A, Nocini PF. Guided bone regeneration with autogenous block grafts applied to Le Fort I osteotomy for treatment of severely resorbed maxillae: a 4- to 6-year prospective study. *Clin Oral Implants Res* 2012; 23(1):60-9.
38. Lucchese A, Gherlone E, Portelli M and Bertossi D. Tooth orthodontic movement after maxillofacial surgery. *Eur J Inflamm* 2012; 10(2):227-31.
39. De Santis D, Canton LC, Cucchi A, Zanotti G, Pistoia E, Nocini PF. Computer-assisted surgery in the lower jaw: double surgical guide for immediately loaded implants in postextractive sites-technical notes and a case report. *J Oral Implantol* 2010; 36(1):61-8.
40. De Santis D, Malchiodi L, Cucchi A, Canton LC, Trevisiol L, Nocini PF: Computer-assisted surgery: Double surgical guides for immediate loading of implants in maxillary postextractive sites. *J Craniofac Surg* 2010; 21(6):1781-5.
41. Bertossi D, Albanese M, Turra M, Favero V, Nocini PF, Lucchese A. Combined rhinoplasty and genioplasty: Long-term follow-up. *JAMA Facial Plast Surg* 2013; 15(3):192-7.
42. Bertossi D, Farronato G, Picozzi V, et al. Treatment of multiple ankylosed teeth using a piezoelectric device. *J Clin Orthod* 2013; 47(11):656-60.
43. De Santis D, Cucchi A, Rigoni G, Longhi C. Short implants with oxidized surface in posterior areas of atrophic jaws: 3- to 5-year results of a multicenter study. *Clin Implant Dent Relat Res* 2015; 17(3):442-52.

44. Bertossi D, Lucchese A, Albanese M, Turra M, Faccioni F, Nocini PF, Rodríguez Y, Baena R. Piezosurgery versus conventional osteotomy in orthognathic surgery: A paradigm shift in treatment. *J Craniofac Surg* 2013; 24(5):1763-6.
45. Nocini PF, Castellani R, Zanotti G, Bertossi D, Luciano U, De Santis D. The use of computer-guided flapless dental implant surgery (NobelGuide) and

- immediate function to support a fixed full-archprosthesis in fresh-frozen homologous patients with bone grafts. *J Craniofac Surg* 2013; 24(6):e511-8.
46. Kandel E. *Alla ricerca della memoria. La storia di una nuova scienza della mente.* E. Kandel, ed. Codice. Torino 2007.

## 15 The rule of hydrogen peroxide long term rinse during a particular alveolar bone healing after ONJ injuries in a patient with periodontal disease: a 4-year radiological follow up report of a mental nerve emergence migration

R. Nocini<sup>1</sup>, D. De Santis<sup>1</sup>, U. Luciano<sup>1</sup>, T. Zambotti<sup>1</sup>, P. Pancera<sup>1</sup>, P. Faccioni<sup>1</sup>, F. Zotti<sup>1</sup>, M. Zarantonello<sup>2</sup>, M. Finotti<sup>3</sup>, A. Bertajola<sup>4</sup>, A. Zangani<sup>1</sup>, A. Iurlaro<sup>1</sup>, C. Alberti<sup>1</sup>, G. Capocasale<sup>1</sup>, D. Donadello<sup>1</sup> and F. Bernardello<sup>4</sup>

<sup>1</sup>Section of Oral and Maxillofacial Surgery, Department of Surgical Sciences, Dentistry, Gynecology and Pediatrics, University of Verona, Italy;

<sup>2</sup>Private Practitioner in Rovigo; <sup>3</sup>Free Practitioner in Padua, Italy; <sup>4</sup>Private Practitioner in Verona, Italy

**Bisphosphonate Related Osteonecrosis of the Jaw (BRONJ) is a pathology initially described in the early 2000s that has become increasingly common in clinical dentistry and maxillofacial practice due to the frequent use of bisphosphonates medical drugs (BPs) to treat various diseases such as osteoporosis, Paget's syndrome, osteomyelitis and in bone metastases secondary to tumors. Supraperiosteal irrigation applied as monotherapy and in combination with root planning or BFs related bone necrosectomy revealed that supraperiosteal irrigation with a variety of agents reduced the gingival microbial load and gingival inflammation. In this 4-year follow-up study we analyze the use of hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) as an antimicrobial agent for maintenance periodontal health, improving the longevity of teeth and oral cavity healing process.**

Since its first description in 2003, reports of bisphosphonate related osteonecrosis of the jaw (BRONJ) have been accumulated. With the ability to reduce bone turnover through selective inhibition of osteoclasts, Bisphosphonates have been used widespread in treatment of osteoporosis and bony metastases of malignant diseases. They are administered orally or intravenously, whereat the bioavailability of oral bisphosphonates is below 1 % (1). Due to local factors like chewing forces, oral bacteria, the periodontal gap and a thin mucosa, the alveolar bone necessitates an elevated osteoclastdependent bone turnover to maintain integrity (2).

When osteoclasts are diminished by a high local concentration of BPs, the bone is not capable to react to these local factors what may end in necrosis (3). Few bacterial lines are the co-factors in formation of gingival-periodontal diseases (4-10) as well as chronic bone infection (osteomyelitis) that could conduct as an open exposition of ill bone into the oral cavity.

Fortunately, some studies have shown the effectiveness of supraperiosteal irrigation applied as monotherapy and in combination with root planning or BFs related bone necrosectomy revealed that supraperiosteal irrigation with a variety of agents reduced the gingival microbial load and gingival inflammation, and as a method of maintenance periodontal therapy, it plays an important role in the longevity of teeth or oral cavity healing process (11). This further emphasizes the importance of supraperiosteal irrigation in the treatment of periodontal disease. Hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) has a long history of use as an effective antimicrobial agent with a broad spectrum of activity, including activity against bacterial spores and viruses (12) and is extensively used in applications where its decomposition into non-toxic byproducts (water and oxygen) is important (13).

The aim of this case report was to underline the efficacy of long-term weekly supraperiosteal irrigations with aerosolized 0.5% H<sub>2</sub>O<sub>2</sub> as maintenance therapy after bone necrosectomy due to BFs administration: its properties had been effective on clinical parameters and on morphological changes in bone tissues healing as this radiological CBCT 4 year follow up revealed.

### MATERIALS AND METHODS

An 82-year-old woman returned to our observation clinic after ten years from the last check-up. She only underwent restorative treatments and full mouth hygiene. The previous dental cemented prosthetic rehabilitation did not show any radiological and clinical sign or symptom of endodontic periapical disease. She only referred a slight pain in the right hemi mandibular region: a red mucosal inflammation area was visible surrounding lower right canine and I premolar teeth. There was no bone exposure or mucosal ulceration. Unfortunately, radiologic exam revealed a large radiolucent area corresponding to bone resorption. The area involved was 13mm long and 10 mm high. An OPT confirmed this radiolucent issue and it appeared worse because of its further posterior extension.

The medical history excluded any oncological impairment as a secondary oncological injury. So, it appeared quite clear it was a BRONJ case. In fact, drug history revealed assumption of Alendronate, (ADROVANCE 70 mg one pill every week for 4 years). We considered mandatory an antibiotics prescription (amoxicillin + acid clavulanic 1 g pills every 8 hours for 6 days).



Inexplicably the patient had been denied checkups for six months. After this period, the clinical situation had decidedly got worse. In fact, she referred increased pain, swelling and slight paresthesia. The oral inspection showed an ulcerated mucosal area surrounding 44 teeth. The underlying tissue appeared had a grey necrotic aspect. The radiological exam and OPT confirmed a bigger radiolucent lesion in apical direction involving the mental foramen. The successive CBCT exam showed effective extension of the radiolucent lesion as it was visible in CBCT section 28, 32 and 41. On the 30th of March 2012, the patient was sent to the Rovigo "Santa Maria della Misericordia" Hospital for a surgical debridement toilet. The subsequent histological examination gave the following result: 'Necrotic bone fragments included in purulent-fibrin material incorporate bacterial colonies morphologically consistent with Actinomyces. For 4 full years, from April 2012 to April 2016, the patient was kept under periodical close medical observation in a private dentist clinic in Legnago (Verona, Italy). Twice a week she underwent careful monitoring of wound healing in concomitance with hydrogen peroxide washing of the affected area. During this period, radiological examinations (CT-Cone Beam and OPT) were carried out at regular intervals to monitor the process and the quality of healing. Four clinical indices of periodontal inflammation have been collected since April 2012: approximal plaque index (API), modified gingival index (MGI), bleeding index (BI), and pocket probing depth (PPD). The patient had shown a substantial clinical improvement during Hydrogen peroxide irrigations.

## RESULTS

We note that Treatment suggestions of manifest BP-ONJ differ. Some authors agree with surgical approach and refer mucosal healing and wound healing after necrosectomy ranging 84 to 100% (14-16). Healing of the necrosis occurs in only 25% after strictly conservative measures and 28-58% after partial resections or debridement without soft tissue closure (17-18). However, in 2014 update the AAOMS still recommends management with antibacterial mouth rinses and antibiotics in most of the cases to preserve the quality of life (19). Others suggest more invasive surgeries for an implant/prosthesis rehabilitation (20-40) and for restoring sufficient quantities of soft tissues (41-47).

Among all the commercially available antibacterial chemical compounds the peroxide hydrogen appears to be very effective. Its oxidative properties hinder the spread of certain specific bacterial lines in periodontal pockets (especially the red complex of Socransky) which negatively affect an already compromised area (48). Among the first bacterial colonizers of the dental surface and of the periodontal pockets we find the Actinomyces Spp. (mostly obligate anaerobes) (49) that with other periodontal pathogen families (yellow, green and purple Socransky complex) are the conditions for the subsequent growth and multiplication of the main etiological agents of periodontal disease (50) which is the Socransky's red complex (51). The red cluster is composed by Treponema Denticola, Tannarella Fonsythus and Porphyromos Gingivalis, this last one is often associated with periodontal bone loss and is microbiologically considered one of a handful of pathogens that cause chronic periodontitis (52). The most common species find on the surface of osteonecrosis area are Staphylococcus Aureus, Streptococcus Aureus (part of yellow Socransky complex) and gram-negative Fusobacterium (orange Socransky complex) (49, 53). To oppose the pathogenic action of P. Gingivalis and F. Nucleatus different medical drugs have been utilized. Few scientific articles reports the use of hydrogen peroxide help to obtain a significant reduction of in vitro growth of P. Gingivalis (54), in vivo reducing periodontal inflammation as an antibacterial minimally invasive additional treatment of periodontal pathology (55) or moreover, used as a long term adjunct mouthwash to daily oral hygiene for reducing the early sings of gingival redness (56) and last in dentifrices containing 0.5% SCN- and 0.1% H2O2 inhibited plaque and decreased gingivitis (57). Moreover, peroxide hydrogen is extremely useful on obligate anaerobes such as few species of Actinomyces Spp. isolated in the bone surface by the histological post-surgery exam in this report. In this context a combined approach (surgical debridement and hydrogen peroxide) resulted to be successful and strictly indicated. Specifically, the long-term rinse.

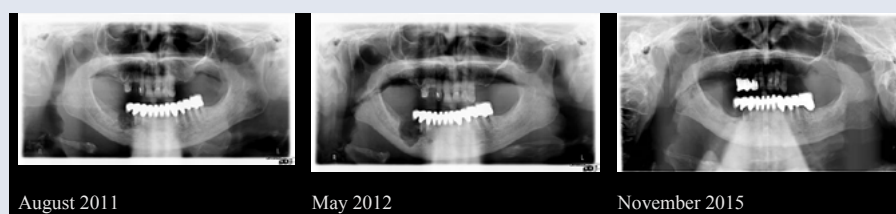


Fig. 1. Orthopantomography

sagittal prospective. These measurements are expressed in millimeters. Comparing specific radiological cuts in the equal points it appears a general increase in bone volume. It can also be noted a peculiar coronal migration of mental nerve's emergency which indicates not only a regression of the initial minus of lesion, but even a further bone centripetal apposition (Fig.1-3).

Histologically it has also been demonstrated that high concentration of hydrogen peroxide affects the wound healing process of tissues through proliferation and differentiation of fibroblast (58), the promotion of myofibroblast differentiation from fibroblast (59) and increases osteoblast survival by decreasing oxidative stress (60). Our case report seems to confirm radiologically these

Through an objective and intersubjective analysis of radiological data in our hands (CT and OPG) we measured at different times (from September 2011 to April 2016) the bone volume between 43-47 in bucco lingual frontal prospective and in apicalcoronal



histological healing processes. The centripetal bone healing apposition had been progressed for 4 years as the CBCT screen shots sequence showed alongside the hydrogen peroxide long term rinse.

## DISCUSSION

The idea arises from the considerations listed above is a complementary treatment of BP-ONJ with a surgical curettage/removal of osteonecrotic areas and frequent washes with hydrogen peroxide.

Encouraging data on the hypothetical success of this therapy comes from this clinical and 5 years long CBCT radiological follow up that describes a singular bone healing appreciable by a coronollization of mental foramen. The present study shows that non-surgical treatment with long term maintenance therapy (twice a week supragingival irrigations with Hydrogen peroxide for 4 years) improved clinical periodontal status and bone healing process. However, these findings need to be confirmed in larger and more controlled studies for any observation regarding the potential benefits of this therapy. Moreover, we found a correspondence between radiological images of bone healing and the long-term use of supragingival hydrogen peroxide rinse in the same period of follow up.

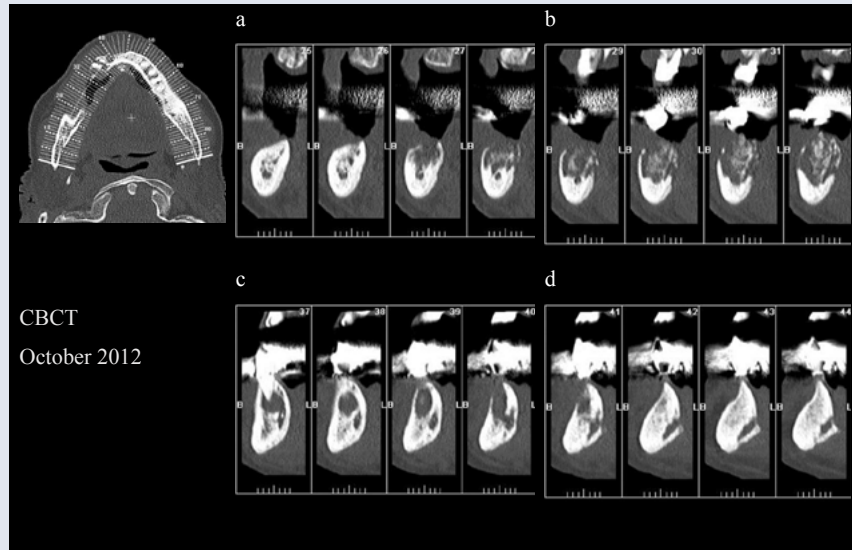


Fig. 2. Cone Beam Computer Tomography. Upper line; a): molar area; b): premolar area. Bottom line; c/d): mental foramen.

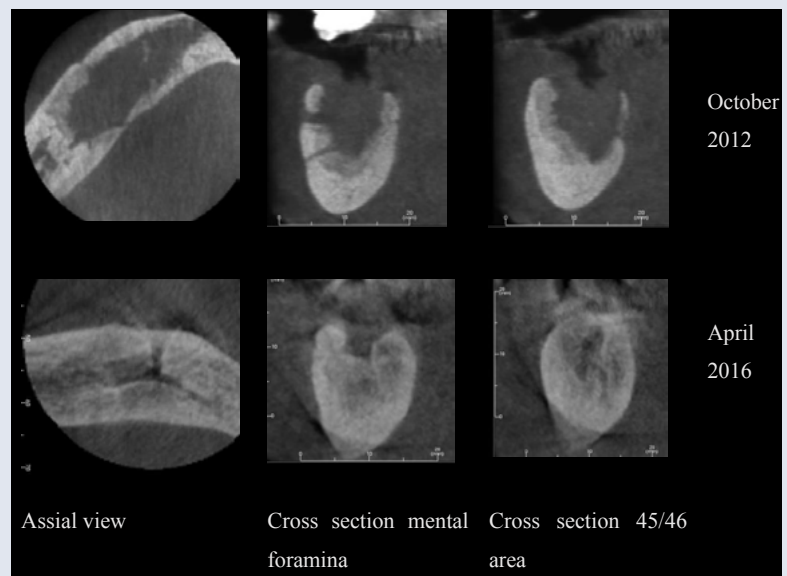


Fig. 3. Assial view

## REFERENCES

- Lin JH. Bisphosphonates: a review of their pharmacokinetic properties. *Bone* 1996; 18:75-85.
- Shibutani T, Murahashi Y, Tsukada E, Iwayama Y, Heersche JN. Experimentally induced periodontitis in beagle dogs causes rapid increases in osteoclastic resorption of alveolar bone. *J Periodontol* 1997; 68:385-91.
- Cheong S, Sun S, Kang B, Bezouglaia O, Elashoff D, McKenna CE, et al. Bisphosphonate uptake in areas of tooth extraction or periapical disease. *J Oral Maxillofac Surg* 2014; 72(12):2461-8.
- Bertossi D, Barone A, Iurlaro A, Marconcini S, De Santis D, Finotti M, Procacci P. Odontogenic Orofacial Infections. *J Craniofac Surg* 2017; 28(1):197-202.
- De Santis D, Pancera P, Luciano U, et al. Evaluation of bacterial flora composition on teeth and periodontal tissues in patients in treatment with rapid palatal expander. *J Biol Regul Homeost Agents* 2018; 32(Suppl. 2):31-36.
- De Santis D, Pancera P, Luciano U, et al. Short-term in vivo evaluation of cellular DNA damage induced by fixed orthodontic appliances. *J Biol Regul Homeost Agents* 2018; 32(Suppl. 2):75-80.
- Nocini PF, Menchini Fabris GB, Gelpi F, et al. Treatment of skin defects with growth factors and biodegradable collagen carrier: histological evaluation in animal model. *J Biol Regul Homeost Agents* 2017 ;31(2 Suppl. 2):1-13.
- De Santis D, Menchini Fabris GB, Lotti J, et al. Bi-layered collagen nano-structured membrane prototype collagen matrix 10826® for soft tissue regeneration in rabbits: an in vivo ultra-structural study of the early healing phase. *J Biol Regul Homeost Agents* 2017; 31(2 Suppl. 2):91-7.
- De Santis D, Gelpi F, Castellani R, et al. Bi-layered collagen nano-structured membrane prototype collagen matrix CM-10826 for oral soft tissue regeneration: an in vivo ultrastructural study on 13 patients. *J Biol Regul Homeost Agents* 2019; 33(Suppl 1):29-41.
- Lucchese A, Gherlone E, Portelli M and Bertossi D. Tooth orthodontic movement after maxillofacial surgery. *Eur J Inflamm* 2012; 10(2):227-31.
- Greenstein G. Research, Science and Therapy Committee of the American Academy of Periodontology. Position paper: The role of supraand subgingival irrigation in the treatment of periodontal diseases. *J Periodontol* 2005; 76(11): 2015-27.
- Von Woedtke T, Haese K, Heinze J et al. Sporicidal efficacy of hydrogen peroxide aerosol. *Pharmazie* 2004; 59(3):207-11.
- Linley E, Denyer SP, McDonnell G et al. Use of hydrogen peroxide as a

- biocide: new consideration of its mechanisms of biocidal action. *J Antimicrob Chemother* 2012; 67(7):1589-96.
14. Voss PJ, Joshi Oshero J, Kovalova-Muller A, et al. Surgical treatment of bisphosphonate-associated osteonecrosis of the jaw: technical report and follow up of 21 patients. *J Craniomaxillofac Surg* 2012; 40:719-25.
  15. Markose G, Mackenzie FR, Currie WJ, Hislop WS. Bisphosphonate osteonecrosis: a protocol for surgical management. *Br J Oral Maxillofac Surg* 2009; 47(4):294-7.
  16. Lemound J, Eckardt A, Kokemuller H, et al. Bisphosphonate-associated osteonecrosis of the mandible: reliable soft tissue reconstruction using a local myofascial flap. *Clin Oral Investig* 2012; 16:1143-52.
  17. Hoff AO, Toth BB, Altundag K, et al. Frequency and risk factors associated with osteonecrosis of the jaw in cancer patients treated with intravenous bisphosphonates. *J Bone Miner Res* 2008; 23:826-36.
  18. Boonyapakorn T, Schirmer I, Reichart PA, Sturm I, Massenkeil G. Bisphosphonate induced osteonecrosis of the jaws: prospective study of 80 patients with multiple myeloma and other malignancies. *Oral Oncol* 2008; 44:857-69.
  19. Ruggiero SL, Dodson TB. American Association of Oral and Maxillofacial Surgeons. Position paper on medication-related osteonecrosis of the jaws, 2014 update. *J Oral Maxillofac Surg* 2014; 72(10):1938-56.
  20. De Santis D, Trevisiol L, D'Agostino A, Cucchi A, De Gemmis A, Nocini PF. Guided bone regeneration with autogenous block grafts applied to Le Fort I osteotomy for treatment of severely resorbed maxillae: a 4-6-year prospective study. *Clin Oral Implants Res* 2012; 23(1):60-9.
  21. De Santis D, Canton LC, Cucchi A, Zanotti G, Pistoia E, Nocini PF. Computer-assisted surgery in the lower jaw: double surgical guide for immediately loaded implants in postextractive sites-technical notes and a case report. *J Oral Implantol* 2010; 36(1):61-8.
  22. De Santis D, Malchiodi L, Cucchi A, Canton LC, Trevisiol L, Nocini PF. Computer-assisted surgery: Double surgical guides for immediate loading of implants in maxillary postextractive sites. *J Craniofac Surg* 2010; 21(6):1781-5.
  23. De Santis D, Cucchi A, Rigoni G, Longhi C. Short implants with oxidized surface in posterior areas of atrophic jaws: 3- to 5-year results of a multicenter study. *Clin Implant Dent Relat Res* 2015; 17(3):442-52.
  24. Nocini PF, Castellani R, Zanotti G, Bertossi D, Luciano U, De Santis D. The use of computer-guided flapless dental implant surgery (NobelGuide) and immediate function to support a fixed full-archprosthesis in fresh-frozen homologous patients with bone grafts. *J Craniofac Surg* 2013; 24(6):e511-8.
  25. Bertossi D, Albanese M, Turra M, Favero V, Nocini PF, Lucchese A. Combined rhinoplasty and genioplasty: Long-term follow-up. *JAMA Facial Plast Surg* 2013; 15(3):192-7.
  26. De Santis D, Cucchi A, Rigoni G, Longhi C, Nocini PF. Relationship Between Primary Stability and Crestal Bone Loss of Implants Placed with High Insertion Torque: A 3-Year Prospective Study. *Int J Oral Maxillofac Implants* 2016; 31(5):1126-34.
  27. Nocini PF, Albanese M, Castellani R, Zanotti G, Canton L, Bissolotti G, De Santis D. Application of the "All-on-Four" concept and guided surgery in a mandible treated with a free vascularized fibula flap. *J Craniofac Surg* 2012; 23(6):e628-31.
  28. De Santis D, Cucchi A, de Gemmis A, Nocini PF. New collagen matrix to avoid the reduction of keratinized tissue during guided bone regeneration in postextraction sites. *J Craniofac Surg* 2012; 23(3):e186-9.
  29. Nocini PF, De Santis D, Morandini B, Procacci P. A dental implant in the infratemporal fossa: case report. *Int J Oral Maxillofac Implants* 2013; 28(4):e195-7.
  30. Covani U, Marconcini S, Ferrini F, Gelpi F, Finotti M, Barone A, de Santis D. Posttraumatic use of dental implants immediately after tooth extraction: clinical study. *J Craniofac Surg* 2014; 25(3):796-8.
  31. Bertossi D, Lucchese A, Albanese M, et al. Piezosurgery versus conventional osteotomy in orthognathic surgery: A paradigm shift in treatment. *J Craniofac Surg* 2013; 24(5):1763-6.
  32. Bertossi D, Giampaoli G, Verner I, Pirayesh A, Nocini R, Nocini P. Complications and management after a nonsurgical rhinoplasty: A literature review. *Dermatol Ther* 2019; 32(4):e12978.
  33. De Santis D, Sinigaglia S, Pancera P, et al. An overview of socket preservation. *J Biol Regul Homeost Agents* 2019; 33:55-9.
  34. De Santis D, Sinigaglia S, Pancera P, et al. An overview of guided bone regeneration. *J Biol Regul Homeost Agents* 2019; 33:49-53.
  35. Tuminelli FJ, Walter LR, Neugarten J, Bedrossian E. Immediate loading of zygomatic implants: A systematic review of implant survival, prosthesis survival and potential complications. *Eur J Oral Implantol* 2017; 10(Suppl 1):79-87.
  36. Robiony M, Lazzarotto A, Nocini R, Costa F, Sembronio S, Franz L. Piezosurgery: Ten Years' Experience of Percutaneous Osteotomies in Rhinoplasty. *J Oral Maxillofac Surg* 2019; 77(6):1237-44.
  37. Zhurakivska K, Maiorano E, Nocini R, et al. Necrotizing sialometaplasia can hide the presence of salivary gland tumors: A case series. *Oral Dis* 2019; 25(4):1084-90.
  38. Bertossi D, Nocini R, Luciano U, et al. Piezoelectric surgery inserts vs conventional burst: a clinical investigation. *J Biol Regul Homeost Agents* 2018; 32(2):15-19.
  39. Bertossi D, Botti G, Gualdi A, Fundarà P, Nocini R, Pirayesh A, van der Lei B. Effectiveness, Longevity, and Complications of Facelift by Barbed Suture Insertion. *Aesthet Surg J* 2019; 39(3):241-7.
  40. Borsani E, Bonazza V, Buffoli B, Nocini PF, Albanese M, Zotti F, Inchingolo F, Rezzani R, Rodella LF. Beneficial Effects of Concentrated Growth Factors and Resveratrol on Human Osteoblasts in Vitro Treated with Bisphosphonates. *Biomed Res Int*. 2018; 2018:4597321.
  41. Barone A, Toti P, Bertossi D, et al. Gene Expression of Human Mesenchymal Stem Cells Cultured on Titanium Dental Implant Surfaces. *J Craniofac Surg* 2016; 27(3):712-7.
  42. Nocini PF, Castellani R, Zanotti G, Gelpi F, Covani U, Marconcini S, de Santis D. Extensive keratinized tissue augmentation during implant rehabilitation after Le Fort I osteotomy: using a new porcine collagen membrane (Mucoderm). *J Craniofac Surg*. 2014; 25(3):799-803.
  43. Albanese M, Zotti F, Capocasale G, Bonetti S, Lonardi F, Nocini PF. Conservative non-surgical management in medication related osteonecrosis of the jaw: A retrospective study. *Clin Exp Dent Res* 2020; 1-7.
  44. Bertossi D, Farronato G, Picozzi V, et al. Treatment of multiple ankylosed teeth using a piezoelectric device. *J Clin Orthod* 2013; 47(11):656-60.
  45. Sculean A, Romanos G, Schwarz F, et al. Soft-Tissue Management as part of the surgical treatment of periimplantitis: A Narrative Review. *Implant Dent* 2019; 28(2):210-16.
  46. De Santis D, Graziani P, Castellani R, et al. A New Radiologic Protocol and a New Occlusal Radiographic Index for Computer-Guided Implant Surgery. *J Craniofac Surg* 2016; 27(5):e506-10.
  47. Nocini PF, Zanotti G, Castellani R, Grasso S, Cristofaro MG, De Santis D: Bi-layered collagen nano-structured membrane prototype (collagen matrix 10826®) for oral soft tissue regeneration: an "in vitro" study. *Clin Oral Implant Res* 2013; 24(6):612-7.
  48. Leke N, Grenier D, Goldner M, Mayrand D. Effects of hydrogen peroxide on growth and selected properties of *Porphyromonas gingivalis*. *FEMS Microbiology Letters* 1999; 174(2):347-53.
  49. Marsh P, Martin MV, et al. *Oral Microbiology*. New York 2002; 75-80.
  50. Thomas JG, Nakaishi LA. Managing the complexity of a dynamic biofilm. *Journal of American Dental Association* 2006; 137(Suppl. I):10s-15s.
  51. Socransky SS, Haffajee AD, Cugini MA, Smith C, Kent R L. Microbial complexes in subgingival plaque. *Journal of Clinical Periodontology* 1998; 25:134-44.
  52. Li N, Collyer CA. Gingipains from *Porphyromonas gingivalis* - Complex domain structures confer diverse functions. *Eur J Microbiol Immunol (Bp)* 2011; 1(1):41-58.
  53. Sarkar J, McHardy IH, Simanian EJ, Shi W, Lux R. Transcriptional responses of *Treponema denticola* to other oral bacterial species. *PLoS One* 2014; 9(2):e88361.
  54. Hady Haririan, Oleh Andrukhov, Kristina Bertl, et al. Microbial analysis of subgingival plaque samples compared to that of whole saliva in patients with periodontitis. *J Periodontol* 2014; 85(6):819-28.
  55. Zakeri Mah, Ghanbari H, Naderi NM, Zareian JM, Zakeri Maj, Arjmand N. Lethal effect of blue light-activated hydrogen peroxide, curcumin and erythrosine as potential oral photosensitizers on the viability of *Porphyromonas gingivalis* and *Fusobacterium nucleatum*. *Laser Ther* 2015; 24(2):103-1.
  56. Hossainian N, Slot DE, Afennich F, Van der Weijden GA. The effects of hydrogen peroxide mouthwashes on the prevention of plaque and gingival inflammation: a systematic review. *Int J Dent Hyg* 2011; 9(3):171-81.
  57. Rosin M, Kocher T, Kramer A: Effects of SCN<sup>-</sup>/H<sub>2</sub>O<sub>2</sub> combinations in dentifrices on plaque and gingivitis. *J Clin Periodontol* 2001; 28(3):270-6.
  58. Balzer J, Heuer K, Demir E, et al. Non-Thermal Dielectric Barrier Discharge (DBD) Effects on Proliferation and Differentiation of Human Fibroblasts Are Primary Mediated by Hydrogen Peroxide. *PLoS One* 2015; 10(12):e0144968.
  59. Toullec A, Gerald D, Despouy G, et al. Oxidative stress promotes myofibroblast differentiation and tumour spreading. *EMBO Mol Med* 2010; 2(6):211-30.
  60. She C, Zhu LQ, Zhen YF, Wang XD, Dong QR. Activation of AMPK protects against hydrogen peroxide-induced osteoblast apoptosis through autophagy induction and NADPH maintenance: new implications for osteonecrosis treatment? *Cell Signal* 2014; 26(1):18.

## 16 Zygomatic implants supported rehabilitations in atrophic maxilla: sinus complications, radiological, periodontal and prosthodontic evaluations: a one year follow up retrospective longitudinal study

A. D'Agostino<sup>1</sup>, U. Luciano<sup>1</sup>, A. Zangani<sup>1</sup>, A. Iurlaro<sup>1</sup>, M. Zarantonello<sup>2</sup>, F. Zotti<sup>1</sup>, A. Poscolere<sup>1</sup>, N. Modena<sup>1</sup>, C. Alberti<sup>1</sup>, G. Capocasale<sup>1</sup>, D. Donadello<sup>1</sup>, P. Faccioni<sup>1</sup>, P. F. Nocini<sup>1</sup>, R. Nocini<sup>1</sup> and D. De Santis<sup>1</sup>

<sup>1</sup>Section of Oral and Maxillofacial Surgery, Department of Surgical Sciences, Dentistry, Gynecology and Pediatrics, University of Verona, Italy;

<sup>2</sup>Free practitioner in Rovigo, Italy

**The rehabilitation of maxillary bone atrophy represents one of the main challenges of modern oral implantology. The use of zygomatic implants in the prosthetic rehabilitation of the patient affected by severe maxillary bone atrophy is another therapeutic alternative, not exempt from complications. The present study included 19 patients with edentulous maxillae who were treated between 2013 to 2015 with at least two zygomatic implants at the Department of Maxillofacial Surgery, Verona, Italy. The purpose of this retrospective longitudinal study was to evaluate sinus complications and radiological, periodontal and prosthetic evaluations of zygomatic implants technique in severe atrophic. Implant-prosthetic rehabilitation of the upper jaw edentulous severely atrophic using zygomatic implants represents one safe and repeatable technique. In terms of implant survival from our study showed an implant CRS (common reporting standard) of 98.5% and a prosthetic CRS 100% with a mean follow-up period of 19.2 months (range). Both recorded data are superimposed on major reported studies in literature.**

The rehabilitation of maxillary bone atrophy represents one of the main challenges of modern oral implantology. The use of zygomatic implants in the prosthetic rehabilitation of the patient affected by severe maxillary bone atrophy is another therapeutic alternative, not exempt from complications. The present study included 19 patients with edentulous maxillae who were treated between 2013 to 2015 with at least two zygomatic implants at the Department of Maxillofacial Surgery, Verona, Italy.

The purpose of this retrospective longitudinal study was to evaluate sinus complications and radiological, periodontal and prosthetic evaluations of zygomatic implants technique in severe atrophic. Implant-prosthetic rehabilitation of the upper jaw edentulous severely atrophic using zygomatic implants represents one safe and repeatable technique.

In terms of implant survival from our study showed an implant CRS (common reporting standard) of 98.5% and a prosthetic CRS 100% with a mean follow-up period of 19.2 month (range). Both recorded data are superimposed on major reported studies in literature.

The great advantage of this type of rehabilitation is not only to minimize postoperative morbidity caused by massive reconstructive surgeries (1-4) such as bone grafting (5-15) or sinus floor elevation, but also to eliminate hospitalization, high cost and risk of complications. The placement of dental implants in the zygomatic bone, introduced by Branemark in 1988, is an alternative technique that can facilitate the rehabilitation procedures in severely atrophic maxilla and maxillectomy defects (16-18), pre prosthetic surgery following ablative tumor surgery (19), congenital cleft lip and or palate (20). Zygomatic implants have been used in conjunction with regular implants or alone in the number of four when the premaxilla presents severely resorbed. The main objective of the present article is to draw a retrospective longitudinal study to evaluate the cumulative zygomatic implants survival rate and peri-implant soft tissues condition and complications at the one-year follow-up.

### MATERIALS AND METHODS

The study included 19 patients (9 males and 10 females) range 46- to 88- years-old (mean age 66+/-12 years) with edentulous maxillae who were treated between 2013 to 2015 with at least two zygomatic implants at the Department of Maxillofacial Surgery, Verona, Italy. The patients enrolled in this study met the following inclusion criteria:

- affected by V-VI or VII Cadwood Howell (21) Nocini (22-23) class maxillary atrophy evaluated through a pre- and post-surgery TC cone beam at least 12 months prior;
- good general/local health which allowed them to undergo this kind of surgical treatment;
- treated with at least two zygomatic implants;
- able to receive a full arch prosthodontics rehabilitation such as Toronto Bridge or other kind of overdentures for six months loading.

Patients were excluded if they fulfilled any of the following exclusion criteria:

- previously treated with zygomatic implants not for atrophic disease;
- not affected by allergic rhinitis;
- not previously treated with sinus surgery;
- addicted to smoking;
- lack of clinical documentation.

All these patients showed an insufficient bone volume for traditional implant treatment. However, for 6 patients, a generic medical

history revealed a positive anamnesis: 2 diabetes type II, 1 HIV+, 1 HBV+, 2 HCV+, 1 Parkinson, 1 mucoviscidosis and chronic pancreatitis. All patients received a detailed description of the procedures and signed an informed consent prior to participation in the study. The study was conducted according to the principles embodied in the Helsinki declaration, as revised in the 2000, for biomedical research involving human subjects. Patients who were included in the study were carefully evaluated by examining the clinical aspects and periapical/panoramic radiographs and computer tomograms (CT); moreover, data were collected for each patient at the implants placement phase (T0), at the prosthodontic loading (T1) and at the follow up date (T2) and reported in Table I.

After the surgical phase, 5 patients received two Zygomatic Implants (ZI) and four dental implants in the premaxilla; other 12 patients had 4 ZI (Quad Technique), one patient had three ZI and two dental implants and one pterygoid implant, one patient had two ZI and three dental implants in the premaxilla. After prosthodontic phase, 13 patients were rehabilitated through a Toronto Bridge fixed full arch, meanwhile other 9 patients received an overdenture.

Panoramic images supplemented with intraoral radiographs were used preoperatively to evaluate the bone volume of the maxilla. Computed tomograms (CT) were used to determine whether the anatomy would allow installation of zygomatic implants (24) and to eliminate the risk of undiagnosed pathologic lesions.

Preoperative Cadwood Howell Nocini Classification was assessed for each patient ranging from V to VI. Postoperatively a new CT was performed at least 12 months after surgery. Pre surgical Protocol: presurgical exams were detected to analyze bone amount in each patient, i.e. panoramic exam, intraoral radiographs, teleradiographs L-L and Cone Beam TC of the maxillo facial process to accurately evaluate anatomic structures. Evaluation was carried out on the size of the malar bone and Higmore antrum, the topography of the front wall of the temporal fossa, the degree of pneumatization of maxillary sinus, the thickness of the alveolar process in the premolar area, the degree of bone atrophy and the skeletal relationship between jaws (Fig. 1).

In order to carry out the most prosthetically guided surgery, it was crucial to study the angularity and the expected emergency position of zygomatic implants: this emergency at the alveolar ridge depends on the spatial relationship between the zygomatic bone, the maxillary sinus and the Alveolar crest. Acute phase sinus pathology and/or signs/symptoms of tissue infection (25-30) surrounding the site insertion area are also evaluated. Where present an adequate amount of bone in the pre-maxilla area it was decided to place two to four conventional implants (31-33), to avoid any bone grafts and best distribution in prosthetic cargo. The position and angle

**Table I.** Documentation between T0 and T2.

Preoperative documentation	
Orthopantomographies of the dental arches	
Intraoral radiographs of the implant sites	
Lateral teleradiography	
CBCT of the facial massif	
Preoperative clinical photos	
Intraoperative documentation (T0)	
Clinical photos with open flap	
Clinical photos of implant placement	
Clinical photos with suture	
Postoperative documentation	
Orthopantomographies of the dental arches	
Clinical photos before hospital discharge	
Hospital discharge letters	
Follow up documentation (T2)	
Clinical photos before and after disassembly of the prosthesis	
Extraoral photos of the prosthesis	
CBCT of the facial massif for evaluation of the zygomatic bone	



**Fig. 1.** Intra-operative documentation. **a)**: front view of edentulous atrophic patient, closed lips; **b)**: details of edentulous atrophic patient's mouth and the lack in trophism of perioral tissues; **c)**: right profile of edentulous atrophic patient, closed lips; **d)**: occlusal view of the patient's atrophic Maxilla, VII class Cadwood and Howell.



**Fig. 2.** From left to right: Intra-operative check of prosthetic parallelism after Zygomatic implants insertion; Intra-operative fracture of Zygomatic arch during zygomatic implants drilling; Intra-operative occlusal view of Zygomatic implants position; Occlusal view of Zygomatic implants position with healing caps.

elevation revealed the nasal apertures and the piriform rim to the inferior aspect of the infraorbital foramina and laterally of the buttress and body of the zygoma bilaterally.

A round bur rather than piezosurgery tools (34-35) was then used to create a lateral window, 5x10 mm, in the lateral wall of the

of the conventional rear implant was determined based on the maxillary sinus anatomy, anterior wall. Surgery was performed under general anesthesia with nasal endotracheal intubation supplemented with infiltration of local anesthetic agents with a vasoconstrictor

for hemostasis. Patients were given benzylpenicillin (3g) and metronidazole (0.5g) preoperatively routinely. A crestal incision was made bilaterally extending from the second upper molar. A vestibular releasing incision was made at the posterior extent of the incision in the maxillary second molar region. A mucoperiosteal flap



maxillary sinus. The sinus mucosa was then carefully reflected and protected through the preparation of the zygomatic implant site. A retractor was placed over the superior aspect of the zygomatic arch to enable correct orientation of the implant site preparation. The zygomatic implant heads were placed palatally and as close as possible to the alveolar crest, in the region of the second premolar and first molar. After penetrating the maxillary bone into the maxillary sinus, the preparation was penetrating the cortical layer of the anterior superior part of the zygomatic bone.

The implant sites were then enlarged. Implant size was determined, and final placement of the implant was accomplished using the standard protocol. The zygomatic implant was placed using a low speed until the tip of the implant engaged the zygomatic bone and was finalized manually until the implant was optimally seated. All 31 zygomatic implants had a stable and ridged primary stability at the installation and were dressed in a cover screw. Patients obtained immediate placement of additional endosseous implants (36-39) in the anterior region of the maxilla (Branemark System, Nobel Biocare AB, Goteborg, Sweden). The wound was closed with a continuous, absorbable 4-0 suture. Postoperatively, the patients were prescribed antibiotics for 1 week. Abutment connection surgery was performed after a healing time of 5 to 8 months (mean 6.4 months).

#### Prosthetic Protocol

The conventional dentures were relined after implant surgery and after abutment connection and were worn provisionally in the healing periods. Fabrication of Toronto Bridge or overdentures implant supported fixed prostheses followed the standard procedures for the implant treatment, as described in literature (40-42). The fixed prosthesis was finally handed out 4 months after the abutment connection procedure. All patients were enrolled in a personally tailored supportive periodontal maintenance program; in this study all patients were maintained with oral hygiene instructions, or air polishing (glycin powder) on an individual basis according to their needs.

#### Follow Up

Input measures examinations and study variables analysis. Data were collected after zygomatic implants placement (baseline or Time 0), at time 1 and time 2; data were retrospectively analyzed according to a research protocol. An examiner not involved in performing the surgical treatment, took all the measurements as outlined below:

- age and gender as demographic variables at T 0,
- surgical technique according to Aparicio's classification (43),
- type and number of implants placed,
- perimplant Pocket Probing Depth (PPD),
- Mombelli Bleeding Index (44) (MBI): was measured with a periodontal probe (Hu-Friedy, PGF-GFS, Hu-Friedy, Chicago, IL, USA) at the buccal (mesial, vestibular and distal) and palatal surfaces,
- Mombelli Plaque Index (MPI): was measured with a periodontal probe (Hu-Friedy, PGF-GFS, Hu-Friedy, Chicago, IL, USA) at the buccal (mesial, vestibular and distal) and palatal surfaces,

- Implant surgery-Prosthesis evaluation: measure of prosthetic screw torque at T1 and T2; moreover, patients had to compile a Visual Analogue Scale (VAS), satisfaction questionnaire about aesthetic, function and phonetic.

- radiological and clinical analysis of the maxillary sinuses: evaluated on Cone Beam CT scan (CBCT, NewTom 3G). The data acquisition was set through a single rotation of the device, with 59 $\mu$ Sv radiant dose for each patient. Coronal, axial and sagittal images were obtained for each implant considered in this study. The osteointegrated portion of the zygomatic bone was calculated using a specific medical imaging viewer: Radiant DICOM Viewer (Radiant DICOM ViewerTM, Medixant, Poznan, Poland). Nineteen patients received zygomatic implant treatment and were included in the study. All patients were contacted for a further prospective follow-up examination. Subsequently the patients underwent clinical and radiographic examination according to the prospective follow-up protocol.



**Fig. 3.** Top line from left to right: front view of the full-mouth prosthetic rehabilitation in occlusal position; left-side view; right-side view; Bottom line from left to right: occlusal view of the zygomatic overdenture rehabilitation; occlusal view of the overdenture bar on Zygomatic implants with retentive pins; front view of the transversal relation between the overdenture bar and the inferior prosthetic rehabilitation.



**RESULTS**

Implant Stability: nineteen patients were treated with 63 zygomatic implants (Branemark System) with lengths range from 35 to 50 mm. One patient was treated with 2 unilateral zygomatic implant, one patient received 3 zygomatic implants, 12 patients received 4 zygomatic implants (quad technique) and 5 patients had 2 zygomatic implants bilaterally (see Table II). Twenty-six additional dental implants (Branemark System or Astra Tech Dental Implant System) were placed (see Table II). Out of 19 patients, 17 were non-smokers and 2 (one male/ one female) were smokers (20 cigarettes in a day).

Serious maxillary bone defects were caused in 14 cases (7 males and 7 females) from periodontitis disease, in 1 case (1 male) by upper cystic process, in another 1 case by partial maxillectomy due to an atypical lymphoproliferative process with a rich follicular component (1 female), 2 cases of previous implant failure (2 females) and 1 trauma case (1 male) (Table II). Post-surgery complications (45-49): one zygomatic implant, in one patient, was removed after a car crash trauma. After a mean follow-up period of 19.2 months (range), the overall cumulative survival rate (CSR) was 94.3%. After the prosthetic loading of the implants the survival percentage was 100%. The follow-up period ranged from 105 to 2483 days from the day of prosthesis delivery, with a mean of 570.52 days (3 years, 10 months). From the patient records, the following parameters were recorded:

Soft Tissues: the mean PPD was 3.16 mm (dev. St.±1.75 range 1-11). The mean mPI was 0.7 (dev. St.±0.9 range 0-3). The mean mBI was 0.54 (dev. St.±0.7 range 0-2). It was not necessary a soft tissue augmentation around the implant exit point (50-65).

*Prosthetic components analysis*

Overall, the torque of 63 prosthetic screws was evaluated: at T1 the mean torque was 15.68 Ncm (dev st±8.41 Ncm range 0-30 Ncm). T2 torque of MUA screw was evaluated to investigate possible unscrewings: at T1 it was serried with 15-18 Ncm. 37 screw on MUA were analyzed: the mean torque was 11.81 Ncm (dev st 4.23 Ncm range0-17 Ncm).

*Prosthesis satisfaction*

The definitive prosthesis was delivered to the patient 4 months after surgery. It had been performed 13 Toronto Bridge and 6 overdentures. A prosthetic questionnaire for the evaluation of the satisfaction (56) based on Visual Analogue Scale (VAS) was given to the patients. It was formed by three parts: function (mean VAS 9.3/10), aesthetic (mean VAS 9.7/10) and phonetic (mean VAS 9.2/10).

*Maxillary sinuses*

The presence of sinusitis was radiologically evaluated according to the Lund and Mackay CT scoring rhinological staging system. So, evaluation of the maxillary sinuses was executed before surgery (mean 0.078±0.27) and after 6 months (0.26±0.5) to evaluate the differences between the two values obtained.

*Entities of rhinosinusual symptomatology*

For each patient, the Questionnaire SNOT-20 (Sino-Nasal Outcome Test) was collected before and after surgery with a minimum 12 months follow up. This tool evaluates a wide range of parameters including health, the Quality of life, physical problems, functional limitations and emotional consequences. (Lachanas et al. 2012). This study has been used to standardize the evaluation of the symptoms pool referred by the patients. Clinical analysis of maxillary sinuses the magnitude of symptomatology of rhinitis-sinus relevance has been evaluated through the administration of the SNOT-20 questionnaire.

In detail, the Preoperative assessment 17 out of 19 patients showed a score Ranging from 0 to 10. The remaining 2 patients reported a score Between 11 and 40 None of these patients considered their disease to be significantly affected Quality of life, limiting the management of any therapy symptoms to the need. The SNOT-20 total score for this sample in the survey Preoperative was 49 points, with an average score of 2.58±6.61, while in the postoperative survey the total score of the sample Was 80 points, with an average of 4.21±6.93. At postoperative evaluation, 16 out of 19 patients reported a score ranging from 0 to 10. Instead, the remaining 3 patients reported a score between 11 and 40.

**Table II.** Demographic variables.

<i>Variables</i>	<i>Results</i>
<i>Patients (n=19)</i>	19
<i>Male</i>	9 (47%)
<i>Female</i>	10 (53%)
<i>Age (average value and range)</i>	66 (46-88)
<i>Loading (day) – average value</i>	276,21
<i>Follow-up (day) average value</i>	570,52
<i>Total implant number</i>	63
<b><i>Surgical technique</i></b>	
<i>Intrasinusal</i>	17
<i>Extrasinusal</i>	2
<i>Quad</i>	12
<i>2 Zygoma + 4 traditional</i>	5
<i>2 Zygoma + 3 traditional</i>	1
<i>2 Zygoma + 1 pterigoid + 2 traditional</i>	1

## DISCUSSION

The purpose of this retrospective longitudinal study was to evaluate sinus complications and a radiological, periodontal, prosthetic evaluations of zygomatic implants technique in severe atrophic at the 1 year follow up.

### *Surgery*

After surgical procedures, we did not register any intraoperative complications; immediately after surgery we only found one implant failure before the prosthetic loading. This study reported implant and prosthetic survival rates so similar to other Authors' clinical experiences.

### *Prosthetic parameters*

In this longitudinal retrospective study, a total of 19 patients were screened for a total of 63 implants and 19 prosthetic rehabilitation. The Med Calc (Med Calc Software bvba, Ostend, Belgium) software was used for statistical analysis. The Mann-Whitney U test for independent variables (level of significance a  $P < 0.05$ ) tested data collected by all 19 patients to determine the possible correlation between the kind of prosthetic rehabilitation and torque measured on the prosthetic screws. It revealed that no statistically significant differences between torque levels on prosthetic screws in non-removable prostheses and Toronto Bridge's ones related to the loading time ( $P > 0.05$ ).

The same Mann Whitney test was used to evaluate the possible correlation between the kind of prosthetic rehabilitation and torque levels measured on the MUA screws. ( $P > 0.05$ ). For measurements collected at 1.2, it was not possible to carry out the Mann Whitney U test due to insufficient samples number. Otherwise, it showed no significant differences in torque registered level on screws between overdenture and Toronto in other sites. In all these cases a  $P > 0.05$  was provided. Therefore, there is no statistically relevant correlation between the type of prosthetic solution adopted and possible tensile stresses at the prosthetic screw and MUA. All the authors decided to evaluate the possible correlations between type of prosthesis and the measurement of Pocket Depth (PD) at T2 using the same Mann Whitney U test with a statistical significance value of  $P < 0.05$ . The text revealed a correlation between prosthesis type and PD at T2 with a  $P < 0.05$ . We observed that two posterior implants 1.4 and 2.4 showed most significant differences. Particularly posterior zygoma implants in overdentures showed higher values of PD than ones in Toronto.

The same statistical test was carried out to analyze the relationship between the follow-up survey bleeding and the type of prosthetic solution. There was no statistical significance from this test that could justify a correlation between the type of prosthesis and the bleeding indices recorded at follow-up. Implanted rehabilitations require, for long-term survival, a great home hygiene by the patient, in order to evaluate which of the two prosthetic solutions provides greater cleanability, the Mann-Whitney test for independent variables Twotier, correlating the type of prosthesis with plaque indexes recorded at the follow up visit.

The test showed that there are statistically significant differences in 2 sites (1.4 P and 2.4 P) in which the amount of plaque detected was found significantly greater in unmistakable prostheses than Toronto. The question of prosthetic satisfaction has provided results. In line with what was reported in the literature by a 12-month analysis from the load reported by Peñarrocha (63).

Radiographic indices Based on Wilcoxon's Row Test for dependent variables, there is a statistically significant increase ( $p < 0.0002$ ) of the magnitude of the postoperative radiological evidence of rhinosinus pathology compared to preoperative evidence. Based on the Lund-Mackay score, the presence of rhinosinus or of mucosal alterations was evaluated by tapered CT in the coronal sections. In detail, no patient had preoperative evaluation total radiopacity of the maxillary sinuses (LMS = 2+2). Three patients showed up unilateral mucous membrane (LMS=1). The remaining patients had bilateral radiotransparency (LMS=0) of the maxillary sinuses. Altogether, there were 35 breasts in the preoperative evaluation jaws with LMS equal to 0.3 maxillary sinuses with LMS equal to 1 and 0 breasts jaws with LMS equal to 2. Clinical analysis of maxillary sinuses: the magnitude of symptomatology of rhinitissinus relevance has been evaluated through the administration of the SNOT-20 questionnaire. In detail, the preoperative assessment 17 out of 19 patients showed a score ranging from 0 to 10. The remaining 2 patients reported a score between 11 and 40. None of these patients considered their own symptomatically affected quality of life, limiting the management of any therapy symptoms to the need.

At postoperative evaluation, 16 out of 19 patients showed a score from 0 to 10. The remaining 3 patients reported a score between 11 and 40 (89%-11%). The SNOT-20 total score for this sample in the survey preoperative was 49 points, with an average score of  $2.58 \pm 6.61$ , while in the postoperative survey the total score of the sample was 80 points, with an average of  $4.21 \pm 6.93$ . Hirsch (Hirsch, et al. 2004) also used the VAS scale for 2004 evaluate the chewing function and the aesthetics of 76 patients rehabilitated with zygomatic implants after 1 year of prosthetic cargo. The 80% of patients were completely satisfied with both aesthetics and asthma for the function.

Comparison of the degree of prosthetic satisfaction, reported in the literature and that recorded by our study, showed 110 fully satisfied with the rehabilitation while the other half of the patients found difficulty in chewing and problems related to oral hygiene, aesthetics and phonetics. Farzad et al. (66) analyzing the answers to questionnaires satisfaction delivered to 11 patients before and

after implantoprosthesis rehabilitation, finds statistically significant differences with respect to chewing and aesthetics but does not find significant changes in the language.

#### *Radiographic indices*

Based on Wilcoxon's Ranks Test for Employee Variables there is a statistically significant increase ( $p < 0.0002$ ) of the entity of postoperative radiological evidence of rhinosinus pathology to preoperative evidence. Inizio modulo

#### *Clinical analysis of maxillary sinuses*

Based on Wilcoxon's Row Test for Employee Variables there is no statistically significant increase ( $p=0.1$ ) of the magnitude of rhinosinus symptomatology compared to preoperative.

The clinical and radiological retrospective study allowed to highlight the following results: implant-prosthetic rehabilitation of the upper jaw edentulous severely atrophic using zygomatic implants represents a safe and repeatable technique. In terms of implant survival from ours. The study showed an implant CRS of 98.5% and a prosthetic CRS 100%. Both recorded data are superimposed on those reported in major studies in literature. As for implant survival it was also not detected no statistically significant difference between the various techniques of zygomatic implant insertion, which are therefore overlapping. The analysis of prosthetic components did not show correlations or statistically significant differences between inamputable prostheses and the Toronto Bridge prostheses, both with respect to the torque values recorded on the prosthetic screws, as well as the torque values recorded at the screws of MUA.

The analysis of periodontal parameters related to the type of prosthesis has produced statistically significant results with regard to depth of the survey, despite the resulting depth values of the poll (PD) greater in, intact, removable prostheses has not found any clinical significance since the modified bleeding index associated with the type of prosthesis has produced statistically significant results. The modified plaque index showed a greater accumulation of palatal plaque at the zygomatic rear implant (1.4 and 2.4) with unmovable prosthesis, this could reflect a greater difficulty in detaching the patient's in-removable implant prosthesis posteriorly due to its conformation.

The radiologic analysis of paranasal sinuses, subjected to zygomatic implantation, showed a statistically significant increase in Lund-Mackay Postoperative Score. The rise of radiologic sinusitis, elsewhere already described as silent sinusitis, does not correspond, and does not correlate with a statistically significant increase in clinical symptoms since SNOT20 postoperative values did not record significant variations. Long-term monitoring and follow-ups is necessary in order to verify the actual incidence of sinusopathies related to the presence of transient zygomatic implants. To conclude, we can say that implant prosthetic rehabilitation through zygomatic implants in cases of extreme atrophy of the edentulous upper jaw is a good alternative to those more invasive procedures such as Le Fort I intervention with interposition grafts or revascularized free flaps characterized by a larger Surgical complexity, a more burdensome post-operative course for the patient, and a greater chance of failure.

#### **ACKNOWLEDGEMENTS**

All the Authors would like to thank and remember a friend and colleague Prof. Pasquale Procacci, who unfortunately prematurely died.

#### **REFERENCES**

- Taylor GI, Miller GD, Ham FJ. The free vascularized bone graft. A clinical extension of microvascular techniques. *Plast Reconstr Surg* 1975; 55(5):533-44.
- Sjostrom M, Sennerby L, Nilson H, Lundgren S. Reconstruction of the atrophic edentulous maxilla with free iliac crest grafts and implants: A 3-Year report of a prospective clinical study. *Clin Implant Dent Relat Res* 2007;9(1):46-59.
- Seiler JG, Johnson J. Iliac crest autogenous bone grafting: donor site complications. *J South Orthop Assoc* 2000; 9(2):91-7.
- Nocini PF, Chiarini L, Fior A, and Bedogni A. Le Fort I osteotomy to correct malocclusion after reconstruction of the maxilla with the free fibula flap. *J Craniofac Surg* 2009; 20(5):1420-3.
- De Santis D, Trevisiol L, D'Agostino A, Cucchi A, De Gemmis A, Nocini PF. Guided bone regeneration with autogenous block grafts applied to Le Fort I osteotomy for treatment of severely resorbed maxillae: a 4- to 6-year prospective study. *Clin Oral Implants Res* 2012; 23(1):60-9.
- De Santis D, Canton LC, Cucchi A, Zanotti G, Pistoia E, Nocini PF. Computer-assisted surgery in the lower jaw: double surgical guide for immediately loaded implants in postextractive sites-technical notes and a case report. *J Oral Implantol* 2010; 36(1):61-8.
- Bertossi D, Albanese M, Turra M, Favero V, Nocini PF, Lucchese A. Combined rhinoplasty and genioplasty: Long-term follow-up. *JAMA Facial Plast Surg* 2013; 15(3):192-7.
- De Santis D, Cucchi A, Rigoni G, Longhi C, Nocini PF. Relationship Between Primary Stability and Crestal Bone Loss of Implants Placed with High Insertion Torque: A 3-Year Prospective Study. *Int J Oral Maxillofac Implants* 2016; 31(5):1126-34.
- De Santis D, Graziani P, Castellani R, Zanotti G, Gelpi F, Marconcini S, Bertossi D, Nocini PF. A New Radiologic Protocol and a New Occlusal Radiographic Index for Computer-Guided Implant Surgery. *J Craniofac Surg* 2016; 27(5):e506-10.
- Brandtner C, Borumandi F, Krenkel C, Gaggi A. A new technique for sandwich osteoplasty with interpositional bone grafts for fixation. *Int J Oral Maxillofac Implants* 2014; 29(5):1164-9.
- Nocini PF, Menchini Fabris GB, Gelpi F, Lotti J, Favero V, Zanotti G, Jurlaro A, Roskopf I, Lotti T, Barone A, Castegnaro G, De Santis D. Treatment of skin defects with growth factors and biodegradable collagen carrier: histological evaluation in animal model. *J Biol Regul Homeost Agents* 2017; 31(2 Suppl. 2):1-13.
- De Santis D, Gelpi F, Castellani R, Palumbo C, Ferretti M, Zanotti G, Zotti F, Montagna L, et al. Bi-layered collagen nano-structured membrane prototype collagen matrix CM-10826 for oral soft tissue regeneration: an in vivo ultrastructural study on 13 patients. *J Biol Regul Homeost Agent* 2019; 33(Suppl 1):29-41.
- Nocini PF, Castellani R, Zanotti G, Bertossi D, Luciano U, De Santis D. The use of computer-guided flapless dental implant surgery (NobelGuide) and immediate function to support a fixed full arch prosthesis in fresh-frozen homologous patients with bone grafts. *J Craniofac Surg* 2013; 24(6):e511-8.

14. De Santis D, Malchiodi L, Cucchi A, Canton LC, Trevisiol L, Nocini PF: Computer-assisted surgery: Double surgical guides for immediate loading of implants in maxillary postextractive sites. *J Craniofac Surg* 2010; 21(6):1781-5.
15. ten Bruggenkate CM, Kraaijenhagen HA, van der Kwast WA, Krekeler G, Oosterbeek HS. Autogenous maxillary bone grafts in conjunction with placement of I.T.I. endosseous implants. A preliminary report. *Int J Oral Maxillofac Surg* 1992; 21(2):81-4.
16. Higuchi KW. The Zygomatic Fixture: An alternative approach for implant anchorage in the posterior maxilla. *Ann R Australas Coll Dent Surg* 2000; 15:28-33.
17. Widmark G, Andersson B, Andrup B, Carlsson GE, Ivanoff CJ, Lindvall AM. Rehabilitation of patients with severely resorbed maxillae by means of implants with or without bone grafts. A 1-Year follow-up study. *Int J Oral Maxillofac Implants* 1998; 13(4):474-82.
18. Nakai, H, Okazaki Y, Ueda M. Clinical application of zygomatic implants for rehabilitation of the severely resorbed maxilla: a clinical report. *Int J Oral Maxillofac Implants* 2003;18(4):566-70.
19. Schramm A, Gellrich NC, Schimming R, Schmelzeisen R. Computer-Assisted insertion of zygomatic Implants (Branemark System) after extensive tumor surgery. *Mund Kiefer Gesichtschir* 2000; 4(5):292-5.
20. Pham AV, Abarca M, De Mey A, Malevez C. Rehabilitation of a patient with cleft lip and palate with an extremely edentulous atrophied posterior maxilla using zygomatic implants: Case Report. *Cleft Palate Craniofac J* 2004; 41(5):571-4.
21. Cawood JI, Howell RA. A Classification of the Edentulous Jaws. *Int J Oral Maxillofac Surg* 1988; 17(4):232-6.
22. Nocini PF, Chiarini L, De Santis D. Treatise on pre-prosthetic surgery and tissue engineering. Ed Martina, Bologna 2005; 9-10.
23. SICMF. Severe atrophies of the jaws. In Italian Society of Maxillofacial Surgery. Treated On Maxillofacial Surgical Pathology. AA VV. ed. Minerva Medica. Torino 2007; 619-20.
24. Nkenke E, Hahn M, Lell M, Wiltfang J, Schultze-Mosgau S, Stech B, Radespiel-Troger M, Neukam FW. Anatomic site evaluation of the zygomatic bone for dental implant placement. *Clin Oral Implants Res* 2003;14(1):72-9.
25. De Santis D, Pancera P, Luciano U, et al. Evaluation of bacterial flora composition on teeth and periodontal tissues in patients in treatment with rapid palatal expander. *J Biol Regul Homeost Agents* 2018; 32(2 Suppl. 2):31-6.
26. De Santis D, Pancera P, Luciano U, et al. Short-term in vivo evaluation of cellular DNA damage induced by fixed orthodontic appliances. *J Biol Regul Homeost Agents* 2018; 32(2 Suppl. 2):75-80.
27. De Santis D, Cucchi A, de Gemmis A, Nocini PF. New collagen matrix to avoid the reduction of keratinized tissue during guided bone regeneration in postextraction sites. *J Craniofac Surg* 2012; 23(3):e186-9.
28. Nocini PF, De Santis D, Morandini B, Procacci P. A dental implant in the infratemporal fossa: case report. *Int J Oral Maxillofac Implants* 2013; 28(4):e195-7.
29. Nocini PF, Albanese M, Castellani R, Zanotti G, Canton L, Bissolotti G, De Santis D. Application of the "All-on-Four" concept and guided surgery in a mandible treated with a free vascularized fibula flap. *J Craniofac Surg* 2012; 23(6):e628-31.
30. Bertossi D, Barone A, Iurlaro A, Marconcini S, De Santis D, Finotti M, Procacci P. Odontogenic Orofacial Infections. *J Craniofac Surg* 2017; 28(1):197-202.
31. Atalay B, Doğanay Ö, Saraçoğlu BK, Bultan Ö, Hafiz G. Clinical evaluation of zygomatic implant-supported fixed and removable prosthesis. *J Craniofac Surg* 2017; 28(1):185-9.
32. Agliardi EL, Romeo D, Panigatti S, de Araújo Nobre M, Maló P. Immediate full-arch rehabilitation of the severely atrophic maxilla supported by zygomatic implants: a prospective clinical study with minimum follow-up of 6 years. *Int J Oral Maxillofac Surg* 2017; 46(12):1592-9.
33. Miglione RM, Coppedè A, Dias Rezende RC, de Mayo T. Restoration of the edentulous maxilla using extrasinus zygomatic implants combined with anterior conventional implants: a retrospective study. *Int J Oral Maxillofac Implants* 2011; 26(3):665-72.
34. Bertossi D, Farronato G, Picozzi V, et al. Treatment of multiple ankylosed teeth using a piezoelectric device. *J Clin Orthod* 2013; 47(11):656-60.
35. Bertossi D, Lucchese A, Albanese M, Turra M, Faccioni F, Nocini PF, Rodriguez Y Baena R. Piezosurgery versus conventional osteotomy in orthognathic surgery: A paradigm shift in treatment. *J Craniofac Surg* 2013; 24(5):1763-6.
36. Jokstad A, Sanz M, Ogawa T, Bassi F, Levin L, Wennerberg A, Romanos GE. A systematic review of the role of implant design in the rehabilitation of the edentulous maxilla. *Int J Oral Maxillofac Implants* 2016; 3(5):43-99.
37. De Santis D, Cucchi A, Longhi C, Vincenzo B. Short threaded implants with an oxidized surface to restore posterior teeth: 1- to 3-year results of a prospective study. *Int J Oral Maxillofac Implants* 2011; 26(2):393-403.
38. Coppedè A, de Mayo T, de Sá Zamperlini M, Amorin R, de Pádua APAT, Shibli JA. Three-year clinical prospective follow-up of extrasinus zygomatic implants for the rehabilitation of the atrophic maxilla. *Clin Implant Dent Relat Res* 2017;19(5):926-34.
39. Mozzati, M., S. B. Monfrin, G. Pedretti, G. Schierano, and F. Bassi. Immediate Loading of Maxillary Fixed Protheses Retained by Zygomatic and Conventional Implants: 24-Month Preliminary Data for a Series of Clinical Case Reports; *Int J Oral Maxillofac Implants* 2008; 23(2):308-14.
40. Davó R, Pons O. Protheses supported by four immediately loaded zygomatic implants: a 3-year prospective study. *Eur J Oral Implantol* 2013; 6(3):263-9.
41. Wang F, Monje A, Lin GH, Wu Y, Monje F, Wang HL, Davó R. Reliability of four zygomatic implant-supported protheses for the rehabilitation of the atrophic maxilla: a systematic review. *Int J Oral Maxillofac Implants* 2015; 30(2):293-8.
42. Aparicio C. A proposed classification for zygomatic implant patient based on the zygoma Anatomy Guided Approach (ZAGA): a cross-sectional survey. *Eur J Oral Implantol* 2011; 4(3):269-75.
43. Mombelli A, Lang NP. Clinical parameters for the evaluation of dental implants. *Periodontol* 2000; 4:81-6. 44. Tuminelli FJ, Walter LR, Neugarten J, Bedrossian E. Immediate loading of zygomatic implants: A systematic review of implant survival, prosthesis survival and potential complications. *Eur J Oral Implantol* 2017; 10(1):79-87.
45. Molinero-Mourelle P, Baca-Gonzalez L, Gao B, Saez-Alcaide LM, Helm A, Lopez-Quiles J. Surgical complications in zygomatic implants: A systematic review. *Med Oral Patol Oral Cir Bucal* 2016; 1.21(6):e751-7.
46. Chrcanovic BR, Albrektsson T, Wennerberg A. Survival and complications of zygomatic implants: an updated systematic review. *J Oral Maxillofac Surg* 2016; 74(10):1949-64.
47. Benatto GB, Bueno CRS, Curvêllo VP, Nary Filho H. Management of zygomatic fixture complication case using extra-short implants. *J Craniofac Surg* 2017; 28(8):e797-e799.
48. D'Agostino A, Trevisiol L, Favero V, Pessina M, Procacci P, Nocini PF. Are zygomatic implants associated with maxillary sinusitis? *J Oral Maxillofac Surg* 2016; 74(8):1562-73.
49. Nocini PF, Zanotti G, Castellani R, Grasso S, Cristofaro MG, De Santis D: Bi-layered collagen nano-structured membrane prototype (collagen matrix 10826®) for oral soft tissue regeneration: an "in vitro" study. *Clin Oral Implant Res* 2013; 24(6):612-7.
50. Barone A, Toti P, Bertossi D, et al. Gene Expression of Human Mesenchymal Stem Cells Cultured on Titanium Dental Implant Surfaces. *J Craniofac Surg* 2016; 27(3):712-7.
51. Deeb GR, Deeb JG. Soft Tissue Grafting Around Teeth and Implants. *Oral Maxillofac Surg Clin North Am* 2015; 27(3):425-48.
52. De Santis D, Cucchi A, Longhi C, Vincenzo B. Short threaded implants with an oxidized surface to restore posterior teeth: 1- to 3-year results of a prospective study. *Int J Oral Maxillofac Implants* 2011; 26(2):393-403.
53. Covani U, Marconcini S, Ferrini F, Gelpi F, Finotti M, Barone A, de Santis D. Posttraumatic use of dental implants immediately after tooth extraction: clinical study. *J Craniofac Surg* 2014; 25(3):796-8.
54. Nocini PF, Castellani R, Zanotti G, Gelpi F, Covani U, Marconcini S, de Santis D. Extensive keratinized tissue augmentation during implant rehabilitation after Le Fort I osteotomy: using a new porcine collagen membrane (Mucoderm). *J Craniofac Surg* 2014; 25(3):799-803.
55. Bertossi D, Giampaoli G, Verner I, Pirayesh A, Nocini R, Nocini P. Complications and management after a nonsurgical rhinoplasty: A literature review. *Dermatol Ther* 2019; 32(4):e12978.
56. De Santis D, Sinigaglia S, Pancera P, Faccioni P, Portelli M, Luciano U, Cosola S, Penarrocha D, Bertossi D, Nocini R, Iurlaro A, Albanese M. An overview of socket preservation. *J Biol Regul Homeost Agents*. 2019; 33:55-9.
57. De Santis D, Sinigaglia S, Pancera P, Faccioni P, Luciano U, Setti AP, Bursi P, Nocini R, Nocini PF, Bertossi D. An overview of guided bone regeneration. *J Biol Regul Homeost Agents* 2019; 33:49-53.
58. Thoma DS, Naenni N, Figuero E, Hämmerle CHF, Schwarz F, Jung RE, Sanz-Sánchez I. Effects of soft tissue augmentation procedures on peri-implant health or disease: A systematic review and metaanalysis. *Clin Oral Implants Res* 2018; 29(Suppl 15):32-49.
59. Robiony M, Lazzarotto A, Nocini R, Costa F, Sembronio S, Franz L. Piezosurgery: Ten Years' Experience of Percutaneous Osteotomies in Rhinoplasty. *J Oral Maxillofac Surg* 2019; 77(6):1237-44.
60. Zhurakivska K, Maiorano E, Nocini R, Mignogna MD, Favia G, Troiano G, Arena C, Caponio VCA, et al. Necrotizing sialometaplasia can hide the presence of salivary gland tumors: A case series. *Oral Dis* 2019; 25(4):1084-90.
61. Bertossi D, Nocini R, Luciano U, Galzignato PF, Ricciardi G, Lucchese A, Tacchino U, Donadello D, et al. Piezoelectric surgery inserts vs conventional burst: a clinical investigation. *J Biol Regul Homeost Agents* 2018; 32(2):15-19.
62. Bertossi D, Botti G, Gualdi A, Fundarà P, Nocini R, Pirayesh A, van der Lei B.

- Effectiveness, Longevity, and Complications of Facelift by Barbed Suture Insertion. *Aesthet Surg J* 2019; 39(3):241-7.
63. Penarrocha, M, Carrillo C, Boronat A, Marti E. Level of satisfaction in patients with maxillary full-arch fixed prostheses: zygomatic versus conventional implants. *Int J Oral Maxillofac Implants* 2007; 22(5):769-73.
64. Marconcini S, Giammarinano E, Covani U, Mijiritsky E, Vela X, Rodiguez X. The effect of tapered abutments on marginal bone level: a retrospective cohort study. *J Clin Med* 2019; 8(9):1305.
65. Marconcini S, Giammarinano E, Toti P, Alfonsi F, Covani U, Barone A. Longitudinal analysis in the effect of insertion torque on delayed single implants: a 3 years randomized clinical study. *Clin Implant Dent Relat Res* 2018; 20(3):322-32.
66. Farzad P, Andersson L, Gunnarsson S, Johansson B. Rehabilitation of severely resorbed maxillae with zygomatic implants: an evaluation of implant stability, tissue conditions, and patients' opinion before and after treatment. *Int J Oral Maxillofac Implants* 2006; 21(3):399-404.

## 17 Ortodonzia chirurgicamente assistita (Piezosurgery®): studio In-Vivo Pre-Clinico e Clinico

Donadello Dario<sup>1</sup>, Capocasale Giorgia<sup>1</sup>, Alberti Christian<sup>1</sup>, Bertossi Dario<sup>1</sup>.

<sup>1</sup>Dipartimento di Scienze Chirurgiche, Odontostomatologiche e Materno-Infantili, Università degli Studi Verona, Verona, Italia

### Introduzione

La terapia ortodontica nei pazienti adulti spesso si traduce in tempi di trattamento prolungati al fine di evitare problematiche parodontali, nello specifico al legamento parodontale e all'osso alveolare.

Per limitare questa problematica, molti autori hanno valutato l'applicazione delle tecniche chirurgiche.

Lo scopo di questo studio in-vivo pre-clinico su modello animale e clinico è stato quello di valutare la risposta infiammatoria a seguito dell'applicazione della metodica "ligament dislocation and distraction technique (MTDL)", utilizzando la tecnologia Piezosurgery®.

### Materiali e Metodi

**Studio pre-clinico.** È stato eseguito uno studio caso-controllo scegliendo il modello animale di Guinea pig (14 cavie). Dopo la corticotomia, sono state eseguite una biopsia a 24 ore, una a 7 giorni e una a 30 giorni, al fine di valutare le differenze morfologiche tramite microscopia ottica ed elettronica a scansione, mentre a 7 e 14 giorni è stata quantificata la risposta dei mediatori infiammatori IL-1 beta, MMP-9 e TIMP-1 attraverso la metodica RT-PCR.

**Studio clinico.** Sono stati reclutati 10 pazienti presso la Facoltà di Medicina di Cluj Napoca (Romania). In tutti i casi, le corticotomie sono state eseguite utilizzando il Piezosurgery® (Piezosurgery III - Mectron, Carasco, Italy).

È stato eseguito un follow-up a 1-2-7-14 e 28 giorni, e successivamente ogni due settimane per due mesi. Le biopsie sono state effettuate durante la corticotomia e dopo 14 giorni. L'analisi morfologica è stata eseguita utilizzando la microscopia elettronica a trasmissione e a scansione.

In tutti i pazienti reclutati, inoltre, abbiamo quantificato attraverso la metodica della RT-PCR, la variazione dei mediatori infiammatori IL-1 beta, TNF alpha e IL-2 a 8, 24 e 48 ore e dopo 7, 14 e 28 giorni dalle corticotomie.

### Risultati

**Studio pre-clinico.** Attraverso la microscopia ottica ed elettronica a scansione, nei campioni a 7 giorni, si riscontrava un'elevata cellularità e intensa angiogenesi che scompariva a 30 giorni.

La RT-PCR ha dimostrato che l'espressione di IL-1 beta e di MMP-9 rimaneva alta entro il 14° giorno, e che TIMP-1 seguiva l'andamento di MMP-9.

**Studio clinico.** Utilizzando la microscopia ottica a scansione a 14 giorni si osservava l'apposizione irregolare di nuovo collagene e il richiamo cellulare nel legamento, mentre con l'utilizzo della microscopia elettronica a scansione, risultava evidente una struttura regolare del legamento e la presenza di osteoni.

Attraverso la RT-PCR è stato valutato che l'espressione di IL-1 beta e TNF-alfa: dopo 24, 48 ore queste raggiungevano il valore massimo, mentre l'espressione di IL-2 risultava aumentata in tempi più lunghi. A 7, 14 e 28 giorni, l'espressione dell'mRNA dei singoli marcatori sembrava diminuire.

### Conclusioni

La tecnica MTLDL con Piezosurgery® risulta valida e sicura, prevenendo il danno del legamento, minimizzando il disagio per il paziente e riducendo i rischi chirurgici.

Infatti, in questo studio, i risultati ottenuti hanno dimostrato come l'anatomia del legamento parodontale risulti preservata senza alcun segno di danno tissutale e con miglioramento della velocità di trattamento nei pazienti adulti.



## 18 An overview of orthodontic retainers

P. Faccioni, U. Luciano, S. Sinigaglia\*, M. Marchiori, N. Zerman, N. Modena, A. Poscolere, M. Magi, T. Zambotti, C. Alberti, D. Donadello, M. Zarantonello, A. Iurlaro, D. Giuliani, A. Cominziolli, F. Balliu and D. De Santis

*Section of Oral and Maxillofacial Surgery, Department of Surgical Sciences, Dentistry, Gynecology and Pediatrics, University of Verona, Verona, Italy*

**Orthodontic retention is the maintenance of the teeth in their ideal position from an aesthetic and functional point of view. The aim of this work is to illustrate the different orthodontic retainers. For this study we proceeded with a research of the abstract concerning this topic from the scientific archive “Pubmed” using terms relating to orthodontic retainers: 40 articles were selected from the research. In addition, 4 textbooks related to this topic have also been consulted. 7 fixed and 10 removable retainers have been identified. The most used retainers are the bonded ones for the lower arch and the Hawley and/or vacuum-formed ones for the upper one. Although numerous studies relating to orthodontic retention have been performed, there is no definitive evidence to identify the best type of orthodontic retainer.**

Orthodontic retention can be defined as the maintenance of the teeth in their ideal position from an aesthetic and functional point of view: the purpose of the retainers is therefore to counteract the tendency of the teeth to return to their previous position (1). The choice of the type of retention must be individualized and must take into account: the severity of the initial malocclusion, the quality of the result achieved with the treatment, anatomical-functional characteristics, age, needs and collaboration of the patient (2).

Orthodontic retainers can be accompanied by some surgical, gnathological and myofunctional procedures aimed at eliminating or controlling some etiological factors that may be present (3). Since numerous orthodontic retainers have been identified in the literature, the aim of this work is to illustrate them and their main characteristics to help the clinician in their daily practice.

### MATERIALS AND METHODS

For this study we proceeded with a research of the abstracts concerning this topic from the scientific archive “Pubmed” using terms relating to orthodontic retainers such as ‘orthodontic retainer’, ‘orthodontic retention’ and ‘orthodontic relapse’. Forty articles were selected. In addition, 4 textbooks related to this topic have also been consulted.

### RESULTS

Seven fixed retainers were identified: multistranded wire retainer; thick wire retainer; fiber reinforced composites retainer (FRC); palatal/lingual arch; retainer with pontic; fixed prosthesis; space maintainer. 10 removable retainers were identified: Hawley retainer; Begg retainer; Schwarz appliance; Van der Linden retainer; vacuum-formed retainer (VFR); wraparound retainer; positioner; acetal ferula; Crozat removable appliance; Osamu retainer.

### Discussion

Multi-stranded wire retainer is an appliance made of multiple twisted-stranded stainless steel wires. It is bonded to the lingual surface of each tooth of the mandibular anterior sextant. At the level of the upper arch, however, it is less used for a greater risk of detachment due to masticatory trauma. The twisted wire offers a better mechanical retention of the composite than the other types of wire. Moreover, this retainer allows the physiological tooth mobility thanks to its elastic properties. Then it is essential that the wire is completely passive to avoid the onset of undesired movements of the teeth (4-6). Thick wire retainer is a stainless steel wire of variable diameter (usually .028, .030 or 0.32 inch) with a loop bent at each end that is bonded to the lingual surface of the lower canines. This retainer effectively maintains the intercanine width; furthermore, it prevents the lingual tipping of the lower incisors, but it hardly controls their rotations (7, 8). FRC is a glass fiber reinforced resin or polyethylene strip that is bonded to the lingual or palatal surfaces of the anterior teeth (from canine to canine). Its advantages are: transparency, aesthetics, ease of modeling, reduced plaque accumulation, comfort and reduced mechanical stress. Initially, the main disadvantage of this retainer was the stiffness, which determined a greater risk of failure than the multi-stranded wire retainer (51% vs 12%); however, the current mechanical characteristics have significantly reduced the difference in reliability between the two appliances (9-11). Palatal/lingual arch consists of a stainless steel wire with a diameter of 0.9 mm, welded to the bands. It is mainly used in the lower arch; it is useful to avoid changes in length or width of the arch and to prevent tooth rotations. Retainer with pontic is a metallic appliance, created in the dental laboratory, which is bonded to the palatal or lingual surface of the anterior teeth in patients with periodontitis or who have undergone important tooth movements on the vertical and sagittal plane. It can have pontics in case the patient lacks some teeth (12-17). Fixed prosthesis is used if one or more teeth are missing or to stabilize periodontally compromised teeth (18-25). Space maintainer is an orthodontic band to which a 0.9 mm diameter steel wire or a pontic is welded and it is used to prevent the mesialization of the tooth on which the band is cemented (13). Regarding the removable appliance, Hawley retainer is the most

common retainer, especially in the maxillary arch. The upper Hawley retainer consists of: an acrylic palatal cover; Adams' clasps on the upper first molars; a "U" loop labial bow, usually spanning from canine to canine. There are variants of this orthodontic appliance: for example, the labial bow can be welded to Adams' clasps or extended to the premolars to keep the spaces closed in patients who have undergone extractions. In addition, a bite plane lingual to the upper incisors can be added to this appliance, on which there is a slight contact of the lower incisors, which serves to maintain an adequate overbite and to avoid deep bite relapse (26-35). The Begg retainer differs from the Hawley retainer due to the fact that Adams' clasps are absent and the labial bow extends to the last molar in the arch and then it is incorporated into the acrylic that covers the palate.

These characteristics permit a better settling of the occlusion and a lower risk of reopening the space between canine and premolar (36). The Schwarz appliance is a removable appliance consisting of an acrylic palatal cover, two Adams' clasps (or ball clasps) and a metallic or acrylic labial bow. It allows maintaining the sagittal and transversal dimensions of the dental arches (13). The Van der Linden retainer is an acrylic appliance for the upper arch with a labial bow (0.028 inch diameter stainless steel wire), passing between lateral incisor and canine, and "C" clasps that surround for three quarters the last molar in the arch. The acrylic palatal cover contacts the anterior teeth maintaining them in position, while material is removed at the level of the posterior teeth allowing the settling of the occlusion (37). VFR is a removable and clear appliance that is manufactured using a vacuum machine, which adapts heat-softened plastic to a cast by negative pressure. It is thin (0.5-1.5 mm) so as not to interfere too much with the occlusion. It can be used for orthodontic finishing, it is well tolerated by the patient for its transparency and can support the home bleaching gels. However, it needs to be replaced periodically as it can deteriorate. Examples of VFRs include Invisalign® and Essix®. The Damon Splint is an appliance consisting of an upper and a lower Essix® connected to each other: in addition to acting as a retainer, it is also useful to rebalance any nighttime respiratory dysfunctions (38-41). Wraparound retainer consists of an acrylic structure, usually reinforced by a stainless steel wire, along the labial and lingual surfaces of the teeth of the entire arch. However, it shows disadvantages: it holds the teeth too firmly in place, not allowing the periodontal ligament to reorganize and it is less comfortable and less effective in maintaining overbite correction than the Hawley retainer. A variant of the wraparound retainer is the clip retainer or spring retainer: it consists of a stainless steel wire with a diameter of 0.9 mm adherent to the dental cervix of canines and covered with resin at the labial and lingual surfaces of the incisors. It is very effective in preventing relapse of crowding of the inferior anterior teeth.

Moore retainer is a canine-to-canine clip retainer that extends distally on the lingual surface to the central groove of the first molar. It can be indicated in case of: treatment that involves the lower premolars extraction because it allows a good control of the closed space; misalignment of posterior teeth prior to orthodontic therapy (6). Positioner is a flexible horseshoe-shaped appliance that simultaneously incorporates the two arches, exceeding the neck of the teeth by 2-3 mm; it has breathing holes in the labial surface. It is an appliance that can be used both for the finishing and for the retention. The main advantage is to effectively maintain both the occlusal relationship and the tooth position. The major disadvantage is the difficulty in wearing it: in fact, this appliance should be worn for 4-6 weeks throughout the night and as much as possible during the day; subsequently it can be worn only at night for an unlimited period of time. It is indicated in highly compliant patients, with vicious oral habits or when the fixed appliance must be removed before the end of the treatment (42). The acetal ferula is an acetal resin strip that surrounds the teeth involved in the retention. It can be complete or partial; it is characterized by a good aesthetics. Furthermore, it has a high elastic memory and can be used as a passive or slightly active appliance if designed on set-up (43).

Crozat removable appliance is an appliance made entirely of metal alloy consisting of a transverse bar, two Jackson clasps, two lingual arms that generally extend from the first molar to the first premolar and from additional elements that serve to maintain the space. It has less encumbrance and wear compared to the acrylic retainers and it is extremely precise (44-45). Osamu retainer is a thermoformed appliance made up of two superimposed layers: the inner layer is made of ethylene-vinyl acetate copolymer (thickness: 1.5 mm), it adapts to the interproximal areas and it covers the palatal and lingual surfaces of the teeth; the outer one is made of rigid elastic polycarbonate (thickness: 0.75 mm) and it covers the occlusal surfaces. This retainer is transparent, cheap, simple to build, thin and robust at the same time. It also allows to correct slight dental malpositions (46).

Fixed retention has the following advantages compared to the removable one: maximum efficacy, minimum encumbrance, good aesthetics, unnecessary patient compliance. The disadvantages are: impossibility of grading the use; impossibility to apply additional forces; difficulty in determining the time of removal; greater difficulty in maintaining an accurate oral hygiene; impediment of physiological occlusal settling (2). The most used retention appliances are the bonded retainer, the Hawley retainer and the vacuum-formed retainer (47). Currently, at the level of the mandibular arch, the multi-stranded wire retainer bonded to the anterior sextant is preferred to the other fixed and mobile appliances as it seems to have a greater effectiveness in maintaining the dental alignment (48-51). If a removable appliance is used for retention of the lower teeth, the vacuum-formed retainer appears to be slightly more performing than the Hawley one (52-55). The latter two appliances are the most chosen by orthodontists to avoid undesired movements of maxillary teeth: in general, their effectiveness is comparable (56), but patients prefer the vacuum-formed ones for their transparency and greater comfort (57-59). Regarding the effects on periodontal tissues, fixed retainers, especially the fiber reinforced composites ones, favor more plaque and tartar retention than mobile appliances (60). With regard to the survival of fixed retainers,

fiber reinforced resin retainers have failure rates (fracture and detachment) now comparable to the metallic wire ones because their mechanical properties have been improved and their bonding occurs under rubber dam isolation (61-62). The detachment of the fiberreinforced resin retainer occurs mainly due to the failure of adhesion at the level of the composite/enamel interface, while instead the metallic wire retainer detaches because the retention at the composite-retainer interface is lost (63). On the other hand, removable appliances, if compared to each other, do not seem to have large differences in survival time; lower Hawley and vacuum-formed retainers tend to break more easily than the upper ones because of their thinner thicknesses (64). Although numerous studies regarding orthodontic retainers have been performed, there is no evidence to provide definitive recommendations on retention procedures after fixed orthodontic treatment (65). The most used retainers are the bonded retainer for the lower arch and the Hawley and/or vacuum-formed retainer for the upper one, but there is no definitive evidence to identify the best type of orthodontic retainer.

## REFERENCES

- Johnston CD, Littlewood SJ. Retention in orthodontics. *Br Dent J*. 2015; 218(3):119-22.
- Joondeph DR. Ritenzione e recidiva. In *Ortodonzia: Tecniche e procedure*. Graber TM, Vanarsdall RL, eds. UTET, Torino, 2003, 987-1011.
- Gottlieb EL, Cozzani M, de Harfin JF, Helmholtz RD, Logan LR, Warren DW. Stability of orthodontic treatment. Part 1. *J Clin Orthod* 2006;40(1):27-38.
- Bearn DR. Bonded orthodontic retainers: a review. *Am J Orthod Dentofacial Orthop*. 1995;108(2):207-13.
- De Santis D. Fibromatosis of the mandible: case report and review of previous publications. *Br J Oral Maxillofac Surg*. 1998;36(5):384-8.
- Zachrisson BU. Multistranded wire bonded retainers: from start to success. *Am J Orthod Dentofacial Orthop*. 2015;148(5):724-7.
- Proffit WR. Contenzione. In *Ortodonzia moderna*. Proffit WR, Fields HW, Sarver DM, eds. Edra, Milano, 2013, 615-23.
- Hedge N, Reddy G, Reddy VP, Handa A. Bonded retainers in orthodontics: a review. *Int J Dent Clin*. 2011;3(3):53-4.
- Diamond M. Resin fiberglass bonded retainer. *J Clin Orthod*. 1987;21(3):182-3.
- Bertossi D, Favero V, Albanese M, et al. Peripheral ameloblastoma of the upper gingiva: Report of a case and literature review. *J Clin Exp Dent*. 2014;6(2):e180-4.
- Bolla E, Cozzani M, Doldo T, Fontana M. Failure evaluation after a 6-year retention period: a comparison between glass fiber-reinforced (GFR) and multistranded bonded retainers. *Int Orthod*. 2012;10(1):16-28.
- Francioli D. I dispositivi di contenzione. In *Contenzione e recidiva: clinica, ageing and litigation*. Bolla E, Francioli D, Doldo T, Giorgetti R, eds. Edizioni Martina, Bologna, 2008, 14-21.
- De Santis D, Pancera P, Sinigaglia S, et al. Tooth agenesis: part 1. Incidence and diagnosis in orthodontics. *J Biol Regul Homeost Agents*. 2019;33(S1):19-22.
- Bertelè G, Mercanti M, Stella F, Albanese M, De Santis D. Osteodistraction in the craniofacial region. *Minerva Stomatol*. 2005;54(4):179-98.
- De Santis D, Cucchi A, de Gemmis A, Nocini PF. New collagen matrix to avoid the reduction of keratinized tissue during guided bone regeneration in postextraction sites. *J Craniofac Surg*. 2012;23(3):e186-9.
- De Santis D, Pancera P, Sinigaglia S, et al. Tooth agenesis: part 2. Orthodontic treatment and prosthetic possibilities. *J Biol Regul Homeost Agents*. 2019;33(S1):23-8.
- De Santis D, Sinigaglia S, Faccioni P, et al. Syndromes associated with dental agenesis. *Minerva Stomatol*. 2019;68(1):42-56.
- Kumbuloglu O, Saracoglu A, Cura C, Userb A. Bonded orthodontic retainer and fixed partial denture made with fiber reinforced composite resin. *Eur J Dent*. 2011;5(2):237-40.
- De Santis D, Sinigaglia S, Pancera P, et al. An overview of socket preservation. *J Biol Regul Homeost Agents*. 2019;33(S1):55-9.
- De Santis D, Graziani P, Castellani R, et al. A New Radiologic Protocol and a New Occlusal Radiographic Index for Computer-Guided Implant Surgery. *J Craniofac Surg*. 2016;27(5):e506-10.
- De Santis D, Sinigaglia S, Pancera P, et al. An overview of guided bone regeneration. *J Biol Regul Homeost Agents*. 2019;33 (1 Suppl. 1): 49-53.
- Barone A, Toti P, Bertossi D, et al. Gene Expression of Human Mesenchymal Stem Cells Cultured on Titanium Dental Implant Surfaces. *J Craniofac Surg*. 2016;27(3):712-7.
- Bertossi D, Nocini R, Luciano U, et al. Piezoelectric surgery inserts vs conventional burst: a clinical investigation. *J Biol Regul Homeost Agents*. 2018;32(2 Suppl. 2):15-19.
- De Santis D, Sinigaglia S, Pancera P, et al. Guidelines for achieving the best implants survival rates in the rehabilitation of the atrophic posterior maxilla. *J Biol Regul Homeost Agents*. 2019;33(1 Suppl. 1):43-7.
- Zanotti G, Gelpi F, Sinigaglia S, et al. Agensis: pilot case report by 2.9 mm implant. *J Biol Regul Homeost Agents*. 2019;33(S1):61-5.
- Hawley CA. A removable retainer. *Int J Orthod Oral Surg*. 1919;5(6):291-305.
- Faccioni P, De Santis D, Luciano U, et al. Efficacy of the Andresen activator before peak growth in class II patients. *J Biol Regul Homeost Agents*. 2019;33(1 Suppl. 1):1-7.
- Barone A, Marconcini S, Giammarinaro E, Mijiritsky E, Gelpi F, Covani U. Clinical Outcomes of Implants Placed in Extraction Sockets and Immediately Restored: A 7-Year Single-Cohort Prospective Study. *Clin Implant Dent Relat Res*. 2016;18(6):1103-12.
- De Santis D, Gelpi F, Castellani R, et al. Bi-layered collagen nano-structured membrane prototype collagen matrix CM-10826 for oral soft tissue regeneration: an in vivo ultrastructural study on 13 patients. *J Biol Regul Homeost Agents*. 2019;33(1 Suppl. 1):29-41.
- Faccioni P, De Santis D, Sinigaglia S, Pancera P, Faccioni F, Nocini PF. Short-term "in vivo" study on cellular DNA damage induced by acrylic Andresen activator in oral mucosa cells. *Orthod Craniofac Res*. 2019;22(3):208-12.
- De Santis D, Pancera P, Luciano U, et al. Evaluation of bacterial flora composition on teeth and periodontal tissues in patients in treatment with rapid palatal expander. *J Biol Regul Homeost Agents*. 2018;32(2 Suppl. 2):31-6.
- De Santis D, Menchini Fabris GB, Lotti J, et al. Bi layered collagen nano-structured membrane prototype collagen matrix 10826® for soft tissue regeneration in rabbits: an in vivo ultra-structural study of the early healing phase. *J Biol Regul Homeost Agents*. 2017;31(2 Suppl. 2):91-97.
- Covani U, Marconcini S, Ferrini F, et al. Posttraumatic use of dental implants immediately after tooth extraction: clinical study. *J Craniofac Surg*. 2014;25(3):796-8.
- De Santis D, Pancera P, Luciano U, et al. Short-term in vivo evaluation of cellular DNA damage induced by fixed orthodontic appliances. *J Biol Regul Homeost Agents*. 2018;32(2 Suppl. 2):75-80.
- Faccioni P, De Santis D, Sinigaglia S, et al. Effects of the sander bite jumping appliance in patients with class II malocclusion before growth peak. *J Biol Regul Homeost Agents*. 2020;34(2 Suppl. 2):1-7.
- Isaacson KG, Miur JD, Reed RT. Retainers. In *Removable orthodontic appliances*. Isaacson KG, Miur JD, Reed RT, eds. Wright, Oxford, 2002, 103-4.
- Van der Linden FP. The Van der Linden retainer. *J Clin Orthod*. 2003;37(5):260-7.
- Mollov ND, Lindauer SJ, Best AM, Shroff B, Tufekci E. Patient attitudes toward retention and perceptions of treatment success. *Angle Orthod*. 2010;80(4):468-73.
- Nocini PF, Menchini Fabris GB, Gelpi F, et al. Treatment of skin defects with growth factors and biodegradable collagen carrier: histological evaluation in animal model. *J Biol Regul Homeost Agents*. 2017;31(2 Suppl. 2):1-13.
- De Santis D, Bertossi D, Zanotti G, et al. Nd-YAP laser assisted frenulectomy: a case series on 23 patients. *Minerva Stomatol*. 2013;62(8 Suppl. 1):27-36.
- Mai W, He J, Meng H, et al. Comparison of vacuumformed and Hawley retainers: a systematic review. *Am J Orthod Dentofacial Orthop*. 2014;145(6):720-7.
- Kesling H. The tooth positioner as the means of final positioning of teeth to a predetermined pattern. *J Dental Child*. 1944;11:103-5.
- Bolla E, Manuzzi W, Lanteri C, Testa M. Applicazioni ortodontiche della resina acetica: la ferula T.L.M. *Ortognatodonza Italiana* 1993;2(3):475-80.
- Owen AH 3rd. 4-4 Crozat retainer. *J Clin Orthod*. 1985;19(3):194-7.
- Albanese M, Ricciardi G, Luciano U, et al. Alveolar splitting with Piezosurgery®, bone bank grafts and NobelActive implants as an alternative to major bone grafting for maxillary reconstruction. *Minerva Stomatol*. 2019;68(1):3-10.
- Fernandez Sanchez J, Pernia Ramirez I, Martin Alonso J. Osamu active retainer for correction of mild relapse. *J Clin Orthod*. 1998;32(1):26-8.
- Al-Moghrabi D, Pandis N, Fleming PS. The effects of fixed and removable orthodontic retainers: a systematic review. *Prog Orthod*. 2016;17(1):24.
- Störmann I, Ehmer U. A prospective randomized study of different retainer types. *J Orofac Orthop*. 2002;63(1):42-50.
- Manuelli M, Marcolina M, Nardi N, et al. Oral mucosal complications in orthodontic treatment. *Minerva Stomatol*. 2019;68(2):84-88.
- Bertossi D, Giampaoli G, Lucchese A, et al. The skin rejuvenation associated treatment-Fraxel laser, Microbotox, and low G prime hyaluronic acid: preliminary results. *Lasers Med Sci*. 2019;34(7):1449-55.

51. O'Rourke N, Albeedh H, Sharma P, Johal A. Effectiveness of bonded and vacuum-formed retainers: A prospective randomized controlled clinical trial. *Am J Orthod Dentofacial Orthop.* 2016;150(3):406-15.
52. Rowland H, Hichens L, Williams A, et al. The effectiveness of Hawley and vacuum-formed retainers: a single-center randomized controlled trial. *Am J Orthod Dentofacial Orthop.* 2007;132(6):730-7.
53. Girolami I, Pantanowitz L, Munari E, et al. Prevalence of PD-L1 expression in head and neck squamous precancerous lesions: a systematic review and meta-analysis. *Head Neck.* 2020;42(10):3018-30.
54. Zotti F, Nocini R, Capocasale G, Fior A, Peretti M, Albanese M. Malignant transformation evidences of Oral Lichen Planus: When the time is of the essence. *Oral Oncol.* 2020;104:104594.
55. Demir A, Babacan H, Nalcaci R, Topcuoglu T. Comparison of retention characteristics of Essix and Hawley retainers. *Korean J Orthod.* 2012;42(5):255-62.
56. Barlin S, Smith R, Reed R, Sandy J, Ireland AJ. A retrospective randomized double-blind comparison study of the effectiveness of Hawley vs vacuum-formed retainers. *Angle Orthod.* 2011;81(3):404-9.
57. Hichens L, Rowland H, Williams A, et al. Cost-effectiveness and patient satisfaction: Hawley and vacuum-formed retainers. *Eur J Orthod.* 2007;29(4):372-8.
58. Bertossi D, Albanese M, Nocini R, Mortellaro C, Kumar N, Nocini PF. Osteotomy in Genioplasty by Piezosurgery. *J Craniofac Surg.* 2018 Jun 25.
59. Saleh M, Hajeer MY, Muessig D. Acceptability comparison between Hawley retainers and vacuum-formed retainers in orthodontic adult patients: a single-centre, randomized controlled trial. *Eur J Orthod.* 2017;39(4):453-61.
60. Torkan S, Oshagh M, Khojastepour L, Shahidi S, Heidari S. Clinical and radiographic comparison of the effects of two types of fixed retainers on periodontium - a randomized clinical trial. *Prog Orthod.* 2014;15(1):47.
61. Salehi P, Zarif Najafi H, Roeinpeikar SM. Comparison of survival time between two types of orthodontic fixed retainer: a prospective randomized clinical trial. *Prog Orthod.* 2013;14:25.
62. Sfondrini MF, Fraticelli D, Castellazzi L, Scribante A, Gandini P. Clinical evaluation of bond failures and survival between mandibular canine-to-canine retainers made of flexible spiral wire and fiber-reinforced composite. *J Clin Exp Dent.* 2014;6(2):e145-9.
63. Foek DL, Yetkiner E, Ozcan M. Fatigue resistance, debonding force, and failure type of fiber-reinforced composite, polyethylene ribbon-reinforced, and braided stainless steel wire lingual retainers in vitro. *Korean J Orthod.* 2013;43(4):186-92.
64. Sun J, Yu YC, Liu MY, et al. Survival time comparison between Hawley and clear overlay retainers: a randomized trial. *J Dent Res.* 2011;90(10):1197-201.
65. Littlewood SJ, Millett DT, Doubleday B, Bearn DR, Worthington HV. Retention procedures for stabilising tooth position after treatment with orthodontic braces. *Cochrane Database Syst Rev.* 2016 29;2016(1):CD002283.

## 19 An overview of photometric analysis to evaluate aesthetics in orthodontic patients

P. Faccioni, U. Luciano, V. Brun\*, M. Marchiori, S. Sinigaglia, N. Zerman, N. Modena, A. Poscolere, M. Magi, T. Zambotti, C. Alberti, D. Donadello, M. Zarantonello, A. Iurlaro, D. Giuliani, A. Cominziolli, F. Balliu and D. De Santis

*Section of Oral and Maxillofacial Surgery, Department of Surgical Sciences, Dentistry, Gynecology and Pediatrics, University of Verona, Verona, Italy*

**Photometric analysis is a facial aesthetics evaluation method which is useful for diagnosis and treatment planning. This system is increasingly applied since there is growing attention to aesthetic improvement and occlusal correction as objectives of orthodontic treatment. Ten articles regarding aesthetic analysis on photos were identified through scientific archives and analysed. The diagnostic rationale, the scientific reliability and the methods used were identified to help clinicians in their practice. Photometric analysis represents an effective, reliable and cheap system for the analysis of craniofacial morphology of the face profile. This analysis can be achieved in subjective or objective ways; the latter modality provides greater reproducibility of the results as well as a good assessment of the harmony between the external craniofacial structures, including soft tissue contribution; it also provides repeatable and reliable measurements, thus enabling a rapid acquisition of the facial image, with long-term durability. Through facial profile photometric analysis it is possible to obtain proportionality, angular and linear measurements. These measures are useful as parameters for an optimal definition of the conditions of normality, harmony and profile balance.**

Any orthodontic treatment causes several changes in the soft tissues, with a consequent significant aesthetic impact (1). To successfully meet expectations on facial aesthetics it is important to understand the impact of orthodontic treatment on it. Studies on craniofacial growth and facial aesthetics typically evaluate soft tissues using cephalometrics, with consequent limitations related to the difficulty in correctly reproducing the "Natural Head Position" and in assessing the real labial and incisal prominence and detailed reproduction of the soft tissues (2). In order to completely evaluate the aesthetics of the face, it is possible to use anthropometry, templates, photographs, videos, 3D reconstructions, lasers and optical surface scanning (3-23).

Photographs are easier to use than anthropometric analyses, allowing also to analyze larger areas and more details than the templates, with lower costs compared to three-dimensional and laser analysis and avoiding patient exposure to radiation, contrary to what happens with teleradiographs from which cephalometries are extrapolated (24-37). Photometric analysis therefore represents an effective, reliable and cheap system for the analysis of the craniofacial morphology in face profile (38).

The aim of this work was to carry out an overview of the literature to analyze the state of the art regarding aesthetic analysis on photos to draw useful conclusions for clinical practice.

### MATERIALS AND METHODS

An initial research of the abstracts was carried out through the scientific archives "PubMed" and "Cochrane Library" and the "full text articles" were downloaded in PDF. The following search terms were selected: "photometric analysis", "photographic analysis",

“aesthetic analysis” or “soft tissue profile”. The research was limited to the international bibliography in English from 2000 to 2018. From the numerous articles found, only those of major scientific rigor were selected for a total of 10 articles. This allowed to deepen the knowledge present in the literature and to draw some conclusions regarding photographic analysis of facial soft tissue profile.

## RESULTS

As observed by Li and Qian, orthodontic treatments produce changes in the soft tissues, with a consequent significant aesthetic impact (1). Many studies have used a subjective evaluation system for analyzing profile aesthetics and changes induced by orthodontic treatment; in particular, Sukhia et al. took into consideration the soft tissue changes resulting from orthodontic treatment by comparing the aesthetic preferences of orthodontists, patients and parents at the beginning and the end of the treatment (39). Similarly, but using a group of external evaluators that included students of art and dentistry alongside the parents of the patients, O'Neill et al. sought to determine the profilometric improvements produced by functional treatment in patients with class II division 1 malocclusion; however, no differences were found between the treated patients and the control group (40). Therefore, it is clear that a purely subjective assessment shows significant limits in terms of the possibility of quantification and reproducibility of the observations, as well as their statistical significance. Since these limits affect the diagnosis and the treatment planning, the use of photo-retouching programs has been proposed in order to visualize the potential aesthetic improvement obtainable thanks to different orthodontic treatments (41-44). However, these are still purely subjective evaluations, which do not allow a “quantification” of aesthetic improvements. Although the photographs are much closer to the real appearance of the face than the radiographs, it emerges that it is necessary to use techniques for the quantitative measurement of the facial structures in order to obtain an objective assessment of the characteristics of the patients' profiles. Photometric analysis techniques have been proposed in order to obtain an objective and biologically and economically advantageous evaluation of the facial aesthetics. In fact, photographs provide a good assessment of the harmony between external craniofacial structures, including the contribution of soft tissues. Furthermore, they provide reliable measurements which, thanks to the almost zero invasiveness, can be repeated during the intermediate stages of treatment, in order to monitor its progression (45-48).

Through the facial profile photometric analysis, it is possible to obtain proportionality, angular and linear measurements, useful as parameters for an optimal definition of normality, harmony and balance profile conditions (49). Various studies have attempted to identify the facial features that account for the pleasantness of a face: some classified facial profiles through subjective analysis of the photographs, others studied some structural features that can influence profile aesthetic (50-53). Fortes et al. conducted a study in order to identify which linear, angular and proportional measures could be considered decisive in influencing the pleasantness of the profile. After a preliminary evaluation by specialists (plastic surgeons and orthodontists) and common people of 150 standardized photographs of the facial profile, classified as “pleasant”, “acceptable” or “unpleasant”, and the selection of the 15 best and 15 worst profiles of the sample, the photographs were scanned using AutoCAD software. Linear, angular and proportional measurements were performed on this scan: they showed a statistically significant difference between pleasant and unpleasant profiles (54).

Once again, Marchiori et al. tried to correlate the cephalometric measurements of the nasolabial angle, of the Holdaway H line and of the distance between the H line and the tip of the nose, in order to overcome a purely subjective assessment of the face profile and to obtain quantitative and statistically relevant data. These measurements were taken on the profile photographs of a sample of 50 subjects (25 males and 25 females, aged between 17 and 24), with the subjective evaluations of a group of common people and orthodontists. From what emerged, there would be an important relationship between subjective and cephalometric evaluations, demonstrated by the best evaluation attributed to the subjects with a profile presenting little deviations from the normal cephalometric values (55). Similarly, Oh et al. performed a comparative analysis between profile photographs and cephalometries of the same subjects, concluding however that the association between objective data and subjective assessments of facial attractiveness, even though formulated by specialists in orthodontics, was less than expected and substantially poor (56).

In order to obtain more predictable and statistically significant results, a cephalometric analysis of the soft tissues can also be carried out using specific software on patient profile photographs, rather than on lateral telerradiographies. In fact, this is the most effective and efficient method, allowing a simultaneous analysis of various data, as well as greater accuracy and precision in the information collected and in the obtainable results. In particular, Dimaggio et al. elaborated an aesthetic analysis applied to the left profile photographs of a sample of I, II and III dentoskeletal class patients. The evaluation was conducted on upper anterior facial height (N-Sn), lower anterior facial height (Sn-Gn), total facial height (N-Gn), facial convexity (N-Sn-Gn), cutaneous analogue of the angle ANB (Sn -N-SI), nasal prominence (Sn-N-Pn), nasolabial angle (Pn-Sn-Ls), interlabial angle ((Sn-Ls) - (Li-SI)), cutaneous class (Projection of Sn and S1 on the Camper plane). The results showed that, given the highlighted correspondence between the cutaneous and the dentoskeletal class and the significant differences in the parameters considered between I, II and III class patients, this protocol represents a non-invasive, simple and low-cost method: it can provide quantitative and qualitative data, useful as a preliminary diagnostic tool for the evaluation of the facial soft tissues. In addition, this procedure can be repeated during treatment, thus providing useful information on the impact of therapy on the soft tissue appearance (57-59).



## DISCUSSION

Although the photometric analysis of the patient's profile has historically been considered purely practical, more functional to a general clinical setting rather than to an effective diagnostic purpose, it is an essential tool for diagnosis and orthodontic planning. Indeed, it represents an effective, reliable and economic tool, which provides some advantages compared to conventional cephalometry, including the possibility of correctly reproducing the "Natural Head Position", of evaluating the real lip and incisal prominence and of reproducing the soft tissues in detail. The use of objective tools also ensures predictable and statistically significant results, thus allowing the advantages of the two types of images, radiographic and photographic, to be combined.

## REFERENCES

- Li RR, Qian YF. Review of the impact of orthodontic treatments on soft tissue profile. *Shanghai Kou Qiang Yi Xue* 2012; 21(2):232-6.
- Hershey HG. Incisor tooth retraction and subsequent profile change in postadolescent female patients. *Am J Orthod* 1972; 61(1):45-54.
- Shahrom AW, Vanezis P, Chapman RC, Gonzales A, Blenkinsop C, Rossi ML. Techniques in Facial Identification: Computer-aided facial reconstruction using a laser scanner and video superimposition. *Int J Legal Med* 1996; 108(4):194-200.
- Morris DO, Illing HM, Lee RT. A prospective evaluation of Bass, Bionator and Twin Block appliances. Part II-The soft tissues. *Eur J Orthod* 1998; 20(6):663-84.
- Bertelè G, Mercanti M, Stella F, Albanese M, De Santis D. Osteodistraction in the craniofacial region. *Minerva Stomatol* 2005; 54(4):179-98.
- Sattarzadeh AP, Lee RT. Assessed facial normality after Twin Block therapy. *Eur J Orthod* 2010; 32(4):363-70.
- De Santis D, Sinigaglia S, Pancera P, et al. An overview of socket preservation. *J Biol Regul Homeost Agents* 2019; 33(Suppl 1 [integer]):55-9.
- De Santis D. Fibromatosis of the mandible: case report and review of previous publications. *Br J Oral Maxillofac Surg* 1998; 36(5):384-8.
- Bertossi D, Favero V, Albanese M, et al. Peripheral ameloblastoma of the upper gingiva: Report of a case and literature review. *J Clin Exp Dent* 2014; 6(2):e180-4.
- De Santis D, Sinigaglia S, Pancera P, et al. An overview of guided bone regeneration. *J Biol Regul Homeost Agents* 2019; 33(Suppl 1 [integer]):49-53.
- De Santis D, Cucchi A, de Gemmis A, Nocini Pier F. New collagen matrix to avoid the reduction of keratinized tissue during guided bone regeneration in postextraction sites. *J Craniofac Surg* 2012; 23(3):e186-9.
- De Santis D, Graziani P, Castellani R, et al. A new radiologic protocol and a new occlusal radiographic index for computer-guided implant surgery. *J Craniofac Surg* 2016; 27(5):e506-10.
- De Santis D, Sinigaglia S, Pancera P, et al. Guidelines for achieving the best implants survival rates in the rehabilitation of the atrophic posterior maxilla. *J Biol Regul Homeost Agents* 2019; 33(Suppl 1 [integer]):43-7.
- De Santis D, Pancera P, Luciano U, et al. Short-term in vivo evaluation of cellular DNA damage induced by fixed orthodontic appliances. *J Biol Regul Homeost Agents* 2018; 32(2 S2):75-80.
- Barone A, Toti P, Bertossi D, et al. Gene Expression of Human Mesenchymal Stem Cells Cultured on Titanium Dental Implant Surfaces. *J Craniofac Surg* 2016; 27(3):712-7.
- McDonagh S, Moss JP, Goodwin P, Lee RT. A prospective optical surface scanning and cephalometric assessment of the effect of functional appliances on the soft tissues. *Eur J Orthod* 2001; 23(2):115-26.
- Stamenković Z, Raičković V, Ristić V. Changes in soft tissue profile using functional appliances in the treatment of skeletal Class II malocclusion. *Srp Arh Celok Lek* 2015; 143(1-2):12-5.
- De Santis D, Gelpi F, Castellani R, et al. Bi-layered collagen nano-structured membrane prototype collagen matrix CM-10826 for oral soft tissue regeneration: an in vivo ultrastructural study on 13 patients. *J Biol Regul Homeost Agents* 2019; 33(1 Suppl. 1):29-41.
- Varlik SK, Gültan A, Tümer N. Comparison of the effects of Twin Block and activator treatment on the soft tissue profile. *Eur J Orthod* 2008; 30(2):128-34.
- Flores-Mir C, Major PW. Cephalometric facial soft tissue changes with the twin block appliance in Class II division 1 malocclusion patients. A systematic review. *Angle Orthod* 2006; 76(5):876-81.
- Lisson JA, Mokrys K, Kinzinger GS, Glasl B, Ludwig B. Changes in soft-tissue profiles after treatment of Class II/1 patients with bite-jumping appliances. *J Orofac Orthop* 2013; 74(2):113-23.
- De Santis D, Pancera P, Luciano U, et al. Evaluation of bacterial flora composition on teeth and periodontal tissues in patients in treatment with rapid palatal expander. *J Biol Regul Homeost Agents* 2018; 32(2 Suppl. 2):31-6.
- Quintão C, Helena I, Brunharo VP, Menezes RC, Almeida MA. Soft tissue facial profile changes following functional appliance therapy. *Eur J Orthod* 2006; 28(1):35-41.
- V an der Geld P, Oosterveld P, V an Heck G, Kuijpers-Jagtman AM. Smile attractiveness. Self-perception and influence on personality. *Angle Orthod* 2007; 77(5):759-65.
- Faccioni P, De Santis D, Luciano U, et al. Efficacy of the Andresen activator before peak growth in class II patients. *J Biol Regul Homeost Agents* 2019; 33(Suppl 1 [integer]):1-7.
- Bertossi D, Nocini R, Luciano U, et al. Piezoelectric surgery inserts vs conventional burst: a clinical investigation. *J Biol Regul Homeost Agents* 2018; 32(2 Suppl. 2):15-19.
- Barone A, Marconcini S, Giammarinaro E, Mijiritsky E, Gelpi F, Covani U. Clinical outcomes of implants placed in extraction sockets and immediately restored: A 7-year single-cohort prospective study. *Clin Implant Dent Relat Res* 2016; 18(6):1103-12.
- Faccioni P, De Santis D, Sinigaglia S, Pancera P, Faccioni F, Nocini PF. Short-term "in vivo" study on cellular DNA damage induced by acrylic Andresen activator in oral mucosa cells. *Orthod Craniofac Res* 2019; 22(3):208-12.
- De Santis D, Pancera P, Sinigaglia S et al. Tooth agenesis: part 1. Incidence and diagnosis in orthodontics. *J Biol Regul Homeost Agents* 2019; 33(Suppl 1 [integer]):19-22.
- De Santis D, Pancera P, Sinigaglia S et al. Tooth agenesis: part 2. Orthodontic treatment and prosthetic possibilities. *J Biol Regul Homeost Agents* 2019; 33(Suppl 1 [integer]):23-8.
- De Santis D, Menchini Fabris GB, et al. Bi-layered collagen nano-structured membrane prototype collagen matrix 10826® for soft tissue regeneration in rabbits: an in vivo ultra-structural study of the early healing phase. *J Biol Regul Homeost Agents* 2017; 31(52):91-97.
- Zanotti G, Gelpi F, Sinigaglia S, et al. Agensis: pilot case report by 2.9 mm implant. *J Biol Regul Homeost Agents* 2019; 33(Suppl 1 [integer]):61-5.
- Covani U, Marconcini S, Ferrini F, Gelpi F, Finotti M, Barone A, de Santis D. Posttraumatic use of dental implants immediately after tooth extraction: clinical study. *J Craniofac Surg* 2014; 25(3):796-8.
- De Santis D, Sinigaglia S, Faccioni P et al. Syndromes associated with dental agenesis. *Minerva Stomatol* 2019; 68(1):42-56.
- Phillips C, Tulloch C, Dann C. Rating of facial attractiveness. *Community Dent Oral Epidemiol* 1992; 20(4):214-20.
- Nocini PF, Menchini Fabris GB, Gelpi F, et al. Treatment of skin defects with growth factors and biodegradable collagen carrier: histological evaluation in animal model. *J Biol Regul Homeost Agents* 2017; 31(2 S2):1-13.
- Farkas LG, Katic MJ, Hreczko TA, Deutsch C, Munro IR. Anthropometric proportions in the upper lip-lower lip-chin area of the lower face in young white adults. *Am J Orthod* 1984; 86(1):52-60.
- Macedo A, Moro A, Scavone Júnior H, Martins LF. A análise facial no diagnóstico e planejamento ortodôntico. *Ortodontia SPO* 2008; 41(3):234-41.
- Sukhia RH, Khan M, Fida M, Shaikh A, Azam SI. Esthetic preferences for facial soft tissue profiles. *Int J Orthod Milwaukee* 2011; 22(3):17-23.
- O'Neill K, Harkness M, Knight R. Ratings of profile attractiveness after functional appliance treatment. *Am J Orthod Dentofacial Orthop* 2000; 118(4):371-6; discussion 377.
- Pişiren AB, Arman-Özçırpıcı A, Tunçer Nİ. Assessing the influence of chin prominence on profile esthetics: A survey study. *Craniofacial Surg* 2018; 46(4):628-34.
- Manuelli M, Marcolina M, Nardi N, et al. A. Oral mucosal complications in orthodontic treatment. *Minerva Stomatol* 2019; 68(2):84-88.
- Bertossi D, Giampaoli G, Lucchese A, et al. The skin rejuvenation associated treatment-Fraxel laser, Microbotox, and low G prime hyaluronic acid: preliminary results. *Lasers Med Sci* 2019; 34(7):1449-55.
- Zarif Najafi H, Sabouri SA, Ebrahimi E, Torkan S. Esthetic evaluation of lip position in silhouette with respect to profile divergence. *Am J Orthod Dentofacial Orthop* 2016; 149(6):863-70.
- de Menezes M, Rosati R, Allievi C, Sforza C. A photographic system for the three-dimensional study of facial morphology. *Angle Orthod* 2009; 79(6):1070-7.
- Girolami I, Pantanowitz L, Munari E, et al. Prevalence of PD-L1 expression in head and neck squamous precancerous lesions: a systematic review and metaanalysis. *Head Neck* 2020; 42(10):3018-30.
- Zotti F, Nocini R, Capocasale G, Fior A, Peretti M, Albanese M. Malignant transformation evidences of Oral Lichen Planus: When the time is of the

- essence. *Oral Oncol* 2020; 104:104594.
48. Schlickmann IAC, Moro A, Anjos A. Análise do perfil facial Male jovem, esteticamente agradável, em fotografias padronizadas: comparação da medição manual com a computadorizada. *Rev Dental Press Ortod Ortop Facial* 2008; 13(6):98-107.
  49. Almeida MD, Farias ACR, Bitencourt MAV. Influência do posicionamento sagital mandibular na estética facial. *Dental Press J Orthod* 2010; 15(2):87-98.
  50. Boneco C, Jardim L. Estudo da morfologia labial em pacientes com padrão vertical alterado. *Rev Port Estomatol Cir Maxilofac* 2005; 46(2):69-80.
  51. De Santis D, Bertossi D, Zanotti G, Rossetto A, Farronato G, Gelpi F, Marconcini S, Covani U. Nd-YAP laser assisted frenulectomy: a case series on 23 patients. *Minerva Stomatol* 2013; 62(8 Suppl 1):27-36.
  52. Albanese M, Ricciardi G, Luciano U, et al. Alveolar splitting with Piezosurgery®, bone bank grafts and NobelActive implants as an alternative to major bone grafting for maxillary reconstruction. *Minerva Stomatol* 2019; 68(1):3-10.
  53. Nomura M, Motegi E, Hatch JP, Gakunga PT, Ng'ang'a PM, Rugh JD, Yamaguchi H. Esthetic preferences of European American, Hispanic American, Japanese, and African judges for soft-tissue profiles. *Am J Orthod Dentofacial Orthop* 2009; 135(S4):S87-95.
  54. Fortes HN, Guimarães TC, Belo IM, da Matta EN. Photometric analysis of esthetically pleasant and unpleasant facial profile. *Dental Press J Orthod* 2014; 19(2):66-75.
  55. Marchiori GE, Sodré LO, Cunha TC, Torres FC, Rosário HD, Paranhos LR. Pleasantness of facial profile and its correlation with soft tissue cephalometric parameters: Perception of orthodontists and lay people. *Eur J Dent* 2015; 9(3):352-5.
  56. Oh HS, Korn EL, Zhang X, Liu Y, Xu T, Boyd R, Baumrind S. Correlations between cephalometric and photographic measurements of facial attractiveness in Chinese and US patients after orthodontic treatment. *Am J Orthod Dentofacial Orthop* 2009; 136(6):762.e1-14; discussion 762-3.
  57. Faccioni P, De Santis D, Sinigaglia S, et al. Effects of the sander bite jumping appliance in patients with class ii malocclusion before growth peak. *J Biol Regul Homeost Agents* 2020;34(6 S2):1-7
  58. Bertossi D, Albanese M, Nocini R, Mortellaro C, Kumar N, Nocini PF. Osteotomy in genioplasty by piezosurgery. *J Craniofac Surg* 2018; 29(8):2156-9.
  59. Dimaggio FR, Ciusa V, Sforza C, Ferrario VF. Photographic soft-tissue profile analysis in children at 6 years of age. *Am J Orthod Dentofacial Orthop* 2007; 132(4):475-80.

## 20 Mini-invasive rehabilitation with removable total prosthesis with mixed conometric connection on 1.4-1.5-2.2 (2.9 mm) implant abutments and 1.6-2.3-2.4 dental abutments: a two-year follow-up

G. Zanotti<sup>1</sup>, U. Luciano<sup>2</sup>, P. Montagna<sup>2</sup>, A. Pardo<sup>2</sup>, N. Zerman<sup>2</sup>, N. Modena<sup>2</sup>, A. Poscolere<sup>2</sup>, M. Magi<sup>2</sup>, T. Zambotti<sup>2</sup>, C. Alberti<sup>2</sup>, D. Donadello<sup>2</sup>, M. Zarbonello<sup>2</sup>, A. Iurlaro<sup>2</sup>, D. Giuliani<sup>2</sup>, A. Cominziolli<sup>2</sup>, F. Balliu<sup>2</sup> and D. De Santis<sup>2</sup>

<sup>1</sup>U.L.S.S. 9 of Verona; <sup>2</sup>Section of Oral and Maxillofacial Surgery, Department of Surgical Sciences, Dentistry, Gynecology and Pediatrics, University of Verona, Verona, Italy

**Nowadays, the best possible approach in respect to the patient is that tailored on the “person”, intended as the result of the balance between the patient’s requirements and expectations, the latter being influenced by contemporary society’s over-information without a proper preparation. It is therefore possible to obtain an efficient and effective treatment by recovering the doctor-patient relationship, which is fundamental to guarantee the respect of the therapist’s pragmatic and common-sense guidance whilst satisfying the patient’s needs. The reported case serves as an example of this choice, combining the psychological support with a valuable minimally invasive surgical implant-prosthetic rehabilitation.**

In our contemporary society, the dental professional needs to balance the best possible approach for the specific patient with his/her requirements and expectations, the latter being influenced by different socio-cultural and economic factors. Among these elements, the symptom of pain is particularly relevant, conceptualised in the dual paradigm “pain-avoidance versus reward-seeking” (1): if pain, or the expectation of it, comes between an individual and reaching a goal, the number of people who put their achievement above pain is lower than those who delay or completely abandon that achievement, proportionally to the expected or felt pain intensity and the determination in reaching the goal itself. Nowadays, this model needs to be correlated to how the sociological concept of physical and psychological pain has changed, in accordance with Illich’s view in 1976. Traditionally, pain was interpreted as an essential component of existence, being part of both life and death; in the 21st century, with the development of the cosmopolitan culture, the above-mentioned element has progressively disappeared. Indeed, pain is now identified as the failure of the modern socio-economic system, implying its alienation from social existence, as well as from the individual daily life, and thus legitimating the avoidance of pain in all its forms as a social goal (2-5), rather than an individual choice. Consequently, the new millennium has brought a wide offer of ancillary drug therapies in the medical and dental sector, based on the large demand from patients, also paediatric (6); however, these treatments have not been accompanied by an equal offer of adjuvant psychological therapies, thus allowing the patient to avoid pain, rather than dealing with it. The combination of the above-described aspects with the recent economic and ethno-demographic changes, which have determined a general impoverishment of the population (7), drives the patient to prefer minimally invasive, quick, and less painful procedures, which are more respectful of the patient’s approach to the pain (8).

Corroborating the above-mentioned elements, which are all part of the same extremely complex and heterogeneous social framework, the identification of a common goal between the clinician and the patient is fundamental and crucial for the success of the treatment in the dentist’s daily practice. This shared objective allows to reach the right balance between the treatment’s invasiveness, its suitability in respect to the clinical circumstance, and the emotional-economic impact the patient is willing to handle (9-12).

In this perspective, the reported case reprises the need for an implant-prosthetic rehabilitation that is in line with the patient’s scarce

propensity to undergo invasive and/or lengthy procedures, nonetheless guaranteeing the appropriate clinical value (13-17) of the cutting-edge treatment (18), which is supported by the scientific community (19-24). The case takes into consideration the treatment of a male adult patient (48 years old) with a negative medical history, but with a limited propensity towards dental treatments due to previous regrettable experiences. The said patient consequently required a minimally invasive approach that avoided any kind of exodontic surgery, thus preserving the existing dental elements and strictly precluding any form of bone regenerative surgery, expansive or appositive, vertical or horizontal. Following the oral cavity physical examination, studying the case by analysing the gypso and radiographic documentation – the latter including maxillary computed tomography – permitted to develop a minimally invasive planning. This procedure was obtained by implementing cuttingedge technologies (11), techniques (13-17) and materials (25) and has been validated by the scientific community (19-22), linked to a pragmatic clinical “common-sense”. The patient’s oral cavity rehabilitation therefore consisted in maintaining the dental stumps in positions 1.6-2.3-2.4 and inserting the implants - with the related differed implant stumps - in positions 1.5-1.4-2.2, to support a removable full denture, anchored to the aforementioned elements through conometric attachments (26). Occlusal elevations on dental elements 4.5-4.4-3.4-3.5 were necessarily combined with the outlined therapeutic project to rebalance the curve of Spee (27). Moreover, upon the patient’s request, it was agreed to preserve the dental element 4.8 and the implant element 1.2 after conservative treatment; however, the patient was informed concerning the uselessness of element 4.8 in terms of chewing. Regarding this, the final mesial odontoplasty of element 4.8 is expected, as well as the impossibility to use element 1.2 for prosthetic purpose, due to the fracture of a portion of the implant margin that makes any load unbearable.

**MATERIALS AND METHODS**

The preparation of the patient’s case consisted in taking initial pictures, realising study models, conducting a preliminary radiographic analysis of the bone availability, to measure the implant length and diameter in advance, and carrying out preliminary occlusal analysis, to obtain a pre-surgical guide indicating the prosthetic ideal inclination (Figs. 1, 2, 3).

Firstly, a professional oral hygiene session and dental element 2.3 conservative restoration in composite resin – exploiting the existing pivot - were performed. Then, the said element was subjected to the sub-gingival preparation with feather edge margin and covered with a conometric primary prosthetic work made in Chromium-Cobalt alloy. Furthermore, the pre-existing conometric primary



Fig. 4. Implant 2.9mm diameter

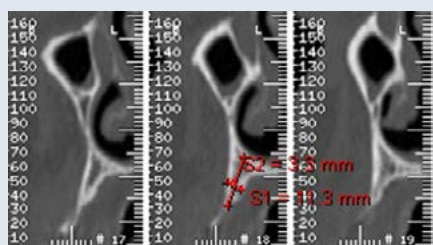


Fig. 1. Implant-prosthetic project by cone beam computer tomography

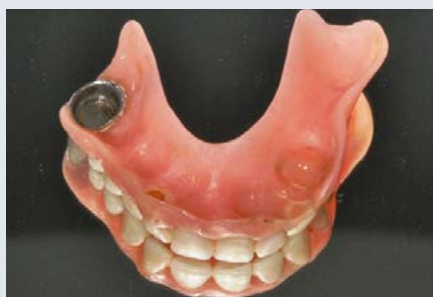


Fig. 2. Previous removable prosthesis



Fig. 3. Pre-implant surgery orthopantomography

prosthetic works on dental elements 1.6-2.4 were polished. Thereafter, the pre-existing mobile prosthesis was set up as a provisional prosthesis, temporarily anchored to the solely “ball attachment” on the previous implant 1.2. This procedure was feasible upon condition of stabilising the mentioned on-site attachment with cyanoacrylate, with the aim of impeding its rotation, which would otherwise cause the disinsertion from the implant due to fracture in the mesial margin of the peri-implant collar initially encountered.

Secondly, after a few weeks, the first surgery phase was initiated by preparing the patient through an ancillary psychological pre-surgical treatment in the hour beforehand to help him deal with the procedure, and a supportive drug treatment through the administration of 20 drops of Diazepam just before the surgery. The patient was then seated and prepared in accordance with the traditional health and hygiene norms to guarantee the maximum sterility. Initially, perioral skin disinfection (povidone iodine 10%) was performed combined with Vaseline to moisten the tissues. The gingival surface was then treated with a topical anaesthetic (Lidocaine + cetrimonium bromide 15%) and, afterwards, the peripheral anaesthesia was inoculated at the vestibular fornix micro-circulation and the palatal levels (Articaine 4% + adrenaline 1/200,000). Following these steps, an oblique incision with tissue decollement was made at the vestibular para-crestal level, with a mid-thick incision at vestibular level and a full-thick incision at the palatal level (scalpel # 12C). The total bone exposition allowed to carry out the explorative milling at 5 mm with a lanceolate cutter (1.9 mm diameter) at the sites 2.2, 1.4 and 1.5, following the presurgical guide dictates. After checking the bone density (D3 Misch classification) (28), the first milling at 5 mm was performed (2.2 mm diameter) by using an implant probe, always keeping the pre-





Fig. 5. Post-implant surgery orthopantomography



Fig. 6. Mucosa during implant activation

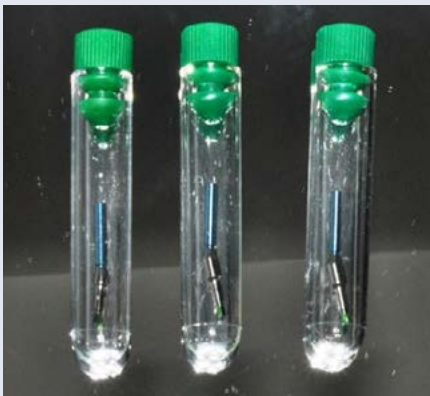


Fig. 7. Intermediate supports for screwing the conometric primary stumps.

surgical guide, which was then removed to complete the milling by following the obtained inclination up to 13 mm. A second milling for 3 mm (2.8mm diameter) was subsequently performed, to avoid an excessive bone pressure during the insertion of the implant element. Three implants were inserted (Titanium 5 HRS surface) with a diameter of 2.9 mm and length of 12 mm up to 2 mm under the bony crest, to favour the prosthetic aesthetics (25). After inserting the screw tap on each implant element, a check-up orthopantomography was carried out to verify the quality of the procedure (Figs. 4, 5). The site was then accurately sutured by executing a closing flap through single intra-papillary stitches in positions 1.6- 2.3 and a crossed horizontal mattress suture between the vestibular and palatal portions. The suture in vestibular para-crestal position obtained from the initial incision is therefore exploited, such that, due to the lateral position of the incision - thus the suture - in respect to the insertion site (glycolic/lactic acid absorbable suture), a decreased risk of implant stump infection is expected. Finally, the temporary total prosthesis was rebased with a soft silicon, to allow the smallest load possible on the surgical site. The patient was then discharged, after being provided with bactericidal and anti-inflammatory antibiotic pharmacological indications (amoxicillin with clavulanic acid 1 g every 8 hours for 6 days, and paracetamol with codeine 500mg + 30mg when needed), combined with post-surgery indications. A thorough hygiene and a soft diet for the first month were also recommended to the patient. After two weeks, the suture was removed, and the patient had to undergo monthly radiographic checks with hygiene for three months. Three months after surgery, the final radiographic control was performed to assess the full osseointegration of the implant elements. The positive outcome of this checkup authorised to proceed with the second surgical phase of re-opening, with the aim of initiating the prosthetic rehabilitation. The patient was then prepared once more with an ancillary psychological pre-surgical

therapy and a drug treatment, identical to that described previously. The patient was seated and prepared in accordance with the traditional health and hygiene norms to guarantee the maximum sterility, as already reported.

Initially, the perioral skin disinfection (povidone iodine 10%) was performed, combined with Vaseline to moisten the tissues. The gingival surface was then treated with a topical anaesthetic (Lidocaine + cetrimonium bromide 15%) and, afterwards, the peripheral anaesthesia was inoculated at the vestibular fornix micro-circulation and the palatal levels (Articaine 4% + adrenaline 1/200,000). Following these steps, an oblique incision with tissue decollement was executed at the vestibular para-crestal level, with a mid-thick

incision at vestibular level and a full-thick incision at palatal level (scalpel # 12C). The total bone exposure allowed the immediate display of the implant elements' peri-implant collar in positions 2.2, 1.4 and 1.5. The implemented approach consisted in immediately

utilising the intermediate supports for screwing the conometric stumps, thus avoiding the usage of healing screws. On site 1.5, a support with a 7.5° angle and 5 mm in length was employed, on site 1.4, a 5 mm length support with a 15° angle and on-site 2.2, a 7 mm length straight support. Finally, primary conometrics were tightened in all sites, with a 3.3 mm diameter, a 4.3 mm height and a 5° angle. Following an additional orthopantomography check-up to verify the correct insertion with of the conometric stumps' intermediate supports in the implant



Fig. 8. Orthopantomography after intermediate supports for screwing the conometric primary stump insertions



Fig. 9. The conometric primary stumps

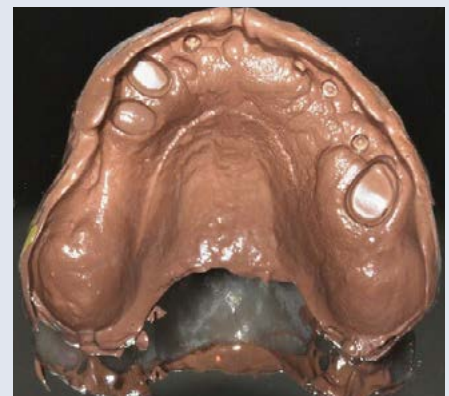


Fig. 10. Accurate impression in order to achieve removable prosthesis



Fig. 11. Structure - vertical dimension - chewing test

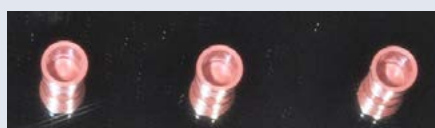


Fig. 12. Peek® secondary conometric crowns

elements, the site was accurately sutured (Figs. 6, 7, 8, 9). As in the previous intervention, the suture consisted in executing a closing flap through single intra-papillary stitches in positions 1.6-2.3 and a crossed horizontal mattress suture between the vestibular and palatal portions. The suture in palatal para-crestal position obtained from the initial incision was therefore exploited, expecting an increase in the thickness of the vestibular attached gingiva and a concurrent soft tissue guide towards a recovery suitable for the conometric stumps' intermediate supports (glycolic/lactic acid absorbable suture). Finally, the temporary total prosthesis was rearranged to allow its permanent usage while keeping the already mentioned supports and the related stumps. The patient was discharged, after being provided with bacteriostatic and anti-inflammatory antibiotic pharmacological indications (azithromycin 500 mg every 24 hours for three days, and paracetamol with codeine 500mg + 30mg when needed), combined with post-surgery indications. After two weeks, the suture was removed to proceed with the development of the permanent mobile total prosthesis. A first polysulfide precision impression was performed in relation to pictures of the patient's face and smile, starting from the previously-made individual spoon. By placing wax rims on the temporary flange, it was possible to identify the vertical dimension, assure the correct occlusion "key" through a precise mastication on auxiliary dedicated wax and point out the interdental midline related to the nose tip and the chin (Figs. 10, 11). Finally, the teeth trial - anterior aesthetic first, posterior functional after - was conducted, accompanied with the concurrent development of composite resin occlusal elevations on dental elements 3.4-3.5-4.4-4.5 to balance the mastication and improve the patient's curve of Spee (27). During the same session, the phonetic trial was also carried out, combined with an additional aesthetic evaluation by a relative. The final step consisted in incorporating three secondary conometric crowns of alloy (Chromium-Cobalt) to the prosthesis, which had been calibrated on the three primary conometric crowns on elements 1.6-2.3-2.4 and consolidated to a supporting base of alloy (Chromium-Cobalt). Moreover, three secondary conometric crowns of PEEK were inserted into the prosthesis through resinous rebasing (polymethylmethacrylate), calibrated on the primary conometric stumps of implant elements 1.5-1.4-2.2 (Figs. 12, 13, 14). In addition to this, the mesial-occlusal odontoplasty of dental element 4.8 was executed, to avoid its interference with achieved chewing balance (Fig. 15).

## RESULTS

After a month from the procedure, the first clinical monitoring took place, focusing on the stability of implants, intermediate prosthetic components, and gingival and tissue structure. Then, after the first post-delivery quarter, a second clinical and radiographic test to analyse the stability of the above-mentioned elements was performed, together with professional hygiene. In both observations, the implants, prosthetic components, and gingival and tissue structure stability proved to be optimal; furthermore, the second test showed radiographic evidence of a full osseointegration. Following another 3-month period, a new professional hygiene was carried out, together with the collection of additional photographic documentation (Fig. 16). During the first year, professional hygiene was performed every 3 months, thus guaranteeing a gingival maintenance treatment of extra-implant mucous canals and making the patient aware of the importance of these regimens to maintain an optimal prosthetic rehabilitation. The annual clinical and radiographic control of implant, intermediate prosthetic components, and gingival and tissue stability showed both clinical and radiographic positive results, observing only one mucositis episode affecting the implant at site 1.2, which was

elements, the site was accurately sutured (Figs. 6, 7, 8, 9). As in the previous intervention, the suture consisted in executing a closing flap through single intra-papillary stitches in positions 1.6-2.3 and a crossed horizontal mattress suture between the vestibular and palatal portions. The suture in palatal para-crestal position obtained from the initial incision was therefore exploited, expecting an increase in the thickness of the vestibular attached gingiva and a concurrent soft tissue guide towards a recovery suitable for the conometric stumps' intermediate supports (glycolic/lactic acid absorbable suture). Finally, the temporary total prosthesis was rearranged to allow its permanent usage while keeping the already mentioned supports and the related stumps. The patient was discharged, after being provided with bacteriostatic and anti-inflammatory antibiotic pharmacological indications (azithromycin 500 mg every 24 hours for three days, and paracetamol with codeine 500mg + 30mg when needed), combined with post-surgery indications. After two weeks, the suture was removed to proceed with the development of the permanent mobile total prosthesis. A first polysulfide precision impression was performed in relation to pictures of the patient's face

and smile, starting from the previously-made individual spoon. By placing wax rims on the temporary flange, it was possible to identify the vertical dimension, assure the



Fig. 13. Peek® secondary conometric crown insertion



Fig. 14. Removable prosthesis



Fig. 15. Occlusal rises in lower jaw



unexploited due to fractures. This inflammation was resolved with a laser-assisted supportive peri-implant treatment (laser diode – 810nm wavelength). At the end of the treatment, the patient received instructions to undergo professional hygiene every four months, to favour the durability of the realised implant-prosthetic rehabilitation. After two years, a clinical and radiographic control of stability was performed and showed positive results (Fig. 17).

## DISCUSSION

The urge to identify a treatment that encounters the patient's clinical requirements and needs is essential nowadays in the dental profession. In the reported case, the patient requested a procedure to restore the functionality, as well as the morphology, of the stomatognathic system, although refusing a classical implant approach, which would have implied changes to the available bone thicknesses (29-31). The patient had also turned down the possibility to perform the exodontics of the elements in position 1.2



Fig. 16. Smile



Fig. 17. Two-year follow-up orthopantomography

(implant) and 4.8 (dental) inside the oral cavity, hence complicating even more the rehabilitative procedure. In the perspective of achieving a common goal, the patient finally accepted to undergo a removable prosthetic rehabilitation, assisted by the clinician's decision-making flexibility. In particular, the rehabilitation would be supported, through conometric connection, by last-generation dental implants, which have demonstrated to handle the masticatory forces generated in the oral cavity (26) despite the limited diameter. In the last decade, the scientific community already approved removable prosthetic rehabilitations supported by dental implant through conometric connection (12-14). However, the reported case describes a procedure that, exploiting the original bone availability without additional changes, employs minimum-diameter dental implants (2.9 mm). These implants were inserted at sites 2.2, 1.4 and 1.5 and linked to the residual dental stumps on sites 1.6, 2.3 and 2.4 by means of a prosthetic device, developed in total conometric removable coupling on a mixed dental-implant support (26). As a completion to the rehabilitative project, it was also decided to rebalance the masticatory plane, by applying composite occlusal suspensions on the antagonist dental elements in positions 4.5, 4.4, 3.4 and 3.5. This procedure guarantees more stability to the entire stomatognathic system (27) and thus more durability to the applied implant-prosthetic rehabilitation. The medical hazard of exploiting implants with a 2.9 mm minimum diameter was then rebalanced

by the concurrent secure additional support on the residual dental stumps, allowing an equal distribution of the masticatory load. Finally, there are two observations to be made. Firstly, the removable prosthesis anchored on dental and implant stumps allows to overcome the potential long-term stability issues, which are caused by the different mobility of the afore-mentioned elements (dental 150  $\mu\text{m}$  - implant around 0  $\mu\text{m}$ ) (13). In case of a cemented or screwed fixed bridge prosthesis, this kind of problems would have been more probable (13, 29, 32-37). Secondly, the conometric connection permitted to grant a reinforced implantdental mixed anchoring system (38-42) and a proper distribution of the masticatory forces perpendicular to the stumps. Moreover, the tangential forces to the stumps, (43-45) which are generated by the daily removal, were reduced to minimum, due to the strict disconnection mode, almost perpendicular to the stumps, that is almost impossible to obtain with simpler ball connection systems. In this scenario, the chosen therapeutical plan permitted not only to achieve optimal clinical results in a patient who would otherwise reject any kind of treatment, but also to obtain additional benefits (46). Firstly, the application of a removable device enables a better domestic cleansing of the stumps, reducing the rate of the medium-long-term failures in patients with a scarce oral hygiene and easing the device readaptation in case of compromised stability of dental pillars over time. Secondly, the operating invasiveness reduction, together with the patient acknowledging the orthodontist as a person who understands their fears and demonstrates medical flexibility, leads to a reduction of anticipatory anxiety in the subject. Consequently, it was possible to apply an anxiolytic psychological and pharmacological approach, which otherwise would have probably shifted towards a higher level of unconsciousness, reaching the state of sedation.

REFERENCES

1. Claes N, Crombez G, Vlaeyen JWS. Pain-avoidance versus reward-seeking: an experimental investigation. *Pain* 2015; 156(8):1449-57.
2. Illich I. Limits to Medicine: Medical Nemesis: The Expropriation of Health. 1976. Marion Boyars, pp 294, ISBN 0-7145-2513-8.
3. De Santis D. Fibromatosis of the mandible: case report and review of previous publications. *Br J Oral Maxillofac Surg* 1998; 36(5):384-8.
4. Bertossi D, Favero V, Albanese M, et al. Peripheral ameloblastoma of the upper gingiva: Report of a case and literature review. *J Clin Exp Dent* 2014; 6(2):180-4.
5. Bendelow GA, Williams SJ. Transcending the dualisms: towards a sociology of pain. *Sociology of Health & Illness* 1995; 17(2):139-65.
6. Marinello L, Zanotti G, Spinelli A, et al. Ketamine in dentistry: a useful way for non-compliant pediatric patients. *J Biol Regul Homeost Agents* 2020; 34(Suppl. 2):63-8.
7. Blanchet T, Chancel L, Gethin A. How Unequal Is Europe? Evidence from Distributional National Accounts 1980-2017. World Inequality Database. Working Paper N. 2019/06.
8. Locker D. Psychosocial consequences of dental fear and anxiety. *Community Dent Oral Epidemiol* 2003; 31(2):144-51.
9. Reissmann DR, Bellows JC, Kasper J. Patient preferred and perceived control in dental care decision making. *JDR Clin Trans Res* 2019; 4(2):151-9.
10. Bertelè G, Mercanti M, Stella F, Albanese M, De Santis D. Osteodistraktion in the craniofacial region. *Minerva Stomatol* 2005; 54(4):179-98.
11. De Santis D, Cucchi A, de Gemmis A, Nocini PF. New collagen matrix to avoid the reduction of keratinized tissue during guided bone regeneration in postextraction sites. *J Craniofac Surg* 2012; 23(3):186-9.
12. Chapple H, Shah S, Caress AL, Kay EJ. Exploring dental patients' preferred roles in treatment decision-making - a novel approach. *Br Dent J* 2003; 194:321-7.
13. Nocini PF, Chiarini L, De Santis D. Trattato di chirurgia pre-protetica e ingegneria tissutale. Ed. Martina 2005.
14. De Santis D, Graziani P, Castellani R, et al. A new radiologic protocol and a new occlusal radiographic index for computer-guided implant surgery. *J Craniofac Surg* 2016; 27:506-10.
15. Barone A, Toti P, Bertossi D, et al. Gene expression of human mesenchymal stem cells cultured on titanium dental implant surfaces. *J Craniofac Surg* 2016; 27:712-7.
16. Bertossi D, Nocini R, Luciano U, et al. Piezoelectric surgery inserts vs conventional burst: a clinical investigation. *J Biol Regul Homeost Agents* 2018; 32:15-9.
17. Rinaldi M, Ganz S, Mottola A. Computer-guided dental implants, bone grafting and reconstructive surgery. Ed. Elsevier 2009.
18. Bressan E, Stocchero M, Jimbo R, Rosati C, Fanti E, Tomasi C, Lops D. Microbial leakage at morse taper conometric prosthetic connection: an in vitro investigation. *Implant Dent* 2017; 26:756-71.
19. Bressan E, Lops D. Conometric retention for complete fixed prosthesis supported by four implants: 2-years prospective study. *Clin Oral Implants Res* 2014; 25:546-52.
20. Barone A, Marconcini S, Giammarinaro E, Mijiritsky E, Gelpi F, Covani U. Clinical outcomes of implants placed in extraction sockets and immediately restored: A 7-year single-cohort prospective study. *Clin Implant Dent Relat Res* 2016; 18:1103-12.
21. De Santis D, Pancera P, Luciano U, et al. Short-term in vivo evaluation of cellular DNA damage induced by fixed orthodontic appliances. *J Biol Regul Homeost Agents* 2018; 32:75-80.
22. Bressan E, Sbricoli L, Guazzo R, Bambace M, Lops D, Tomasi C. Five-year prospective study on conometric retention for complete fixed prostheses. *Int J Oral Implantol* 2019; 12:105-13.
23. De Santis D, Gelpi F, Castellani R, et al. Bi-layered collagen nano-structured membrane prototype collagen matrix CM-10826 for oral soft tissue regeneration: an in vivo ultrastructural study on 13 patients. *J Biol Regul Homeost Agents* 2019; 33(Suppl. 1):29-41.
24. Krennmair G, Krainhöfner M, Waldenberger O, Piehslinger E. Dental implants as strategic supplementary abutments for implant-toothsupported telescopic crown-retained maxillary dentures: a retrospective follow-up study for up to 9 years. *Int J Prosthodont* 2007; 20:617-22.
25. Zanotti G, Gelpi F, Sinigaglia S, et al. Agensis: pilot case report by 2.9 mm implant. *J Biol Regul Homeost Agents* 2019; 33(Suppl. 1):61-5.
26. Lian M, Zhao K, Feng Y, Yao Q. Prognosis of combining remaining teeth and implants in doublecrown-retained removable dental prostheses: A systematic review and meta-analysis. *Int J Oral Maxillofac Implants* 2018; 33:281-97.
27. Prati S. *Disordini Cranio-Mandibolari*. Ed. Martina 2017.
28. Misch C. Classifications and treatment options of the completely edentulous arch in implant dentistry. *Dent Today* 1990; 9:28-30.
29. McAllister BS, Haghghat K. Bone augmentation techniques. *J Periodontol* 2007; 78:377-96.
30. De Santis D, Menchini Fabris GB, Lotti J, et al. Bi-layered collagen nano-structured membrane prototype collagen matrix 10826® for soft tissue regeneration in rabbits: an in vivo ultra-structural study of the early healing phase. *J Biol Regul Homeost Agents* 2017; 31:91-7.
31. Covani U, Marconcini S, Ferrini F, et al. Post traumatic use of dental implants immediately after tooth extraction: clinical study. *J Craniofac Surg* 2014; 25:796-8.
32. Pessoa RS, Sousa RM, Pereira LM, et al. Bone remodeling around implants with external hexagon and morse-taper connections: A randomized, controlled, split-mouth, clinical trial. *Clin. Implant Dent Relat Res* 2017; 19:97-110.
33. De Santis D, Pancera P, Luciano U, et al. Evaluation of bacterial flora composition on teeth and periodontal tissues in patients in treatment with rapid palatal expander. *J Biol Regul Homeost Agents* 2018; 32:31-36.
34. Nocini PF, Menchini Fabris GB, Gelpi F, et al. Treatment of skin defects with growth factors and biodegradable collagen carrier: histological evaluation in animal model. *J Biol Regul Homeost Agents* 2017; 31:1-13.
35. De Santis D, Bertossi D, Zanotti G, et al. Nd-YAP laser assisted frenulectomy: a case series on 23 patients. *Minerva Stomatol* 2013; 62:27-36.
36. Albanese M, Ricciardi G, Luciano U, et al. Alveolar splitting with Piezosurgery®, bone bank grafts and NobelActive implants as an alternative to major bone grafting for maxillary reconstruction. *Minerva Stomatol* 2019; 68:3-10.
37. Chrcanovic BR, Kisch J, Larsson C. Analysis of technical complications and risk factors for failure of combined tooth-implant-supported fixed dental prostheses. *Clin Implant Dent Relat Res* 2020; 22:523-32.
38. Bressan E, Lops D, Tomasi C, Ricci S, Stocchero M, Carniel EL. Experimental and computational investigation of Morse taper conometric system reliability for the definition of fixed connections between dental implants and prostheses. *Proc Inst Mech Eng H* 2014; 228:674-81.
39. Manuelli M, Marcolina M, Nardi N, et al. Oral mucosal complications in orthodontic treatment. *Minerva Stomatol* 2019; 68:84-8.
40. Bertossi D, Giampaoli G, Lucchese A, et al. The skin rejuvenation associated treatment - Fraxel laser, Microbotox, and low G prime hyaluronic acid: preliminary results. *Lasers Med Sci* 2019; 34:1449-55.
41. Girolami I, Pantanowitz L, Munari E, et al. Prevalence of PD-L1 expression in head and neck squamous precancerous lesions: a systematic review and metaanalysis. *Head Neck* 2020; 42:3018-30.
42. Costa Dayrell A, Yoshito Noritomi P, Mie Takahashi J, Leonardo Consani R, Ferraz Mesquita M, Bertolini dos Santos M. Biomechanical analysis of implant-supported prostheses with different implant-abutment connections. *Int J Prosthodont* 2015; 28:621-3.
43. Melilli D, Davi G, Messina P, Scardina GA. Tooth-implant connection in removable denture. *Minerva Stomatol* 2017; 66:35-42.
44. Zotti F, Nocini R, Capocasale G, Fior A, Peretti M, Albanese M. Malignant transformation evidences of oral lichen planus: When the time is of the essence. *Oral Oncol* 2020; 104:104594.
45. Bertossi D, Albanese M, Nocini R, Mortellaro C, Kumar N, Nocini PF. Osteotomy in genioplasty by piezosurgery. *J Craniofac Surg* 2018; doi: 10.1097/SCS.0000000000003150.
46. Zitzmann NU, Marinello CP. Treatment outcomes of fixed or removable implant-supported prostheses in the edentulous maxilla. Part I: patients' assessments. *J Prosthodont* 2000; 8:424-33.

## 21 Short-term sagittal changes of the upper and lower jaws in patients treated with acrylic-splint rapid palatal expander before growth peak

P. Faccioni, P. Pancera\*, U. Luciano, S. Sinigaglia, M. Marchiori, N. Zerman, N. Modena, A. Poscolere, M. Magi, T. Zambotti, C. Alberti, D. Donadello, M. Zarantonello, A. Iurlaro, D. Giuliani, A. Cominzioli, F. Balliu and D. De Santis

Section of Oral and Maxillofacial Surgery, Department of Surgical Sciences, Dentistry, Gynecology and Pediatrics, University of Verona, Verona, Italy

Rapid palatal expansion can determine an improvement of the sagittal relationship between maxilla and mandible. The purpose of this study was to evaluate the skeletal and dentoalveolar effects of the upper and lower jaws on the sagittal plane in subjects treated with acrylic-splint rapid palatal expander before growth peak. 36 patients aged 6-10 years with a cervical vertebral maturation stage of CS1 or CS2 were selected. Skeletal and dentoalveolar variables on the cephalometric traces of the lateral telerradiographs were measured before (T0) and at the end (T1) of the orthodontic treatment. The same variables were measured in a subgroup (20 subjects) of the same sample, characterized by a skeletal Class II malocclusion ( $ANB \geq 4^\circ$ ) at T0. Statistics used was paired samples t-test. The p-value was considered statistically significant for  $P < 0.05$ . In the whole sample ANB showed a significant decrease ( $-0.96 \pm 1.75^\circ$ ). Pg-OLp and Co-OLp + Pg-OLp increased of  $4.25 \pm 6.07$  mm and  $4.89 \pm 6.65$  mm respectively. FMA angle showed a significant decrease ( $-1.26 \pm 2.47^\circ$ ). In the subgroup with skeletal Class II malocclusion the results were similar, but it was also registered a significant increase of SNB ( $1.37 \pm 2.14^\circ$ ). In addition to the correction of the cross-bite, the treatment with acrylic-splint rapid palatal expander determined an improvement of the dento-basal discrepancy in the maxilla, an improvement of the skeletal maxillo-mandibular relationships, an anterior repositioning and length increase of the mandible and a facial height reduction.

The rapid palatal expansion has acquired a role of primary importance in modern orthodontics as a safe, predictable and effective method to correct the transverse maxillary deficit (1). In addition to an increase of the transverse diameter of the palatal vault and the correction of the cross-bite, there are many data in the literature regarding the favorable effects of this therapy in increasing the amplitude of the nasal cavities and the length of the upper arch perimeter (2-19). Concerning the effects of the rapid palatal expansion on the sagittal plane, the opinions presented in the literature appear conflicting. Some Authors reported a forward and downward repositioning of the maxilla after rapid palatal expansion (20-23). Cleall et al. considered that the maxilla gets back to its original position during retention (24). Other Authors observed that the forward and downward displacement of the maxilla can be minimized by using a type of expander with acrylic occlusal splints (25). Other studies reported a spontaneous anterior repositioning of the mandible after rapid palatal expansion in patients with Class II malocclusion due to mandible retrusion (26-29). The aim of this study was to evaluate the skeletal and dentoalveolar effects at the level of upper and lower jaws on the sagittal plane in subjects treated with acrylic-splint rapid palatal expander before growth peak.

### MATERIALS AND METHODS

In this study 36 subjects (18 males and 18 females) aged between 6 and 10 years were selected. At the beginning of the treatment (T0) the patients were in mixed dentition and their mean age was  $8.11 \pm 2.3$  years. The inclusion criteria were: skeletal transverse deficit of the maxilla; monolateral or bilateral skeletal cross-bite; CS1 or CS2 cervical vertebral maturation stage according to Baccetti et al. (30). The exclusion criteria were: genetic or endocrine diseases that could affect the treatment plan; previous orthopaedic and/or orthodontic treatment; skeletal abnormalities or significant facial asymmetry (19,31-36). The transverse discrepancy of the patients was measured on the dental casts using a caliper with 0.01 mm accuracy to quantify the needed expansion. Since all subjects had a

mixed dentition, the transverse discrepancy was the result of the difference between the superior intermolar distance (distance between the central fossae of the upper first permanent molars) and the inferior intermolar distance (distance between the top of the distobuccal cusps of the inferior first permanent molars). All subjects had an initial upper arch width inferior to 30 mm. The patients were treated with acrylic-splint rapid palatal expander (i.e. McNamara-type rapid palatal expander): it was composed of Hyrax-type screw embedded into a wire-and-acrylic framework; the acrylic splints were

Table I. Skeletal and dentoalveolar variables.

Variable	Description
SNA	Antero-posterior positioning of maxilla in relation to cranial base
SNB	Antero-posterior positioning of mandible in relation to cranial base
ANB	Relative position of the maxilla to mandible
A-OLp	Position of the maxillary base
Pg-OLp	Position of the mandibular base
Co-OLp	Position of the condylar head
Pg-OLp + Co-OLp	Sagittal mandibular length
Co-Gn	Total mandibular length
Co-A	Maxillary length
FMA	Frankfort-Mandibular plane Angle
U1-OL	Inclination of upper incisor
L1-OL	Inclination of lower incisor
U1-L1	Interincisal angle
is/OLp - ii/OLp	Overjet
ms/OLp - mi/OLp	Molar relation
U1-SN	Inclination of maxillary incisor to anterior cranial base
IMPA (L1-MP)	Incisor Mandibular Plane Angle
FMIA (L1-FH)	Frankfort-Mandibular Incisor Angle

bonded to the deciduous molars and the permanent first molars (37- 38). The patients' parents were instructed to activate the expansion screw twice a day until the palatal cusps of the maxillary posterior teeth approximated the buccal cusps of the mandibular posterior teeth: every activation was a 0.25 mm expansion. Once reached the correct expansion, the screw was blocked and the expander was kept in place for six months: this period was necessary to allow the reorganization of the midpalatal suture. At the end of this period (T1), the expander was removed, cleaned and given to the patient to wear it as retainer at night for further 6 months. If the expander was not sufficiently retentive, the patient wore a Hawley retainer (39). At the end of the orthodontic treatment skeletal and dentoalveolar variables on the cephalometric traces of the initial (T0) and final (T1) lateral teleradiographs were measured with Dolphin Imaging 11.7 software (Dolphin, Imaging & Management Solutions, Chatsworth, CA, USA). Parameters derived from Steiner, Tweed, Ricketts, Pancherz and Bjork cephalometric analyses were measured in order to gather all the measurement variables often used in the literature (Table I) (40). This study was approved by the Clinical Investigation Ethics Committee of Verona and Rovigo, Italy (protocol number 70252). The statistical analysis was performed using the software STATA (version 13; StataCorp LP, College Station, Texas, USA). Mean and standard deviation (SD) were calculated for all cephalometric variables at T0 (pre-treatment) and at T1 (after treatment). Paired samples t test was performed for the evaluation of the skeletal and dentoalveolar changes that occurred during treatment with rapid palatal expander. The p-value was considered statistically significant if less than 0.05. The same evaluation was performed for a subgroup (20 subjects) of the same sample, characterized by a skeletal Class II malocclusion ( $ANB \geq 4^\circ$ ) at T0.

**RESULTS**

The results of the changes of the skeletal variables at T0 and T1 are reported in Table II. SNA and SNB showed no statistically significant differences between T0 and T1. ANB underwent a statistically significant decrease between T0 and T1 ( $-0.96 \pm 1.75^\circ$ ,  $P < 0.05$ ), indicating an improvement of the sagittal relationships between the maxilla and the mandible. Pancherz analysis was adopted to assess the

positions of the maxilla, the condylar head and the mandible and the length of the mandible on the sagittal plane. No statistically significant differences were found for A-OLp ( $1.93 \pm 5.23$  mm,  $P > 0.05$ ) and Co-OLp ( $0.61 \pm 2.50$ ,  $P > 0.05$ ). Pg-OLp showed a statistically significant increase ( $4.25 \pm 6.07$  mm,  $P < 0.05$ ), suggesting an advancement of the mandibular position. As regards the total mandibular length, measured as Co-OLp + Pg-OLp, a statistically significant increase ( $4.89 \pm 6.65$  mm,  $P < 0.05$ ) was found. FMA

**Table II.** Changes of the pre- (T0) and post-treatment (T1) skeletal variables.

Skeletal variables	T0	T1	T1-T0	P-value (P)	Significant (S) / Not Significant (NS)
SNA (°)	81.18 ± 4.04	81.19 ± 3.87	0.02 ± 1.47	0.9622	NS
SNB (°)	77.35 ± 3.51	78.29 ± 3.41	0.94 ± 2.03	0.0661	NS
ANB (°)	3.86 ± 2.14	2.89 ± 2.33	- 0.96 ± 1.75	0.0325	S
A-OLP (mm)	73.38 ± 6.48	75.31 ± 5.23	1.93 ± 5.23	0.1355	NS
Pg-OLP (mm)	80.11 ± 8.58	84.36 ± 7.15	4.25 ± 6.07	0.0086	S
Co-OLP (mm)	4.01 ± 3.98	4.61 ± 2.37	0.61 ± 2.50	0.3191	NS
Pg-OLP + Co-OLP (mm)	84.1 ± 8.17	88.99 ± 7.42	4.89 ± 6.65	0.0062	S
Co-Gn (mm)	98.26 ± 8.74	103.32 ± 9.69	5.06 ± 8.90	0.0274	S
Co-A (mm)	77.51 ± 6.60	80.12 ± 5.44	2.61 ± 6.23	0.0941	NS
FMA (°)	26.28 ± 3.10	25.03 ± 3.41	- 1.26 ± 2.47	0.0453	S

angle showed a statistically significant decrease between T0 and T1 ( $-1.26 \pm 2.47$  mm,  $P > 0.05$ ), indicating a horizontally mandibular advancement rather than a vertical one. The results regarding the changes of the dentoalveolar variables at T0 and T1 are reported in Table III.

Only the variables related to the inclination of the upper incisors showed statistically significant changes: in particular, there was a proclination of the upper incisors given by the decrease of U1-OL angle ( $-2.55 \pm 3.39^\circ$ ,  $P < 0.05$ ) and by the increase of U1-SN angle ( $3.12 \pm 4.07^\circ$ ,  $P < 0.05$ ). The results regarding the changes of the skeletal and dentoalveolar variables at T0 and T1 in the subgroup of Class II malocclusion patients are reported in Table IV. With regard to the sagittal position of the maxilla, SNA and A-OLp did not show statistically significant differences between T0 and T1. The sagittal mandibular position was evaluated by analysing SNB and Pg-OLp. As regards the comparison between the values of Pg-OLp at T0 and T1, a statistically significant increase was found ( $3.85 \pm 6.38$  mm,  $P < 0.05$ ), suggesting an advancement of the sagittal mandibular position. SNB increased of  $1.37 \pm 2.14^\circ$  ( $P < 0.05$ ). The maxillo-mandibular relationship was evaluated through ANB: the angle decreased of  $1.27 \pm 1.63^\circ$  ( $P < 0.05$ ). FMA showed a statistically significant decrease between T0 and T1 ( $-2.01 \pm 2.06^\circ$ ,  $P < 0.05$ ), indicating a mandibular advancement in the horizontal direction rather than in the vertical one. Regarding the dentoalveolar variables, the only significant change regarded the proclination of the upper incisors, as it was observed in the total sample.

**DISCUSSION**

No statistically significant differences were found in the sagittal position of the maxilla (expressed by SNA, A-OLp and Co-A) between T0 and T1. As these values were not significant, it can be inferred that the therapy with the acrylic-splint rapid palatal expander did not affect the maxillary growth in the anteroposterior direction. These results were in agreement with the studies conducted by



**Table III.** Changes of the pre- (T0) and post-treatment (T1) dentoalveolar variables.

Dentoalveolar variables	T0	T1	T1-T0	P-value (P)	Significant (S) / Not Significant (NS)
U1-OL (°)	58.1 ± 43.65	55.59 ± 3.07	- 2.55 ± 3.39	0.0054	S
L1-OL (°)	71.98 ± 5.61	70.71 ± 5.11	- 1.27 ± 3.87	0.1807	NS
U1-L1 (°)	130.12 ± 7.77	126.28 ± 6.28	- 3.84 ± 3.41	0.0002	S
is/OLP-ii/OLP (mm)	3.68 ± 2.36	3.683 ± 2.68	0.006 ± 1.57	0.9882	NS
ms/OLP-mi/OLP (mm)	- 0.43 ± 1.7	- 1.23 ± 1.85	- 0.8 ± 1.71	0.0629	NS
U1-SN (°)	103.84 ± 5.57	106.96 ± 5.05	3.12 ± 4.07	0.0046	S
IMPA (L1-MP) (°)	91.81 ± 6.14	93.29 ± 5.26	1.49 ± 3.62	0.0993	NS
FMIA (L1-FH) (°)	61.93 ± 5.65	61.67 ± 5.02	- 0.27 ± 4.50	0.8046	NS

The values are expressed as mean±standard deviation (SD) and their difference. It is also reported the p-value and the significance obtained by the paired samples t test.

**Table IV.** Changes of the pre- (T0) and post-treatment (T1) skeletal and dentoalveolar variables in the subgroup of Class II malocclusion patients.

Skeletal and dentoalveolar variables	T0	T1	T1-T0	P-value (P)	Significant (S) / Not Significant (NS)
SNA (°)	81.61 ± 4.31	81.74 ± 3.94	- 0.2 ± 1.53	0.7634	NS
SNB (°)	76.78 ± 3.79	78.15 ± 3.79	1.37 ± 2.14	0.0401	S
ANB (°)	4.85 ± 0.99	3.58 ± 2.19	- 1.27 ± 1.63	0.0156	S
A-OLP (mm)	73.01 ± 6.43	74.50 ± 4.64	1.49 ± 4.86	0.2898	NS
Pg-OLP (mm)	78.61 ± 8.05	82.47 ± 4.52	3.85 ± 6.38	0.0499	S
Co-OLP (mm)	4.19 ± 4.52	4.61 ± 2.68	0.42 ± 2.53	0.5578	NS
Pg-OLP + Co-OLP (mm)	82.78 ± 7.94	87.11 ± 4.62	4.32 ± 6.69	0.0382	S
Co-Gn (mm)	96.28 ± 7.85	100.03 ± 5.06	3.75 ± 8.27	0.1283	NS
Co-A (mm)	77.31 ± 6.67	79.27 ± 4.61	1.95 ± 5.72	0.2419	NS
FMA (°)	26.38 ± 3.54	24.38 ± 3.01	- 2.01 ± 2.06	0.0043	S
U1-OL (°)	57.77 ± 4.19	55.49 ± 3.30	- 2.29 ± 3.79	0.0586	S
L1-OL (°)	70.48 ± 4.33	69.37 ± 4.91	- 1.11 ± 4.01	0.3388	NS
U1-L1 (°)	128.23 ± 7.17	124.92 ± 5.88	- 3.31 ± 3.70	0.0072	S
is/OLP - ii/OLP (mm)	3.81 ± 2.58	3.777 ± 3.16	- 0.039 ± 1.51	0.9285	NS
ms/OLP - mi/OLP (mm)	- 0.34 ± 1.75	- 1.22 ± 1.98	- 0.88 ± 2.01	0.1378	NS
U1-SN (°)	103.10 ± 6.12	106.31 ± 5.26	3.21 ± 4.63	0.0276	S
IMPA (L1-MP) (°)	94.05 ± 4.58	95.10 ± 4.76	1.02 ± 3.88	0.3606	NS
FMIA (L1-FH) (°)	59.58 ± 3.69	60.54 ± 5.23	0.95 ± 4.00	0.4067	NS

The values are expressed as mean±standard deviation (SD) and their difference. It is also reported the p-value and the significance obtained by the paired samples t test.

as in the Class II subgroup (-1.27±1.63°, P<0.05). This suggested that the acrylic-splint rapid palatal expander can be an effective choice for the treatment of all those patients who have a transverse maxillary deficit associated with a mandibular retrusion. In the subjects with Class II malocclusion the therapy with rapid palatal expander favoured a spontaneous mandibular repositioning that led to an improvement of the maxillo-mandibular relationship. This is why it is important to perform the Frankel manoeuvre to assess the need of a palatal

expansion before the orthodontic treatment in Class II malocclusion subjects with mandibular retrusion (43). This consideration, together with our results, is in agreement with a study by Guest et al, in which the sagittal effects of a group of Class II division I malocclusion subjects treated with acrylic-splint rapid palatal expander are compared with those of an untreated control group with the same malocclusion (26). These observations are also comparable to those reported by McNamara, who observed that the rapid palatal expansion led to a spontaneous growth or to an advancement of the mandible in subjects with Class II malocclusion (44-45). Regarding the effects of the rapid palatal expansion on the vertical plane, there was a statistically significant decrease of FMA (-1.26±2.47mm, P>0.05), indicating a facial height reduction. This might be caused by the likely intrusion of the posterior maxillary teeth, due to the action of masticatory forces on acrylic splints. This suggested that therapy with the acrylicsplint rapid palatal expander can be very favourable in hyperdivergent subjects, who present a vertical mandibular growth pattern. Our results were similar to those by De Rossi et al. and Cohen and Silverman, who affirmed that the presence of the acrylic splints could inhibit the alveolar growth and the eruption of the posterior teeth, thus becoming the ideal choice for all those patients with an increased facial height and overly inclined mandibular plane (46-47). Regarding the analysed dentoalveolar variables, only the values representing the inclination of the upper incisors and the interincisal angle showed statistically significant variations. In particular, a proclination of the upper incisors was found. This finding could be due to the presence of the resin splints which determined an anterior position

Da Silva et al., Asanza et al. and Sarver et al. (25,41,42). In this latter study the Authors observed that the anterior displacement of the maxilla due to treatment with banded rapid palatal expander could be minimized through the use of an acrylic-splint rapid palatal expander: therefore, it can be an effective treatment option for patients with Class II malocclusion. Regarding the sagittal position and

the length of the mandible, it was found: an increase of Pg-OLp distance, indicating an anterior displacement of the lower jaw; an increase of Pg-OLp + Co-OLp and Co-Gn, indicating an increased mandibular length. The anterior displacement of the mandible was in part due to the mandibular growth and in part to its anterior repositioning. The values representing the sagittal position of the mandible were even more expressive in the subgroup of Class II malocclusion patients. In particular, there was a statistically significant increase of SNB (1.37±2.14°, P<0.05) and Pg-OLp (3.85±6.37 mm, P<0.05) between T0 and T1. Therefore, the therapy with acrylic-splint rapid palatal expander favoured an advancement of the mandible thanks to its release from the dental occlusal contacts with the upper jaw: in this way, it led to an improvement of the maxillo-mandibular relationships. This was also confirmed by the statistically significant reduction of ANB both in the whole sample (-0.96±1.75°, P<0.05) as well

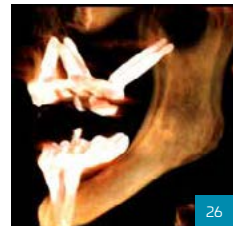
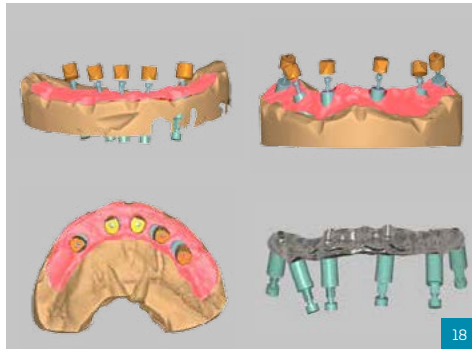
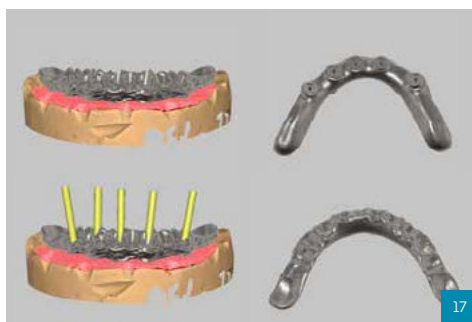
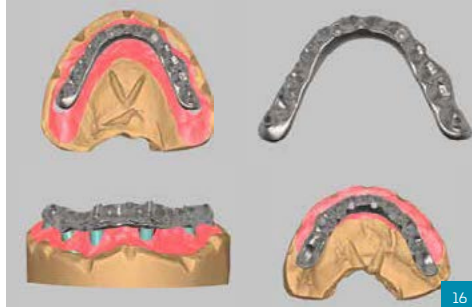
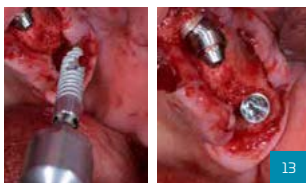
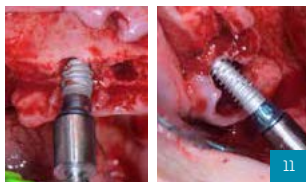
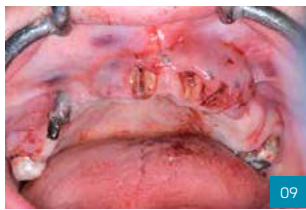
of the tongue in contact with the upper incisors, causing an almost continuous force able to procline them.

In addition to the correction of the cross-bite, the orthodontic treatment with acrylic-splint rapid palatal expander in subjects before growth peak determined: improvement of the dento-basal discrepancy in the upper jaw; improvement of the skeletal maxillomandibular relationship; anterior repositioning and length increase of the mandible; facial height reduction.

This therapy appears to be effective and advantageous in all those subjects that present a Class II malocclusion with mandibular retrusion and/or hyperdivergent growth pattern.

REFERENCES

1. Bucci R, D'Antò V, Rongo R, Valletta R, Martina R, Michelotti A. Dental and skeletal effects of palatal expansion techniques: a systematic review of the current evidence from systematic reviews and meta-analyses. *J Oral Rehabil*. 2016;43(7):543-64.
2. Lagravere MO, Major PW, Flores-Mir C. Long-term skeletal changes with rapid maxillary expansion: a systematic review. *Angle Orthod* 2005;75(6):1046-52.
3. De Santis D. Fibromatosis of the mandible: case report and review of previous publications. *Br J Oral Maxillofac Surg*. 1998;36(5):384-8.
4. Bertossi D, Favero V, Albanese M, et al. Peripheral ameloblastoma of the upper gingiva: Report of a case and literature review. *J Clin Exp Dent*. 2014;6(2):e180-4.
5. Ballanti F, Lione R, Baccetti T, Franchi L, Cozza P. Treatment and posttreatment skeletal effects of rapid maxillary expansion investigated with low-dose computed tomography in growing subjects. *Am J Orthod Dentofacial Orthop*. 2010;138(3):311-7.
6. Fastuca R, Lorusso P, Lagravère MO, et al. Digital evaluation of nasal changes induced by rapid maxillary expansion with different anchorage and appliance design. *BMC Oral Health*. 2017;17(1):113.
7. Bertelè G, Mercanti M, Stella F, Albanese M, De Santis D. Osteodistraction in the craniofacial region. *Minerva Stomatol*. 2005;54(4):179-98.
8. De Santis D, Cucchi A, de Gemmis A, Nocini PF. New collagen matrix to avoid the reduction of keratinized tissue during guided bone regeneration in postextraction sites. *J Craniofac Surg*. 2012;23(3):e186-9.
9. Galeotti A, Festa P, Viarani V, et al. Prevalence of malocclusion in children with obstructive sleep apnoea. *Orthod Craniofac Res*. 2018;21(4):242-7.
10. Garrett BJ, Caruso JM, Runghcharassaeng K, Farrage JR, Kim JS, Taylor GD. Skeletal effects to the maxilla after rapid maxillary expansion assessed with cone-beam computed tomography. *Am J Orthod Dentofacial Orthop*. 2008;134(1):8-9.
11. De Santis D, Graziani P, Castellani R, et al. A New Radiologic Protocol and a New Occlusal Radiographic Index for Computer-Guided Implant Surgery. *J Craniofac Surg*. 2016;27(5):e506-10.
12. Barone A, Toti P, Bertossi D, et al. Gene Expression of Human Mesenchymal Stem Cells Cultured on Titanium Dental Implant Surfaces. *J Craniofac Surg*. 2016;27(3):712-7.
13. Bertossi D, Nocini R, Luciano U, et al. Piezoelectric surgery inserts vs conventional burst: a clinical investigation. *J Biol Regul Homeost Agents*. 2018;32(2 Suppl. 2):15-19.
14. De Santis D, Pancera P, Luciano U, et al. Short-term in vivo evaluation of cellular DNA damage induced by fixed orthodontic appliances. *J Biol Regul Homeost Agents*. 2018;32(52):75-80.
15. Barone A, Marconcini S, Giammarinaro E, Mijiritsky E, Gelpi F, Covani U. Clinical Outcomes of Implants Placed in Extraction Sockets and Immediately Restored: A 7-Year Single-Cohort Prospective Study. *Clin Implant Dent Relat Res*. 2016;18(6):1103-12.
16. De Santis D, Gelpi F, Castellani R, et al. Bi-layered collagen nano-structured membrane prototype collagen matrix CM-10826 for oral soft tissue regeneration: an in vivo ultrastructural study on 13 patients. *J Biol Regul Homeost Agents*. 2019;33(1 Suppl. 1):29-41.
17. Cameron CG, Franchi L, Baccetti T, McNamara JA Jr. Long-term effects of rapid maxillary expansion: a posteroanterior cephalometric evaluation. *Am J Orthod Dentofac Orthop* 2002;121(2):129-35.
18. De Santis D, Menchini Fabris GB, Lotti J, et al. Bi-layered collagen nano-structured membrane prototype collagen matrix 10826® for soft tissue regeneration in rabbits: an in vivo ultra-structural study of the early healing phase. *J Biol Regul Homeost Agents*. 2017;31(2 Suppl. 2):91-7.
19. De Santis D, Sinigaglia S, Faccioni P, et al. Syndromes associated with dental agenesis. *Minerva Stomatol*. 2019;68(1):42-56.
20. Haas AJ. Palatal expansion: just the beginning of dentofacial orthopaedics. *Am J Orthod*. 1970;57(3):219-55.
21. Nocini PF, Menchini Fabris GB, Gelpi F, et al. Treatment of skin defects with growth factors and biodegradable collagen carrier: histological evaluation in animal model. *J Biol Regul Homeost Agents*. 2017;31(2 Suppl. 2):1-13.
22. Covani U, Marconcini S, Ferrini F, et al. Posttraumatic use of dental implants immediately after tooth extraction: clinical study. *J Craniofac Surg*. 2014;25(3):796-8.
23. Wertz RA, Dreskin M. Midpalatal suture opening: a normative study. *Am J Orthod*. 1977;71(4):367-81.
24. Cleall JF. Dentofacial orthopedics. *Am J of Orthod*. 1974;66(3):237-50.
25. Sarver DM, Johnston MW. Skeletal changes in vertical and anterior displacement of the maxilla with bonded rapid palatal expansion appliances. *Am J Orthod Dentofac Orthop* 1989;95(6):462-6.
26. Guest SS, McNamara JA Jr, Baccetti T, Franchi L. Improving Class II malocclusion as a side-effect of rapid maxillary expansion: a prospective clinical study. *Am J Orthod Dentofacial Orthop*. 2010;138(5):582-91.
27. De Santis D, Bertossi D, Zanotti G, et al. Nd-YAP laser assisted frenulectomy: a case series on 23 patients. *Minerva Stomatol*. 2013;62(8 Suppl. 1):27-36.
28. Albanese M, Ricciardi G, Luciano U, et al. Alveolar splitting with Piezosurgery®, bone bank grafts and NobelActive implants as an alternative to major bone grafting for maxillary reconstruction. *Minerva Stomatol*. 2019;68(1):3-10.
29. Baratieri C, Alves M Jr, Sant'anna EF, Nojima Mda C, Nojima LI. 3D mandibular positioning after rapid maxillary expansion in class II malocclusion. *Braz Dent J*. 2011;22(5):428-34.
30. Baccetti T, Franchi L, McNamara Jr JA. The cervical vertebral maturation (CVM) method for the assessment of optimal treatment timing in dentofacial orthopedics. *Semin Orthod* 2005;11(3):119-29.
31. Faccioni P, De Santis D, Sinigaglia S, et al. Effects of the sander bite jumping appliance in patients with class II malocclusion before growth peak. *J Biol Regul Homeost Agents*. 2020;34(2 Suppl. 2):1-7.
32. Manuelli M, Marcolina M, Nardi N, et al. Oral mucosal complications in orthodontic treatment. *Minerva Stomatol*. 2019;68(2):84-8.
33. Bertossi D, Giampaoli G, Lucchese A, et al. The skin rejuvenation associated treatment-Fraxel laser, Microbotox, and low G prime hyaluronic acid: preliminary results. *Lasers Med Sci*. 2019;34(7):1449-55.
34. Faccioni P, De Santis D, Luciano U, et al. Efficacy of the Andresen activator before peak growth in class II patients. *J Biol Regul Homeost Agents*. 2019;33(1 Suppl. 1):1-7.
35. Girolami I, Pantanowitz L, Munari E, et al. Prevalence of PD-L1 expression in head and neck squamous precancerous lesions: a systematic review and metaanalysis. *Head Neck*. 2020;42(10):3018-30.
36. Faccioni P, De Santis D, Sinigaglia S, Pancera P, Faccioni F, Nocini PF. Short-term "in vivo" study on cellular DNA damage induced by acrylic Andresen activator in oral mucosa cells. *Orthod Craniofac Res*. 2019;22(5):208-12.
37. Schulz SO, McNamara JA Jr, Baccetti T, Franchi L. Treatment effects of bonded RME and vertical-pull chincup followed by fixed appliance in patients with increased vertical dimension. *Am J Orthod Dentofacial Orthop*. 2005;128(3):326-36.
38. Zotti F, Nocini R, Capocasale G, Fior A, Peretti M, Albanese M. Malignant transformation evidences of Oral Lichen Planus: When the time is of the essence. *Oral Oncol*. 2020;104:104594.
39. De Santis D, Pancera P, Luciano U, et al. Evaluation of bacterial flora composition on teeth and periodontal tissues in patients in treatment with rapid palatal expander. *J Biol Regul Homeost Agents*. 2018;32(2 Suppl. 2):31-6.
40. Proffit WR, Sarver DM, Ackerman JL. Diagnosi ortodontica: approccio clinico ai problemi ortodontici. In *Ortodonzia moderna*. Proffit WR, Fields HW, Sarver DM, eds. Edra, Milano, 2013, 192-202.
41. Da Silva Filho OG, Boas MC, Capelozza Filho L. Rapid maxillary expansion in the primary and mixed
42. Asanza S, Cisneros GJ, Nieberg LG. Comparison of Hyrax and bonded expansion appliances. *Angle Orthod*. 1997;67(1):15-22.
43. Martina R, D'Antò V, Chiodini P, et al. Reproducibility of the assessment of the Frankel manoeuvre for the evaluation of sagittal skeletal discrepancies in Class II individuals. *Eur J Orthod*. 2016;38(4):409-13.
44. McNamara JA Jr. Early intervention in the transverse dimension: is it worth the effort? *Am J Orthod dentitions: a cephalometric evaluation. Am J Orthod Dentofacial Orthop*. 1991;100(2):171-9. *Dentofacial Orthop*. 2002;121(6):572-4.
45. Bertossi D, Albanese M, Nocini R, Mortellaro C, Kumar N, Nocini PF. Osteotomy in Genioplasty by Piezosurgery. *J Craniofac Surg*. 2018 Jun 25.
46. Rossi Md, Rossi Ad, Abrão J. Skeletal alterations associated with the use of bonded rapid maxillary expansion appliance. *Braz Dent J*. 2011;22(4):334-9.
47. Cohen M, Silverman E. A new and simple palate splitting device. *J Clin Orthod*. 1973;7(6):368-9.







Systematic Review

# A New Matrix for Soft Tissue Management

Daniele De Santis, Umberto Luciano, Paola Pancera, Giacomo Castegnaro, Christian Alberti and Federico Gelpi \* 

Head and Neck Department, Department of Surgery, Dentistry, Pediatrics and Gynecology, University of Verona, 37124 Verona, Italy; daniele.desantis@univr.it (D.D.S.); umbel@hotmail.it (U.L.); p.pancera9@gmail.com (P.P.); giacomo.castegnaro@gmail.com (G.C.); studiodentisticoalberti@gmail.com (C.A.)

\* Correspondence: federico.gelpi@libero.it

**Abstract:** Gingival recession is a mucogingival defect defined as the apical shifting of the gingival margin in relation to the CEJ. The use of connective tissue autografts allows for the obtention of very satisfactory results but is associated with undoubted disadvantages. The aim of the present work is to carry out a systematic review of the literature using a meta-analysis to investigate the clinical efficacy of xenogeneic collagen matrix (XCM) in the treatment of gingival recessions. This revision was carried out strictly following the guidelines published in the Cochrane Handbook. Thus, a meta-analysis was performed to calculate relative risks and standardized mean differences for each of the variables considered. The results of the meta-analysis show that CAF + CTG was statistically better than CAF + XCM in almost all the variables analyzed: complete root coverage (RR 0.46), mean root coverage (SMD -0.89), recession reduction (SMD -0.98), clinical attachment level (SMD -0.63) and gingival thickness (SMD -1.68). Meanwhile, CAF + XCM was slightly better than CAF alone in regard to: mean root coverage (SMD 0.51), recession reduction (SMD 0.47) and gingival thickness (SMD 0.56). It is possible to conclude that CAF + CTG still remains the gold standard in radicular coverage.

**Keywords:** gingival recession; collagen matrix; connective tissue graft; free gingival graft



**Citation:** De Santis, D.; Luciano, U.; Pancera, P.; Castegnaro, G.; Alberti, C.; Gelpi, F. A New Matrix for Soft Tissue Management. *J. Clin. Med.* **2022**, *11*, 4486. <https://doi.org/10.3390/jcm11154486>

Academic Editor: Paul R. Cooper

Received: 7 June 2022

Accepted: 12 July 2022

Published: 1 August 2022

**Publisher's Note:** MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



**Copyright:** © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

## 1. Introduction

Gingival recession (GR) is a mucogingival defect defined as the apical shifting of the gingival margin in relation to its physiological position, located 1–2 mm coronally to the cemento-enamel junction (CEJ) [1,2]. This defect is associated with aesthetic impairment because of the exposure of root surface and/or other conditions such as dentinal hypersensitivity and abrasive or carious lesions at the cervical area of the teeth. The treatment of these defects evolved over the years [3,4] until the introduction of bilaminar techniques [5], which consist of the use of a connective tissue graft (CTG) partially or totally covered by a pedunculated flap [6]. According to recent literature reviews, CTG below a coronally advanced flap (CAF) represents the gold standard for the treatment of gingival recessions, as it yields better results in short- and long-term follow-ups [7]. The use of connective tissue autografts in these periodontal surgery procedures yields very satisfactory results even if it is associated with undoubted disadvantages related to: post-operative morbidity, duration of surgery and limited availability of harvested tissue [8]. To overcome these unfavorable conditions, new biomaterials were developed: barrier membranes, enamel matrix derivatives [9] and acellular dermal matrix [10,11]. The latter, derived from human donors, is associated with ethical problems and the risk of transmitting infectious diseases [12]. For these reasons, a new xenogeneic collagen matrix (XCM) of porcine origin, indicated for root coverage and other periodontal plastic surgery, has recently been marketed. Different XCMs are produced by different manufacturers, but those most used in the clinical scenario are characterized by a bi-layered structure of type I and III collagen without cross-linking [13]. The compact layer is thin and less permeable to cellular infiltration while the spongy layer is thicker than the latter, and the presence of large pores in the thicker layer allows a huge degree of cellular migration and proliferation [14]. As an alternative, another commercial



product exists, consisting of a single layer with interconnected pores and parallel drilling peaks on the side facing the pristine connective tissue in order to promote neo-angiogenesis. Another variant consists of a porcine collagen matrix with resorbable interconnected pores and volumetric stability, thanks to chemical cross-linking [15].

Nowadays, the real effect of XCMs on the treatment of GRs is unclear. The aim of the present work is to carry out a systematic review of literature with meta-analysis to investigate the clinical efficacy of XCM in the treatment of GRs.

## 2. Materials and Methods

This study followed the PRISMA statement guidelines [15]. This systematic review was conducted according to the population, intervention, control and outcome (PICO) format. We analyzed clinical trials involving patients with at least one gingival recession classified as Miller I or II (P) who were treated with xenogeneic collagen matrix + CAF (I) or with subepithelial connective tissue graft + CAF or coronally advanced flap alone (C) in order to answer a specific question: the effectiveness of these procedures at least 6 months after surgery (O) (Figure 1).



**Figure 1.** (A) Mucogingival defect of the first mandibular molar; (B) insertion of the xenogeneic collagen matrix; (C) flap suture; (D) healing of the surgical site after 6 months.

### 2.1. Focused Question

Is xenogeneic collagen matrix superior than subepithelial connective tissue graft + CAF or coronally advanced flap alone with regard to the treatment of GRs?

### 2.2. Information Sources

Electronic research was performed through the MEDLINE (PubMed) and Cochrane Library databases. In addition, in order to further increase the number of eligible articles

and not omit potentially relevant publications, an analysis of the reference list of the main literature reviews and studies performed on the topic of interest was carried out.

### 2.3. Search Strategy

The electronic search was conducted by four independent examiners to minimize reviewer biases, applying the following filters: human studies, date of publication starting 01/01/1998 up to the time of the search (May 2022) and articles published exclusively in English. The search strategy made use of the following terms: “collagen matrix” OR “acellular dermal matrix” OR “dermal matrix allograft” OR “alloderm” OR “keratinized gingiva” OR “keratinized tissue” OR “soft tissue graft” OR “subepithelial connective tissue graft” OR “free gingival graft” OR “mucograft” OR “mucoderm” OR “gingival autograft” OR “attached gingiva” OR “attached mucosa” OR “connective tissue graft” AND “gingival recession”.

### 2.4. Eligibility Criteria

The following inclusion and exclusion criteria were applied in order to carry out study selection.

#### 2.4.1. Inclusion Criteria

- Randomized controlled clinical trials (RCT) and prospective studies with a minimum follow-up of 6 months, which is necessary for the complete healing and maturation of soft tissues subjected to surgery [16];
- Studies with  $\geq 5$  patients involved;
- Patients with single or multiple GRs classified as class I or II according to Miller 4 or class RT1 according to Cairo et al. [2];
- Studies applying these types of surgery: CAF/tunnel + XCM, CAF/tunnel + CTG, or CAF.

#### 2.4.2. Exclusion Criteria

- In vitro studies, animal studies, retrospective studies, case reports, case series, and systematic reviews;
- Studies with a follow-up < 6 months;
- Studies with < 5 patients involved;
- Patients with single or multiple GRs classified as class III or IV according to Miller [4] or class RT2 or RT3 according to Cairo et al. [2]. We decided to exclude these types of defects as they involve a loss of attachment and bone support at the interproximal level that does not allow for complete and predictable root coverage;
- Surgical interventions other than those previously specified, with biomaterials other than the xenogeneic collagen matrix or with interventions that, although adopting XCM, aimed to compare two different surgical techniques.

### 2.5. Data Items

The variables sought in each study were defined as follows:

- Complete root coverage (CRC), which is a percentage value describing the number of sites, with respect to the total number of sites treated, that obtained a complete radicular covering at a given time of follow-up. The formula to calculate it is the following:  $CRC = (n. \text{ of sites with CRC}) / (\text{total n. of sites treated}) \times 100\%$ ;
- Mean root coverage (MRC), which is a percentage value that describes the rate of reduction of the recession compared to the initial recession;
- Recession reduction (RecRed), which is a millimeter value that describes the difference between the recession measure at a given follow-up and the measure of the initial recession;
- Differential clinical attachment level ( $\Delta$ CAL), which reflects the gain or loss of CAL at the end of the time of a given follow-up;

- Differential keratinized tissue width ( $\Delta$ KTW). KTW is the distance from the free gingival margin to muco-gingival junction;
- Differential gingival thickness ( $\Delta$ GT). GT is a millimeter measurement that indicates the thickness of the attached gingiva.

#### 2.6. Study Selection

Titles deriving from the research previously highlighted were reviewed (identification) by two examiners. In the case of disagreement, the two reviewers discussed each case jointly to arrive at a final decision concerning inclusion or exclusion. Articles identified as potentially useful through analysis of the title only were then selected for a more in-depth investigation by reading the abstract. In the examination of the abstract (screening), attention was paid to assessing the compliance of the study with the inclusion criteria. The selected studies were saved as a digital or paper version and submitted to a reading of the full-text (eligibility). In this way, only articles that conformed to the aforementioned criteria were included (included).

#### 2.7. Data Extraction

Data extraction was performed by filling in a table with the following data: author, publication year, study design, setting, type of test surgery, type of control surgery, total number of patients, number of test patients, number of control patients, GR type, total number of sites, number of test sites, number of control sites, primary outcomes test, primary outcomes control, secondary outcomes test, secondary outcomes control, patient-reported outcome test (pain, post-operative bleeding or swelling), aesthetics, patient-reported outcome control, follow-up and number of drop-outs.

#### 2.8. Quality Assessment

The RCTs included in the meta-analysis were qualitatively assessed using the Cochrane Collaboration tool [17]. The following parameters were adopted for the evaluation of risk of bias: random sequence generation and allocation concealment (selection bias), blinding of participants and personnel (performance bias), blinding of outcome assessment (detection bias), incomplete outcome data (attrition bias), selective reporting (reporting bias) and other possible reasons for bias.

#### 2.9. Meta-Analysis

A meta-analysis was performed, splitting the selected studies into two groups based on the performed surgical technique: (1) CAF + XCM vs. CAF + CTG and (2) CAF + XCM vs. CAF. Since the result of root coverage may follow different temporal trends between the various techniques, only the studies with a 12-month follow-up were included in the meta-analysis. The results of the meta-analysis were expressed as standardized mean difference (SMD) for quantitative variables (MRC, RecRed,  $\Delta$ CAL,  $\Delta$ KTW, and  $\Delta$ GT) and as relative risk (RR) for the qualitative variable (CRC). The magnitude of the SMD was interpreted as mild if SMD = 0.2, mean if SMD = 0.5 and high if SMD = 0.8. [18]. The heterogeneity between studies was assessed with the homonymous test and quantified with the heterogeneity index of Higgins ( $I^2$ ), which describes the proportion of heterogeneity of the single studies that cannot be explained by the sampling error and has the advantage of being intrinsically independent from the number of studies. Since the heterogeneity test was significant and/or  $I^2$  was > 30% [19,20] for all the variables considered, a statistical model with “random” effects was used. Arbitrarily, heterogeneity is considered low if  $I^2$  is less than 50%, substantial if  $I^2$  is between 50% and 75% and considerable/high if this parameter exceeds 75%. The pooled estimates and relative confidence intervals were calculated using the DerSimonian and Laird method [21]. The results were graphically represented using a forest plot. The level of statistical significance was set at 5% and confidence intervals (CI) were calculated at 95%. All data was analyzed with the STATA Software (Version 15), StataCorp 4905 Lakeway Drive College Station, Texas 77845 USA.

### 3. Results

#### 3.1. Study Selection

The electronic search through the PubMed database identified 902 publications, while the search using the Cochrane Library database identified 565 titles. Following the removal of all duplicates, 1151 articles were identified from 1998 to 2022. Among these, 214 publications were maintained for screening. After the reading of all abstracts, 18 studies positive for eligibility were read entirely (full-text). The reading of full-texts allowed for the exclusion of 4 articles with reason, so the electronic search identified 14 articles, whose data are reported in Table 1 [22–36]. A flow chart summarizing the study selection procedure was constructed in accordance with PRISMA guidelines (2009) (Figure 2).

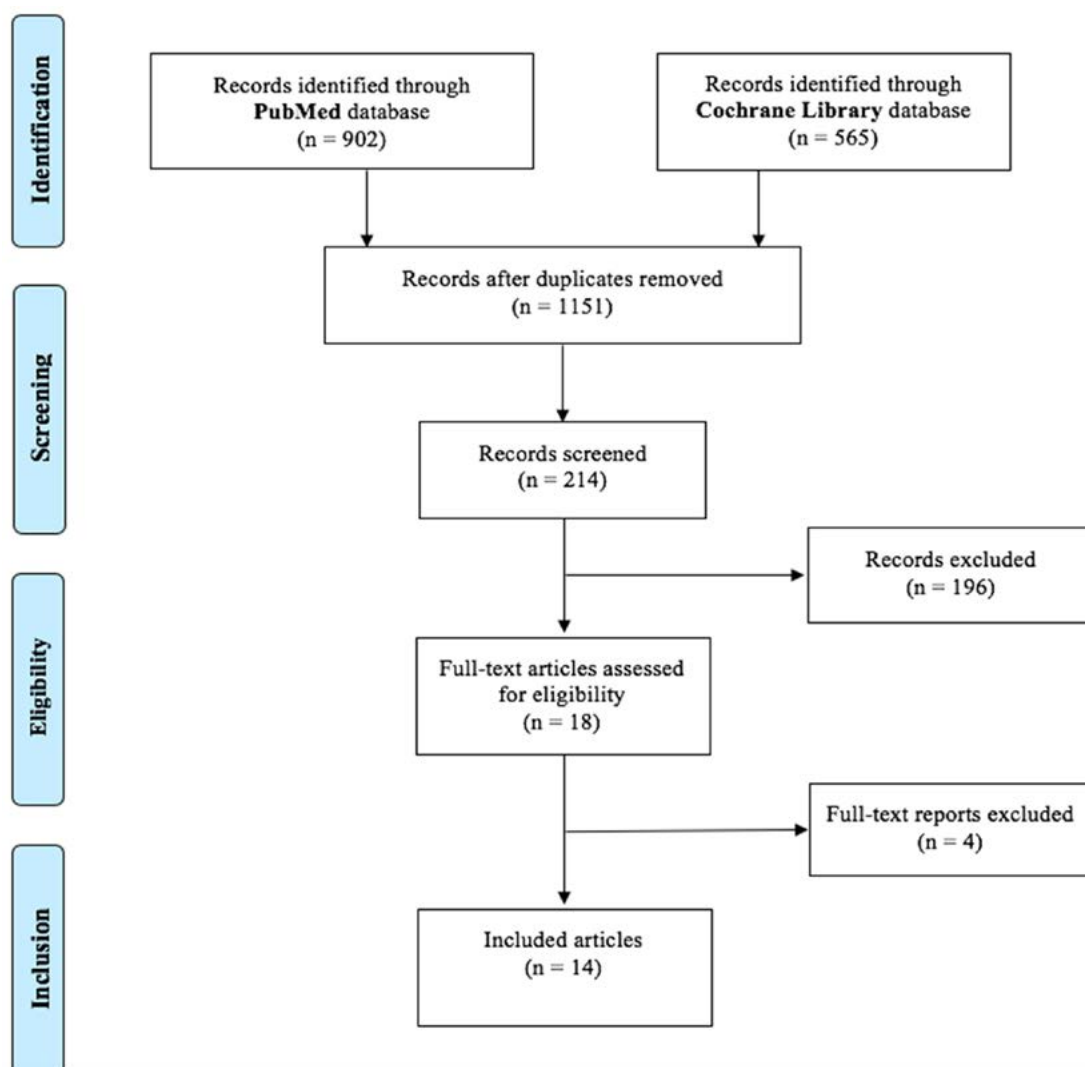


Figure 2. Flow chart of study selection.



**Table 1.** Articles included from the study selection.

Authors	Year	Design	Setting	N° Patients	N° Sites	Test Surgery	Control Surgery	Type of Defect	Follow-Up (Months)
Matoh et al. [23]	2019	RCT (split mouth)	University	10	20	CAF + XCM	CAF + CTG	single GRs	12
Pietruska et al. [24]	2019	RCT (split mouth)	University	20	91	tunnel + XCM	tunnel + CTG	multiple GRs	12
Tonetti et al. [25]	2018	RCT (parallel groups)	University	187	485	CAF + XCM	CAF + CTG	multiple GRs	6
Jepsen et al. [26]	2017	RCT (split mouth)	University	18	36	CAF + XCM	CAF	single GRs	36
Tatarakis et al. [35]	2017	RCT (parallel groups)	University	8	8	CAF + XCM	CAF + CTG	single GRs	6
Cieslik-Wegmund et al. [27]	2016	RCT (parallel groups)	University	28	106	tunnel + XCM	tunnel + CTG	multiple GRs	6
McGuire et al. [28]	2016	RCT (split mouth)	Private practice	17	34	CAF + XCM	CAF + CTG	single GRs	60
Moreira et al. [34]	2016	RCT (parallel groups)	University	40	40	CAF + XCM	CAF	single GRs	6
Stefanini et al. [29]	2016	RCT (split mouth)	University and private practice	45	90	CAF + XCM	CAF	single GRs	12
Cardaropoli et al. [30]	2014	RCT (parallel groups)	Not specified	32	113	CAF + XCM	CAF	multiple GRs	12
Aroca et al. [31]	2013	RCT (split mouth)	University	22	156	tunnel + XCM	tunnel + CTG	multiple GRs	12
Jepsen et al. [36]	2013	RCT (split mouth)	University and private practice	45	90	CAF + XCM	CAF	single GRs	6
Cardaropoli et al. [32]	2012	RCT (parallel groups)	Private practice	18	22	CAF + XCM	CAF + CTG	multiple GRs	12
McGuire et al. [33]	2010	RCT (split mouth)	Private practice	25	50	CAF + XCM	CAF + CTG	single GRs	12

### 3.2. Characteristics of the Included Study

As stated in inclusion criteria, all 14 studies included in this review were randomized controlled clinical trials (RCTs) [22–36]. Eight of these articles were performed with a split mouth design, in which each patient was treated with both test and control surgical intervention; in six studies, a parallel groups design was adopted in order to divide patients into two groups treated with the test or control surgery, respectively. All publications compared two types of periodontal surgery for GRs: CAF/tunnel + XCM (test) vs. CAF/tunnel + CTG or CAF alone (control).

The number of patients included in each study ranged from 8 to 187 and the number of sites treated varied from 8 to 485. The number of patient drop-outs was reported in all articles, most of which were 0. Only four patients from two articles [13,25] dropped out of the study: the number of drop-outs was so low that it did not influence the results.

In eight studies single GRs were treated, while in the remaining six studies multiple GRs were subjected to surgery. Only few articles reported the reason why patients asked for intervention: in most cases the indications for the intervention were represented by the aesthetic need to mask the mucogingival defect and/or the treatment of dentinal hypersensitivity. For further details see Table 1.

### 3.3. Risk of Bias

The assessment of the risk of bias within the studies included in this review is summarized in Figure 3.

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Matoh et al, 2019	+	+	+	+	+	+	?
Pietruska et al, 2019	+	+	+	+	+	+	+
Tonetti et al, 2018	+	+	+	+	+	+	+
Jepsen et al, 2017	+	+	+	+	+	+	?
Tatarakis et al, 2017	+	+	+	?	+	+	?
Cieslik-Wegwmund et al, 2016	+	+	+	+	+	+	+
McGuire et al, 2016	+	+	+	+	+	+	?
Moreira et al, 2016	+	+	+	+	+	+	+
Stefanini et al, 2016	+	+	+	+	+	+	+
Cardaropoli et al, 2014	+	?	+	+	+	+	+
Aroca et al, 2013	+	?	+	+	+	+	?
Jepsen et al, 2013	+	+	+	+	+	+	+
Cardaropoli et al, 2012	+	?	+	+	+	+	?
McGuire et al, 2010	+	+	+	+	+	+	?

Figure 3. Assessment of risk of bias.

Six articles were classified as low risk of bias, while eight publications were classified as unclear risk of bias. In particular, with regard to “random sequence generation”, the risk of bias was adequate in all publications. “Allocation concealment” was generally performed using an opaque envelope containing the type of intervention that the operator had to perform on the patient: this envelope was opened only after the design of the flap on the treatment site. This risk of error was unclear in three articles. The blinding of participants to the type of intervention selected was not possible due to the nature of the intervention itself, which required either the execution of a second surgical site on the palate for collecting the connective graft or the use of the collagen matrix/CAF alone. The blinding of the staff in relation to the type of surgery performed was obviously not possible (the surgeon knows the type of intervention he is carrying out on the patient). Despite this, it is the opinion of the author that performance bias did not compromise the quality of the studies considered, as in oral surgery it is very difficult, if not impossible, to eliminate this bias. For these reasons, it was arbitrarily decided to consider all articles low-risk with regard to performance bias. Only one article [34] was classified as unclear risk of bias relative to “detection bias”. Despite some limited patient drop-outs (4 drop-outs), it is possible to state that there were no incomplete data. Furthermore, no errors were reported in reporting the results. As regards the “other bias” section, it was decided to attribute a risk of unclear bias to the articles in which the collagen matrix was subsidized by the manufacturer.

### 3.4. Results of Individual Studies

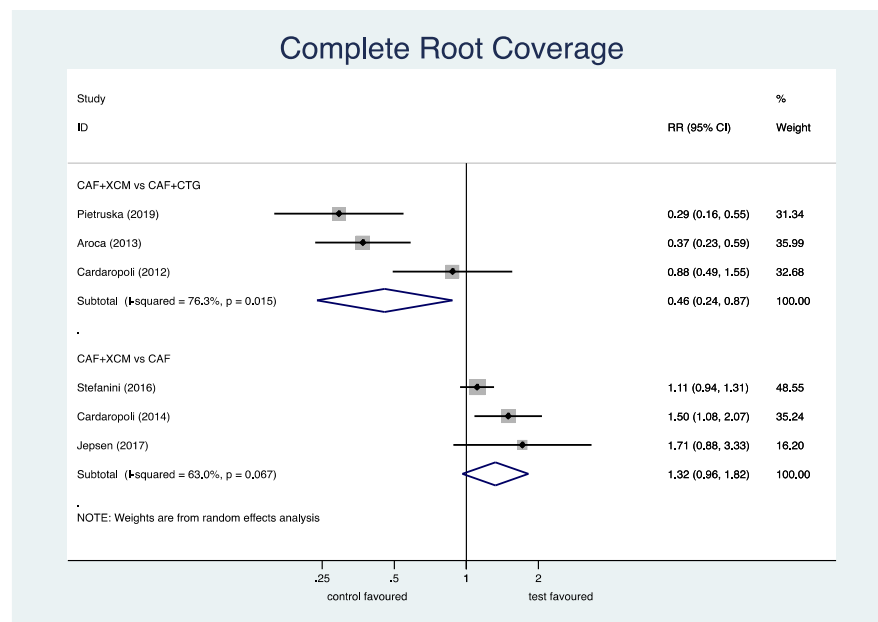
The parameter CRC was reported by 13 articles: it ranged from 14.3% to 100% of treated sites. Thirteen studies reported the parameter MRC, which varied in a range from 53.20% ± 32.17% to 99.3% ± 2.54%. The parameter RecRed was present in eight

publications and ranged from  $1.00\% \pm 0.69\%$  to  $2.95\% \pm 0.69\%$ . For the values of the other parameters and for further details see Table 2.

### 3.5. Synthesis of Results

In order to reduce the heterogeneity between studies and to improve the quality of the statistics, only the studies with a 12-month follow-up were included in the meta-analysis. There were eight publications included in the meta-analysis [22,23,25,28–32] and six parameters considered (CRC, MRC, RecRed,  $\Delta$ CAL,  $\Delta$ KTW and  $\Delta$ GT). For each parameter, we created a forest plot in order to explore the efficacy of CAF + XCM (test) compared to CAF + CTG or CAF alone (control).

- Complete root coverage (Figure 4): the meta-analysis shows a statistically significant difference in favor of CAF + CTG compared to CAF + XCM relative to the parameter of complete root coverage at the 12-month follow-up: RR (relative risk) 0.46; 95% CI (confidence interval) from 0.24 to 0.87;  $p = 0.018$ . On the contrary, the difference between CAF + XCM and CAF alone is not statistically significant: RR 1.32; 95% CI from 0.96 to 1.82;  $p = 0.085$ .
- Mean root coverage (Figure 5): the statistical analysis shows a statistically significant difference in favor of CAF + CTG compared to CAF + XCM relative to the parameter mean root coverage at 12-months follow-up: SMD (standardized mean difference)  $-0.89$ ; 95% CI from  $-1.12$  to  $-0.66$ ;  $p < 0.001$ . The difference between CAF + XCM and CAF alone is statistically significant in favor of the first surgical procedure: SMD 0.51; 95% CI from 0.002 to 1.01;  $p = 0.049$ . Notice that SMD is the ratio between the means and the estimated common standard deviation.



**Figure 4.** Forest plot relating to complete root coverage.

**Table 2.** Parameters used in the articles and their values.

Authors	Year	Surgery Test VS Control	CRC (%)	MRC (%)	RecRed (mm)	$\Delta$ CAL (mm)	$\Delta$ KTW (mm)	$\Delta$ GT (mm)	Follow-Up (Months)
Matoh et al. [23]	2019	CAF + XCM	70	85 $\pm$ 24	-	-	-	0.3 $\pm$ 0.2	12
		CAF + CTG	100	100	-	-	-	0.9 $\pm$ 0.2	
Pietruska et al. [24]	2019	Tunnel + XCM	19.6	53.20 $\pm$ 32.17	1.00 $\pm$ 0.69	-	0.52 $\pm$ 0.65	0.27 $\pm$ 0.40	12
		Tunnel + CTG	68.8	83.10 $\pm$ 27.63	1.54 $\pm$ 0.58	-	2.78 $\pm$ 1.53	1.1 $\pm$ 0.54	
Tonetti et al. [25]	2018	CAF + XCM	48	-	1.7 $\pm$ 1.1	-	-0.1 $\pm$ 1.1	-	6
		CAF + CTG	70	-	2.1 $\pm$ 1	-	0.5 $\pm$ 1.2	-	
Jepsen et al. [26]	2017	CAF + XCM	61.1	91.70 $\pm$ 12.05	2.92 $\pm$ 0.71	3.17 $\pm$ 1.11	1.92 $\pm$ 1	0.59 $\pm$ 0.39	36
		CAF + CTG	100	100	-	-	-	0.9 $\pm$ 0.2	
Cieslik-Wegwmund et al. [27]	2016	Tunnel + XCM	14.3	91 $\pm$ 13	-	-	-	-	6
		Tunnel + CTG	71.4	95 $\pm$ 11	-	-	-	-	
McGuire et al. [28]	2016	CAF + XCM	52.9	77.6 $\pm$ 29.2	-	-	-	-	60
		CAF + CTG	88.2	95.5 $\pm$ 12.8	-	-	-	-	
Moreira et al. [34]	2016	CAF + XCM	40	77 $\pm$ 21.2	2.41 $\pm$ 0.73	-	-	0.40 $\pm$ 0.19	6
		CAF	35	72 $\pm$ 14.4	2.25 $\pm$ 0.50	-	-	0.14 $\pm$ 0.29	
Stefanini et al. [29]	2016	CAF + XCM	93.3	76.28 $\pm$ 28.07	2.48 $\pm$ 1.46	-	1.06 $\pm$ 1.07	0.52 $\pm$ 0.46	12
		CAF	84.4	75.05 $\pm$ 25.24	2.26 $\pm$ 1.17	-	0.64 $\pm$ 1.05	0.27 $\pm$ 0.43	
Cardaropoli et al. [30]	2014	CAF + XCM	72.4	93.25 $\pm$ 10.01	2.28 $\pm$ 0.82	-	-	-	12
		CAF	48.1	81.49 $\pm$ 23.45	1.85 $\pm$ 0.99	-	-	-	
Aroca et al. [31]	2013	Tunnel + XCM	23	71 $\pm$ 21	-	-	-	-	12
		Tunnel + CTG	59	90 $\pm$ 18	-	-	-	-	
Cardaropoli et al. [32]	2012	CAF + XCM	72	94.32 $\pm$ 11.68	2.86 $\pm$ 0.39	2.41 $\pm$ 0.83	1.23 $\pm$ 0.61	1 $\pm$ 0.32	12
		CAF + CTG	81	96.97 $\pm$ 6.74	2.95 $\pm$ 0.69	2.95 $\pm$ 0.82	1.27 $\pm$ 0.65	1.23 $\pm$ 0.47	
McGuire et al. [33]	2010	CAF + XCM	-	88.5 $\pm$ 21.08	2.17 $\pm$ 0.67	2.26 $\pm$ 1.21	1.11 $\pm$ 0.82	-	12
		CAF + CTG	-	99.3 $\pm$ 2.54	3.17 $\pm$ 0.38	2.85 $\pm$ 0.63	1.09 $\pm$ 1.6	-	

- Recession reduction (Figure 6): the difference between CAF + XCM and CAF + CTG is statistically significant in favor of the latter procedure relative to the reduction of recession depth 12 months after surgery: SMD  $-0.98$ ; 95% CI from  $-1.80$  to  $-0.15$ ;  $p = 0.02$ . Furthermore, there is a statistically significant difference between CAF + XCM and CAF alone in favor of the first procedure: SMD  $0.47$ ; 95% CI from  $0.10$  to  $0.85$ ;  $p = 0.013$ .
- Differential clinical attachment level (Figure 7): the meta-analysis shows a statistically significant difference in favor of CAF + CTG compared to CAF + XCM relative to the



parameter of clinical attachment level at the 12-month follow-up: SMD  $-0.63$ ; 95% CI from  $-1.10$  to  $-0.15$ ;  $p = 0.01$ .

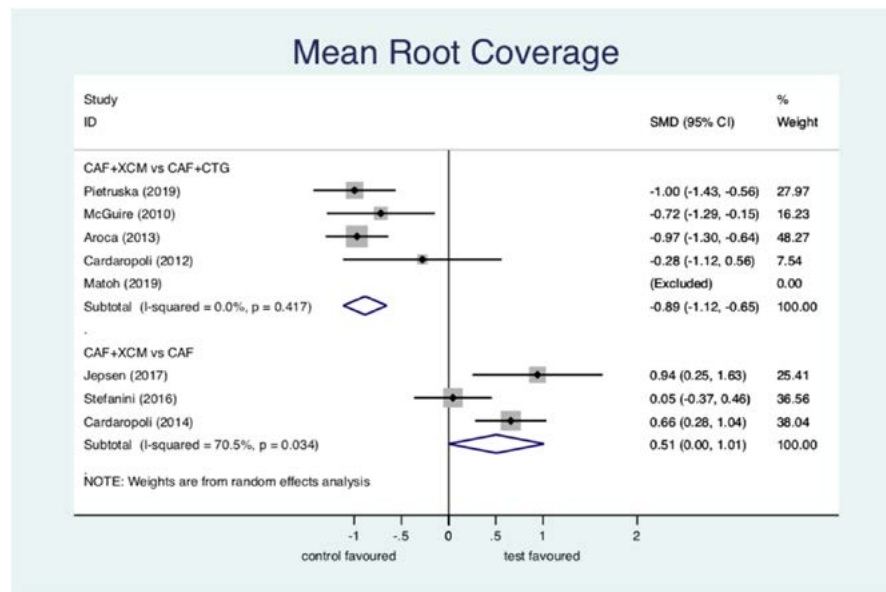


Figure 5. Forest plot relating to mean root coverage.

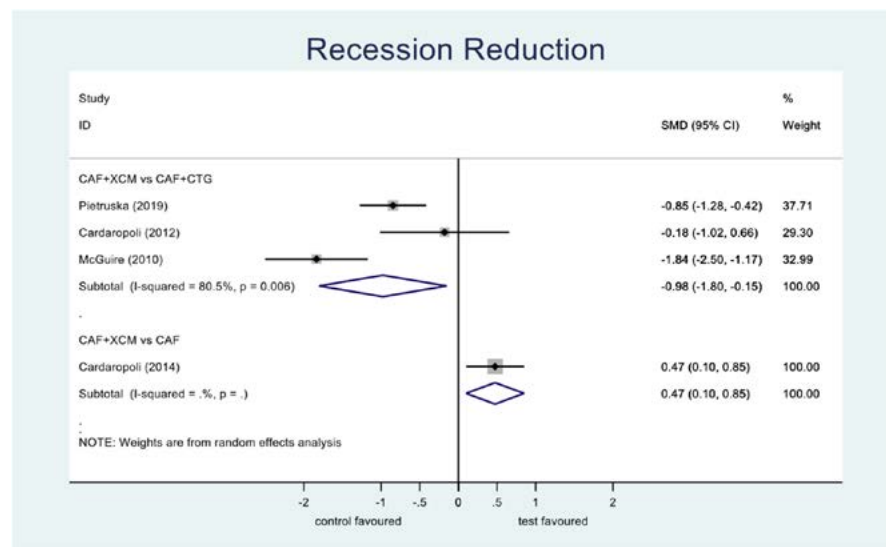


Figure 6. Forest plot relating to recession reduction.

- Differential keratinized tissue width (Figure 8): the difference between CAF + XCM and CAF + CTG is not statistically significant relative to the parameter  $\Delta$ KTW 12 months after periodontal surgery: SMD  $-0.68$ ; 95% CI from  $-2.06$  to  $0.71$ ;  $p = 0.34$ . The difference between CAF + XCM and CAF alone is not statistically significant too: SMD  $0.27$ ; 95% CI from  $-0.15$  to  $0.68$ ;  $p = 0.209$ .

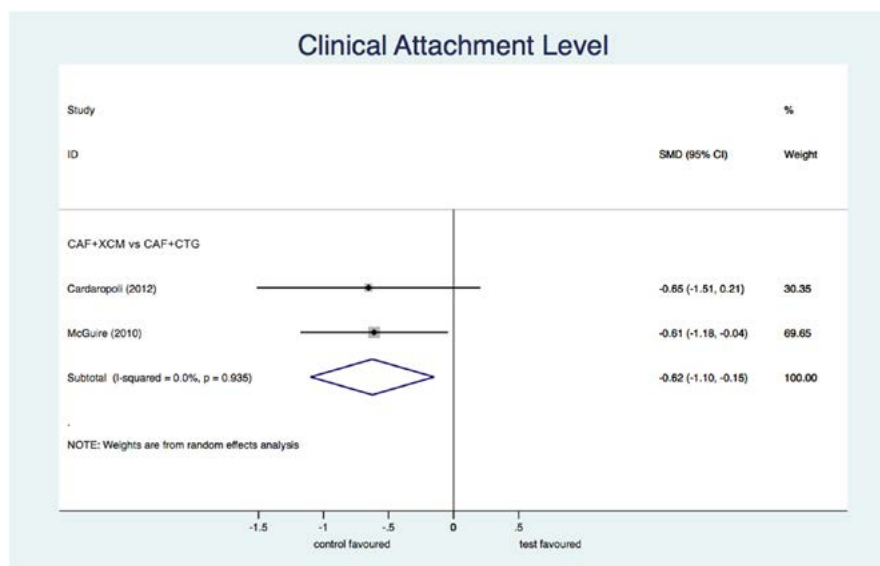


Figure 7. Forest plot relating to the clinical attachment level.

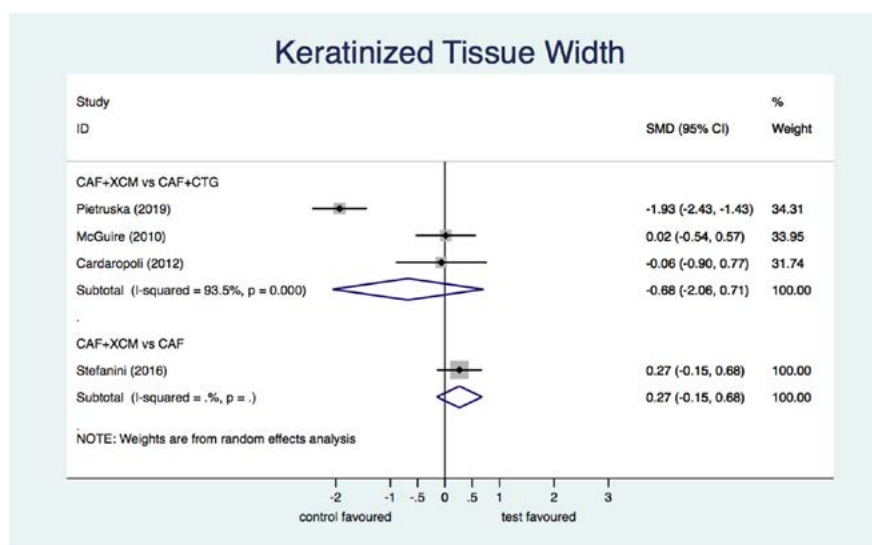


Figure 8. Forest plot relating to keratinized tissue width.

- Differential gingival thickness (Figure 9): the statistical analysis finds a statistically significant difference in favor of CAF + CTG compared to CAF + XCM relative to gingival thickness gain at 12-months follow-up: SMD  $-1.68$ ; 95% CI from  $-2.78$  to  $-0.58$ ;  $p = 0.003$ . The difference between CAF + XCM and CAF alone is statistically significant in favor of the first procedure: SMD  $0.56$ ; 95% CI from  $0.14$  to  $0.98$ ;  $p = 0.009$ .

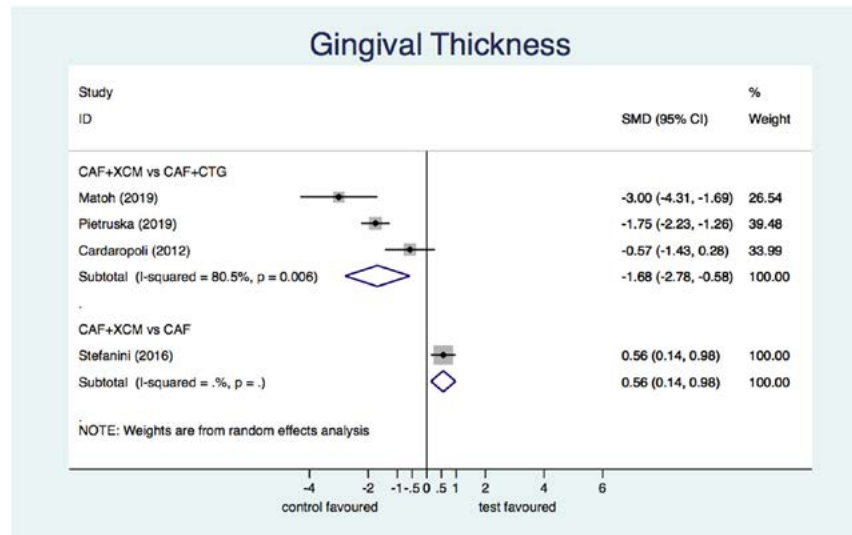


Figure 9. Forest plot relating to gingival thickness.

#### 4. Discussion

##### 4.1. Quantitative Analysis of Evidence

From a quantitative point of view, the meta-analysis performed in this study stated that CAF + XCM was significantly worse than CAF + CTG with regard to most of the parameters considered (CRC, MRC, RecRed,  $\Delta$ CAL and  $\Delta$ GT). In fact, the probability to achieve a complete root coverage with the matrix was halved, and gingival thickness, mean root coverage and recession reduction were decreased by about 1–1.5 standard deviations. Relative to the parameter  $\Delta$ KTW, the difference between CAF + XCM and CAF + CTG, though in favor of the latter, was not statistically significant.

However, CAF + XCM was slightly superior to CAF alone with respect to gingival thickness, mean root coverage and recession reduction. The increase, although significant, was only about half of the common standard deviation.

The results of this meta-analysis could be used to realize a rank of the three investigated procedures: the most effective result of CAF + CTG, followed by CAF + XCM and CAF alone, respectively. It is important to emphasize that the meta-analyses were performed considering the results at 12 months because of the lack of wider follow-up data in randomized controlled clinical trials selected from scientific literature. Hence, researchers should make a greater effort to perform delayed clinical evaluations at 24 and 36 months on patients enrolled in randomized clinical trials.

In the scientific literature, there are 16 systematic reviews with meta-analysis on this topic [37–52]. The two main systematic reviews with meta-analysis are Atieh et al. [37] and Huang et al. [38]. The latter has the disadvantage of not reporting any forest plots or useful graphs with interpretation of the results as well as using data coming from studies with different follow-up periods, while the first publication includes a reduced number of studies. With respect to CAF + XCM vs. CAF + CTG, previous reviews are consistent with the results of this meta-analysis as regards most of parameters considered; the only differences concern MRC (Atieh et al. did not report a statistically significant difference between the two procedures) and  $\Delta$ KTW (Huang et al. reported a statistically significant difference between the two procedures). With respect to CAF + XCM vs. CAF alone, Huang et al. and Atieh et al. reported results consistent with those of this meta-analysis; the only difference concerns CRC, since Huang et al. indicated that CAF + XCM was statistically better than CAF alone.

#### 4.2. Qualitative Analysis of Evidence

Bilaminar techniques are considered the gold standard in gingival recession surgery because of their proven efficacy, which was confirmed by our meta-analysis too. A recent review of literature [9] stated that the procedure of CAF + CTG, analyzed in 28 randomized controlled clinical trials, achieved a mean root coverage of 84.7% and a complete root coverage of 51.8%. Notwithstanding these good results, connective tissue harvesting from a patient's palate is associated with some disadvantages, such as post-operative pain or discomfort, limited tissue availability and long chair time [8]. Xenogeneic collagen matrix was produced with the aim of overcoming the above-mentioned disadvantages. In fact, in the randomized controlled clinical trial of Tonetti et al. [24], post-operative pain, investigated using a visual analogue scale, was always slightly lower in the group treated with XCM compared to that of the group treated with a connective tissue graft, although these results did not achieve statistical significance; a study published by Aroca et al. [30] investigated post-operative pain through the VAS scale: patients who received collagen matrix complained of a statistically lower pain than patients with connective tissue autografts. Despite the limited scientific evidence, these data suggest that collagen matrix allows for the reduction of post-operative pain in patients treated for root coverage and avoids a second surgical site. Thus, reduction of patient morbidity is one of XCM's major advantages.

The possibility of avoiding the collection of a connective tissue graft from the palate is also associated with reduction of surgical time, which is a substantial advantage, especially for phobic patients [24,30].

Another aspect that could support the use of XCM is the limited availability of autologous CTG, which is a problem in the case of multiple adjacent recessions.

Finally, as regards patients' aesthetic satisfaction, in most of selected studies results were slightly higher or comparable with those obtained using a connective tissue graft, although differences between the two types of procedure never reached statistical significance. Therefore, the aesthetic equivalence of XCM and CTG makes both clinicians and patients particularly satisfied about the aesthetics of soft tissue following root coverage with XCM.

#### 4.3. Quality and Limitations of Included Studies

The assessment of the reported studies has already been extensively described in the [Results Section](#), to which the authors refer the reader.

### 5. Conclusions

Within the limits of the present work, it is possible to state that the use of xenogeneic collagen matrix under a coronally advanced flap or a tunnel to achieve root covering tends to show a slightly greater efficacy compared to the results of CAF alone. However, the results achieved with CAF + XCM were lower than those with CAF + CTG in relation to all clinical parameters observed. Therefore, it is possible rank these root covering procedures in decreasing order of efficacy:

1. CAF/tunnel + CTG;
2. CAF/tunnel + XCM;
3. CAF.

XCM was worse than CTG in relation to all the clinical parameters analyzed, but it has undoubted advantages that in some situations make it preferable even to autografting. In fact, it avoids the preparation of a donor surgical site for the harvesting of connective tissue (usually from the palate), consequently reducing post-operative morbidity and the duration of surgery. In future investigations we suggest reporting long-term results, even as simply as recalling the patients already treated for the collection of further data. Furthermore, considering the small number of RCTs on the use of XCM in root coverage, further studies are required to evaluate the efficacy of XCM in this type of periodontal surgery with greater significance.



**Author Contributions:** D.D.S.: surgery. F.G. and D.D.S.: conceptualization and supervision. U.L.: writing. G.C.: data curation. P.P.: investigation. C.A.: formal analysis. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research did not receive any external funding.

**Acknowledgments:** A kind acknowledgment to Cordioli Edoardo for his support during the revision process.

**Conflicts of Interest:** The authors declare no conflict of interest.

## References

- Cortellini, P.; Bissada, N.F. Mucogingival conditions in the natural dentition: Narrative review, case definitions, and diagnostic considerations. *J. Periodontol.* **2018**, *89*, S204–S213. [[CrossRef](#)] [[PubMed](#)]
- Cairo, F.; Nieri, M.; Cincinelli, S.; Mervelt, J.; Pagliaro, U. The interproximal clinical attachment level to classify gingival recessions and predict root coverage outcomes: An explorative and reliability study. *J. Clin. Periodontol.* **2011**, *38*, 661–666. [[CrossRef](#)] [[PubMed](#)]
- Bernimoulin, J.-P.; Luscher, B.; Muhlemann, H.R. Coronally repositioned periodontal flap. Clinical evaluation after one year. *J. Clin. Periodontol.* **1975**, *2*, 1–13. [[CrossRef](#)] [[PubMed](#)]
- Miller, P.D., Jr. A classification of marginal tissue recession. *Int. J. Periodontics Restor. Dent.* **1985**, *5*, 8–13.
- Langer, B.; Langer, L. Subepithelial Connective Tissue Graft Technique for Root Coverage. *J. Periodontol.* **1985**, *56*, 715–720. [[CrossRef](#)]
- Zucchelli, G. *Chirurgia Estetica Mucogingivale*; Quintessenza Edizioni: Verona, Italy, 2014; ISBN 978-88-7492-196-6.
- Cairo, F.; Nieri, M.; Pagliaro, U. Efficacy of periodontal plastic surgery procedures in the treatment of localized facial gingival recessions. A systematic review. *J. Clin. Periodontol.* **2014**, *41* (Suppl. 15), S44–S62. [[CrossRef](#)]
- Griffin, T.J.; Cheung, W.S.; Zavras, A.I.; Damoulis, P.D. Postoperative complications following gingival augmentation procedures. *J. Periodontol.* **2006**, *77*, 2070–2079. [[CrossRef](#)]
- Cairo, F. Periodontal plastic surgery of gingival recessions at single and multiple teeth. *Periodontology 2000* **2017**, *75*, 296–316. [[CrossRef](#)]
- Wei, P.-C.; Laurell, L.; Geivelis, M.; Lingen, M.W.; Maddalozzo, D. Acellular Dermal Matrix Allografts to Achieve Increased Attached Gingiva. Part 1. A Clinical Study. *J. Periodontol.* **2000**, *71*, 1297–1305. [[CrossRef](#)]
- Wei, P.-C.; Laurell, L.; Lingen, M.W.; Geivelis, M. Acellular Dermal Matrix Allografts to Achieve Increased Attached Gingiva. Part 2. A Histological Comparative Study. *J. Periodontol.* **2002**, *73*, 257–265. [[CrossRef](#)]
- Sanz, M.; Lorenzo, R.; Aranda, J.J.; Martin, C.; Orsini, M. Clinical evaluation of a new collagen matrix (Mucografts prototype) to enhance the width of keratinized tissue in patients with fixed prosthetic restorations: A randomized prospective clinical trial. *J. Clin. Periodontol.* **2009**, *36*, 868–876. [[CrossRef](#)]
- Costa, D.R.; Nicolau, R.A.; Raniero, L.J.; Oliveira, M.A. FTIR and SEM analysis applied in tissue engineering for root recovering surgery. *J. Biomed. Mater. Res. Part B Appl. Biomater.* **2015**, *105*, 1326–1329. [[CrossRef](#)]
- Ghanaati, S.; Schlee, M.; Webber, M.J.; Willershausen, I.; Barbeck, M.; Balic, E.; Görlach, C.; I Stupp, S.; A Sader, R.; Kirkpatrick, C.J. Evaluation of the tissue reaction to a new bilayered collagen matrix in vivo and its translation to the clinic. *Biomed. Mater.* **2011**, *6*, 015010. [[CrossRef](#)]
- Thoma, D.S.; Nänni, N.; Benic, G.I.; Weber, F.E.; Hämmerle, C.H.F.; Jung, R.E. Effect of platelet-derived growth factor-BB on tissue integration of cross-linked and non-cross-linked collagen matrices in a rat ectopic model. *Clin. Oral. Implants Res.* **2015**, *26*, 263–270. [[CrossRef](#)]
- Moher, D.; Liberati, A.; Tetzlaff, J.; Altman, D.G. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. *Int. J. Surg.* **2010**, *8*, 336–341. [[CrossRef](#)]
- Wilderman, M.N.; Wentz, F.M. Repair of a Dentogingival Defect with a Pedicle Flap. *J. Periodontol.* **1965**, *36*, 218–231. [[CrossRef](#)]
- Higgins, J.P.T.; Green, S. (Eds.) *Cochrane Handbook for Systematic Reviews of Interventions*; Version 5.1.0 [updated March 2011]; The Cochrane Collaboration: London, UK, 2011.
- Cohen, J. *Statistical Power Analysis for the Behavioral Sciences*, 2nd ed.; Lawrence Erlbaum Associates: Hillsdale, NJ, USA, 1988.
- Higgins, J.P.T.; Thompson, S.G.; Deeks, J.J.; Altman, D.G. Measuring inconsistency in meta-analyses. *BMJ* **2003**, *327*, 557–560. [[CrossRef](#)]
- Higgins, J.P.T.; Thompson, S.G. Quantifying heterogeneity in a meta-analysis. *Stat. Med.* **2002**, *21*, 1539–1558. [[CrossRef](#)]
- DerSimonian, R.; Laird, N. Meta-analysis in clinical trials. *Control Clin. Trials* **1986**, *7*, 177–188. [[CrossRef](#)]
- Matoh, U.; Petelin, M.; Gašperšič, R. Split-Mouth Comparison of Coronally Advanced Flap with Connective Tissue Graft or Collagen Matrix for Treatment of Isolated Gingival Recessions. *Int. J. Periodontics Restor. Dent.* **2019**, *39*, 439–446. [[CrossRef](#)]
- Pietruska, M.; Skurska, A.; Podlewski, L.; Milewski, R.; Pietruski, J. Clinical evaluation of Miller class I and II recessions treatment with the use of modified coronally advanced tunnel technique with either collagen matrix or subepithelial connective tissue graft: A randomized clinical study. *J. Clin. Periodontol.* **2019**, *46*, 86–95. [[CrossRef](#)] [[PubMed](#)]

25. Tonetti, M.; Cortellini, P.; Pellegrini, G.; Nieri, M.; Bonaccini, D.; Allegri, M.; Bouchard, P.; Cairo, F.; Conforti, G.; Fourmoussis, L.; et al. Xenogenic collagen matrix or autologous connective tissue graft as adjunct to coronally advanced flaps for coverage of multiple adjacent gingival recession: Randomized trial assessing non-inferiority in root coverage and superiority in oral health-related quality of life. *J. Clin. Periodontol.* **2018**, *45*, 78–88. [[PubMed](#)]
26. Jepsen, K.; Stefanini, M.; Sanz, M.; Zucchelli, G.; Jepsen, S. Long-Term Stability of Root Coverage by Coronally Advanced Flap Procedures. *J. Periodontol.* **2017**, *88*, 626–633. [[CrossRef](#)]
27. Cieřlik-Wegemund, M.; Wierucka-Mynarczyk, B.; Tanasiewicz, M.; Gilowski, L. Tunnel Technique with Collagen Matrix Compared with Connective Tissue Graft for Treatment of Periodontal Recession: A Randomized Clinical Trial. *J. Periodontol.* **2016**, *87*, 1436–1443. [[CrossRef](#)] [[PubMed](#)]
28. McGuire, M.K.; Scheyer, E.T. Long-Term Results Comparing Xenogeneic Collagen Matrix and Autogenous Connective Tissue Grafts with Coronally Advanced Flaps for Treatment of Dehiscence-Type Recession Defects. *J. Periodontol.* **2016**, *87*, 221–227. [[CrossRef](#)] [[PubMed](#)]
29. Stefanini, M.; Jepsen, K.; de Sanctis, M.; Baldini, N.; Greven, B.; Heinz, B.; Wennström, J.; Cassel, B.; Vignoletti, F.; Sanz, M.; et al. Patient-reported outcomes and aesthetic evaluation of root coverage procedures: A 12-month follow-up of a randomized controlled clinical trial. *J. Clin. Periodontol.* **2016**, *43*, 1132–1141. [[CrossRef](#)]
30. Cardaropoli, D.; Tamagnone, L.; Roffredo, A.; Gaveglio, L. Coronally Advanced Flap with and without a Xenogenic Collagen Matrix in the Treatment of Multiple Recessions: A Randomized Controlled Clinical Study. *Restor. Dent.* **2014**, *34*, S97–S102.
31. Aroca, S.; Molnár, B.; Windisch, P.; Gera, I.; Salvi, G.E.; Nikolidakis, D.; Sculean, A. Treatment of multiple adjacent Miller class I and II gingival recessions with a Modified Coronally Advanced Tunnel (MCAT) technique and a collagen matrix or palatal connective tissue graft: A randomized, controlled clinical trial. *J. Clin. Periodontol.* **2013**, *40*, 713–720. [[CrossRef](#)]
32. Cardaropoli, D.; Tamagnone, L.; Roffredo, A.; Gaveglio, L. Treatment of Gingival Recession Defects Using Coronally Advanced Flap with a Porcine Collagen Matrix Compared to Coronally Advanced Flap with Connective Tissue Graft: A Randomized Controlled Clinical Trial. *J. Periodontol.* **2012**, *83*, 321–328. [[CrossRef](#)]
33. McGuire, M.K.; Scheyer, E.T. Xenogeneic Collagen Matrix with Coronally Advanced Flap Compared to Connective Tissue with Coronally Advanced Flap for the Treatment of Dehiscence-Type Recession Defects. *J. Periodontol.* **2010**, *81*, 1108–1117. [[CrossRef](#)]
34. Moreira, A.R.O.; Santamaria, M.P.; Silvério, K.G.; Casati, M.Z.; Junior, F.H.N.; Sculean, A.; Sallum, E.A. Coronally advanced flap with or without porcine collagen matrix for root coverage: A randomized clinical trial. *Clin. Oral Investig.* **2016**, *20*, 2539–2549. [[CrossRef](#)]
35. Tatarakis, N.; Gkraniias, N.; Darbar, U.; Donos, N. Blood flow changes using a 3D xenogeneic collagen matrix or a subepithelial connective tissue graft for root coverage procedures: A pilot study. *Clin. Oral Investig.* **2017**, *22*, 1697–1705. [[CrossRef](#)]
36. Jepsen, K.; Jepsen, S.; Zucchelli, G.; Stefanini, M.; de Sanctis, M.; Baldini, N.; Greven, B.; Heinz, B.; Wennström, J.; Cassel, B.; et al. Treatment of gingival recession defects with a coronally advanced flap and a xenogeneic collagen matrix: A multicenter randomized clinical trial. *J. Clin. Periodontol.* **2013**, *40*, 82–89. [[CrossRef](#)]
37. Atieh, M.A.; Alsabeeha, N.; Tawse-Smith, A.; Payne, A.G.T. Xenogeneic collagen matrix for periodontal plastic surgery procedures: A systematic review and meta-analysis. *J. Periodontol. Res.* **2016**, *51*, 438–452. [[CrossRef](#)]
38. Huang, J.P.; Liu, J.M.; Wu, Y.M.; Chen, L.L.; Ding, P.H. Efficacy of xenogeneic collagen matrix in the treatment of gingival recessions: A systematic review and meta-analysis. *Oral. Dis.* **2019**, *25*, 996–1008. [[CrossRef](#)]
39. Barootchi, S.; Tavelli, L.; Zucchelli, G.; Giannobile, W.V.; Wang, H.L. Gingival phenotype modification therapies on natural teeth: A network meta-analysis. *J. Periodontol.* **2020**, *91*, 1386–1399. [[CrossRef](#)]
40. Chambrone, L.; Salinas Ortega, M.A.; Sukekava, F.; Rotundo, R.; Kalemaj, Z.; Buti, J.; Pini Prato, G.P. Cochrane Database. *Syst. Rev.* **2018**, *10*, CD007161.
41. Tavelli, L.; Ravidà, A.; Lin, G.-H.; Del Amo, F.S.-L.; Tattan, M.; Wang, H.-L. Comparison between Subepithelial Connective Tissue Graft and De-epithelialized Gingival Graft: A systematic review and a meta-analysis. *J. Int. Acad. Periodontol.* **2019**, *21*, 82–96.
42. Tavelli, L.; Barootchi, S.; Nguyen, T.V.N.; Tattan, M.; Ravidà, A.; Wang, H.-L. Efficacy of tunnel technique in the treatment of localized and multiple gingival recessions: A systematic review and meta-analysis. *J. Periodontol.* **2018**, *89*, 1075–1090. [[CrossRef](#)]
43. Xu, C.; Wang, Q.; Chen, J.; Wu, Y.; Zhao LXu, C. Collagen Matrix for Periodontal Plastic Surgery Procedures: A Meta-analysis Update. *Int. J. Periodontics Restor. Dent.* **2019**, *39*, e129–e155. [[CrossRef](#)]
44. Konflanz, W.; Orth, C.C.; Celeste, R.K.; Muniz, F.W.M.G.; Haas, A.N. Influence of Donor Site and Harvesting Technique of Connective Tissue Graft on Root Coverage Outcomes of Single Gingival Recessions: Systematic Review and Meta-analyses. *J. Int. Acad. Periodontol.* **2021**, *23*, 79–98. [[PubMed](#)]
45. Alsarhan, M.A.; Al Jasser, R.; Tarish, M.A.; AlHuzaimi, A.I.; Alzoman, H. Xenogeneic collagen matrix versus connective tissue graft for the treatment of multiple gingival recessions: A systematic review and meta-analysis. *Clin. Exp. Dent. Res.* **2019**, *5*, 566–579. [[CrossRef](#)] [[PubMed](#)]
46. Ye, P.; Wei, T.; Wang, Y.; Cai, Y.-J. Autologous Platelet Concentrates as Clinical Substitutes for Connective Tissue Graft in the Treatment of Miller Class I and II Gingival Recessions: An Updated Meta-Analysis. *Int. J. Periodontics Restor. Dent.* **2020**, *40*, e53–e63. [[CrossRef](#)] [[PubMed](#)]
47. Moraschini, V.; de Almeida, D.C.F.; Sartoretto, S.; Bailly Guimarães, H.; Chaves Cavalcante, I.; Diuana Calasans-Maia, M. Clinical efficacy of xenogeneic collagen matrix in the treatment of gingival recession: A systematic review and meta-analysis. *Acta Odontol. Scand.* **2019**, *77*, 457–467. [[CrossRef](#)] [[PubMed](#)]

48. Bhatia, A.; Yadav, V.S.; Tewari, N.; Kumar, A.; Sharma, R.K. Efficacy of modified coronally advanced flap in the treatment of multiple adjacent gingival recessions: A systematic review and meta-analysis. *Acta Odontol. Scand.* **2021**, *79*, 562–572. [[CrossRef](#)]
49. Mancini, L.; Tarallo, F.; Quinzi, V.; Fratini, A.; Mummolo, S.; Marchetti, E. Platelet-Rich Fibrin in Single and Multiple Coronally Advanced Flap for Type 1 Recession: An Updated Systematic Review and Meta-Analysis. *Medicina* **2021**, *57*, 144. [[CrossRef](#)]
50. Elangovan, S. Tunneling Technique in Conjunction with Autogenous Graft or Graft Substitutes Is a Predictable Surgical Approach to Achieve Root Coverage in Isolated or Multiple Gingival Recession Defects. *J. Evid. Based Dent. Pract.* **2019**, *19*, 189–191. [[CrossRef](#)]
51. Li, R.; Liu, Y.; Xu, T.; Zhao, H.; Hou, J.; Wu, Y.; Zhang, D. The Additional Effect of Autologous Platelet Concentrates to Coronally Advanced Flap in the Treatment of Gingival Recessions: A Systematic Review and Meta-Analysis. *BioMed Res. Int.* **2019**, *2019*, 2587245. [[CrossRef](#)]
52. Panda, S.; Khijmatgar, S.; Arbildo-Vega, H.; Das, A.C.; Kumar, M.; Das, M.; Mancini, L.; Del Fabbro, M. Stability of biomaterials used in adjunct to coronally advanced flap: A systematic review and network meta-analysis. *Clin. Exp. Dent. Res.* **2022**, *8*, 421–438. [[CrossRef](#)]



Article

# Custom Bone Regeneration (CBR): An Alternative Method of Bone Augmentation—A Case Series Study

Daniele De Santis <sup>1</sup>, Luciano Umberto <sup>1</sup>, Donadello Dario <sup>1</sup>, Faccioni Paolo <sup>1</sup>, Morris Zarantonello <sup>1</sup>, Christian Alberti <sup>2</sup>, Giuseppe Verlato <sup>3</sup> and Federico Gelpi <sup>1</sup>

- <sup>1</sup> Head and Neck Department, Department of Surgery, Dentistry, Pediatrics and Gynecology, University of Verona, 37124 Verona, Italy
- <sup>2</sup> Free Practitioner, 36100 Vicenza, Italy
- <sup>3</sup> Department of Diagnostics, Public Health University of Verona, 36100 Verona, Italy
- \* Correspondence: federico.gelpi@libero.it

**Abstract:** We performed this clinical study in order to evaluate the reliability of the Guided Bone Regeneration (GBR) surgical technique through the use of customized CAD CAM titanium meshes (Yxoss CBR<sup>®</sup> Reoss) in order to show an alternative method of bone augmentation. Materials and methods: Nine patients presenting 10 bone defects were referred to solve oral dysfunction due to edentulous atrophic ridges. Guided bone regeneration was performed with titanium meshes combined with autogenous bone grafting and heterologous bovine bone mineral grafting, and exclusively a “poncho technique” soft tissue approach for all the cases. After a mean 9 months of graft healing (range 6–12 months), titanium meshes were removed, and implant surgery was subsequently performed. The results we obtained were positive in terms of volumetric increases in height, length and thickness of the atrophic ridges without biological complications detectable before implant surgery. Results: Out of nine, one site met titanium mesh exposure: however, in all 10 sites a three-dimensional volumetric bone implementation was obtained. The statistical results were estimated by uploading and superimposing cbct scans before and after CBR surgery for each patient, so it was possible to evaluate the maximum linear vertical and horizontal bone gain through dedicated Cad Cam software (Exocad GmbH<sup>®</sup>). The average horizontal gain was  $6.37 \pm 2.17$  mm (range 2.78–9.12 mm) and vertical gain was  $5.95 \pm 2.06$  mm (range 2.68–9.02 mm). A total of 18 implants were placed into the grafted sites with a 100% survival rate (clearly they are relative percentages to be compared to the short time elapsed). Conclusions: The results we obtained in this study suggest that this CBR procedure (Yxoss<sup>®</sup> by Reoss) is reliable and safe for bone regeneration to allow implant-prosthetic restoration in horizontal, vertical and combined bone defects. The soft tissue management is diriment: all the cases were managed with a “poncho” flap approach to decrease exposure complication.



**Citation:** De Santis, D.; Umberto, L.; Dario, D.; Paolo, F.; Zarantonello, M.; Alberti, C.; Verlato, G.; Gelpi, F. Custom Bone Regeneration (CBR): An Alternative Method of Bone Augmentation—A Case Series Study. *J. Clin. Med.* **2022**, *11*, 4739. <https://doi.org/10.3390/jcm11164739>

Academic Editor: Gianrico Spagnuolo

Received: 22 May 2022

Accepted: 29 July 2022

Published: 13 August 2022

**Publisher’s Note:** MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.



**Copyright:** © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

**Keywords:** custom bone regeneration; bone defect; digital flow; superimposition; digital planning in surgery

## 1. Introduction

Nowadays, it can be assumed that dental implantology represents a reliable treatment both aesthetically and in functional restoration according to the different edentulism stage [1]. However, the loss of dental elements commonly turns over into a lack of bone that prevents the implant rehabilitation of the affected areas.

The main objective of all regenerative techniques in the dental field is to stimulate new bone tissue so the correct inter arches prosthetic relationship could be easier than in the initial clinical situation [2]. Guided bone regeneration (GBR) is a well consolidated surgical procedure that allows new bone formation in atrophies or various types of hard tissue defects.

Titanium-reinforced polytetrafluoroethylene (PTFE) membranes held in place by small screws are considered the best equipment for tissue augmentation during or before implant

insertion surgery (even without total and universal consent on the part of all clinical users) [3].

To date, there is no unique scientifically shared consensus concerning the most suitable membrane choice (non-absorbable or resorbable) [4].

The implant success on regenerated bone in the literature is postulated to be between 68% and 100% [5,6].

The traditional titanium mesh (TM) represents a good alternative tool to restore bone defects.

However, the literature reports some criticism concerning TM, such as a learning curve to acquire the skills to cut, shape and adapt the TM to the irregular defects. This procedure usually is an intraoperative time-consuming phase, and the final result might be unideal: angles and edges, if not properly rounded, could represent, in the healing phase, a traumatic aspect for the surrounding soft tissue. This condition may lead to flap perforation and TM exposure. The clinical consequence may be infection and partial or total loss of the grafted bone [7].

The digital flow has been an ally in integrating this TM technique and supporting it to overcome limitations and disadvantages.

A new generation of titanium meshes has been recently introduced: these digital conceived titanium meshes are Cad Cam designed and created to be customized and precisely adapted to an irregular bone defect. Cad Cam technology allows one to produce laser sintered three dimensional custom scaffolds [8,9].

This clinical case series study focuses on the clinical efficacy of digital custom titanium mesh combined with autologous bone and bovine bone minerals (BBM) covered with collagen membranes to restore atrophic ridges. Specifically, it underlines the horizontal and vertical bone gain (digitally determined) in association with the peculiar poncho technique approach for the soft tissue management, which has been perfected in recent years, especially by the Veronese school. It allows one to avoid tension around the flap. The packaging of the flap according to this methodology is perhaps the most delicate and important point for a good result of the entire intervention, which is why it must be performed in the best way with the utmost care and precision with respect to the adjacent tissues.

## 2. Materials and Methods

This case series enrolled nine patients referred to the Maxillofacial Surgery and Dentistry Unit of the Hospital G.B. Rossi in Verona to solve chewing and functional problems due to atrophic edentulous ridges. All of them met the following inclusion criteria:

1. Clear clinical and radiographic identification (using some or all the tools at our disposal) of maxillary/mandibular bone defects or atrophic ridge (different in causality but similar for problems presented), specifically less than 8 mm in height and 5 in thickness.
2. No presence of any local or systemic contraindication to surgical treatment, such as infections, smoking habit of >10 cigarettes a day, uncontrolled diabetes (HBA1c  $\geq$  7.5%), previous radiotherapy in the head and neck anatomical areas, chemotherapy, liver, blood and kidney diseases, immunosuppression, state of pregnancy, inflammatory and autoimmune diseases of the oral cavity, poor oral hygiene and poor motivation.
3. No (learned from clinical practice) need to insert dental implants before 8 months of complete healing.
4. Nine patients (3 males and 6 females) aged between 43 and 65 years (mean 53.11 years, SD 6.79) affected by oral dysfunction due to atrophic edentulous ridges were enrolled in this study.

Table 1 reports the details concerning the distribution of the bone defects.



**Table 1.** Distribution of the bone defects and maximum vertical/horizontal/volume bone gain recovered through measurements on CTCB.

Patient No.	Site	Age	Gender	Max Horizontal Gain (mm)	Max Vertical Gain (mm)	Pre Clinical Volume Gain Plan (mm <sup>3</sup> )	Superimposition (T0–T1)
1	36	65	F	4.4	4.7	718	3330.56
2	36	51	F	9.1	9.0	927	3221.47
3	22–23–24	43	F	6.0	5.5	1008	1273.18
4	13–11–23–24	62	F	5.7	4.5	1208	2960.2
5	14–15–16	49	M	8.6	7.3	4250	5342.31
6	46	55	M	5.2	4.9	364	1686.84
7	13	53	M	6.7	6.3	1070	6879.74
8	36	51	F	8.9	8.6	895	2217.1
9	11–12–13–14	49	F	2.8	2.7	1632	1676.75

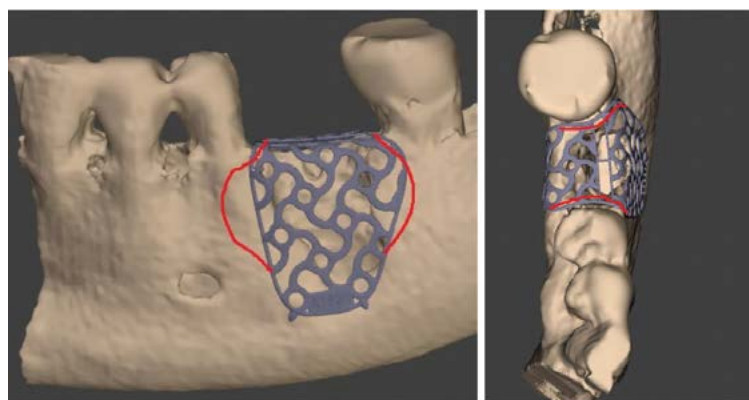
All of them received a customized titanium mesh (Yxoss CBR<sup>®</sup> Reoss) derived from a Cad Cam technology and necessary to maintain in the grafted area a mixture of autogenous bone particles and deproteinized bovine bone mineral (Bio-Oss<sup>®</sup>—Geistlich Biomaterials AG, Wolhusen, Switzerland) in a 50% ratio, and it was covered with collagen membranes (Bio-Gide<sup>®</sup>—Geistlich Biomaterials AG).

Informed consent was obtained from all patients prior to treatment, including (a) the purpose of the treatment; (b) a detailed description of the procedure; (c) the potential side effects and complications; (d) the patients’ authorization to use their data for statistical analysis.

The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of the University of Verona, Italy (Project identification code CICG-1935CESC, date: 16 October 2018).

**Preoperative planning and patient preparation.**

All the enrolled patients received a CBCT scan before CBR (T0): DICOM files obtained were sent to the Master Centre (Yxoss CBR<sup>®</sup> by Reoss) to share the Ti mesh planning and design. A digital model of the Ti-mesh was provided by the manufacturer for the final approval. Any planned change to the mesh, if necessary, was communicated by clinician to the digital technician to achieve an appropriate mesh morphology (Figure 1).



**Figure 1.** These screenshots show all the customized Ti mesh changes shared between the surgeon and the digital technician in the pre-clinical digital planning.

These CBCTs were compared as the reference point (time 0 = T0) to the following CBCTs (T1) to calculate bone volume gain.

After final clinician approval, the custom Ti mesh (class IV titanium) was produced through laser sintering CAD/CAM technology (Yxoss CBR<sup>®</sup> by Reoss).

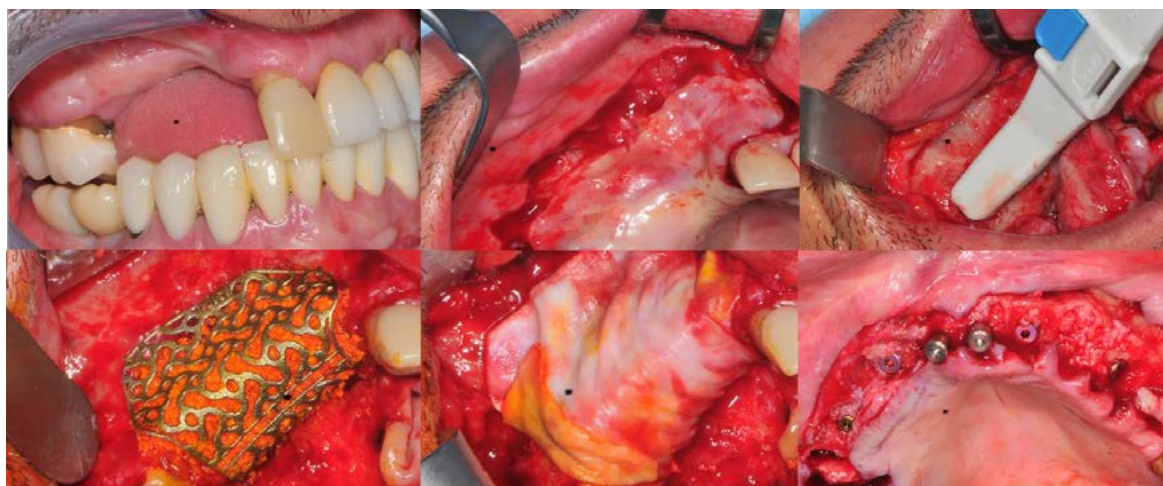
The treatment protocol was as follows:

Antibiotic prophylaxis, oral administration of amoxicillin and clavulanate (2 pills, 1 g, 1 h before the surgical date), was prescribed.

- Anesthesia with loco-regional infiltration of anesthetic mepivacaine with adrenaline 1:100,000 (no patient had physio-pathological conditions to require anesthesia without constricting vessel liquid).
- Flap design: Very gentle soft tissue handling had to be carried out. The shape and extension of the flap had to ensure no tension in primary closure, especially with a bulky graft. Our suggestion in these cases is the “poncho” flap [8,10]. This technique includes a first large vestibular incision of the mucosa and the muscle/periosteal structures to increase their mobility, and two further vertical incisions not so close to the graft site. After the incision, the preparation of a muco-periosteal flap and the remotion of scar tissue, a full thickness flap was raised until the bone defect was uncovered [11–13]. Finally, the positioning of the customized titanium mesh was passively tested to evaluate its fit intra-operatively.
- Preparation of the receiving site: It was necessary to carefully clean the underlying bone and drill corticotomy to allow bleeding and to make a connection with the inner medulla bone, which has osteogenetic potential.
- Particulate bone: We used miscellaneous bone, autologous and heterologous, mixed together in equal parts (50:50) (Bio-Oss<sup>®</sup>—Geistlich Biomaterials AG). The autologous bone samples (essential to allow the 50:50 mix) were collected from different sites based on volumetric availability; they included the retromolar mandible area, tuber maxillae and ascending branches of the mandible (by combining all the quantities from the various sites for a total of approximately 3.5–4 cm<sup>3</sup>). We used a manual bonescraper (Manufactured from AISI 420 German stainless steel. Product Conforms to ISO 9001, CE-Quality Mark, ISO 13485).
- Positioning of the customized titanium mesh (Yxoss CBR<sup>®</sup> Reoss): since the titanium grid was built on previously designed projects, it was not necessary to make any changes because it fit perfectly to the bone residue.
- Fixation and coverage: Fixation was a fundamental point for the success of the intervention. Usually, mini titanium screws are used (5 mm long and 1.35 mm diameter), placed with special dedicated screwdrivers and subsequently covered with a resorbable membrane (Bio-Gide<sup>®</sup>—Geistlich Biomaterials AG).
- Passivation of the flap: Subtle periosteal incisions were performed to allow easier and greater mobility of the entire flap aimed at closure by primary intention without any kind of tension, thereby creating passivation.
- Suture: Precise closure had to be obtained through horizontal mattress sutures 5 mm beneath from the incision line, and subsequently, with single interrupted stitches connecting the edges of the flap. In this way it was possible to obtain an approximation of the edges of the flap with intimate contact between the two parts and the interposition of connective tissue (Figures 2 and 3)

Oral antibiotics were prescribed for all the patients (amoxicillin and clavulanate-3 g/day for 6 days). Sutures were removed 2–3 weeks after surgery.

During the healing phase, only one patient had later exposure of the titanium mesh: it did not affect the whole CBR procedure because partial removal of the exposed titanium mesh was performed: the poncho technique was re-applied, including sectioning with rotary cutter of the portion of the exposed grid and repositioning of the cover flap.



**Figure 2.** CBR involving upper jaws. Top line, from left to right: initial clinical situation, flap design, bone refreshing. Bottom line from left to right: CBR in place, covering of it with a resorbable membrane, implanting of insertion after grid removal and clinical evaluation of the bone quality obtained.



**Figure 3.** Occlusal and frontal intra-oral aspects of the immediate loaded full arch prosthesis. (Left): occlusal view. (Right): front view.

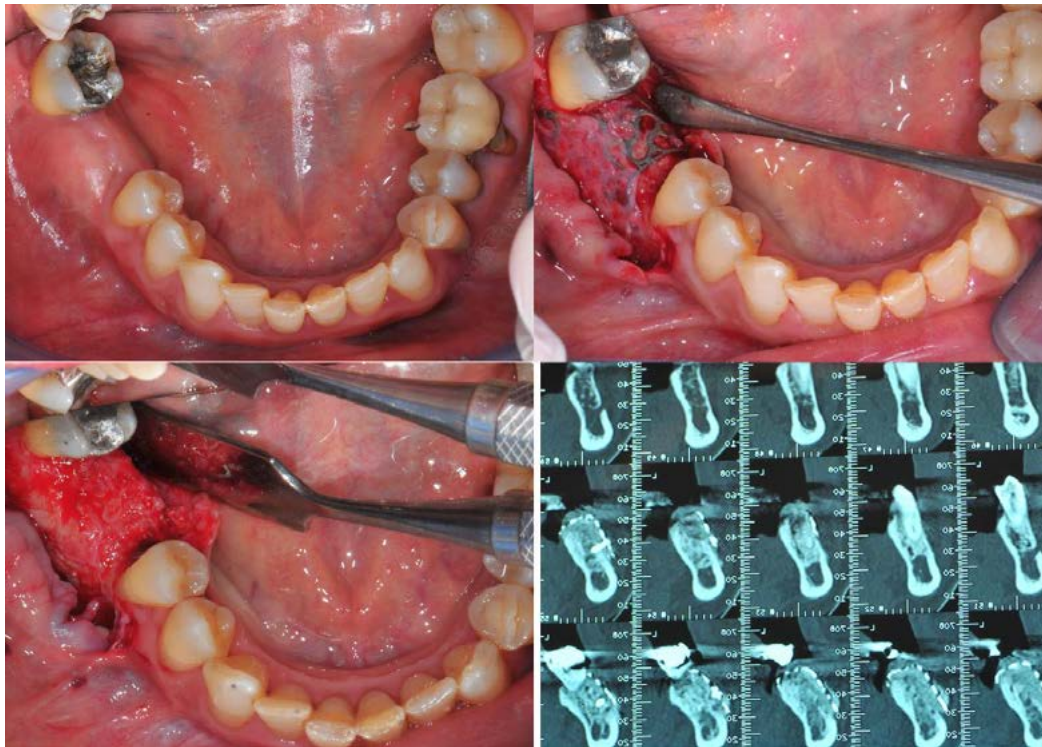
Not less than six months after CBR, a CBCT was scanned for all the patients (T1) to control the outcomes of the surgery after the graft healing phase (6–12 months) (Figures 4 and 5).

It was possible to compare the Dicom file derived from T0 e T1 CBCT scan exams to evaluate all these CBR procedures and the bone gain from a bi/tridimensional aspect.

First of all, through dedicated software (Real Guide Universal Open System 3 Diemme), all the Dicom format files were converted to .stl format files (known as a segmentation process).

After that, through other dedicated software (Exocad GmbH-specific tool “cross section view”), it was possible to superimpose T0 e T1 CBCT scans to trace and evaluate the linear maximum vertical and horizontal gains for all the patients (in mm) and bone volume gains for all the grafted sites (in mm<sup>3</sup>) (Figures 6 and 7).

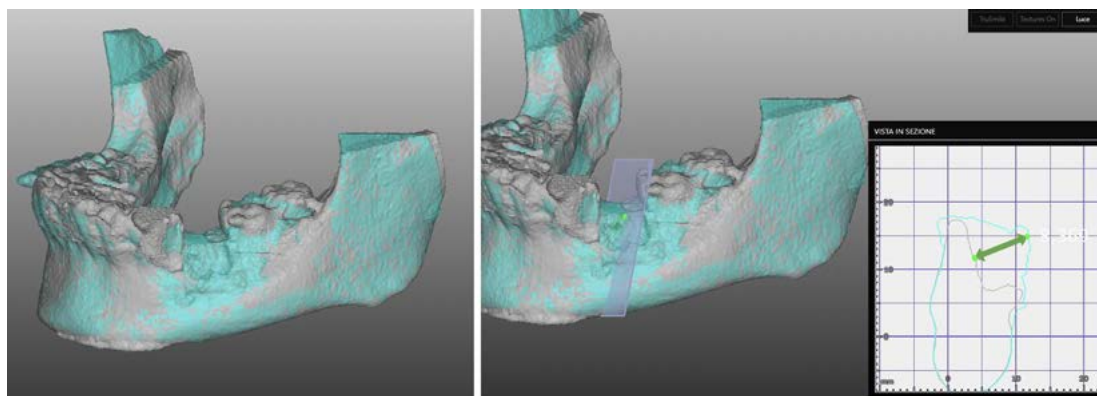




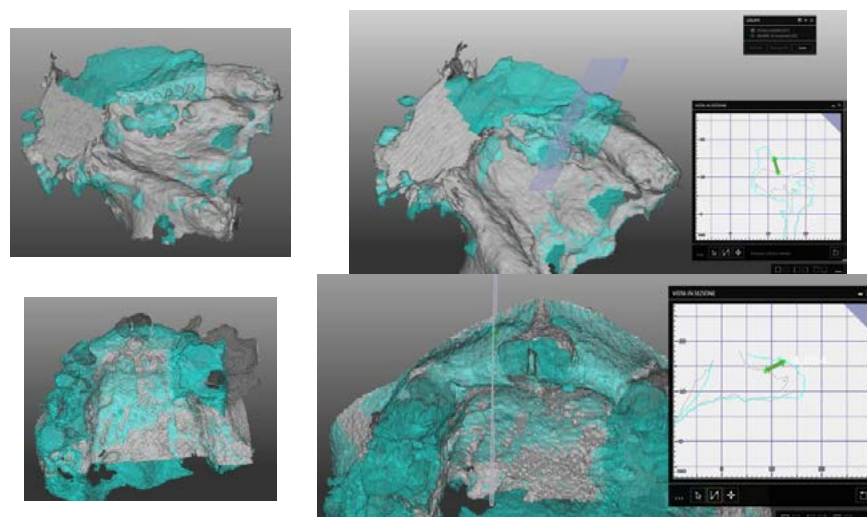
**Figure 4.** This composite resumes the surgical workflow from the custom Ti Mesh graft healing to the implant placement. In the CBCT (T1) screenshots it is possible to appreciate the bone volume gain. From the top left clockwise: starting situation, grid removal after 6 months; section of CBCT shows the bone volume gain, occlusal view just before implant surgery.



**Figure 5.** Intra oral radiograph before and after implant placement. Left: intra-oral X-ray after grid removal and healing occurred. Right: fixture installation.



**Figure 6.** Segmentation of Dicom file and (T0–T1) CBCT superimposition to evaluate horizontal, vertical and bone volume gains.



**Figure 7.** Segmentation of Dicom file and (T0–T1) CBCT superimposition to evaluate horizontal, vertical and bone volume gains for upper jaw case.

All the values collected are reported in Table 1.

### 3. Results and Statistical Analysis

#### Statistical Analyses

Qualitative variables are summarized by absolute and percent frequencies, and quantitative variables by mean and standard deviation (Figure 8).

Maximum and vertical gains, obtained in the present series, were compared with historical data, and the significance of differences was evaluated by the *t*-test for unpaired data, after verifying the homoscedasticity and normality assumptions (Figure 8).

Overall, 18 implants were inserted in nine patients. Four of them were put in mandibular sites and five in maxillary sites. The resulting total healing took place in 8–9 months for eight patients, but not in one case due to limited mesh exposure (in a maxillary site). In no case was the bone volume gain effected.





**Figure 8.** Maximum and vertical gains, obtained in the present series, are compared with historical data, and the significance of differences was evaluated by the *t*-test for unpaired data, after verifying the homoscedasticity and normality assumptions.

In this last case, only the exposed portion of the custom titanium mesh was removed, and this patient used chlorhexidine-based (0.2%) mouthwash.

Despite the limited number of the sample, all 18 implants (placed at T1 after the custom titanium mesh removal) met osteointegration and showed a survival rate of 100%.

#### 4. Discussion

First of all, in this context we should have a little digression about the use of bio-material fillers in this surgical CBR technique.

In the last decades, the literature concerning the deproteinized bovine bone has been extensive and increasing [11–15]. It suggests several and undoubted advantages, such as the potentially infinite quantity of material that can be used and the absence of further and more complex surgical interventions to obtain it. Another aspect to be considered, is the fundamental and intrinsic property of osteoconduction [16–18] (defined as the process by which the regeneration of new bone tissue is facilitated, acting as a temporary scaffold); the autologous bone, which is universally recognized as the gold standard for bone reconstructions, adds osteoinduction [19–22] (the ability to stimulate the cells proposed to form bone by inducing or increasing their function precisely with the so-called growth factors and morphogenetic proteins induce the formation of bone) and osteogenesis [23–26] (the osteoblasts mediated process), which leads to the formation of new bone tissue starting from the graft.

These three characteristics listed above are essential cornerstones for guided bone regeneration. Thus, this 50:50 mix can well be considered the biomaterial par excellence. It is defined by “Definitions in Biomaterials”, Chester consensus conference in 1986 [27], as any substance intended to be connected to living tissues and/or biological fluids to maintain or change the shapes or to replace any tissue, organ or function of the body and further demonstrating, according to Osborne, three essential characteristics of a biomaterial, or rather biotolerance, bioinertness and bioactivity [28].

Using a resorbable membrane of collagenic nature to improve healing is universally recognized to be faster and better [29–33]. The fundamental principle of GBR (guided bone regeneration) is in fact the use of this type of membrane to maintain primary wound closure, angiogenesis, space creation/maintenance and stability for the initial blood clot [34]. In addition, it seems that the interaction between the titanium mesh and the resorbable membrane can help the formation of a soft tissue similar to the periosteum [35] that can be formed on the internal or external surface of the mesh, or both sides of the mesh, and promote mucosal healing [36], protect titanium mesh and bone graft material from gingiva and reduce inflammation during wound healing [37]. Ultimately, we recall that

a negative predictive factor in the success of the use of this technique is the lack of soft tissues enveloping the area. Proximity to muscle insertions and a lack of keratinized mucosa are factors that affect the mobilization of the flap, and therefore, increase the risk of dehiscence [7]. Therefore, the use of this tissue identified histologically by Arx could be useful for compensating the physiological lack of keratinized tissue.

The last but not the least biomaterial to be mentioned is titanium, which is widely used in surgical treatments due to its high stiffness, low density, corrosion resistance and effective biocompatibility. Titanium mechanical properties are fundamental to a safe CBR strategy: high strength and stiffness concur to space maintenance in the osteogenesis; the stability is mandatory for the bone graft volume during wound healing [38]. Thickness and porosity are mechanical features affecting titanium properties. Literature suggests that the thickness of titanium is a factor affecting the final bone formation; moreover, the pore diameter may affect the proportions of soft and hard tissue under the titanium mesh [39]. The thickness of titanium mesh (commonly ranging from 0.1 to 0.6 mm) is proportionally linked to its mechanical properties.

A titanium mesh of 0.2 mm is suitable for most instances. At this thickness, titanium mesh can provide sufficient stiffness to maintain space and protect grafts, while offering appropriate flexibility to reduce the risk of tissue rupture. Concerning the pore diameter, it also affects the performance of titanium mesh during bone augmentation. The pore of the titanium mesh seems to rise an essential role in establishing blood supply and facilitating metabolic processes of the grafts at the defect site [40].

This aspect may be associated with the increased delivery of blood supply, nutrients and oxygen due to the large aperture. On the contrary, a study showed that the use of a titanium mesh with large diameter (>2 mm) may lead to more soft tissue growth upon the surface of new bone than the use of a titanium mesh with a small diameter [41]. However, the relationship between the pore size of titanium mesh and bone formation is still controversial. For the intrinsic nature of pores on titanium mesh, selective cell isolation is not insured, and soft tissue often grows under titanium meshes [40].

#### 4.1. Biological Properties and Osteogenic Property

Titanium mesh offers good biocompatibility. This behavior of materials usually can be distinguished into corrosion resistance and cytotoxicity. Commonly, titanium shows low electrical conductivity; it is basically disposed to perform electrochemical oxidation to form a passive and inert oxide layer [42]. This oxide layer can be retained at the pH of the human body, leading to high and persistent corrosion resistance for titanium [43]. A thin layer of 1–2 mm thick soft tissue (defined as “pseudo-periosteum”) has been observed in several studies upon the regenerated bone surface through a titanium mesh [35].

Probably, the pseudo-periosteum formation could depend on the not sufficient cell exclusion behavior of the titanium mesh due to its pores. A clear set of evidence sustains its role in bone graft protection, and its roles in infection prevention and absorption. Currently, it is often removed with the titanium mesh in a subsequent operation [44].

#### 4.2. Progress in Material Modification

In the last few decades, the research trend has been developing surface modification of titanium mesh to achieve better biological activity. Bioactive coatings for accelerating bone regeneration by improving the differentiation and proliferation of osteoblasts have been widely developed in tissue engineering.

In a previous study conducted on a rat model, Nguyen compared the different behavior of titanium mesh covered by calcium phosphorus coating and untreated titanium mesh [45–47].

There was no soft tissue intervention under the titanium mesh of the experimental group, and the bone density was higher ( $p < 0.05$ ). There was consequently improved structural durability of the grafted site. In another succeeding study, strontium was proposed to promote osteoblasts' proliferation and differentiation, and inhibit osteoclasts' activity.

It was tested in guided bone regeneration in a rat model combined with a calcium–phosphorus coating on the surface of titanium mesh. Compared to no treatment and calcium–phosphorus-coated titanium mesh treatment, the strontium–calcium–phosphorus coating resulted in more uniform and denser bone, enabling higher bone density in the regenerated area, improving the osseointegration between bone and titanium mesh and preventing infiltration of soft tissue in the early stage of healing.

After this study it is reasonable to think that proper coating treatment can lead to more stable bone regeneration without specific adverse reactions.

#### 4.3. Radiological Considerations

Another aspect we should underline is the radiological behavior of customized titanium mesh during the cbct or rx scan: its physico-chemical features allow it to minimize the scattering effect. This implicitly guarantees a clear radiological image of the control exam (T1), and it is thus possible to trace the calculation lines underlying the edge of the customized mesh, thereby minimizing the error. Customized titanium meshes have been recently proposed as an alternative surgical procedure to the conventional TM. [8] A lot of advantages seem to sustain this affirmation:

- (a) The custom titanium meshes features do not need modelling or trimming;
- (b) These custom scaffolds are self-contained, and it is possible to load the graft outside the oral cavity, causing very strong reductions in the risks of graft dispersion and contamination intraorally;
- (c) Safe stabilization with a small number of screws and custom mesh passiveness.

All these aspects seem to be so relevant for safe graft healing below the custom titanium mesh.

To the best of our knowledge [7–9], the main critical issue concerning TM is mesh exposure (at different time) with variable degrees of bone resorption.

This aspect seems to depend on a strong learning curve to acquire the skills to cut, shape and adapt the TM to the irregular defects. This procedure usually is an intraoperatively time-consuming phase, and the final result might not be ideal: angles and edges, if not properly rounded, could represent, in the healing phase, a traumatic aspect for the surrounding soft tissue. This condition may lead to flap perforation and TM exposure. The clinical consequences may be infection and partial or total loss of the grafted bone [7].

In the only case of exposure of the grid, it was not necessary to remove it, as there were no signs of infection, and it did not worsen or diminish the pre-established final result of bone regeneration. This exposure occurred in the maxilla, a result that might be in accordance with other authors using the same location in the mouth [8], but in this case we think it may have been due to the friction of the grid (particularly extended) with the overlying soft tissues.

All the authors believe that soft tissue management represents the most critical issue for this technique, which involves the shape of the surgical flap, for a stress-free first intention closure. The extension of the incision should be broad, involving at least two additional dental elements both medially and distally to allow a more secure and sealed closure.

For all the nine patients, a “poncho technique” soft tissue approach was performed: this soft tissue management seems to play a favorable role in preventing meshes’ exposure, as confirmed by other authors, compared to the crestal incision approach [8].

The presence of a fibrous granulation tissue below the titanium mesh could increase the low probability of infection. This tissue has been analyzed and is similar to the periosteum, constituting a real mechanical shield from bacterial contamination and subsequent surface exposure with bone reduction. The real nature and origin of this tissue are not well known [48–50].

The present clinical case series has shown the potential of the digital flow to integrate a conventional surgical procedure such as TM to achieve a safer and more efficacious bone regeneration technique.

Results from the present study seem to confirm data reported in literature: an average horizontal gain of  $6.37 \pm 2.17$  mm (range 2.78–9.12 mm) and a vertical gain of  $5.95 \pm 2.06$  mm (range 2.68–9.02 mm). In detail, if these mean values are compared to those obtained by other authors, we notice: 0.9747 in horizontal gains, and t: 0.1030 in vertical gains [33,51].

Furthermore, other results derived from the data collection concerning the T0–T1 CBCT scans' superimposition have confirmed a mean bone volume gain value of  $3012 \pm 1938$  mm<sup>3</sup> (range 1273–6879). It is, however, worth nothing that these last results gave us an overestimated mean bone volume gain value if compared to the presurgical planned bone volume gain value. Results are also comforting if related to other GBR procedures with resorbable and non-resorbable membranes [33].

## 5. Conclusions

Given the small number of implants inserted and the even smaller number of patients enrolled for these treatments, we are now far from standardization of procedures and a global consensus. However, this study suggests that CBRs with customized meshes represent predictable and encouraging alternatives for the future.

The planned construction of the grid itself and the attention paid to the design of the flap and its management are essential factors for clinical success. Partial exposure of the mesh does not necessarily lead to the failure of the CBR technique. All authors consider the surgical “poncho” technique the best approach to avoid uncovering of the grid, superinfections and the failure of the intervention itself in general. In addition, careful pre-operative planning and the precision of the grid/bone tissue fit seem to further reduce the margins of operator-dependent error.

**Author Contributions:** D.D.S., conceptualization, data curation, formal analysis, investigation; L.U., investigation; D.D., review and editing; F.P. investigation; M.Z. data curation and writing; C.A. formal analysis; G.V., provided all statistical analysis; F.G., conceptualization data curation and writing. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** The study was conducted in accordance with the Declaration of Helsinki, and approved by the Ethics Committee of the University of Verona, Italy (Project identification code CICG-1935CESC, date: 16 October 2018).

**Informed Consent Statement:** Not applicable.

**Data Availability Statement:** Not applicable.

**Acknowledgments:** Warm acknowledgment to Bonazzi Andrea, Tfaily Ahmad and Dental Digital Technician Diego Ziviani for their supports.

**Conflicts of Interest:** The authors declare no conflict of interest.

## References

1. Nocini, P.F.; Chiarini, L.; De Santis, D. *Pre-Prosthetic Surgery and Tissue Engineering Treatment*; Martina: Minneapolis, MN, USA, 2005; p. 1.
2. Chiapasco, M.; Casentini, P.; Zaniboni, M. Bone augmentation procedures in implant dentistry. *Int. J. Oral Maxillofac. Implant.* **2009**, *24*, 237–259.
3. Rakhmatia, Y.D.; Ayukawa, Y.; Furuhashi, A.; Koyano, K. Current barrier membranes: Titanium mesh and other membranes for guided bone regeneration in dental applications. *J. Prosthodont. Res.* **2013**, *57*, 3–14. [[CrossRef](#)] [[PubMed](#)]
4. Buser, D.; Dula, K.; Hess, D.; Hirt, H.P.; Belser, U.C. Localized ridge augmentation with autografts and barrier membranes. *Periodontology 2000* **1999**, *19*, 151–163. [[CrossRef](#)] [[PubMed](#)]
5. Cordaro, L.; Sarzi Amadè, D.; Cordaro, M. Clinical results of alveolar ridge augmentation with mandibular block bone grafts in partially edentulous patients prior to implant placement. *Clin. Oral Implant. Res.* **2002**, *13*, 103–111. [[CrossRef](#)]
6. Kolerman, R.; Nissan, J.; Mijiritski, E.; Hamoudi, N.; Mangano, C.; Tai, H. Esthetic assessment of immediately implants combined with GBR and free connective tissue graft. *Clin. Oral Implant. Res.* **2016**, *27*, 1414–1422. [[CrossRef](#)]
7. Briguglio, F.; Falcomatà, D.; Marconcini, S.; Fiorillo, L.; Briguglio, R.; Farronato, D. The use of titanium mesh in guided bone regeneration: A systematic review. *Int. J. Dent.* **2019**, *2019*, 9065423. [[CrossRef](#)]

8. Sagheb, K.; Schiegnitz, E.; Moergel, M.; Walter, C.; Al-Nawas, B.; Wagner, W. Clinical outcome of alveolar ridge augmentation with individualized CAD-CAM-produced titanium mesh. *Int. J. Implant Dent.* **2017**, *3*, 36. [[CrossRef](#)]
9. De Santis, D.; Gelpi, F.; Verlato, G.; Luciano, U.; Torroni, L.; Antonucci, N.; Bernardello, F.; Zarantonello, M.; Nocini, P.F. Digital customized titanium mesh for bone regeneration of vertical, horizontal and combined defects: A case series. *Medicina* **2021**, *57*, 60. [[CrossRef](#)] [[PubMed](#)]
10. Schlegel, K.A.; Sindet-Pedersen, S.; Hoepffner, H.J. Clinical and histological findings in guided bone regeneration (GBR) around titanium dental implants with autogeneous bone chips using a new resorbable membrane. *J. Biomed. Mater. Res.* **2000**, *53*, 392–399. [[CrossRef](#)]
11. Aludden, H.C.; Mordenfeld, A.; Hallman, M.; Dahlin, C.; Jensen, T. Lateral ridge augmentation with Bio-Oss alone or Bio-Oss mixed with particulate autogenous bone graft: A systematic review. *Int. J. Oral Maxillofac. Surg.* **2017**, *46*, 1030–1038. [[CrossRef](#)] [[PubMed](#)]
12. Xu, D.; Yao, C.; Gu, M. Clinical study of Bio-Oss powder and Bio-Oss collagen for site preservation during implantology. *Shanghai Kou Qiang Yi Xue* **2020**, *29*, 414–417.
13. Jensen, T.; Schou, S.; Stavropoulos, A.; Terheyden, H.; Holmstrup, P. Maxillary sinus floor augmentation with Bio-Oss or Bio-Oss mixed with autogenous bone as graft: A systematic review. *Clin. Oral Implant. Res.* **2012**, *23*, 263–273. [[CrossRef](#)] [[PubMed](#)]
14. Schlegel, A.K.; Donath, K. BIO-OSS—a resorbable bone substitute? *J. Long Term Eff. Med. Implant.* **1998**, *8*, 201–209.
15. Keil, C.; Gollmer, B.; Zeidler-Rentzsch, I.; Gredes, T.; Heinemann, F. Histological evaluation of extraction sites grafted with Bio-Oss Collagen: Randomized controlled trial. *Ann. Anat.* **2021**, *237*, 151722. [[CrossRef](#)] [[PubMed](#)]
16. Weber, F.E. Reconsidering osteoconduction in the era of additive manufacturing. *Tissue Eng. Part B Rev.* **2019**, *25*, 375–386. [[CrossRef](#)]
17. Dimitriou, R.; Jones, E.; McGonagle, D.; Giannoudis, P.V. Bone regeneration: Current concepts and future directions. *BMC Med.* **2011**, *9*, 66. [[CrossRef](#)]
18. Cornell, C.N.; Lane, J.M. Current understanding of osteoconduction in bone regeneration. *Clin. Orthop. Relat. Res.* **1998**, *355*, S267–S273. [[CrossRef](#)]
19. Solheim, E. Osteoinduction by demineralised bone. *Int. Orthop.* **1998**, *22*, 335–342. [[CrossRef](#)]
20. García-Gareta, E.; Coathup, M.J.; Blunn, G.W. Osteoinduction of bone grafting materials for bone repair and regeneration. *Bone* **2015**, *81*, 112–121. [[CrossRef](#)]
21. Miron, R.J.; Zhang, Y.F. Osteoinduction: A review of old concepts with new standards. *J. Dent. Res.* **2012**, *91*, 736–744. [[CrossRef](#)]
22. Yamada, M.; Egusa, H. Current bone substitutes for implant dentistry. *J. Prosthodont. Res.* **2018**, *62*, 152–161. [[CrossRef](#)] [[PubMed](#)]
23. Zhao, R.; Yang, R.; Cooper, P.R.; Khurshid, Z.; Shavandi, A.; Ratnayake, J. Bone grafts and substitutes in dentistry: A review of current trends and developments. *Molecules* **2021**, *26*, 3007. [[CrossRef](#)] [[PubMed](#)]
24. Xuan, F.; Lee, C.U.; Son, J.S.; Jeong, S.M.; Choi, B.H. A comparative study of the regenerative effect of sinus bone grafting with platelet-rich fibrin-mixed Bio-Oss and commercial fibrin-mixed Bio-Oss: An experimental study. *J. Cranio Maxillofac. Surg.* **2014**, *42*, e47–e50. [[CrossRef](#)]
25. Heiß, C.; Rupp, M.; Knapp, G. Bone replacement and bone formation. *Z. Fur Orthop. Und Unf.* **2019**, *157*, 715–728.
26. Qi, J.; Yu, T.; Hu, B.; Wu, H.; Ouyang, H. Current biomaterial-based bone tissue engineering and translational medicine. *Int. J. Mol. Sci.* **2021**, *22*, 10233. [[CrossRef](#)] [[PubMed](#)]
27. Williams, D.F. Definitions in biomaterials. In Proceedings of the 2nd Consensus Conference of the European Society for Biomaterials, Chester, UK, 3–5 March 1991.
28. Osborn, J.F. Biomaterials and their application to implantation. *SSO Schweiz. Mon. Zahnheilkd.* **1979**, *89*, 1138–1139.
29. Sbricoli, L.; Guazzo, R.; Annunziata, M.; Gobatto, L.; Bressan, E.; Nastri, L. Selection of collagen membranes for bone regeneration: A literature review. *Materials* **2020**, *13*, 786. [[CrossRef](#)]
30. Lim, G.; Lin, G.H.; Monje, A.; Chan, H.L.; Wang, H.L. Wound healing complications following guided bone regeneration for ridge augmentation: A systematic review and meta-analysis. *Int. J. Oral Maxillofac. Implant.* **2018**, *33*, 41–50. [[CrossRef](#)]
31. Soldatos, N.K.; Stylianou, P.; Koidou, V.P.; Angelov, N.; Yukna, R.; Romanos, G.E. Limitations and options using resorbable versus nonresorbable membranes for successful guided bone regeneration. *Quintessence Int.* **2017**, *48*, 131–147.
32. Dowlatshahi, S.; Chen, C.Y.; Zigdon-Giladi, H.; Horwitz, J.; Ahn, C.; Kim, D.M.; Machtei, E.E. Volumetric assessment of changes in the alveolar ridge dimension following GBR using a combination FDBA with collagen membrane or novel resorbable scaffold: A prospective two-center clinical trial. *J. Periodontol.* **2021**, *93*, 343–353. [[CrossRef](#)]
33. Cucchi, A.; Vignudelli, E.; Napolitano, A.; Marchetti, C.; Corinaldesi, G. Evaluation of complication rates and vertical bone gain after guided bone regeneration with non-resorbable membranes versus titanium meshes and resorbable membranes. A randomized clinical trial. *Clin. Implant Dent. Relat. Res.* **2017**, *19*, 821–832. [[CrossRef](#)] [[PubMed](#)]
34. Wang, H.L.; Boyapati, L. “PASS” principles for predictable bone regeneration. *Implant Dent.* **2006**, *15*, 8–17. [[CrossRef](#)] [[PubMed](#)]
35. Cucchi, A.; Sartori, M.; Aldini, N.N.; Vignudelli Corinaldesi, G. A proposal of pseudo-periosteum classification after GBR by means of titanium-reinforced d-PTFE membranes or titanium meshes plus cross-linked collagen membranes. *Int. J. Periodontics Restor. Dent.* **2019**, *39*, e157–e165. [[CrossRef](#)] [[PubMed](#)]
36. Lim, H.C.; Lee, J.S.; Choi, S.H.; Jung, U.W. The effect of overlaying titanium mesh with collagen membrane for ridge preservation. *J. Periodontal Implant Sci.* **2015**, *45*, 128–135. [[CrossRef](#)] [[PubMed](#)]



37. Isler, S.C.; Soysal, F.; Ceyhanlı, T.; Bakırarar, B.; Unsal, B. Regenerative surgical treatment of peri-implantitis using either a collagen membrane or concentrated growth factor: A 12-month randomized clinical trial. *Clin. Implant Dent. Relat. Res.* **2018**, *20*, 703–712. [[CrossRef](#)] [[PubMed](#)]
38. Gyu-Un, J.; Jae-Yun, J.; Kyung-Gyun, H.; Chang-Joo, P. Preliminary evaluation of a three-dimensional, customized, and preformed titanium mesh in peri-implant alveolar bone regeneration. *J. Korean Assoc. Oral Maxillofac. Surg.* **2014**, *40*, 181–187.
39. Rakhmatia, Y.D.; Ayukawa, Y.; Furuhashi, A.; Koyano, K. Microcomputed tomographic and histomorphometric analyses of novel titanium mesh membranes for guided bone regeneration: A study in rat calvarial defects. *Int. J. Oral Maxillofac. Implant.* **2014**, *29*, 826–835. [[CrossRef](#)]
40. Gutta, R.; Baker, R.A.; Bartolucci, A.A.; Louis, P.J. Barrier membranes used for ridge augmentation: Is there an optimal pore size? *J. Oral Maxillofac. Surg.* **2009**, *67*, 1218–1225. [[CrossRef](#)]
41. Her, S.; Kang, T.; Fien, M.J. Titanium mesh as an alternative to a membrane for ridge augmentation. *J. Oral. Maxillofac. Surg.* **2012**, *70*, 803–810. [[CrossRef](#)]
42. Elias, C.; Lima, J.; Valiev, R.; Meyers, M. Biomedical applications of titanium and its alloys. *JOM* **2008**, *60*, 46–49. [[CrossRef](#)]
43. Sidambe, A.T. Biocompatibility of advanced manufactured titanium implants—A review. *Materials* **2014**, *7*, 8168–8188. [[CrossRef](#)] [[PubMed](#)]
44. Lizio, G.; Corinaldesi, G.; Marchetti, C. Alveolar ridge reconstruction with titanium mesh: A three-dimensional evaluation of factors affecting bone augmentation. *Int. J. Oral. Maxillofac. Implant.* **2014**, *29*, 1354–1363. [[CrossRef](#)] [[PubMed](#)]
45. Nguyen, T.D.; Moon, S.H.; Oh, T.J.; Seok, J.J.; Lee, M.H.; Bae, T.S. Comparison of Guided Bone Regeneration between surface-modified and pristine titanium membranes in a rat calvarial model. *Int. J. Oral Maxillofac. Implant.* **2016**, *31*, 581–590. [[CrossRef](#)] [[PubMed](#)]
46. Hirota, M.; Ikeda, T.; Tabuchi, M.; Ozawa, T.; Tohnai, I.; Ogawa, T. Effects of ultraviolet photofunctionalization on bone augmentation and integration capabilities of titanium mesh and implants. *Int. J. Oral. Maxillofac. Implant.* **2017**, *32*, 52–62. [[CrossRef](#)]
47. Att, W.; Ogawa, T. Biological aging of implant surfaces and their restoration with ultraviolet light treatment: A novel understanding of osseointegration. *Int. J. Oral Maxillofac. Implant.* **2012**, *27*, 753–761.
48. Von Arx, T.; Kurt, B. Implant placement and simultaneous ridge augmentation using autogenous bone and a micro titanium mesh: A prospective clinical study with 20 implants. *Clin. Oral Implant. Res.* **1999**, *10*, 24–33. [[CrossRef](#)]
49. Von Arx, T.; Kurt, B. Implant placement and simultaneous peri-implant bone grafting using a micro titanium mesh for graft stabilization. *Int. J. Periodontics Restor. Dent.* **1998**, *18*, 117–127.
50. Von Arx, T.; Kurt, B. Localized ridge augmentation using a micro titanium mesh: A report on 27 implants followed from 1 to 3 years after functional loading. *Clin. Oral Implant. Res.* **1998**, *9*, 123–130. [[CrossRef](#)]
51. Malchiodi, L.; Scarano, A.; Quaranta, M.; Piatelli, A. Rigid fixation by means of titanium mesh in edentulous ridge expansion for horizontal ridge augmentation in the maxilla. *Int. J. Oral Maxillofac. Implant.* **1998**, *13*, 701–705.

*Review*

### **Investigation on the accuracy of implant surgery in dynamic navigation: metanalysis and systematic review of literature**

U. Luciano<sup>1</sup>, D. De Santis<sup>1</sup>, N. Modena<sup>1</sup>, P. Faccioni<sup>1</sup>, M. Bonioli<sup>1</sup>, M. Magi<sup>1</sup>, A. Iurlaro<sup>1</sup>,  
C. Alberti<sup>1</sup>, F. Melloni<sup>1</sup>, T. Zambotti<sup>1</sup>, F. Gelpi<sup>1</sup>, N. Zerman<sup>1</sup> and A. Trotolo<sup>1</sup>

<sup>1</sup>*Section of Oral and Maxillofacial Surgery, Department of Surgical Sciences, Dentistry,  
Gynecology and Pediatrics, University of Verona, Verona, Italy*

---

*Corresponding Author:*

Dr. Umberto Luciano,  
Section of Oral and Maxillofacial Surgery,  
Department of Surgical Sciences, Dentistry,  
Gynecology and Pediatrics,  
University of Verona,  
Verona, Italy  
Tel.: +39 3405438438  
e-mail: umbel@hotmail.it

**Keywords:** *implant placement, implant surgery, Dynamic Navigation, DN, Static Navigation, SN, osteointegrated implants*

Received: 20 July 2022  
Accepted: 4 January 2023

Copyright:  
Journal of Applied Cosmetology ©2023  
www.journalofappliedcosmetology.com  
Copyright © by Journal of Applied Cosmetology

ISSN 2974-6140 (online) ISSN 0392-8543 (print).

This publication and/or article is for individual use only and may not be further reproduced without written permission from the copyright holder. Unauthorized reproduction may result in financial and other penalties  
**DISCLOSURE: ALL AUTHORS REPORT NO CONFLICTS OF INTEREST RELEVANT TO THIS ARTICLE.**

## ABSTRACT

The object of this study was to compare, through meta-analysis, the accuracy in implant placement obtained in Dynamic Navigation (DN) with Static Navigation (SN) and with conventional free-hand surgery (CS) and to provide some useful clinical parameters to consider during the planning phase of the intervention. A meta-analysis was performed, dividing the selected studies into two groups based on the statistical technique adopted: DN vs CS and DN vs SN. The heterogeneity between the various studies was assessed with the homonymous test and quantified with I<sup>2</sup>. The results were graphically represented using a forest plot. Egger's test and funnel plot were used to investigate the "small study effect". The search was performed through the PubMed database, and the Cochrane Library database identified 448 articles. After applying the inclusion criteria, 14 articles were selected and used for quantitative synthesis (meta-analysis). From the results obtained from this meta-analysis, it can be stated that the Dynamic Navigation mode allows for better accuracy than conventional surgery, the most used type of surgery, and is comparable to Static Navigation, the gold standard for accuracy.

## INTRODUCTION

The rehabilitation of partial and total edentulism using osteointegrated implants is a method that has proven to be highly effective and predictable, with success rates reported in the literature that are also high in the long-term follow-up (1, 2). In order to obtain these results, the diagnostic phase of pre-surgical planning is fundamental and if carried out correctly, reduces complications connected to implant malposition, such as an occlusal overload of the implant that can lead to a preterm failure, unsatisfactory aesthetics, in particular in the anterior sectors, and prosthetist difficulty in creating a prosthetic product (3). Complications of greater interest always linked to a malposition of the implant can be cortical perforations, lesions of adjacent teeth and damage to particular anatomical structures, such as the inferior alveolar nerve or the maxillary sinus (4).

Once the planning has been carried out, i.e. once the ideal implant position has been identified on the software, the clinician's objective is to transfer it with maximum reproducibility to the real site (transition to the surgical phase); in order to do this, there are 2 methods available:

- Analogical: Conventional surgery, also called Free Hand or Mental Navigation
- Digital: Computer Assisted Surgery (CAS), also known as Computer Guided Surgery or Surgery in Navigation

This last method is divided into two modalities:

- Surgery in Static Navigation
- Surgery in Dynamic Navigation

A distinction can be made between static navigation using templates (dime) and direct dynamic navigation using optical transmission systems (5). The last frontier in the field of implant surgery is represented by Dynamic Navigation, a practical aid to minimise the discrepancies between the virtually planned implant position (using special software) and the real position of the dental implant. This technique is therefore added to the other two already available in implantology: conventional free-hand surgery and static navigation. The following discussion will compare the accuracy of these three surgical modalities through a systematic review and meta-analysis of what is currently reported in the literature.

## MATERIALS AND METHODS

The guidelines in the *Cochrane Handbook for Systematic Reviews of Interventions (the Handbook)*, version 5.1.0 of March 2011, were followed for this systematic review of the literature accompanied by meta-analysis. Furthermore, the PRISMA Statement (2015) Guidelines for reporting systematic reviews and meta-analyses were followed to realise the Materials and methods section. (6) To search for scientific publications, the online databases most used in Italy, “PubMed” and “Cochrane Library”, were used. The bibliographic research was carried out from February 2021 until the end of June of the same year by a single author (M.B.).

The following filters were applied to search for publications in the online databases mentioned above: 1) publication date included in the period from 01/01/2000 to 31/06/2021; 2) articles published exclusively in English. In addition, the research was carried out to select studies that compared the accuracy obtained from implant surgery in Dynamic Navigation (DN) with the one obtained from other types of implant placement, such as Static Navigation (SN) and/or free-hand conventional surgery (CS). The search strategy was based on the following terms: “Oral Implant”, OR “Endosseous Implant”, OR “Dental Implant”, OR “Implant Placement”, AND “Navigation surgery”, OR “Image-guided surgery” OR “Dynamic Navigation” OR “Dynamic surgery” AND “Free-hand” OR “Conventional surgery” OR “Computer-Aided Design” OR “Static Navigation” OR “Static surgery” OR “Template” AND “Mesh” OR “custom titanium mesh” OR “custom mesh” OR “titanium mesh”.

### *Eligibility criteria*

Regarding the articles potentially includable in the review, randomised-controlled clinical trials (RCT), controlled clinical trials (CCT), cohort studies, comparative cadaver studies and comparative model studies were considered. Cadaver and model studies were included to compensate for the reduced availability of articles regarding implant placement in Dynamic Navigation due to the recent introduction of this technique, and this was possible as no Patient-centered outcomes or other data requiring a follow-up period were assessed but only those relating to the accuracy of the system, which can also be measured in this type of studies. Studies involving pterygoid implants, zygomatic implants, orthodontic mini-screws, studies with no control and Case reports were not included in the review.

As indicated by the *Cochrane Handbook for Systematic Reviews of Interventions*, the protocol for the formulation of the PICO question was adopted to outline the criteria for the inclusion of the articles, as shown below (7):

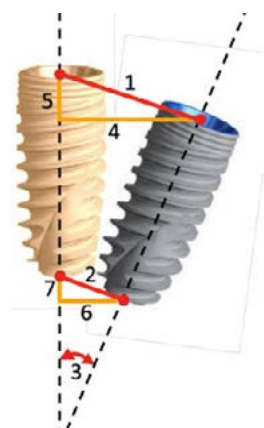
- **Population:** Only articles regarding patients, models and cadavers with partial or total edentulism to be rehabilitated with the placement of dental implants preceded by virtual planning were considered. Furthermore, the number of total implants had to be greater than or equal to 10 in the test and control groups.
- **Intervention:** The test group had to be composed of Dynamic Navigation implant placement.
- **Comparison:** The control group had to consist of implant placement with Static Navigation surgery, the gold standard for accuracy, or with conventional surgery, the most used procedure.
- **Outcomes:** The outcomes searched for in the articles were divided into primary and secondary outcomes. The primary outcome searched was the accuracy measured by superimposition between the virtual plan and the real position of the implant and reported as one of the following parameters:
  - *angular deviation,*
  - *total apical deviation*
  - *total coronal deviation.*

In addition, the following accuracy parameters were considered secondary outcomes:

- *apical depth deviation*
- *coronal depth deviation*
- *lateral apical deviation and lateral coronal deviation.*

#### *Data characteristics*

Coronal and apical deviations were assessed in individual clinical trials as follows: a first CBCT is executed to allow the digital pianification of the ideal implant position. After the surgery, a second CBCT is performed to evaluate the actual implant position. Then a superimposition of the first and second CBCT is performed to evaluate the accuracy of the surgery technique adopted (Fig. 1).



**Fig. 1.** The primary outcomes are shown in red, and the secondary outcomes are shown in orange. Angular deviation (3): evaluates the amplitude of the angle formed by the axis of the positioned implant and the insertion axis of the virtual implant, expressed in degrees ( $^{\circ}$ ). Total apical deviation (2): it is the overall distance between the center of the positioned implant apex and the center of the virtual implant apex, expressed in mm. This variable, considering also the depth and the angular deviation, is reported, in some articles, as a 3D apical distance. Total coronal deviation (1): this is the total distance between the center of the platform of the positioned implant and the center of the virtual implant platform, expressed in mm. This variable, considering also the depth and the angular deviation is reported, in some articles, as 3D coronal distance. Apical depth deviation (7): it is the distance between the center of the positioned implant apex and the center of the virtual implant apex, measured along the Z axis. It is expressed in mm. Coronal depth deviation (5): it is the distance between the center of the placed implant platform and the center of the virtual implant platform, measured along the Z axis. It is expressed in mm. Lateral apical deviation (6): it is the distance between the center of the positioned implant apex and the insertion axis of the virtual implant, measured perpendicular to the latter. It is expressed in mm. Lateral coronal deviation (4): it is the distance between the center of the platform of the positioned implant and the insertion axis of the virtual implant, measured perpendicular to the latter. It is expressed in mm.



---

U. Luciano et al.

---

### *Study selection*

The PRISMA 2009 flow diagram guidelines were followed to select the articles (6). The titles obtained through the generic research previously explained were subsequently reviewed one by one (identification) by a single author (M.B.). At this point, the articles were selected by analysing the title and reading the abstract. In this second phase (screening), the full satisfaction of the inclusion criteria by the article in question was assessed. Therefore, studies that did not meet the inclusion criteria were excluded at this stage. Instead, the publications in which the abstract reading was insufficient to understand if the inclusion criteria were met were included in the next phase (reading the full text (eligibility)). In this way, it was possible to include (*included*) only the studies that met all the criteria set out above.

### *Data collection process*

The data of interest were extrapolated and grouped in data collection tables. The following parameters were analysed: 1) authors, year of publication, type of study; 2) test surgery modality and machinery used, comparison surgery modality; 3) the total number of patients, cadavers, models, number of test patients, cadavers, models, number of control patients, cadavers, models; 4) number of test implants, number of control implants; 5) type of edentulous test, type of edentulous control; 6) primary outcomes, secondary outcomes.

### *Statistical analysis*

A meta-analysis was performed, dividing the selected studies into two groups based on the statistical technique adopted: DN vs CS and DN vs SN.

The meta-analysis results were expressed as standardised mean difference (SMD = Standardized Mean Difference) for the quantitative variables (Total Coronal Deviation, Coronal lateral D., Coronal depth D., Total apical D., Lateral apical D., Apical Depth D., Angular Axes D.). The extent of SMD was interpreted as mild, SMD = 0.2; medium, SMD = 0.5; and high, SMD = 0.8.

The heterogeneity between the various studies was assessed with the homonymous test and quantified with I<sup>2</sup>. The Higgins heterogeneity index (I<sup>2</sup>) describes the proportion of heterogeneity of the individual studies that cannot be explained by the sampling error and has the advantage of being intrinsically independent of the number of studies. Since the heterogeneity test was significant and/or the I<sup>2</sup> was > 30% (8) for all the variables considered, a “random” effects statistical model was used. The combined (pooled) estimates and the related confidence intervals were calculated using Der Simonian and Laird (9). Finally, the results were graphically represented using a forest plot.

Egger’s test and funnel plot were used to investigate the “small study effect” (10). As a general rule, funnel plot asymmetry tests should only be used when at least 10 studies are included in the meta-analysis because when there are fewer studies, the tests’ power is insufficient to distinguish randomness from true asymmetry. The level of statistical significance was set at 5%, and the confidence intervals (CI) were calculated at 95%. All data were analysed with the STATA Software (Version 15).

## **RESULTS**

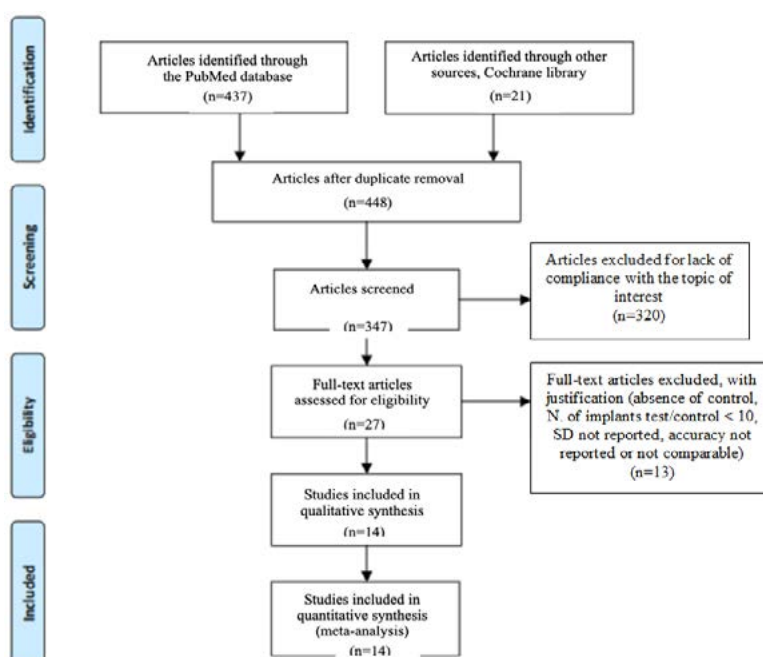
### *Study selection and description*

The search through the PubMed database identified 437 articles; instead, the search through the Cochrane Library database identified 21 articles. After eliminating the duplicates, 448 publications were obtained. A single operator (M.B.) viewed all these 448 titles and selected 347 abstracts to be read to assess whether or not they comply with the topic of interest. After the screening phase, 320 articles were removed. The 27 papers

that tested positive for eligibility were investigated by reading the full text to assess whether they adhered to the inclusion criteria and, consequently, their possible use in the systematic review and meta-analysis. After reading the text, it was possible to exclude 13 jobs (Table I). From the initial research, 14 articles were selected: 14 were used for the qualitative synthesis (systematic review of the literature), and 14 were used for quantitative synthesis (meta-analysis). Following the *PRISMA 2009 guidelines*, a flow chart was constructed summarising the study selection procedure (Fig. 2). It is always important to mention and consider the possibility and the risk of bias in the included studies. The general characteristics of the 14 studies included in the quantitative synthesis were collected and summarised in the following table (Table II). Five clinical studies were identified (11-15), 1 study on the anatomical specimen (16) and 8 in vitro studies (4, 17-23).

**Table I.** Articles excluded with motivation.

Author	Year	Reason for exclusion
Pellegrino et al.	2019	Absence of control
Stefanelli L. et al.	2019	Absence of control
Widmann et al.	2010	Absence of control
Kim et al.	2015	Absence of control
Golob Deeb J. et al.	2019	Absence of control
Emery et al.	2016	Absence of control
Sun et al.	2019	Absence of control
Ma L. et al.	2019	N. implants test/control < 10, DS not reported
Jokstad A. et al.	2018	Accuracy not reported or not comparable
Herklotz I. et al.	2017	Accuracy not reported or not comparable
Mischkowski R. et al.	2016	Accuracy not reported or not comparable
Kramer F. et al.	2004	Accuracy not reported or not comparable
Sießegger M. et al.	2001	Accuracy not reported or not comparable



**Fig. 2.** PRISMA flow chart.

U. Luciano et al.

Table II. General characteristics of the included studies.

Author, Year	Study type	Surgical technique adopted		N(patients)		N(implants)		Edentulous type	
		Test	Control	Test	Control	Test	Control	Test	Control
<b>HUMAN (VIVO)</b>									
Kaewsiri, 2019	Human RCT	DN (IRIS-100)	SN	30	30	30	30	PE	PE
Block, 2017	Human CT	DN(X-Guide, full guide)	CS	tot 478		219	122	PE	PE
		DN(X-Guide, partial guide)				373		PE	PE
Yimarj P. 2020	RCT parallel	DN(Iris-100)	SN (Visijet MP200)	Tot 30		30	30	Partial (two neighboring implants)	Partial (two neighboring implants)
Sun 2020	Non-RCT	DN(AqNavi)	- sCAIS	NR		32	32	NR	NR
			- d+sCAIS			32			
			Freehand			32			
Aydemir 2020	Split-mouth RCT	DN(Navident)	Freehand	15	15	43	43	Partial (posterior bilateral edentulism)	Partial (posterior bilateral edentulism)
<b>EX VIVO (CADAVER)</b>									
Ruppini, 2008	Ex Vivo (human cadaver mandibles)	DN (RoboDent) DN (Artma Virtual Patient)	SN	tot20 (20 human cadaver mandibles)		40	40	TE-PE	TE-PE
						40		TE-PE	
<b>VITRO (MODEL)</b>									
Mediavilla Guzman 2019	In vitro study (Polyurethane model)	DN(Navident)	SN(NemoStudio® / ProJet 6000)	10 models	10 models	20	20	Total	Total
Zhou 2020	In vitro study (Resin 3D printed model)	DN (Yizhimei)	sCAIS (Visijet M3)	10 models	10 models	40	40	Partial	Partial
Jorba-Garcia 2019	In-vitro study (Resin model)	DN (NaviDent)	CS	3 models	3 models	18	18	PE	PE
Chen CK, 2018	In vitro study (Plaster model)	DN (AQ Navi SNS)	SN	10 models	10 models	50	50	PE	PE
			CS		10 models		50		
Somogyi-Ganss, 2014	In vitro study	DN (NaviDent)	CS	50	50	400	400	PE	PE
			SN (Strauman GS) SN (Simplant SG) SN (Nobel Guide)	50 50 50	50 50 50	400 400 400	400 400 400		
Kang, 2014	In vitro study	DN (CBYON Suite System), zona canini	SN	10	10	20	20	TE	TE
		DN (CBYON Suite System), zona molari				20	20	TE	TE
Hoffmann, 2005	In vitro study	DN (Vector Vision Compact)	CS	8	8	112	112	TE	TE
Brief, 2005	In vitro study	DN (RoboDent)	CS	5	5	15	15	PE	PE
		DN (DenX IGI System)		5	5	15	15	PE	PE

DN: Dynamic Navigation, SN: Static Navigation, CS: Conventional Surgery PE: partially edentulous TE: totally edentulous NR: not reported, dCAIS dynamic computer – aided implant surgery, sCAIS static computer – aided implant surgery

All the studies included analysed the implant positioning in Dynamic Navigation (DN) as a test intervention; in particular, 1 of these studies used and evaluated two DN systems as a test; 1 divided the test group based on the site of insertion in canine and molar position and 1 study divided the test group, based on the method of insertion, between Full and Partial Guide. If control intervention is considered, only 6 studies represented implant placement in Static Navigation (SN), 5 studies by conventional surgery alone (CS), and 3 by SN and CS.

Considering the total number of implants inserted and divided into the 3 groups used in the subsequent meta-analysis, the data concerning 1517 implants in the DN test group, 1482 implants in the SN control group and 792 implants in the CS control group were collected.

In almost all the articles considered, the type of edentulism treated was exclusive of the partial type, with the exception of 3 in vitro studies which performed the insertion of implants in models characterised by total edentulism. In the remaining studies, it was not possible to separate the number of partial edentulous ones from the total edentulous ones.

#### *Results of the individual studies*

This paper examined the following primary outcomes resulting from the implant placement: Total coronal deviation, Total apical deviation and Angular deviation. The secondary outcomes considered are Coronal lateral deviation, Coronal depth deviation, Apical lateral deviation and Apical depth deviation.

#### *Primary outcomes*

The Total Coronal Deviation parameter was analysed in 8 studies, 4 clinical (11-13, 15) and 4 in vitro (4, 17, 18, 19). The total apical deviation was analysed in 11 studies, 5 clinical (11-15) and 6 in vitro (4, 17, 1-20, 23).

The Angular Deviation parameter was analysed in all included studies (4, 11-23). The primary outcomes were grouped in the table below (Table III).



U. Luciano et al.

Table III. Primary Outcomes.

Author, Year	Study Type	Surgery type		N(implants)		Mean Total Coronal Deviation (SD); mm		Mean Total Apical Deviation (SD); mm		Mean Angular Deviation (SD); °	
		Test	Control	Test	Control	Test	Control	Test	Control	Test	Control
<b>HUMAN (VIVO)</b>											
Kaewsiri, 2019	Human RCT	DN	SN	30	30	1,05 (0,44)	0,97 (0,44)	1,29 (0,5)	1,28 (0,46)	3,06 (1,37)	2,84 (1,71)
Block, 2017	Human CT	DN f	CS	219	122	1,16 (0,59)	1,78 (0,77)	1,29 (0,65)	2,27 (1,02)	2,97 (2,09)	6,5 (4,21)
		DNp		373		1,31 (0,68)		1,52 (0,78)		3,43 (2,33)	
Yimarj P 2020	RCT parallel	DN	SN	30	30	1,24 (0,39)	1,04 (0,67)	1,58 (0,56)	1,54 (0,79)	3,78 (1,84)	4,08 (1,69)
Sun 2020	Non-RCT	DN	- sCAIS	32	32			1,25 (0,09)	1,49 (0,08)	3,24 (0,36)	4,54 (0,29)
			- d+sCAIS		32				0,98 (0,19)		2,20 (0,38)
			Freehand		32				1,89 (0,09)		6,12 (0,12)
Aydemir 2020	Split-mouth RCT	DN	Freehand	43	43	1,01 (0,07)	1,70 (0,13)	1,83 (0,12)	2,51 (0,21)	5,59 (0,39)	10,04 (0,83)
<b>EX VIVO (CADAVER)</b>											
Ruppin, 2008	Ex Vivo (human cadaver mandibles)	DN	SN	40	40					8,1 (4,6)	7,9 (5)
		DN		40						8,1 (4,9)	
<b>VITRO (MODEL)</b>											
Mediavilla Guzman 2019	in vitro study (Polyurethane model)	DN	SN	20	20	0,85 (0,48)	0,78 (0,43)	1,18 (0,60)	1,20 (0,48)	4,00 (1,41)	2,95 (1,48)
Zhou 2020	in vitro study (Resin 3D printed model)	DN	sCAIS	40	40	0,4 (0,41)	1,15 (0,34)	0,34 (0,33)	1,37 (0,38)	0,97 (1,21)	2,6 (1,11)
Jorba-Garcia 2019	in vitro study (Resin model)	DN	CS	18	18	1,29 (0,46)	1,50 (0,58)	1,33 (0,5)	2,26 (1,11)	1,6 (1,3)	9,7 (5,2)
Chen CK, 2018	In vitro study (Plaster model)	DN	SN	50	50	1,07 (0,48)	1,02 (0,46)	1,35 (0,55)	1,5 (0,79)	4,45 (1,97)	6,02 (3,71)
			CS		50		1,44 (0,56)		2,00 (0,79)		9,26 (3,62)
Somogyi-Ganss, 2014	In vitro study	DN	CS	400	400			1,71 (0,61)	2,32 (1,18)	2,99 (1,68)	8,95 (4,65)
			SN 1	400	400			1,71 (0,86)			3,31 (1,86)
			SN 2	400	400			1,46 (0,76)			3,09 (1,9)
			SN 3	400	400			1,91 (0,94)			4,24 (2,66)
Kang, 2014	In vitro study	DNc	SNe	20	20					12,37 (4,18)	6,72 (3,41)
			DNm	SN m	20	20					8,97 (3,83)
Hoffmann, 2005	In vitro study	DN	CS	112	112					4,2 (1,8)	11,2 (5,6)
Brief, 2005	In vitro study	DN 1 DN 2	CS	15	15			0,6 (0,2)	1,89 (0,8)	2,12 (0,78)	4,59 (2,84)
				15	15			0,94 (0,4)		4,21 (4,76)	

DN: Dynamic Navigation, SN: Static Navigation, CS: Conventional Surgery PE: partially edentulous TE: totally edentulous; NR: not reported, dCAIS dynamic computer – aided implant surgery, sCAIS static computer – aided implant surgery, c: canines, m: molars

### Secondary outcomes

The Lateral Coronal Deviation parameter was analysed in a total of 6 studies, 1 clinical (12), 1 on an anatomical piece (16) and 4 in vitro (18, 20, 21, 23). The Coronal Depth Deviation parameter was analysed in 2 studies, 1 clinical (12) and 1 in vitro (21).

The apical lateral deviation parameter was analysed in 4 studies, 1 clinical (12) and 3 in vitro (20, 21, 23). The Apical Depth Deviation parameter was analysed in a total of 7 studies, 2 clinical (12, 14), 1 on an anatomical piece (16) and 4 in vitro (18, 20, 21, 23). The secondary outcomes were grouped in the table below (Table IV).



Table IV. Secondary Outcomes.

Author, Year	Study Type	Surgery type		N(implants)		Mean coronal lateral deviation (SD); mm		Mean coronal depth deviation (SD); mm		Mean apical lateral deviation (SD); mm		Mean apical depth deviation (SD); mm	
		Test	Control	Test	Control	Test	Control	Test	Control	Test	Control	Test	Control
<b>HUMAN (VIVO)</b>													
Kaewsiri, 2019	Human RCT	DN	SN	30	30								
Block, 2017	Human CT	DN f	CS	219	122	0,74 (0,43)	1,19 (0,68)	0,76 (0,6)	1,12 (0,83)	0,9 (0,55)	1,84 (1,05)	0,78 (0,6)	1,1 (0,82)
		DNp		373		0,8 (0,49)		0,89 (0,73)		1,01 (0,65)		0,9 (0,74)	
Yimarj P 2020	RCT parallel	DN	SN	30	30								
Sun 2020	Non-RCT	DN	-sCAIS	32	32							0,73 (0,13)	1,00 (0,15)
			-d+sCAIS		32								0,52 (0,20)
			Freehand		32								1,42 (0,25)
Aydemir 2020	Split-mouth RCT	DN	Freehand	43	43								
<b>EX VIVO (CADAVER)</b>													
Ruppini, 2008	Ex Vivo (human cadaver mandibles)	DN	SN	40	40	1,0 (0,5)	1,5 (0,8)					0,6 (0,3)	0,6 (0,4)
		DN		40		1,2 (0,6)						0,8 (0,7)	
<b>VITRO (MODEL)</b>													
Mediavilla Guzman 2019	in vitro study (Polyurethane model)	DN	SN	20	20								
Zhou 2020	in vitro study (Resin 3D printed model)	DN	sCAIS	40	40								
Iorba-Garcia 2019	In-vitro study (Resin model)	DN	CS	18	18	0,85 (0,41)	1,26(0,66)					0,88 (0,47)	0,57(0,33)
Chen CK, 2018	In vitro study (Plaster model)	DN	SN CS	50	50								
Somogyi-Ganss, 2014	In vitro study	DN	CS SN 1	400	400	1,14 (0,55)	1,14 (0,68)			1,18 (0,56)	1,74 (1,07)	1,04 (0,71)	0,73 (0,71)
			SN 2	400	400	0,76 (0,54)	0,9 (0,48)			1,19 (0,62)	1,05 (0,86)	1,1 (0,79)	
			SN 3	400	400	0,81 (0,55)	0,81 (0,55)			0,99 (0,64)	1,24 (0,8)	1,27 (0,86)	
Kang, 2014	In vitro study	DNc	SNc	20	20	2,06 (1,43)	0,73(0,41)	1,14 (1,25)	0,47(0,34)	2,76 (1,03)	2,03(0,97)	1,42 (1,01)	1,52(1,31)
		DNm	SN m	20	20	3,03 (1,81)	0,68 (0,44)	0,76 (0,84)	0,32 (0,25)	3,31 (2,07)	1,08 (0,77)	1,96 (0,93)	0,52 (0,52)
Hoffmann, 2005	In vitro study	DN	CS	112	112								
Brief, 2005	In vitro study	DN 1	CS	15	15	0,35 (0,17)	1,35 (0,56)			0,47 (0,18)	1,62 (0,68)	0,32 (0,21)	0,84 (0,65)
		DN 2		15		0,65 (0,58)				0,68 (0,31)		0,61 (0,36)	

DN: Dynamic Navigation, SN: Static Navigation, CS: Conventional Surgery PE: partially edentulous TE: totally edentulous NR: not reported, dCAIS dynamic computer – aided implant surgery, sCAIS static computer – aided implant surgery, c: canines, m: molars

Clinical outcomes

Before dealing with the section regarding quantitative synthesis to extrapolate clinical data that can be valid as a reference during the planning phase of an intervention in Dynamic Navigation, a further investigation was made where the overall mean and standard deviation of all studies included in the systematic review were

Copyright JAC

U. Luciano et al.

calculated. The overall mean and standard deviation of Dynamic Navigation is shown in the following table, divided into primary and secondary outcomes. (Table V).

**Table V.** Accuracy of Dynamic Navigation.

Primary outcomes	Mean (SD)
Total Coronal Deviation	1,04 (0,44)
Total apical deviation	1,25 (0,45)
Axis angular deviation	4,7 (2,27)
Secondary outcomes	Mean (SD)
Lateral coronal deviation	1,18 (0,7)
Coronal depth deviation	0,89 (0,86)
Lateral apical deviation	1,47 (0,76)
Apical depth deviation	0,91 (0,56)

#### Quantitative synthesis of the results

A quantitative comparison for the accuracy of implant placement was performed through a meta-analysis of each of the 7 primary and secondary outcomes evaluated.

Forest plot graphs were extrapolated from the meta-analysis to allow a simpler graphical interpretation. In addition, where possible, or where the number of studies allowed their realisation, the Egger test was also performed accompanied by the graphical representation through a funnel plot to investigate the “small study effect”.

The results of the statistical tests accompanied by the reference graphs are shown in the section below, divided by parameter. In order to facilitate the interpretation, the results relating to the comparison between Dynamic Navigation and conventional surgery (DN vs CS) were highlighted in blue, and those between Dynamic Navigation vs Static Navigation (DN vs SN) in yellow.

#### Total coronal deviation

For the total coronal deviation, the statistical analysis shows that there is a high difference (SMD = -1.650), statistically significant ( $p < 0.001$ ), in favor of Dynamic Navigation in comparison with conventional surgery. From the comparison of Dynamic Navigation vs Static Navigation, a slight difference emerges (SMD = -0.234) in favor of Dynamic Navigation, but this difference does not reach statistical significance ( $p = 0.576$ ) (Table VI).

**Table VI. Total Coronal Deviation.**

Study	SMD	[95% Conf. Interval]		% Weight
<b>DN vs CS</b>				
Aydemir (2020)	-6.609	-7.694	-5.524	8.00
Chen CK (2018)	-0.709	-1.114	-0.305	10.40
Jorba-Garcia (2019)	-0.401	-1.061	0.259	9.63
Block (2017)	-0.668	-0.877	-0.460	10.78
Block (2017)	-0.940	-1.172	-0.707	10.75
Sub-total				
D+L pooled SMD	-1.650	-2.509	-0.791	49.56
<b>DN vs SN</b>				
Chen CK (2018)	0.106	-0.286	0.499	10.43
Zhou (2020)	-1.991	-2.530	-1.453	10.03
Mediavilla (2019)	0.154	-0.467	0.774	9.76
Yimarj P (2020)	0.365	-0.146	0.875	10.11
Kaewsiri (2019)	0.182	-0.325	0.689	10.12
Sub-total				
D+L pooled SMD	-0.234	-1.055	0.586	50.44
Overall				
D+L pooled SMD	-0.933	-1.527	-0.339	100.00

Test(s) of heterogeneity:

	Heterogeneity statistic	degrees of freedom	P	I-squared**	Tau-squared
DN vs CS	113.91	4	0.000	96.5%	0.8741
DN vs SN	52.99	4	0.000	92.5%	0.8074
Overall	192.50	9	0.000	95.3%	0.8400

\*\* I-squared: the variation in SMD attributable to heterogeneity)

Note: between group heterogeneity not calculated; only valid with inverse variance method

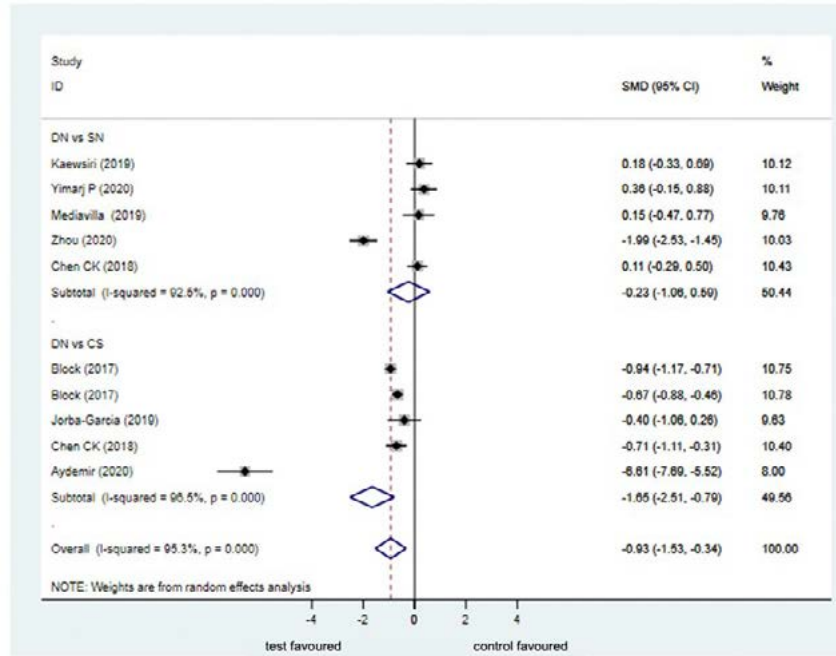
Significance test(s) of SMD=0

DN vs CS	z= 3.77	p = 0.000
DN vs SN	z= 0.56	p = 0.576
Overall	z= 3.08	p = 0.002

Total coronal deviation: forest plot

Observing the forest plot, of which the upper portion concerns the DN vs SN comparison and the lower portion the DN vs CS comparison, it can be seen that the test, the DN, is favoured in comparison with the CS and comparable to the SN, although presenting a very slight difference, however not significant (Fig. 3).

U. Luciano et al.



**Fig. 3.** Total Coronal Deviation, forest plot.

#### Total apical deviation

For the total apical deviation, the statistical analysis shows that there is a high difference (SMD = -1.919), statistically significant ( $p < 0.001$ ), in favor of Dynamic Navigation in comparison with conventional surgery. From the comparison of Dynamic Navigation vs Static Navigation, a moderate difference emerges (SMD = -0.556) in favor of Dynamic Navigation, reaching statistical significance ( $p = 0.008$ ) (Table VII).

**Table VII. Total Apical Deviation.**

Study	SMD [95% Conf. Interval]			% Weight
<b>DN vs CS</b>				
Block (2017)	-1.222	-1.462	-0.982	6.17
Block (2017)	-0.887	-1.099	-0.676	6.20
Sun (2020)	-7.111	-8.455	-5.767	3.53
Aydemir (2020)	-3.976	-4.711	-3.241	5.12
Jorba-Garcia (2019)	-1.080	-1.782	-0.378	5.20
Chen CK (2018)	-0.955	-1.369	-0.541	5.88
Somogyi-Ganss (2014)	-0.649	-0.792	-0.507	6.27
Brief (2005)	-2.212	-3.133	-1.291	4.61
Brief (2005)	-1.502	-2.319	-0.685	4.90
Sub-total				
D+L pooled SMD	-1.919	-2.482	-1.355	47.88
<b>DN vs SN</b>				
Kaewsiri (2019)	0.021	-0.485	0.527	5.69
Yimarj P (2020)	0.058	-0.448	0.565	5.69
Sun (2020)	-2.819	-3.516	-2.121	5.22
Mediavilla-Guzman (2	-0.037	-0.657	0.583	5.41
Zhou (2020)	-2.894	-3.525	-2.263	5.39
Chen CK (2018)	-0.220	-0.614	0.173	5.92
Somogyi-Ganss (2014)	0.000	-0.139	0.139	6.27
Somogyi-Ganss (2014)	0.363	0.223	0.503	6.27
Somogyi-Ganss (2014)	-0.252	-0.392	-0.113	6.27
Sub-total				
D+L pooled SMD	-0.556	-0.969	-0.143	52.12
Overall				
D+L pooled SMD	-1.220	-1.601	-0.840	100.00

Test(s) of heterogeneity:

	Heterogeneity statistic	degrees of freedom	P	I-squared**	Tau-squared
DN vs CS	177.38	8	0.000	95.5%	0.6313
DN vs SN	181.71	8	0.000	95.6%	0.3465
Overall	560.92	17	0.000	97.0%	0.5960

\*\* I-squared: the variation in SMD attributable to heterogeneity)

Note: between group heterogeneity not calculated; only valid with inverse variance method

Significance test(s) of SMD=0

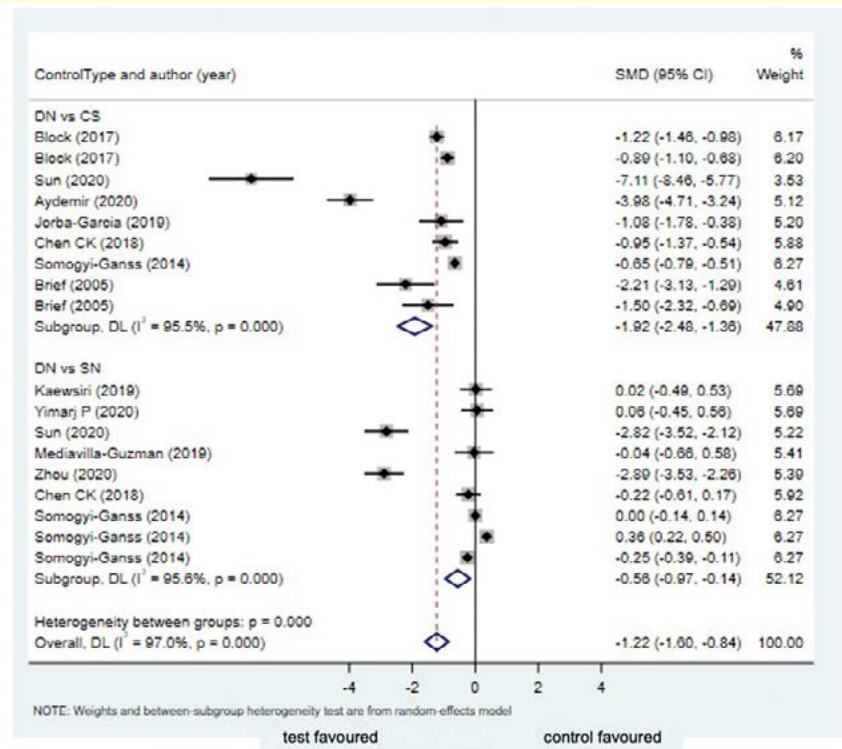
DN vs CS	z = 6.67	p = 0.000
DN vs SN	z = 2.64	p = 0.008
Overall	z = 6.29	p = 0.000

*Total apical deviation: forest plot*

Observing the forest plot, of which the upper portion concerns the DN vs CS comparison and the lower portion the DN vs SN comparison, it can be seen that the test, the DN, is favoured in comparison with the CS and also favoured in comparison with the SN, with statistical significance in both comparisons (Fig. 4).



U. Luciano et al.



**Fig. 4.** Total Apical Deviation, forest plot.

#### Axis angular deviation

For the angular deviation of the axes, the statistical analysis shows that there is a high difference (SMD = -2.269), statistically significant ( $p < 0.001$ ), in favor of Dynamic Navigation in comparison with conventional surgery. From the comparison of Dynamic Navigation vs Static Navigation, a slight difference emerges (SMD = -0.199) in favor of Dynamic Navigation, but this difference does not reach statistical significance ( $p = 0.239$ ) (Table VIII).

Table VIII. Axis Angular Deviation.

Study	SMD	[95% Conf. Interval]		% Weight
<b>DN vs SN</b>				
Kaewsiri (2019)	0.142	-0.365	0.649	4.50
Yimarj P (2020)	-0.170	-0.677	0.337	4.50
Sun (2020)	-3.977	-4.831	-3.123	3.94
Ruppin (2008)	0.042	-0.397	0.480	4.58
Ruppin (2008)	0.040	-0.398	0.479	4.58
Mediavilla Guzman (2020)	0.726	0.085	1.367	4.30
Zhou (2020)	-1.404	-1.894	-0.913	4.52
Chen CK (2018)	-0.529	-0.927	-0.130	4.63
Somogyi-Ganss (2014)	-0.181	-0.319	-0.042	4.84
Somogyi-Ganss (2014)	-0.056	-0.194	0.083	4.84
Somogyi-Ganss (2014)	-0.562	-0.703	-0.421	4.84
Kang (2014)	1.481	0.778	2.185	4.20
Kang (2014)	1.579	0.865	2.293	4.18
Sub-total				
D+L pooled SMD	-0.199	-0.529	0.132	58.44
<b>DN vs CS</b>				
Block (2017)	-1.168	-1.406	-0.930	4.78
Block (2017)	-1.056	-1.271	-0.842	4.80
Sun (2020)	-10.733	-12.685	-8.781	2.17
Aydemir (2020)	-6.862	-7.983	-5.742	3.46
Jorba-Garcia (2019)	-2.137	-2.965	-1.310	3.98
Chen CK (2018)	-1.651	-2.106	-1.196	4.56
Somogyi-Ganss (2014)	-1.705	-1.867	-1.543	4.83
Hoffmann (2005)	-1.683	-1.988	-1.378	4.73
Brief (2005)	-1.186	-1.966	-0.406	4.07
Brief (2005)	-0.097	-0.813	0.619	4.17
Sub-total				
D+L pooled SMD	-2.269	-2.850	-1.688	41.56
Overall				
D+L pooled SMD	-1.073	-1.460	-0.686	100.00

Test(s) of heterogeneity:

	Heterogeneity statistic	degrees of freedom	P	I-squared**	Tau-squared
DN vs SN	186.57	12	0.000	93.6%	0.3069
DN vs CS	223.40	9	0.000	96.0%	0.7433
Overall	800.09	22	0.000	97.3%	0.7992

\*\* I-squared: the variation in SMD attributable to heterogeneity)

Note: between group heterogeneity not calculated; only valid with inverse variance method

Significance test(s) of SMD=0

DN vs SN	z = 1.18	p = 0.239
DN vs CS	z = 7.65	p = 0.000
Overall	z = 5.44	p = 0.000

Axis angular deviation: forest plot

Observing the forest plot, of which the upper portion concerns the DN vs SN comparison and the lower portion the DN vs CS comparison, it can be seen that the DN test is favoured in comparison with the CS and comparable to the SN, although presenting a very slight difference, however not significant. Furthermore, it can be observed that the difference between DN and SN remains minimal and negligible both by analysing the data as a whole and in individual studies, except for the data reported by Kang et al. and Sun et al. which differ considerably from the other data reported (Fig. 5).

U. Luciano et al.

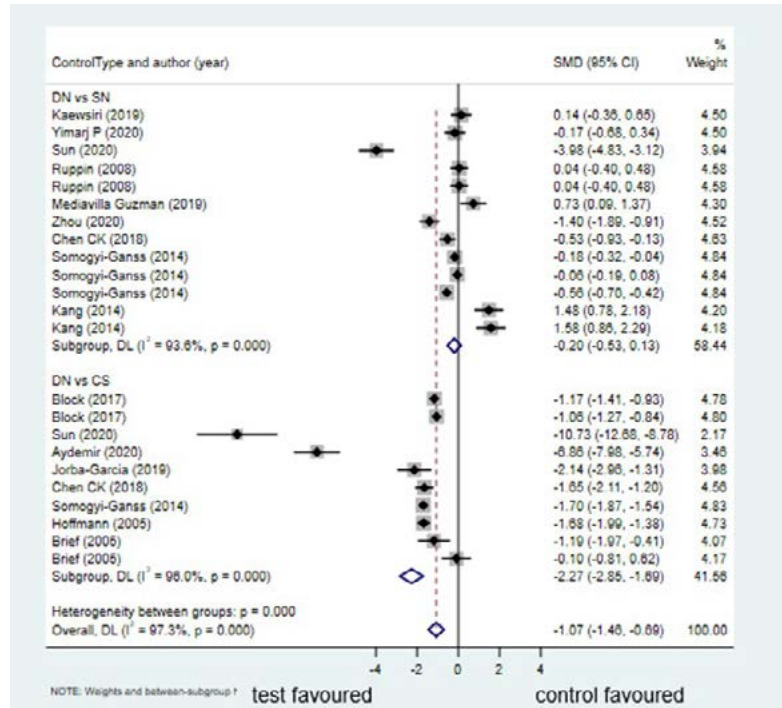


Fig. 5. Axis Angular Deviation, Forest Plot.

The presence of the “small study effect” was investigated using the funnel plot and the Egger test:

- Funnel Plot Axis Angular Deviation, DN vs CS comparison (Fig. 6).
- Funnel Plot Axis Angular Deviation, DN vs SN comparison (Fig. 7).
- Since the  $p = 0.148$ , the presence of “small-study effects” is excluded from the comparison between DN and CS. (Table IX).
- Since  $p = 0.840$ , the presence of “small-study effects” is excluded from the comparison between DN and SN. (Table X).

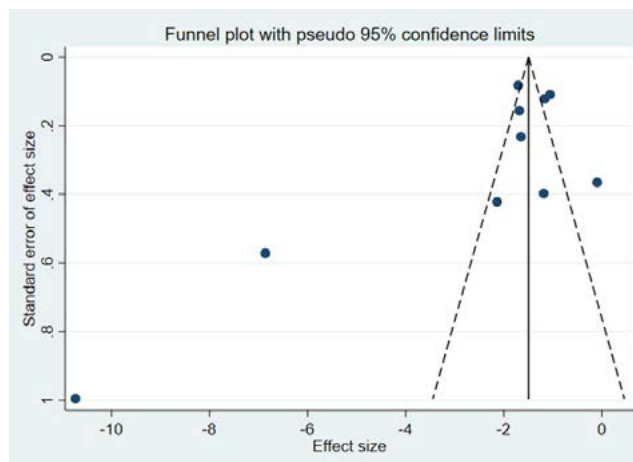


Fig. 6. Funnel Plot Axis Angular Deviation, DN vs CS comparison.

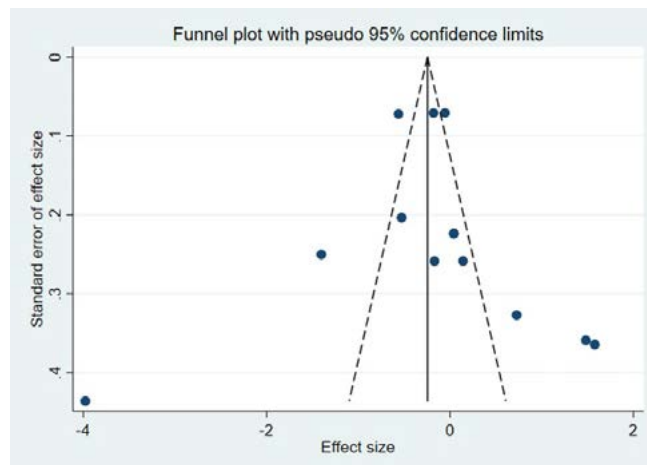


Fig. 7. Funnel Plot Axis Angular Deviation, DN vs SN comparison.

Table IX. Since the  $p = 0.148$ , the presence of "small-study effects" is excluded in the comparison between DN vs CS.

```

. ***CHECKING PUBLICATION BIAS WITH EGGER'S TEST FOR DN vs CS
. *table (P VALUE)
. metabias _ES _seES if ControlType=="DN vs CS", egger
    
```

Note: data input format theta se\_theta assumed.

Egger's test for small-study effects:  
Regress standard normal deviate of intervention effect estimate against its standard error

Number of studies = 10 Root MSE = 4.598

Std_Eff	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
slope	-.9547596	.4109467	-2.32	0.049	-1.902405	-.0071148
bias	-4.062364	2.53608	-1.60	0.148	-9.910575	1.785846

Test of H0: no small-study effects P = 0.148

Table X. Since  $p = 0.840$ , the presence of "small-study effects" is excluded in the comparison between DN vs SN.

```

. ***CHECKING PUBLICATION BIAS WITH EGGER'S TEST FOR DN vs SN
. *table (P VALUE)
. metabias _ES _seES if ControlType=="DN vs SN", egger
    
```

Note: data input format theta se\_theta assumed.

Egger's test for small-study effects:  
Regress standard normal deviate of intervention effect estimate against its standard error

Number of studies = 13 Root MSE = 4.11

Std_Eff	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
slope	-.2887218	.2567526	-1.12	0.285	-.8538305	.2763869
bias	.3977745	1.925844	0.21	0.840	-3.840979	4.636528

Test of H0: no small-study effects P = 0.840

Copyright JAC

U. Luciano et al.

*Coronal lateral deviation*

For the lateral coronal deviation, the statistical analysis shows a high difference (SMD = -0.867), statistically significant ( $p = 0.001$ ), in favor of Dynamic Navigation compared to conventional surgery. From the comparison of Dynamic Navigation vs Static Navigation, a moderate difference emerges (SMD = 0.449) in favor of Static Navigation, reaching statistical significance ( $p = 0.006$ ) (Table XI).

**Table XI.** *Coronal Lateral Deviation.*

Study	SMD	[95% Conf. Interval]		% Weight
<b>DN vs CS</b>				
Block (2017)	-0.844	-1.075	-0.614	8.57
Block (2017)	-0.718	-0.928	-0.509	8.62
Jorba-Garcia (2019)	-0.746	-1.423	-0.069	6.84
Somogyi-Ganss (2014)	0.000	-0.139	0.139	8.75
Brief (2005)	-2.416	-3.372	-1.461	5.58
Brief (2005)	-1.228	-2.012	-0.443	6.34
Sub-total				
D+L pooled SMD	-0.867	-1.358	-0.376	44.70
<b>DN vs SN</b>				
Ruppig (2008)	-0.750	-1.203	-0.296	7.82
Ruppig (2008)	-0.424	-0.868	0.019	7.86
Somogyi-Ganss (2014)	0.465	0.324	0.605	8.75
Somogyi-Ganss (2014)	0.697	0.554	0.840	8.75
Somogyi-Ganss (2014)	0.600	0.458	0.742	8.75
Kang (2014)	1.264	0.583	1.946	6.02
Kang (2014)	1.784	1.046	2.522	6.55
Sub-total				
D+L pooled SMD	0.449	0.129	0.768	55.30
<b>Overall</b>				
D+L pooled SMD	-0.133	-0.503	0.238	100.00

## Test(s) of heterogeneity:

	Heterogeneity statistic	degrees of freedom	P	I-squared**	Tau-squared
DN vs CS	77.56	5	0.000	93.6%	0.3037
DN vs SN	70.89	6	0.000	91.5%	0.1437
Overall	352.23	12	0.000	96.6%	0.4030

\*\* I-squared: the variation in SMD attributable to heterogeneity)

Note: between group heterogeneity not calculated;  
only valid with inverse variance method

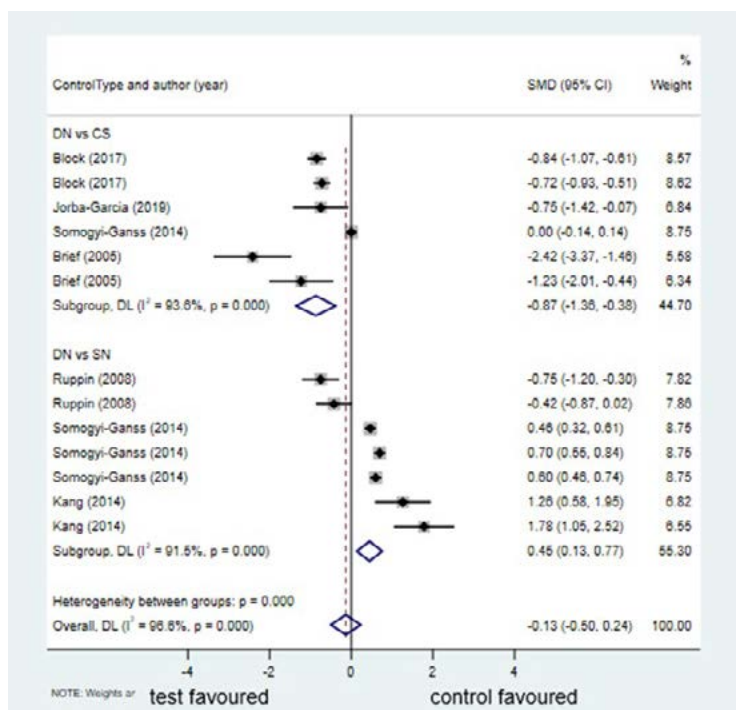
## Significance test(s) of SMD=0

DN vs CS	z= 3.46	p = 0.001
DN vs SN	z= 2.75	p = 0.006
Overall	z= 0.70	p = 0.483

*Coronal lateral deviation: forest plot*

Observing the forest plot, of which the upper portion concerns the DN vs CS comparison and the lower portion the DN vs SN comparison, it can be seen that the test, the DN, is very favored in comparison with the CS but disadvantaged when compared to the SN, with statistical significance in both comparisons (Fig. 8).





**Fig. 8.** Coronal Lateral Deviation, Forest Plot.

*Coronal depth deviation*

For the coronal depth deviation, the statistical analysis shows that there is a moderate difference (SMD = -0.408), statistically significant ( $p < 0.001$ ), in favor of Dynamic Navigation in comparison with conventional surgery. From the comparison of Dynamic Navigation vs Static Navigation, a moderate difference emerges (SMD = 0.721) in favor of Static Navigation, and this difference reaches statistical significance ( $p = 0.002$ ) (Table XII).

U. Luciano et al.

**Table XII.** Coronal Depth Deviation.

Study	SMD [95% Conf. Interval]			% Weight
<b>DN vs CS</b>				
Block (2017)	-0.521	-0.746	-0.296	29.68
Block (2017)	-0.304	-0.510	-0.099	30.01
Sub-total				
D+L pooled SMD	-0.408	-0.620	-0.195	59.69
<b>DN vs SN</b>				
Kang (2014)	0.731	0.090	1.373	20.14
Kang (2014)	0.710	0.070	1.350	20.17
Sub-total				
D+L pooled SMD	0.721	0.268	1.174	40.31
Overall				
D+L pooled SMD	0.045	-0.431	0.520	100.00

Test(s) of heterogeneity:

	Heterogeneity statistic	degrees of freedom	P	I-squared**	Tau-squared
DN vs CS	1.95	1	0.163	48.6%	0.0114
DN vs SN	0.00	1	0.963	0.0%	0.0000
Overall	23.20	3	0.000	87.1%	0.1851

\*\* I-squared: the variation in SMD attributable to heterogeneity)

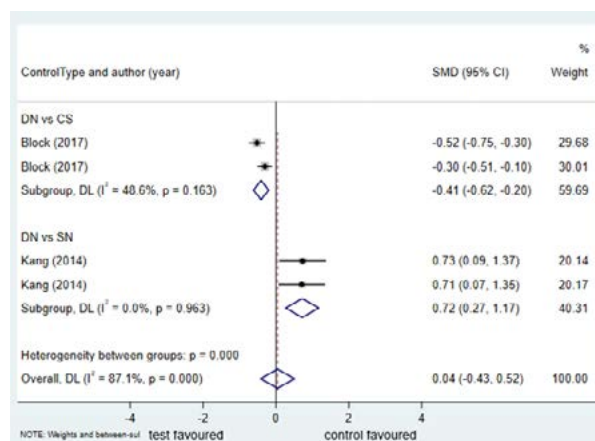
Note: between group heterogeneity not calculated; only valid with inverse variance method

Significance test(s) of SMD=0

DN vs CS	z= 3.77	p = 0.000
DN vs SN	z= 3.12	p = 0.002
Overall	z= 0.18	p = 0.854

*Coronal depth deviation, forest plot*

Observing the forest plot, of which the upper portion concerns the DN vs CS comparison and the lower portion the DN vs SN comparison, it can be seen that the test, the DN, is favoured in comparison with the CS but disadvantaged if compared to SN, with statistical significance in both comparisons (Fig. 9).

**Fig. 9.** Coronal Depth Deviation, Forest Plot.

*Lateral apical deviation*

For the lateral apical deviation, the statistical analysis shows that there is a high difference (SMD = -1.216), statistically significant (p <0.001), in favor of Dynamic Navigation in comparison with conventional surgery. From the comparison of Dynamic Navigation vs Static Navigation, a slight difference emerges (SMD = 0.289) in favor of Static Navigation, and this difference reaches statistical significance (p = 0.048) (Table XIII).

**Table XIII. Lateral Apical Deviation.**

Study	SMD [95% Conf. Interval]			% Weight
<b>DN vs CS</b>				
Block (2017)	-1.226	-1.466	-0.986	11.10
Block (2017)	-1.081	-1.296	-0.866	11.19
Somogyi-Ganss (2014)	-0.656	-0.798	-0.513	11.40
Brief (2005)	-2.312	-3.250	-1.375	7.07
Brief (2005)	-1.779	-2.633	-0.925	7.57
Sub-total				
D+L pooled SMD	-1.216	-1.603	-0.829	48.32
<b>DN vs SN</b>				
Somogyi-Ganss (2014)	-0.017	-0.156	0.122	11.41
Somogyi-Ganss (2014)	0.316	0.177	0.455	11.40
Somogyi-Ganss (2014)	-0.087	-0.226	0.052	11.41
Kang (2014)	0.730	0.089	1.371	8.91
Kang (2014)	1.428	0.730	2.126	8.55
Sub-total				
D+L pooled SMD	0.289	0.003	0.576	51.68
<b>Overall</b>				
D+L pooled SMD	-0.419	-0.818	-0.019	100.00

Test(s) of heterogeneity:					
	Heterogeneity statistic	degrees of freedom	P	I-squared**	Tau-squared
DN vs CS	33.90	4	0.000	88.2%	0.1402
DN vs SN	36.53	4	0.000	89.1%	0.0773
Overall	293.37	9	0.000	96.9%	0.3596

\*\* I-squared: the variation in SMD attributable to heterogeneity)

Note: between group heterogeneity not calculated; only valid with inverse variance method

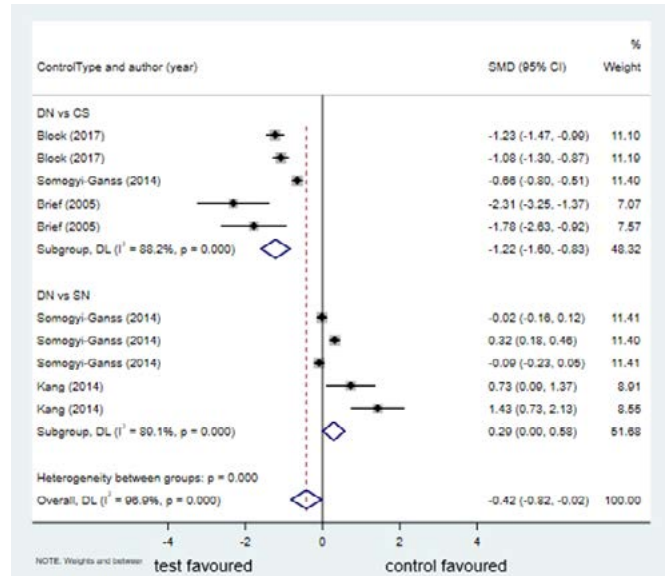
  

Significance test(s) of SMD=0		
DN vs CS	z= 6.16	p = 0.000
DN vs SN	z= 1.98	p = 0.048
Overall	z= 2.05	p = 0.040

*Lateral apical deviation: forest plot*

Observing the forest plot, of which the upper portion concerns the DN vs CS comparison and the lower portion the DN vs SN comparison, it can be seen that the test, the DN, is favoured in comparison with the CS but disadvantaged if compared to SN, with statistical significance in both comparisons (Fig. 10).

U. Luciano et al.



**Fig. 10.** Lateral Apical Deviation, Forest Plot.

#### Apical depth deviation

For the apical depth deviation, the statistical analysis shows a moderate difference (SMD = -0.577) with borderline statistical significance ( $p = 0.055$ ) in favor of Dynamic Navigation compared to conventional surgery. From the comparison of Dynamic Navigation vs Static Navigation, a slight difference emerges (SMD = -0.065) in favor of Dynamic Navigation, and this difference does not reach statistical significance ( $p = 0.673$ ) (Table XIV).

**Table XIV. Apical Depth Deviation.**

Study	SMD	[95% Conf. Interval]		% Weight
<b>DN vs CS</b>				
Block (2017)	-0.466	-0.690	-0.242	7.88
Block (2017)	-0.263	-0.468	-0.058	7.94
Sun (2020)	-3.463	-4.245	-2.681	5.00
Jorba-Garcia (2019)	0.763	0.085	1.441	5.55
Somogyi-Ganss (2014)	0.437	0.296	0.577	8.13
Brief (2005)	-1.077	-1.846	-0.307	5.06
Brief (2005)	-0.438	-1.163	0.287	5.30
Sub-total				
D+L pooled SMD	-0.577	-1.167	0.013	44.85
<b>DN vs SN</b>				
Sun (2020)	-1.924	-2.519	-1.328	6.00
Ruppin (2008)	0.000	-0.438	0.438	6.88
Ruppin (2008)	0.351	-0.091	0.793	6.86
Somogyi-Ganss (2014)	-0.013	-0.151	0.126	8.14
Somogyi-Ganss (2014)	-0.080	-0.219	0.059	8.14
Somogyi-Ganss (2014)	-0.292	-0.431	-0.152	8.13
Kang (2014)	-0.085	-0.706	0.535	5.86
Kang (2014)	1.911	1.157	2.665	5.14
Sub-total				
D+L pooled SMD	-0.065	-0.366	0.236	55.15
Overall				
D+L pooled SMD	-0.260	-0.537	0.017	100.00

Test(s) of heterogeneity:

	Heterogeneity statistic	degrees of freedom	P	I-squared**	Tau-squared
DN vs CS	149.27	6	0.000	96.0%	0.5567
DN vs SN	76.21	7	0.000	90.8%	0.1429
Overall	228.90	14	0.000	93.9%	0.2406

\*\* I-squared: the variation in SMD attributable to heterogeneity)

Note: between group heterogeneity not calculated; only valid with inverse variance method

Significance test(s) of SMD=0

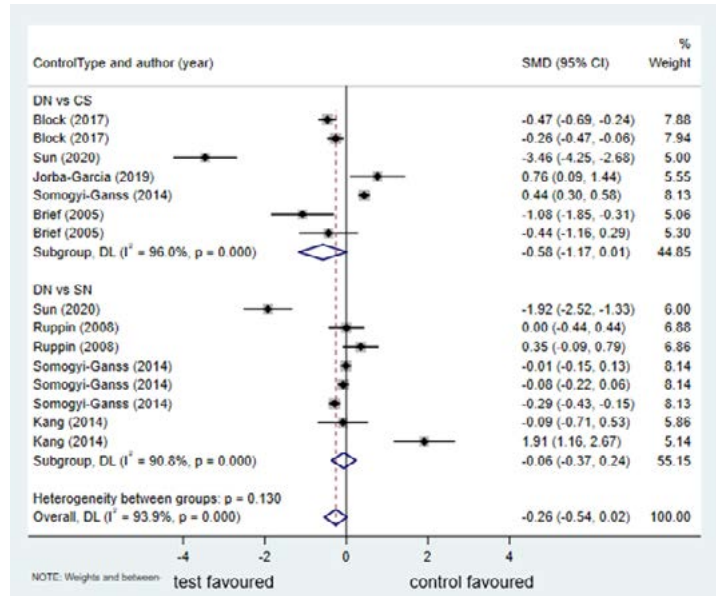
DN vs CS	z = 1.92	p = 0.055
DN vs SN	z = 0.42	p = 0.673
Overall	z = 1.84	p = 0.066

*Apical depth deviation: forest plot*

Observing the forest plot, of which the upper portion concerns the DN vs CS comparison and the lower portion the DN vs SN comparison, it can be seen that the test, the DN, is favoured in comparison with the CS and comparable to SN, although presenting a very slight difference, however not significant (Fig. 11).



U. Luciano et al.



**Fig. 11.** Apical Depth Deviation, Forest Plot.

#### Summary of Meta-analysis results

In almost all the meta-analyses, heterogeneity was found between the studies, partly reflecting the variability of the surgical experiences.

Concerning primary outcomes, using a Dynamic Navigation method allows for significantly better accuracy than conventional surgery; compared to static navigation; however, two slight differences are not statistically significant, and a moderate difference that is statistically significant, all in favor of dynamic navigation.

Regarding secondary outcomes, Dynamic Navigation is significantly more accurate than conventional surgery but less than Static Navigation, except for the Apical Depth Deviation in comparison with static navigation, which has minimal and no significant differences (Table XV).

**Table XV.** Summary of Meta-analysis results, statistically significant differences are shown in bold.

	DN vs SN		DN vs CS	
	SMD, 95%CI (p)	I2 (p)	SMD, 95%CI (p)	I2 (p)
<b>PRIMARY OUTCOMES</b>				
Total coronal deviation	-0.234, -1.055; 0.586 (p=0.576)	<b>92.5%</b> (p=0.000)	-1.650, -2.509; -0.791 (p=0.000)	<b>96.5%</b> (p=0.000)
Total apical deviation	<b>-0.556, -0.969; -0.143</b> (p=0.008)	<b>95.6%</b> (p=0.000)	-1.919, -2.482; -1.355 (p=0.000)	<b>95.5%</b> (p=0.000)
Axis angular deviation	-0.199, -0.529; 0.132 (p=0.239)	<b>93.6%</b> (p=0.000)	-2.269, -2.850; -1.688 (p=0.000)	<b>96.0%</b> (p=0.000)
<b>SECONDARY OUTCOMES</b>				
Linear coronal deviation	<b>0.449, 0.129; 0.768</b> (p=0.006)	<b>91.5%</b> (p=0.000)	-0.867, -1.358; -0.376 (p=0.001)	<b>93.6%</b> (p=0.000)
Coronal depth deviation	<b>0.721, 0.268; 1.174</b> (p=0.002)	0.0% (p=0.963)	-0.408, -0.620; -0.195 (p=0.000)	48.6% (p=0.163)
Linear apical deviation	<b>0.289, 0.003; 0.576</b> (p=0.048)	<b>89.1%</b> (p=0.000)	-1.216, -1.603; -0.829 (p=0.000)	<b>88.2%</b> (p=0.000)
Apical depth deviation	-0.065, -0.366; 0.236 (p=0.673)	<b>90.8%</b> (p=0.000)	-0.577, -1.167; 0.013 (p=0.055)	<b>96.0%</b> (p=0.000)

## DISCUSSION

From the results obtained from this meta-analysis, it can be stated that the Dynamic Navigation mode allows for better accuracy than conventional surgery, the most used type of surgery, and is comparable to Static Navigation, the gold standard for accuracy.

### Dynamic Navigation vs Conventional Surgery

Compared with conventional surgery, Surgery in Dynamic Navigation presents notable and significant differences in all the parameters taken into consideration.

In more detail, slight differences are found in the results obtained from conventional surgery (control surgery) in the two different clinical and model study settings, which appears to be slightly more accurate in model studies than at a clinical level. This difference can be traced back and explained by the fact that in the experimental setting, mainly due to the absence of saliva, blood, and soft tissue encumbrance, the notch on the drill used as a reference during the osteotomy is more easily identifiable.

### Dynamic Navigation vs Static Navigation

When considering the primary outcomes from the comparison with Static Navigation, the data show that Dynamic Navigation has better accuracy. The Total Apical Deviation shows a moderate difference in favor of Dynamic Navigation and reaches statistical significance, while the Total Coronal Deviation and the Axis Angular Deviation show slight differences in favor of Dynamic Navigation, but neither of them reaches statistical significance.

---

U. Luciano et al.

---

Regarding the different types of studies (clinical, anatomical preparation, and model studies), in all three primary outcomes, there is some agreement in the results of the different types of studies, with some exceptions (14, 17, 21).

Kang et al., in regards to the Axes Angular Deviation, clearly differs from the other studies with a clear difference in favor of Static Navigation (values comparable to the other studies for Static Navigation, the worst among all studies included for Dynamic Navigation). However, the discrepancy between the study by Kang 21 and the other studies included manifesting itself in the test (DN) and being negligible as regards the control (SN) may be partly justified by the systematics used for Dynamic Navigation, which is not among those available on the market and therefore presumably still in the experimentation phase. In some studies, the discrepancy could be attributed to the systematics used (14, 17).

In secondary outcomes, compared with Static navigation, the data show that Static Navigation has better accuracy. The Coronal Lateral Deviation presents a moderate difference in favor of the Static Navigation and reaches statistical significance, the Coronal Depth deviation presents a high difference in favor of the Static Navigation and reaches statistical significance, the apical lateral deviation presents a slight difference in favor of Static Navigation and reaches statistical significance. In contrast, the apical depth deviation presents a slight difference in favor of Dynamic navigation but does not reach statistical significance.

Since the primary outcomes favour Dynamic navigation while the secondary outcomes favour Static Navigation, it can be concluded that overall Dynamic Navigation and Static Navigation have comparable accuracy.

Furthermore, the fact that secondary outcomes show better accuracy for static navigation must be analysed, taking into consideration that the data derive mainly from anatomical preparation studies and in vitro studies and little from clinical studies since secondary outcomes were considered in only one clinical study, and detail only the apical depth. The almost total absence of the clinical component in the analysis of secondary outcomes may explain the reason for the difference found with the primary ones.

The accuracy of Static Navigation strictly depends on the stability of the surgical guide, which in turn depends on the type of edentulousness from the supporting tissue, the movements of the muscle compartment, and the thickness and resilience of the supporting tissues (24, 25). All conditions in model studies, no matter how much you try to recreate and reproduce them, do not negatively affect the performance of this navigation mode, thus resulting in better accuracy than in anatomical preparation studies and clinical studies (26). However, exactly the opposite happens for Dynamic Navigation; considering Dynamic Navigation, this trend not only does not manifest itself but also presents an opposite trend; by comparing the weighted averages obtained on the model and in the clinical setting, a better accuracy emerges in favor of clinical studies in all the parameters considered except for the Total Coronal Deviation (Table XVI).

**Table XVI.** Comparison of Dynamic Navigation results divided by study type.

	Total coronal deviation, mm	Total apical deviation, mm	Axis angular deviation, °	Lateral coronal deviation, mm	Coronal depth deviation, mm	Lateral apical deviation, mm	Apical depth deviation, mm
CLINICAL	1.23 (0.59)	1.45 (0.65)	3.41 (2)	0.78 (0.47)	0.84 (0.68)	0.97 (0.61)	0.85 (0.66)
ANATOMICAL PREPARATION	-	-	8.1 (4.75)	1.1 (0.55)	-	-	0.7 (0.5)
VITRO	0.86 (0.46)	1.50 (0.56)	3.6 (1.85)	1.21 (0.62)	0.95 (1.05)	1.30 (0.62)	1.05 (0.7)
OVERALL	1.17 (0.57)	1.47 (0.61)	3.75 (2.1)	0.98 (0.54)	0.85 (0.70)	1.12 (0.61)	0.92 (0.67)

*Comparison of Dynamic Navigation results divided by study type*

The fact that in Dynamic Navigation, the clinical data are better than the model studies can be partly explained by the fact that the clinical studies are recent and therefore report the data of systematic DNs updated and tested over time than those used in experimental settings on a model, which may still be in the process of being perfected or even prototypes. It should also be considered that using these DN systematics in the clinical setting is reserved for operators who have usually completed extra-clinical training before using them on the patient. This condition is not necessary for experimental settings based on the model and in which it can therefore be assumed that the inexperience in the use of these systematic DNs adversely affects the performance detected, in fact, the existence of a learning curve in the use of Dynamic Navigation has been demonstrated, with statistically significant differences between the measurements obtained in the first and subsequent surgical interventions (12, 27) (Table XVI).

**CONCLUSIONS**

Although this meta-analysis has limitations due to the small number of articles in the literature regarding this recent surgical technique and also due to the high heterogeneity obtained by including anatomical preparation studies and model studies, we can conclude that further clinical studies, possibly RCTs, are needed in order to make a comparison characterised by greater statistical power and better homogeneity (28-30).

Despite these limitations, based on the foregoing sections, it can be stated that the introduction and use of a Dynamic Navigation system in implantology represents a predictable and reliable surgical technique. (31-33) (Table XVI).

Compared to conventional surgery, which is still the most widespread implant placement modality, Dynamic Navigation allows for greater accuracy, which potentially translates into a lower number of intra-operative complications and more optimal prosthetic management, simplifying its steps and reducing the need to use complex and unexpected solutions that would lead to an increase in costs and times. (34-37).

When using Dynamic Navigation, a safety distance of at least 2 mm from the surrounding anatomical structures must be established and considered in the design phase, as for Static Navigation (38, 39); this is because Dynamic Navigation while allowing a high reduction of the discrepancy detected between virtual planning and real positioning, has a residual margin of error (40-42).

Compared with Static Navigation, currently the gold standard in terms of accuracy, Dynamic Navigation allows you to obtain overlapping results whose possible differences, found mainly in the secondary outcomes, remain slight and insignificant. (43, 44)

U. Luciano et al.

This minimal difference in favor of Static Navigation is, however, entirely compensated by the many advantages introduced by Dynamic Navigation; first of all, the enormous flexibility of use which, not being constrained by a rigid template (typical instead of Static Navigation), allows the surgeon the possibility to modify the rehabilitation project in the intra-operative phase and to manage the peri-implant tissues in the most suitable way for the patient's clinical situation. (45, 46)

In conclusion, although further studies are necessary to validate the cost-benefit ratio, the possible extension of operating times must also be carried out for the reasons just expressed, Dynamic Navigation is proposed, when available, as the system of the first choice in implantology, combining in a single instrument the indispensable versatility offered by conventional surgery with the accuracy typical of Static Navigation. (47, 48)

#### *Conflicts of Interest*

All the Authors confirm no conflict of interest or financial support.

#### REFERENCES

1. Moraschini V, Poubel LAC, Ferreira VF, Barboza ESP. Evaluation of survival and success rates of dental implants reported in longitudinal studies with a follow-up period of at least 10 years: A systematic review. *Int J of Oral and Maxillofac Surg* 2015; 44(3):377–88.
2. Pjetursson BE, Thoma D, Jung R, Zwahlen M, Zembic A. A systematic review of the survival and complication rates of implant-supported fixed dental prostheses (FDPs) after a mean observation period of at least 5 years. *Clin Oral Implants Res* 2012; 23(suppl 6):22–38.
3. Hämmerle CHF, Tarnow D. The etiology of hard- and soft-tissue deficiencies at dental implants: A narrative review. *J Clin Periodontol* 2018; 45(Suppl 20):S267–S277.
4. Mediavilla Guzmán A, Riad Deglow E, Zubizarreta-Macho Á, Agustín-Panadero R, Hernández Montero S. Accuracy of Computer-Aided Dynamic Navigation Compared to Computer-Aided Static Navigation for Dental Implant Placement: An In Vitro Study. *J Clin Med* 2019; 8(12):2123.
5. Herklotz I, Beuer F, Kunz A, Hildebrand D, Happe A. Navigation in implantology. *Int J Comput Dent* 2017; 20(1): 9–19.
6. Moher D, Liberati A, Tetzlaff J, Altman DG, PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *PLoS Med* 2009; 6(7):e1000097.
7. Milner KA, Cosme S. The PICO Game: An Innovative Strategy for Teaching Step 1 in Evidence-Based Practice. *Worldviews Evid Based Nurs* 2017; 14(6):514–516.
8. Higgins JPT, Thompson SG. Quantifying heterogeneity in a meta-analysis. *Stat Med* 2002; 21(11):1539–58.
9. DerSimonian R, Laird N. Meta-analysis in clinical trials. *Control Clin Trials* 1986; 7(3):177–88.
10. Egger M, Smith GD, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. *BMJ* 1997; 315(7109):629–34.
11. Kaewsiri D, Panmekiate S, Subbalekha K, Mattheos N, Pimkhaokham A. The accuracy of static vs. dynamic computer-assisted implant surgery in single tooth space: A randomised controlled trial. *Clin Oral Implants Res* 2019; 30(6):505–514.
12. Block MS, Emery RW, Cullum DR, Sheikh A. Implant Placement Is More Accurate Using Dynamic Navigation. *J Oral and Maxillofac Surg* 2017; 75(7):1377–1386.
13. Yimarj P, Subbalekha K, Dhanesuan K, Siriwatana K, Mattheos N, Pimkhaokham A. Comparison of the accuracy of implant position for two-implants supported fixed dental prosthesis using static and dynamic computer-assisted implant surgery: A randomised controlled clinical trial. *Clin Implant Denti Relat Res* 2020; 22(6):672–678.
14. Sun TM, Lee HE, Lan TH. Comparing accuracy of implant installation with a navigation system (NS), a laboratory guide (LG), NS with LG, and free-hand drilling. *Int J Environ Res Public Health* 2020; 17(6):2107.



15. Aydemir CA, Arisan V. Accuracy of dental implant placement via dynamic navigation or the free-hand method: A split-mouth randomised controlled clinical trial. *Clin Oral Implants Res* 2020; 31(3):255–263.
16. Ruppin J, Popovic A, Strauss M, Spüntrup E, Steiner A, Stoll C. Evaluation of the accuracy of three different computer-aided surgery systems in dental implantology: Optical tracking vs. stereolithographic splint systems. *Clin Oral Implants Res* 2008; 19(7):709–16.
17. Zhou M, Zhou H, Li SY, Zhu YB, Geng YM. Comparison of the accuracy of dental implant placement using static and dynamic computer-assisted systems: an in vitro study. *J Stomatol Oral Maxillofac Surg* 2021; 122(4):343–348.
18. Jorba-García A, Figueiredo R, González-Barnadas A, Camps-Font O, Valmaseda-Castellón E. Accuracy and the role of experience in dynamic computer guided dental implant surgery: An in-vitro study. *Med Oral Patol Oral Cir Bucal* 2019; 24(1):e76–e83.
19. Chen CK, Yuh DY, Huang RY, Fu E, Tsai CF, Chiang CY. Accuracy of Implant Placement with a Navigation System, a Laboratory Guide, and Freehand Drilling. *Int J Oral Maxillofac Implants* 2018; 33(6):1213–1218.
20. Somogyi-Ganss E, Holmes HI, Jokstad A. Accuracy of a novel prototype dynamic computer-assisted surgery system. *Clin Oral Implants Res* 2015; 26(8):882–890.
21. Kang SH, Lee JW, Lim SH, Kim YH, Kim MK. Verification of the usability of a navigation method in dental implant surgery: In vitro comparison with the stereolithographic surgical guide template method. *J Cranio-Maxillofac Surg* 2014; 42(7):1530–5.
22. Hoffmann J, Westendorff C, Gomez-Roman G, Reinert S. Accuracy of navigation- guided socket drilling before implant installation compared to the conventional free-hand method in a synthetic edentulous lower jaw model. *Clin Oral Implants Res* 2005; 16(5):609–14.
23. Brief J, Edinger D, Hassfeld S, Eggers G. Accuracy of image-guided implantology. *Clin Oral Implants Res* 2005; 16(4), 495–501.
24. Tahmaseb A, Wu V, Wismeijer D, Coucke W, Evans C. The accuracy of static computer-aided implant surgery: A systematic review and meta-analysis. *Clin Oral Implants Res* 2018; 29(Suppl 16):416–435.
25. Tahmaseb A, Wismeijer D, Coucke W, Derksen W. Computer Technology Applications in Surgical Implant Dentistry: A Systematic Review. *Int J Oral Maxillofac Implants* 2014; 29(Suppl):25–42.
26. Bover-Ramos F, Viña-Almunia J, Cervera-Ballester J, Peñarrocha-Diago M, García-Mira B. Accuracy of Implant Placement with Computer-Guided Surgery: A Systematic Review and Meta-Analysis Comparing Cadaver, Clinical, and In Vitro Studies. *Int J Oral Maxillofac Implants* 2018; 33(1):101–115.
27. Stefanelli L, DeGroot B, Lipton D, Mandelaris G. Accuracy of a Dynamic Dental Implant Navigation System in a Private Practice. *Int J Oral Maxillofac Implants* 2019; 34(1):205–213.
28. Barone A, Toti P, Bertossi D, Marconcini S, De Santis D, Nocini PF, Iurlaro A, Alfonsi F, Covani U. Gene Expression of Human Mesenchymal Stem Cells Cultured on Titanium Dental Implant Surfaces. *J Craniofac Surg* 2016; 27(3):712-7.
29. Bertossi D, Fiorino P, Corega C, Sbricoli L, De Santis D, Donadello D, Ricciardi G, Luciano U, Bressan E, Pardo A, Albanese M, Zangani A. Cone-beam volumetric imaging in craniofacial medicine. *Minerva Stomatol* 2019; 68 (4):200-212.
30. Corega C, Vaida L, Festila DG, Rigoni G, Albanese M, D'Agostino A, Nocini PF, Bertossi D, Pardo A, Marconcini S, Gelpi F. Blood levels of interleukins in patients with ameloblastoma. *Minerva Stomatol* 2013; 62:23-26.
31. Bertossi D, Nocini R, Luciano U, et al. Piezoelectric surgery inserts vs conventional burst: a clinical investigation. *J Biol Regul Homeost Agents* 2018; 32(2 Suppl 2):15-19.
32. Corega C, Vaida L, Festila DG, et al. The benefits of Quercetin for dentistry and maxillofacial surgery: a systematic review [published online ahead of print, 2014 Jan 14]. *Minerva Stomatol* 2014.
33. De Santis D, Graziani P, Castellani R, et al. A New Radiologic Protocol and a New Occlusal Radiographic Index for Computer-Guided Implant Surgery. *J Craniofac Surg* 2016; 27(5):e506-10.
34. Genovesi AM, Lorenzi C, Lyle DM, et al. Periodontal maintenance following scaling and root planing. A randomised single-center study comparing minocycline treatment and daily oral irrigation with water [published online ahead of print, 2014 Jan 14]. *Minerva Stomatol* 2014.

---

U. Luciano et al.

---

35. Lombardo G, Pardo A, Signoretto C, Signoriello A, Simeoni E, Rovera A, Nocini PF. Hyperbaric oxygen therapy for the treatment of moderate to severe periodontitis: a clinical pilot study. *Undersea Hyperb Med* 2020; 47 (4):571-580.
36. Corega C, Vaida L, Festila DG, et al. Dental white spots associated with bulimia nervosa in orthodontic patients [published online ahead of print, 2014 Jan 14]. *Minerva Stomatol* 2014.
37. De Santis D, Sinigaglia S, Pancera P, et al. An overview of guided bone regeneration. *J Biol Regul Homeost Agents* 2019; 33(1 Suppl. 1):49-53.
38. Gelpi F, Romoli L, D'Arienzo D, et al. Lateral periodontal cyst (LPC) mimicking periodontal socket in a young patient: Report of a case and review of the literature [published online ahead of print, 2014 Jan 14]. *Minerva Stomatol* 2014.
39. Lombardo G, Signoretto C, Corrocher G, et al. A topical desiccant agent in association with ultrasonic debridement in the initial treatment of chronic periodontitis: A clinical and microbiological study. *New Microbiol* 2015; 38(3):393-407.
40. De Santis D, Sinigaglia S, Pancera P, et al. An overview of socket preservation. *J Biol Regul Homeost Agents* 2019; 33(1 Suppl. 1):55-59.
41. Lombardo G, Signoriello A, Corrocher G, Signoretto C, Burlacchini G, Pardo A, Nocini PF. A topical desiccant agent in association with manual debridement in the initial treatment of peri-implant mucositis: A clinical and microbiological pilot study. *Antibiotics (Basel)* 2019; 8(2):82.
42. Marconcini S, Barone A, Perrini N, et al. Conservative treatment of unicystic odontogenic keratocyst by piezosurgery approach. A case report [published online ahead of print, 2014 Jan 14]. *Minerva Stomatol* 2014.
43. Nocini PF, De Santis D, Ferrari F, Bertele GP. A Customised Distraction Device for Alveolar Ridge Augmentation and Alignment of Ankylosed Teeth. *Int J Oral and Maxillofa Implants* 2004; 19(1):133-44.
44. Pardo A, Signoriello A, Signoretto C, et al. Detection of periodontal pathogens in oral samples and cardiac specimens in patients undergoing aortic valve replacement: A pilot study. *J Clin Med* 2021; 10(17):3874
45. Marconcini S, Genovesi AM, Marchisio O, et al. In vivo study of titanium healing screws surface modifications after different debridement procedure [published online ahead of print, 2014 Jan 14]. *Minerva Stomatol* 2014.
46. Pedullà E, Plotino G, Scibilia M, et al. Cyclic fatigue comparison among endodontic instruments with similar cross section and different surface coating. *Minerva Stomatol* 2019; 68(2):67-73.
47. Pellegrino G, Taraschi V, Zacchino A, Ferri A, Marchetti C. Dynamic navigation: a prospective clinical trial to evaluate the accuracy of implant placement. *Int J Comput Dent* 2019; 22(2):139-147.
48. Ricci M, Marchisio O, Genovesi AM, et al. Comparison between oscillating-twisting rotating of brush head vs a characteristic sweeping bristles motion on reducing oral inflammation [published online ahead of print, 2014 Jan 14]. *Minerva Stomatol* 2014.

*Review*

## **Could digital workflow replace the conventional? A narrative review**

A. Zangani, F. Gelpi, P. Faccioni, U. Luciano, A. Pardo, F. Melloni, T. Zambotti,  
C. Alberti and N. Zerman

*Head and Neck Department, Department of Surgery, Dentistry, Pediatrics and Gynecology,  
University of Verona, Verona, Italy*

---

*Corresponding author:*

Dr. Alessandro Zangani,  
Department of Dentistry and Maxillo-Facial Surgery,  
University of Verona, Policlinico G. B. Rossi,  
Piazzale I. Scuro 10,  
37134, Verona, Italy  
Tel.: +39.045.8126589  
e-mail: [alessandro.zangani@aovr.veneto.it](mailto:alessandro.zangani@aovr.veneto.it)

**Keywords:** *workflow, prosthodontics, computer-aided design, dentistry, dental implants*

Received: 20 July 2022  
Accepted: 9<sup>th</sup> November 2022

Copyright:  
Journal of Applied Cosmetology ©2023  
[www.journalofappliedcosmetology.com](http://www.journalofappliedcosmetology.com)  
Copyright © by Journal of Applied Cosmetology

ISSN 2974-6140 (online) ISSN 0392-8543 (print).

This publication and/or article is for individual use only and may not be further reproduced without written permission from the copyright holder. Unauthorized reproduction may result in financial and other penalties  
**DISCLOSURE: ALL AUTHORS REPORT NO CONFLICTS OF INTEREST RELEVANT TO THIS ARTICLE.**

## ABSTRACT

**In the last ten years, digital technologies have conditioned our lives in many ways. Also, in dentistry, new inventions changed our working routine, accompanying the clinician from the analogic epoch to the digital. A fully digital workflow seems to be very promising in terms of less discomfort for the patients and less time needed to make an impression than the traditional method. However, many aspects still need to be investigated, such as the procedure's complexity, the optical impression's reliability, the precision of the CAD-CAM-made crown, the costs, and the time needed to deliver a final crown. This review aims to understand, analyzing some RCT studies, whether a digital workflow is reliable compared to the analogic.**

## INTRODUCTION

In the last years, digital Technologies have become part of our lives to the point of conditioning the timing and how we communicate with each other. Nowadays, it would be unthinkable to work without any electronic device, whether a computer, a smartphone, or a tablet, since such devices allow us to store and share a significant amount of fundamental data for our activities.

In dentistry, digital progress has been principally developed in CAD/CAM systems and imaging systems. Computer-aided design (CAD) systems and computer-aided manufacturing systems were initially developed in 1950 by the American Air Force to design automotive and aeroplane components. After three decades, this technology was also applied to dentistry when Francois Duret developed the first CAD/CAM dentistry device, which was substantially made by an optical device for the impression and a numerically controlled milling machine (1).

Werner Mormann developed the CEREC System, the first commercially available chairside CAD/CAM system for dentistry, and it allowed delivery of a fixed final crown in a few hours (2). The first chairside treatment made with CEREC was executed in 1985 at the Zurich Dental School and the fact that this system allowed the clinician to deliver a fixed final ceramic crown the same day as the impression was revolutionary (3-7).

Nowadays, the CEREC system is largely used worldwide, and with the progress of technology, it has become a predictable and accessible workflow system. The evolution of dentistry digital imaging started with the invention of CBCT (8) and culminated 10 years ago with the invention of optical scanners.

The intraoral optical scanners allow the clinician to take a direct impression by projecting a light source onto the teeth and soft tissues of the mouth (9, 10). The image is captured by high-resolution cameras and processed by powerful software that produces a 3D digital model (11, 12). It allows the clinician to avoid the traditional plaster models and to have, in a few minutes, a digital model that replicates dentogingival tissues (13, 14).

There are many different types of optical impressions systems; the most common ones on the market are Trios 3, 4, 5(3Shape), iTERO Element 2, iTERO 5d Element (Align Technology), CS3800 (Carestream), Panda P2 (Pengtum technologies), Medit i700 (Medit Corporation), Planmeca Emerald S (Planmeca), Cerec Omnicam (Dentsply Sirona).

Each scanner has specific characteristics; comparative studies comparing different scanners have been performed, such as the one performed by Pokpong Amornvit, Dinesh Rokaya and Sasiwimol Sanohkan: "Comparison of Accuracy of Current Ten Intraoral Scanners" (15). In this study, a maxilla model was scanned with different scanners and measurements were taken on the respective STL files in the X, Y, Z and XY axes.

A. Zangani et al.

According to the study, the greater the distance the scanner travels, the lower the accuracy and the greater the error. The precision in this study appears similar for all the scanners analyzed, while the trueness value varies, showing that Trios 3 and 4 from 3Shape reported better results than the others in both categories.

Other studies comparing the various optical impression systems include, for example, Miran Kwon and Coll's "Full-arch accuracy of five intraoral scanners: In vivo analysis of trueness and precision" (16) from which, comparing trueness and precision values, concludes that in the two categories the one that seems to perform better still turns out to be Trios 3.

The analysis conducted by Walter Renne, "Evaluation of the accuracy of 7 digital scanners: An *in vitro* analysis based on 3-dimensional comparisons" (17), shows that regarding trueness values for the full-arch, the best performance was recorded by D800 (3Shape), followed by iTero (Align Technology), TRIOS 3 (3Shape), followed by the others.

Regarding Precision values in full-arch scanning, the best scanner was CS3500 (Carestream), then iTero (Align Technology), then TRIOS3 (3Shape) and then all others. On the other hand, the most accurate and truthful scanner for posterior sextant scanning was the CS3500 (Carestream), while for full-arch scan, TRIOS3 (3Shape) offers the best compromise between scanning speed and accuracy.

The traditional impression technique could sometimes be very uncomfortable for patients, especially those with strong gag reflexes (18-20). On the contrary, the optical impression is well tolerated by the patients, and sometimes it could also be easier for the clinician (18, 21, 22). Once the 3D model is obtained, it can be used by the technician to project and model a prosthesis, a provisional and final crown or bridge, a Toronto bridge, a bite, a surgical or radiological guide and so on.

One of the most widely used software is Exocad's Dental Cad software, which allows for most designs, from custom abutments, screw-retained bridges, simple and complex bars, monolithic zirconia crowns, metal copings, esthetic veneers and more (23). When the technician completes the projecting phases, the STL file can be sent to a CAM milling machine or a 3D printer to obtain the final physical product.

A fully digital workflow seems advantageous for patients and clinicians, but it is a relatively new way of working, and we are still trying to understand the limits of this technique. Therefore, this review aims to investigate those aspects that could be critics in making a prosthetic rehabilitation using a fully digital workflow compared to the traditional, analyzing data from four specific articles in which these protocols had been examined.

The secondary aim is to provide unbiased information about a new digital way of working, analyzing features such as operative times, prosthetic success rate, costs, patient satisfaction and more.

An overview of the advantages and disadvantages of both traditional and digital workflow will be provided, helping the reader understand the clinical situations in which a digital workflow can be used successfully. This article wants to analyze the available data about these technologies impartially, obtaining some clear indications about their use in clinical practice.

#### *Design of the review*

The digital workflow is a current argument in research, one of the first articles about digital workflow making CAD-CAM references was written by Dennis J Fasbinder in 2010 (24). In the last twelve years, reviews have been written to clarify this new workflow's positive and negative aspects, sometimes showing discordant outcomes.

This paper aims to indagate the argument by analyzing data of RCT studies and trying to track a common line to shed light on the present and future of restorative and prosthodontic dentistry.



For this review, PubMed research has been conducted using the keywords “digital” AND “crown” and selecting RCT as an option. The research produced 100 articles which were reduced to 20 after selecting “full-text”. Articles published before 2015 were excluded from this review to obtain updated data about the topic.

Only articles with a good level of evidence were selected. Four articles were chosen from the twenty after reading the abstract, following homogeneity criteria. The selected articles strictly dealt with the topic and provided valuable data in accordance with the aims of this study.

We opted to do a narrative review, analyzing aspects that could be more critical for clinicians and patients. The most important findings of the articles selected for the present study were analyzed and reported in the review. The focus of this review is to answer simple questions that clinicians could ask before approaching these new techniques:

- Is the digital workflow equally efficient compared to the analogic one?
- Does the digital workflow have fewer working and crafting prosthesis times than the analogic workflow?
- How do the patients perceive the optical impression compared to the traditional one?
- What kind of technique do the clinicians and technicians prefer?
- Is the quality of the prosthesis comparable?
- Does the cost of the prosthesis decrease for the clinician using a digital workflow?
- Are there more complications using a digital workflow compared to the analogic workflow?

## RESULTS

### *First article*

To answer these questions, we analyzed four articles: the first one was written in 2018 by Francesco Mangano: “Digital versus Analog Procedures for the Prosthetic Restoration of Single Implants: A Randomized Controlled Trial with 1 Year of Follow-Up” (25).

This RCT study compares a digital workflow to an analogic workflow in single implant restoration. The population was made of 50 patients, 22 male and 28 female, with an average age of 52, divided with randomization into two groups of 25, the test and control groups. Both groups were treated with single-implant prosthetic crowns. The test group was treated with a monolithic zirconia crown following a digital workflow; the control group was treated with a single ceramic-steel crown following the analogic workflow instead.

After a one-year follow-up, no patient dropped out of the study, and the success rate was 92% for both groups. The test group recorded a percentage of biological and prosthetic complications of 4%, while the control group had 8% of biological complications but no prosthetic complications. Both groups showed a prosthetic success rate of 92% without any statistically significant difference between them. Also, in the case of marginal bone loss, no differences between the groups were recorded, with a total value of  $0.47 \pm 0.31$  mm.

Patient satisfaction was evaluated with a VAS scale, and during the impression procedure, patients considered the optical impression more comfortable than the traditional one, with fewer gagging and nausea episodes. However, no differences were observed in comfort during the restoration phase.

The digital workflow received a higher rating in treatment times (average difference in VAS: +16,  $p < 0.0001$ ) and costs (+9.2,  $p = 0.01$ ). For the esthetic results, there were no differences between the two groups. However, the VAS total score showed a statistically significant difference in favour of digital workflow (+ 9.9,  $p < 0.0001$ ).

To take an optical impression requires less time than the analogic one made with the double impression technique, which requires more than double the time ( $20 \pm 5$ min versus  $50 \pm 7$ min;  $p < 0.0001$ ). When

A. Zangani et al.

calculating the active working time for the dental technician, the workflow in the test group was more efficient than that of the control group for both the provisional ( $70 \pm 15$  min versus  $340 \pm 37$  min;  $p < 0.0001$ ) and the final crown ( $29 \pm 9$  min versus  $260 \pm 26$  min;  $p < 0.0001$ ). There were no differences in the delivery times.

The realization cost of a final zirconia crown with a digital workflow was Euro 277.3, whereas a ceramic-steel final crown made with a traditional analogic workflow was Euro 392.2.

In analyzing this article, a digital workflow seems to be more advantageous in terms of comfort for the patient, working times and costs. Regarding impression times, such a big difference between the two groups could be due to the double impression technique used for the control group. This data contrasts with other works, and using a different technique, such as a polyether mono-impression, could significantly reduce the traditional impression times.

#### *Second article*

The title of the second article analyzed was “Randomized controlled clinical trial of digital and conventional workflows for the fabrication of zirconia-ceramic fixed partial dentures.

Part I: Time efficiency of complete-arch digital scans versus conventional impressions”: it included a small population of 10 patients needing a posterior tooth-supported 3-unit FPD (26). The clinical treatments were performed by 3 calibrated clinicians (I.S., G.B., S.M.) experienced with digital scanners and ceramic CAD-CAM prostheses. For each patient, the clinicians used three digital scanners (iTero, Cerec and Lava) and one conventional impression.

The results showed that the full-arch conventional impression took less time than the intraoral scanner. The difference was statistically significant for two of the three scanners, iTero and Cerec; moreover, using Cerec took more time than the other two systems. The scanning had to be repeated three times with the Lava scanner and seven times with iTero, while the conventional impression was only made once.

When the VAS value was assessed, the patients and the clinician evaluated the digital scanner less comfortably than the conventional impression; in particular, they found scanners that required powder during the procedure more complex than the others. However, the patients generally did not express any preference between the different impression methods.

The clinician preferred traditional impressions to digital ones and impressions without using powder to the ones with powder. In this study, data regarding the timing of the procedures are opposite to the results of the first study.

#### *Third article*

The third article examined is an RCT (27) which analyzes the prosthetic implant restoration of single implant tissue level Straumann RN, comparing the optical impression to the analogical one, using polyether. Again, 32 patients underwent rehabilitation, and a total of 32 implants were used: 23 for the test group and 22 for the control group.

Twenty-one patients received a single crown, 9 patients two crowns and 2 patients 3 crowns. In 9 of the 23 patients in the test group (39.1%) and 2 of the 22 patients in the control group (18.2%), fitting was adequate and did not require modifications. Fourteen crowns in the test group and 18 in the control group required modifications before being placed in the mouth. The time used by the clinician to modify the crown went from 3 to 11 minutes (mean = 3.35 min) in the test group and from 2 to 18 minutes (mean = 6,09 min) in the control group.

During the first year of loading, two complications occurred to the same implant in the control group. In the test group, one biological complication developed after three months of loading, leading to implant mobility with no signs of inflammation.

The results of this study show that a try-in of a CAD-CAM solitary screw-retained monolithic zirconia implant restoration needs shorter adjustment times than the conventional for the same restoration type and exhibit low complication rates and higher survival rate on the short-term (one-year follow-up).

#### *Fourth article*

The fourth study reviewed is an RCT titled “Digital vs conventional workflow for one-abutment one-time immediate restoration in the esthetic zone: a randomized controlled trial” (28). The article analyzes the short-term outcomes of single implants in esthetic areas in 18 patients, using the technique “one abutment, one time” and comparing a conventional workflow (analogical) to a fully digital workflow.

In the study, the impressions were made using alginate and 3Shape (TRIOS®, Denmark) for each patient; then the patients got CBCT scan, and the STL files from the digital impression were imported and merged in DicoDiagnostiX® software. The implant positioning was planned using this software.

The test group used the CARES software to do a digital tooth setup. The setup was combined with the initial planning, modifying the position of the implant to have a prosthetic-favourable final position. A fully guided drill guide was ordered at the end of the planning phase. The technician, guided by the previous planning, created a custom-made zirconia abutment and a provisional prosthesis in PMMA CAD-CAM, which were then used on the day of the surgery. Moreover, the technician built a silicon verification key on the surgical guide’s buccal side so it was possible to verify the implant position during its placement.

In the control group, orthocryl free-hand surgical guides based on a conventional wax-up were performed, and the technicians created an individual impression tray. During surgery, the consecutive drills of the implantation procedure were carried through the free-hand guide to position the implant according to the prosthodontic planning. A precision impression was then taken using the individual impression tray immediately after the implant insertion. Using the impression taken after the surgery, the technician planned a final zirconia abutment using the diagnostic wax-up. Following this phase, a PMMA-stratified provisional crown was produced.

#### *Surgical results*

In the control group, the insertion of the conventional guide was possible for every patient with no modifications; in the test group, the surgical guide needed modifications in order to be fitted. The higher deviation in the entrance site was 1.13 mm in the test group’s surgical guide, which was modified later. In one case, the clinician had to change the height of the implant due to a standard deviation of 2mm in the vertical dimension.

The global apical deviation (GAD) was significantly higher in the control group compared to the test group ( $p = 0.014$ ). In addition, significant differences were observed for the Angular deviation ( $p = 0.014$ ) and the Apical vestibular deviation ( $p = 0.038$ ) in favor of the fully guided surgery.

No significant differences were registered regarding the Coronal global deviation, Coronal distal deviation, Coronal vestibular deviation, Coronal apical deviation, Apical distal deviation, and Apical deviation.

All the implants obtained primary stability, a 15Nm torque was used for all the custom-made zirconia abutments, and all the provisional prostheses were inserted right after the surgery in the test group and after 10 days in the control group. There were no statistically significant differences between the two groups concerning occlusion and interproximal contacts; the two groups both required occlusal modifications in almost half of the patients.

The White Esthetic Score (WES) showed no significant difference between the two groups, even though the scoring was not higher in the group with the conventional stratified provisional crown. However, the PES

A. Zangani et al.

score tended to be higher in the test group. In terms of soft tissue colour and texture, the values of “2” were recorded for all patients in the test group, while the proportion of score “2” was 44.4% in the control group ( $p = 0.029$ , respectively).

The satisfaction scores were similar between the groups, except for the comfort during the polyether impression (control group) vs digital impression (test group); the digital impression was found to be significantly more comfortable compared to the conventional one ( $p = 0.014$ ). No statistical differences were registered in the esthetic VAS in the two groups. Both methods showed the authors registered satisfactory results and no statistically significant differences in the outcome regarding esthetics. The patients preferred the optical impression to the conventional polyether one, as the previous one caused less discomfort.

## DISCUSSION

In the past two decades, dentistry has made great strides in evolution in both techniques and materials (29-48), nowadays increasing number of clinicians use the optical impression in their office, choosing the digital workflow for many reasons. From these studies, we deduce that in terms of aesthetics and reliability of the final crown, there are no differences between digital and analogic workflow, which also concerns the need for occlusal and interproximal modification in the delivery appointment.

There were no differences between the two groups in the post-delivery prosthetic complications. For what concerns the times needed for the impression, there is a certain discrepancy of data and, in our opinion, it depends a lot on the conventional impression technique used for the comparison; however, it seems to be easier to take the impression using a scanner without the necessity of the powder.

A fully digital workflow seems to be more efficient for the realization of the final crown, showing shorter times in the crafting process. The costs of a final crown made using a fully digital workflow seem less expensive for the clinician compared to the analogic.

The patient, except for the second article, appears to prefer the optical impression compared to the traditional one, mainly because of a less gagging and nausea episodes, whereas there are still contrasting opinions among the clinicians, and it might depend on the dexterity in using the new technique.

These data agreed with recently published systematic reviews such as “3D Digital Impression Systems Compared with Traditional Techniques in Dentistry: A Recent Data Systematic Review” by Marco Cicciù et al. (49), in which, in addition to what has already been said, there is evidence of greater ease of use of the optical impression for students than for established professionals, this may be due to the unwillingness of those professionals, who have been used to working in a certain way for so long, to change.

### *Limitations*

Since digital workflow was introduced in dentistry not years ago, only a few data about these new technologies are available in the literature. Moreover, the high cost of the equipment makes it even more challenging to design clinical studies that provide data with a high level of evidence.

Extended research that includes a larger number of reliable studies should be conducted in the future when more knowledge about these technologies will be acquired, and the use of the equipment will be extended in clinical practice.

This paper has not considered all the techniques that could be used for digital workflow; however, interesting recent reviews, such as that of Lavorgna et al. (50), does compare the values obtained with different optical impression systems and the photo-detection system on which Digital Smile Design is based.

## CONCLUSIONS

The use of the optical impression undoubtedly required a learning curve to optimize times and avoid making the same impression many times. However, even with some critical points, such as powder use, the optical impression seems reliable and precise, especially for single or small implant-supported bridges.

From the analysis of these papers, we can conclude that, for what concerns fixed implant-supported prosthesis, a digital workflow showed promising results. However, the limits of these methods are the powder's use and the time needed to take an impression.

A digital workflow is a viable alternative to the traditional workflow; it seems to work better for some treatments than others. However, there is still a conflicting opinion in the literature and among clinicians about its applicability and benefits in daily clinical practice.

It will undoubtedly be interesting to carry out new research in the future, also trying to create large databases to enter all the various digital data collection systems and compare them with each other in order to highlight the strengths and weaknesses of each.

## REFERENCES

1. Duret F, Blouin JL, Duret B. CAD-CAM in dentistry. *J Am Dent Assoc* 1988; 117(6):715-720.
2. Mormann WH, Brandestini MLF. The Cerec system: computer-assisted preparation of direct ceramic inlays in 1 setting. *Quintessenza* 1987; 38:457-70.
3. Mörmann WH. The evolution of the CEREC system. *J Am Dent Assoc* 2006; 137 Suppl(9 SUPPL.).
4. Miyazaki T, Hotta Y, Kunii J, Kuriyama S, Tamaki Y. A review of dental CAD/CAM: current status and future perspectives from 20 years of experience. *Dent Mater J* 2009; 28(1):44-56.
5. Miyazaki T, Hotta Y. CAD/CAM systems available for the fabrication of crown and bridge restorations. *Aust Dent J* 2011; 56 Suppl 1(SUPPL. 1):97-106.
6. Van Noort R. The future of dental devices is digital. *Dent Mater* 2012; 28(1):3-12.
7. Davidowitz G, Kotick PG. The use of CAD/CAM in dentistry. *Dent Clin North Am* 2011; 55(3):559-570.
8. Bertossi D, Fiorino P, Corega C, et al. Cone-beam volumetric imaging in craniofacial medicine. *Minerva Stomatol* 2019; 68(4):200-212.
9. Zimmermann M, Mehl A, Mörmann WH, Reich S. Intraoral scanning systems - a current overview. *Int J Comput Dent* 2015; 18(2):101-129.
10. Martin CB, Chalmers E V., McIntyre GT, Cochrane H, Mossey PA. Orthodontic scanners: what's available? *J Orthod* 2015; 42(2):136-143.
11. Ting-shu S, Jian S. Intraoral Digital Impression Technique: A Review. *J Prosthodont* 2015; 24(4):313-321.
12. Logozzo S, Zanetti EM, Franceschini G, Kilpelä A, Mäkynen A. Recent advances in dental optics – Part I: 3D intraoral scanners for restorative dentistry. *Opt Lasers Eng* 2014; 54:203-221.
13. Imburgia M, Logozzo S, Hauschild U, Veronesi G, Mangano C, Mangano FG. Accuracy of four intraoral scanners in oral implantology: a comparative in vitro study. *BMC Oral Health* 2017; 17(1).
14. Aragón MLC, Pontes LF, Bichara LM, Flores-Mir C, Normando D. Validity and reliability of intraoral scanners compared to conventional gypsum models measurements: a systematic review. *Eur J Orthod* 2016; 38(4):429-434.
15. Amornvit P, Rokaya D, Sanohkan S. Comparison of Accuracy of Current Ten Intraoral Scanners. *Biomed Res Int* 2021; 2021:2673040
16. Kwon M, Cho Y, Kim DW, Kim M, Kim YJ, Chang M. Full-arch accuracy of five intraoral scanners: In vivo analysis of trueness and precision. *Korean J Orthod* 2021; 51(2):95-104.
17. Renne W, Ludlow M, Fryml J, et al. Evaluation of the accuracy of 7 digital scanners: An in vitro analysis based on 3-dimensional comparisons. *J Prosthet Dent* 2017; 118(1):36-42.
18. Yuzbasioglu E, Kurt H, Turunc R, Bilir H. Comparison of digital and conventional impression techniques:



A. Zangani et al.

- evaluation of patients' perception, treatment comfort, effectiveness and clinical outcomes. *BMC Oral Health* 2014; 14(1).
19. Wismeijer D, Mans R, van Genuchten M, Reijers HA. Patients' preferences when comparing analogue implant impressions using a polyether impression material versus digital impressions (Intraoral Scan) of dental implants. *Clin Oral Implants Res* 2014; 25(10):1113-1118.
  20. Means CR, Flenniken IE. Gagging--a problem in prosthetic dentistry. *J Prosthet Dent* 1970; 23(6):614-620.
  21. Park HR, Park JM, Chun YS, Lee KN, Kim M. Changes in views on digital intraoral scanners among dental hygienists after training in digital impression taking. *BMC Oral Health* 2015; 15(1).
  22. Joda T, Brägger U. Time-Efficiency Analysis Comparing Digital and Conventional Workflows for Implant Crowns: A Prospective Clinical Crossover Trial. *Int J Oral Maxillofac Implants* 2015; 30(5):1047-1053.
  23. EXOCAD. No Title. <https://exocad.com/our-products/exocad-dentalcad>. Accessed November 7, 2022.
  24. Fasbinder DJ. Digital dentistry: innovation for restorative treatment. *Compend Contin Educ Dent* 2010; 31 Spec No 4:2-11.
  25. Mangano F, Veronesi G. Digital versus Analog Procedures for the Prosthetic Restoration of Single Implants: A Randomized Controlled Trial with 1 Year of Follow-Up. *Biomed Res Int* 2018; 2018:5325032.
  26. Sailer I, Mühlemann S, Fehmer V, Hämmerle CHF, Benic GI. Randomized controlled clinical trial of digital and conventional workflows for the fabrication of zirconia-ceramic fixed partial dentures. Part I: Time efficiency of complete-arch digital scans versus conventional impressions. *J Prosthet Dent* 2019; 121(1):69-75.
  27. Derksen W, Tahmaseb A, Wismeijer D. Randomized Clinical Trial comparing clinical adjustment times of CAD/CAM screw-retained posterior crowns on ti-base abutments created with digital or conventional impressions. One-year follow-up. *Clin Oral Implants Res* 2021; 32(8):962-970.
  28. Hanozin B, Li Manni L, Lecloux G, Bacevic M, Lambert F. Digital vs. conventional workflow for one-abutment one-time immediate restoration in the esthetic zone: a randomized controlled trial. *Int J Implant Dent* 2022; 8(1).
  29. Lombardo G, Signoriello A, Corrocher G, Signoretto C, Burlacchini G, Pardo A, Nocini PF. A Topical Desiccant Agent in Association with Manual Debridement in the Initial Treatment of Peri-Implant Mucositis: A Clinical and Microbiological Pilot Study. *Antibiotics (Basel)* 2019; 8(2):82.
  30. Pedullà E, Plotino G, Scibilia M, et al. Cyclic fatigue comparison among endodontic instruments with similar cross section and different surface coating. *Minerva Stomatol* 2019; 68(2):67-73.
  31. Lombardo G, Signoretto C, Corrocher G, et al. A topical desiccant agent in association with ultrasonic debridement in the initial treatment of chronic periodontitis: a clinical and microbiological study. *New Microbiol* 2015; 38(3):393-407.
  32. Corega C, Vaida L, Festila DG, et al. The benefits of Quercetin for dentistry and maxillofacial surgery: a systematic review. *Minerva Stomatol* 2014.
  33. Pardo A, Signoriello A, Signoretto C, et al. Detection of Periodontal Pathogens in Oral Samples and Cardiac Specimens in Patients Undergoing Aortic Valve Replacement: A Pilot Study. *J Clin Med* 2021; 10(17):3874.
  34. Corega C, Vaida L, Festila DG, et al. Dental white spots associated with bulimia nervosa in orthodontic patients. *Minerva Stomatol* 2014; ahead of print.
  35. Marconcini S, Barone A, Perrini N, et al. Conservative treatment of unicystic odontogenic keratocyst by piezosurgery approach. A case report. *Minerva Stomatol* 2014; ahead of print.
  36. Ricci M, Marchisio O, Genovesi AM, et al. comparison between oscillating-twisting rotating of brush head vs a characteristic sweeping bristles motion on reducing oral inflammation. *Minerva Stomatol* 2014; ahead of print.
  37. Lombardo G, Pardo A, Signoretto C, Signoriello A, Simeoni E, Rovera A, Nocini PF. Hyperbaric oxygen therapy for the treatment of moderate to severe periodontitis: a clinical pilot study. *Undersea Hyperb Med* 2020 Fourth-Quarter; 47(4):571-580.
  38. Bertossi D, Fiorino P, Corega C, et al. Cone-beam volumetric imaging in craniofacial medicine. *Minerva Stomatol* 2019; 68(4):200-212.
  39. Gelpi F, Romoli L, D'Arienzo D, et al. Lateral periodontal cyst (LPC) mimicking periodontal socket in a young patient: report of a case and review of the literature. *Minerva Stomatol* 2014; ahead of print.
  40. Genovesi AM, Lorenzi C, Lyle DM, et al. Periodontal maintenance following scaling and root planing. A

- randomized single-center study comparing minocycline treatment and daily oral irrigation with water. *Minerva Stomatol* 2014; ahead of print.
41. Marconcini S, Genovesi AM, Marchisio O, et al. In vivo study of titanium healing screws surface modifications after different debridement procedure. *Minerva Stomatol* 2014; ahead of print.
  42. Corega C, Vaida L, Festila DG, et al. Blood levels of interleukins in patients with ameloblastoma. *Minerva Stomatol* 2014; ahead of print.
  43. Nocini PF, De Santis D, Ferrari F, Bertele GP. A customized distraction device for alveolar ridge augmentation and alignment of ankylosed teeth. *Int J Oral Maxillofac Implants* 2004; 19(1):133-44.
  44. De Santis D, Graziani P, Castellani R, et al. A New Radiologic Protocol and a New Occlusal Radiographic Index for Computer-Guided Implant Surgery. *J Craniofac Surg* 2016; 27(5):e506-10.
  45. Bertossi D, Nocini R, Luciano U, et al. Piezoelectric surgery inserts vs conventional burst: a clinical investigation. *J Biol Regul Homeost Agents* 2018; 32(2 Suppl. 2):15-19.
  46. Barone A, Toti P, Bertossi D, et al. Gene Expression of Human Mesenchymal Stem Cells Cultured on Titanium Dental Implant Surfaces. *J Craniofac Surg* 2016; 27(3):712-7.
  47. De Santis D, Sinigaglia S, Pancera P, et al. An overview of socket preservation. *J Biol Regul Homeost Agents* 2019; 33(1 Suppl. 1):55-59.
  48. De Santis D, Sinigaglia S, Pancera P, et al. An overview of guided bone regeneration. *J Biol Regul Homeost Agents* 2019; 33(1 Suppl. 1):49-53.
  49. Ciccì M, Fiorillo L, D'Amico C, et al. 3D Digital Impression Systems Compared with Traditional Techniques in Dentistry: A Recent Data Systematic Review. *Materials (Basel)* 2020; 13(8):1982.
  50. Lavorgna L, Cervino G, Fiorillo L, et al. Reliability of a Virtual Prosthodontic Project Realized through a 2D and 3D Photographic Acquisition: An Experimental Study on the Accuracy of Different Digital Systems. *Int J Environ Res Public Health* 2019; 16(24):5139.

*Review*

### **Minimally invasive rehabilitation with total removable implants supported prosthesis with conometric connection**

G. Zanotti<sup>1</sup>, U. Luciano<sup>2</sup>, P. Faccioni<sup>2</sup>, P. Montagna<sup>2</sup>, A. Bertajola<sup>1</sup>, M. Zarantonello<sup>2</sup>, T. Zambotti<sup>2</sup>,  
M. Magi<sup>2</sup>, F. Melloni<sup>2</sup>, A. Iurlaro<sup>2</sup>, C. Alberti<sup>2</sup>, D. De Santis<sup>2</sup> and N. Zerman<sup>2</sup>

<sup>1</sup>Free practitioner in Verona; <sup>2</sup>Section of Oral and Maxillofacial Surgery, Department of Surgical Sciences,  
Dentistry, Gynecology and Pediatrics, University of Verona, Verona, Italy

---

*Corresponding author:*

Dr. Guglielmo Zanotti, DDS, MSC  
Doctor in dental surgery,  
Orthognatodontic Specialist  
Implantology and Oral Surgery Master  
Periodontology and Oral Surgery Master  
Via Giusti 1, 37030 Lavagno, (VR), Italy  
Tel.: +390456106137  
e-mail: [guglielmozanotti@gmail.com](mailto:guglielmozanotti@gmail.com)

**Keywords:** *minimally invasive, simplicity, conometry, efficiency*

Received: 20 July 2022  
Accepted: 13 December 2022

ISSN 2974-6140 (online) ISSN 0392-8543 (print).

Copyright:  
Journal of Applied Cosmetology ©2023  
[www.journalofappliedcosmetology.com](http://www.journalofappliedcosmetology.com)  
Copyright © by Journal of Applied Cosmetology

This publication and/or article is for individual use only and may not be  
further reproduced without written permission from the copyright holder.  
Unauthorized reproduction may result in financial and other penalties  
DISCLOSURE: **ALL AUTHORS REPORT NO CONFLICTS OF  
INTEREST RELEVANT TO THIS ARTICLE.**

## ABSTRACT

Since its inception, modern dentistry has been a discipline in continuous evolution. Thanks to this progress, the prosthetic rehabilitation of the edentulous patient can now be effectively addressed by multiple therapeutic approaches rooted in the decision-making marriage between patient and clinician in both partial and total edentulous patients. From a historical perspective, the aesthetic-functional restoration of the completely edentulous maxillary arch has been subverted in the possibilities of intervention by the introduction of implantology, which has made it possible to overcome the otherwise mandatory use of removable devices with complete mucous support (1). The current study is intended to be an example of this evolution by describing one out of five clinical cases performed. Furthermore, it is intended to demonstrate how the newly proposed implant-prosthetic techniques, where a fixed implant rehabilitation is not possible due to age constraints, lack of bone support or unfavourable mechanical-aesthetics parameters, allow the rehabilitation of the upper total edentulous jaw with a removable device without a solidarizing intermediate bar to rely upon for the implants. The implants and the whole rehabilitation are, however, consolidated thanks to the stability provided by the presence of a telescopic connection, combining viable long-term survival (2) with optimal results for the patient in terms of cost (3), comfort, chewing capability (4), aesthetics and home hygiene.

## INTRODUCTION

The therapeutic possibilities for the implant-prosthetic rehabilitation of the oral cavity afflicted by total edentulism can be primarily distinguished in relation to the possibility of removal, both by the patient and by the doctor, of the strictly prosthetic component constituting the rehabilitation.

According to reports by Misch (5) in 1990, there are five categories of implant-prosthetic rehabilitation for fully edentulous arches, three fixed and two removable; the distinction between the two removable options is mainly related to the fact that the support can either be based entirely on dental implants (RP-4) or be the combination of an implant-mucous one (RP-5).

According to the literature (6), the choice to carry out a removable implant-prosthetic rehabilitation may be justified by multiple reasons. Among these, the reduced cost offered by these treatment plans compared to the fixed counterparty, often resulting from a reduced implant demand, is very important for decision-making. Indeed, the implants are frequently placed in the anterior maxillary region, and the posterior region is supported by the combination of a cantilever element with mucous support, thus making it less pressing to perform higher bone additive procedures since the anterior bone resorption is, in general, less marked.

Other advantages attributable to a removable prosthesis on implants lie in the possibility of making up for soft tissue deficiency (7, 8), the best home hygiene that the patient can put in place, the possibility of removing the prosthesis at night to mitigate the effects of a possible parafunctional habit and the ease of repair, given the possibility of delivering the artefact to the dental laboratory.

While conducting a cost-benefit analysis of prosthetic rehabilitation, the clinician must assess the degree of atrophy and the patient's age (9). Regarding the degree of atrophy, one of the most appreciated classifications in the literature, that of Misch & Judy (10), published in 1987, notes the existence of a biomechanical relationship between the residual crestal bone amplitude and the maximum inclination of the dental implant with respect to the bone base, such that when the values of crestal amplitude are less than 5mm the inclination

as mentioned above should not exceed 20 degrees. In these scenarios, the therapeutic will to guarantee, through a full-mouth fixed bridge, adequate home hygiene and satisfying aesthetic contrasts with the implant biomechanics and, therefore, the needle of the balance “cost-effectiveness” tends towards a removable implant-prosthetic rehabilitation.

When it comes to the removable implant-supported rehabilitation of the completely edentulous upper arch, it is common to find in the literature (6, 10-13) that a device with a “bar” retention system with solidarized implants is superior on both the mechanical and hygienic-prognostic planes compared to other types of connections on non-solidarized dental implants (14, 15). From a combined clinical and biomechanical perspective, the magnitude of the stabilization mentioned above derives, at least partly, from the type of connection chosen. The literature (16, 17) reports a greater ability to withstand functional loads for “locator” attachments and bar-supported solutions when compared to “ball” attachments.

The literature is not so rich regarding “telescopic” or “conometric” connections; however, it is sufficient for some considerations. It is reported that the connections guarantee greater stability and rigidity than others (18) and allow the distribution of masticatory forces comparable to that obtainable with a bar, albeit with some differences (19); furthermore, one must consider that the literature has not come to a clear conclusion when considering the marginal bone loss as the effect of the overload applied on fully osseointegrated implants (20). The mechanical advantage of these connections is attributed (21) to the intimate circumferential contact between the components, resulting in the reduction of rotational torque generated by applying any masticatory load.

Considering the statements mentioned above, this study aims to report the possibility of performing an implant-prosthetic rehabilitation of the maxillary district through a telescopic connection without a “bar” superstructure, granting hygienic and economic benefits without mechanical or prognostic sacrifice.

In order to give scientific support to the therapeutic option proposed in the current paper, a search has been conducted on the bibliographic search engines PubMed and Scopus to identify similar publications, which allowed a broader spectrum of considerations than the ones directly inherited by the individual sample reported by the authors and which could therefore support the scientific rationale of the therapeutic plan.

#### *Case study*

The case involves an adult male patient (74 years) with a medical history positive for hypertension, which is reported to be pharmacologically compensated at the time of treatment. The patient, who has a total edentulous upper arch, has requested a prosthetic rehabilitation of this sector through an implant-prosthetic treatment, not bearing the possibility of a completely mucous-supported prosthesis.

Following the case study, carried out through gipsographic models, radiographic examinations and objective evaluation of the oral cavity, the therapeutic possibilities individualized for the specific case were illustrated. Given the massive bone atrophy and unfavourable aesthetic-prosthetic parameters when a fixed implant-supported device was considered, a removable prosthesis with telescopic connection on implants placed in the 1.3, 1.2, 2.2 and 2.3 sites was theorized.

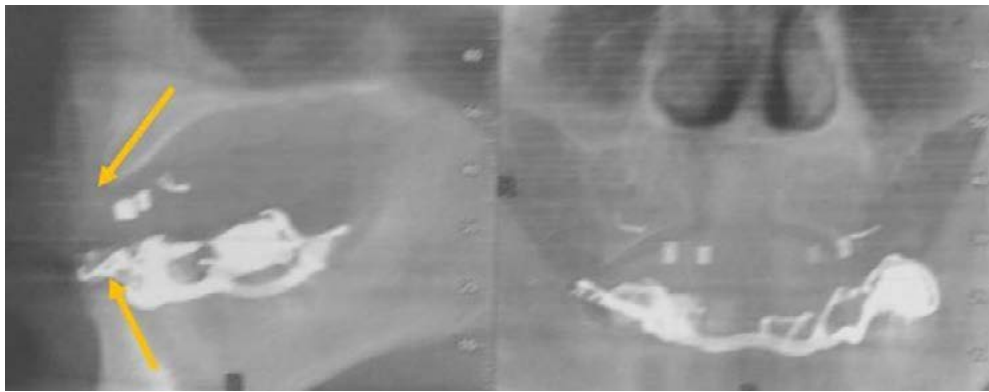
From the subsequent comparison with the patient, it was decided to proceed with the therapy, given the criteria set out in the previous section and the lowest cost of the whole treatment plan. Therefore, the treatment plan was carried out with the placement of the dental implants, of size and diameter commensurate with bone availability and biomechanical aspects (14, 22), in the planned sites and, after waiting an adequate time for osteointegration to happen, with the positioning of the relative implant connection abutments. Then, the removable prosthetic device, coupled through a telescopic connection, was manufactured on those supports.



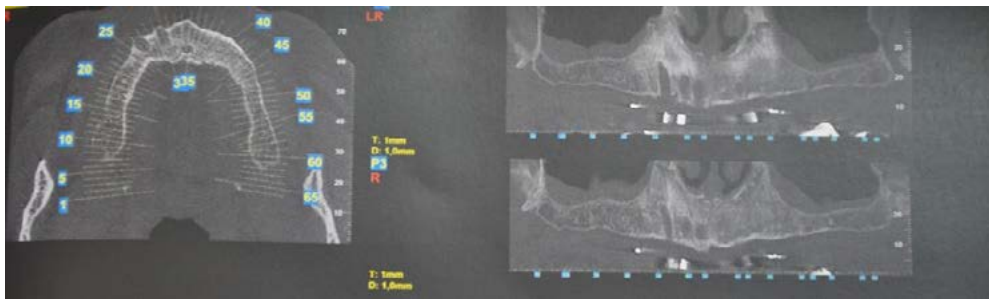
G. Zanotti et al.

## MATERIALS AND METHODS

The preparation of the patient involved obtaining the preliminary analogue-digital documentation, consisting of initial photos (analysis of chewing - exposure of the smile - general aesthetics of the patient), study models and computed tomography to define bone availability. A radiological-surgical-prosthetic template was then commissioned to the dental laboratory, through which the position chosen for the dental implant was radiologically and prosthetically verified before the surgery (Fig. 1, 2).



**Fig. 1.** *Implant-prosthetic project by cone beam computerized tomography.*



**Fig. 2.** *Pre-implant surgery orthopantomography.*

Then, we proceeded with the surgical phase. Firstly, perioral skin disinfection (Povidone Iodine 10%) was associated with Vaseline to moisten the tissues, and local anaesthesia followed. The gingival surface was then treated with a topical anaesthetic (Lidocaine + cetrimonium bromide 15 %), and plexal anaesthesia was inoculated both at the level of the upper vestibular fornix microcirculation and in the palate (Articaine 4% + adrenaline 1/200,000).

Secondly, an oblique incision of the tissues at the vestibular paracrestal level was made with full-thickness tissue cleavage palatally and narrowly at the vestibular level (scalpel 12C). The total bone exposure made it possible to trace the reference points determined by the positioning of the radiological-surgical-prosthetic template and the consequent execution of exploratory milling using “lanceolate” milling (1.9 mm) at 5mm in the predetermined sites 1.3-1.2-2.2-2.3.

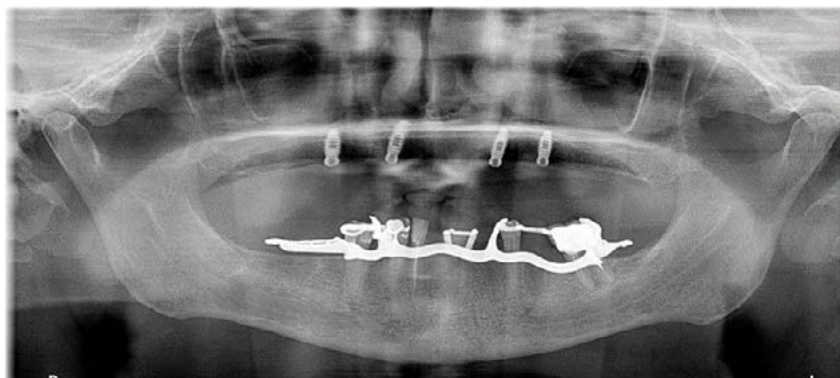
After a clinical examination of bone density (D3 classification of Misch (5)) with an implant probe, the first milling (2.2mm) was performed at 5mm and then completed, radiologically verified the inclination, up to 13 mm in sites 1.2-2.2 and up to 11 mm in sites 1.3-2.3. A second milling for 5mm (diameter 2.8 mm) and a third

milling (diameter 3.3 mm) was subsequently carried out for 3mm to prevent excessive bone pressure by the implant element during insertion, favoring the primary osteogenesis but also ensuring implant stability. Four implants (titanium 5 HRS surface) were inserted, with a diameter of 3,75 mm and a length of 12 mm in the 1.2 and 2.2 locations, and a diameter of 3,75 mm and a length of 10 mm in the 1.3 and 2.3 locations, up to 1 mm below the bone ridge, favoring prosthetic aesthetics (23).

Following the insertion of the cap screw on each implant, a check orthopantomography was performed to verify the operation's success. Next, the flap was carefully sutured using a closing flap through single intrapapillary stitches in positions 1.4-2.4 and a horizontal mattress crossed between the vestibular and palatal front portions.

This method, the wrapping of the suture in the vestibular paracrestal position obtained from the initial incision mode, has decreased the risk of infection of the implant stumps since the incision and the consequential suture are both laterally placed to the insertion site (glycolic acid absorbable suture).

The patient was discharged following pharmacological indications, antibiotic bactericidal and anti-inflammatory (amoxicillin with clavulanic acid 1gr every 8 hours for six days and paracetamol with codeine 500mg + 30mg when needed), associated with post-surgical indications, indications to hygiene and, for the first month, to a soft diet. The patient was finally given the temporary, pre-packaged, mobile prosthesis with light silicone relining, adapting the occlusion to the lower arch. Three weeks later, the sutures were removed, and a monthly radiographic check was carried out for a quarter. We proceed with the radiographic control three months after the surgery to assess osseointegration (Fig. 3).



**Fig. 3.** Post-implant surgery orthopantomography.

The optimal results in the radiogram made it possible to proceed with the second surgical phase of implant uncovering to start the prosthetic rehabilitation. In this phase, about a quarter from the previous one, we proceeded with the same procedure of disinfection and anesthesiology, as reported above. We then drew a flap characterized by an oblique paracrestal palatal incision with partial thickness cleavage vestibular and full thickness palatally (scalpel 12C). This incision increased the volume of vestibular tissues, the simultaneous exposure of the smooth peri-implant collar and the subsequent placement of healing screws (Fig. 4).

G. Zanotti et al.



**Fig. 4.** *Mucosa during implant activation.*

Once the necessary healing screws were placed, the suture (glycolic acid absorbable suture) and the readaptation of the temporary mobile prosthesis were performed. Finally, the photographic documentation was updated, and an alginate impression was taken to create an individual impression holder before the surgical phase mentioned above.

Once the time of the healing of the perimplant tissues had elapsed, the treatment plan was continued with the taking of a first analogic precision mucostatic impression (polysulfide) necessary for the realization of the removable prosthesis. In the same session, a second precision analogic impression was performed (polysilicon) using transfers to determine the correct position of the implant pillars. With this information, the intermediate supports necessary for the subsequent screwing of the primary telescopic abutment (standard length 4.3mm and standard angle 5° of the patient) were chosen, relying on the gum volume at the intraoral level and the parallelism between primary stumps at the extraoral level on dedicated models (Fig. 5).



**Fig. 5.** *Implant position evaluation.*

Specifically, an intermediate support of length 1.5mm with an inclination of 25° was placed in position 1.3; in seat 1.2, the length was 5mm with an inclination of 15°; in site 2.2 length was 5mm with an inclination of 35° and in seat 2.3 length was 3mm with an inclination of 25° (Fig. 6, 7).



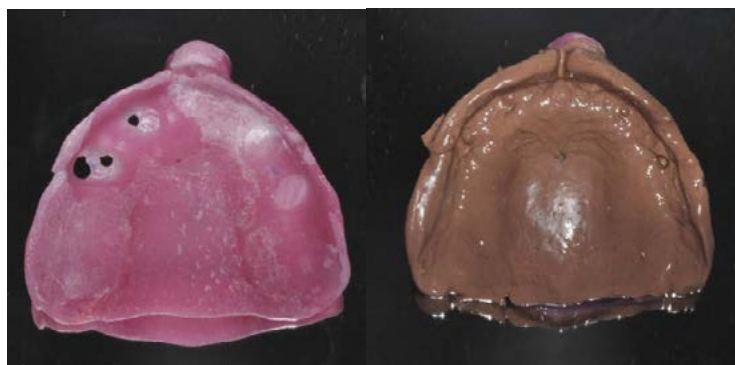
**Fig. 6.** Intermediate supports for screwing the telescopic primary stumps.



**Fig. 7.** The telescopic primary stumps.

In the following sessions, we realized the prosthesis through the test of the wax rims, placed on the provisional prosthetic flange, and thus detecting the vertical dimension, the correct model of occlusion, through precise mastication on dedicated auxiliary wax, and the interdental midline related to the tip of the nose and chin.

The tooth test was then performed, first in the front and then in the rear (Fig. 8, 9); the prosthesis was also subjected to a chewing control, in which we assured that while performing lateral excursions and protrusions, there were not too many tangential stresses (Fig. 10).



**Fig. 8.** Accurate impression in order to produce a removable prosthesis.

G. Zanotti et al.



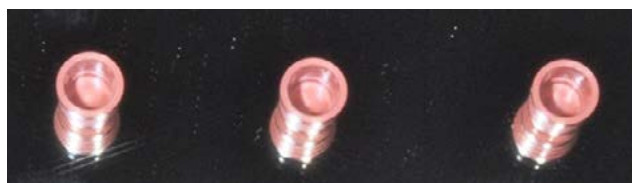
**Fig. 9.** *Structure test - vertical dimension evaluation - chewing test.*



**Fig. 10.** *Chewing test.*

In the same session, a phonetic test was also carried out, associated with a further aesthetic evaluation by a family member. As a final step, the palatal coverage was removed from the prosthesis, and an alloy reinforcement grid (chromium-cobalt) was incorporated at the dental laboratory.

Finally, at the time of delivery, four secondary telescopic crowns in peek (Standard length 4.3mm and standard angle 5,6 mm) have been inserted into the final removable prosthesis using a direct relining (polymethyl methacrylate). Those were calibrated for the primary telescopic abutments of the implant elements 1.3-1.2-2.2-2.3 and were necessary to determine the telescopic anchorage on the implant elements of the said prosthesis (Fig. 11-13).



**Fig. 11.** *Peek® secondary telescopic crowns.*





**Fig. 12.** *Peek® secondary telescopic crowns insertion.*



**Fig. 13.** *Removable prosthesis.*

After approximately one month, the patient was reviewed for the execution of an indirect relining through the support of the dental laboratory updating, in the same session, the photographic documentation and verifying the positive course of rehabilitation (Fig. 14).

---

G. Zanotti et al.

---



**Fig. 14.** *Smile.*

In order to perform a comparison of the proposed rehabilitation protocol with other similar publications, a search has been carried out on the search engines PubMed and Scopus, using as a query the following string: ' ("Telescopic" or "Conometric" or "Milled bar") AND ("Overdentures" or "implant-supported prosthesis" or "Dental Bridge" or "Removable prosthesis") AND "Dental Implants"'. The titles and abstracts of the 93 individual results were then analyzed to make a further selection of the comparative studies, and the three independent revisors involved selected a preliminary total of 4 publications.

Only one article (15) was found to be suitable for comparison since it included removable telescopic-coupled overdentures, among other types of connections, supported by more than 4 implants in treating patients with edentulous upper jaws.

## RESULTS

At the end of the first trimester, the first clinical inspection checked the stability of the implants, the intermediate prosthetic components and the gum tissue structure and professional oral hygiene were performed. After delivery, the second clinical and radiographic check was carried out to analyze the stability of the implants, the intermediate prosthetic components and the gum-tissue structure.

In both measurements, the stability of the implants, prosthetic components, and gingival-tissue structure was optimal, accompanied, in the second examination, by the radiographic evidence of complete osseointegration. Therefore, professional oral hygiene was carried out every four months for the first year, ensuring gum health of the mucous channels and making the patient aware of the importance of such attention to achieve an optimal duration of the prosthetic rehabilitation.

## DISCUSSION

Dentistry is a medical discipline that requires a certain amount of therapeutic flexibility on the part of the practitioner: no protocol allows all clinical cases to be successfully concluded, but all clinical cases can be fully satisfied by the correct choice of a treatment plan (24).

A further aspect of peculiarity, which constitutes the foundation of modern medicine, is the continuous evolution of therapeutic methods, where what was generally considered not optimal in the past can be, to date, thanks to technical progress, considered the best desirable treatment for a specific patient (25).

A clear example of the importance of adapting the prosthetic treatment plan to the patient's needs using new therapeutic algorithms has already been reported by Zanotti and colleagues in the minimally invasive telescopic prosthetic restorations (26). The concept is further evidenced by the reported clinical cases, in which the need to converge objectives on the appropriate levels of stability, aesthetics and durability of rehabilitation sought by the clinician with the patient's expectations, existing both clinically and economically, has imposed an innovative approach to the total removable prosthetic rehabilitation of the upper jaw, denying the poor predictability that is attributed in the literature to IODs (27, 28) (maxillary implant-supported overdentures).

The rehabilitation method adopted, assuming as a requirement the adequate availability of bone in the premaxilla, has allowed the placement of the implants in the optimal locations for the realization of a removable prosthesis with mixed implant-mucous support and thus allowed to reduce costs and discomfort for the patient compared to fixed alternatives, which would have required surgical bone augmentation procedures.

The contextual design of a telescopic device based on mixed support, as opposed (29, 30) to the ones solidarized by bars or other types of connections, has further contained costs without sacrificing stability and prognosis, in line with the assertions in the previous sections. Furthermore, an advantage obtained, thanks to the prosthetic-implant design proposed, further than those mentioned above, consists in the possibility to reduce the prosthetic flange on the vestibular side and eliminate the palatal component, thanks to the convergence of the coronal prosthetic component to the implant support resulting from the absence of a rigid superstructure.

Eliminating the palatine component improves patient comfort since many phonemes are produced by addressing the tip of the tongue to the premaxilla, and the presence of clutter is often referred to as an obstruction to the phonation (31). At the same time, the reduction of the vestibular flange made the rehabilitation more appealing aesthetically, in compliance with the perioral musculature.

There is no clear evidence that implant solidarization employing a bar is favourable for the survival of the rehabilitation, where the possible advantage of its use as a better compensation of the tangential forces in a phase of disengagement of the device in the case of non-aligned implants in patients with marked modification of the original arch shape, would not have been significant in the specific patient analyzed.

What emerges clearly from the literature (31, 32) is the strong influence that the "hygienic potential" conferred by the prosthetic design has on peri-implant disease. For example, Serino (31) reports that in 48% of the samples analyzed, peri-implantitis was associated with poor prosthesis hygiene and that this parameter had predictive power for the onset of the pathology for 82%. The authors, therefore, consider, in the light of the above literary data and based on their clinical experience, that they can summarize the advantages of the treatment solution adopted as follows.

The first aspect is the possibility of rehabilitating an elderly edentulous patient if the initial bone volume does not allow the realization of a fixed implant-supported prosthesis without performing regenerative surgery, with low costs compared to bars and comparable costs to alternative couplings. The second advantage is that compared to the aforementioned alternative couplings, namely 'Interlock' and "ball" attachments, the wear of the structural components seems to be lower, while the hygienic potential of the device is kept extremely high. The clinician should also note that telescopic is an approach that makes extreme precision its pivotal point and therefore requires meticulous accuracy in all its steps, which from a certain point of view, can be a disadvantage;

Secondly, telescopic systems tend to show a more significant number of mechanical complications during maintenance. However, it should be noted that in the literature, this data is discordant (33, 34), and, in the scenario of those happening, they are fully manageable on a regular ambulatorial recall.

## CONCLUSIONS

In the reported scenarios, the chosen therapeutic plan made it possible to achieve optimal and stable clinical results, giving a hopeful demonstration of the importance of critically interpreting the consolidated prosthetic dictates resulting from empirical experience. The authors also consider it necessary to stress that, in addition to the obvious advantages in economic terms and invasiveness compared to fixed or bar-supported counterparts, the approach adopted, that is, the use of a removable device without a fixed superstructure has allowed for improved hygiene at home, which is by no means secondary to the incidence of peri-implant disease (32, 33, 34).

In order to document the difficulty of comparing the therapeutic approach described therein with statistical data available in the literature, a recent systematic review is considered, published by Kern et. Al (35). The work has shown that the factors influencing the clinical success of implant-prosthetic rehabilitation are many. In general, fixed rehabilitations have a greater survival rate than the removable alternatives; that is why the latter would be preferable under idealistic conditions. However, the same publication also reports the impossibility of making a direct comparison between the implant's survival rate obtainable with "ball" attachments and telescopic connections rather than between "bar" structures and telescopic connections since the number of studies available is very limited.

It is therefore considered, in agreement with the literature, plausible to conclude that, although within the limitations of the experiential sample considered, the total removable prosthesis with telescopic connections may constitute a therapeutically and prognostically comparable alternative (36), if not even superior in terms of peri-implant soft tissues health (37), to bar retained IODs in cases where, due to medical, clinical or economic reasons, fixed rehabilitation loses absolute value; while adopting this approach the clinician should, however, consider the possibility of encountering a slightly higher number of mechanical complications during maintenance visits: this statement is based on literary data (15), given the already mentioned timespan and sample limitations of this study.

## REFERENCES

1. Buser D, Sennerby L, De Bruyn H. Modern implant dentistry based on osseointegration: 50 years of progress, current trends and open questions. *Periodontol* 2000; 73(1):7-21.
2. Ghiasi P, Ahlgren C, Larsson C, Chrcanovic BR. Implant and prosthesis failure rates with implant-supported maxillary overdentures: a systematic review. *Int J Prosthodont* 2021; 34(4):482-491.
3. Zhang Q, Jin X, Yu M, Ou G, Matsui H, Liang X, Sasaki K. Economic Evaluation of Implant-Supported Overdentures in Edentulous Patients: A Systematic Review. *Int J Prosthodont* 2017; 30(4):321-326.
4. Afrashtehfar KI, Schimmel M. Muscular activity may improve in edentulous patients after implant treatment. *Evid Based Dent* 2016; 17(4):119-120.
5. Misch C. Classifications and treatment options for the completely edentulous arch in implant dentistry. *Dent Today* 1990; 9(8):26, 28-30.
6. Mericske-Stern R. Treatment outcomes with implant-supported overdentures: clinical considerations. *J Prosthet Dent* 1998; 79(1):66-73.
7. Misch CE. *Dental Implant Prosthetics*. Second Edition. Mosby 2015.
8. Blum IR, McCord JF. A clinical investigation of the morphological changes in the posterior mandible when implant-retained overdentures are used. *Clin Oral Implants Res* 2004; 15(6):700-8.
9. Gil-Montoya JA, de Mello AL, Barrios R, Gonzalez-Moles MA, Bravo M. Oral health in the elderly patient and its impact on general well-being: a nonsystematic review. *Clin Interv Aging* 2015; 10:461-7.

10. Misch CE, Judy KW. Classification of partially edentulous arches for implant dentistry. *Int J Oral Implantol* 1987; 4(2):7-13.
11. Mañes Ferrer JF, Fernández-Estevan L, Selva-Otaolaurruchi E, Labaig-Rueda C, Solà-Ruiz MF, Augustin-Panadero R. Maxillary Implant-Supported Overdentures: Mechanical Behavior Comparing Individual Axial and Bar Retention Systems. A Cohort Study of Edentulous Patients. *Medicina (Kaunas)* 2020; 56(3):139.
12. Raghoobar GM, Meijer HJ, Slot W, Slater JJR, Vissink A. A systematic review of implant-supported overdentures in the edentulous maxilla, compared to the mandible: how many implants? *Eur J Oral Implantol* 2014; 7 (Suppl 2):S191-201.
13. Takahashi T, Gonda T, Maeda Y. Effects of Reinforcement on Denture Strain in Maxillary Implant Overdentures: An In Vitro Study Under Various Implant Configurations. *Int J Oral Maxillofac Implants* 2016; 31(6):e162-e167.
14. Kiener P, Oetterli M, Mericske E, Mericske-Stern R. Effectiveness of maxillary overdentures supported by implants: maintenance and prosthetic complications. *Int J Prosthodont* 2001; 14(2):133-40.
15. Zou D, Wu Y, Huang W, Wang F, Wang S, Zhang Z, Zhang Z. A 3-year prospective clinical study of telescopic crown, bar, and locator attachments for removable four implant-supported maxillary overdentures. *Int J Prosthodont* 2013; 26(6):566-73.
16. Sabouri, A, Barjini N, Tabatabaian F. Comparison of the effect of ball and bar attachment designs on retention and stability of mandibular implant-supported overdentures. *Journal of Dental School, Shahid Beheshti University of Medical Sciences* 2017; 35(1):21-25.
17. Ebiary M, Eldid L, Abdelhakim A. Comparative study of bar, positioner and ball attachment in solitary versus splinted implant assisted mandibular overdenture (in vitro study). *Alexandria Dental Journal* 2021; 46(3):110-116.
18. ELSyad MA, Soliman TA, Khalifa AK. Retention and Stability of Rigid Telescopic and Milled Bar Attachments for Implant-Supported Maxillary Overdentures: An In Vitro Study. *Int J Oral Maxillofac Implants* 2018; 33(5):e127-e133.
19. Heckman SM, Winter W, Meyer M, Weber HP, Wichmann MG. Overdenture attachment selection and the loading of implant and denture-bearing area. Part 2: A methodical study using five types of attachment. *Clin Oral Implants Res* 2001; 12(6):640-7.
20. Afrashtehfar KI, Afrashtehfar CD. Lack of association between overload and peri-implant tissue loss in healthy conditions. *Evid Based Dent* 2016; 17(3):92-93.
21. Alqutaibi AY, Kaddah AF. Attachments used with implant supported overdenture. *International Dental & Medical Journal of Advanced Research*. 2016; 1(2):1-5.
22. Di Francesco F, De Marco G, Gironi Carnevale UA, Lanza M, Lanza A. The number of implants required to support a maxillary overdenture: a systematic review and meta-analysis. *J Prosthodont Res* 2019; 63(1):15-24.
23. Zanutti G, Gelpi F, Sinigaglia S, et al. Ageneis: pilot case report by 2.9 mm implant. *J Biol Regul Homeost Agents* 2019; 33(Suppl 1):61-65.
24. Pjetursson BE, Lang NP. Prosthetic treatment planning on the basis of scientific evidence. *J Oral Rehabil* 2008; 35 Suppl 1:72-9.
25. Chipidza FE, Wallwork RS, Stern TA. Impact of the Doctor-Patient Relationship. *Prim Care Companion CNS Disord* 2015; 17(5):10.
26. Zanutti G, Luciano U, Montagna P, et al. Mini-invasive rehabilitation with removable total prosthesis with mixed conometric connection on 1.4-1.5-2.2 (2.9 mm) implant abutments and 1.6-2.3-2.4 dental abutments: a two-year follow-up. *J Biol Regul Homeost Agents* 2021; 35(Suppl1):23-32.
27. De Bruyn H, Raes S, Matthys C, Cosyn J. The current use of patient-centered reported outcomes in implant dentistry: a systematic review. *Clin Oral Implants Res* 2015; 26(Suppl) 11:45-56.
28. Trbakovic A, Toljanic JA, Kumar VV, Thor A. Eight to eleven-year follow-up of immediately loaded implants placed in edentulous maxillae with compromised bone volume and poor bone quality: a prospective cohort study. *Clin Implant Dent Relat Res* 2020; 22(1):69-76.



---

G. Zanotti et al.

---

29. Mirchandani B, Zhou T, Heboyan A, Yodmongkol S, Buranawat B. Biomechanical Aspects of Various Attachments for Implant Overdentures: A Review. *Polymers (Basel)* 2021; 13(19):3248.
30. Hatakeyama W, Takafuji K, Kihara H, et al. A review of the recent literature on maxillary overdenture with dental implants. *J Oral Sci* 2021; 63(4):301-305.
31. Selim K, Ali S, Reda A. Implant Supported Fixed Restorations versus Implant Supported Removable Overdentures: A Systematic Review. *Open Access Maced J Med Sci* 2016; 4(4):726-732.
32. Serino G, Ström C. Peri-implantitis in partially edentulous patients: association with inadequate plaque control. *Clin Oral Implants Res* 2009; 20(2):169-74.
33. Krennmair G, Seemann R, Weinländer M, Piehslinger E. Comparison of ball and telescopic crown attachments in implant-retained mandibular overdentures: a 5-year prospective study. *Int J Oral Maxillofac Implants* 2011; 26(3):598-606.
34. Kern JS, Kern T, Wolfart S, Heussen N. A systematic review and meta-analysis of removable and fixed implant-supported prostheses in edentulous jaws: post-loading implant loss. *Clin Oral Implants Res* 2016; 27(2):174-95.
35. Heitz-Mayfield LJA, Heitz F, Lang NP. Implant Disease Risk Assessment IDRA-a tool for preventing peri-implant disease. *Clin Oral Implants Res* 2020; 31(4):397-403.
36. Cercadillo-Ibarguren I, Sánchez-Torres A, Figueiredo R, Schwarz F, Gay-Escoda C, Valmaseda-Castellon E. Immediately loaded implant-supported full-arches: Peri-implant status after 1-9 years in a private practice. *J Dent* 2017; 67:72-76.
37. Krennmair G, Sütö D, Seemann R, Piehslinger E. Removable four implant-supported mandibular overdentures rigidly retained with telescopic crowns or milled bars: a 3-year prospective study. *Clin Oral Implants Res* 2012; 23(4):481-8.
38. Elsyad M, Denewar BA, Elsaih EA. Clinical and Radiographic Evaluation of Bar, Telescopic, and Locator Attachments for Implant-Stabilized Overdentures in Patients with Mandibular Atrophied Ridges: A Randomized Controlled Clinical Trial. *Int J Oral Maxillofac Implants* 2018; 33(5):1103-1111.

Copyright JAC



## A FULLY DIGITAL PLANNING AND MANUFACTURING OF AN AESTHETICALLY CONCEIVED AND GUIDED FULL-ARCH IMPLANT-SUPPORTED REHABILITATION

T. Tealdo<sup>1</sup>, M. Bevilacqua<sup>2</sup>, L. Scaglione<sup>1</sup>, C. Alberti<sup>3</sup>, P. Montagna<sup>4</sup> and F. Gelpi<sup>4</sup>

<sup>1</sup>Private Practitioner in Alba (CN), Italy;

<sup>2</sup>Private Practitioner in Boves (CN), Italy;

<sup>3</sup>Private Practitioner in Rosà (VI), Italy;

<sup>4</sup>Head and Neck Department, Department of Surgery, Dentistry, Pediatrics and Gynecology, University of Verona, Verona, Italy

*Correspondence to:*

Federico Gelpi, DDS

Head and Neck Department,

Department of Surgery, Dentistry, Pediatrics and Gynecology,

University of Verona,

Verona, Italy

e-mail: federico.gelpi@libero.it

**KEYWORDS:** *full upper arch, hopeless teeth, aesthetic analysis, intraoral scanner, IOS, scanface, ITAKA® comfort position, CBCT, Exocad®*

### ABSTRACT

In the rapidly evolving implant dentistry scenario, integrating digital technologies has significantly advanced the precision and efficiency of treatments, especially in full arch implant-supported rehabilitations. Despite these advancements, a completely digital approach to complex cases remains difficult and very challenging, necessitating a hybrid approach that utilizes both digital and traditional techniques. This technical note delineates a combined digital workflow for aesthetically guided, full arch implant-supported rehabilitations in the upper jaw, avoiding the need for interim dentures. Integrating a precise analogical plaster implant impression, advanced digital scanning and planning, mandibular movement registration (ITAK®), and face scans are possible by detecting a reference area defined by the palatine wrinkles. This approach aims to maximize aesthetic, functional, and biomechanical outcomes and addresses the ongoing debate about the accuracy of intraoral scanner scans versus traditional impression methods for full arch restorations. Although digital methods are increasingly favored for their efficiency and potential for trueness and precision, our procedure underscores the relevance of detecting an anatomical area as a reference. Through a detailed technical note, this paper showcases a reproducible protocol that combines the effectiveness of analogic plaster impressions with the benefits of digital planning and Computer-Aided Manufacturing, representing a step towards the future of implant dentistry where digital processes may fully supplant traditional procedures for the immediate loading and the further final prosthetic restoration, enhancing patient outcomes through more accurate and efficient treatment modalities.

### INTRODUCTION

Implant dentistry has witnessed remarkable advancements driven by technological innovation and an expanding understanding of mechanical and biological aspects. The treatment of complex cases, historically challenged by

Received: 9 January 2024  
Accepted: 20 February 2024

ISSN 2038-4106 print  
ISSN 2975-044X online  
Copyright © by BIOLIFE 2024

This publication and/or article is for individual use only and may not be further reproduced without written permission from the copyright holder. Unauthorized reproduction may result in financial and other penalties. Disclosure: All authors report no conflicts of interest relevant to this article.

T. Tealdo et al.

anatomical constraints, prosthetic considerations, and patient expectations for functionality and aesthetics, has evolved significantly. Traditionally, rehabilitating patients presenting hopeless teeth involved creating a removable denture from an initial impression and a facebow registration. This denture, worn post-extraction, was a practical method to evaluate aesthetics, phonetics, and functional integration.

Literature reports various methods to assess the correct Vertical Dimension of Occlusion (VDO) for a patient (1), acknowledging it as an adaptability range from which clinicians choose a value to balance aesthetic and functional requirements (2). However, it is also noted that no universal, well-established rules exist for determining VDO once it is lost, mainly due to inter-patient variations (3,4). If teeth are present or a removable denture has already been fabricated and the current VDO is deemed correct, pre-extraction records have been suggested because teeth represent an index.

Digital technologies have heavily influenced how specific tasks are performed in dentistry, including full arch implant-supported restorations. As reported in a recent paper by Feng et al. (5), the traditional systems to transfer information from the dental clinic to the dental laboratory are time-consuming and prone to cumulative errors. At the same time, digital methods are faster and less prone to data modification during the transferring phase. The same Authors, in their report on a dentate patient, noted that intraoral scanners (IOS), facial scanners, 3D low-dose radiographic exams like cone beam computed tomography (CBCT), and digital dynamic occlusion registration can nowadays be blended into specific planning software to create a virtual patient and make many manual steps outdated, especially if they decide to consider the palatine wrinkles as an anatomical reference.

Given the effectiveness of digital technologies, it is possible to integrate different files derived from several digital devices into a single project due to the coupling of the same anatomical reference, even if many elements are still required to streamline the digital protocol completely. Detecting a common anatomical reference among all the different files (intraoral scans during the diagnostic phase, digital wax-up proposal, master cast derived from the plaster impression) is pivotal in a stable, reliable, reproducible information transferring among all the phases.

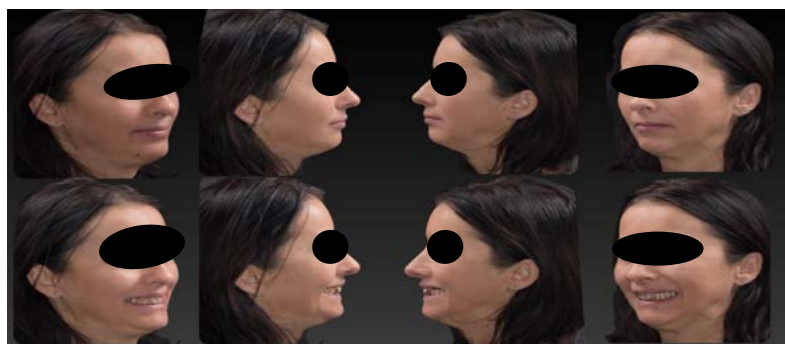
Moreover, despite some authors (6, 7) reporting potentially comparable results in full arch implants IOS vs. plaster impressions, many are still cautious in considering digital scans on full arch implant-supported restorations as a substitute for the current gold standard (8–10). On the other hand, some authors recently reported no significant difference when comparing computer-aided manufacturing (CAM) produced full arch frameworks derived from digital impressions with the plaster impression counterparts (11). Discrepancies in reports might be attributable to the evolution of scanning equipment, acquisition protocols, and operator experience (12, 13). Nevertheless, digital planning and CAM integration hold promise, particularly as full-arch frameworks produced via Computer Numerical Control (CNC) machining have shown greater precision than traditional casting, given that an accurate impression is provided (14).

This paper details the author's approach to digital upper jaw full arch implant-supported rehabilitations. This method exploits digital technologies to prevent the need for physical dentures and facebow registrations while maximizing integration in patient aesthetics thanks to new technologies. By creating a virtual patient, this protocol enhances treatment accuracy and capitalizes on the benefits of CAD/CAM while retaining the precision of analog plaster impressions. As digital impression precision continues to improve, this protocol represents a step towards a future where digital processes can fully replace traditional methods in implant dentistry, thereby enhancing patient outcomes through more accurate and efficient treatment modalities.

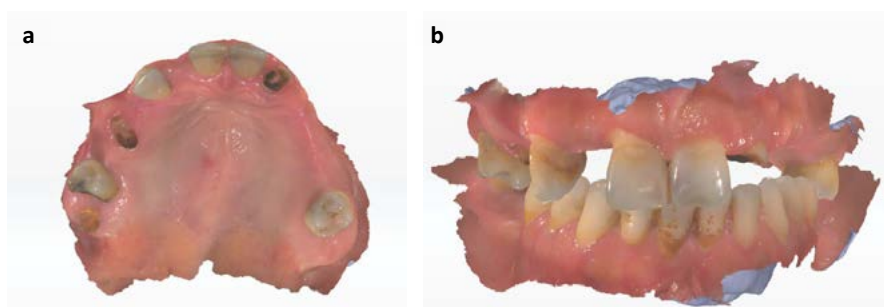
## CASE REPORT

In this case study, a 38-year-old female dental-phobic patient (with a traumatic dental background and long-standing phobia regarding dental check-ups and treatments) sought dental treatment at our private practice, aiming for a fixed rehabilitation and aesthetic restoration of the hopeless upper and lower arches. The patient presented an unremarkable medical history, classifying her as ASA I, and prioritized aesthetics while expressing a desire for swift rehabilitation. She emphasized avoiding any visible void in the aesthetic zone following extractions. She sought a solution to restore her full masticatory function, which had been significantly impaired and limited to her anterior teeth.

The first clinical step aimed to gather all the relevant information for the author's digital workflow. Extraoral, smiling, non-smiling, and intraoral photographs were acquired using a standardized protocol (Fig. 1), highlighting the lack of soft tissue support and Posterior Bite Collapse (PBC). Subsequently, a CBCT exam was acquired to gather anatomical information, primarily bone availability and maxillary sinus morphology, and a double arch digital impression, including palatine wrinkles for the upper jaw, with a virtual occlusal record was acquired as a prosthetic reference (Fig. 2).



**Fig. 1.** Patient panel reporting the initial extraoral condition.



**Fig. 2.** Digital scans of the individual jaws and the upper one with the palatine wrinkles (a) and arches articulated one another (b).

During the initial consultation, a comprehensive clinical examination was carried out, revealing a significant occlusal deficiency due to the loss of multiple posterior teeth in both arches, resulting in a condition identified as PBC (Fig. 3). Given the absence of any previous records to define the patient's original occlusal schema, a detailed facial registration (MetiSmile, SHINING 3D Tech Co., Ltd., Hangzhou, China) (Fig. 4) alongside dynamic occlusion measurements, specifically called jaw kinematic analysis, (Cyclops, Itaka Way Med SRL, Marcon, Venice, Italy) were obtained (Fig. 5). A surface electromyography examination was executed (Teethan®, Teethan S.p.A, Milan, Italy) to evaluate the current occlusal schema and verify the absence of parafunctional loads. These assessments were instrumental in establishing the optimal occlusal relationship for the forthcoming rehabilitation process.



**Fig. 3.** Patient's composite reporting the starting intraoral condition.

T. Tealdo et al.

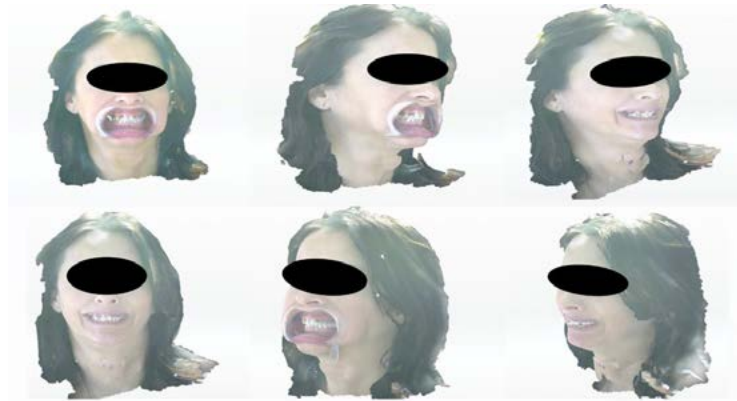


Fig. 4. Various steps of a face scan acquisition through MetiSmile's software.

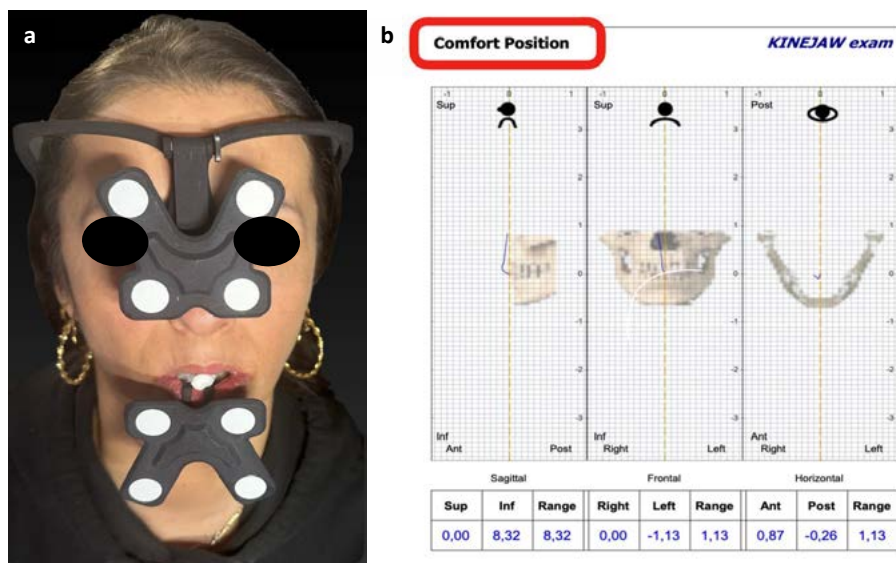


Fig. 5. ITAKA Kinematic jaw exam execution (a) and related report on the comfort position (b).

The authors advocate for an extemporary fabrication of a Lucia Jig, employed as a muscle de-programmer, in tandem with a digital capture of the mandibular range of motion. This approach enables a precise determination of the patient's comfort zone, wherein the centric relation is established. This process considers the VDO required to meet aesthetic and functional requisites, thereby defining a neurofunctional position that extends beyond mere anatomical considerations, usually defining centric relation.

#### Virtual planning phase

The dental laboratory was equipped with a detailed collection of diagnostic information, encompassing extraoral and intraoral pictures, digital models of both arches, a digital bite record, a facial scan, and a digital evaluation of the lower jaw's movements. This comprehensive dataset eliminates the necessity for conventional facebow registration by utilizing the facial scan as a critical reference point. This scan is used to accurately align the digital upper jaw model with



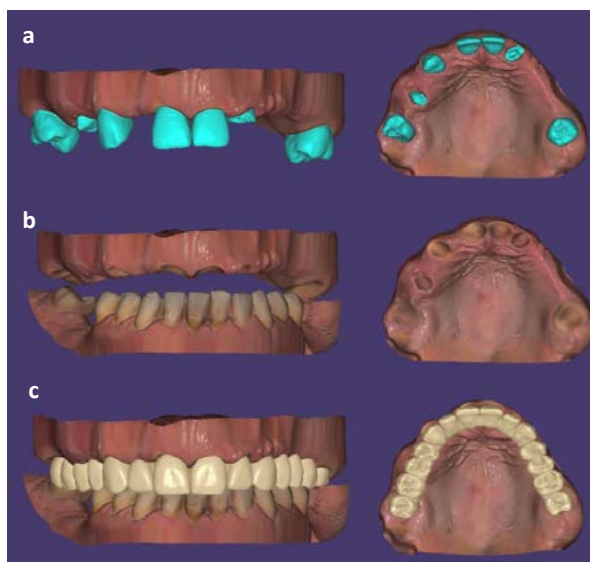
T. Tealdo et al.

the patient's cranial base, advocating for a facially driven approach in the planning and executing full arch implant-supported rehabilitations. Initially focusing on facial aesthetics ensures the restorative work is tailored to enhance the patient's overall appearance, subsequently guiding the prosthetic and surgical phases of treatment.

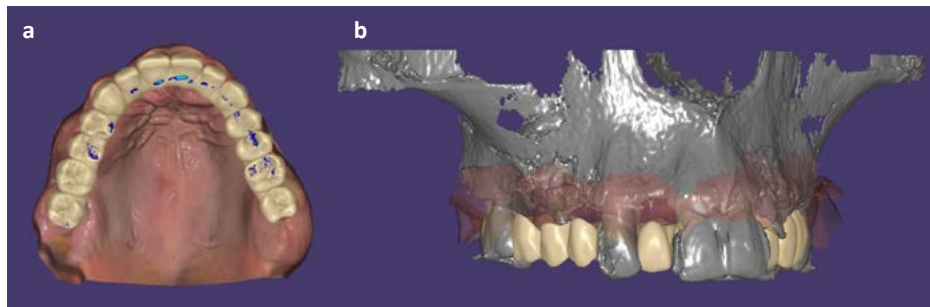
The provided data requirements to be matched for creating a virtual patient. The software of choice in the author's daily practice is Exocad (DentalCAD version 3.2) since it can handle all the planning and designing phases in a complete suite. 3D Standard Tessellation Language (.STL) files are uploaded and mutually registered using a dedicated wizard, including lower jaw kinematics. The next crucial step involves the integration of In-CAD Smile Design through the Smile Creator feature within Exocad. This tool transforms patient photographs into three-dimensional models, which can later be aligned with the 3D dental scan. This step serves as a double-check measure because any error in the data acquisition would be reflected in an incorrect 2D-3D matching and as a guide during the provisional fabrication.

Indeed, the next step is for the dental technician to start the fabrication of the first provisional, which won't be delivered before surgery but will be adapted when the post-operative impression is sent so it can be delivered as fast as possible. This includes calculating the prosthetic space, derived by subtracting the freeway space from the VDO and determining the aesthetic space. A systematic review reports that 75%-100% of the upper front teeth are exposed during smiling (15). In contrast, another systematic review identified laypersons' preference for a slight coverage of front teeth crowns (16), placing the aesthetic space in the upper region at around 80% of the prosthetic space. The aesthetic space is crucial as it delineates the restoration segment visible during a smile and can be identified by the sustained pronunciation of the phoneme 'I'. However, this metric may vary and be tailored to accommodate the unique dental exposure observed in the patient pre-operatively.

In this specific patient, the dental lab digitally extracted residual hopeless teeth (used as index before) using the dedicated tool and proceeded with digital wax-up teeth positioning based on the aesthetic needs (Fig 6); once the distribution is accommodated on aesthetic, a simple tool can make slight changes to consider the previously acquired data on lower jaw movements to implement dynamic occlusion onto the newly created occlusal schema (Fig. 7). The result is a digital wax-up, that is confirmed by both the patient and the clinician.



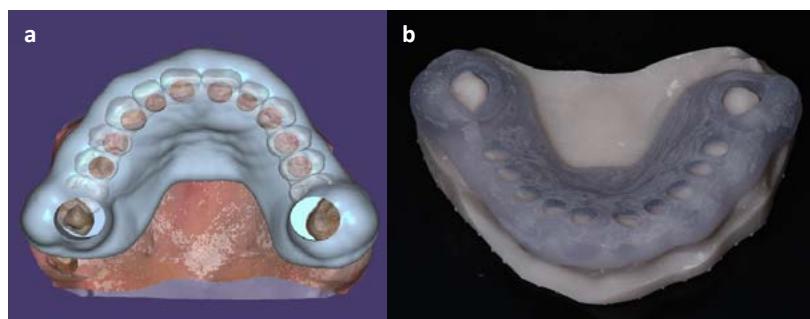
**Fig. 6.** Hopeless teeth are marked (a) and virtually extracted (b). Aesthetic and static occlusion guide the initial positioning of denture teeth (c).



**Fig 7.** Teeth are adjusted to dynamic occlusion (a), and the provisional project is finalized (b).

The concluding steps of the pre-surgical process are timed. Ideally, all preparatory procedures, specifically the finalization of the digital wax-up, are completed one week before the scheduled surgery. This timeframe is crucial as it allows for necessary adjustments based on patient or clinician feedback. In the final week leading up to the surgery, attention turns to the design and fabrication of a customized prosthetic-surgical guide. This stent is peculiar in its design approach. Following the virtual extraction of the deemed hopeless teeth, save for the most distal ones, it is crafted to replicate the soft-tissue contours accurately.

The design is informed by the previously finalized provisional, supported by the palatine wrinkles, with strategic perforations aligned over the crestal bone where each prosthetic tooth, not implant, is to be placed (Fig. 8). The primary function of this surgical stent is not to direct the implant drills physically but to serve as a visual reference for the future dental prosthesis. This innovative approach allows the clinician to place implants with a prosthetically driven mindset, ensuring the implants' optimal position, the Low Profile Zimvie® abutments choice, and proper orientation for the planned restoration.



**Fig. 8.** A prosthetic-surgical stent is designed according to the teeth's future position (a) and is 3D-printed for delivery on the day of surgery (b). Note the mucosal support given by the palatine wrinkles.

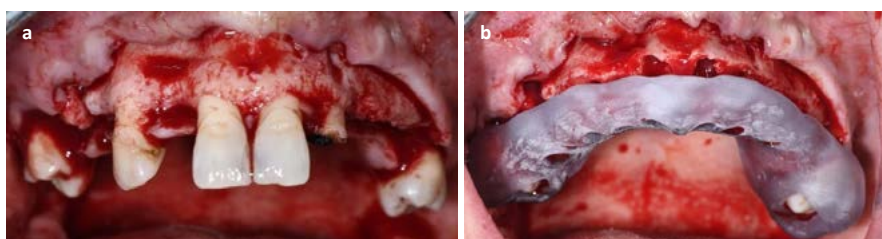
In preparation for the surgery, a second template is crafted using digital design and 3D printing technologies - a custom individual impression tray tailored for easier data matching (Fig. 9). This template follows the previously outlined steps for the virtual extraction of hopeless teeth and the fabrication of a soft tissue-adapted stent, yet it introduces some additional feature. Firstly, the tray design incorporates an open top, allowing for the adequate placement of rigid impression materials, namely plaster. Additionally, the tray design extends over the palatine wrinkles since they are stable over time and unextensible, making it an ideal reference point for future data matching. Furthermore, a practical hand-hold is included, facilitating the device's manipulation and usage during the impression-taking step.



**Fig. 9.** A digitally designed customized open-top impression tray extending over the palatine rugae.

#### *Implant surgery and provisional delivery*

On the day of surgery, a full-thickness flap was elevated, with the initial crestal incision slightly decentred on the palatal side. The failing teeth, except for the distal ones, were extracted to allow the placement of the previously fabricated prosthetic-surgical stent (Fig. 10).

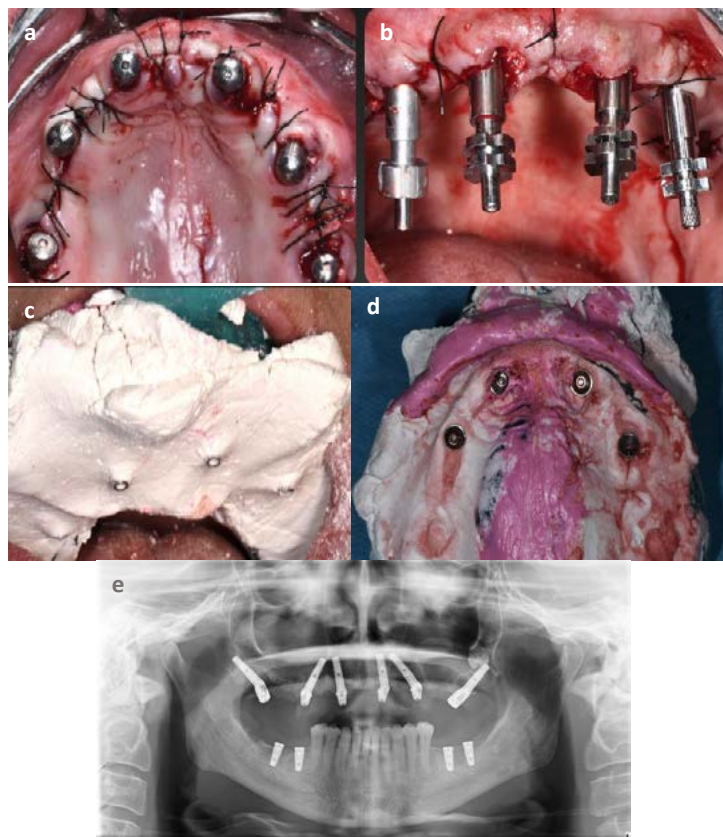


**Fig. 10.** A full-thickness flap is raised (a), and the prosthetic-surgical glass-like template is placed after failing anterior teeth extraction (b).

This template does not represent a static surgical guide but a pre-implant aesthetic guide. After that evaluation, tapered dental implant placement (T3® PRO, Zimvie Inc., Westminster, USA) in the premaxilla was possible, maximizing bone availability. Once the stent had fulfilled its role, it was removed, the distal teeth were extracted, and two tilted implants were positioned.

These posterior implants engaged the pterygoid lamina as part of the authors' usual implant positioning protocol for atrophic patients (17). Low-profile angled abutments were screwed in place, and grafting material (Endobon® Xenograft Granules, Zimvie Inc., Westminster, USA) was used to secure adequate marginal bone levels over time. Before suturing with single stitches using Vicryl® 3.0 (Vicryl® 3.0, Ethicon, Raritan, USA), healing abutments were secured in place.

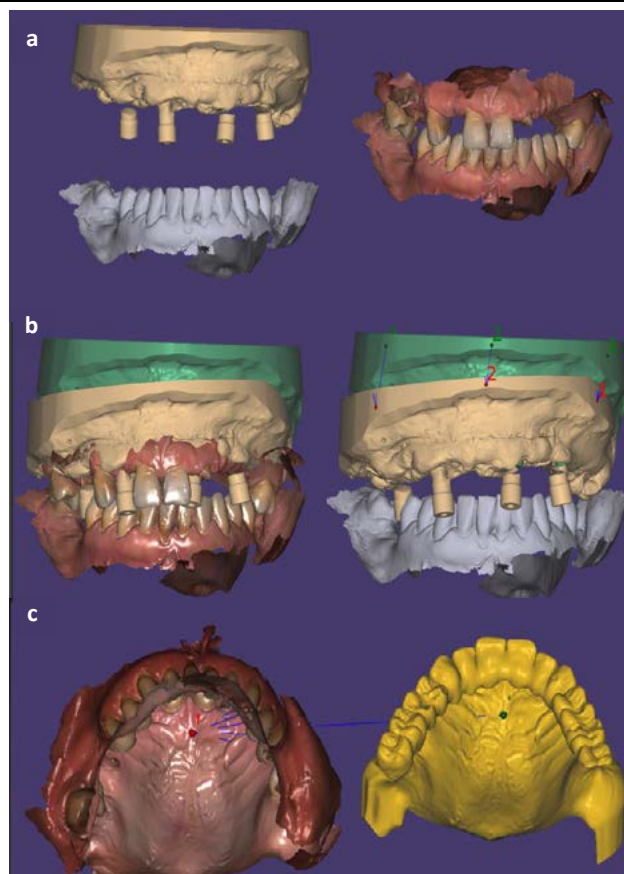
As a final step, open-tray impression transfers were used in combination with plaster, polyvinylsiloxane, and the previously fabricated individual tray to obtain an immediate impression of the four anterior implants since the immediate load was not planned for the posterior pterygoid (Fig. 11).



**Fig. 11.** *Implants and healing cups are placed, and sutures are positioned (a). A mixed plaster impression is taken with transfers positioned on the four anterior implants (b, c, and d) using a customized impression tray derived from the same aesthetic guide template and mucosal supported in the same palatine wrinkles reference area. The radiological Orthopantomography is scanned after the delivery of the milled Polymethyl Methacrylate (PMMA) provisional restoration screwed on 4 Low Profiles: let's note the radiolucent aspect depending on the absence of the armor (e).*

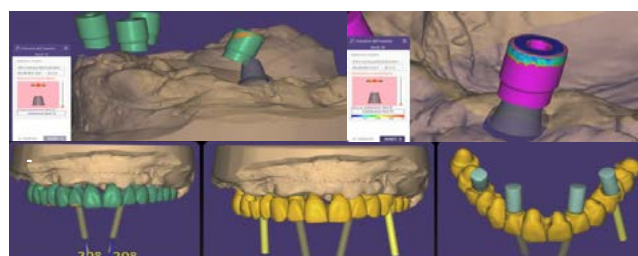
The patient is dismissed with post-operative indications for a few hours. In the meantime, at the dental laboratory, the plaster impression cast is scanned using scan bodies, and the post-operative data is aligned with the presurgical plan thanks to the palatine wrinkles, which are a stable reference point that allows for VDO maintenance (Fig 12).

T. Tealdo et al.



**Fig. 12.** The immediate mixed impression is digitalized (a) using scan bodies and imported into the presurgical project (b). Palatine wrinkles allow for the data matching (c).

Thanks to these newly gathered data, the dental technician matches the ScanBodies of the post-operative plaster cast digitalization with their digital correspondence. In the Authors' experience, using higher offset ScanBodies allows for a more precise matching. Specifically, scan bodies with 6 matching references at the coronal level were employed (ScanBody ProCam, Biaggini Medical Devices srl, Arcola, Italy). Once this step is accomplished, the previously designed provisional can be adapted according to the newly established implant positions to accommodate holes slightly larger than the abutments (Fig. 13). The abutments will be luted with anaerobic cement, allowing maximum passivity.

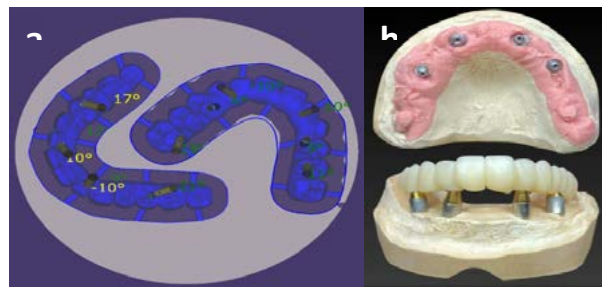


**Fig. 13.** ScanBodies are precisely matched thanks to the coronal offset of the 6 reference points (a), and the previously confirmed digital mock-up is adapted (b).

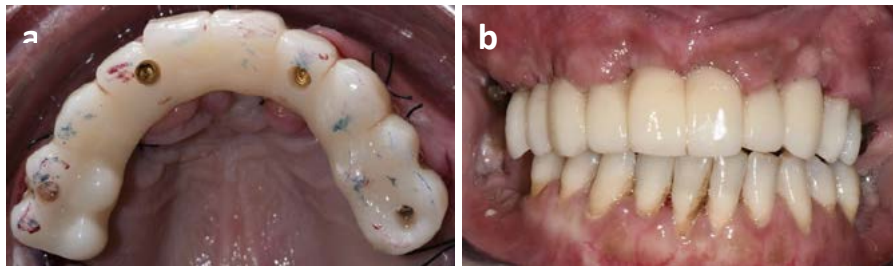


T. Tealdo et al.

The resulting .STL file is sent to a 5-axis milling machine to obtain a long-lasting multilayer Polymethyl Methacrylate (PMMA) (Dentsply Sirona Inc., Charlotte, USA) provisional (Fig. 14); this material is chosen for its optimal mechanical properties, specifically an elasticity module greater than 2200 MPa and flexural strength greater than 80 MPa. The product is checked for passivity both digitally prior to the milling, thanks to a one-screw test, and on the original plaster cast. The provisional rehabilitation, loaded on four implants, is delivered within 24 hours, and minor occlusal corrections are made if necessary (Fig 15).



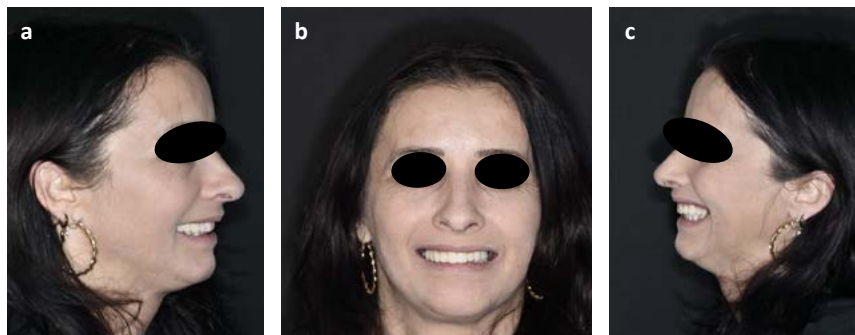
**Fig. 14.** The provisional restoration project is sent to a milling machine (a), and the deriving product is checked for absolute passivity on the plaster cast (b).



**Fig. 15.** Contact points are refined intraorally (a), and the provisional is delivered within 24 hours of surgical intervention (b).

#### Provisional re-evaluation

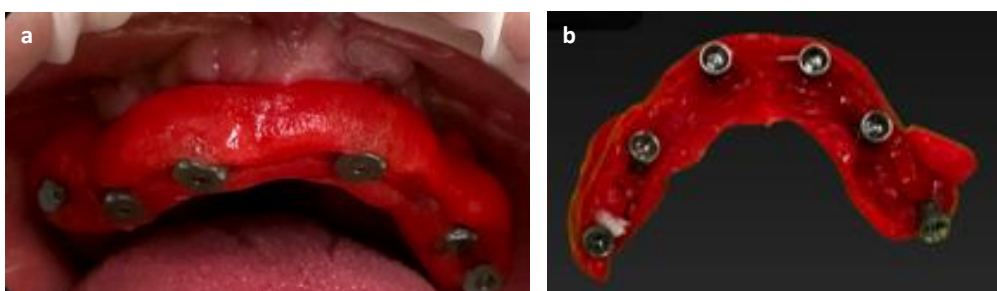
At the 3 months, the provisional needs to be re-evaluated, and further data must be acquired. While a detailed exposition of the fabrication process for a final full-arch implant-supported rehabilitation exceeds the scope of this document and has been comprehensively addressed in a recent publication by the authors (18), key steps will be outlined here to ensure a complete case presentation (Fig. 16).



**Fig. 16.** Front facing (b) and profile (a, c) smiling photos of the patient with the final restoration in situ.

T. Tealdo et al.

At this stage, the provisional is removed from the oral cavity, and intraoral ScanBodies (ScanBody ProCam, Biaggini Medical Devices Srl, Arcola, Italy) are positioned on the implants. The ScanBodies are interconnected using a pattern resin splint to ensure a highly accurate intraoral scan. This technique solidifies the ScanBodies as a single unit, stabilizing them to prevent any movement during scanning, which could compromise the precision of the data capture. Following the stabilization of the ScanBodies, a detailed intraoral scan is conducted. This scan captures comprehensive data on the soft tissues surrounding the implants and the solidarized ScanBodies, providing a precise digital representation of the mouth's current state. This data is further enriched by an extraoral scan of the provisional and an extraoral scan of the patten resin jig (Fig. 17).



**Fig. 17.** Thanks to pattern resin, ScanBodies are interconnected (a), and the jig is scanned intraorally and extraorally (b).

A fundamental second step in this phase involves acquiring an extraoral scan of the worn provisional prosthesis and conducting a follow-up surface electromyography (Teethan®, Teethan S.p.A, Milan, Italy). This approach enables, after import in the CAD software, a detailed assessment of the functional wear on the provisional by comparing the.STL file from the scan with the initial CAD project. Such comparison aids in identifying any deviations or wear patterns that may have occurred during the provisional functionalization timeframe. Meanwhile, surface electromyography serves a dual purpose. It confirms the achievement of a balanced occlusion in the absence of prior pathological indicators. It assesses the impact of the rehabilitation process, especially if there were initial complaints or symptoms. Thanks to this data, the clinician and the dental technician can proceed with the final restoration fabrication.

## DISCUSSION

In the conventional framework of implant dentistry, particularly when addressing full arch implant-supported restorations in failing or absent dentitions, a series of critical steps are indispensable for ensuring the success of the treatment. Among these, the accurate determination of the VDO stands out as a foundational requirement. This process, essential for both aesthetic outcomes and functional efficiency, varies depending on the presence of any remaining natural teeth. In cases where residual dentition persists, the assessment typically commences with measurements of the existing VDO. However, in scenarios where posterior dental contacts are missing, a meticulous registration of centric relation (CR) is performed to establish a base from which a new VDO can be evaluated.

This traditional method often necessitates the fabrication of an intermediate removable denture. While critical for assessing a suitable new VDO, this step introduces several challenges to the treatment timeline and patient experience. Firstly, it significantly prolongs the overall duration of treatment. Each phase, from the initial evaluation to the final loading of implants, is extended due to the additional steps required to fabricate and adjust the removable denture. Furthermore, this approach incurs higher costs attributed to the materials and labor involved in creating the denture and the extended clinical and laboratory work duration. Most notably, from the patient's perspective, this process mandates using a removable device from the moment of teeth extraction up until the placement and loading of implants. While necessary for determining the correct VDO, this interim solution may compromise the patient's comfort, aesthetics, and overall satisfaction with the treatment process. The necessity to adapt to a removable denture, even temporarily, can be a significant inconvenience, impacting their daily life and confidence.

Despite the benefits of digital technologies facilitating immediate loading protocols in edentulous arches, transferring occlusal information, namely VDO, from the removable provisional denture to the fixed one remains challenging due to the lack of reference points in edentulous impressions (19). The emerging digital workflow addresses

T. Tealdo et al.

these difficulties by minimizing the need for a physical interim denture for occlusal evaluation and exploiting digital techniques for data alignment and VDO transfer from initial assessment to post-operative restoration. In this context, hopeless teeth can be used as starting indexes for VDO assessment before extraction, thanks to the digital scans, if they still carry valuable information.

A notable advancement by Lorenzetti et al. (20) in 2021 introduced a method for fabricating an immediate load fixed implant-supported interim prosthesis for both arches without a removable denture, using palatine rugae as a reference point for the upper jaw. Lorenzetti's protocol still required analogic adjustments to the VDO and interocclusal relationship if necessary. At the same time, this proposed approach is based on fully digital evaluations, so no physical adjustment is required in the patient's mouth before taking the pre-operative impressions. A significant help in this direction is the implementation of both a face scan and a digital registration of the inferior jaw dynamics so that the most meaningful parameters are digitalized and joined into a single software. Palatine wrinkles are the chosen point of reference due to their inextensibility and stability over time, two mandatory features when identifying a fixed landmark; the data matching is indeed possible thanks to their presence both in the post-operative plaster impression and in the digital wax-up, eliminating reliance on mini-implants, which are poorly tolerated by patients and augment costs.

A second key element of the proposed approach is the retention of the most distal hopeless teeth during implant surgery. The specially designed stent can be accommodated with tooth support, which is much more precise than mucosal and less invasive than bone stabilization (21). This stent is defined as a prosthetic-surgical guide. Its focus is not to serve as a limiting guide to implant placement but rather to be a visual representation of the optimal teeth positioning, replacing the role of an interim denture with the benefits of no additional cost and little effort.

This workflow also highly emphasizes aesthetic considerations, starting from macroesthetic principles and extending to microesthetic considerations. The ability to create a virtual patient model by capturing a face scan and joining it with 2D photos in various settings makes it possible to analyze the dynamic aspects of facial expressions during social interactions within the dental laboratory. This analysis focuses on the proportions of the facial thirds, their alignment with the midline on the coronal plane, as well as the relationship of the maxilla to the skull base, and the VDO of occlusion on the sagittal plane. The virtual patient framework also facilitates the examination of the smile line and tooth proportions, enhancing the clinician's ability to communicate with the dental technician and the patient concerning the expected outcomes and aesthetic preferences, all without the need for creating a physical aesthetic try-in.

As the field evolves, the Authors anticipate an increasingly digital future for implant dentistry. Particularly for the discussed protocol and its variations, there's a push towards more accurate and streamlined digital scanning processes in full arch rehabilitations. Progress is evident with the introduction of dual-purpose impression abutments, designed to serve as transfer points for traditional plaster impressions and scan bodies for digital model casting. This innovation marks a significant step towards integrating and enhancing the precision of digital workflows in implant dentistry, bridging the gap between analogic and digital impression techniques.

## CONCLUSIONS

This clinical report showed the efficacy of a mixed analogic and digital workflow in managing complex full-arch rehabilitation of the upper jaw. By employing a prosthetic-surgical guide and advanced preoperative digital planning, the proposed method facilitated the accurate transfer of crucial occlusal and aesthetic parameters from the initial assessment to the final restoration. Notably, this approach eliminated the need for traditional interim dentures to propagate the VDO of occlusion through different phases, exploiting the adequateness of digital scans in specific contexts and the traditional plaster impression, among others. This system significantly streamlined the treatment process, reducing treatment duration and costs without sacrificing the predictability of aesthetic and functional outcomes in complex cases.

## REFERENCES

1. Gittelsohn GL. Vertical Dimension of Occlusion in Implant Dentistry: Significance and Approach. *Implant Dentistry*. 2002;11(1):33-40. doi:<https://doi.org/10.1097/00008505-200201000-00012>
2. Goldstein G, Goodacre C, MacGregor K. Occlusal Vertical Dimension: Best Evidence Consensus Statement. *Journal of Prosthodontics*. 2021;30(S1):12-19. doi:<https://doi.org/10.1111/jopr.13315>
3. Fayz F, Eslami A. Determination of occlusal vertical dimension: A literature review. *The Journal of Prosthetic Dentistry*. 1988;59(3):321-323. doi:[https://doi.org/10.1016/0022-3913\(88\)90182-5](https://doi.org/10.1016/0022-3913(88)90182-5)
4. Spear F. Approaches to vertical dimension. *Adv Esthet In-Terdiscip Dent*. 2006;2:2-14.
5. Feng Y, Zhan L, Sun X, Li J, Liu W. A fully digital workflow to register maxillomandibular relation using a jaw motion tracer for fixed prosthetic rehabilitation: A technical report. *Journal of Esthetic and Restorative Dentistry*. 2023;35(7):1068-

T. Tealdo et al.

1076. doi:<https://doi.org/10.1111/jerd.13058>
6. D'haese R, Vrombaut T, Roeykens H, Vandeweghe S. In Vitro Accuracy of Digital and Conventional Impressions for Full-Arch Implant-Supported Protheses. *Journal of Clinical Medicine*. 2022;11(3):594. doi:<https://doi.org/10.3390/jcm11030594>
  7. Cappare P, Sannino G, Minoli M, Montemezzi P, Ferrini F. Conventional versus Digital Impressions for Full Arch Screw-Retained Maxillary Rehabilitations: A Randomized Clinical Trial. *International Journal of Environmental Research and Public Health*. 2019;16(5):829. doi:<https://doi.org/10.3390/ijerph16050829>
  8. Nedelcu R, Olsson P, Thulin M, Nyström I, Thor A. In vivo trueness and precision of full-arch implant scans using intraoral scanners with three different acquisition protocols. *Journal of Dentistry*. 2023;128:104308. doi:<https://doi.org/10.1016/j.jdent.2022.104308>
  9. Arikan H, Muhtarogullari M, Uzel SM, et al. Accuracy of digital impressions for implant-supported complete-arch prosthesis when using an auxiliary geometry device. *Journal of Dental Sciences*. 2023;18(2):808-813. doi:<https://doi.org/10.1016/j.jds.2023.01.012>
  10. Noémie Drancourt, Auduc C, Aymeric Mouget, et al. Accuracy of Conventional and Digital Impressions for Full-Arch Implant-Supported Protheses: An In Vitro Study. *Journal of Personalized Medicine*. 2023;13(5):832-832. doi:<https://doi.org/10.3390/jpm13050832>
  11. Pera F, Pesce P, Bagnasco F, et al. Comparison of Milled Full-Arch Implant-Supported Frameworks Realised with a Full Digital Workflow or from Conventional Impression: A Clinical Study. *Mater Basel Switz*. 2023;16(2):833-833. doi:<https://doi.org/10.3390/ma16020833>
  12. Thomas AA, Jain RK. Influence of Operator Experience on Scanning Time and Accuracy with Two Different Intraoral Scanners - A Prospective Clinical Trial. *Turkish Journal of Orthodontics*. 2023;36(1):10-14. doi:<https://doi.org/10.4274/TurkJOrthod.2022.2021.0220>
  13. Resende CCD, Barbosa TAQ, Moura GF, et al. Influence of operator experience, scanner type, and scan size on 3D scans. *The Journal of Prosthetic Dentistry*. 2021;125(2):294-299. doi:<https://doi.org/10.1016/j.prosdent.2019.12.011>
  14. Ortorp A, Jemt T, Bäck T, Jälevik T. Comparisons of precision of fit between cast and CNC-milled titanium implant frameworks for the edentulous mandible. *The International Journal of Prosthodontics*. 2003;16(2):194-200.
  15. Passia N, Blatz M, Jörg Rudolf Strub. Is the smile line a valid parameter for esthetic evaluation? A systematic literature review. *The European journal of esthetic dentistry : official journal of the European Academy of Esthetic Dentistry*. 2011;6(3):314-327.
  16. Batra P, Kaur H, Dawar A, Mehta V. The threshold of acceptability of excessive gingival display by laypersons: a systematic review. *PubMed*. 2022;16(2):216-235.
  17. Tealdo T, Gelpi F, Grivetto F, et al. A retrospective multicentric study of 56 patients treated with 92 pterygoid implants for partial/ full arch implant supported fixed rehabilitation: implant and prosthesis success rate. *Eur J Musculoskel Dis*. 2023;12(3):119-126.
  18. Gelpi F, Alberti C, Bevilacqua M, Montagna P, De Santis D, Tealdo T. A Novel Classification and a Chart-Making Decision Flow Proposal for Fixed Full-Arch Implant-Supported Prosthesis. *Eur J Musculoskel Dis*. 2024;13(1):17-40.
  19. Venezia P, Torsello F, Santomauro V, Dibello V, Cavalcanti R. Full Digital Workflow for the Treatment of an Edentulous Patient with Guided Surgery, Immediate Loading and 3D-Printed Hybrid Prosthesis: The BARI Technique 2.0. A Case Report. *International Journal of Environmental Research and Public Health*. 2019;16(24):5160. doi:<https://doi.org/10.3390/ijerph16245160>
  20. Lorenzetti M, Lorenzetti V, Carossa M, Cavagnetto D, Mussano F. Using a Preoperative Scan Digital Impression and a Digital Index to Build Immediate Interim Full-Arch Implant-Supported Prosthesis. A Case Report and Proof of Concept. *Applied Sciences*. 2021;11(3):996. doi:<https://doi.org/10.3390/app11030996>
  21. Shi Y, Wang J, Ma C, Shen J, Dong X, Lin D. A systematic review of the accuracy of digital surgical guides for dental implantation. *International Journal of Implant Dentistry*. 2023;9(1):38. doi:<https://doi.org/10.1186/s40729-023-00507-w>



*Case report*

## **INTERNAL-EXTERNAL LARYNGOCELE TREATED WITH EXCLUSIVELY TLM: HOW I DO IT.**

G. Molteni<sup>1</sup>, C. Liberale<sup>2</sup>, V. Arietti<sup>2\*</sup>, G. Fulco<sup>2</sup>, R. Nocini<sup>2</sup>, B. Le Pera<sup>2</sup>, C. Alberti<sup>2</sup>, G. Barbera<sup>3</sup> and L. Sacchetto<sup>2</sup>

<sup>1</sup>Department of Otorhinolaryngology, Head and Neck Surgery, IRCCS Azienda Ospedaliero-Universitaria di Bologna, Policlinico S. Orsola-Malpighi, Bologna, Italy;

<sup>2</sup>Unit of Otorhinolaryngology, Head and Neck Department, University of Verona, Verona, Italy;

<sup>3</sup>Unit of Maxillo-Facial Surgery, Head & Neck Department, University of Verona, Verona, Italy.

*\*Correspondence to:*

Valerio Arietti, MD

Unit of Otorhinolaryngology,

Head and Neck Department,

University of Verona,

Verona, Italy

e-mail: valerio.arietti@gmail.com

**KEYWORDS:** *laryngocele, Transoral Laser Microsurgery, TLM, minimally invasive surgery*

### **ABSTRACT**

Laryngocele is a rare pathology with different grades of extension. Minimally invasive surgery, such as Transoral Laser Microsurgery, is also widely used for combined laryngocele (with internal and external components). In this paper, we show the step-by-step procedure for the treatment of a combined laryngocele with Transoral Laser Microsurgery. This technique allows us to obtain good clinical results: complete removal of the disease, short hospitalization, low morbidity, and rapid recovery. At clinical evaluation after three months, the patient showed no recurrence of the disease.

### **INTRODUCTION**

A laryngocele is an abnormally dilated laryngeal saccular cavity that may be filled with air (classic laryngocele), mucus (laryngomucocele), or purulent secretions (laryngopyocele). Laryngoceles are classified as internal, which is confined to the endolarynx, external, which extends beyond the borders of the laryngeal cartilages, and combined, which has an internal and external component (1). It may be the result of a repeated increase in pressure in the upper respiratory tract, as may occur in glass workers or players of wind instruments; in rare cases is associated with occult squamocellular glottic carcinoma (2).

Received: 02 October 2023

Accepted: 08 October 2023

ISSN: 2038-4106

Copyright © by BIOLIFE 2023

This publication and/or article is for individual use only and may not be further reproduced without written permission from the copyright holder. Unauthorized reproduction may result in financial and other penalties. **Disclosure: All authors report no conflicts of interest relevant to this article.**



Laryngocele is a rare condition. According to recent data, the incidence of the disease is 151 per 2.5 million people per year (1). The highest incidence is observed in the sixth decade of life, with a predominance in the male sex (males: females = 3:1). Nearly half of the laryngoceles are discovered incidentally, such as during head and neck examinations or CT and MRI examinations for other purposes (3).

Treatment of laryngoceles requires surgery (4). There are several types of surgery, mainly open or transoral. The choice of surgical technique depends on the location and extent of the disease (5), but also the surgeon's experience. Internal laryngoceles are usually treated with transoral procedures only, while external and combined laryngoceles may be treated with a combination of transoral and open transcervical approaches (6). Nowadays, Transoral Laser Microsurgery (TLM) is widely used with good results in external or combined laryngoceles, avoiding open surgery. This approach allows for a reduction of surgical and hospitalization time and surgical complications (7). The aim of this study is to show step by step how to manage a combined internal-external laryngocele with exclusively TLM.

## MATERIALS AND METHODS

Before surgery, the patient underwent CT and MRI scans of the neck and fiberoptic endoscopic examination of the internal anatomy of the larynx. These findings provided a reliable assessment of the size of the laryngocele and its relationship to surrounding structures. Appropriate surgical planning can be made only after adequate clinical and radiological examination.

Written informed consent was obtained from the patient, and the surgical procedure was discussed in detail with the patient to inform her of the risks and benefits of the chosen technique. The surgical procedure is performed under general anaesthesia. Removal of the internal and external components of the laryngocele is performed under a surgical microscope and with CO<sub>2</sub> laser (9).

## RESULTS

The patient was discharged the day after the procedure, without any particular problems. Since awakening after surgery, the patient breathed and spoke without difficulty. The voice remained unchanged. Food intake was also resumed regularly without any restrictions.

The patient underwent endoscopic follow-up 1 month and 3 months postoperatively. At the last checkup, a regular surgical result with complete mucosal healing at the laryngeal level was observed. Macroscopically, there were no signs of disease recurrence. In addition, the patient reported no symptoms related to the pathology; specifically, she reported no dyspnea, dysphonia, or dysphagia.

## DISCUSSION

The treatment of laryngocele has evolved in recent years. Originally, almost all cases of laryngocele were treated through an open approach with various surgical procedures: transthyrohyoid membrane approach, thyrotomy with resection of the upper third of the thyroid cartilage, and V-shaped thyrotomy (8). Nowadays, the transoral approach is most commonly used because of its numerous advantages. Many authors have demonstrated successful transoral treatment of laryngocele in both internal and combined laryngocele. With increasing use of CO<sub>2</sub> laser (9), TLM is a less invasive technique that can be performed in less time compared with the open technique. Devesa et al (9) performed a retrospective study in which three patients with combined laryngoceles were treated with an endoscopic approach, with no complications and good clinical outcomes. Ciabatti et al (10) have shown that resection with CO<sub>2</sub> laser (9) is currently the preferred technique because it is precise, efficient, and safe compared with an open approach. In addition, the hospitalization of patients treated with the endoscopic procedure lasts only a few days, and patients make a full recovery more quickly. Moreover, there are no relevant effects on swallowing and speech in patients who have undergone endoscopic treatment of laryngocele (11). Patients can speak, drink and eat within a few hours of the procedure, without the need for medications or precautions.

Another surgical procedure that is gaining popularity for combined laryngoceles is transoral robotic surgery (TORS).

As an endoscopic procedure, this surgical technique offers all of the above advantages. In addition, the outer portion of the laryngocele can be better visualized because of its range of motion. However, it should be kept in mind that the choice of surgical technique depends primarily on the particular patient, the type of lesion, and also on the surgeon's skills and preferences.

In summary, the literature shows that the treatment of laryngocele has progressed since its initial description, from an open to an endoscopic approach. Recently, the robotic surgical approach has gained popularity. Nevertheless, the transoral approach with TLM is the first choice for internal laryngocele and selected combined laryngocele.

#### *Surgical technique*

In the following, we describe an exclusive TLM approach using CO<sub>2</sub> laser to treat an internal-external laryngocele. The patient underwent general anaesthesia, and a small-diameter reinforced tube was used. After exposure of the larynx with a rigid laryngoscope, the surgical microscope was positioned. The laryngocele was clearly visible through the right ventricular fold.

Step 1: Visualization of the larynx. The bulging at the level of the right ventricular fold, clearly visible, indicates the internal component of the laryngocele (Fig. 1);

Step 2: Incision of the upper part of the ventricular fold is performed with CO<sub>2</sub> laser until the capsule of the laryngocele is reached. A small cottonoid is placed to protect the tube (Fig. 2);

Step 3: The laryngocele is then cut, and its glue content is suctioned (Fig. 3);

Step 4: Once empty, the borders of the laryngocele are more clearly visible. At this point, the surgeon begins the detachment of the lateral wall of the capsule by gently pulling it medially (Fig. 4). This step is crucial to allow adequate mobilization, traction, and dissection to completely remove both the internal and external components of the laryngocele;

Step 5: If the external portion of the laryngocele is very deep, it might be useful to adopt a piecemeal dissection technique (Fig. 5);

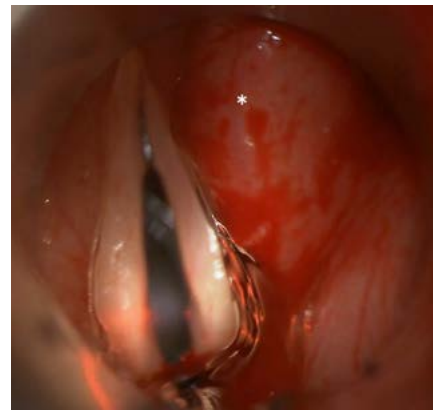
Step 6: Once the excision is completed, the bottom of the ventricle is clearly visible. In this case, the surgeon preferred to preserve the more medial portion of the ventricular fold to allow better recovery (Fig. 6);

Step 7: Endoscopic inspection (Fig. 7) with an angled rigid 70° endoscope was performed to verify the complete removal of the laryngocele. Control was made 1 month after surgery. Recovery was nearly complete, with no evidence of residual lesion (Fig. 8).

#### *Summary*

Laryngocele is a very rare condition that can be life-threatening because it can lead to acute airway obstruction.

Many cases of laryngocele are detected incidentally.



**Fig. 1.** Visualization of the larynx.



**Fig. 2.** Incision of the upper part of the ventricular fold is performed.



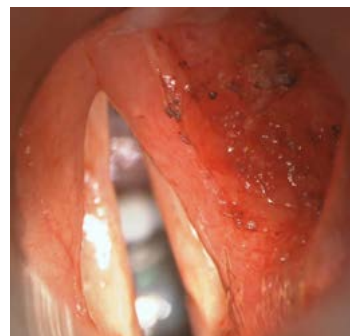
**Fig. 3.** Cut of the laryngocele.



**Fig. 4.** Detachment of the lateral wall of the capsule.



**Fig. 5.** dissection technique.



**Fig. 6.** the bottom of the ventricle upon completion of the excision.

Treatment of laryngoceles requires surgery and has evolved in recent years.

Internal laryngoceles are treated with an exclusively transoral approach, whereas combined internal and external laryngoceles are often treated with a combined transoral and open cervicotomy approach.

Surgery is performed under general anaesthesia.

Radiological examination must be performed before surgery to select the best surgical procedure.

The transoral approach with CO<sub>2</sub> laser for combined laryngoceles has fewer complications and morbidities and allows for a faster recovery and shorter hospital stay while maintaining satisfactory clinical outcomes.

There are no relevant effects on swallowing and speech in transorally treated patients.

TORS is becoming increasingly popular for combined laryngoceles.

The choice of surgical technique also depends on the surgeon's skills and preferences.

#### Author contributions

CL wrote the paper; VA edited the images; GM, performed the surgical procedure; RN, LB, GF and LS corrected the paper and supervised the whole work.

#### Conflict of interest

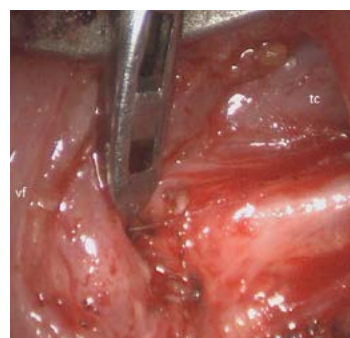
The authors have no financial relationship to disclose.

#### Ethical approval

All procedures performed in studies involving human participants conformed to the ethical standards of the Institutional and/or National Research Commission and the 1964 Declaration of Helsinki and its subsequent amendments or comparable ethical standards. The Clinical Trials Ethics Committee of the Provinces of Verona and Rovigo exempted this study from its approval. All authors read and approved the manuscript.

#### REFERENCES

1. Slonimsky E, Goldenberg D, Hwang G, Gagnon E, Slonimsky G. A Comprehensive Update of the Incidence and Demographics of Laryngoceles in Adults. *Annals of Otolaryngology, Rhinology & Laryngology*. 2021;131(10):1078-1084. doi:<https://doi.org/10.1177/00034894211055336>



**Fig. 7.** Endoscopic inspection.



**Fig. 8.** Fiberoptic examination at 1 month post-surgery.

2. Mitroi M, Căpitănescu A, Popescu FC, et al. Laryngocele associated with laryngeal carcinoma. *Romanian Journal of Morphology and Embryology = Revue Roumaine De Morphologie Et Embryologie*. 2011;52(1):183-185.
3. Slonimsky G, Hawng G, Goldenberg D, Gagnon E, Slonimsky E. Terminology, Definitions, and Classification in the Imaging of Laryngoceles. *Current Problems in Diagnostic Radiology*. 2020;50(3). doi:<https://doi.org/10.1067/j.cpradiol.2020.06.002>
4. Singh R, Karantanis W, Fadhil M, Kumar SA, Crawford J, Jacobson I. Systematic review of laryngocele and pyolaryngocele management in the age of robotic surgery. *Journal of International Medical Research*. 2020;48(10):030006052094044. doi:<https://doi.org/10.1177/0300060520940441>
5. Purnell PR, Haught E, Turner M. Minimally invasive treatment of laryngoceles: a systematic review and pooled analysis. *Journal of Robotic Surgery*. 2021;16(1):1-14. doi:<https://doi.org/10.1007/s11701-021-01210-x>
6. Mobashir MK, Basha WM, Mohamed AES, Hassaan M, Anany AM. Laryngoceles: Concepts of Diagnosis and Management. *Ear, Nose & Throat Journal*. 2017;96(3):133-138. doi:<https://doi.org/10.1177/014556131709600313>
7. Mishra A. Single Stage Conservative Surgery to Avoid Recurrence in Combined Laryngocele: Important Modifications. *Indian Journal of Otolaryngology and Head & Neck Surgery*. 2020;74(S2):2014-2018. doi:<https://doi.org/10.1007/s12070-020-01955-1>
8. Zelenik K, Stanikova L, Smatanova K, Cerny M, Kominek P. Treatment of Laryngoceles: What Is the Progress over the Last Two Decades? *BioMed Research International*. 2014;2014:1-6. doi:<https://doi.org/10.1155/2014/819453>
9. Devesa PM, Ghufour K, Lloyd S, Howard D. Endoscopic CO2 Laser Management of Laryngocele. *The Laryngoscope*. 2002;112(8):1426-1430. doi:<https://doi.org/10.1097/00005537-200208000-00018>
10. Pier Guido Ciabatti, Giulia Burali, Luca D'Ascanio. Transoral robotic surgery for large mixed laryngocele. *The Journal of Laryngology & Otology*. 2013;127(4):435-437. doi:<https://doi.org/10.1017/s0022215113000236>
11. Fatma Tülin Kayhan, Selçuk Güneş, Arzu Karaman Koç, Ayşe Pelin Yiğider, Kamil Hakan Kaya. Management of Laryngoceles by Transoral Robotic Approach. *Journal of Craniofacial Surgery*. 2016;27(4):981-985. doi:<https://doi.org/10.1097/scs.0000000000002641>



*Case Report*

## **EXCLUSIVE TRANSCANAL ENDOSCOPIC REMOVAL OF GLOMUS TYMPANICUM: A STEP-BY-STEP DESCRIPTION OF SURGICAL TECHNIQUE**

D. Soloperto, G. Ronzani, C. Gillone, R. Nocini\*, B. Le Pera, G. Fulco, C. Alberti, V. Arietti and L. Sacchetto

Unit of Otolaryngology, Head and Neck Department, University Hospital of Verona, Italy

*\*Correspondence to:*

Riccardo Nocini, MD  
Unit of Otolaryngology,  
Head and Neck Department,  
University Hospital of Verona,  
Verona, Italy  
e-mail: riccardo.nocini@gmail.com

### **ABSTRACT**

The purpose of this article is to show step-by-step the exclusive transcanal endoscopic approach to a glomus tympanicum tumour, along with its pre- and post-operative management. Glomus tympanicum is a benign and slow-growing vascular tumour of the middle ear. Staging corresponds to extension within middle ear space and adjacent structures, and it is represented either by Glasscock-Jackson and modified Fisch-Mattox scales. Many strategies have been proposed as treatment options. When surgery is indicated, the evolution of endoscopic ear surgery has allowed an alternative approach to the traditional one. The patient was referred for persistent monolateral pulsatile tinnitus. Computed tomography (CT) scan is essential to define the extension of the lesion in the temporal bone while CT angiography shows its supplying arteries. If the tumour is limited to the middle ear cavity, an exclusive transcanal endoscopic approach is therefore indicated and the patient may be discharged after 24-48 hours after the surgical procedure. Endoscopic excision for small and localized glomus tympanicum tumour represents a safe and effective option with low intra- and post-operative complications.

**KEYWORDS:** *glomus tympanicum, transcanal endoscopic approach, tumour, middle-ear, endoscopic excision*

### **INTRODUCTION**

Middle ear paraganglioma, also known as glomus tympanicum, is a benign and slow-growing vascular neoplasm arising from the tympanic plexus of Arnold's and Jacobson's nerve onto cochlear promontory (1). It is the most

Received: 24 September 2023  
Accepted: 02 October 2023

ISSN: 2038-4106  
Copyright © by BIOLIFE 2023

This publication and/or article is for individual use only and may not be further reproduced without written permission from the copyright holder. Unauthorized reproduction may result in financial and other penalties. **Disclosure: All authors report no conflicts of interest relevant to this article.**

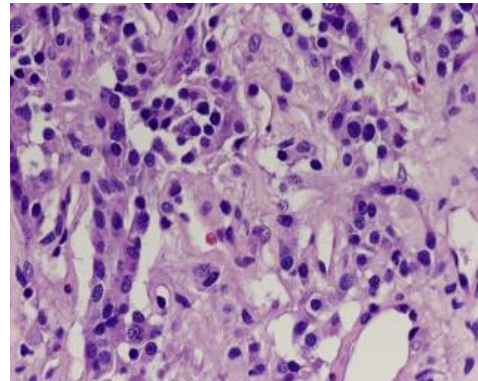


common tumour within the tympanic cleft, while is the rarest among its counterparts in other head and neck districts, with the carotid body paraganglioma being the most frequent. All are histologically composed of chief cells and sustentacular cells. Less frequently, a malignant or catecholamine-producing type may be encountered (Fig. 1, 2).

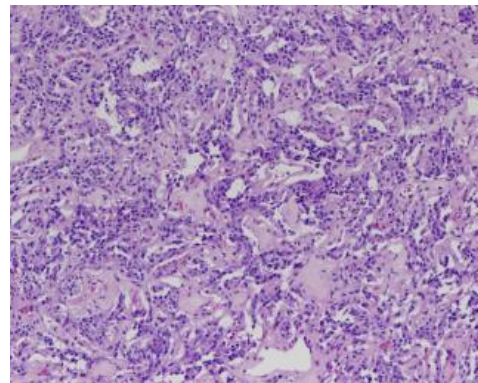
Epidemiologically, glomus tympanicum is more frequent within the female gender, with a bimodal distribution in the late 30s and the early 60s. Clinically a glomus tympanicum often presents with a history of long-term pulsatile tinnitus and auricular fullness, with or without hearing loss (1). Rarely it is associated with bloody otorrhea or neuropathies. In most cases, the diagnosis is incidental. At the otoendoscopic examination, a reddish and bulging tympanic membrane is suggestive of it.

Staging of glomus tympanicum corresponds to the extension within the middle ear space and adjacent structures and it is represented by the Glasscock-Jackson (Table I) and modified Fisch-Mattox scales (Table II) (2). CT- and MRI-scan are very helpful in defining the nature and limits of the lesion while, due to the vascular origin, CT-angiography allows detection of its supplying vascular branches (3).

Therapeutic options may include wait-and-scan policy, external radiotherapy and surgical resection (3, 7). The indications for a conservative approach are non-secreting small tumour (< 1 cm), slow-growing rate, absence of symptoms and older patients with comorbidities precluding major surgery. In these cases, close clinical and radiological follow-up must be planned. External radiotherapy, in terms of conventionally fractionated external beam RT (EBRT) or stereotactic body RT (SBRT), may provide long-term disease control for unresectable growing paragangliomas. Anyway, surgical option is often the preferred method of treatment.



**Fig. 1.** High-magnification histopathology of paraganglioma. The chief cells are small with basophilic cytoplasm and have round, granular nuclei (Hematoxylin and Eosin stain).



**Fig. 2.** Low-magnification histopathology of paraganglioma. The Zellballen architecture is visible, along with a richly vascular stroma and focal fibrosis (Hematoxylin and Eosin stain).

**Table I.** Glasscock-Jackson classification system.

Grade	Definition
1	Tumor margins completely visible on otoscopy
2	Tumor filling the middle ear
3	Tumor filling the middle ear and the mastoid
4	Tumor extending through the tympanic membrane into the external auditory canal

**Table II.** Modified Fisch-Mattox classification system.

Grade	Definition
A1	Tumor margins completely visible on otoscopy
A2	Tumor margins not completely visible on otoscopy
B1	Tumor filling the middle ear and extending into the hypotympanum or sinus tympani
B2	Tumor filling the middle ear and in the mastoid
B3	Tumor eroding into the carotid canal

*Surgical options*

Traditionally, most middle ear paragangliomas have been managed with surgical excision and, considering resection, preoperative treatment planning is essential. Firstly, the chosen approach depends on the extent of the tumour within the middle ear and mastoid cavity (1, 2) with the Glasscock-Jackson and modified Fisch-Mattox scales being the most used. Then, the risk of intraoperative blood loss must be estimated: preoperative angiography is mandatory to assess any vessels leading to the lesion, even if in most cases limited to the tympanic cleft embolization is not necessary. Lastly, the need for pharmacological intervention should be considered, to determine whether perioperative a-adrenergic and possibly b-adrenergic blockades are necessary. In this scenario, a transcanal and/or retroauricular microscope-based approach is the traditional technique used to manage this kind of tumour (3-5).



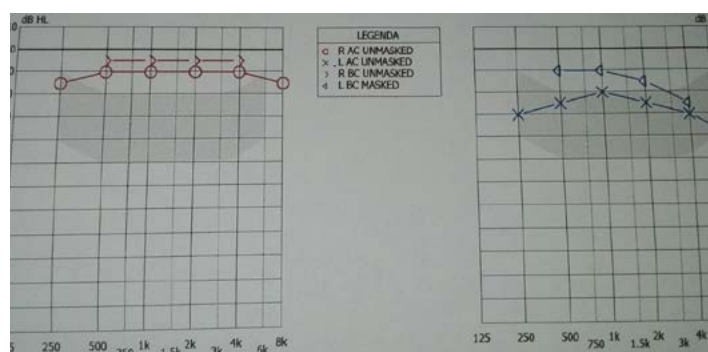
**Fig. 3.** Preoperative endoscopic view of left tympanic membrane.

The transmastoid approach is necessary for tumour extending into the mastoid, into the ear canal or significantly engaging the pro- and hypotympanicum areas. A mastoidectomy is helpful to visualize tumours that extend superiorly into the attic, with an extended posterior tympanotomy in front of tumours extending inferiorly. A modified radical mastoidectomy with or without canal overclosure may be necessary for advanced tumours with external auditory canal erosion. Moreover, even small tumours in patients with very narrow external auditory canal may require postauricular approach. The transcanal microscopic approach is indicated for small tumours limited to the middle ear, even if it is more frequently used in combination with the posterior approach (6, 7).

The rising use of the endoscope in ear surgery introduced a new strategy within the management of this kind of tumour (8, 9, 10). In the beginning, it was just used as a tool to achieve a better visualization of some anatomical details or to explore hidden areas. Then it appeared to be reliable in approaching pathologies of the temporal bone, limited to the middle ear cavity.

*Case presentation*

A 56-year-old female presented with a history of persistent pulsatile tinnitus limited to the left ear. She did not report any vertigo or other cochleovestibular symptoms. At the otologic examination, the tympanic membrane appeared regular (Fig. 3), while hearing evaluation through pure tone audiometry revealed an ipsilateral air-bone gap of 15 dB (Fig. 4) associated with a type A tympanogram. No stapedial reflex was evocated. A CT scan was then performed, showing a small mass centered in the hypotympanum (Fig. 5A, B) while a CT- angiography showed vascularization from an internal carotid artery vessel in its petrous segment (Fig. 5C). Since the tumour was strictly limited to the pro-/



**Fig. 4.** Preoperative pure tone audiometry

hypo-tympanum, it was classified as Modified Fisch-Mattox Class A and as a Glasscock-Jackson Class 1. As previously mentioned, for a small, localized glomus tympanicum tumour a transcanal endoscopic resection was indicated.

## SURGICAL TECHNIQUE

### *Surgical anatomy*

The introduction of endoscope in ear surgery allowed a more detailed description of the middle ear anatomy since many subspaces can be easily explored.

### *Protympanic space*

The protympanic area represents the most anterior portion of the middle ear cavity. It communicates superiorly with the anterior epitympanic space, through the tensor fold, and inferiorly with the hypotympanum, while posteriorly it continues into the mesotympanum. Medially, the lateral wall of the vertical carotid artery and the Eustachian tube orifice are found, while laterally it is bounded by the mandibular fossa.

### *Hypotympanic space*

The hypotympanic area represents the most inferior portion of the middle ear cavity. It communicates superiorly with the mesotympanum, to the protympanum through the protiniculus bone ridge and to the retrotympaanum through the finiculus bone ridge. It houses the jugular bulb, whose height determines this subsite's volume.

### *Mesotympanic space*

The mesotympanic space is the area one can explore through the external auditory canal. In detail, it is delimited from the tympanic membrane laterally and the promontory area (the bone covering the cochlea) medially. It contains a malleus handle, the long process of incus, the incudostapedial joint and the stapes superstructure.

### *Epitympanic space*

The epitympanic space is the most superior part of the middle ear cavity, which communicates posteriorly with the mastoid cavity through the antrum and inferiorly with the mesotympanum through the epitympanic diaphragm. Anteriorly the tensor fold is found, superiorly the tegmen tympani (which separates the eardrum from the middle cranial fossa), medially the sovrageniculate fossa and laterally the scutum and the pars flaccida. It can be divided into an anterior and posterior portion by the cog, a bone ridge lying from the tegmen to the cochleariform process, where the tensor tympani muscle is attached.



**Fig. 5.** Paraganglioma of the left middle ear involving the hypotympanum. A. Axial view of non-contrasted CT-scan; B. Coronal view of non-contrasted CT-scan; C. Preoperative angiography showing a small vessel originating before the petrous segment of ICA.

This space is occupied mostly by the ossicular chain (head of malleus, body, and short process of incus) and its ligaments, while medially lies the tympanic tract of facial nerve.

#### *Retrotympanic space*

The retrotympanic space is the most posterior area of the middle ear cavity. It communicates anteriorly with the mesotympanum and inferiorly with the hypotympanum through the finiculus. It can be divided into a superior and inferior portion by the subiculum bony ridge lying from the round window to the styloid eminence. Moreover, it can be divided into a medial and lateral portion by the tympanic tract of the facial nerve. An important structure is the pyramidal eminence, from which the stapes muscle arises, representing the lateral border of the sinus tympani.

#### *Operating room*

The procedure is performed under general anaesthesia with the patient in the supine position and his head extended and turned about 45° toward the opposite side of the involved ear. The video equipment is placed in front of the surgeon and the instruments' trolley and scrub nurse are positioned at the head of the patient. Endoscopes 4 mm in diameter and 18 cm in length, with angulation of 0° and 45°, are used, connected to a high-definition monitor (Karl Storz, Germany) (6). A facial nerve intraoperative monitoring system is carried out using NIM-Response 3.0 (Medtronic Xomed Inc., Jacksonville), with intramuscular electrodes inserted to capture the responses of orbicularis oculi and mentalis muscles.

### **SURGICAL STEPS**

#### *Tympano-meatal flap elevation*

The ear is prepared and sterilized by filling the external auditory canal (EAC) with iodine solution. After proper infiltration of EAC skin with mixture of mepivacaine 2% and epinephrine, a posterior incision from the 5 o'clock to the 12 o'clock position is made approximately 0.5/1 cm from the fibrous annulus using a circular scalpel (4, 10). Usually, a previous tattooing of the incision with cautery has been made to help the surgeon to minimize bleeding during this first step (5). A lateral to medial skin dissection is then made detaching the tympanomeatal flap from the underlying bone using cottonoids soaked in epinephrine to avoid excessive bleeding. An otologic microhook usually allows to raise the fibrous annulus and gain access to the middle ear. The tympanomeatal flap is lastly dissected from the malleus and transposed and flattened onto the anterior surface of EAC (Fig. 6).

#### *Tympanic cavity exploration*

Once the tympanic cleft and tumoural mass are exposed, the tympanic cavity is explored (10) with both a 0° and 45° endoscope, to assess the extension of the lesion as well as its relationship with the facial nerve and the ossicular chain. Indeed, if the lesion presents with a medial extension relative to the ossicles, chain removal may be necessary to obtain a radical excision of the tumour. However, the well-known endoscopic ability to "look behind the corner" makes this scenario less frequent, as described in the present case.



**Fig. 6.** Tympanic flap elevation from external auditory canal infiltration to its dissection from malleus handle.



Tympanic cavity exploration reveals a vascularized lesion consistent with a tympanic glomus type A located at the inferior aspect of the protympanic region bordering with the hypotympanum (Fig. 7). Delicate bone removal of hypotympanic cells is performed utilizing the Piezosurgery to extend the view so that the tumour margins are well visualized. The ossicular chain appeared intact so there was no need to interrupt it. The bone covering the facial nerve did not seem dehiscent and anyway far from the vascular lesion.

#### *Glomus tympanicum cauterization*

Cautery of this type of tumour is mandatory before dissection (10). Hence, coarctation of the mass as well as cauterization of blood vessels supplying the tumour is performed using bipolar micro-pliers (Fig. 8).

#### *Tumour dissection and management of eventual bleeding*

The dissection is carefully performed with gentle instruments, using a microhook, bone curette and otologic suction (10) (Fig. 9). Cottonoids soaked with saline/diluted epinephrine solution were used to maintain a clean surgical field and achieve adequate hemostasis, which can be refined with bipolar micro-pliers.

#### *Drilling of tumour attachment*

Once the mass has been removed, endoscopic exploration must be carefully performed in the tympanic cavity and along the bony margins where the tumour is attached. Deep drilling of the bony tissue underlying tumour bed is absolutely mandatory to obtain a radical surgery (10). This procedure minimizes the risk of recurrence, which is possible in front of tumours arising from paraganglia (Fig. 10).

#### *Revision of haemostasis and closure*

At the end of the procedure, further exploration of the tympanic cavity is done to check for possible bleeding spots, which are eventually cauterized with bipolar pliers or cottonoids soaked with diluted epinephrine (Fig. 11). Sometimes, absorbable homeostatic products (e.g., Tabotamp Fibrillar) are left in the surgical field. Moreover, the integrity of the facial nerve through intraoperative nerve stimulation, of the ossicular chain by gentle pressure, and of the tympanic membrane are checked. Lastly, the tympanomeatal flap, eventually repaired with a myringoplasty if damaged, is returned to its original position. No histological examination has been requested due to piecemeal dissection and intraoperative appearance.

Absorbable haemostatic gelatin sponges (Spongostan) are left in the external auditory canal to guarantee proper healing of tympanomeatal flap (10).

#### *Peri- and postoperative assessment*

The patient was discharged after 24 hours without complications. An audiometry test was not performed at the discharge as no manipulation



**Fig. 7.** Tympanic cavity exploration reveals a vascular lesion consistent with a glomus tympanicum located in the protympanum. Gt: glomus tympanicum; Ma: malleus; ISJ: incudo-stapedial joint; P: promontorium; Ht: hypotympanum.



**Fig. 8.** Cauterization of glomus tympanicum attachment with bipolar forceps.



**Fig. 9.** Tumor dissection gently performed with the aim of a bone curette.



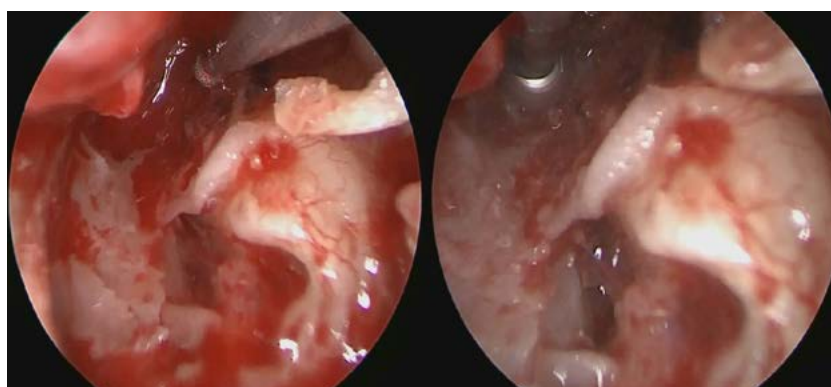
of the ossicular chain occurred. The post-operative indications included the usage of antibiotic ear drops and avoidance of water into the treated ear and pressure surges for 1-2 months (11-16). In our clinic regular follow-up is maintained, firstly within 2-4 weeks, then with a post-operative audiometric test after 3-6 months and finally annually through a CT scan. The patient complained of homolateral tinnitus but no vertigo. The audiometric examination at 3 months showed a neurosensorial hearing loss of 15 dB, while a one-year CT scan showed no signs of recurrence.

## CONCLUSIONS

Surgical excision for glomus tympanicum is the first treatment choice in most cases. The approach is determined by the location and the extension of the lesion, assessed with CT or MR-scan. In the era of minimally invasive treatments, exclusive endoscopic ear surgery can be considered a valid alternative, especially in Glasscock–Jackson type 1 and modified Fisch–Mattox class A tumours. Indeed, this method provides a dynamic and close tumour visualization, leading to a safe, controlled and effective removal without any sutures or canaloplasty, especially if approached by trained surgeons. Thanks to it, this procedure significantly reduces the operating time, and it is even suitable for 24-hour hospital stay.

### *Declaration of competing interest*

The authors have no conflict of interest to declare.



**Fig. 10.** *Drilling of the protympanic and hypotympanic tumour attachment with the aim of a diamond burr.*



**Fig. 11.** *Tympanic cavity at the end of surgical procedure of exclusive endoscopic glomus tympanicum excision. The pro- and hypo-tympanic cells are clearly visible as drilled out.*

## REFERENCES

1. Isaacson B, Nogueira JF. *Endoscopic Management of Middle Ear and Temporal Bone Lesions*. Otolaryngol Clin North Am. 2016 Oct;49(5):1205-14.
2. Killeen DE, Wick CC, Rivas A, Wanna GB, Nogueira JF, Kutz JW Jr, Isaacson B. *Endoscopic Management of Middle Ear Paragangliomas: A Case Series*. Otol Neurotol. 2017 Mar;38(3):408-415.
3. Yildiz E, Dahm, V et Al. *Long-Term Outcome and Comparison of Treatment Modalities of Temporal Bone Paragangliomas*. Cancers 2021, 13-5083.
4. Kaul VF, Filip P, Schwam ZG, Wanna GB. *Nuances in transcanal endoscopic surgical technique for glomus tympanicum tumours*. Am J Otolaryngol. 2020 Sep-Oct;41(5):102562.
5. Marchioni D, Alicandri-Ciufelli M, Gioacchini FM, Bonali M, Presutti L. *Transcanal endoscopic treatment of benign middle ear neoplasms*. Eur Arch Otorhinolaryngol. 2013 Nov;270(12):2997-3004.
6. Daneshi A, Asghari A et Al. *Total Endoscopic Approach in Glomus Tympanicum Surgery*. Iran J Otorhinolaryngol. 2017 Nov;29(95):305-311.
7. Sweeney AD, Carlson ML, Wanna GB, Bennett ML. *Glomus tympanicum tumours*. Otolaryngol Clin North Am. 2015 Apr;48(2):293-304.
8. Satish Nair, K.V.R. Brijith, J.G. Aishwarya, V. Pavithra. *Transcanal endoscopic excision of tympanic paraganglioma: A three-case series*. Laparoscopic, Endoscopic and Robotic Surgery, Vol. 3, Issue 4, 2020, Pages 126-130.
9. Fermi M, Ferri G, Bayoumi Ebaied T, Alicandri-Ciufelli M, Bonali M, Badr El-Dine M, Presutti L. *Transcanal Endoscopic Management of Glomus Tympanicum: Multicentric Case Series*. Otol Neurotol. 2021 Feb 1;42(2):312-318.
10. Marchioni D, Alicandri-Ciufelli M, Gioacchini FM, Bonali M, Presutti L. *Transcanal endoscopic treatment of benign middle ear neoplasms*. Eur Arch Otorhinolaryngol. 2013 Nov;270(12):2997-3004.
11. Presutti L, Nogueira JF, Alicandri-Ciufelli M, Marchioni D. *Beyond the middle ear: endoscopic surgical anatomy and approaches to inner ear and lateral skull base*. Otolaryngol Clin North Am. 2013 Apr;46(2):189-200.
12. Marchioni D, Rubini A, Soloperto D. *Endoscopic Ear Surgery*. *Otolaryngologic Clinics of North America*. 2021;54(1):25-43. doi:<https://doi.org/10.1016/j.otc.2020.09.003>
13. Marchioni D, Molteni G, Presutti L. *Endoscopic Anatomy of the Middle Ear*. *Indian Journal of Otolaryngology and Head & Neck Surgery*. 2011;63(2):101-113. doi:<https://doi.org/10.1007/s12070-011-0159-0>
14. Marchioni D, Mattioli F, Matteo Alicandri-Ciufelli, Presutti L. *Endoscopic approach to tensor fold in patients with attic cholesteatoma*. *Acta Oto-laryngologica*. 2009;129(9):946-954. doi:<https://doi.org/10.1080/00016480802468187>
15. Nogueira JF, Mattioli F, Presutti L, Marchioni D. *Endoscopic Anatomy of the Retrotympanum*. *Otolaryngologic Clinics of North America*. 2013;46(2):179-188. doi:<https://doi.org/10.1016/j.otc.2012.10.003>
16. Casano K, Giangrosso G, Mankekar G, Sevy A, Mehta R, Arriaga M. *Additional Benefits of Facial Nerve Monitoring during Otologic Surgery*. *Otolaryngology–Head and Neck Surgery*. 2020;163(3):572-576. doi:<https://doi.org/10.1177/0194599820915458>



*Case Report*

## SEPTIC THROMBOPHLEBITIS OF INTERNAL JUGULAR VEIN AND PULMONARY EMBOLISM: LEMIERRE'S SYNDROME, A FORGOTTEN BUT PRESENT LIFE-THREATENING COMPLICATION OF ACUTE PHARYNGO-TONSILLITIS

G. Confuorto<sup>1</sup>, S. Meneghesso<sup>1</sup>, G. Gobbo<sup>1</sup>, P. Tesaro<sup>2</sup>, B. Le Pera<sup>1</sup>, V. Arietti<sup>1</sup>, C. Alberti<sup>1</sup>, C. Liberale<sup>1</sup>, G. Fulco<sup>1</sup>, and R. Nocini<sup>1</sup>

<sup>1</sup>Unit of Otorhinolaryngology, Head & Neck Department, University of Verona, Verona, Italy;

<sup>2</sup>Department of Otorhinolaryngology, Head and Neck Surgery, IRCCS Azienda Ospedaliero-Universitaria di Bologna, Policlinico S.Orsola-Malpighi, Bologna, Italy

*Correspondence to:*

Beatrice Le Pera, MD  
Unit of Otorhinolaryngology,  
Head & Neck Department,  
University of Verona,  
Verona, Italy  
e-mail: [beatrice.lepera@unive.it](mailto:beatrice.lepera@unive.it)

### ABSTRACT

Lemierre's Syndrome is characterized by clinical or radiological evidence of suppurative thrombophlebitis of the internal jugular vein with a history of recent oropharyngeal infection and can be complicated by septic systemic embolism. The disease is usually caused by Gram-negative anaerobic organisms, mainly *Fusobacterium necrophorum*. Once called the forgotten disease in the pre antibiotics era, it may not be that uncommon after all. We report a case of Lemierre's Syndrome in a 14-year-old patient, with a blank medical history, with an oropharyngeal infection and onset of neck and thoracic pain. Computed tomography of the neck and thorax showed a thrombophlebitis of the internal jugular vein and septic emboli in the lungs. *F. necrophorum* was isolated from blood cultures. The isolated *F. necrophorum* showed susceptibility to metronidazole, clindamycin and betalactam/ beta-lactamase inhibitor combinations with no signs of resistance or reduced sensitivity, so prolonged multidrug therapy was considered the mainstay of treatment. Anticoagulation is believed to play a favourable role in the recovery of the disease because of the potential for faster resolution of thrombophlebitis, but the use of anticoagulation is still heavily debated due to conflicting results in literature. Lemierre's Syndrome is an unfamiliar syndrome, once considered rare, with an increasing number of reported cases recently. It is due to septic complications of oropharyngeal infections, which lead to thrombophlebitis of the internal jugular vein with potentially fatal complications occurring primarily in young, otherwise healthy individuals, which requires a prompt diagnosis and treatment. In this case report, we present a case of Lemierre's Syndrome in a 14-year-old

Received: 20 September 2023  
Accepted: 28 September 2023

ISSN: 2038-4106

Copyright © by BIOLIFE 2023

This publication and/or article is for individual use only and may not be further reproduced without written permission from the copyright holder. Unauthorized reproduction may result in financial and other penalties. **Disclosure: All authors report no conflicts of interest relevant to this article.**

patient treated with long-term antibiotic and anticoagulant therapy, considering the young age and the extent of the septic emboli to lungs, with complete resolution of the disease at the end of the treatment.

**KEYWORDS:** *Lemierre's Syndrome, thrombophlebitis, internal jugular vein, septic emboli, case report*

## INTRODUCTION

In 1936 André-Alfred Lemierre reported on a series of 20 cases of postpharyngitis sepsis, of whom only 2 survived. The syndrome, diagnosed by a combination of clinical signs, positive blood cultures and radiological findings, classically comprises pharyngeal infection, internal jugular vein septic thrombosis, producing disseminated emboli to the periphery (often septic pulmonary emboli) and the presence of the anaerobic bacterium *Fusobacterium necrophorum* in blood culture (1, 2). This condition was eventually named after Lemierre's syndrome.

Lemierre's Syndrome usually begins as a local oropharyngeal infection and presents with fever, cough, sore throat and neck swelling. Later during the course, after the throat had settled, infection spreads via blood stream to other organs (the venous thrombosis is likely the result of endothelial dysfunction caused by inflammatory factors from the local infection) and led to overwhelming systemic infection (3). Lemierre recognized the importance of the progression from thrombophlebitis of the tonsillar veins to internal jugular vein thrombophlebitis with subsequent septicemia due to the release of small pieces of infected thrombus (4). This spread of septic emboli may produce lung lesions (lungs are affected in up to 85% of cases) that commonly appear as necrotic cavitory lesions but can also present as infiltrates, pleural effusions, empyema, lung abscesses, and necrotizing mediastinitis and patients can develop acute respiratory distress syndrome that requires mechanical ventilation (5, 6). Less commonly the hematogenous spread may involve joints, liver, spleen, kidneys and muscles (7).

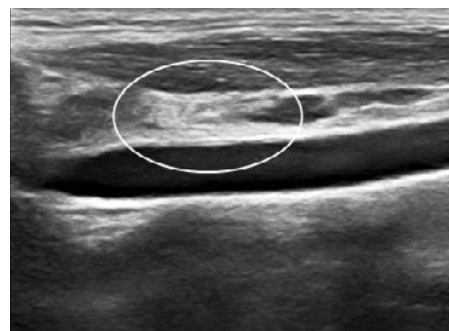
Several authors highlighted that septic thrombophlebitis was also a feature of *F. necrophorum* infection in other sites, such as otogenic infection, having a higher incidence of intracranial complications, iliac vein thrombophlebitis associated with post-prostatectomy infection, portal vein thrombophlebitis associated with infection secondary to rectal carcinoma, and mesenteric thrombophlebitis after an appendectomy. Stimulating clot formation and multiplying in the clot with subsequent embolic spread is clearly a fundamental feature of the pathogenesis of *F. necrophorum* infection (8,9).

Although uncommon, clinicians need to be aware of this condition because patients with Lemierre's Syndrome require prompt and appropriate therapy.

## CASE REPORT

We describe the case of a fourteen-year-old female patient who accessed the ER because of sore throat, fever and chest pain. Her clinical history was silent. She has presented a sore throat for four days and a fever for three days with peaks up to 40°C. She was therefore taken to her general medicine practitioner, who prescribed her an oral antibiotic with clarithromycin for pultaceous tonsillitis. After one day without improvement, her doctor advised her to switch to a therapy with amoxicillin-clavulanate, with an improvement in her symptoms. The same night, however, she woke up with chest pain localized on the right shoulder and in the scapular region bilaterally, which worsened with deep inspiration and was only mildly responsive to ibuprofen. For this reason, she accessed an ER in a peripheral hospital, where a nasal-pharyngeal swab for Sars-cov-2 (negative) and blood samples (mild increase in inflammation markers, CRP 69 mg/L, WBC 13.360/mmc) were performed. ECG and chest X-Ray were unremarkable.

At the ENT evaluation, hypertrophy and medialization of the left tonsil with a laterocervical lymphadenopathy was diagnosed. The patient was therefore admitted in the Paediatric ward to start endovenous administration of amoxicillin-clavulanate, which the next day was changed to ceftriaxone. A bedside ultrasound showed multiple reactive lymphnodes in



**Fig. 1.** Neck ultrasound showed venous blockage in the internal jugular vein by a thrombus (circle).

the left laterocervical region and the nasal-pharyngeal swab culture revealed no pathological microorganism growth. The day after a new US was then performed, which confirmed the presence of left lymphadenopathy but also showed a poorly compressible left internal jugular vein, suggesting a jugular vein thrombosis (Fig.1).

In light of all these findings a diagnosis of Lemierre’s Syndrome was suggested, which was confirmed by an urgent neck CT scan which showed thrombophlebitis of the left internal jugular vein, multiple ovoid lymphnodes in the left laterocervical region, at the mandibular angle and in the supraclavicular compartment bilaterally (Fig. 2). Lung CT scan was also performed and showed bilateral cavitated pulmonary nodules, as result of metastatic septic emboli (Fig. 3).

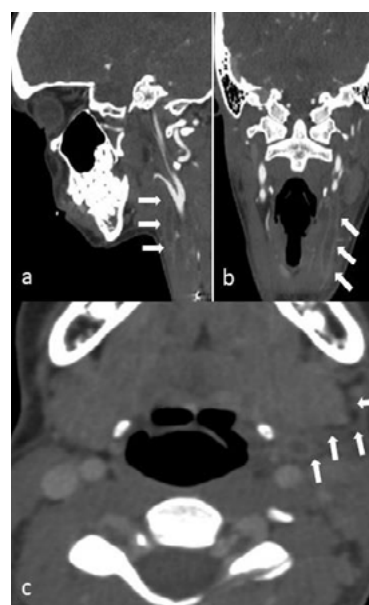
The patient was therefore transferred to the University Hospital of Verona and admitted in the Paediatric ward under the ENT team care. She was administered an anticoagulant therapy with Enoxaparin at the therapeutic range of 5000UI. The antibiotic therapy was set with ceftriaxone 2g/die and clindamycin 600g/die, substituted the next day according to the infective disease consult with metronidazole 500 mg x3/die. After ten days of antibiotic and anticoagulant therapy, symptoms and inflammation markers were back to normal. The neck US showed patency of the left internal jugular vein.

The patient was discharged with a prescription of Enoxaparin for three months and oral amoxicillin-clavulanate 1g x 3/die for a month, until the follow-up CT scan programmed after one month. This confirmed patency of the vein and showed that the pulmonary nodules were diminishing in number and size (Fig. 4). The patient’s conditions were evaluated every month for 6 months both clinically and with blood tests. A tonsillectomy was also scheduled in order to prevent the recurrence of the condition.

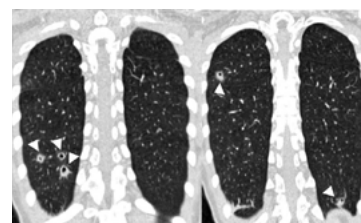
**DISCUSSION**

Lemierre’s Syndrome is an uncommon disease of the postantibiotic era but can carry dangerous potential sequelae with a high mortality rate. In the past the syndrome was common, but with the widespread use of antibiotics for upper respiratory tract infection in the 1940s, the incidence of the syndrome dropped, and it eventually became known as the “forgotten disease” (10). Since the 1990s, however, there has been a marked resurgence of Lemierre’s syndrome, and it is unclear if this rising trend in cases is due to advancement in diagnostic techniques, restriction in antibiotic use for sore throat, decreased number of tonsillectomies or increased antibiotic resistance to organisms. It is usually seen among young adults, with the highest incidence between 15-25 years of age, and according to a Danish study made by analysing all the cases from 1998 to 2001, the annual incidence among individuals aged 14 to 24 was 14.4 cases per million people while the incidence in the whole population was 3.6 cases per million people (11).

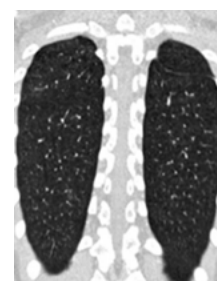
Little is known regarding the reason for this age distribution with possible reasons linked to anatomy, hormonal changes, social behavior (human to human oral contact), co-infections and the presence of tonsils (reaching their largest size in puberty) (12). Lemierre’s Syndrome refers to septic



**Fig. 2.** Contrast-enhanced CT of the neck region with axial, coronal and sagittal reconstruction showing a hypoechoic thrombus in the middle and distal tract.



**Fig. 3.** Chest computed tomography (CT) with coronal reconstruction (A and B) demonstrating multiple bilateral pulmonary nodules, most of which were cavitated and associated with areas of consolidation (arrows).



**Fig. 4.** After 4 weeks of treatment, repetition of chest CT scan showed resolution of pulmonary localisations.



thrombophlebitis of the internal jugular vein (IJV) and despite its nonnegligible annual incidence of  $> 1/100000$ , often goes undiagnosed due to its non-specific symptoms (13). The syndrome typically begins with an oropharyngeal infection, usually in association with tonsil or peritonsillar involvement. Other antecedent conditions include oral cavity or dental infections, mastoiditis, otitis or infectious mononucleosis (14). Lemierre's Syndrome is caused by bacteria that invade the pharyngeal mucosa and lateral pharyngeal space, inflammation within the wall of the vein and infected thrombus within the lumen resulting in subsequent internal jugular vein septic thrombophlebitis and metastatic infections, due to disseminated emboli to the periphery (often septic pulmonary emboli) (15,16).

The most commonly associated organism, *F. necrophorum*, is a gram-negative, anaerobic bacterium that is part of the normal flora of the oropharynx, but the recent development of various antibiotics and advancements in medical care have led to diversified and antibiotic-resistant strains, therefore multiple other bacteria have been implicated in Lemierre's Syndrome, such as *Streptococcal species*, *Eikenella corrodens*, and *Staphylococcus aureus* (17).

A multidisciplinary approach is necessary to treat patients with Lemierre's Syndrome. Collaboration with infectious disease experts, radiologists and otolaryngologists is essential to reach a prompt diagnosis and achieve a good therapeutic outcome, in order to prevent its devastating effects (18).

Antibiotic therapy is the mainstay of treatment. *F. necrophorum* shows *in vitro* susceptibility to metronidazole, clindamycin, beta-lactam and carbapenems. Any antimicrobial regimen should include a b-lactamase inhibitor, because b-lactamase-producing strains of *F. necrophorum* have been reported and co-infecting pathogens might also produce b-lactamases (19). One review showed that metronidazole was the most commonly prescribed antibiotic; it shows excellent penetration into most tissues and can be administered orally without compromising bioavailability.

*In vitro* data have shown that metronidazole or carbapenem shows greater bactericidal activity against *F. necrophorum* than clindamycin (20). *F. necrophorum* is intrinsically resistant to macrolides, fluoroquinolones, tetracyclines, and aminoglycosides (22,21). A review of 100 *F. necrophorum* isolates from 1990 to 2000 revealed that all strains were susceptible to metronidazole, clindamycin, imipenem, amoxicillin-clavulanate, and cefoxitin and 15% of strains were resistant to erythromycin. The level of 15% resistance to erythromycin may be important as this drug or its newer derivatives are regularly prescribed by primary care physicians for the treatment of upper respiratory tract infections (20-22). Antimicrobial therapy should be prescribed for 3-6 weeks. Once the infection is controlled, therapy can be completed orally.

Despite providing appropriate antimicrobial treatment, the observed clinical response might be slow. One explanation for the slow response is that Lemierre's Syndrome is an endovascular infection and that antibiotics have difficulty in penetrating the fibrin clot (23, 24). Theoretically, a septic thrombus sequesters bacteria and creates a barrier to antibiotic penetration. When the thrombus is dissolved by anticoagulants, the bacteria are exposed to a higher concentration of antibiotics, increasing accessibility (20, 23, 24).

On the other hand, the role of anticoagulation in the treatment of Lemierre's Syndrome is more uncertain and it is not clear its effect on the recanalization of the vessels. Due to a lack of high-level evidence there is no current consensus

(25). Some physicians believe that it is possible to achieve the dissolution of the thrombus simply by using antibiotics, since it originated from an infection. Other physicians instead confirm that anticoagulation plays a favourable role in the recovery of the disease because of the potential faster resolution of thrombophlebitis and the prevention from other complications, such as cavernous sinus thrombosis or pulmonary embolism (13). Theoretically speaking, behind these two opposite ideas, there is the thought that, given that the thrombus sequesters bacteria, with anticoagulants there is the risk of increasing the bacteraemia and of causing more septic emboli, but on the other hand it is also possible to increase the effect of the antibiotics (13).

Many studies or reviews indicate a favourable outcome both with and without anticoagulation. Despite this, there is an increase in use of anticoagulant in treatment of Lemierre's Syndrome over the last few years. In older reviews 21-23% of patients were given anticoagulants (26, 27) in contrast to the reviewed population of Johannesen et al. and Rebelo et al. (64% and 100% resp.) (26, 28).

A recent meta-analysis examined 394 patients treated for Lemierre's Syndrome between 1980 and 2017 but failed to find a statistically significant improvement in vessel recanalization and mortality using anticoagulants (25). Many recent cases, especially considering the pediatric population, reported the use of some form of anticoagulants which seemed to have reduced or slowed the progression of thrombosis (29). The use of anticoagulants is still questionable and randomized

clinical trials should be set in order to identify the optimal anticoagulant therapy.

Even the duration of the anticoagulation is debated, but it is probable that it is indicated for at least six weeks due to the concomitant embolic disease (30, 31). For example, Goldenberg et al have analyzed the outcome of 8 patients treated with anticoagulants for a median duration of 3 months (range: 7 weeks-1 year) noticing the complete recovery from the disease and no recurrent thromboembolism or anticoagulant-associated major hemorrhage after one year of follow up (32).

Therefore, the treatment should be tailored for every patient considering his clinical status, the kind of disease complications and the improvement obtained from the therapy. This is why an adequate follow up should be set, providing US of the neck or CT scans to monitor the recanalization of the internal jugular vein and regular blood tests to analyze the inflammatory markers. In the literature there is no consensus on how long the follow up should be and on how often the clinical evaluations should be organized. However, it seems common to repeat the imaging after one or two months and to monitor the patients for no more than six months or one year.

Finally, surgical treatment of the thrombosis is very seldomly indicated and the internal jugular ligation or excision is rarely performed. The main function of surgery is to drain the cervical abscess, commonly in the peritonsillar and lateral pharyngeal region, and to treat possible complications such as lung empyema or septic joints (29).

## CONCLUSIONS

Lemierre's Syndrome is now a rare entity which can be fatal. It is a bacterial condition, mostly caused by *Fusobacterium necrophorum*, with systemic complications which can be fatal, and it should be suspected in young people with persistent fever and neck pain and/or distal metastatic septic lesions. Contrast-enhanced computed tomography of the neck is the best diagnostic method as it detects vascular thrombosis of the internal jugular vein and other complications such as pulmonary emboli. A multidisciplinary approach is necessary to treat patients with Lemierre's Syndrome. Collaboration with infectious disease experts, radiologists and otolaryngologists is essential to reach a prompt diagnosis and achieve a good therapeutic outcome, in order to prevent its serious long-term complications, including neurologic deficits and debilitating conditions potentially requiring long and resource-intensive additional care.

## REFERENCES

1. Lemierre A. On certain septicemias due to anaerobic organisms. *Lancet* 1936;227:701e3.
2. Osowicki J, Kapur S, Phuong LK, Dobson S. The long shadow of Lemierre's syndrome. *J Infect* 2017;74:S47e53.
3. Hagelskjaer LH, Nagy M, Wingate J, Bailey L, Wax M. Lemierre syndrome: a complication of acute pharyngitis. *Int J Pediatr Otorhinolaryngol* 1998; 45:51–57
4. Riordan T, Wilson M Lemierre's syndrome: more than a historical curiosa. *Postgraduate Medical Journal* 2004;**80**:328-334.
5. Lee WS, Wang FD, Shieh YH, Teng SO, Ou TY. Lemierre syndrome complicating multiple brain abscesses caused by extended-spectrum b-lactamase-producing *Klebsiella pneumoniae* cured by fosfomycin and meropenem combination therapy. *J Microbiol Immunol Infect* 2012;45:72e4.
6. Walkty A, Embil J. Lemierre's syndrome. *N Engl J Med* 2019 Mar 21;380(12):e16. <https://doi.org/10.1056/NEJMicm1808378>.
7. Vogel LC, Boyer KM. Metastatic complications of *Fusobacterium necrophorum* sepsis. *Am J Dis Child* 1980; 134:356–358.
8. Kim JH, Kwon HY, Durey A. Thrombophlebitis of superior mesenteric vein with bacteremia of *Gemella sanguinis* and *Streptococcus gordonii*. *J Microbiol Immunol Infect* 2019;52:672e3.
9. Armstrong AW, Spooner K, Sanders JW. Lemierre's syndrome. *Curr Infect Dis Rep* 2000;2:168e73.
10. Lee WS, Jean SS, Chen FL, Hsieh SM, Hsueh PR. Lemierre's syndrome: A forgotten and re-emerging infection. *J Microbiol Immunol Infect*. 2020 Aug;53(4):513-517.
11. Hagelskjaer Kristensen L, Prag J. Lemierre's syndrome and other disseminated *Fusobacterium necrophorum* infections in Denmark: a prospective epidemiological and clinical survey. *Eur J Clin Microbiol Infect Dis*. 2008 Sep;27(9):779-89.

12. Holm K, Bank S, Nielsen H, et al. The role of *Fusobacterium necrophorum* in pharyngotonsillitis – A review. *Anaerobe* 2016 Dec;42(42):89–97.
13. Ge J, Zhou P, Yang Y, Xu T, Yang X. Anticoagulation may contribute to antimicrobial treatment of Lemierre syndrome: a case report. *Thromb J*. 2021 Nov 4;19(1):80.
14. Sinave CP, Hardy GJ, Fardy PW. The Lemierre syndrome: suppurative thrombophlebitis of the internal jugular vein secondary to oropharyngeal infection. *Medicine (Baltimore)* 1989; 68:85.
15. Forrester LJ, Campbell BJ, Berg JN, Barrett JT. Aggregation of platelets by *Fusobacterium necrophorum*. *J Clin Microbiol*. 1985;22:245e9.
16. Brown CE, Stettler RW, Twickler D, Cunningham FG. Puerperal septic pelvic thrombophlebitis: incidence and response to heparin therapy. *Am J Obstet Gynecol* 1999;181:143e8.
17. Sinave CP, Hardy GJ, Fardy PW. “The Lemierre’s syndrome: suppurative thrombophlebitis of the internal jugular vein secondary to oropharyngeal infection”. *Medicine (Baltimore): Williams & Wilkins*; 1989 68 (2): 85–94
18. Osowicki J, Kapur S, Phuong LK, Dobson S. The long shadow of Lemierre’s syndrome. *J Infect* 2017;74:S47e53.
19. Kahn JB, Baharestani S, Beck HC. Orbital dissemination of Lemierre syndrome from gram-positive septic emboli. *Ophthal Plast Reconstr Surg* 2011;27:67e8.
20. Freeman CD, Klutman NE, Lamp KC. Metronidazole. A therapeutic review and update. *Drugs* 1997;54:679e708.
21. Osowicki J, Kapur S, Phuong LK, Dobson S. The long shadow of Lemierre’s syndrome. *J Infect* 2017;74:S47e53.
22. Kuppalli K, Livorsi D, Talati NJ, Osborn M. Lemierre’s syndrome due to *Fusobacterium necrophorum*. *Lancet Infect Dis*
23. 2012;12:808e15.
24. Walkty A, Embil J. Lemierre’s syndrome. *N Engl J Med* 2019 Mar 21;380(12):e16.
25. Karkos PD, Asrani S, Karkos CD, Leong SC, Theochari EG, Alexopoulou TD, et al. Lemierre’s syndrome: a systematic review. *Laryngoscope* 2009;119:1552e9.
26. Gore MR. Lemierre Syndrome: A Meta-analysis. *Int Arch Otorhinolaryngol*. 2020 Jul;24(3):e379-e385.
27. Johannesen KM, Bodtger U. Lemierre’s syndrome: current perspectives on diagnosis and management. *Infect Drug Resist*. 2016 Sep;14(9):221–227.
28. McGouran D, Keene A, Walklin R, et al. A complex case of bilateral Lemierre syndrome with suggestions on anticoagulation management. *Intern Med J*. 2013 Jun 1;43(6):728–730.
29. Rebelo J, Nayan S, Choong K, et al. To anticoagulate? Controversy in the management of thrombotic complications of head & neck infections. *Int J Pediatr Otorhinolaryngol*. 2016 Sep;88:129–135.
30. Hemani F, Naveed A, Akhtar S, Shahid S. Lemierre’s syndrome in a child. *Pak J Med Sci*. 2022;38(2):433-435.
31. Gomide LMES, Zarate Nissel MA, Weihermann V, et al. Septic Thrombophlebitis of the Internal Jugular Vein in an Immunocompromised Patient with Lemierre Syndrome: A Case Report. *Transplant Proc*. 2022;54(5):1388-1390. doi:10.1016/j.transproceed.2022.03.042
32. Goldenberg NA, Knapp-Clevenger R, Hays T, Manco-Johnson MJ. Lemierre’s and Lemierre’s-like syndromes in children: survival and thromboembolic outcomes. *Pediatrics*. 2005 Oct;116(4):e543-8.



*Case Report*

## **ENDOSCOPIC ASSISTED TRASCERVICAL-TRANSPAROTID APPROACH FOR PARAPHARYNGEAL GIANT TUMOR: A CASE REPORT.**

G. Fulco<sup>1</sup>, L. Sacchetto<sup>1</sup>, R. Rosaia<sup>1</sup>, R. Rebelo<sup>1</sup>, N. Cornale<sup>1</sup>, C. Alberti<sup>1</sup>, R. Nocini<sup>1</sup>, B. Le Pera<sup>1</sup>, G. Lobbia<sup>2</sup> and G. Molteni<sup>3</sup>

<sup>1</sup>Unit of Otorhinolaryngology, Head and Neck Department, University of Verona, Verona, Italy;

<sup>2</sup>Unit of Maxillo-Facial Surgery, Head & Neck Department, University of Verona, Verona, Italy

<sup>3</sup>Department of Otorhinolaryngology, Head and Neck Surgery, IRCCS Azienda Ospedaliero-Universitaria di Bologna, Policlinic S.Orsola-Malpighi, Bologna, Italy;

*\*Correspondence to:*

Raffaele Rosaia, MD

Unit of Otorhinolaryngology,

Head and Neck Department,

University of Verona,

Verona, Italy

### **ABSTRACT**

Parapharyngeal space (PPS) is an anatomical complex area of the neck that extends from the skull base to the hyoid bone level. Tumors arising from this space are a heterogeneous group of neoplasm, indeed more than 70 different histological types have been described. This is a case report of a 48-year-old man with a giant tumor of PPS. It has been removed using a transcervical-transparotid route. The use of the endoscope helped the surgeon to reach the deepest and highest part of the PPS, identify a residual of tumor and remove it. The endoscope should be considered a crucial part of the surgical armamentarium in the approach of PPS masses in some cases. In fact, it assists the surgeon on thoroughly examining the PPS in all its extension. Furthermore, the endoscope in this case avoided other and more invasive approaches, reducing associated comorbidities.

### **INTRODUCTION**

Parapharyngeal space (PPS) is an anatomical complex area of the neck that extends from the skull base to the hyoid bone level. Tumors arising from this space are a heterogeneous group of neoplasm, indeed more than 70 different histological types have been described. They represent 0,5% of the head and neck neoplasms: 82% of them are benign tumors, 18% are malignant (1). The most frequent tumors arise from salivary gland (45%) and nerves (41%), but also rare neoplasms are described such as teratomas, cystic hygromas, rhabdomyosarcomas or chondrosarcomas (2).

Received: 02 October 2023

Accepted: 08 October 2023

ISSN: 2038-4106

Copyright © by BIOLIFE 2023

This publication and/or article is for individual use only and may not be further reproduced without written permission from the copyright holder. Unauthorized reproduction may result in financial and other penalties. **Disclosure: All authors report no conflicts of interest relevant to this article.**

Surgery represents the first choice of treatment. Optimal approach varies in relation to the characteristics of the neoplasms and patients, and to surgeon's experience. The main surgical approaches are: transcervical or transcervical-transparotid route with mandibulotomy in selected case as recurrency, malignancy or huge size of the lesion; mininvasive transcervical endoscopic route; transoral endoscopy or robotic surgery; transnasal access to the upper part of the PPS; microdebrider assisted cavitation or intracapsular enucleation reserved for schwannomas; in some cases, a combination of different techniques may be used (3).

Due to all those characteristics of PPS and its tumors, surgical treatment and histological diagnosis could be challenging even for expert surgeons and pathologists.

## CASE REPORT

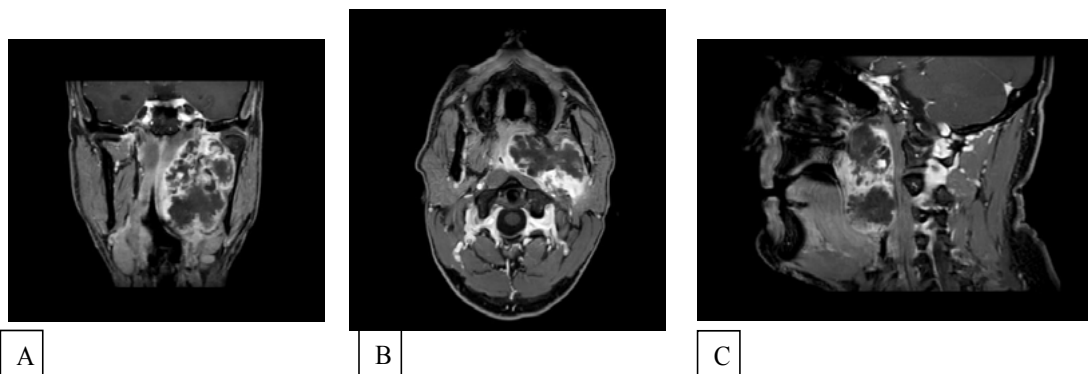
### *Pre-operative assessment*

We present a case of a 48-year-old man who came to the emergency room with a 2-months history of dysphonia and dysphagia. On physical examination it was evident a large neck mass of the left parotid region extended along the lateral cervical region and a prominent medialisation of the same-side lateral wall of the oropharynx. Videoendoscopy revealed a submucosal mass occupying the nasopharynx, descending along the left lateral wall of the pharynx and reaching the pharyngeal-epiglottic fold. A TC scan and an MRI (Fig.1) were performed. MRI showed a voluminous solid expansive neoplasm (7x4x7.5 cm) in the left parapharyngeal/masticatory spaces reaching cranially the nasopharynx, without a clear plane of cleavage towards the left medial pterygoid muscle and inferiorly touching the left submandibular salivary gland, without a clear plane of cleavage. The findings suggested a parotid origin of the lesion; the tumor presented heterogeneous enhancement after contrast injection. There were no gross lymphadenopathies identified in the laterocervical area. A fine-needle aspiration was executed, but the cytological examination was inconclusive, without evidence of any malignant cells. Considering dimensions and extension of the mass the surgeon's initial early decision was to proceed with a transcervical-transparotid route.

### *Surgical procedure*

Nerve Integrity Monitor (NIM) for facial nerve was used. A Blair modified incision was performed and the skin flap elevated. The following structures were identified and preserved: the anterior margin of the sternocleidomastoid muscle and the posterior belly of the digastric muscle, the internal jugular vein, the spinal accessory nerve, the hypoglossal nerve and the external carotid artery.

After identification of the cartilaginous pointer, the common trunk of the VII cranial nerve was identified; its main branches have been followed and spared (Fig. 2A). The superficial lobe of parotid gland has been also spared. After excision of the deep lobe of the parotid gland, the PPS has been reached and the giant mass exposed. Thus, it has been gently freed and removed by finger dissection (Fig. 2B). At this point the neoplasm seemed to have been completely



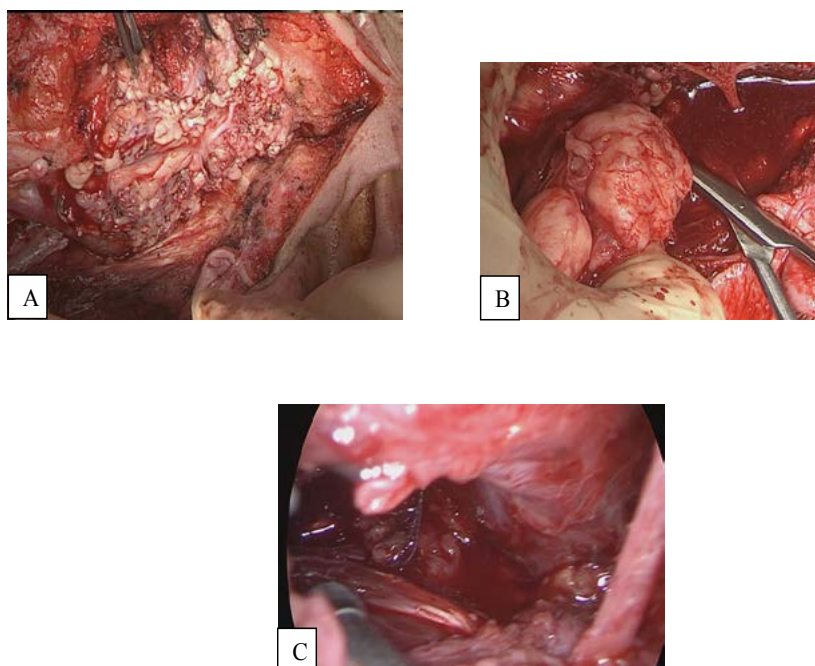
**Fig. 1.** MRI. A) coronal plane; B) axial plane; C) sagittal plane.



removed. An endoscopic check of the surgical field was performed: a small residual of tumor was seen at the most cranial and medial part of the PPS. (Fig. 2C) So, it was completely removed under endoscopic view (Fig. 3).

#### *Post-operative evaluation*

The postoperative period was uneventful. No cranial nerves palsy occurred. Three days after surgery the cervical drainage was removed and 5 days after surgery the patient was discharged. No signs of recurrence were noted at follow-up MRI after 6 months.



**Fig. 2.** Surgical steps. *A)* identification of facial nerve; *B)* tumor dissection; *C)* endoscopic view of residual of tumor.



**Fig. 3.** Surgical specimen.

## DISCUSSION

The complex anatomy of the PPS makes the management of tumors of this area a challenge when it comes to choosing the most suitable surgical approach. Anatomically, the PPS is a crucial area since it contains important structures as: cranial nerves IX, X, XI and XII, the internal jugular vein (IGV), the carotid artery with its bifurcation, the internal maxillary artery, the ascending pharyngeal artery and the venous plexus. This tricky space can be anatomically divided by the styloid fascia into anterolateral (pre-styloid) compartment, and a posteromedial (post-styloid) compartment. So, approaching the PPS, the surgery must not only aim at removing the tumor but to do so without compromising the nervous function (2, 4).

The surgical approach to giant lesions could be demanding when the neoplasm reaches the masticatory space, skull base or overcome the median line through the prevertebral space. Different surgical approaches have been described. In each case the choice of the best surgical strategy should be guided by the size, the position, the radiological aspects of the lesion, and the cytological/histological results.

The most common surgical technique to the PPS is the transcervical approach that provides a wide exposure of the superficial area of the PPS. In case of a benign tumor arising from the deep parotid gland lobe, the superficial lobe can be spared. This guarantees a better aesthetic result for the patient and provides an anatomical covering that protects the facial nerve, this is known as the transcervical-transparotid approach.

In selected cases mandibulotomy can be required in addition to a transcervical approach when a wider view of the PPS is required. These cases include malignancy, recurrency, lesions with a high vascular pattern or involvement of major neck vessels.

Recently some authors have proposed a minimally invasive transcervical approach using the endoscope through a small incision performed below the mandibular angle, at the level of the digastric muscle. According to Pilolli et al. (5), risk. However, is safe and allows a better visualization of the surgical plane of cleavage and a reduction of the bleeding risk, however it is not suitable for giant masses (larger than 7 cm in its widest dimension) and not recommended in malignant neoplasms (6).

Exclusive transoral approaches have caused even more debate. This technique is limited by a narrow access to the PPS and consequently causes a more challenging identification of neurovascular structures and a higher risk of surgical complications. The introduction of the new technologies as endoscopy and transoral robotic surgery (TORS) have improved the use of this technique by amplifying the surgeon's field of vision and as such reducing the percentage of intraoperative and postoperative complications. However, this approach is not suitable if the lesion extends laterally or encases a major vascular structure (3). The TORS usually implies an intraoperative fragmentation of the tumors, in particular for prestyloid lesions in more cases than the transcervical procedures (7, 8).

More recently a transnasal endoscopic access has been described. This approach passes through the infratemporal fossa and uses the Eustachian tube as an essential landmark. Excisions of lesion en-bloc have been described. Nevertheless, the indications for an exclusive transnasal procedure are very limited (9).

In alternative, transoral and transnasal approaches can be combined with a transcervical approach when the mass invades masticatory muscle space, the pterygopalatine fossa, or reaches the postero-lateral wall of the pharynx, and the upper part of PPS (10). In our case the excision of the neoplasm was performed with a transcervical transparotid approach combined with the use of endoscopy via the transcervical surgical skin incision.

Considering the characteristics of the mass the exclusive transoral or transnasal approach would not be feasible as this approach provides best the exposure only of the superomedial PPS (11). In addition, a combined transoral/transcervical could be an option when approaching this mass but would clearly convey an increased risk of an oral fistula and spreading of neck infection. On the other hand, a minimally invasive transcervical surgery would not be appropriate primarily due to the mass size but also given the extension to the masticatory space and nasopharynx without a clear plane of cleavage to the medial pterygoid muscle.

The transcervical-transparotid approach was chosen owing to the need for a wider exposure of the PPS and considering the absence of pathological tissue in the superficial lobe of the parotid gland, showed by the MRI and TC exams. Yet the exclusive transcervical technique seemed to be insufficient to guarantee a complete mass excision since the surgeon is

'blind' to the deeper and upper area of the PPS. To overcome this limitation, after a near total removal of the neoplasm, we used a 0° optic endoscope to examine this region. As described above, with this technique we were able to uncover a residual macroscopic portion of the tumor located in the upper part of the PPS and thus perform a complete excision of the tumor that appeared adherent to the nasopharynx postero-lateral wall. Another aspect of this case was the challenging histopathological diagnosis.

Over 70 different types of tumors have been described arising from the structures content in the PPS, and most of them are rare neoplasms. The most frequent source is the parotid gland (pleomorphic adenomas, adenoidocystic carcinomas), but also nerves (e.g., neuromas, paragangliomas or neurofibromas), vessels (e.g., hemangioma or aneurysms) and other tissues (e.g., meningiomas, condrosarcomas, rhabdomyosarcomas) could be the origin of the tumors.

Due to the variety of histological types also the histological analysis could be challenging as in the case reported. Indeed, the first histological response from our hospital's anatomopathological unit deposited for Teratoma with immature heterologous component; due to the rarity of this diagnosis a second opinion was requested to the Brescia hospital's anatomopathological unit and the definitive diagnosis of Pleomorphic Adenoma with extensive squamous metaplasia was defined without evidence of squamous cell carcinoma.

## CONCLUSIONS

The endoscope should be considered a crucial part of the surgical armamentarium in the approach of PPS masses. The endoscope in transcervical approach to PPS allows not only a magnification of the anatomical structures but also assists the surgeon on thoroughly examining the PPS in all its extension. Furthermore, the endoscope avoided the combination of techniques that might create a communication between the cervical soft tissue and the aereo-digestive tract, reducing associated comorbidities.

### Declarations:

*Conflict of interest:* The authors have no financial relationship to disclose.

*Sponsorships:* None.

*Ethical approval:* All procedures performed in studies involving human participants conformed to the ethical standards of the Institutional and/or National Research Commission and the 1964 Declaration of Helsinki and its subsequent amendments or comparable ethical standards. The Clinical Trials Ethics Committee of the Provinces of Verona and Rovigo exempted this study from its approval. All authors read and approved the manuscript.

## REFERENCES

1. Riffat F, Dwivedi RC, Palme C, Fish B, Jani P. A systematic review of 1143 parapharyngeal space tumors reported over 20years. *Oral Oncology*. 2014;50(5):421-430. doi:https://doi.org/10.1016/j.oraloncology.2014.02.007
2. Kuet ML, Kasbekar AV, Masterson L, Jani P. Management of tumors arising from the parapharyngeal space: A systematic review of 1,293 cases reported over 25 years. *The Laryngoscope*. 2014;125(6):1372-1381. doi:https://doi.org/10.1002/lary.25077
3. Paderno A, Piazza C, Nicolai P. Recent advances in surgical management of parapharyngeal space tumors. *Current Opinion in Otolaryngology & Head and Neck Surgery*. 2015;23(2):83-90. doi:https://doi.org/10.1097/moo.000000000000134
4. Silver AJ, Mawad ME, Hilal SK, Sane P, Ganti SR. Computed tomography of the nasopharynx and related spaces. Part I: Anatomy. *Radiology*. 1983;147(3):725-731. doi:https://doi.org/10.1148/radiology.147.3.6844608
5. Pilolli F, Giordano L, Galli A, Bussi M. Tumori dello spazio parafaringeo: approccio transcervicale video-assistito mini invasivo. *Acta Otorhinolaryngologica Italica*. 2016;36(4):259-264. doi:https://doi.org/10.14639/0392-100x-709
6. Beswick DM, Vaezi A, Caicedo-Granados E, Duvvuri U. Minimally invasive surgery for parapharyngeal space tumors. *The Laryngoscope*. 2012;122(5):1072-1078. doi:https://doi.org/10.1002/lary.23244
7. Chan J, Li RJ, Lim M, Hinojosa AQ, Boahene K. Endoscopic transvestibular paramandibular exploration of the infratemporal fossa and parapharyngeal space: A minimally invasive approach to the middle cranial base. *The Laryngoscope*. 2011;121(10):2075-

2080. doi:<https://doi.org/10.1002/lary.22159>
8. O'Malley Jr. BW, Quon H, Leonhardt FD, Chalian AA, Weinstein GS. Transoral Robotic Surgery for Parapharyngeal Space Tumors. *ORL*. 2010;72(6):332-336. doi:<https://doi.org/10.1159/000320596>
  9. Battaglia P, Turri-Zanoni M, Dallan I, et al. Endoscopic Endonasal Transpterygoid Transmaxillary Approach to the Infratemporal and Upper Parapharyngeal Tumors. *Otolaryngology-Head and Neck Surgery*. 2014;150(4):696-702. doi:<https://doi.org/10.1177/0194599813520290>
  10. Fang Y, Wu H, Tan AD, Cheng L. Transcervical endoscopic approach for parapharyngeal space: a cadaver study and clinical practice. *PubMed*. 2020;140(2):163-169. doi:<https://doi.org/10.1080/00016489.2019.1663924>
  11. Ducic Y, Oxford L, Pontius A. Transoral Approach to the Superomedial Parapharyngeal Space. *Otolaryngology - Head and Neck Surgery*. 2006;134(3):466-470. doi:<https://doi.org/10.1016/j.otohns.2005.10.003>



Case Reports

## A NOVEL CLASSIFICATION AND A CHART-MAKING DECISION FLOW PROPOSAL FOR FIXED FULL-ARCH IMPLANT-SUPPORTED PROSTHESIS

F. Gelpi<sup>1</sup>, C. Alberti<sup>2</sup>, M. Bevilacqua<sup>3</sup>, P. Montagna<sup>1</sup>, D. De Santis<sup>1</sup> and T. Tealdo<sup>4</sup>

<sup>1</sup>Head and Neck Department, Department of Surgery, Dentistry, Pediatrics and Gynecology, University of Verona, Verona, Italy;

<sup>2</sup>Private Practitioner in Rosà (VI), Italy;

<sup>3</sup>Private Practitioner in Boves (CN), Italy;

<sup>4</sup>Private Practitioner in ALBA (CN), Italy

*Correspondence to:*

Federico Gelpi, DDS

Head and Neck Department,

Department of Surgery, Dentistry,

Pediatrics and Gynecology,

University of Verona,

Verona, Italy

e-mail: federico.gelpi@libero.it

### ABSTRACT

Full-arch screw-retained implant-supported rehabilitations represent a dependable solution for thoroughly treating edentulous patients or those with terminal dentition. Despite extensive literature discussing and reporting data to refine the outcomes of these treatments, there is a notable gap in guidance focusing on post-surgical phases, especially in a schematic and detailed manner addressing prosthetic concerns. This paper seeks to bridge this gap by delineating a standardized workflow in the daily approach to managing patients seeking full-arch screw-retained implant-supported prostheses. It builds upon existing research while introducing a novel, structured guide to assist practitioners after the surgical phase up to the final prosthesis delivery. Moreover, we introduce a comprehensive classification system for viable full-arch screw-retained implant-supported prostheses, supplementing it with a decision-making flowchart. This tool, forged from both daily workflow experiences and thorough existing literature, aims to aid in selecting the most appropriate prosthetic design tailored for each patient. To validate the applicability and effectiveness of the proposed classification and workflow, we conclude with a series of case studies showcasing successful full-arch rehabilitations where this decision-making flowchart has been practically applied.

**KEYWORDS:** *full arch implants supported rehabilitations, classifications, decision flowcharts, frameworks, digital and analogical flow in dentistry*

Received: 18 August 2023  
Accepted: 04 October 2023

ISSN: 2038-4106

Copyright © by BIOLIFE 2024

This publication and/or article is for individual use only and may not be further reproduced without written permission from the copyright holder. Unauthorized reproduction may result in financial and other penalties. Disclosure: All authors report no conflicts of interest relevant to this article.



F. Gelpi et al.

## INTRODUCTION

Full-arch screw-retained implant-supported prostheses are increasingly acknowledged as a reliable treatment modality for patients presenting a failing dentition or complete edentulism. These prostheses offer the opportunity to provide patients with a customized, enduring, and functionally effective solution, addressing both functional and aesthetic considerations in their rehabilitation.

Furthermore, the increasing adoption of digital technologies in dentistry (1) has enabled clinicians to perform such rehabilitation and do it rapidly. In the context of implant dentistry and its prosthetic timing, three loading protocols can be identified. Conventional or delayed loading is when the first provisional is delivered at least two months after the implant placement surgery. Early loading is referred to as the delivery of the provisional between one week and two months after the surgery, while immediate loading is defined as the provisional delivery within 1 week from the implant placement, with most protocols aiming to stay within the 48-hour mark. In recent years, immediate loading timing protocols have garnered increasing attention, with numerous studies focusing on surgical factors and preliminary evaluation to determine their success rate (2). The recently introduced “Same Day Delivery” approach, which has further reduced the technical time, effectively transforms compromised dentitions into aesthetically pleasing ones within hours (3). These solutions restore masticatory, phonetic, and aesthetic functions more swiftly than previous methods and offer tailored options to meet individual patients’ best needs. Importantly, they do not exhibit significant disadvantages compared to other treatment alternatives (4).

Clinicians must consider many factors when formulating a comprehensive treatment plan for full-arch screw-retained prostheses (5). These considerations encompass both mechanical and biological aspects, as well as individual patient preferences (6). The mechanical and biological considerations associated with such cases have been extensively discussed. With the aid of digital technologies and CAD/CAM, it has become increasingly feasible to provide immediate-load full-arch provisionals that offer pleasing aesthetics and enhanced durability (7). However, it is noteworthy that a substantial portion of the existing literature predominantly focuses on the surgical aspects when addressing full-arch rehabilitations (8 - 10), with relatively few resources offering a clear pathway for the actual design of the provisional prosthesis (11). Addressing this limitation, the Columbus Bridge Protocol (CBP), which finds its roots in the Novum Protocol (12), was introduced by Tealdo et al. (13). This protocol aims to create a fine-tuned load on the post-surgical provisional through the optimization of prosthetic factors, primarily focusing on the fit of the metal framework, as well as the stability and the even load distribution of the provisional.

Acknowledging that the term ‘provisional’ implies that the device is not intended to endure throughout the rehabilitation lifespan is essential. While a high-quality provisional is indispensable for soft tissue maturation and aesthetics during immediate loading protocols, the final restoration is designed to be long-lasting. Therefore, clinicians must clearly understand the design options for the final restoration to achieve a high success rate and ensure patient satisfaction.

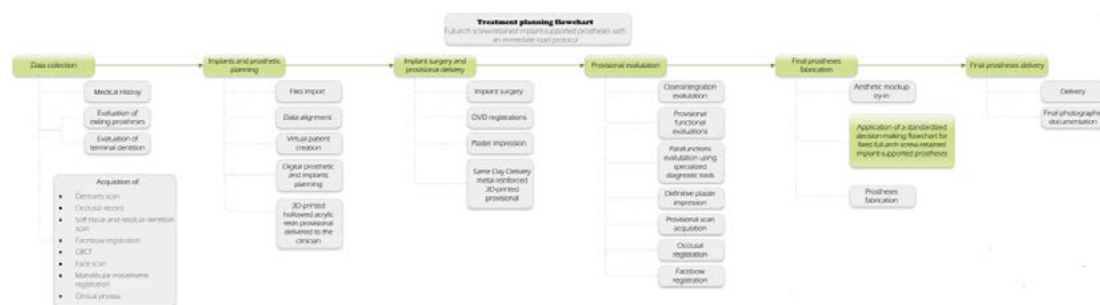
This paper addresses the lack of prosthetic standardization within the domain of full-arch screw-retained implant-supported prostheses, regardless of whether they are subject to immediate loading. Readers will receive a comprehensive overview of the procedural steps typically employed in clinical practice, as practised by the authors, encompassing the entire spectrum from initial treatment planning to the ultimate delivery of the final restoration. The primary objective of this paper is to introduce a classification system designed to provide a lucid and systematic decision-making framework for the final restoration’s design. Drawing insights from clinical reports, the intention is to offer guidance to clinicians involved in rehabilitating edentulous jaws. Additionally, this paper will demonstrate the effective integration of recent advancements in digital dentistry into conventional workflows.

### *Surgical and prosthetic protocol for full-arch screw-retained implant-supported rehabilitations.*

Many experts emphasize the fundamental role of precise diagnostic information as the cornerstone of effective treatment planning (15). Properly charting the treatment trajectory from the initial consultation is vital for success.

In this paper, the Authors delineate their daily protocol for creating full-arch screw-retained implant-supported prostheses, applied in both immediate and non-immediate loading situations (Fig. 1). The procedure starts with systematic data collection, followed by a strategic implant-prosthetic planning based on the acquired information. The subsequent surgical stage includes implant placement and temporary prosthesis delivery, scheduled based on the loading protocol; this leads to the preparatory stage for the final restoration, entailing provisional reevaluation and the necessary recordings for an accurate fit and pleasing aesthetics. Before concluding with the delivery of the final restoration, an aesthetic try-on is conducted.

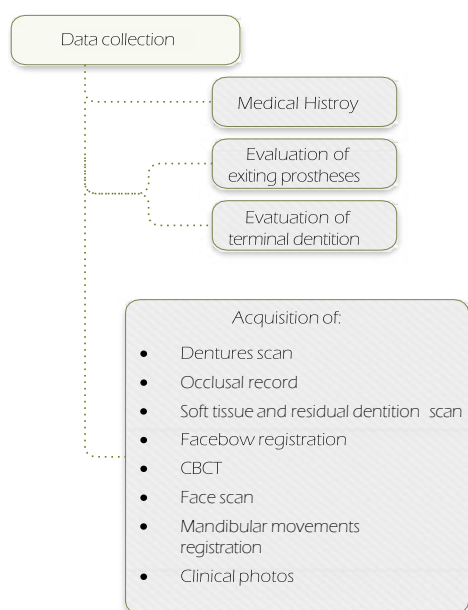
F. Gelpi et al.



**Fig. 1.** Treatment flowchart for fixed full-arch screw-retained implant-supported prostheses.

*Data collection*

The data collection step (Fig. 2) holds fundamental importance as it not only allows for determining whether the patient seeks a full-arch fixed restoration but also provides valuable insights into the type of restoration best suited for the specific scenario. The process begins with a meticulous anamnesis, gathering information about the patient’s general health, medical history, medications, and psychosocial elements.



**Fig. 2.** Illustrates the various steps involved in the data collection phase.

The subsequent objective examination and radiological assessment vary depending on the patient’s current oral status. For denture wearers, an evaluation of the existing device is necessary. If it is deemed functional and aesthetically suitable, it can be used as a starting point for a full-arch prosthesis after proper relining. Alternatively, a new denture should be fabricated from scratch, with special attention to determining the occlusal vertical dimension (OVD), phonetics, aesthetics, and soft tissue support, as it serves as a reference for provisional fabrication. The introduction of digital technologies has made the use of Digital Smile Design (DSD) in planning software (Exocad version 3.1 Rijeka) a viable option, potentially obviating the need for a new denture under specific conditions.

The subsequent step has been significantly influenced by the integration of intraoral scanners (IOSs) and other registration tools into daily clinical practice. In the past, acquiring prosthetic information from a denture required the creation of a radiological guide or adherence to the Double Scan Protocol (14). Nowadays, clinicians can directly acquire this information in a digital STL format using an intraoral scanner (Aoralscan 3, Shining 3D). Dentures can be scanned outside the mouth one by one, with the option of using additional markers for smoother acquisition (DentalMark, SureMark®), and then manually aligning them in occlusion to capture an occlusal registration using scannable silicones (Occlufast CAD, Zhermack). The approach may vary depending on the condition of the opposing arch, but even a

F. Gelpi et al.

removable denture on a single arch can be scanned extraorally and later aligned intraorally. Regardless, the generated files should be carefully checked for continuity in both the inner and outer surfaces.

For edentulous patients, acquiring oral soft tissue data becomes a separate step. This can be particularly challenging when the crest is significantly resorbed, and usual landmarks are lost. In such scenarios, it is beneficial to place sticky markers in reproducible positions before both IOS scanning and CBCT acquisition to facilitate both the scanning process and subsequent data alignment.

In cases where the patient still retains natural teeth, the initial examination should focus on the diagnosis and therapeutic indications for each tooth, considering endodontic, prosthetic, and periodontal aspects (16). When the dentition is judged as a failing one further element are to be considered before extraction: the clinician should inspect the aesthetic of the current situation, considering asymmetries or patients concerns. When the dentition is deemed failing, additional elements are considered before extraction. Clinicians should evaluate the current aesthetic situation, considering any asymmetries or patient concerns. The authors of the CBP protocol also recommend performing periodontal probing, which will later influence the choice of restoration (11). A digital impression of the failing dentition and soft tissues is taken.

In any of the mentioned scenarios, we acquire a facebow registration using digital technologies (Artex facebow, Artex). As an additional recommendation, we propose proceeding with the model plastering on the semi-individual articulator (Snow white plaster, Kerr) in an outpatient setting. It's essential to ensure that the dental laboratory possesses an exact replica of such an articulator set with the same parameters. This approach not only facilitates the shipment of smaller packages to the dental lab, eliminating the need to ship a facebow, but also fosters smoother communication between technicians and prosthodontists.

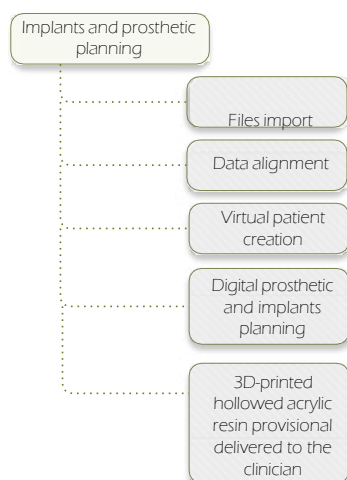
For both failing dentitions and edentulism, further anatomical information is required. A CBCT scan is acquired and exported in DICOM format, while a face scanner (MetiSmile, Shining 3D) captures extraoral soft tissue and smile line data. In this phase, the use of a mandibular movement registration tool (Cyclops, Itaka) is advised. Through specific hardware components, this tool registers dynamic occlusion.

Further information is obtained, useful also for later comparison, shooting a standardized set of photos. The protocol starts by providing reproducible setting, not only by consistently setting the camera and the framing, but also guiding the patient in natural head position (NHP), which is proved to have greater standardization over other possible references (17). At this stage the authors usually take two front-facing shots. First, with the patient sat down in NHP and the dental assistant at his back holding a set of Y-shaped cheek retractors, an open mouth photo is acquired. Subsequently the dental assistant gently removes the cheek retractors, trying to not move the patient's head., and the same shot is acquired but with the patient slightly smiling.

#### *Implants and prosthetic planning*

Once all the essential anatomical, prosthetic, and aesthetic data have been adequately collected, these are consolidated into a unified platform, effectively creating a virtual patient (Fig. 3). To accomplish this, we adopt specialized software (Exocad version 3.1 Rijeka) due to its integrated capabilities. This software not only facilitates comprehensive diagnosis and planning for full-arch screw-retained implant-supported rehabilitation but also streamlines prosthetic design within the same environment.

F. Gelpi et al.



**Fig. 3.** Illustrates the various steps involved in the implant and prosthetic planning phase.

Following the data import, including the CBCT scan (if required), intraoral soft-tissue scan, prostheses scan, opposing arch/prosthesis scan, occlusion bite and dynamic occlusion, facebow registration, and face scan, our next step involves aligning these models utilizing the dedicated wizard feature. An important point to note before moving forward is the orientation of the triangles in the digital scan of a prosthetic device. Like all STL files, this scan is represented by a mesh of small triangles, which typically face outward. This can be likened to having an impression of the denture that's awaiting casting into a physical model.

To fully understand the need for inversion, we must delve into how digital scans operate. When an intraoral scan is executed, the outcome is an STL file that depicts the object's surface through a mesh of triangles. In most scans, these triangles are oriented so that their normals point outward, representing the external surface of the scanned object. However, in certain contexts, such as when aiming to create a negative model of the denture for designing and fabricating devices that must perfectly replicate the original denture, it becomes necessary to invert the orientation of these triangles.

This digital step simulates the process of creating a negative mold, that compared to an analogic impression would be a plaster cast, eliminating the manual need to duplicate dentures in plaster. Fortunately, most dental CAD software solutions, including Exocad, provide a function to digitally invert the model's vertices.

This virtual patient serves as a virtual workspace, allowing the dental technician to operate as if the patient were physically present. Collaborating closely with the prosthodontist, the technician designs a temporary prosthetic device intended for immediate delivery on the day of implant placement surgery. For edentulous patients, we consider compensating for soft tissue deficiencies based on an evaluation of the distance between the cervical portion of the prosthetic teeth and the alveolar ridge. Compensation is deemed necessary when this distance exceeds 25% of the length of the prosthetic teeth. In cases of failing dentition, these considerations are guided by the mean probing depth, serving as an indirect measure of bone and soft tissue resorption. A value of 5 mm or more typically indicates the need for soft tissue replacement. In any scenario, the false gingiva is incorporated into the manufacturing process after the surgery is completed.

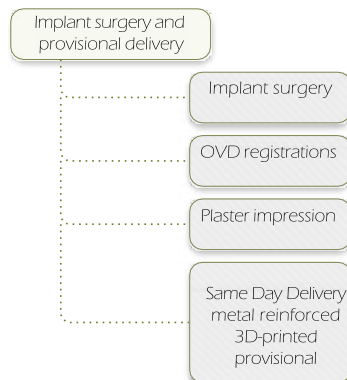
If the existing occlusal vertical dimension (OVD) is deemed suitable in terms of function and aesthetics, we proceed to create and verify proper contacts using the virtual patient established earlier. It is imperative to note that the OVD encompasses both the freeway space, essential for aesthetics and function, and the prosthetic space, establishing a bidirectional relationship with prosthetic design. For more complex cases, an intermediate restoration is designed and fabricated to assess aesthetics and function rigorously. Alternatively, Digital Smile Design (DSD) can be employed.

The concluding phase involves providing the clinician with the temporary restoration. The authors typically employ A2 colored acrylic resin, 3D-printed from a CAD project, and later manually customized to achieve tooth characterization and refine the restoration. The adoption of acrylic resin for provisionals aligns with substantial support in the literature, owing to its capacity to absorb stresses that might otherwise be transmitted at the implant-bone interface (18). Notably, the provisional is initially delivered in a hollowed-out state, ready for subsequent assembly to the metal framework. This framework is fabricated through welding a metal bar to the provisional cannula, previously screwed onto the angled abutments.

F. Gelpi et al.

*Implant surgery and screw-retained immediately loaded provisional delivery.*

The subsequent surgical phase (Fig. 4) is case-specific, but the authors adhere to certain general principles. As a general guideline, the utilization of long and wide tilted implants (measuring 13 mm or more) with a rough surface, an external hex connection, and angled abutments is favored, avoiding reliance on regenerative procedures and reducing cantilever length. In cases where immediate loading is planned an insertion torque exceeding 40Ncm is targeted, also considering surgical site underpreparation.



**Fig. 4.** Illustrates the sequential steps in the implant surgery and provisional delivery phase.

These principles, as outlined in the Columbus Bridge Protocol (11), are derived from research comparing stress distribution in the bone surrounding immediately-loaded tilted implants versus traditional straight implants and their associated outcomes (19, 20). Research has shown that using longer tilted implants, particularly when splinted with a framework, results in a more even stress distribution in the surrounding bone compared to straight implants. Furthermore, tilted implants often obviate the need for additional bone regeneration procedures. They also enable the placement of longer implants, thus achieving the primary stability crucial for immediate loading (21 - 23), and they assist in reducing cantilevers.

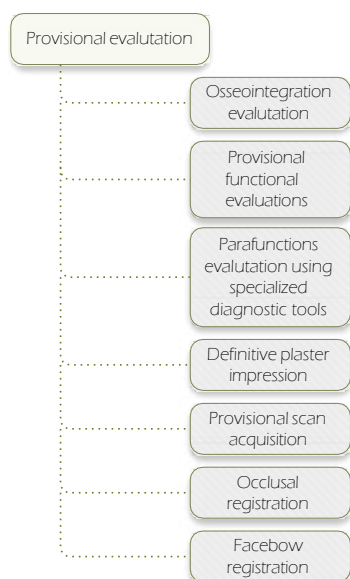
The surgical procedure begins with the extraction of any remaining failing teeth. Following an immediate placement protocol, implants are inserted along with low-profile angled abutments. Before suturing, abutments are placed, and a plaster impression is obtained using an open-tray technique. Subsequently, an interocclusal registration wax is created and later relined with aluminium wax, considering both the presurgical and planned occlusal vertical dimension (OVD) as measured on fixed landmarks. On the same day, within the framework of the “Same Day Delivery” concept, an in-house dental laboratory produces a passive metal framework. Verification of its passive fit through a single screw test precedes its secure attachment to the provisional superstructure.

*Evaluation of provisional restoration after 4 months*

Following a four-month interval, the transition to the phase of prosthetic reassessment (Fig. 5) is made. At this stage, careful attention is given to ensuring the provisional restoration aligns seamlessly with both the patient’s aesthetic expectations and the biomechanical functional requisites. Adjustments are made as necessary, considering the extent of functional wear, if present. If significant modifications are deemed essential, the option of crafting an additional provisional restoration is considered. It’s important to note that, in cases following a delayed loading protocol, this phase represents the fabrication of the initial provisional restoration, with evaluations deferred to later stages.



F. Gelpi et al.



**Fig. 5.** Illustrates the sequential steps in the provisional evaluation phase.

To enhance the probability of success in fixed full-arch screw-retained implant-supported rehabilitations, a pivotal factor that merits precise consideration when evaluating the appropriateness of a temporary restoration is parafunctions and bruxism. A recent study by Thymi (26), through interviews with oral implantologists practicing in non-academic clinical environments in the Netherlands, has highlighted that the majority of clinicians do not perceive bruxism as a contraindication to implant therapy, provided that pain is absent. Furthermore, it has been noted that certain clinicians do not factor bruxism into their material selection for rehabilitation. In this context, a recent systematic review and meta-analysis by Häggman-Henrikson (27) indicate that individuals classified as probable bruxers may exhibit an elevated risk of implant failure in comparison to non-bruxers. In the case of immediately loaded implants, this heightened risk may be attributed to diminished proprioception around the implants and the detrimental consequences of micromovements during the orthopedic healing process of peri-implant bone.

Given the current lack of unequivocal evidence concerning the impact of bruxism and parafunctions on full-arch rehabilitation, and drawing insights from our collective experience, the adoption of advanced diagnostic and monitoring tools proves advantageous for addressing patients presenting such conditions. These diagnostic tools come to the forefront primarily when both the patient and the clinician express contentment with the aesthetic and functional aspects of the provisional restoration, yet the patient reports discomfort despite the absence of clear evidence indicating imbalanced occlusal contacts and muscular stresses.

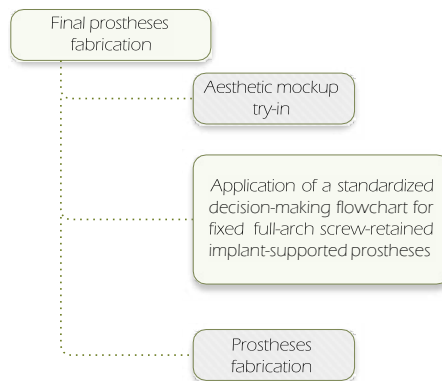
One such tool the authors employ is an electromyography system specifically designed for dental applications, complemented by its dedicated software (Teethan®). This system aids in the precise identification of a patient's parafunctional activities, including the specific muscles involved and their distribution within the occlusal scheme. To further enhance diagnostic accuracy, the incorporation of a portable Holter (BruxOff®) gives insight in the diagnosis and continuous monitoring of sleep bruxism (SB) when worn uninterruptedly for a minimum duration of 6 hours. These diagnostic tools offer more than mere identification; when seamlessly integrated into the clinician's workflow and coupled with physiotherapy, they facilitate the fine-tuning of provisional function based on significant findings and patient complaints, ensuring adaptation before proceeding to the fabrication of the final restoration.

At this juncture, additional data acquisition becomes imperative. Thanks to the previously mentioned systems a comprehensive dataset is compiled, including STL models of the provisionals (Aoralscan 3, Shining 3D), an occlusal record (Occlufast, Zhermack), soft tissue scan, a facebow registration (Artex facebow, Artex), and plaster impressions using an open-tray technique (Snow white plaster, Kerr). The principles governing data variation to accommodate specific scenarios, as delineated in the data acquisition section, are diligently applied.

F. Gelpi et al.

#### *Fabrication of a fixed screw-retained full-arch implant-supported prosthesis*

In this phase, clinicians encounter critical decision-making challenges regarding prosthetic design (Fig. 6). These considerations will be addressed in a subsequent paragraph. For now, the workflow will be described, assuming that these decisions have been made for continuity.



**Fig. 6.** Illustrates the sequential steps in the final prosthesis fabrication phase.

The dental laboratory receives both analog and digital patient information and proceeds to create a wax denture for the final aesthetic try-in. It is important to emphasize the concept of integration between digital and analog procedures. According to our perspective, supported by literature (28, 29), digital impressions' precision is not comparable to conventional plaster impressions when considering full-arch rehabilitations. For this reason, digital technologies are utilized in many steps of author's daily practice, but plaster impressions are preferred for such cases.

Moving forward, dental technicians incorporate additional data into the existing information, including updated face scans, occlusal registrations and a functionally adapted, aesthetically pleasing provisional. The framework is designed in a CAD environment using a virtual patient (Exocad version 3.1 Rijeka). It is initially tested for passivity through a virtual one-screw test before being sent to an external facility for manufacturing. Simultaneously, the superstructure is integrated into the project. Upon receiving the metal structure, a further passivity test is conducted, both on the plaster model and in the patient's mouth.

The final steps, which vary based on the chosen prosthetic design, encompass creating the superstructure, adding characterizations to it, assembling the framework with the aesthetic superstructure, and finalizing the rehabilitation in vivo (Fig. 7). An optional but highly recommended step is capturing photographs of the final conditions, following the same pattern described during the data acquisition phase.



**Fig. 7.** Illustrates the sequential steps in the final prosthesis delivery phase.

#### *Factors influencing the prosthetic design.*

In their clinical practice authors employ five primary types of full-arch screw-retained implant-supported prosthetic designs. While this range doesn't cover the ever-expanding array of options, it is worth noting that some, namely full monolithic Zirconia restorations and PEEK (polyether-ether-ketone) frameworks, are intentionally excluded.

The exclusion of full monolithic Zirconia restorations is motivated by their increased susceptibility to chipping, despite their potential for superior soft-tissue response and aesthetic appeal compared to Titanium frameworks (30-32). Similarly, PEEK, which has gained popularity in the dental community, is not part of the repertoire. PEEK is found to be unsuitable for permanent restorations due to its tendency to undergo plastic deformation, abrasion, and fracturing, especially under stress. This is largely attributed to its low elastic modulus and relative softness (33).

F. Gelpi et al.

The first solution suggested is the Toronto bridge, which involves a CAD/CAM designed and manufactured framework made of either Titanium or Chromium-Cobalt (Cr-Co) alloy combined with denture teeth and resin compensation for soft tissue loss. The second design, called Natural bridge, is similar in framework but incorporates fully customized Composite resin teeth, polymerized in a transparent mold, for aesthetic veneering. The Thimble technique is the third option, featuring a Titanium or Chromium-Cobalt alloy framework containing stumps, or thimbles, that replicate the function of natural teeth abutments and support individually luted monolithic Zirconia crowns. The fourth solution, namely the Titanium-Zirconia bridge, uses a CAD/CAM titanium framework luted on a milled monolithic Zirconia superstructure or a cut-back customized Zirconia veneering. Finally, there is a design that employs a CAD/CAM Titanium framework with ball attachments to support a removable metal-reinforced overdenture. One last design worth citing is the full Zirconia framework one, presenting a monolithic Zirconia framework combined with either monolithic zirconia or ceramic veneering stratified over a carved monolithic Zirconia structure for teeth. As stated, we don't embrace this last design due issues related to its fit and passivity. The following figure offers an overview on presented options (Fig. 8).

Classification of full-arch screw-retained implant-supported prostheses

Classification	Framework	Aesthetic Covering (teeth)
1) Toronto bridge	Titanium/Chromium-Cobalt (CAD/CAM)	Denture teeth
2) Natural bridge	Titanium/Chromium-Cobalt (CAD/CAM)	Composite resin
3) Thimble technique	Titanium/Chromium-Cobalt (CAD/CAM)	Single Zirconia crowns
4) Titanium-Zirconia bridge	Titanium	Milled monolithic zirconia or customized zirconia using Cut-Back
5) Bar overdenture	Titanium	Counter-bar embedded in a removable overdenture
6) Full Zirconia	Zirconia CAD/CAM	Monolithic zirconia or Stratified ceramic on monolithic zirconia

Fig. 8. Options for full-arch screw-retained implant-supported prostheses.

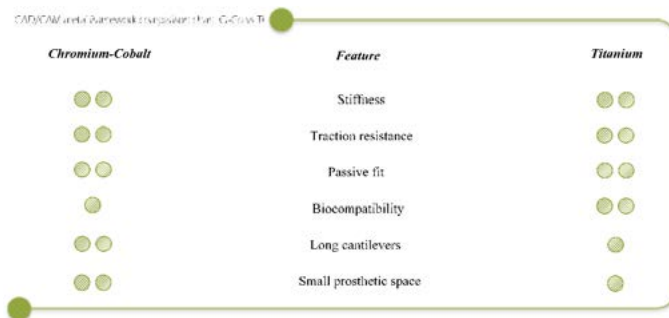
*Chromium-Cobalt alloy vs titanium as framework materials.*

Chromium-Cobalt is renowned for its strength, longevity, biocompatibility, and resistance to corrosion (34). It can also be effectively bonded with ceramics. However, the traditional casting techniques for Cr-Co come with their set of challenges. The cumulative effects of distortion and porosity, coupled with high labor expenses, make the finishing process intricate.

In contrast, Titanium frameworks are recognized for their corrosion resistance and biocompatibility, largely attributed to a slender protective oxide layer (35). To achieve these characteristics, titanium requires specific casting and finishing techniques, especially considering its high melting point of approximately 1668°C and a swift oxidation rate surpassing 900°C. This calls for advanced equipment. Notably, at 883°C, titanium transitions from an alpha-hexagonal configuration to a beta-cubic form. This alteration alters the framework and forces ceramics to be fired at temperatures under 800°C.

Distortions and porosity, common challenges in this domain, are effectively tackled using CAD/CAM methodologies. This is particularly beneficial for extensive rehabilitations, like full-arch structures, when utilizing titanium and Chromium-Cobalt. The accuracy offered by CAD/CAM facilitates the manufacturing processes and minimizes distortions and porosity, ensuring an enhanced fit and reduced bacterial attachment (36). When the two are compared (Fig. 9) Titanium seems to be the material of choice for the framework of full-arch screw-retained implant-supported prosthesis due to its enhanced biocompatibility, aside from the scenarios in which either prosthetic space is lacking or long cantilevers are planned (37).

F. Gelpi et al.



**Fig. 9.** CAD/CAM metal framework comparison. Chromium-cobalt alloy and titanium.

#### *Aesthetics*

Rehabilitation procedures should be tailored to meet the individual aesthetic requirements of patients. In scenarios where a high degree of customization is sought to achieve superior aesthetic outcomes, Zirconia outpaces other alternatives owing to its natural appearance. Composite resin dentitions, however, may sufficiently meet the demands of less demanding patients. Additionally, the extent of smile exposure necessitates careful evaluation of design choices to avoid potential disadvantages; for instance, the transition line to soft tissues in a Toronto bridge might be less bothersome for individuals with a low smile line, compared to those with a high smile line.

#### *Available prosthetic space and minimum material thickness requirements*

Determining the available prosthetic space, calculated by subtracting the Freeway space from the OVD, is pivotal in steering the prosthetic design choice, thereby averting complications such as veneer chippings or framework fractures. In the Toronto bridge solution involving a Cr/Co framework, it is advised to maintain as minimum thickness parameters 0.5 mm for tube and 2.5 mm for section. A similar approach applies to the Titanium framework but with differing values, 0.8 mm and 4 mm for tube and section, respectively.

Employing the Natural bridge solution generally involves larger volumes while adhering to the same framework thickness parameters. The Thimble technique showcases a more anatomical structure, enhancing volumes significantly while imposing a minimum Zirconia thickness of 0.6 mm. Conversely, the luted Titanium-Zirconia bridge solution, characterized by its vertical extension, prescribes a minimum thickness of 0.8 mm for Zirconia, aligning with the minimum thickness values dictated for the frameworks. Full Zirconia solutions recommend a minimum thickness of 0.6 mm, with a special emphasis on increased palatal thickness to reduce the risk of fractures at common stress points caused by forces acting on the implant.

The authors consider the bar overdenture and the luted Titanium-Zirconia bridge the ones requiring the most vertical prosthetic space, followed by the thimble technique and other solutions.

#### *Ease of reparability*

With patients undergoing full-arch rehabilitation averaging 61 years of age (42), and taking into account the 2020 reported life expectancy in Europe of 80 years (43), the age factor becomes pivotal in the context of long-term planning. Considering the age at which a specific patient is receiving the rehabilitation is crucial in the long term.

In this regard, the Thimble technique emerges as a prudent choice for young adults with enough financial means. Despite its higher fabrication costs, it facilitates relatively economical and straightforward repairs, since luting single crowns on the mesostructure allows their individual replacement without necessitating extensive procedures. Composite resin and denture teeth share this benefit, also offering chairside reparability for minor fractures.

#### *Hygienic potential*

Given the documented decline in self-care and oral hygiene abilities in elderly patients, the selection of an appropriate solution becomes central to sustaining oral health (45-47). Reports denote a superior hygienic potential in overdentures, advocating for their preference among elderly individuals with diminished manual dexterity (44).

#### *Nature of the opposing dentition and patient's parafunctions*

It is well established that implant-supported prostheses have a reduced proprioception if compared to the natural dentition (48). The material chosen for the occlusal surfaces should be balanced with its effects on the opposing dentition,

F. Gelpi et al.

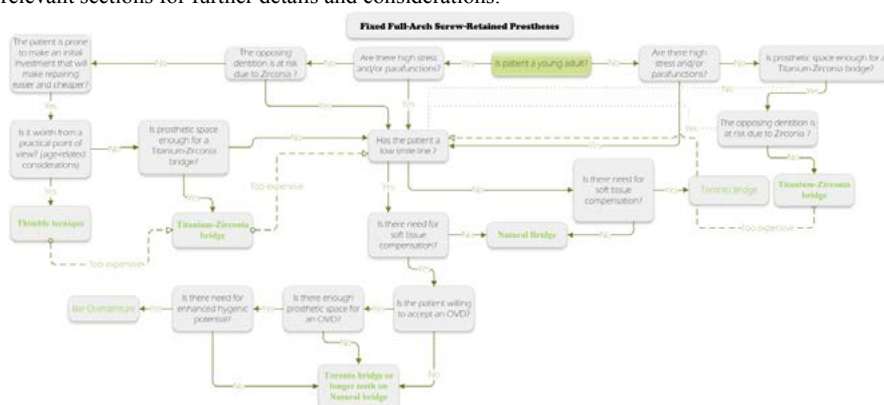
for instance privileging Composite resin if the opposing arch presents natural teeth partially compromised by periodontal disease. This can be of lesser impact in elderly with a reduced masticatory force and no parafunction, but it is of primary importance in young people. Moreover, zirconia is not advised in parafunctional patients for its high hardness, that more likely leads to chippings rather than abrasions.

*Conservation of the OVD*

Owing to its robust mechanical properties, Zirconia emerges as the most suitable material for maintaining a consistent occlusal vertical dimension (OVD) among the options considered. In contrast, materials such as acrylic resin or Composite resin are prone to abrasion in response to masticatory forces. This abrasion is influenced by the nature of the opposing arch's dentition and can lead to significant alterations in a patient's occlusal vertical dimension over time. Zirconia is a durable and wear-resistant material, making it a great choice for long-lasting full-arch rehabilitations. This is especially true for younger patients who need a solution that will maintain a stable OVD for many years. This material pairs with the Thimble technique, offering a reliable choice for young adults. However, if this option isn't suitable due to its high cost or other factors such as age-related considerations, a Titanium-Zirconia bridge is a viable alternative.

*The decision-making*

Taking into account the previously presented data, the provided flowchart serves as a helpful guide for clinicians when selecting the most suitable prosthetic option for a particular patient (Fig. 10). It's essential to acknowledge that while this flowchart offers valuable guidance, strict adherence may not always be appropriate, as adjustments may be needed to accommodate variations in both practitioner preferences and patient needs. Additionally, when considering options that may involve either a Chromium-Cobalt alloy framework or a Titanium framework, it's advisable to refer to the relevant sections for further details and considerations.



**Fig. 10.** The proposed decision-making flowchart. Straight lines and dotted lines are the main path, the latter indicating a major redirect. Dashed lines redirect the clinician when a given solution doesn't fit the specific patient (mainly due to costs). OVD stands for overdenture.

*Application of the proposed classification*

Application of the proposed classification is exemplified through a series of five clinical cases, illustrating how the classification system was effectively utilized. All patients received treatment in an outpatient setting, following the outlined workflow. These case studies not only validate the classification but also provide practical insights into its application, aiding practitioners in adapting it to their unique clinical scenarios.

**CASE I: TORONTO BRIDGE**

A 76-year-old male, wearing complete removable dentures in both jaws, presented at our attention requiring a fixed solution to replace the removable rehabilitation. As reported in the previous sections we acquired all the relevant medical information about the patient's health and no contraindication to implant therapy was found. The existing denture was then analyzed and deemed unsatisfactory in terms of OVD, aesthetics and functions. Upon relining of the dentures all the necessary scans and photos were acquired (Fig. 11, 12).



F. Gelpi et al.

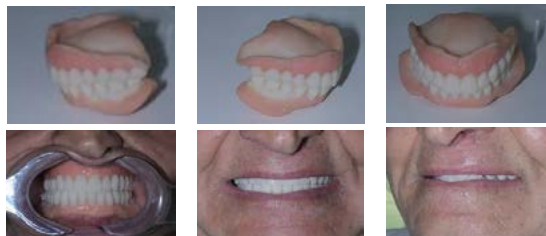


**Fig. 11.** Data acquisition step. Initial photos. **A)**: photos without dentures in situ, showing the class III relationship between the jaws; **B)**: Photos with dentures in situ, showing inadequate soft-tissue support.



**Fig. 12.** Data acquisition step. Existing denture. **A)**: Existing dentures being relined; **B)**: Occlusal registration inside the mouth.

A new OVD was determined to meet both aesthetic and functional criteria. Initially assessed digitally, it was subsequently transformed into a PMMA try-in (Fig 13). Surgery followed, involving the placement of four tilted implants (two pterygoid and two straight) in the maxilla, and four implants (two tilted) in the lower jaw. An open-tray technique was used to obtain a plaster impression for delivering an immediately loaded provisional, which was 3D printed based on an aesthetic project and later equipped with a metallic mesostructure (Fig. 14). Note that the pterygoid implants were not loaded during this initial phase.



**Fig. 13.** New dentures try-in. Notice the newly determined OVD and the enhanced soft tissue support.



**Fig. 14.** Provisional registrations and delivery. Note the absence of open-tray transfers on the pterygoid implants.

Upon completion of the osseointegration period, the pterygoid implants were incorporated as supporting pillars in the provisional restoration. The proposed classification was consistently applied at this stage, although an initial assessment could have been made in previous steps (Fig. 15). Considering all relevant factors, a Toronto bridge was determined as the most suitable prosthetic design for this patient.

F. Gelpi et al.

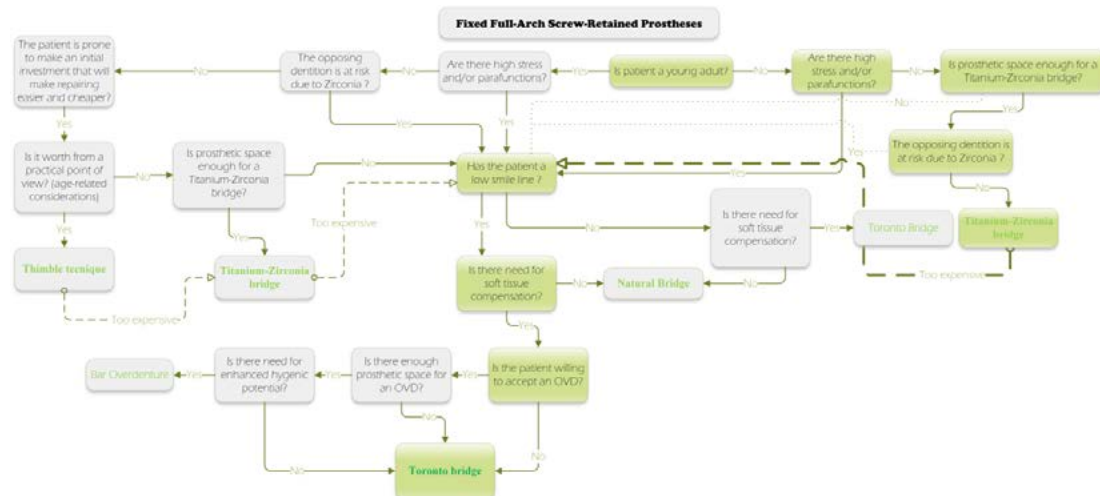


Fig. 15. Decision-making flowchart applied for a Toronto bridge.

A plaster impression using an open-tray technique and an occlusal registration in centric relation were acquired to fabricate an aesthetic try-in. Once the try-in was deemed optimal, a metallic framework (Fig. 16) was manufactured.



Fig. 16. Clinical and laboratory procedures to design the metallic framework.

This framework was then sent to a local milling center to obtain a Chromium-Cobalt mesostructure. Upon its delivery to the dental laboratory, a one-screw test was conducted on the plaster casts, followed by an in vivo test. Standard procedures for the fabrication of the final prostheses were followed (Fig. 17). In the final step, the completed restoration was delivered to the patient, and photos of the result were taken for comparative and future reference (Fig. 18).

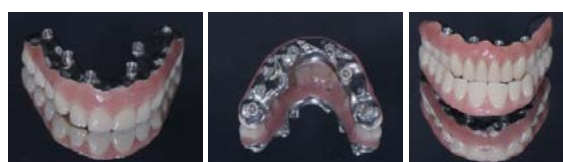


Fig. 17. Definitive Prostheses. Observe that the portions contacting the mucosa are constructed from polished metal, facilitating improved hygiene both professionally and at home.

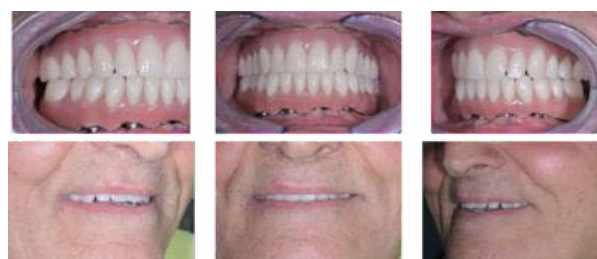


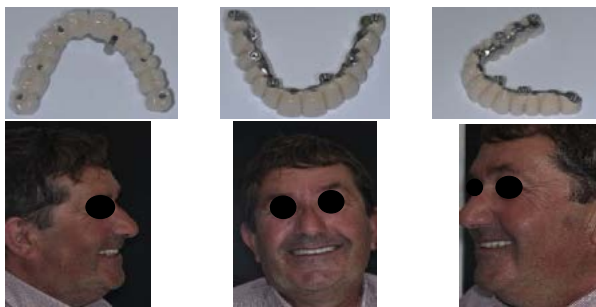
Fig. 18. Final situation.

F. Gelpi et al.

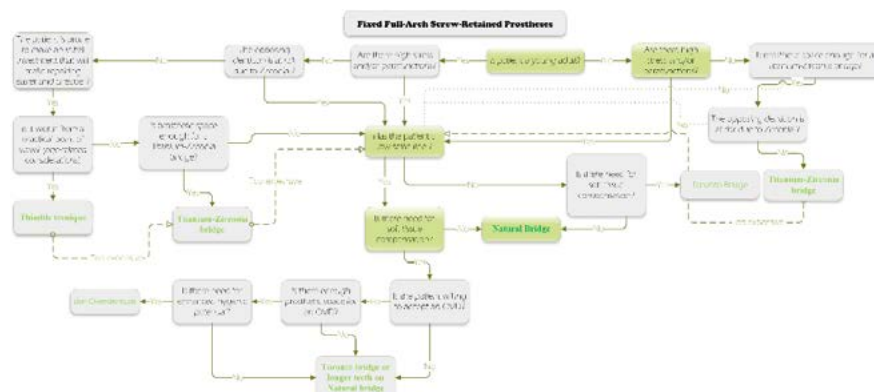
**CASE II: NATURAL BRIDGE**

In the case of a 63-year-old edentulous patient seeking fixed upper jaw rehabilitation, the authors found it better to be more concise in the discussion of this patient, given the extensive coverage of clinical and laboratory procedures in previous sections.

After analyzing the influencing factors, the authors determined that the most suitable prosthetic design was a Natural bridge with a CAD/CAM Chromium-Cobalt framework and customized composite teeth (Fig. 19, 20). Cr-Co was chosen due to its space-efficient characteristics compared to titanium.



**Fig. 19.** Final rehabilitation in situ. Note the absence of false.



**Fig. 20.** Decision-making flowchart applied for a natural bridge.

**CASE III: THIMBLE TECHNIQUE**

In the case of a 54-year-old male seeking a durable and aesthetically pleasing fixed restoration for his upper jaw, the patient's failing dentition and unsatisfactory aesthetics and function were evident (Fig. 21, 22). Upon gathering all relevant prosthetic and anatomical information, surgery was performed, followed by a plaster impression and an occlusal registration (Fig. 23).

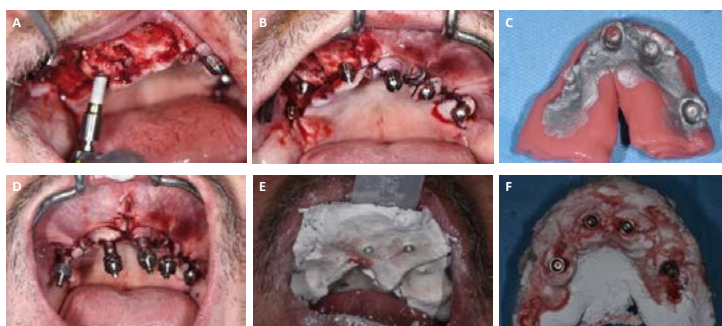


**Fig. 21.** Extraoral photos of the initial situation.

F. Gelpi et al.



**Fig. 22.** Intraoral photos of the initial situation.



**Fig. 23.** Surgical Implant Placement and Provisional registrations. **A)** Placement of implants (Biomax UNIPLANT with a diameter of 4.0 mm). **B)** Securing of the healing cups in position. **C)** Establishment of occlusal registration by guiding the patient to a centric relation using the "Chin Point" technique, coupled with the use of pink wax and Aluwax (Aluwax, Aluwax Dental Products). **D)** Positioning of the open-tray transfers. **E, F)** Capture of a detailed plaster impression.

After the completion of the osseointegration period, another impression was taken, and a PMMA try-in was 3D printed. It's worth noting that the dental midline was slightly shifted during this phase (Fig. 24).



**Fig. 24.** PMMA try-in and small adjustments to the dental midline.

The final restoration design was then evaluated (Fig. 25). Given the patient's youth, desire for long-lasting results, aesthetic requirements, and absence of cost constraints, the Thimble technique was chosen as the most suitable prosthetic design.



F. Gelpi et al.

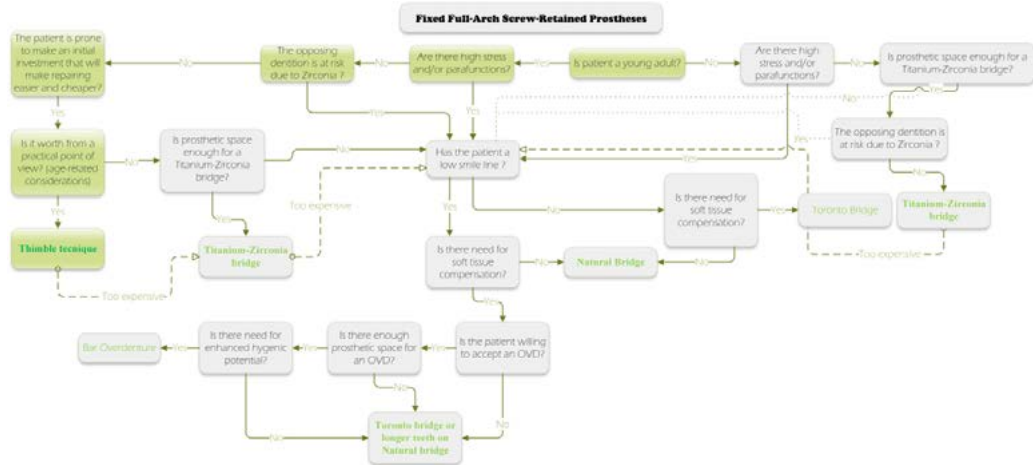


Fig. 25. Decision-making flowchart applied for a Thimble technique.

The fabrication process for a full-arch screw-retained implant-supported prosthesis using the Thimble technique commences with the construction of a Titanium framework, featuring stumps for the individual Zirconia crowns (Fig. 26).



Fig. 26. CAD designing of a full-arch prosthesis using the Thimble technique CAD-On.

Once the framework is delivered to the dental laboratory usual passivity tests are executed before luting each prosthetic crown in place. At last, the final restoration is delivered (Fig. 27).



Fig.27. Final restoration delivery.

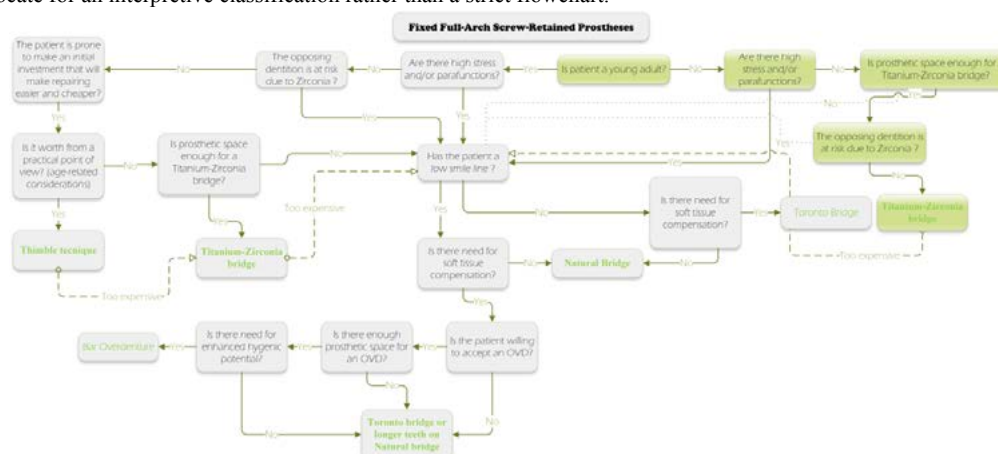


F. Gelpi et al.

**CLASS IV: TITANIUM-ZIRCONIA BRIDGE**

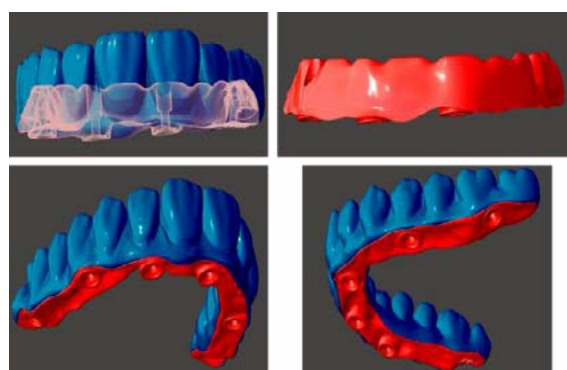
A 75-year-old female patient has sought our expertise with a request for a fixed upper jaw rehabilitation. This case closely resembles the previous one, with the primary difference being the patient’s age.

While the ease of repair is less critical for a 75-year-old patient, stringent aesthetic requirements remain a priority. After a comprehensive evaluation, a Titanium-Zirconia bridge was chosen (Fig. 28). The Thimble technique was ruled out due to its high cost and diminishing returns in meeting the patient’s specific needs. Similarly, a Toronto bridge was not considered because it would not meet the patient’s desired aesthetic standards. This illustrates why the authors advocate for an interpretive classification rather than a strict flowchart.



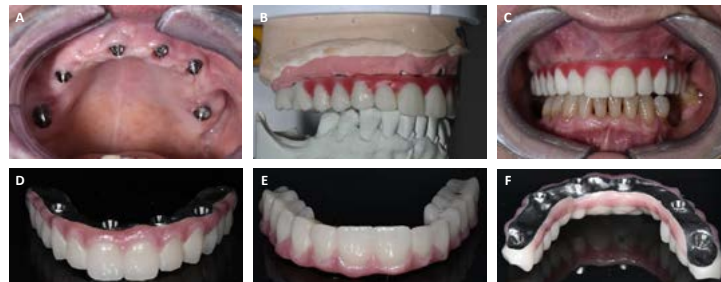
**Fig. 28.** Decision-making flowchart applied for a Titanium-Zirconia luted bridge.

In this technique, a Titanium framework is meticulously designed to perfectly match a monolithic Zirconia superstructure. These two components are then bonded using an anaerobic cement, which requires some extra space but ensures mutual passivity (Fig. 29). The clinical results are briefly presented (Fig. 30).



**Fig. 29.** This illustrates the two steps process of designing a prosthesis using CAD software and Blender. Initially, the entire prosthesis is assembled as a single piece in the CAD software to enhance aesthetics, function and harmony with soft tissue. Subsequently, the design is uploaded into Blender where a dedicated dental plugin is used to create the mesostructured, facilitating better management of luting spaces and passivity.

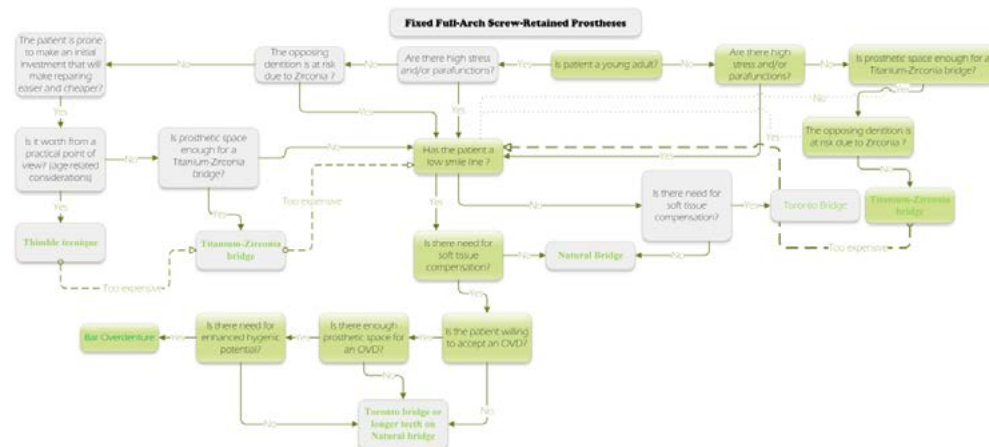
F. Gelpi et al.



**Fig. 30.** Patient Panel. **A):** Angled abutments in situ showcased with a soft tissue view. **B, C):** Intraoral trial of PMMA and pink wax gingiva. **D-F):** Different perspectives of the final restoration, assembled through manual luting of previously digitally designed components, adhering to the Titanium-Zirconia bridge luting technique.

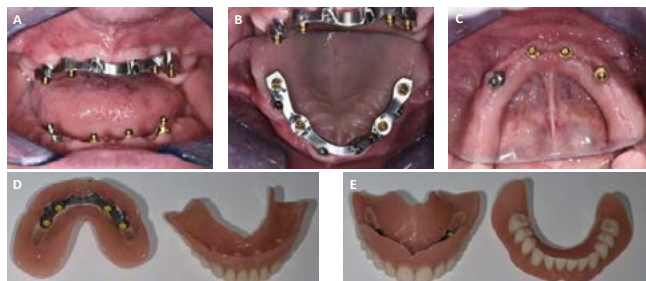
### CASE V: BAR OVERDENTURE

In a clinical case involving a 72-year-old male patient, both jaws rehabilitation was necessary as he had previously relied on a removable denture. The primary concern for this patient was functional improvement, with less emphasis on aesthetic considerations. Economic constraints and his suboptimal oral hygiene also played a role in the decision-making process (Fig. 31).



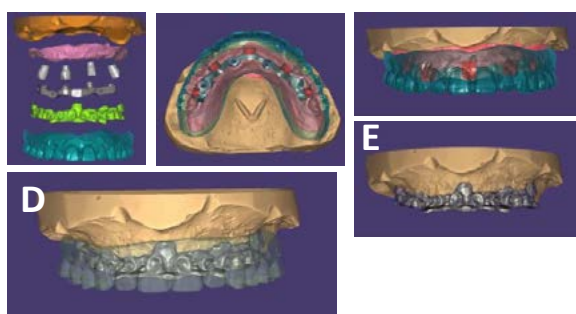
**Fig. 31.** Decision-making flowchart applied for a bar overdenture.

After a thorough assessment of all relevant factors, the authors concluded that a bar-supported overdenture (OVD) was the most suitable choice (Fig. 32). As reported earlier this design involves creating a bar primary bar with ball attachments to it, to be coupled with a second metal structure embedded into the removable OVD (Fig. 33).



**Fig. 32.** Overdenture delivery. **A-C):** show the bar structure in situ. **D, E):** provide a complete view of the prostheses.

F. Gelpi et al.



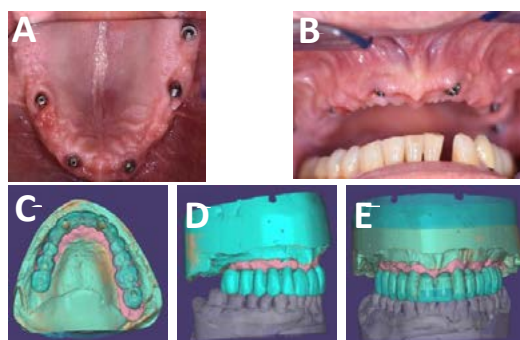
**Fig. 33.** Upper overdenture designing. *A*): shows the model base, the gingiva, the scan bodies, the primary structure, the secondary structure, and the aesthetic portion. *B, C*): show the overall prosthetic volume of the upper rehabilitation. *D, E*): show the volumetric relationship between the secondary structure and the aesthetic volume.

Throughout the decision-making process, careful consideration was given to balancing various factors. As part of the comprehensive care provided to the patient, detailed information was offered regarding the potential need for maintenance associated with this type of prosthesis. Maintenance may become necessary due to the gradual wear and tear of attachments resulting from routine cycles of insertion and removal.

**CASE VI: FULL ZIRCONIA**

As previously noted by the Authors, the deployment of a full zirconia bridge is generally discouraged due to the substantial technical hurdles in realizing passivity. Despite these reservations, the report presents a clinical case exemplifying the use of this methodology. However, it should be noted that no flowchart will be furnished, as this procedure does not constitute a regular component of the authors' daily practice.

A 65-year-old male requested an upper jaw rehabilitation by the mean of osseointegrated implants and a fixed prosthesis. The fabrication process involves various steps to achieve high passivity (Fig. 34, 35).



**Fig. 34.** *A, B*): Refer to the soft tissue after a healing period of 4 month. *C-E*): partially report the various digital phases of prosthesis fabrication.



**Fig. 35.** Intraoral and extraoral views of the final restoration.

F. Gelpi et al.

As reported by Tirone et al (49) in a recent systematic review the ratios between the cantilever extension and cross-sectional connector area should be  $<0.51$ , while the ratio between the former and screw access opening length should be  $<1.48$ .

## DISCUSSION

The proposed classification of full-arch screw-retained implant-supported prostheses is a valuable tool for guiding clinicians in making informed decisions about the most suitable final restoration for their patients. This paper systematically considers a wide range of factors influencing the decision-making process and provides a case series to illustrate its practical application. The case series demonstrates the versatility and adaptability of the classification system across various clinical scenarios. It emphasizes the importance of evaluating each patient's unique circumstances, including medical history, anatomical considerations, aesthetics, and economic constraints. This patient-centered approach allows clinicians to tailor treatment plans to meet specific needs and expectations.

Furthermore, the integration of digital technologies and advanced diagnostic tools is highlighted as a key aspect of the decision-making process. These tools enable clinicians to gather precise data, evaluate dynamic occlusion, and enhance treatment planning accuracy. Digital visualization and assessment of restorative designs offer significant advantages in achieving optimal outcomes. It's important to note that this classification system provides a baseline for decision-making but is not rigid or prescriptive. Clinicians can adapt and customize it based on individual patient profiles and clinical expertise. Flexibility allows for adjustments and deviations when necessary.

## CONCLUSIONS

In conclusion, the proposed classification enhances the decision-making process for clinicians, facilitating the selection of the most appropriate prosthetic design for each patient. Through the case series, we've demonstrated its practical application and versatility in addressing diverse clinical scenarios.

### Acknowledgements

A warm and sincere thanks to the Dental Technicians for their constant effort and support (Scaglione Luca, Seghesio Piercarlo, Bartolomeo Denis, Boschiazzo Luca, Poma Gabriele, Giberti Lorenzo, Bulgarelli Ettore).

### Conflict of Interest Statement

All the Authors declare no conflict of interest.

## REFERENCES

1. Mascitti M, Campisi G. Dental Public Health Landscape: Challenges, Technological Innovation and Opportunities in the 21st Century and COVID-19 Pandemic. *International Journal of Environmental Research and Public Health*. 2020;17(10):3636. doi:<https://doi.org/10.3390/ijerph17103636>
2. De Bruyn H, Raes S, Östman PO, Cosyn J. Immediate loading in partially and completely edentulous jaws: a review of the literature with clinical guidelines. *Periodontology 2000*. 2014;66(1):153-187. doi:<https://doi.org/10.1111/prd.12040>
3. Gelb DA, Klein M, Tuckman M. Immediate Implant Placement, Immediate Load With Same-Day Fully Digital Fabrication of a Screw-Retained Provisional Implant Prosthesis. *Compendium of Continuing Education in Dentistry (Jamesburg, NJ: 1995)*. 2023;44(5):256-266.
4. Gallardo YNR, da Silva-Olivio IR, Gonzaga L, Sesma N, Martin W. A Systematic Review of Clinical Outcomes on Patients Rehabilitated with Complete-Arch Fixed Implant-Supported Prostheses According to the Time of Loading. *Journal of Prosthodontics*. 2019;28(9):958-968. doi:<https://doi.org/10.1111/jopr.13104>
5. Tsigarida A, Chochlidakis K. A Comparison Between Fixed and Removable Mandibular Implant-Supported Full-Arch Prostheses: An Overview of Systematic Reviews. *The International Journal of Prosthodontics*. 2021;34:s85-s92. doi:<https://doi.org/10.11607/ijp.6911>
6. Sadowsky SJ. The implant-supported prosthesis for the edentulous arch: Design considerations. *The Journal of Prosthetic Dentistry*. 1997;78(1):28-33. doi:[https://doi.org/10.1016/s0022-3913\(97\)70084-2](https://doi.org/10.1016/s0022-3913(97)70084-2)
7. Montero J. A Review of the Major Prosthetic Factors Influencing the Prognosis of Implant Prosthodontics. *Journal of Clinical Medicine*. 2021;10(4):816. doi:<https://doi.org/10.3390/jcm10040816>
8. Caramês J. A comprehensive classification to full arch implant rehabilitation. *Revista Portuguesa de Estomatologia, Medicina Dentária e Cirurgia Maxilofacial*. 2019;60(4). doi:<https://doi.org/10.24873/j.rpemd.2019.12.687>
9. Soto-Penalzoa D, Zaragoza-Alonso R, Penarrocha-Diago M, Penarrocha-Diago M. The all-on-four treatment concept:

F. Gelpi et al.

- Systematic review. *Journal of Clinical and Experimental Dentistry*. 2017;9(3). doi:<https://doi.org/10.4317/jced.53613>
10. Daudt Polido W, Aghaloo T, Emmett TW, Taylor TD, Morton D. Number of implants placed for complete-arch fixed prostheses: A systematic review and meta-analysis. *Clinical Oral Implants Research*. 2018;29(S16):154-183. doi:<https://doi.org/10.1111/clr.13312>
  11. Tealdo T, Bevilacqua M, Pera P. *Columbus Bridge Protocol. Riabilitazione Implantoprotesica Fissa Del Mascellare Edentulo Con Funzione Immediata*. Quintessenza; 2009.
  12. Brånemark PI, Engstrand P, Ohnell LO, et al. Brånemark Novum: a new treatment concept for rehabilitation of the edentulous mandible. Preliminary results from a prospective clinical follow-up study. *Clinical implant dentistry and related research*. 1999;1(1):2-16. doi:<https://doi.org/10.1111/j.1708-8208.1999.tb00086.x>
  13. Tealdo T, Bevilacqua M, Pera F, et al. Immediate function with fixed implant-supported maxillary dentures: A 12-month pilot study. *The Journal of Prosthetic Dentistry*. 2008;99(5):351-360. doi:[https://doi.org/10.1016/s0022-3913\(08\)60082-7](https://doi.org/10.1016/s0022-3913(08)60082-7)
  14. Arcuri L, De Vico G, Ottria L, et al. Smart fusion vs. double scan: a comparison between two data-matching protocols for a computer guided implant planning. *Clin Ter*. 2016;167(3):55-62. doi:<https://doi.org/10.7417/ct.2016.1926>
  15. Stefanac SJ, Nesbit SP. *Diagnosis and Treatment Planning in Dentistry*. Mosby; 2023.
  16. Samet N, Jotkowitz A. Classification and prognosis evaluation of individual teeth—a comprehensive approach. *Quintessence international (Berlin, Germany : 1985)*. 2013;40(5).
  17. Verma SK, Maheshwari S, Gautam SN, Prabhat K, Kumar S. Natural head position: key position for radiographic and photographic analysis and research of craniofacial complex. *Journal of Oral Biology and Craniofacial Research*. 2012;2(1):46-49. doi:[https://doi.org/10.1016/s2212-4268\(12\)60011-6](https://doi.org/10.1016/s2212-4268(12)60011-6)
  18. Menini M, Conserva E, Tealdo T, et al. Shock Absorption Capacity of Restorative Materials for Dental Implant Prostheses: An In Vitro Study. *The International Journal of Prosthodontics*. 2013;26(6):549-556. doi:<https://doi.org/10.11607/ijp.3241>
  19. Bevilacqua M, Tealdo T, Menini M, et al. The influence of cantilever length and implant inclination on stress distribution in maxillary implant-supported fixed dentures. *The Journal of Prosthetic Dentistry*. 2011;105(1):5-13. doi:[https://doi.org/10.1016/s0022-3913\(10\)60182-5](https://doi.org/10.1016/s0022-3913(10)60182-5)
  20. Monje A, Chan HL, Suarez F, Galindo-Moreno P, Wang HL. Marginal bone loss around tilted implants in comparison to straight implants: a meta-analysis. *The International Journal of Oral & Maxillofacial Implants*. 2012;27(6):1576-1583.
  21. Menini M, Signori A, Tealdo T, et al. Tilted Implants in the Immediate Loading Rehabilitation of the Maxilla. *Journal of Dental Research*. 2012;91(9):821-827. doi:<https://doi.org/10.1177/0022034512455802>
  22. Capelli M, Zuffetti F, Del Fabbro M, Testori T. Immediate rehabilitation of the completely edentulous jaw with fixed prostheses supported by either upright or tilted implants: a multicenter clinical study. *The International Journal of Oral & Maxillofacial Implants*. 2007;22(4):639-644.
  23. Cortés-Bretón Brinkmann J, García-Gil I, Pedregal P, Peláez J, Prados-Frutos JC, Suárez MJ. Long-Term Clinical Behavior and Complications of Intentionally Tilted Dental Implants Compared with Straight Implants Supporting Fixed Restorations: A Systematic Review and Meta-Analysis. *Biology*. 2021;10(6):509. doi:<https://doi.org/10.3390/biology10060509>
  24. Manfredini D, Winocur E, Guarda-Nardini L, Paesani D, Lobbezoo F. Epidemiology of bruxism in adults: a systematic review of the literature. *Journal of Orofacial Pain*. 2013;27(2):99-110. doi:<https://doi.org/10.11607/jop.921>
  25. Minervini G, Franco R, Marrapodi MM, et al. The Association between COVID-19 Related Anxiety, Stress, Depression, Temporomandibular Disorders, and Headaches from Childhood to Adulthood: A Systematic Review. *Brain Sciences*. 2023;13(3):481. doi:<https://doi.org/10.3390/brainsci13030481>
  26. Thymi M, Rollman A, Visscher CM, Wismeijer D, Lobbezoo F. Experience with bruxism in the everyday oral implantology practice in the Netherlands: a qualitative study. *BDJ Open*. 2018;4(1):1-12. doi:<https://doi.org/10.1038/s41405-018-0006-4>
  27. Birgitta Häggman-Henrikson, Dahir Abdi Ali, Mustafa, Bruno Ramos Chrcanovic. Bruxism and dental implants: A systematic review and meta-analysis. *Journal of Oral Rehabilitation*. Published online August 17, 2023. doi:<https://doi.org/10.1111/joor.13567>
  28. Noémie Drancourt, Auduc C, Aymeric Mouget, et al. Accuracy of Conventional and Digital Impressions for Full-Arch Implant-Supported Prostheses: An In Vitro Study. *Journal of Personalized Medicine*. 2023;13(5):832-832. doi:<https://doi.org/10.3390/jpm13050832>
  29. Abduo J. Accuracy of casts produced from conventional and digital workflows: A qualitative and quantitative analyses. *The Journal of Advanced Prosthodontics*. 2019;11(2):138. doi:<https://doi.org/10.4047/jap.2019.11.2.138>
  30. Papaspyridakos P, Lal K. Computer-assisted design/computer-assisted manufacturing zirconia implant fixed complete prostheses: clinical results and technical complications up to 4 years of function. *Clinical Oral Implants Research*. 2012;24(6):659-665. doi:<https://doi.org/10.1111/j.1600-0501.2012.02447.x>
  31. Tioosi R, Gomes ÉA, Faria ACL, Rodrigues RCS, Ribeiro RF. Biomechanical behavior of titanium and zirconia frameworks for implant-supported full-arch fixed dental prosthesis. *Clinical Implant Dentistry and Related Research*. 2017;19(5):860-866. doi:<https://doi.org/10.1111/cid.12525>
  32. Carames J, Tovar Suinaga L, Yu YCP, Pérez A, Kang M. Clinical Advantages and Limitations of Monolithic Zirconia Restorations Full Arch Implant Supported Reconstruction: Case Series. *International Journal of Dentistry*. 2015;2015. doi:<https://doi.org/10.1155/2015/392496>
  33. Alqurashi H, Khurshid Z, Ul Yaqin Syed A, Rashid Habib S, Rokaya D, Sohail Zafar M. Polyetherketoneketone (PEKK): An emerging biomaterial for oral implants and dental prostheses. *Journal of Advanced Research*. 2021;28:87-95. doi:<https://doi.org/10.1016/j.jare.2020.09.004>





F. Gelpi et al.

34. Delucchi F, De Giovanni ED, Pesce P, et al. Framework Materials for Full-Arch Implant-Supported Rehabilitations: A Systematic Review of Clinical Studies. *Materials*. 2021;14(12):3251. doi:<https://doi.org/10.3390/ma14123251>
35. Farawati FA, Nakaparksin P. What is the Optimal Material for Implant Prosthesis? *Dental Clinics of North America*. 2019;63(3):515-530. doi:<https://doi.org/10.1016/j.cden.2019.02.002>
36. Karl M, Taylor T. Parameters Determining Micromotion at the Implant-Abutment Interface. *The International Journal of Oral & Maxillofacial Implants*. 2014;29(6):1338-1347. doi:<https://doi.org/10.11607/jomi.3762>
37. Jivraj S. Material Considerations for Full-Arch Implant-Supported Restorations. In: *Graftless Solutions for the Edentulous Patient*. Springer, Cham; 2018:189-211.
38. Bosse LP, Taylor TD. Problems associated with implant rehabilitation of the edentulous maxilla. *Dental Clinics of North America*. 1998;42(1):117-127.
39. Carpentieri J, Greenstein G, Cavallaro J. Hierarchy of restorative space required for different types of dental implant prostheses. *The Journal of the American Dental Association*. 2019;150(8):695-706. doi:<https://doi.org/10.1016/j.adaj.2019.04.015>
40. Misch CE, Goodacre CJ, Finley JM, et al. Consensus Conference Panel Report: Crown-Height Space Guidelines for Implant Dentistry - Part 2. *Implant Dentistry*. 2006;15(2):113-121. doi:<https://doi.org/10.1097/01.id.0000217907.18396.18>
41. Resnik R. *Misch's Contemporary Implant Dentistry E-Book*. Elsevier Health Sciences; 2020.
42. de Luna Gomes JM, Lemos CAA, Santiago Junior JF, de Moraes SLD, Goiato MC, Pellizzer EP. Optimal number of implants for complete-arch implant-supported prostheses with a follow-up of at least 5 years: A systematic review and meta-analysis. *The Journal of Prosthetic Dentistry*. 2019;121(5):766-774.e3. doi:<https://doi.org/10.1016/j.prosdent.2018.06.001>
43. World Bank. World bank group - international development, poverty, & sustainability. World Bank. Published 2022. <https://www.worldbank.org/en/home>
44. Hamilton A, Putra A, Pranai Nakapaksin, Pongrapee Kamolroongwarakul, Gallucci GO. Implant prosthodontic design as a predisposing or precipitating factor for peri-implant disease: A review. *Clinical Implant Dentistry and Related Research*. 2023;25(4):710-722. doi:<https://doi.org/10.1111/cid.13183>
45. Jablonski RA, Kolanowski A, Therrien B, Mahoney EK, Kassab C, Leslie DL. Reducing care-resistant behaviors during oral hygiene in persons with dementia. *BMC Oral Health*. 2011;11(1). doi:<https://doi.org/10.1186/1472-6831-11-30>
46. Ribeiro GR, Campos CH, Garcia RCMR. Removable prosthesis hygiene in elders with Parkinson's disease. *Special Care in Dentistry*. 2017;37(6):277-281. doi:<https://doi.org/10.1111/scd.12251>
47. Jablonski RA, Munro CL, Grap MJ, Elswick RK. The Role of Biobehavioral, Environmental, and Social Forces on Oral Health Disparities in Frail and Functionally Dependent Nursing Home Elders. *Biological Research For Nursing*. 2005;7(1):75-82. doi:<https://doi.org/10.1177/1099800405275726>
48. Jacobs R, Van Steenberghe D. Comparative evaluation of the oral tactile function by means of teeth or implant-supported prostheses. *Clinical Oral Implants Research*. 1991;2(2):75-80. doi:<https://doi.org/10.1034/j.1600-0501.1991.020205.x>
49. Tealdo T, Gelpi F, Grivetto F, et al. A retrospective multicentric study of 56 patients treated with 92 pterygoid implants for partial/full arch implant supported fixed rehabilitation: implant and prosthesis success rate. *European Journal of Musculoskeletal Diseases*. 2023;12(3):119-126.

Protocol

## Five Steps for the Maintenance and Interception of Complications in Zygomatic Implants

Consuela Sanavia <sup>1</sup>, Edoardo Vallerga <sup>2</sup>, Fanny Alessi <sup>3</sup>, Tiziano Tealdo <sup>1</sup>, Marco Bevilacqua <sup>1</sup>, Christian Alberti <sup>3</sup>, Maria Menini <sup>4</sup>  and Paolo Pesce <sup>1,\*</sup> 

<sup>1</sup> Department of Surgical Sciences, University of Genoa, 16126 Genoa, Italy; consuela1@icloud.com (C.S.); tiziano@tealdocentriodontoiatrici.com (T.T.); m.bevilh2o@icloud.com (M.B.)

<sup>2</sup> Independent Researcher, 12058 Santo Stefano Belbo, Italy; edoardo@tealdocentriodontoiatrici.com

<sup>3</sup> Independent Researcher, 36027 Rosà, Italy; fanny.alessi@gmail.com (F.A.); studiodontisticoalberti@gmail.com (C.A.)

<sup>4</sup> Division of Prosthodontics and Implant Prosthodontics, Department of Surgical Sciences, University of Genoa, 16126 Genoa, Italy; maria.menini@unige.it

\* Correspondence: paolo.pesce@unige.it

**Abstract:** Zygomatic implants are used for the rehabilitation of the upper jaw of patients with severe and moderate bone atrophy. Possible post-surgical complications include soft tissue dehiscence, sinusitis, and prosthodontic fractures, and maintaining an accurate control is crucial. Additionally, zygomatic implants have a unique peri-implant anatomy, making traditional periodontal parameters unsuitable. The present paper aims to provide guidelines for the maintenance and interception of complications in patients rehabilitated with these kinds of implants. The proposed protocol includes: 1. intra/extraoral and temporo-mandibular joint examination; 2. soft tissue and transmucosal path observation with magnifiers; 3. peri-implant health indices and digital stimulation of tissues; 4. examination of prosthodontic devices; and 5. photographic recording. These steps facilitate the comprehensive evaluation and monitoring of clinical conditions of zygomatic-supported rehabilitations, including dehiscence and occlusal wear during follow-up appointments.

**Keywords:** dental implants; zygomatic implants; maintenance; dental hygienist; guidelines



**Citation:** Sanavia, C.; Vallerga, E.; Alessi, F.; Tealdo, T.; Bevilacqua, M.; Alberti, C.; Menini, M.; Pesce, P. Five Steps for the Maintenance and Interception of Complications in Zygomatic Implants. *Dent. J.* **2023**, *11*, 226. <https://doi.org/10.3390/dj11100226>

Academic Editors: Claude Jaquiéry, Patrick R. Schmidlin and Fawad Javed

Received: 11 August 2023  
Revised: 15 September 2023  
Accepted: 21 September 2023  
Published: 22 September 2023



**Copyright:** © 2023 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

### 1. Introduction

Zygomatic implants are increasingly being used to treat patients with severe bone atrophies of the upper jaw. While this technique has a success rate comparable to conventional techniques, it is not without complications and requires a certain level of surgical experience [1,2].

Zygomatic implants have demonstrated their effectiveness as a viable solution in addressing the challenges of managing atrophic edentulous maxilla [3–6] and maxillectomy defects [7]. Brånemark introduced these implants to cater to patients requiring prosthetic rehabilitation due to extensive maxillary defects resulting from tumor resections, trauma, and congenital issues [8]. The zygomatic arch's bone was utilized as a secure foundation for a lengthy implant, which, when combined with traditional implants, could serve as an anchor for epistheses, prostheses, and/or obturators. This innovative approach has significantly enhanced the rehabilitation prospects for these patients, restoring both function and aesthetic appeal. Moreover, it has granted numerous individuals the opportunity to reclaim a sense of normalcy in their social lives.

Appropriate maintenance is fundamental for long-term success and the prevention of complications of dental implants. Renvert et al., during the 2017 world workshop, reported on how to define a dental implant as healthy [9]. However, zygomatic implants present some unique characteristics that differentiate them from classical implants (length; inclination; position; relationship with other body structures such as the sinus and eye;

absence or reduced amount of bone in the crestal area, prosthesis design) and that make the classical examination approach impossible.

A recent systematic review highlighted soft tissue dehiscence, sinusitis, and prosthodontic fractures as the most common complications affecting rehabilitations supported by zygomatic implants [4]. Additionally, during maintenance, severe gingival hyperplasia/hypertrophy, pressure ulcers, fistulas, and horizontal gingival fissures may be observed. Aparicio et al., in 2006, also suggested that sinus health control should be performed as part of the maintenance program [10].

Soft tissue alterations may increase the risk of bacterial mucositis, and preventing and controlling this is crucial to prevent peri-implantitis [11]. Indeed, although a direct correlation between plaque accumulation and peri-implantitis has not been demonstrated for full-arch implant-supported rehabilitations [12,13], microbiological studies on zygomatic implants show a correlation between bleeding on probing and periodontal pathogenic bacteria [14].

Zygomatic implants have a different peri-implant anatomy compared to standard intraoral implants, since the vestibular portion of the implant is surrounded by soft tissues only most of the time, and sometimes the palatal bone is also missing, as implant stability is mainly given by the implant apex inserted into the zygoma. This prevents the use of standard periodontal parameters usually applied for dental implants and requires the use of a delicate probing technique to avoid altering desmosomal adhesion. Probing will only serve to verify the good soft tissue attachment and prevent complications, as suggested in the prospective study by Agliardi et al. in 2017 [15]. Additionally, the emergence of the implant often diverges from the bone crest, either buccally or palatally, and the formation of mucosal folds, the lack of adherent gingiva, and the frequent palatal placement make the examination, probing and peri-implant hygienic maneuvers difficult when the prosthesis is in situ. Although probing around zygomatic implants is challenging, it remains one of the most useful clinical acts to intercept peri-implant tissue inflammation.

According to Aparicio et al., the reporting of results and complications pertaining to zygomatic implants in the existing literature exhibits inconsistency and lacks a standardized systematic review. Notably, there exists a dearth of clear criteria tailored to precisely delineate outcomes in zygomatic implant rehabilitation and to gauge the degree of success or potential treatment risks associated with them. Furthermore, a tendency persists to appraise and analyze zygomatic implants on the same grounds as conventional implants placed in pristine alveolar bone. Nonetheless, zygomatic implants deviate from traditional implants in biomechanics, clinical protocols, outcomes, and eventual complications. These implants are linked to resorptive changes in both the alveolar and the basal bone, rendering the application of conventional assessment criteria inadequate for describing implant outcomes [16].

Considering implant–prosthodontic rehabilitation as a whole, a careful observation of prosthodontic structures is also necessary to detect fracture lines or abnormal wear to report to the prosthodontist. An examination of the temporomandibular joint (TMJ) should also be routinely performed to intercept any occlusal changes or patient-reported pain. In 2020, Aparicio revised the zygoma success code, updating the ORIS criteria of success [16]. Based on Aparicio's criteria, the evaluation of zygomatic implants can be categorized into five possible conditions:

- Success Condition 1: This represents the optimal stage, where the zygomatic implant shows excellent performance and meets all the proposed criteria for success.
- Success Condition 2: This condition indicates a minor alteration from the routine, without any significant clinical impact on the implant's functionality or patient's well-being.
- Success Condition 3: In this situation, the zygomatic implant shows borderline characteristics with clinically manifested alterations. However, these alterations can still be successfully treated to ensure the implant's long-term viability.

- Condition 4: This condition refers to a surviving implant that supports the prosthesis, but it has not been measured using the proposed evaluation criteria. Further assessment may be necessary to determine its overall success.
- Condition 5: This reflects implant failure, where the zygomatic implant has not met the expected criteria for success and requires appropriate intervention or revision.

It is important to assess zygomatic implants thoroughly, using these criteria to ensure the best outcomes for patients and to identify any potential issues that may arise during treatment. No specific guidelines for the examination of zygomatic implants preventing possible complications are present in the literature. This is the first paper aiming to provide guidelines for maintenance and the interception of possible complications of zygomatic implants, allowing the early identification of patients in stage 2 and 3 of the ORIS scale. The clinical procedures and devices useful for a comprehensive extra- and intra-oral examination will be described for the prevention or early interception of biological and technical complications in patients with severe bone atrophy who have undergone advanced implant–prosthodontic rehabilitations with zygomatic implants.

## 2. Materials and Equipment

The proposed protocol is intended for fixed rehabilitations supported by zygomatic implants and has been developed on the basis of the clinical experience of the authors in the rehabilitation and maintenance of more than 200 patients rehabilitated with zygomatic implants.

At each follow-up appointment, the clinician must first of all carefully check the clinical record and the radiographic exams realized following the placement of the prosthesis. This will enable them to ascertain the number of connected implants, their positions, connections, and transmucosal paths, and prosthesis fitting and design.

In this type of rehabilitation, it would also be advisable to have a comprehensive set of photographs of the mouth taken after implant insertion and without the prosthesis, as a baseline reference for the comparison of future observations.

At each follow-up appointment, before intra- and extra-oral examination, the clinician should interview the patient to obtain information about his/her satisfaction with the oral rehabilitation and to identify possible symptoms and to check adherence to oral hygiene instructions.

## 3. Detailed Procedure

After implant insertion, a provisional full-arch screwed prosthesis is delivered in the following 24 h. The authors believe that a provisional prosthesis is needed for the first 4 months to achieve the stabilization of bone and soft tissues, especially considering the significant tissue detachment often required during the intervention.

Surgical sutures are removed two weeks after surgery, and during the healing phase the patient should be advised to use an extra-soft toothbrush with a gel-based toothpaste containing 0.12–1% chlorhexidine digluconate [17] and a gel or mouthwash with hyaluronic acid to improve the healing of mucosal tissues.

During the provisional phase it is suggested to check on the patient at least once a month.

Four months after surgery, a radiographic control is performed, a final impression is obtained, and a definitive prosthesis is delivered. The final implant-supported prosthesis should be tailored to prevent plaque accumulation, provide access for the patient's home hygiene, and allow for clinical evaluation.

It is recommended to schedule four appointments with the dental hygienist during the first year. In the first appointment with the dental hygienist, one month after receiving the definitive prosthesis, the dental hygienist educates the patient on proper hygiene and maintenance and starts the examination using the proposed five-step protocol. This step is essential to prevent complications related to poor patient hygiene and to detect any issue that may require specialist attention, which will be described in the following five steps.

This aspect becomes particularly important for patients with complete rehabilitations and severe atrophy. Often, patients in need of such rehabilitations have lost a considerable number of teeth due to poor oral care and inadequate oral hygiene, and may also be smokers or have limited manual dexterity. Additionally, full-arch prosthodontic structures do not resemble the natural tooth anatomy and can be bulky and challenging to clean, especially in lingual and palatal regions. Therefore, an intensive re-education program is necessary.

For these full-arch prosthodontic reconstructions, the authors recommend avoiding prosthesis removal for professional oral hygiene, except in cases of severe mucositis, severe inflammation, peri-implantitis, suppuration, swelling, or technical complications. Therefore, before delivering the definitive prosthesis, it is advisable to photograph it, also including a picture of the intaglio surface. This will help the dental hygienist to properly instruct the patient on cleaning the prosthesis/mucosal tissue interface. In fact, concave areas and long flanges could hinder proper hygiene access and promote biofilm accumulation.

Additionally, as proposed by Aparicio et al., a CBCT is recommended 1 year after surgery and every 5 years thereafter to evaluate the maxillary sinuses. As proposed by Aparicio et al., the Lund–Mackay staging system is suggested [18], which is a validated scoring system endorsed by the Task Force on Rhinosinusitis for research outcomes. This radiological assessment encompasses six distinct regions: anterior ethmoid, posterior ethmoid, maxillary, frontal, sphenoid, and the osteomeatal complex. Each of these regions is assigned a score of 0, 1, or 2. Any scan registering a score greater than 0 is indicative of an abnormal or “positive” result. In the context of zygomatic implant rehabilitation, intraoral X-rays, as suggested by Malevez et al. [19], may not yield significant information. This is primarily due to two key factors: Firstly, the atrophic maxilla often undergoes a reduction in the curvature of the palatal region. Secondly, zygomatic implants are typically placed at an inclined position. Furthermore, in cases where the head and a portion of the body of the implant are situated externally to the residual alveolar process or partially outside the anterior maxillary wall, these implants lack bone support around their entire circumference. In such instances, evaluating implant success by measuring marginal bone height becomes less meaningful since the implant was intentionally positioned, at least in part, beyond the osseous boundaries.

The proposed protocol for the follow-up and maintenance of patients rehabilitated with zygomatic implants consist of five steps that are described below, and it is suggested that it be used in the maintenance phase after the final prosthesis delivery (that is, approximately 4 months after surgery).

### 3.1. Step 1—Intra/Extraoral and TMJ Examination

The first step consists of the examination of intra- and extra-oral soft tissues and of the temporomandibular joint. The clinician should check the TMJ for clicking or referred pain (Figure 1). This is particularly important in patients rehabilitated with a full-arch immediate loading protocol, especially when the prosthodontic vertical dimension has been considerably changed. In case of TMJ problems, a careful examination of the dental occlusion balance is suggested, combined with electromyography through a portable Holter monitor capable of simultaneously recording the activity of the masseter muscles and the heart to evaluate episodes of bruxism. In case of bruxism, a night guard is suggested.

The following steps consist of the palpation of facial and neck lymph nodes (Figure 2a) and the extraoral digital percussion of nasal sinuses (Figure 2b) in order to detect early signs of an inflammatory process around the implants and in the sinuses.

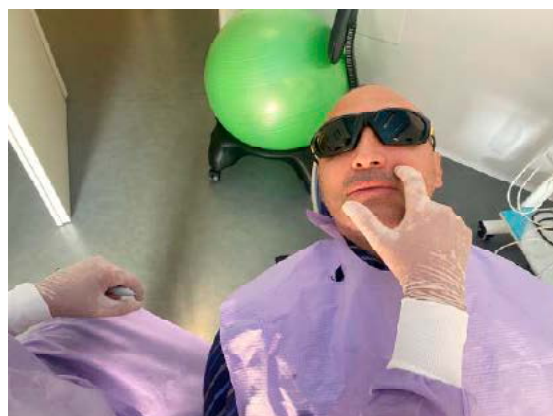




**Figure 1.** Examination of the TMJ in a patient with a full-arch rehabilitation supported by zygomatic implants.



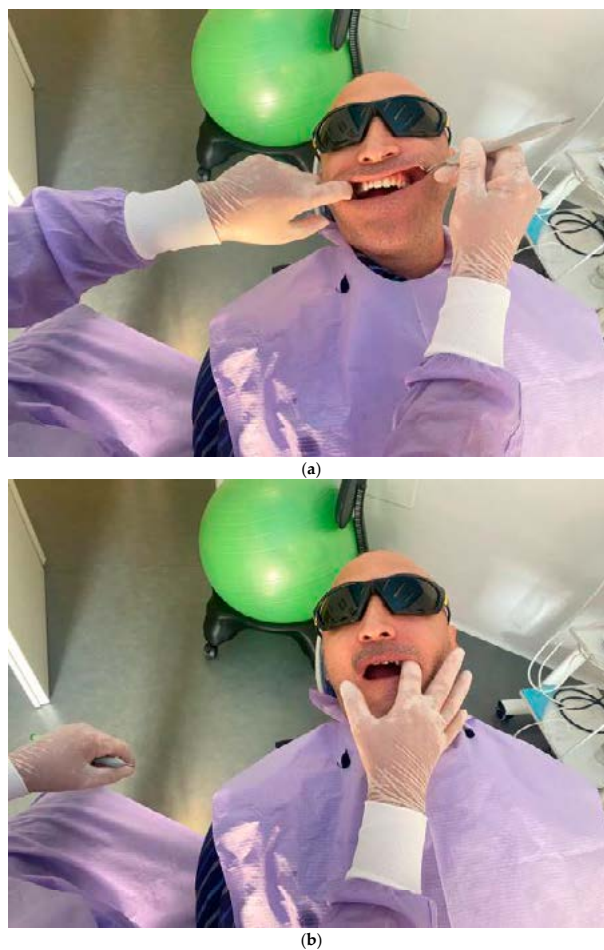
(a)



(b)

**Figure 2. (a,b)** Examination of the lymph nodes and of the sinuses.

Afterwards, intraoral soft tissues should be carefully checked to detect signs of masticatory trauma or infectious processes. This should include the examination of the tongue and of the general area, and the observation and palpation of the palate and masticatory mucosa. Additionally, an observation and palpation of the fornix to detect pain, the presence of fistulas, or suppuration must be performed (Figure 3a,b). Apical/coronal squeezing of peri-implant tissues should be conducted to detect the presence of exudate and/or suppuration.



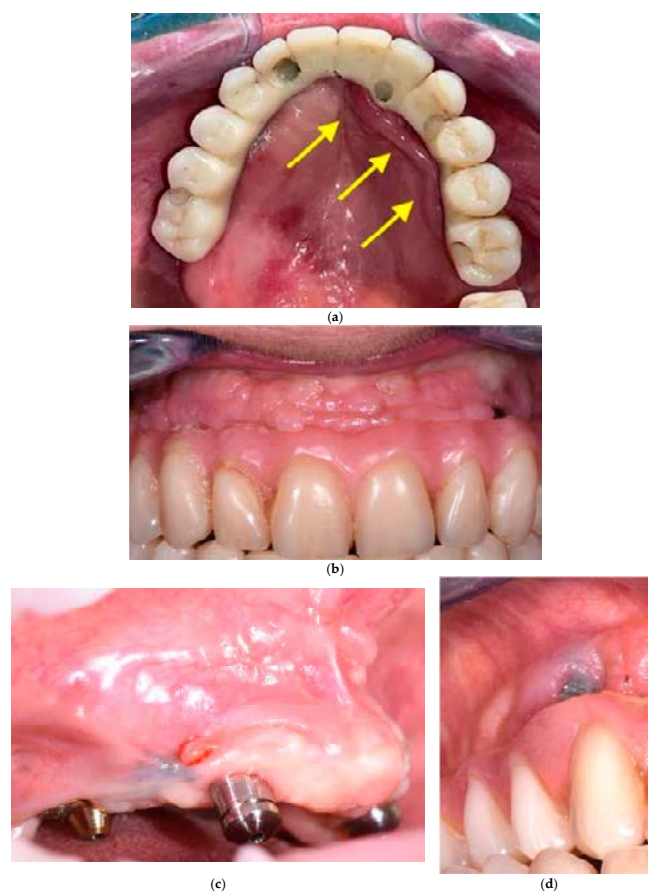
**Figure 3.** (a,b) Examination and palpation of the fornix.

It is also recommended to register persistent halitosis, as reported by the patients or perceived by the operator. This phase is particularly important to diagnose eventual rhinosinusitis. As suggested by Lanza and Kennedy [20], major and minor criteria to diagnose rhinosinusitis exist. Major criteria are facial pain or pressure, facial congestion or fullness, nasal obstruction, purulent discharge, hyposmia or anosmia, purulence on examination, and fever. Minor criteria are headache, fever (not acute), halitosis, fatigue, dental pain, cough, otalgia, or aural fullness. According to these criteria, the diagnosis of

rhinosinusitis is made if two or more major criteria are present or one major and two or more minor criteria.

### 3.2. Step 2—Soft Tissue and Transmucosal Path Observation

The second step consists of the examination of the soft tissues next to the implants and the prosthesis. In this phase, transmucosal decubitus (Figure 4a), fenestrations, hypertrophy (Figure 4b), fistulas (Figure 4c), and dehiscence (Figure 4d) must be identified and registered. In these cases, the prosthesis is unscrewed to assess peri-implant tissues and the morphology of the prosthodontic framework; investigations are conducted regarding any difficulties in maintaining hygiene due to inadequate space between the gums and the prosthesis. The devices to be used in this phase are retractors (i.e., Optragate, Ivoclar Vivadent, Schaan, Liechtenstein), gauze, and optical magnifiers.



**Figure 4.** (a–d) Intraoral pictures of possible biological complications of zygomatic implants: decubitus (a), hypertrophy (b), fistulas (c), and dehiscence (d).

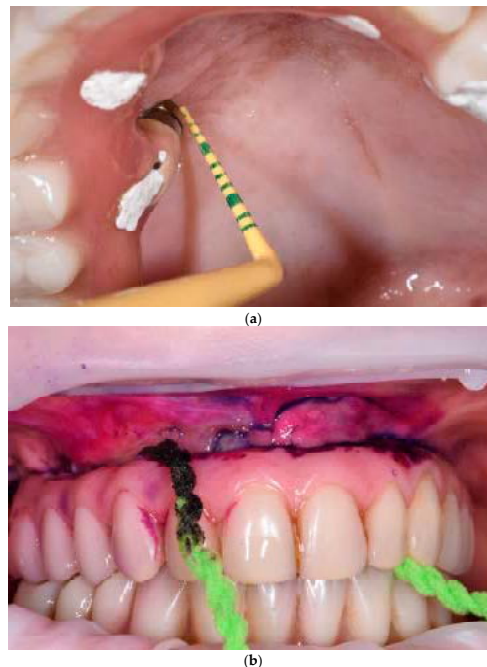
### 3.3. Step 3—Peri-Implant Indices and Digital Stimulation of Tissues

For conventional dental implants, the latest guidelines define peri-implant probing as a necessary clinical procedure to assess crestal bone loss and determine the health or disease status around the implant [21]. However, the same criterion cannot be applied to extra-sinus zygomatic implants because it is impossible to monitor crestal bone that is not

present on the vestibular aspect. Additionally, in zygomatic implants, the transmucosal path cannot be evaluated with a periodontal probe due to the lack of standard reference values, thicker mucosa, bulky prosthesis, and the use of angled abutments, which prevent crestal bone monitoring through probing.

Instead, the use of a probe around this type of implant could be employed for the clinical assessment of bleeding and the health status of the mucosal seal. The probe angle should be more open than the conventional  $45^\circ$  to avoid breaking the desmosomal seal surrounding the implants, which could potentially lead to an oro-antral communication [7].

A gentle probing of 0.25 N is performed using a flexible, non-metallic periodontal probe (Figure 5a) to check the mucosal seal, record plaque index (PI), and any bleeding (BoP) and/or suppuration around the implants.



**Figure 5.** (a,b) Peri-implant probing and plaque check.

Plaque deposits on prosthesis and implants can be detected and shown to the patient using a plaque disclosing solution (Figure 5b). However, when dealing with acrylic resin prostheses, the use of a disclosing solution is recommended only if low-grit air-polishing systems ( $<65 \mu\text{m}$ ) are available; otherwise, the removal of the disclosing solution may be challenging.

The devices used in this phase are a non-metallic flexible probe, plaque detector, spongy dental floss, and optical magnifiers.

#### 3.4. Step 4—Prosthesis Examination

Detecting mechanical issues during the first year of function of the implant-supported prosthodontic device is of utmost importance to prevent biomechanical complications that may compromise osseointegration and lead to inflammation in the peri-implant mucosal tissue. The healthcare provider overseeing the patient's progress during this phase should possess the expertise to identify prosthodontic abnormalities and promptly communicate them to the specialist. In this perspective, the fourth step consists of the examination of

prosthodontic structures to identify occlusal wear (Figure 6a), chipping (Figure 6a), fracture lines (Figure 6b), horizontal and vertical mobility (Figure 6c), and hygienic access to the prosthesis (Figure 6d). If occlusal problems are identified, then initially the opposing arch is assessed, and then the implant prosthesis is removed, followed by reassembly in an articulator to reassess masticatory movements. Repairs are carried out in case of chipping and, if necessary, palatal metal protection is added.



(a)



(b)



(c)

**Figure 6.** *Cont.*





(d)

**Figure 6.** (a–d) Intraoral pictures of possible technical complications of zygomatic implants: chipping and occlusal wear (a), prosthesis fracture (b), vertical mobility (c), challenging access for hygienic devices (d).

The materials used in this phase are spongy dental floss and optical magnifiers.

### 3.5. Step 5—Photographic Recording

The last suggested step is the collection of intraoral and extraoral pictures at least once a year to monitor the evolution of possible dehiscence, occlusal wear, and other complications.

## 4. Discussion

To the authors' knowledge, this is the first paper presenting guidelines for the maintenance of patients rehabilitated with zygomatic implants and proposing a protocol to examine them. The only similar report available is the study by Aparicio et al. [16], where the ORIS criteria for the success of zygomatic-implant-supported rehabilitation are described. The objective of the Aparicio article was to examine the success criteria employed for both traditional and zygomatic implants and to present an updated Zygomatic Success Code outlining precise criteria for evaluating the results of a rehabilitation with zygomatic implants.

For more than three decades, the practice of bone grafting before or concurrently with implant placement has been a standard procedure in the oral rehabilitation of severely compromised patients. Despite a plethora of publications on the subject, the efficacy of sinus grafting procedures remains a topic of controversy [7]. Much of the existing literature that discusses these techniques lacks clearly defined criteria for determining implant success and failure, and frequently fails to provide initial bone height measurements along with standardized radiographic follow-up data [7]. A recently published retrospective paper reports a CSR of 95% at ten years and 85% at twenty years for implants placed simultaneously with lateral maxillary sinus floor augmentation [22]. At the same time, a systematic revision reports a CSR of 95.21% after 12 years for zygomatic implants [23]. The ultimate aim of zygomatic implants is to reinstate masticatory function, aesthetics, and comfort, and bolster self-esteem and social confidence in patients with severely compromised maxillae. Implant-supported fixed prostheses effectively fulfill all these goals, culminating in elevated patient contentment with the treatment and, subsequently, elevated success rates [24]. Studies analyzing patients' quality of life and satisfaction report that revitalizing individuals with edentulous atrophic maxillae via fixed prostheses bolstered by a combination of zygomatic implants and anterior implants in the premaxilla led to a notably improved quality of life and heightened treatment satisfaction among patients [24].

The present manuscript highlights the challenges and possible complications associated with zygomatic implants. The authors emphasize the importance of maintaining a

strict maintenance protocol and checking various aspects of intra- and extra-oral tissues to prevent possible complications.

The five-step approach proposed in this study aims at the early interception of complications and at maintaining the health of patients with zygomatic implants. The dental hygienist who eventually intercepts a complication must immediately submit the case to the surgeon in order to undertake the necessary checks and/or interventions.

The present manuscript represents a preliminary contribution to the development of detailed clinical protocols targeted at both professional and home maintenance of patients to improve long-term outcomes and patient satisfaction.

In fact, while specific devices and protocols have been proposed for the professional and home oral hygiene of full-arch fixed prostheses supported by standard dental implants [25], the same techniques might not apply to zygomatic implants, due to the specific features of peri-implant tissues and prosthesis design. For instance, air polishing devices have proven to be effective in the professional oral hygiene of fixed full-arch implant-supported prostheses, including when the prosthesis is bulky and is not removed.

However, they might not be safe if not properly applied, in the case of zygomatic implants, and specific guidelines for their use should be provided due to the delicate soft tissue seal of zygomatic implants and their proximity with other sensitive extraoral anatomic structures.

At the same time, some features of the present protocol could be used to analyze pterygoid implants. Pterygoid implant placement involves less invasiveness compared to zygomatic implant placement [26]. Pterygoid implants surpass conventional dental implants in length due to their requirement for insertion through the maxillary tuberosity and the pyramidal process of the palatine bone to securely engage with the pterygoid process of the sphenoid bone [27]. When employed in conjunction with the all-on-four technique, positioning a pterygoid implant within the posterior region of each maxillary quadrant eliminates the necessity for distal cantilevers. This extension of the posterior occlusion range facilitates comprehensive full-arch rehabilitation while simultaneously minimizing complications associated with the prosthetic design.

In a recent scientometric study paper, Ramal-Sanchez analyzed the research papers published within the interval 1990–2021 that included the keywords “zygomatic implants”. This study underscores the imperative of collaborative efforts among experts in this field to facilitate knowledge sharing. Such collaboration contributes significantly to standardizing this practice, thereby enhancing patients’ quality of life and mitigating potential complications effectively [28].

To promote clinical success and reduce the incidence of complications in the case of zygomatic implants, a surgical and prosthodontic learning curve is necessary but not sufficient, and should be combined with appropriate and dedicated maintenance programs. This cannot be prescinded from an effective collaboration of the entire dental team, and of the surgeon, prosthodontist, dental hygienist, and dental technician.

In conclusion, the present manuscript aims to provide guidelines to examine patients rehabilitated with zygomatic implants to detect complications that could undermine the implant-supported rehabilitation as soon as possible. Future reports should analyze the professional hygiene protocol to be used to maintain this kind of rehabilitation.

**Author Contributions:** Conceptualization, C.S. and E.V.; methodology, P.P.; formal analysis, F.A.; investigation, P.P.; resources, T.T., M.B. and C.A.; data curation, E.V.; writing—original draft preparation, P.P.; writing—review and editing, M.M. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Written informed consent has been obtained from the patient(s) to publish this paper.

**Data Availability Statement:** No data is available.

**Conflicts of Interest:** The authors declare no conflict of interest.

## References

1. Pesce, P.; Menini, M.; Bagnasco, F.; Gamalero, M.; Pera, F.; Tealdo, T. Outcomes of Zygomatic Implants Combined with Anterior Regular Implants: A Retrospective Analysis with a Mean Follow-up Time of 36 Months. *Int. J. Oral Maxillofac. Implant.* **2023**, *38*, 251–258. [[CrossRef](#)] [[PubMed](#)]
2. Brennand Roper, M.; Vissink, A.; Dudding, T.; Pollard, A.; Gareb, B.; Malevez, C.; Balshi, T.; Brecht, L.; Kumar, V.; Wu, Y.; et al. Long-term treatment outcomes with zygomatic implants: A systematic review and meta-analysis. *Int. J. Implant. Dent.* **2023**, *9*, 21. [[CrossRef](#)] [[PubMed](#)]
3. Lorusso, F.; Conte, R.; Inchingolo, F.; Festa, F.; Scarano, A. Survival Rate of Zygomatic Implants for Fixed Oral Maxillary Rehabilitations: A Systematic Review and Meta-Analysis Comparing Outcomes between Zygomatic and Regular Implants. *Dent. J.* **2021**, *9*, 38. [[CrossRef](#)] [[PubMed](#)]
4. Sola Perez, A.; Pastorino, D.; Aparicio, C.; Pegueroles Neyra, M.; Khan, R.S.; Wright, S.; Ucer, C. Success Rates of Zygomatic Implants for the Rehabilitation of Severely Atrophic Maxilla: A Systematic Review. *Dent. J.* **2022**, *10*, 151. [[CrossRef](#)]
5. Di Cosola, M.; Ballini, A.; Zhurakivska, K.; Ceccarello, A.; Nocini, R.; Malcangi, A.; Mori, G.; Lo Muzio, L.; Cantore, S.; Olivo, A. Retrospective Analysis of Clinical and Radiologic Data Regarding Zygomatic Implant Rehabilitation with a Long-Term Follow-Up. *Int. J. Environ. Res. Public Health* **2021**, *18*, 12963. [[CrossRef](#)]
6. Nocini, R.; Panozzo, G.; Trotolo, A.; Sacchetto, L. Maxillary Sinusitis as a Complication of Zygomatic Implants Placement: A Narrative Review. *Appl. Sci.* **2022**, *12*, 789. [[CrossRef](#)]
7. Aparicio, C.; Manresa, C.; Francisco, K.; Claros, P.; Alandez, J.; Gonzalez-Martin, O.; Albrektsson, T. Zygomatic implants: Indications, techniques and outcomes, and the zygomatic success code. *Periodontology 2000* **2014**, *66*, 41–58. [[CrossRef](#)]
8. Branemark, P.I.; Grondahl, K.; Ohnrell, L.O.; Nilsson, P.; Petruson, B.; Svensson, B.; Engstrand, P.; Nannmark, U. Zygoma fixture in the management of advanced atrophy of the maxilla: Technique and long-term results. *Scand. J. Plast. Reconstr. Surg. Hand Surg.* **2004**, *38*, 70–85. [[CrossRef](#)]
9. Renvert, S.; Persson, G.R.; Pirih, F.Q.; Camargo, P.M. Peri-implant health, peri-implant mucositis, and peri-implantitis: Case definitions and diagnostic considerations. *J. Clin. Periodontol.* **2018**, *45*, S278–S285. [[CrossRef](#)]
10. Aparicio, C.; Ouazzani, W.; Garcia, R.; Arevalo, X.; Muela, R.; Fortes, V. A prospective clinical study on titanium implants in the zygomatic arch for prosthetic rehabilitation of the atrophic edentulous maxilla with a follow-up of 6 months to 5 years. *Clin. Implant. Dent. Relat. Res.* **2006**, *8*, 114–122. [[CrossRef](#)]
11. Jepsen, S.; Berglundh, T.; Genco, R.; Aass, A.M.; Demirel, K.; Derks, J.; Figuero, E.; Giovannoli, J.L.; Goldstein, M.; Lambert, F.; et al. Primary prevention of peri-implantitis: Managing peri-implant mucositis. *J. Clin. Periodontol.* **2015**, *42* (Suppl. S16), S152–S157. [[CrossRef](#)] [[PubMed](#)]
12. Menini, M.; Setti, P.; Pera, P.; Pera, F.; Pesce, P. Peri-implant Tissue Health and Bone Resorption in Patients with Immediately Loaded, Implant-Supported, Full-Arch Prostheses. *Int. J. Prosthodont.* **2018**, *31*, 327–333. [[CrossRef](#)] [[PubMed](#)]
13. Canullo, L.; Schlee, M.; Wagner, W.; Covani, U.; Montegrotto Group for the Study of Peri-implant, D. International Brainstorming Meeting on Etiologic and Risk Factors of Peri-implantitis, Montegrotto (Padua, Italy), August 2014. *Int. J. Oral. Maxillofac. Implant.* **2015**, *30*, 1093–1104. [[CrossRef](#)]
14. Al-Nawas, B.; Wegener, J.; Bender, C.; Wagner, W. Critical soft tissue parameters of the zygomatic implant. *J. Clin. Periodontol.* **2004**, *31*, 497–500. [[CrossRef](#)] [[PubMed](#)]
15. Agliardi, E.L.; Romeo, D.; Panigatti, S.; de Araujo Nobre, M.; Malo, P. Immediate full-arch rehabilitation of the severely atrophic maxilla supported by zygomatic implants: A prospective clinical study with minimum follow-up of 6 years. *Int. J. Oral. Maxillofac. Surg.* **2017**, *46*, 1592–1599. [[CrossRef](#)] [[PubMed](#)]
16. Aparicio, C.; Lopez-Piriz, R.; Albrektsson, T. ORIS Criteria of Success for the Zygoma-Related Rehabilitation: The (Revisited) Zygoma Success Code. *Int. J. Oral Maxillofac. Implant.* **2020**, *35*, 366–378. [[CrossRef](#)] [[PubMed](#)]
17. Bidra, A.S.; Daubert, D.M.; Garcia, L.T.; Gauthier, M.F.; Kosinski, T.F.; Nenn, C.A.; Olsen, J.A.; Platt, J.A.; Wingrove, S.S.; Chandler, N.D.; et al. A Systematic Review of Recall Regimen and Maintenance Regimen of Patients with Dental Restorations. Part 2: Implant-Borne Restorations. *J. Prosthodont.* **2016**, *25* (Suppl. S1), S16–S31. [[CrossRef](#)]
18. Lund, V.J.; Mackay, I.S. Staging in rhinosinusitis. *Rhinology* **1993**, *31*, 183–184.
19. Malevez, C.; Abarca, M.; Durdu, F.; Daelemans, P. Clinical outcome of 103 consecutive zygomatic implants: A 6–48 months follow-up study. *Clin. Oral Implant. Res.* **2004**, *15*, 18–22. [[CrossRef](#)]
20. Lanza, D.C.; Kennedy, D.W. Adult Rhinosinusitis Defined. *Otolaryngol. Head. Neck Surg.* **1997**, *117*, S1–S7. [[CrossRef](#)]
21. Herrera, D.; Berglundh, T.; Schwarz, F.; Chapple, I.; Jepsen, S.; Sculean, A.; Kebschull, M.; Papapanou, P.N.; Tonetti, M.S.; Sanz, M.; et al. Prevention and treatment of peri-implant diseases—The EFP S3 level clinical practice guideline. *J. Clin. Periodontol.* **2023**, *50* (Suppl. S26), 4–76. [[CrossRef](#)] [[PubMed](#)]
22. Park, W.B.; Kang, K.L.; Han, J.Y. Factors influencing long-term survival rates of implants placed simultaneously with lateral maxillary sinus floor augmentation: A 6- to 20-year retrospective study. *Clin. Oral Implant. Res.* **2019**, *30*, 977–988. [[CrossRef](#)]

23. Chrcanovic, B.R.; Albrektsson, T.; Wennerberg, A. Survival and Complications of Zygomatic Implants: An Updated Systematic Review. *J. Oral Maxillofac. Surg.* **2016**, *74*, 1949–1964. [[CrossRef](#)]
24. Fernandez-Ruiz, J.A.; Sanchez-Siles, M.; Guerrero-Sanchez, Y.; Pato-Mourelo, J.; Camacho-Alonso, F. Evaluation of Quality of Life and Satisfaction in Patients with Fixed Prosthesis on Zygomatic Implants Compared with the All-on-Four Concept: A Prospective Randomized Clinical Study. *Int. J. Environ. Res. Public Health* **2021**, *18*, 3426. [[CrossRef](#)]
25. Menini, M.; Piccardo, P.; Baldi, D.; Dellepiane, E.; Pera, P. Morphological and chemical characteristics of different titanium surfaces treated by bicarbonate and glycine powder air abrasive systems. *Implant. Dent.* **2015**, *24*, 47–56. [[CrossRef](#)] [[PubMed](#)]
26. Ren, J.; Shu, L. Pterygoid Implant-Based “VIV” Design for Rehabilitation of Extreme Maxillary Atrophy. *J. Craniofac. Surg.* **2022**, *33*, 2195–2198. [[CrossRef](#)] [[PubMed](#)]
27. Graves, S.L. The pterygoid plate implant: A solution for restoring the posterior maxilla. *Int. J. Periodontics Restor. Dent.* **1994**, *14*, 512–523.
28. Ramal-Sanchez, M.; Lorusso, F.; Taraschi, A.; Valbonetti, L.; Bernabò, N.; Bugea, C.; Scarano, A. Zygomatic Implants Research: A Scientometric Analysis from 1990 to 2021. *Prosthesis* **2023**, *5*, 208–220. [[CrossRef](#)]

**Disclaimer/Publisher’s Note:** The statements, opinions and data contained in all publications are solely those of the individual author(s) and contributor(s) and not of MDPI and/or the editor(s). MDPI and/or the editor(s) disclaim responsibility for any injury to people or property resulting from any ideas, methods, instructions or products referred to in the content.



*Retrospective Study*

## **A RETROSPECTIVE MULTICENTRIC STUDY OF 56 PATIENTS TREATED WITH 92 PTERYGOID IMPLANTS FOR PARTIAL/FULL ARCH IMPLANT SUPPORTED FIXED REHABILITATION: IMPLANT AND PROSTHESIS SUCCESS RATE**

T. Tealdo<sup>1</sup>, F. Gelpi<sup>2\*</sup>, F. Grivetto<sup>3</sup>, E. Vallerga<sup>4</sup>, A. Tfaily<sup>5</sup>, D. De Santis<sup>2</sup>, C. Alberti<sup>6</sup> and M. Bevilacqua<sup>7</sup>

<sup>1</sup>Private Practice in Alba (CN), Italy;

<sup>2</sup>Head and Neck Department, Department of Surgery, Dentistry, Pediatrics and Gynecology, University of Verona, Verona, Italy;

<sup>3</sup>Maggiore della Carità di Novara Hospital, Piemonte Orientale University, "Amedeo Avogadro" Novara, Italy;

<sup>4</sup>Dental Hygienist, Private Practitioner in Alba (CN), Italy;

<sup>5</sup>MD Specialization School in Health Statistics & Biometry, Department of Diagnostics & Public Health, University of Verona, Verona, Italy;

<sup>6</sup>Private Practitioner in Rosà (VI), Italy;

<sup>7</sup>Private Practitioner in Boves (CN), Italy

*\*Correspondence to:*

Federico Gelpi, DDS

Head and Neck Department,

Department of Surgery, Dentistry, Pediatrics and Gynecology,

University of Verona,

Verona, Italy

e-mail: federico.gelpi@libero.it

### **ABSTRACT**

In the case of severe atrophic patients, the search for native bone can be extended beyond the anatomical limits of the oral cavity. So remote anchorage solutions could involve the pterygomaxillary complex composed of the maxillary tuberosity, the pyramidal process of the palatine bone and the pterygoid pillar. Pterygoid implants are typically placed in this zone to rehabilitate patients affected by severe maxillary atrophy. This study's aim consists of the surgical and prosthetic success rate evaluation concerning the pterygoid implants placed to support fixed partial or full arch rehabilitation without a cantilever. All team members designed and conceived this retrospective multicenter study (performed in three different clinical offices) to evaluate the reliability and predictability of this anatomically guided surgical technique without immediate loading. The study was successful with 100 per cent surgical success and all torque values  $\geq 45$  N/cm considered as a threshold value. The series comprised 56 people who underwent 92 procedures. The male-to-female ratio

Received: 26 July 2023

Accepted: 06 September 2023

ISSN: 2038-4106

Copyright © by BIOLIFE 2023

This publication and/or article is for individual use only and may not be further reproduced without written permission from the copyright holder. Unauthorized reproduction may result in financial and other penalties. **Disclosure: All authors report no conflicts of interest relevant to this article.**



was close to one (27 men, 29 women). The mean age ( $\pm$  SD) was  $64.0 \pm 9.3$  years (range 41-85 years). Only one prosthetic failure was recorded in a woman aged 67 years receiving a full arch pterygoid implant. Pterygoid implants supported by fixed rehabilitation represent a reliable strategic solution for treating severe atrophic posterior maxilla.

**KEYWORDS:** *pterygoid implants; cantilever free, insertion torque, fixed rehabilitation, atrophic maxilla, graftless surgery*

## INTRODUCTION

Osseointegrated implantology represents a reliable treatment solution to solve edentulism in jaws (1) in daily clinical practice. Insufficient bone amount and closeness to important anatomical landmarks could prevent implant placement. Each anatomical area is characterized by features and limitations (bone quality and quantity, nerve course, maxillary sinus cavity), which certainly conditioned/impacted this surgical procedure.

Among all, the atrophic posterior maxilla represents a critical and demanding area in the patient's rehabilitation through the insertion of integrated bone implants (2, 3) since it often lacks both in height and in thickness, thus preventing the placement of implants without adjunctive strategies (4).

The presence of the maxillary sinus, an inadequate bone in terms of quality or amount, a large fatty marrow space or the rare presence of cortical bone covering the alveolus represent some of the critical aspects that surgeons could meet during the surgical approach. Regenerative techniques such as maxillary sinus elevation, block grafts, or Customized Bone Regeneration allow bypassing these anatomical criticalities, even if they are not free from long healing periods or donor site morbidity (5-8). In implant surgery, it is mandatory to minimize patients' morbidity, especially if implant patients are getting older. Consequently, therapeutic, surgical procedures must be tailored to them and their ingrained features, systemic diseases, pharmacological therapies, and functional sinus impairment due to sinus lift augmentation (9). According to the current guidelines, daily clinical practice should consider the most cost-effective treatment equal to clinical efficacy.

Although surgical reliability is well documented, there is still disagreement on clinical and prosthetic primacy techniques. Some suggest it could be a good practice to go beyond these critical issues, using shorter and wider diameter implants to reach a high bone implant surface contact (10, 11). Furthermore, biomechanical considerations such as the intense chewing forces acting in the atrophic posterior maxilla should not be forgotten. Ideally, a prosthetic cantilever should be avoided for this aspect (12): several complications could occur, such as screw and framework fracture, marginal bone loss or implant osteointegration loss.

In the case of severe atrophic patients, the search for native bone can be extended beyond the anatomical limits of the oral cavity. So remote anchorage solutions could involve the pterygomaxillary complex composed of the maxillary tuberosity, the pyramidal process of the palatine bone and the pterygoid pillar. Pterygoid implants are typically placed in this zone to rehabilitate patients affected by severe maxillary atrophy (13).

Bone availability in the maxillary tuberosity is highly variable and is based mainly on the adjacent maxillary sinus pneumatization amount. In 1989, Tulasne (14) introduced implant placement in the pterygoid region to overcome anatomical limitations due to atrophic alveolar bone.

The pterygoid implant entails the fixture penetrating three specific osseous structures: maxillary tuberosity, the pyramidal process of the palatine bone and pterygoid pillar, and if it reaches osteointegration successfully, it offers support and stability to the final cantilever-free prosthesis. It significantly differs from tuberosity implant usually placed in the tuberosity region (mainly composed of 3 or 4 types of cancellous bone at the most distal portion of the maxillary alveolar process) and rarely with an angulation above 10 degrees. The pterygoid implants are usually placed with an angulation of 30 – 60 degrees relative to the horizontal maxillary plane, and they could offer support in partial and full arch prosthetic fixed rehabilitation. This anchorage satisfies surgeons and patients due to the time-consuming surgical strategy and favourable cost-benefit ratio.

The aim of this study consists of the surgical and prosthetic success rate evaluation concerning the pterygoid implants placed (with a minimum torque of 45 Ncm) to support fixed partial or full arch rehabilitation without a cantilever. Its proposal consolidates the literature evidence with our shared experience, whose data were analyzed and interpreted according to a characteristic descriptive statistical analysis.

## MATERIAL AND METHODS

### Study design

All team members designed and conceived this retrospective multicenter study with an enrolled sample of 92 pterygoid implants to evaluate the reliability and predictability of this anatomically guided surgical technique (Noris Medical PteriFit™) with a 1-year follow-up. It was performed in three different clinical offices:

1. Dr Tealdo Tiziano Clinical Office, Alba, Italy;
2. Dr Bevilacqua Marco Clinical Office, Boves, Italy;
3. Dr Alberti Christian Clinical Office, Rosà, Italy.

Only one type of pterygoid implant (Noris Medical PteriFit™) was employed not to introduce further variables. All the patients previously visited after a CBCT 3D scan (Gendex GXDP-700 S) showed clinical and radiological signs of hopeless dentition and severe atrophy. After computer-assisted surgery planning (DTX Studio Clinic software, Nobel Biocare), the implant placement was defined in the pterygoid region. The study was conducted according to the Helsinki Declaration of 1975 principles and revised in 2000 for biomedical research involving human subjects.



**Fig. 1a.** Initial case of the atrophic patient in the maxillary arch.



**Fig. 1b.** 2D radiological images and 3D reconstruction of the same atrophic patient.

Since the authors analyzed preexisting and no identifiable data of patients, who were all informed about the nature of the data treatment and their written consent was obtained prior to participation.

### Pterygoid rehabilitation protocol

All the patients enrolled in this study had to meet the inclusion criteria or good general health, no contraindications to implant placement or insufficient pterygoid bone amount (Fig. 1a, 1b, Fig. 2). All patients had at least 1 year of follow-up after the prosthesis delivery.

The surgical protocol applied to all the enrolled patients (January 2021 to February 2022) consisted of raising a full-thickness flap to expose the pterygomaxillary synostosis and performing the osteotomy for implant placement according to the manufacturer's guidelines. The implant site



**Fig. 2.** Initial case of the patient from the occlusal point of view.

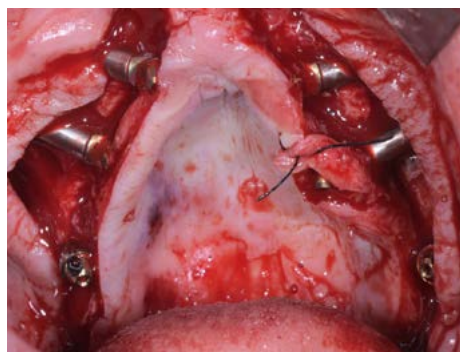
preparation sequence included a marking drill, the subsequent passage of a manual osteotome with a 2mm tip to define the implant insertion axis, the use of a 2.3mm diameter twist drill at approximately 1000 RPM, a second 2.8 mm diameter twist drill along the entire working length. The implant insertion was manually performed using a dedicated straight screwdriver.

Manual insertion did not allow the implant insertion torque to be objectively quantified; therefore, a torque wrench was fitted to accept the achievement of a torque of 45 Ncm or greater. Unstable pterygoid implants were immediately removed, and the osteotomy was filled with a hemostatic gelatin sponge (Spongostan -Ethicon). Since the Noris Medical Pterifit TM is soft-tissue level fixture, part of the stained neck of the implant was purposely left with extra bone to contract the relationship with the soft tissues in the tuber area.

The axis of the implants was corrected during the surgery by connecting a pre-angled conical abutment at 30Ncm. Before suturing the flap, a healing cup at 10 Ncm was connected above the stump to achieve non-submerged healing. The one-stage solution offers to screw a 5 mm healing cap on the pterygoid implant immediately after the surgery without any risk of interference with the opposite teeth, as interference during mastication with the chewing forces could prejudice the primary stability, and a surgical failure may occur. Thus, it could be recommended to cover the head of the pterygoid implant with the flap after the implant placement (two-stage) (Fig. 3-5).

After a minimum period of 3 months without prosthetic load, the pterygoid implants were registered with the pick-up and open tray technique for the definitive rehabilitation, which envisaged their union with other implants inserted in the same period.

A specific quick-setting plaster (BF plaster - Dentaltorino, Italy) was used as impression material for fixed full arch rehabilitation. In the case of partial rehabilitation, in addition to the impression plaster to solidify the implants together, silicone was also used for the remaining fixed dental elements. The final prosthetic frameworks were tightened by a



**Fig. 3.** Intra-operative picture after implant insertion and Multi Unit Abutment (MUA) connection on different kind of implants.



**Fig. 4.** Intraoral picture after a healing period of 4 months.



**Fig. 5.** Frontal aspect of the provisional prosthesis delivery.



**Fig. 6.** Frontal aspect of the final prosthesis delivery supported by the pterygoid implants.

motor with a torque of 25Ncm on the pterygoid implants Unigrip™ connection (Fig. 6, 7).

#### Study variables

This kind of implant differs from conventional dental implants according to their extra-oral anchorage. For this reason, all the Authors considered only two outcome variables for this study: surgical and prosthetic success rate. Concerning the surgical success rate, only the pterygoid implants that reached a minimum of 45 Ncm insertion torque were considered and maintained in the pterygoid bone (otherwise, they were immediately removed during the surgical phase). The study was successful with 100 per cent surgical success and all torque values  $\geq 45$  N/cm. The evaluated criteria to meet the prosthetic success rate were overall stability, comfort, function and patient acceptance. This last concept means that after prosthesis delivery, patients met satisfaction in chewing and phonetics without any excessive encumbrance or symptom. All the patients' feedback was collected and recorded during the follow-up dates planned after the prosthesis delivery.

#### Predictor variables

The following determinant or predictor variable was addressed in this study:

- demographic factors (gender, age) (Fig. 8);
- dental factors (size, length, diameter, MUA angle, torque insertion, surgical date, one or two-stage, number of implants, nasal implants, zygoma implants, partial/full arch rehabilitation, prosthesis delivery) (Fig. 9).

## RESULTS

#### Population under study

The series comprised 56 people who underwent 92 procedures. The male-to-female ratio was close to one (27 men, 29 women). The mean age ( $\pm$  SD) was  $64.0 \pm 9.3$  years (range 41-85 years). The primary endpoint was torque.

#### Surgical technique

The two-stage approach was used in nearly all patients. The one-stage approach was used in just one patient, a woman aged 74 years receiving a full arch pterygoid implant. Zygomatic implants were done in 15 patients (27%), and nasal implants in 10 (19%). Five patients had both zygomatic and nasal implants.

Variable angulation was never considered. A full arch was used in most subjects ( $39/56=70\%$ ), while a partial arch was used in less than one-third ( $17/56 = 30\%$ ).

Patients in the series received  $5.6 \pm 1.4$  implants overall (mean  $\pm$  SD) (range 2-8). Patients receiving partial arch had an



Fig. 7. A final Orthopantomography exam after the delivery of the final prosthesis.

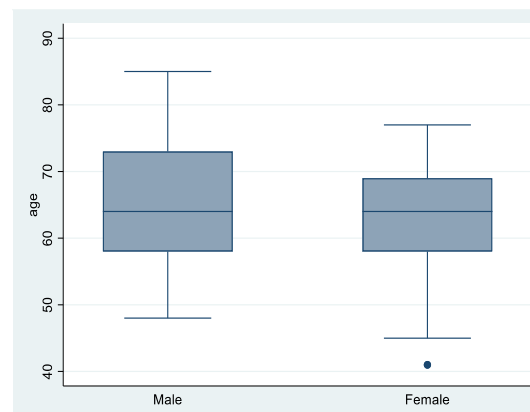


Fig. 8. Distribution of the age range between the genders.

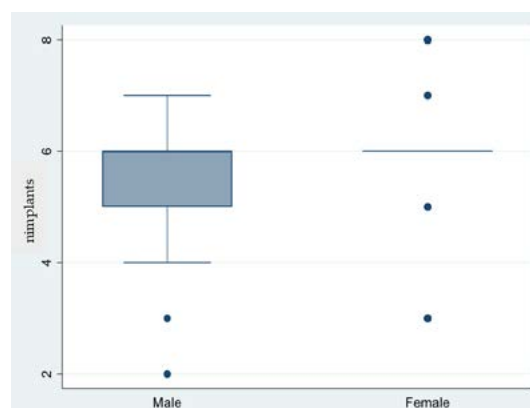


Fig. 9. Graph describing the distribution of the number of implants over genders (male/female).

average of  $4.3 \pm 1.9$  implants (median 4, range 2-8), while patients receiving full arch had an average of  $6.1 \pm 0.7$  implants (median 6, range 5-8). Notably, two-thirds of the latter group (26/39) received 6 implants. The length of pterygoid implants ranges from 16 to 28 mm (median value 20.78 mm).

#### *Surgical outcomes*

The study succeeded with 100% surgical success and all torque values  $\geq 45$  N/cm. Only one prosthetic failure was recorded in a woman aged 67 years receiving a full arch pterygoid implant.

### **DISCUSSION**

In the case of severe atrophic posterior maxilla, the search for extraoral implant anchorages could represent a reliable strategy to restore and rehabilitate patients and prevent other alternative regenerative treatments (7, 15); in fact, the pterygoid implants play a crucial role in the reaching of extra oral bony pillar (rescue implants).

This retrospective study shows a success with 100 per cent surgical success and with all torque values  $\geq 45$  N/cm, even if other authors reported lower success rates for pterygoid implants (ranging from 80% to 99%) (10-16, 17). However, the surgical success rate we have observed should not mislead us into thinking it is a simple technique. This surgical approach requires operative skills and learning curves. The surgeon should recur to an accurate previous CBCT scan evaluation.

Clinicians should always consider that numerous vascular structures such as maxillary artery, descending palatine artery and pterygoid venous plexus can be detected in this area. Only with a detailed observation of pre-clinical CBCT can the placement of pterygoid implants be relatively safely planned. Up to now, three surgical techniques exist concerning pterygoid implant placement (18). The first is a free-hand surgical technique: we use this to plan and manage the pterygoid region. After a CBCT examination of the area to determine the correct axis insertion of the pterygoid implant, we expose the pterygoid-maxillary synostosis to access and approach the area. The surgeon can alternatively fold up a guided surgery, particularly a static fully guided implant placement (option #2) or a dynamic guided implant placement (option #3). For the static guide surgery, it is very important to consider the opening of the patient's mouth due to the encumbrance of the template and the dedicated drills (19); either technique requires continuous application and a constant learning curve to reach a well-established surgical skill.

This type of retrospective study requires a descriptive statistical analysis: the primary endpoint was the insertion torque; a value equal to or above 45 N/cm was the initial parameter considered. The authors want to underline the important prognostic value of the insertion torque ( $\geq 45$  N/cm) on the surgical success rate. The primary stability is not always reachable during surgery. Whenever the insertion torque cannot satisfy the minimum of 45 N/cm, it is recommended removing the implant to place another in another surgery date. An eventual prosthetic connection with nasal implants (10%) or zygomatic implants (27%) does not seem to play a prognostic decisive role. Even if these pterygoid implants differ from conventional intra-oral dental implants, they show a common feature: the importance of primary stability.

Furthermore, the length of pterygoid implants should be enough to allow these fixtures to engage the pterygoid process of the sphenoid bone. In the present study, implants of length ranging from 16 to 28 mm were used (median value 20.78 mm). The length of these implants is very closely related to primary stability and long-term success, as reported in the literature (16-20). Paying attention to all the surrounding anatomical determinants is mandatory in this situation.

It is possible to perform the one-stage surgery (5 mm height for the healing cap) only in safe conditions: at least 5 mm distance from the antagonist teeth. In case of interference during mastication, the chewing forces could prejudice the primary stability, and a surgical failure may occur. Compared to previous studies (20, 21), all the authors decided to redefine the clinical reliability of some parameters, such as:

- angulation of pterygoid implants: it was initially evaluated on an orthopantomography exam. In our opinion, a Cephalometric evaluation could be more indicated to estimate angulation than an Opt evaluation; it gives only an interpretation of the angulation: but would expose patients to further radiological exposure.
- bone loss: the pterygoid region represents a deep area for anchorage. All the authors consider estimating effective bone loss affecting pterygoid implants very challenging. To the best of our knowledge, the literature does not offer



solid support for scientific evidence on the calculation of bone loss around these implants. These are, unfortunately, empirical evaluations (21);

- bleeding on probing (BoP): in this deep posterior area, the mucosal tunnel is deeper, and a possible BoP is not a necessary sign of inflammation. Therefore, we cannot consider this biological parameter as reliable as dental implants; If we consider this procedure from a prosthetic and biomechanical point of view, unscrewing and cantilever should be prevented.

The unscrewing may occur if the screw is not tightened with a torque wrench (20 Ncm).

The mobility of the Multi Unit Abutment (MUA) resulting from unscrewing can induce bleeding, suppuration and tenderness and impact the function and satisfaction of the patient. Finally, the cantilever may play an unfavourable role in the overloading and consequent bone loss around the implants (20).

The bone loss was assessed in other studies (22, 23) comparing Opt exams scanned after 1 year of prosthetic loading. We argue that this calculation method is only interpretative but not scientifically reproducible and repeatable.

The postoperative healing phase of each patient did not have any particular signs or events worthy of note: bleeding could occur due to veins of the pterygoid muscles. These events could be stopped with the pterygoid implant placement. Patient acceptance of the distal prosthetic framework was high.

This retrospective study has only one prosthetic failure due to a partial fracture of the framework. As reported in Literature (24), our population under study confirmed high satisfaction with the fixed prostheses. No phonetic problems or speaking problems were referred. Correct and daily hygiene maintenance is mandatory to avoid high levels of plaque index, tissue hyperplasia or mucosal inflammation.

## CONCLUSIONS

Fixed maxillary rehabilitations supported by Pterygoid implants represent an alternative reliable treatment solution for atrophic patients in the posterior maxilla; this anchorage allows the time reduction in the surgical procedure and the prosthesis restoration and favourably impacts the quality of the patient's life. This retrospective study met a surgical success of 100% with all torque values  $\geq 45$  N/cm. Furthermore, these rehabilitation techniques are integrated with the digital flow up from the initial previsualization diagnostic phase, where the patient has real indications of final expectations.

### Acknowledgements:

A warm and sincere thanks to Prof. Giuseppe Verlatto ( MD Specialization School in Health Statistics & Biometry, Department of Diagnostics & Public Health, University of Verona, Verona, Italy) for his support. A special thanks to the Dental Technicians for their constant effort and support (Denis Bartolomeo, Luca Boschiasso, Luca Scaglione, Piercarlo Seghesio).

### Conflict of Interest Statement:

All the Authors declare no conflict of interest.

## REFERENCES

1. Brånemark PI., Breine U, Adell R, Hansson BO, Lindström J, Ohlsson Å. Intra-Osseous Anchorage of Dental Prostheses: I. Experimental Studies. *Scandinavian Journal of Plastic and Reconstructive Surgery*. 1969;3(2):81-100. doi:https://doi.org/10.3109/02844316909036699
2. Adell R, Lekholm U, Rockler B, Brånemark PI. A 15-year study of osseointegrated implants in the treatment of the edentulous jaw. *International Journal of Oral Surgery*. 1981;10(6):387-416. doi:https://doi.org/10.1016/s0300-9785(81)80077-4
3. Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants: a review and proposed criteria of success. *The International Journal of Oral & Maxillofacial Implants*. 1986;1(1):11-25.
4. Barone A, Santini S, Marconcini S, Giacomelli L, Gherlone E, Covani U. Osteotomy and membrane elevation during the maxillary sinus augmentation procedure. *Clinical Oral Implants Research*. 2008;19(5):511-515. doi:https://doi.org/10.1111/j.1600-0501.2007.01498.x
5. Adell R, Eriksson BO, Ulf Lekholm, Per-Ingvar Brånemark, Torsten Jemt. Long-term follow-up study of osseointegrated implants

- in the treatment of totally edentulous jaws. *PubMed*. 1990;5(4):347-359.
6. De Santis D, Umberto L, Dario D, et al. Custom Bone Regeneration (CBR): An Alternative Method of Bone Augmentation—A Case Series Study. *J Clin Med*. 2022;11(16):4739-4739. doi:<https://doi.org/10.3390/jcm11164739>
  7. De Santis D, Gelpi F, Verlatto G, et al. Digital Customized Titanium Mesh for Bone Regeneration of Vertical, Horizontal and Combined Defects: A Case Series. *Medicina (Kaunas)*. 2021;57(1):60-60. doi:<https://doi.org/10.3390/medicina57010060>
  8. Wood RM, Moore DL. Grafting of the maxillary sinus with intraorally harvested autogenous bone prior to implant placement. *The International Journal of Oral & Maxillofacial Implants*. 1988;3(3):209-214.
  9. Schimmel M, Müller F, Suter V, Buser D. Implants for elderly patients. *Periodontology 2000*. 2016;73(1):228-240. doi:<https://doi.org/10.1111/prd.12166>
  10. Langer B, Langer L, Herrmann I, Jorneus L. The wide fixture: a solution for special bone situations and a rescue for the compromised implant. Part 1. *The International Journal of Oral & Maxillofacial Implants*. 1993;8(4):400-408.
  11. Bahat O. Osseointegrated implants in the maxillary tuberosity: report on 45 consecutive patients. *The International Journal of Oral & Maxillofacial Implants*. 1992;7(4):459-467.
  12. Bevilacqua M, Tealdo T, Menini M, et al. The influence of cantilever length and implant inclination on stress distribution in maxillary implant-supported fixed dentures. *The Journal of Prosthetic Dentistry*. 2011;105(1):5-13. doi:[https://doi.org/10.1016/s0022-3913\(10\)60182-5](https://doi.org/10.1016/s0022-3913(10)60182-5)
  13. Rieger MR. Loading Considerations for Implants. *Oral and Maxillofacial Surgery Clinics of North America*. 1991;3(4):795-804. doi:[https://doi.org/10.1016/s1042-3699\(20\)30549-5](https://doi.org/10.1016/s1042-3699(20)30549-5)
  14. Tulasne J. Osseointegrated fixtures in the pterygoid region. In: *Advanced Osseointegration Surgery. Applications in the Maxillofacial Region*. Quintessence; 1992:182-188.
  15. Boyne PJ. Augmentation of the posterior maxilla by way of sinus grafting procedures: recent research and clinical observations. *Oral and Maxillofacial Surgery Clinics of North America*. 2004;16(1):19-31. doi:<https://doi.org/10.1016/j.coms.2003.10.006>
  16. Bidra AS, May GW, Tharp GK, Chambers MS. Pterygoid Implants for Maxillofacial Rehabilitation of a Patient With a Bilateral Maxillectomy Defect. *J Oral Implantol*. 2013;39(1):91-97. doi:<https://doi.org/10.1563/aaid-joi-d-10-00181>
  17. Candel E, Peñarrocha D, Peñarrocha M. Rehabilitation of the Atrophic Posterior Maxilla With Pterygoid Implants: A Review. *Journal of Oral Implantology*. 2012;38(S1):461-466. doi:<https://doi.org/10.1563/aaid-joi-d-10-00200>
  18. Bidra AS, Peña-Cardelles J, Iverson M. Implants in the pterygoid region: An updated systematic review of modern roughened surface implants. *Journal of Prosthodontics*. 2022;32(4). doi:<https://doi.org/10.1111/jopr.13600>
  19. De Santis D, Graziani P, Castellani R, et al. A New Radiologic Protocol and a New Occlusal Radiographic Index for Computer-Guided Implant Surgery. *Journal of Craniofacial Surgery*. 2016;27(5):e506-e510. doi:<https://doi.org/10.1097/scs.0000000000002490>
  20. Jaemsuwan S, Arunjaroen Suk S, Kaboosaya B, Subbalekha K, Mattheos N, Pimkhaokham A. Comparison of the accuracy of implant position among free-hand implant placement, static and dynamic computer-assisted implant surgery in fully edentulous patients: a non-randomized prospective study. *International Journal of Oral and Maxillofacial Surgery*. 2022;52(2). doi:<https://doi.org/10.1016/j.ijom.2022.05.009>
  21. Curi MM, Cardoso CL, Ribeiro K de CB. Retrospective Study of Pterygoid Implants in the Atrophic Posterior Maxilla: Implant and Prosthesis Survival Rates Up to 3 Years. *The International Journal of Oral & Maxillofacial Implants*. 2015;30(2):378-383. doi:<https://doi.org/10.11607/jomi.3665>
  22. Bevilacqua M, Tealdo T, Pera F, et al. Three-dimensional finite element analysis of load transmission using different implant inclinations and cantilever lengths. *The International Journal of Prosthodontics*. 2008;21(6):539-542.
  23. Peñarrocha M, Carrillo C, Boronat A, Peñarrocha M. Retrospective study of 68 implants placed in the pterygomaxillary region using drills and osteotomes. *The International Journal of Oral & Maxillofacial Implants*. 2009;24(4):720-726.
  24. Balshi SF, Wolfinger GJ, Balshi TJ. Analysis of 164 titanium oxide-surface implants in completely edentulous arches for fixed prosthesis anchorage using the pterygomaxillary region. *The International Journal of Oral & Maxillofacial Implants*. 2005;20(6):946-952.

Marco Bevilacqua, Tiziano Tealdo, Christian Alberti, Maria Menini  
Implant Journal, 02-2019, pag 8-9

## 03 CLINICAL CASE REPORT



Marco BEVILACQUA Tiziano TEALDO



Christian ALBERTI Maria MENINI

Chi si occupa di implantoprotesi sa come la scelta dell'impianto sia di fondamentale importanza per l'ottenimento del successo clinico immediato e a lungo termine.

Le caratteristiche principali da valutare nella scelta fra le diverse tipologie di impianti oggi presenti sul mercato sono quattro<sup>1-3</sup>:

1. Macro-struttura o macro-architettura, determinata dalla forma dell'impianto, che, nonostante l'ormai consolidata preferenza per la forma radicolare (tronco-conica o root-form), può essere anche cilindrica, a lama, a disco, ad ago e in altre morfologie.
2. Micro-struttura o profilo dell'impianto, determinata dalla geometria delle spire (quantità, altezza, spessore, angolazione): a parità di morfologia macroscopica, il profilo può presentarsi lineare con spire o con gradini e tali elementi possono avere una geometria e una dimensione diversa. Queste caratteristiche influenzano la direzione dei vettori della forza di carico esercitata sull'osso circostante.
3. Micro-topografia, determinata dal trattamento della superficie: l'impianto può mostrare vari gradi di rugosità, di tipo diverso e di entità variabile a seconda del trattamento utilizzato nella produzione del manufatto o presentare esclusivamente le striature dovute al processo di tornitura ed è quindi definito "impianto con superficie liscia" (machined).
4. Struttura chimica, determinata dalla composizione chimica della superficie a seguito del trattamento di produzione: regola gli scambi ionici con l'organismo ed è alla base di fenomeni di citotossicità e infiammazione. Inoltre, la deposizione e l'adsorbimento di proteine dal sangue, processi influenzati dalla struttura chimica, sono di basilare importanza nello stabilire l'interfaccia tessuto-impianto.

La macro-struttura e la micro-struttura dell'impianto condizionano il comportamento biomeccanico dell'impianto e quindi influiscono sulla stabilità primaria e sulla distribuzione di forze all'interfaccia osso-impianto in seguito al carico oclusale. La micro-topografia e la struttura chimica agiscono invece sul comportamento biologico tra il dispositivo alloplastico e l'ospite<sup>4,5</sup> (Fig. 1).

Sulla base di questa premessa, Biomax ha

# Razionale e utilizzo clinico di un nuovo impianto con macro e micro-struttura modificata

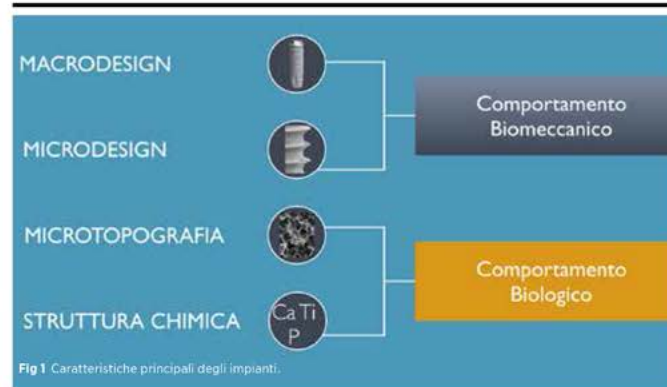


Fig 1 Caratteristiche principali degli impianti.



Fig 2 Impianto tradizionale cilindrico (a sinistra), impianto conico Osseotite, impianto Uniplant (a destra).

sviluppato un nuovo impianto (UNIPLANT) con macro e micro-struttura di ultima generazione che racchiude i più moderni concetti biomeccanici (Fig.2).

Tutti i particolari del disegno dell'UNIPLANT concorrono a creare un impianto il cui obiettivo principale è di offrire un'adeguata stabilità primaria anche nelle situazioni più critiche: dall'osso di scarsa qualità ai siti post estrattivi, dalle procedure di carico immediato più estreme ai ritrattamenti implantari (Fig. 3-7)

Il trattamento implantare con UNIPLANT è particolarmente indicato in presenza di tessuto osseo di scarsa qualità (tipo III e IV secondo Leckholm e Zarb) ma seguendo gli appositi protocolli di preparazione può essere inserito anche in osso più compatto utilizzando maschiatori dedicati.

Il torque massimo raccomandato con chiavi dinamometrie è di 70/80 NCm a seconda del diametro implantare.

La conicità del corpo implantare<sup>6</sup> (dovuta al minor diametro a livello apicale) crea un impianto dalle spiccate caratteristiche autofillettanti e osteocompattanti che abbinate ad una sottopreparazione del sito implantare aumentano significativamente la stabilità primaria<sup>7</sup>. L'apice implantare è in grado di aggirare la zona utile dell'alveolo post

estrattivo anche per poche spire, riuscendo comunque a dare un'elevata stabilità anche nei casi di carico immediato (Fig. 8-11). Gli impianti sono attualmente disponibili fino ad una lunghezza di 20 mm (nei diametri da 4 e 4,5 mm).

La spira profonda ed autofillettante dell'impianto è studiata in modo da ottenere stabilità primaria anche dove l'osso è meno denso e per ottimizzare la trasmissione dei carichi masticatori all'osso perimplantare. Le scanalature presenti sul corpo dell'impianto creano dei profili autofillettanti che si alternano a profili autobloccanti per mantenere la stabilità dell'impianto nelle fasi immediatamente successive all'inserimento. Le scanalature, che si prolungano fino al colletto terminando in microsolchi orizzontali crestali, facilitano l'inserimento dell'impianto nel sito osteotomico e aiutano a ridurre le forze tensivo che si creano durante l'avvitamento.

Il disegno delle spire, la loro ampiezza, numero, profilo e spaziatura sono elementi determinanti dal punto di vista biomeccanico, con ripercussioni sul mantenimento dell'osseo integrazione dell'impianto. Infatti, l'osso è caratterizzato da un estremo dinamismo metabolico, che determina un continuo ricambio delle sue componenti organiche e

inorganiche e il cui equilibrio viene influenzato da fattori sia endocrini sia metabolici. Inoltre, come espresso dalla legge di Wolff, il tessuto osseo si rimodella in base ai carichi funzionali cui è sottoposto<sup>8</sup>.

Per quanto riguarda la micro-topografia, la superficie implantare, ottenuta tramite trattamenti fisico-meccanici (sabbatura con materiali a granulometria controllata) e successivi trattamenti chimici (doppia mordenzatura acida), è da considerarsi moderatamente ruvida, più pronunciata verso l'apice e ridotta al colletto. Questo tipo di superficie è utilizzato da diversi anni e vanta un'ampia e rigorosa letteratura di supporto con follow-up a lungo termine.

Da un punto di vista protesico, UNIPLANT combina le caratteristiche di una connessione conica con una connessione antirotazionale, posta alla base del cono, per dare ulteriore stabilità alla componentistica protesica. Il sigillo conico consente di ottenere un'adeguata precisione tra la parete dell'impianto e quella dei monconi. La precisione così ottenuta si traduce in stabilità della connessione e trasmissione assiale ottimale delle forze che si disperdono in maniera controllata lungo l'asse dell'impianto. I componenti protesici presentano due sole piattaforme per tutti i diametri implantari (small: Ø 3,5 mm, 4mm e regular: Ø 4,5 mm, 5mm).

Per le procedure di carico immediato sono disponibili monconi conici (UNICONE) da 0°, 17° e 30°. Le connessioni sono dotate di platform switching integrato con rispetto dell'ampiezza biologica.

L'esperienza clinica iniziata dal nostro gruppo con il nuovo impianto da più di due anni, soprattutto nei mascellari superiori, in osso D3 e D4 in un numero consistente di pazienti, sta dando risultati molto incoraggianti con percentuali di successo elevate, grazie alla stabilità primaria iniziale ottenibile con maggiore facilità.

Come per tutti i dispositivi ad elevate performance, l'utilizzo di questo sofisticato impianto richiede una curva di apprendimento (Fig.12-15). Si consiglia pertanto un'attenta selezione soprattutto dei primi casi clinici da trattare: la qualità ossea dovrà essere realmente D3 e D4 per meglio apprezzare i vantaggi e il comportamento del nuovo impianto.

Uniplant consente al clinico una maggior applicabilità dei protocolli implantari e una maggior predicibilità grazie al raggiungimento di un'elevata stabilità primaria anche in condizioni avverse con un tessuto osseo di qualità decisamente scarsa.

### Ringraziamenti

Si ringraziano gli odontotecnici Luca Scaglione, Pier Carlo Seghesio, Feliciano Maggi e Luca Boschiazio per la preziosa collaborazione.

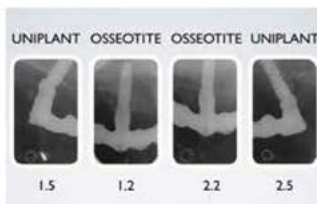




**Fig 3** Caso clinico di riabilitazione mascellare in una paziente donna che presenta fallimento di una protesi fissa tradizionale su monconi naturali per severa parodontopatia. Il volume osseo residuo appare adeguato, ma di scarsa qualità soprattutto nei settori distali.



**Fig 4** Ponte fisso provvisorio ad modum "Columbus Bridge Protocol" a 48 ore dall'intervento.



**Fig 5** Radiografie endorali di controllo. Posteriormente, dove la qualità ossea era di tipo IV, sono stati inseriti 2 impianti inclinati Uniplant da 18 mm. Anteriormente 2 impianti conici tradizionali Osseotite da 15 mm. Il provvisorio di tipo avvitato con framework in metallo è stato passivato con la tecnica dell'incollaggio differenziato senza cantiever distali.



**Fig 6** L'estetica della paziente prima della riabilitazione.



**Fig 7** Visione finale del Columbus Bridge definitivo di tipo "natural".



**Fig 8** Trattamento implantare post estrattivo con carico immediato.



**Fig 9** particolari del caso iniziale.



**Fig 10** Visione ravvicinata della macro e micro-struttura del nuovo impianto Uniplant. Si possono chiaramente apprezzare il disegno delle spire, la forma conica del corpo implantare, le scanalature, i microsolchi orizzontale del colletto e il driver dedicato. Sono stati utilizzati impianti da 18 e 20 mm.



**Fig 11** Particolare connessione conica e pilastro angolato.



**Fig 12** Particolare del carico immediato protesico.



**Fig 13** Controllo radiografico a 24 mesi. Si osservi il mantenimento dei livelli ossei.



**Fig 14** Caso di ritrattamento implantare



**Fig 15** Tessuti molli alla consegna della protesi provvisoria.



**Fig 16** Protesi provvisoria.



**Fig 17** Protesi provvisoria in situ, visione occlusale.



**Fig 18** Guarigione dei tessuti molli.



**Fig 19** RX endorale in cui si evidenziano il platform switching e la connessione conica per il mantenimento ottimale dei livelli tissutali.

**BIBLIOGRAFIA** 1) Schierano G, Pera P, Macaluso MM, Galli C, Conserva E. Impianti dentari. In: Preti G. Riabilitazione protesica. Torino: UTET, 2005;341-67. 2) Morra M, Cassinelli C, Di Carlo F. Le superfici implantari. In: Malchiodi M. Chirurgia implantare. Bologna: Edizioni Martina, 2003. 3) Pera P, Conserva E, Pin D, Acquaviva A, Tealdo T, Xotta M, Valente S. Analisi "in vitro" della citotossicità di differenti sistemi implantari in relazione al tipo di microtopografia di superficie. *Implantologia* 2004;3:207-17. 4) Arcelli D, Palmieri A, Pezzetti F, Brunelli G, Zollino I, Carinci F. Genetic effects of a titanium surface on osteoblasts: a meta-analysis. *J Oral Science* 2007;4:299-309. 5) Li LH, Kong YM, Kim HW, Kim YW, Kim HE, Heo SJ, Koak JY. Improved biological performance of Ti implants due to surface modification by micro-arc oxidation. *Biomaterials* 2004;25:2867-75. 6) O'Sullivan D, Sennerby L, Meredith N. Influence of implant taper on the primary and secondary stability of osseointegrated titanium implants. *Clin Oral Implants Res* 2004;15(4):474-80. 7) Lioubavina-Hack N, Lang NP, Karring T. Significance of primary stability for osseointegration of dental implants. *Clin Oral Implants Res* 2006;17(3):244-50. 8) Wolff J. *Das Gesetz der Transformation der Knochen*. Berlin: Hirschwald, 1982.



# Razionale e utilizzo clinico di un nuovo impianto con macro e micro-struttura modificata



Marco BEVILACQUA, Tiziano TEALDO, Christian ALBERTI, Maria MENINI, Francesco PERA, Paolo PERA

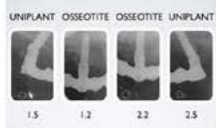


**Fig 3** Caso clinico di riabilitazione mascellare in una paziente donna che presenta l'afollimento di una arcata fissa tradizionale su monconi naturali per avere un'occlusione. Il volume osseo residuo appare adeguato, ma è scarsa qualità soprattutto nei settori distali.

Chi si occupa di implantoprotesi sa come la scelta dell'impianto sia di fondamentale importanza per l'ottenimento del successo clinico immediato e a lungo termine. Le caratteristiche principali da valutare nella scelta fra le diverse tipologie di impianti oggi presenti sul mercato sono quattro<sup>1,2</sup>:



**Fig 4** Ponte fisso provvisorio ad medium "Columbus Bridge Protocol" a 48 ore dall'intervento.



**Fig 5** Radiografie endorali di controllo. Posteriormente, dove la qualità ossea era di tipo IV, sono stati inseriti 2 impianti Uniplant di 18 mm. Anteriormente 2 impianti conici tradizionali Osseotite di 15 mm. Il provvisorio di tipo avvitato con framework in metallo è stato passivato con la tecnica dell'incollaggio offerebbero senza cancellere distal.



**Fig 6** L'estetica della paziente prima della riabilitazione.



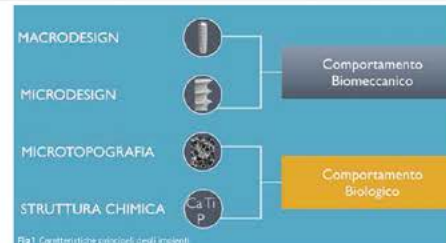
**Fig 7** Visione finale del Columbus Bridge definitivo di tipo "natural".



**Fig 8** Trattamento implantare post estrattivo con carico immediato.



**Fig 9** Particolari del caso iniziale.



**Fig 1** Caratteristiche principali degli impianti.



**Fig 2** L'impianto tradizionale (a sinistra), l'impianto conico Osseotite, l'impianto Uniplant (a destra).

sviluppare un nuovo impianto (UNiPLANT) con macro e micro-struttura di ultima generazione che racchiude i più moderni concetti biomeccanici (Fig.2).

Tutti i particolari del disegno dell'UNiPLANT concorrono a creare un impianto il cui obiettivo principale è di offrire un'adeguata stabilità primaria anche nelle situazioni più critiche: dall'osso di scarsa qualità ai siti post estrattivi, dalle procedure di carico immediato più estreme ai ritrattamenti implantari (Fig.3-7). Il trattamento implantare con UNiPLANT è particolarmente indicato in presenza di tessuto osseo di scarsa qualità (tipo III e IV secondo Lachhoni e Zarb) ma seguendo gli appositi protocolli di preparazione può essere inserito anche in osso più compatto utilizzando miscelatori dedicati.

Il torque massimo raccomandato con chiavi dinamometrie è di 70/80 Ncm a seconda del diametro dell'impianto. La conicità del corpo implantare<sup>6</sup> (dovuta al minor diametro a livello apicale) crea un impianto dalle spiccate caratteristiche auto-flettenti e osteocompatibili che abbinate ad una sottopreparazione del sito implantare aumentano significativamente la stabilità primaria. L'apice implantare è in grado di ingaggiare la zona utile dell'avevole post

inorganiche e il cui equilibrio viene influenzato da fattori sia endocrini sia metabolici. Inoltre, come espresso dalla legge di Wolff, il tessuto osseo si rimodella in base ai carichi funzionali cui è sottoposto<sup>1</sup>.

Per quanto riguarda la micro-topografia, la superficie implantare, ottenuta tramite trattamenti fisico-meccanici (sabbiatura con materiali a granulometria controllata) e successivi trattamenti chimici (doppia moderata acida), è da considerarsi moderatamente ruvida, più pronunciata verso l'apice e ridotta al colletto. Questo tipo di superficie è utilizzato da diversi anni e vanta un'ampia e rigorosa letteratura di supporto con follow-up a lungo termine.

Da un punto di vista protesico, UNiPLANT combina le caratteristiche di una connessione conica con una connessione antirotazionale, posta alla base del cono, per dare ulteriore stabilità alla componentistica protesica. Il sigillo conico consente di ottenere un'adeguata precisione tra la parete dell'impianto e quella dei monconi. La precisione così ottenuta si traduce in stabilità della connessione e trasmissione assiale ottimale delle forze che si disperdono in maniera controllata lungo l'asse dell'impianto. I componenti protesici presentano due sole piattaforme per tutti i diametri implantari (Small Ø 3,5 mm, 4mm e Regular Ø 4,5 mm, 5mm).

Per le procedure di carico immediato sono disponibili monconi conici (UNiCONE) da 0°, 17° e 30°. Le connessioni sono dotate di platform switching integrato con rispetto dell'ampiezza biologica.

L'esperienza clinica iniziata dal nostro gruppo con il nuovo impianto da più di due anni, soprattutto nei mascellari superiori, in osso D3 e D4 in un numero consistente di pazienti, sta dando risultati molto incoraggianti con percentuali di successo elevate, grazie alla stabilità primaria iniziale ottenibile con maggiore facilità. Come per tutti i dispositivi ad elevato performance, l'utilizzo di questo sofisticato impianto richiede una curva di apprendimento (Fig.12-15). Si consiglia pertanto un'attenta selezione soprattutto dei primi casi clinici da trattare: la qualità ossea dovrà essere realmente D3 e D4 per meglio apprezzare i vantaggi e il comportamento del nuovo impianto.

Uniplant consente al clinico una maggior applicabilità dei protocolli implantari e una maggior prevedibilità grazie al raggiungimento di un'elevata stabilità primaria anche in condizioni avverse con un tessuto osseo di qualità decisamente scarsa.



**Fig 11** Particolare connessione conica e piastra antirotazionale.



**Fig 10** Visione ravvicinata delle macro e micro-strutture del nuovo impianto Uniplant. Si possono chiaramente apprezzare il disegno delle spire, la forma conica del corpo implantare, le scanalature, i microslit orizzontali del colletto e il driver codificato. Sono stati utilizzati impianti da 18 e 20 mm.



**Fig 12** Particolare del carico immediato protesico.



**Fig 13** Controllo radiografico a 24 mesi. Si osservi il mantenimento dei livelli ossei.



**Fig 14** Caso di ritrattamento implantare.



**Fig 15** Tessuti molli alla consegna della protesi provvisoria.



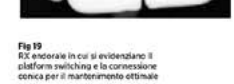
**Fig 16** Protesi provvisoria.



**Fig 17** Protesi provvisoria in situ, visione occlusale.



**Fig 18** Guiglione dei tessuti molli.



**Fig 19** RX endorale in cui si evidenziano il platform switching e la connessione conica per il mantenimento ottimale.

**BIBLIOGRAFIA** 1) Schierano G, Pera P, Machluso MM, Galli C, Conserva E. Impianti dentari. In: Preti G. Riabilitazione protesica. Torino: UTET, 2005:341-67. 2) Morra M, Cassinelli C, Di Carlo F. Le superfici implantari. In: Mischiodi M. Chirurgia implantare. Bologna: Edizioni Martina, 2003. 3) Pera P, Conserva E, Pin D, Acquaviva A, Tealdo T, Xotta M, Valente S. Analisi "in vitro" della citotossicità di differenti sistemi implantari in relazione al tipo di microtopografia di superficie. Implantologia 2004;3:207-17. 4) Arceoli D, Palmieri A, Pezzetti F, Brunelli G, Zolliro I, Carofini F. Genetic effects of a titanium surface on osteoblasts: a meta-analysis. J Oral Science 2007;4:299-309. 5) Li LH, Kong YM, Kim HW, Kim YW, Kim HE, Heo SJ, Koak JY. Improved biological performance of Ti implants due to surface modification by micro-arc oxidation. Biomaterials 2004;25:2867-75. 6) O'Sullivan D, Sennery L, Meredith N. Influence of implant taper on the primary and secondary stability of osseointegrated titanium implants. Clin Oral Implants Res 2004;15(4):474-80. 7) Lioabavina-Hack N, Lang NP, Karring T. Significance of primary stability for osseointegration of dental implants. Clin Oral Implants Res 2005;17(3):244-50. 8) Wolff J. Das Gesetz der Transformation der Knochen. Berlin: Hirschwald, 1982.





# Università degli Studi di Padova

Dipartimento di Neuroscienze  
UOC di Clinica Odontostomatologica  
Direttore Prof. E. Stellini



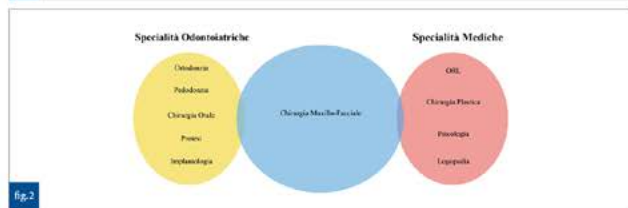
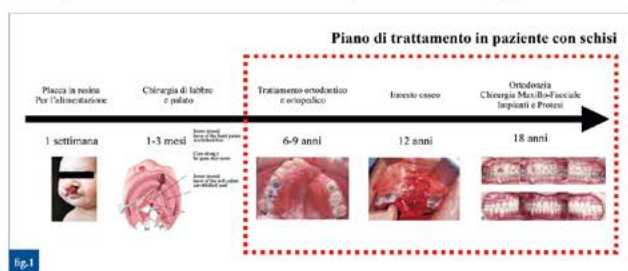
ASSOCIATION FOR PEDIATRIC ORAL SURGERY - 3° Congresso Firenze, 27-28 Marzo 2020

## GESTIONE MULTIDISCIPLINARE DI UN PAZIENTE CON LABIOPALATOSCHISI



### CASE REPORT

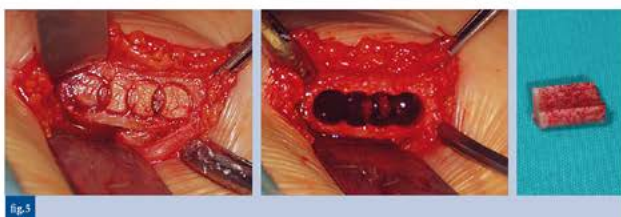
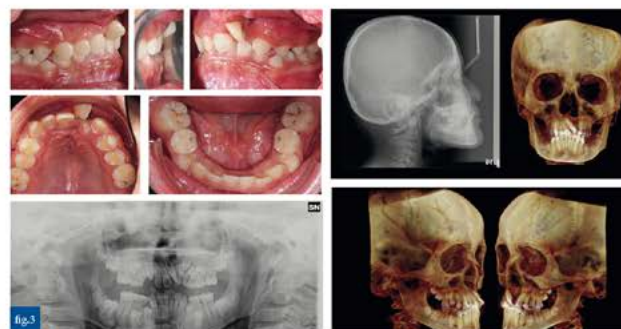
La gestione del paziente pediatrico con labiopalatoschisi (fig.1) è necessariamente multidisciplinare e coinvolge figure sia nell'ambito delle specialità odontoiatriche che di quelle mediche (fig.2).



Un paziente di 11 anni, originario della Cina, presenta labiopalatoschisi precedentemente operata ma con persistente comunicazione oro-nasale. Il paziente non ha anamnesi familiare disponibile, mentre all'esame odontoiatrico viene rilevata la posizione ectopica di 2.1 e 2.2 che si presenta anche di forma conoide (fig.3). Il piano di trattamento ha previsto un intervento di innesto nella zona della schisi (fig.4) Osteoplastica della schisi alveolare mediante innesto di osso autologo prelevato dalla cresta iliaca (fig.5), il recupero in arcata dell'elemento 2.1, l'estrazione del 2.2 con la risoluzione della malocclusione (fig.6) e riabilitazione protesica con dente provvisorio a lungo termine ancorato su miniviti palatali (fig.7).

Alla fine del trattamento tutti gli obiettivi di trattamento sono stati raggiunti: il paziente presenta una prima classe molare e canina, un adeguato overjet e overbite, un corretto allineamento dentale in arcata superiore e inferiore, una buona estetica, una centratura delle linee mediane e un appiattimento della curva di Spee.

Il trattamento nei pazienti con labiopalatoschisi richiede un approccio multidisciplinare che coinvolge molte figure mediche ed odontoiatriche per tutto l'arco della vita del paziente. L'approccio proposto richiede fin da subito una pianificazione degli obiettivi che si vorranno ottenere a livello funzionale ed estetico prevedendo la riabilitazione dell'arcata dentaria con un provvisorio a lungo termine supportato da miniviti palatali. Il piano di trattamento ha richiesto oltre alla figura centrale del chirurgo maxillofacciale l'intervento dall'ortodontista, del chirurgo orale, dell'implantologo e del protesista.







PAT27

## Teledentistry for the early detection of oral lesions: a lesson from the COVID-19 pandemic

Capocasale G<sup>1</sup>, Alberti C<sup>1</sup>, Donadello D<sup>1</sup>, Causarano G<sup>1</sup>, Luciano U<sup>1</sup>, Guerini A<sup>2</sup>, Albanese M<sup>1</sup>



<sup>1</sup>Dipartimento di Scienze Chirurgiche, Odontostomatologiche e Materno-Infantili, Università degli studi di Verona, Verona, Italia.

<sup>2</sup>Dipartimento di Patologia, Ospedale di Bassano del Grappa, Bassano del Grappa, Italia.

### INTRODUZIONE

La telemedicina può essere definita come la condivisione di dati medici attraverso l'utilizzo delle nuove tecnologie al fine di fornire, a distanza, l'assistenza medica al paziente o il consulto a colleghi. Attraverso la descrizione di questo caso clinico, vorremmo richiamare l'attenzione sulla fattibilità della tecnologia nella diagnosi precoce delle lesioni orali, in particolare durante la pandemia COVID-19; infatti, la necessità di evitare contatti interpersonali per prevenire la diffusione del virus, ha reso le consultazioni a distanza ancora più significative.

### CASE REPORT

Un uomo caucasico di 49 anni ha contattato telefonicamente un chirurgo orale (AC) per spiegare i suoi sintomi e segni: ha riferito la presenza di gonfiore gengivale associato a parestesia del labbro inferiore. Considerando quanto riportato, gli abbiamo chiesto di inviare le foto della lesione orale tramite la chat room di WhatsApp: la foto inviata dal paziente ha evidenziato la presenza di una tumefazione gengivale di colore rosso in sede V sestante (**Figure 1**).

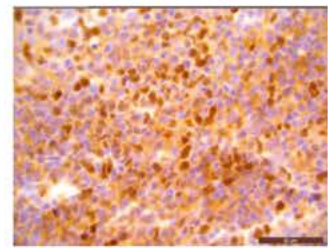
Grazie ad un'immediata valutazione telefonica, siamo stati in grado di organizzare per il giorno seguente una biopsia incisoria urgente.

L'esame istologico ha mostrato la diagnosi di linfoma diffuso a grandi cellule B (Bcl 6, MUM 1 E CD20 positivo) (**Figure 2, 3, 4**)

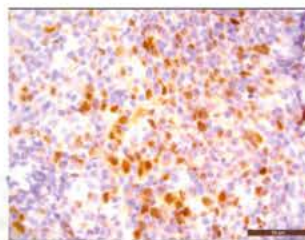
Il paziente è stato indirizzato dall'oncologo e ha iniziato il trattamento con la chemio-radioterapia.



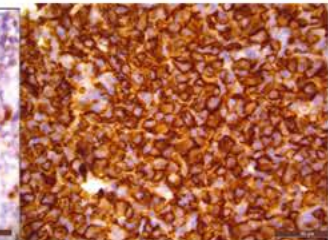
**Figura 1:** foto inviata dal paziente attraverso lo Smartphone



**Figura 2:** Bcl6. Positività nucleare dei linfociti neoplastici (63X)



**Figura 3:** MUM 1. Positività nucleare dei linfociti neoplastici (63X)



**Figura 4:** CD20. Forte positività di membrana per il marcatore linfoide (63X)

### CONCLUSIONE

In medicina orale è importante supportare nuove strategie di diagnosi precoce: Smartphone e Apps sono di facile accesso e utilizzo per la maggior parte della popolazione.

Considerando la situazione sanitaria generata dalla pandemia da COVID-19, la telemedicina potrebbe svolgere un ruolo chiave nel futuro della medicina orale, in modo particolare nei casi in cui qualsiasi ritardo nella diagnosi può avere importanti implicazioni sulla morbilità e mortalità della condizione.

## TOOTH-DERIVED BONE OBTAINED FROM TOOTH TRANSFORMER AS GRAFT MATERIAL: A LITERATURE REVIEW

G. Causarano\*, D. De Santis\*, M. Albanese\*, C. Alberti\*, U. Luciano\*, M. Magi\*, N. Modena\*,  
A. Poscolere\*, M. Zarantonello\*, P. F. Nocini\*

\* Reparto di Chirurgia Orale e Maxillo facciale, Dipartimento di Scienze Chirurgiche  
Odontostomatologiche e Materno-Infantili, Università degli Studi di Verona, Italia.



### INTRODUZIONE

Scopo dello studio è stato di eseguire una revisione della letteratura sull'uso di matrice dentale demineralizzata ottenuta mediante l'utilizzo del Tooth Transformer (BIOMAX S.p.A. Italia) nel trattamento dei difetti ossei alveolari. Tramite l'impiego del TT è possibile ottenere dagli elementi dentali materiale da innesto autologo. La matrice dentinale demineralizzata ottenuta aumenta la biodisponibilità di BMP inducendo osteoinduzione e osteodifferenziazione cellulare. La capacità di reclutamento, dal tessuto circostante, di cellule mesenchimali che si differenziano in cellule osteogeniche è data dalla presenza di molecole che vengono preservate anche a distanza di tempo nel dente e non sono influenzate dal grado di conservazione, le BMP.

Il tessuto dentale, come l'osso, è composto di collagene tipo 1 e minerali di idrossiapatite (HA), quest'ultimo essendo ad elevata cristallinità, non è riassorbibile. Il TT riduce la cristallinità dell' HA e il particolato ottenuto è in grado di determinare un meccanismo di osteoinduzione, in grado di stimolare l'adesione, la proliferazione e la differenziazione cellulare durante la rigenerazione ossea.

### MATERIALI E METODI

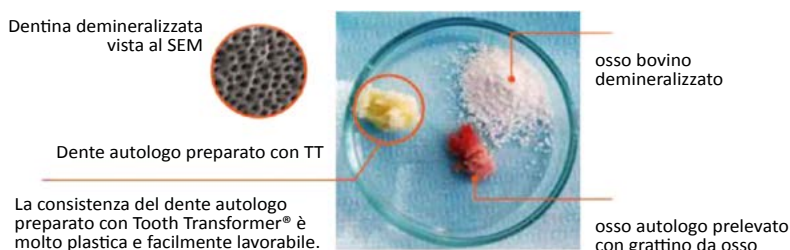
Lo studio è stato condotto mediante una ricerca bibliografica per identificare la letteratura scientifica rilevante indicizzata dal 2012 al 2020 utilizzando database internazionali (MEDLINE, PUBMED). Abbiamo utilizzato studi clinici, istologici e analisi istomorfometriche per effettuare una revisione della letteratura sull'impiego di matrice autologa demineralizzata ottenuta tramite TT. Molti studi sull'impiego del particolato di origine dentale in tecniche di GBR, socket preservation, rigenerazione orizzontale e rialzo di seno mascellare, miravano a dimostrare la formazione di nuovo tessuto duro nella terapia dei difetti ossei.

### RISULTATI

Diversi autori hanno dimostrato che la dentina demineralizzata può mantenere intatta la struttura dell'innesto autogeno ed indurre la formazione ossea. In linea teorica anche lo smalto è dotato di buone capacità di osteoconduttività ma, avendo una componente minerale inorganica superiore (98 % rispetto al 60-70 % della dentina) risulta meno facilmente riassorbibile anche dopo la demineralizzazione. Tramite l'impiego del TT è stata stimata una quantità di circa 1,4 - 2,8 gr, ottenuti da un dente molare a seconda dello stato di idratazione dello stesso, da cui è possibile ottenere molecole che promuovono la guarigione e il rimodellamento osseo. La BMP2 è una delle molecole osteoinduttive più efficaci in grado di stimolare la formazione e la riparazione ossea. Già in uno studio degli anni novanta, condotto su animali, veniva studiato il ruolo osteoinduttivo di molecole presenti a livello dentale, la BMP presente nella matrice extracellulare della dentina umana è stata estratta, purificata e trasferita sperimentalmente nei ratti. Indagini effettuate successivamente all'impianto nell'animale hanno dimostrato che le BMP, ricavate dalla matrice dentinale, hanno indotto a distanza di tre settimane nuova formazione ossea. La BMP derivata da matrice dentinale è simile alla BMP derivata dalla matrice ossea, entrambi i tipi di molecole hanno dimostrato di avere la stessa azione in vivo. È stato inoltre visto che alcuni fattori di crescita come BMP2, IGF, TGF- $\beta$  si conservano a lungo nel tempo permettendone l'impiego anche dopo diversi anni.

Analisi istologiche hanno riportato percentuali di neoformazione ossea comprese tra il 45% e l'87%, un intervallo considerevole rispetto ad altri sostituti ossei, in tutti i casi revisionati è stato riportato un riempimento completo con tessuto duro confermato dall'osservazione clinica e radiografica. La guarigione dei tessuti dopo le procedure di innesto era priva di complicazioni o processi infettivi cronici e l'aspetto dell'osso rigenerato è apparso omogeneo rendendo indistinguibili le particelle dell'innesto dall'osso nativo, è stata inoltre rilevata assenza di segni di infiammazione indice di assoluta biocompatibilità.

Ulteriori studi hanno valutato, dal punto di vista istologico e istomorfometrico, il tessuto osseo ottenuto dopo la guarigione dell'innesto, sono state osservate trabecole ossee di nuova formazione, indice di rimodellamento tessutale, differenti dal surrogato osseo riscontrato con l'impiego di biomateriali deantigenizzati di origine animale.



### CONCLUSIONI

Tale revisione ci porta a concludere che l'uso della matrice ossea demineralizzata di origine dentale, ottenuta tramite l'uso di TT, porta ad una buona guarigione e neoformazione ossea. Il TT prevede un procedimento in più fasi: pulizia, decontaminazione, triturazione e demineralizzazione offrendo la possibilità di utilizzare anche elementi decidui sebbene dotati di una minore componente dentinale. Il TT aumenta la biodisponibilità delle BMP dentali altrimenti vincolate dall'alto grado di cristallinità dell'idrossiapatite che viene quindi ridotta. Questa tecnica potrebbe essere una ragionevole alternativa ai materiali attualmente impiegati nel trattamento dei difetti ossei dei mascellari, offre il vantaggio di avere un basso costo clinico, non richiede un secondo sito di prelievo, possono essere utilizzati anche elementi decidui e l'innesto viene completamente sostituito da nuovo osso.



**FLUSSO DI LAVORO DIGITALE NELLA RIABILITAZIONE DEL QUADRANTE EDENTULO E ATROFICO**

A. Poscolere \*, C. Alberti \*, D. De Santis \*, M. Albanese \*, G. Causarano\*, U. Luciano \*, M. Magi \*, N. Modena \*, M. Zarantonello \*, P.F. Nocini \*

\* Reparto di chirurgia orale e maxillo facciale, Dipartimento di Scienze Chirurgiche Odontostomatologiche e Materno-Infantili, Università degli Studi di Verona, Italia.

**INTRODUZIONE**

Paziente di sesso femminile di 49 anni, anamnesi negativa, nega allergie ad antibiotici ed anestetici locali.

Si rivolge al reparto di Chirurgia Orale dell'Azienda Ospedaliera Universitaria Integrata di Verona per riabilitare il primo quadrante. All'esame obiettivo e radiografico si rilevano esiti di parodontite cronica in terapia di mantenimento, buon controllo dell'igiene orale, edentulia elementi 3.5, 3.6, 4.7 ed edentulia completa dei settori premolare e molare del primo quadrante, caratterizzato da un avanzato riassorbimento osseo dovuto ad un precedente intervento di rimozione di una lesione cistica.

**MATERIALI E METODI**

Dalla CBCT viene ricavato un modello tridimensionale del tessuto osseo della paziente e tramite un apposito software viene realizzata una mesh in titanio customizzata per eseguire un intervento di rigenerativa ossea guidata (GBR). A distanza di 9 mesi si rimuove la mesh utilizzata e si avvia l'iter diagnostico per il successivo intervento di posizionamento implantare.

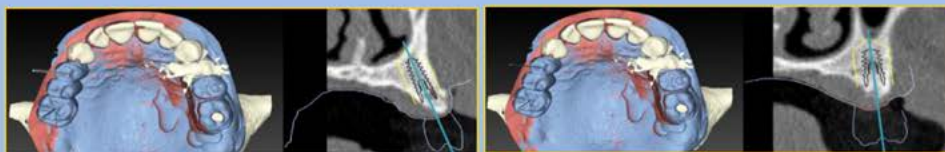


Durante il primo appuntamento vengono rilevate le impronte dell'arcata superiore ed inferiore e il loro rapporto oclusale per consentire all'odontotecnico di eseguire una ceratura diagnostica, la quale verrà successivamente scansionata per ricavarne un file .nxa. Durante la stessa seduta si va ad improntare la clip con la quale la paziente effettuerà l'indagine radiografica, il lato oclusale della clip è composto da un materiale termoplastico che viene portato ad una temperatura di circa 70° e consente, una volta avvenuto il rammollimento testimoniato dal cambiamento cromatico, di prendere un'impronta precisa degli elementi dentari adiacenti al sito chirurgico. All'interno della clip sono presenti delle sfere metalliche, i fiducial marker, che consentiranno la sovrapposizione tra la scansione TC e l'arcata reale della paziente.

Eseguita la scansione TC, viene importato, sul software DTX-Studio®, il file DICOM contenente le informazioni riguardanti il tessuto osseo della paziente ed il file .nxa, ottenuto dalla scansione di modello e ceratura diagnostica, contenente le informazioni riguardanti i tessuti molli e la futura riabilitazione protesica (protesi fissa su impianti, avvitata).



Grazie alla funzione "Smart Fusion" i due file vengono sovrapposti utilizzando gli elementi dentari come repere comune. Terminata questa fase, denominata Superimposition, si procede con la pianificazione della posizione implantare e la selezione delle dimensioni delle fixture. La progettazione viene poi esportata in un sistema di Chirurgia Computer Assistita in modalità Dinamica (d-CAIS) con il quale verrà effettuato l'intervento (X-Guide®)



Subito prima di procedere con la fase chirurgica viene eseguita la calibrazione del sistema X-Guide® che prevede l'esposizione dei vari tracker (paziente, manipolo e fresa) alla sorgente luminosa proveniente dalle telecamere optoelettroniche le quali hanno la capacità di ricevere e trasdurre il segnale luminoso riflesso dai tracker stessi e di poterne quindi tracciare le relative posizioni in tempo reale. Terminata la calibrazione, si eseguono le osteotomie per inserire un impianto Nobel Active® 3.5 x 13 mm in posizione 1.4 e un 4.3 x 10 in posizione 1.6 potendo costantemente osservare sul monitor l'avanzamento delle frese e delle fixture in tempo reale fino al raggiungimento della posizione pianificata.

**RISULTATI**

L'utilizzo di una mesh in titanio customizzata, preformata sui volumi ossei della CBCT, ha permesso di ridurre i tempi intraoperatori e di ottenere un adeguato volume osseo.

L'utilizzo di un sistema d-CAIS ha permesso l'inserimento degli impianti in una corretta posizione protesica, precedentemente determinata, e la gestione dei tessuti molli senza ripercussioni sull'accuratezza della sistemazione.

**CONCLUSIONI**

L'utilizzo delle tecnologie digitali nelle fasi pre-chirurgiche e intraoperatorie consente di ottimizzare i risultati riabilitativi in siti atrofici.



**TOOTH-DERIVED BONE OBTAINED FROM TOOTH TRANSFORMER AS GRAFT MATERIAL: A LITERATURE REVIEW**

G. Causarano\*, D. De Santis\*, M. Albanese\*, C. Alberti\*, U. Luciano\*, M. Magi\*, N. Modena\*, A. Poscolere\*, M. Zarantonello\*, P. F. Nocini\*

\* Reparto di Chirurgia Orale e Maxillo facciale, Dipartimento di Scienze Chirurgiche Odontostomatologiche e Materno-Infantili, Università degli Studi di Verona, Italia.

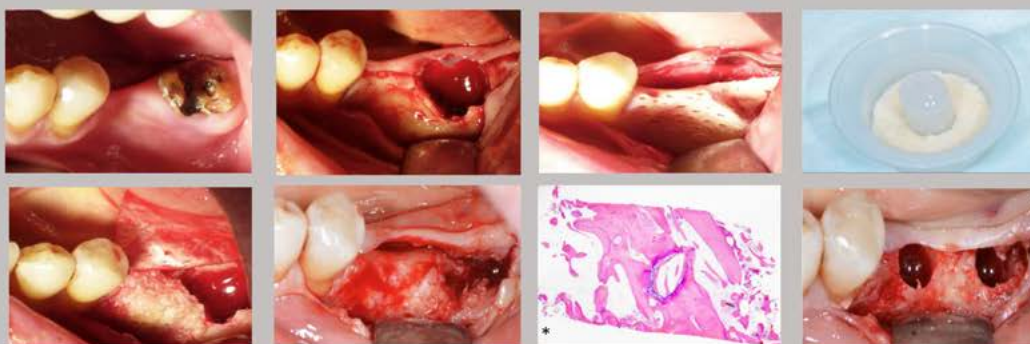


**INTRODUZIONE**

Scopo dello studio è stato di eseguire una revisione della letteratura sull'uso di matrice dentale demineralizzata ottenuta mediante l'utilizzo del Tooth Transformer (BIOMAX S.p.A, Italia) nel trattamento dei difetti ossei alveolari. Tramite l'impiego del TT è possibile ottenere dagli elementi dentali materiale da innesto autologo. La matrice dentinale demineralizzata ottenuta aumenta la biodisponibilità di BMP inducendo osteoinduzione e osteodifferenziazione cellulare. La capacità di reclutamento dal tessuto circostante di cellule mesenchimali che si differenziano in cellule osteogeniche è data dalla presenza di molecole che vengono preservate anche a distanza di tempo nel dente e non sono influenzate dal grado conservazione, le BMP. Il tessuto dentale, come l'osso, è composto di collagene tipo 1 e minerali di idrossiapatite (HA), quest'ultimo essendo ad elevata cristallinità, non è riassorbibile. Il TT riduce la cristallinità dell' HA e il particolato ottenuto è in grado di determinare un meccanismo di osteoinduzione, in grado di stimolare l'adesione, la proliferazione e la differenziazione cellulare durante la rigenerazione ossea.

**MATERIALI E METODI**

Lo studio è stato condotto mediante una ricerca bibliografica per identificare la letteratura scientifica rilevante indicizzata dal 2012 al 2020 utilizzando database internazionali (MEDLINE, PUBMED). Abbiamo utilizzato studi clinici, istologici e analisi istomorfometriche per effettuare una revisione della letteratura sull'impiego di matrice autologa demineralizzata ottenuta tramite TT. Molti studi sull'impiego del particolato di origine dentale in tecniche di GBR, socket preservation, rigenerazione orizzontale e rialzo di seno mascellare, miravano a dimostrare la formazione di nuovo tessuto duro nella terapia dei difetti ossei.



\* TESSUTO CALCIFICATO TOTALE 47,33%  
 NUOVO OSSO 41,67 %  
 DENTINA/TOOTH TRANSFORMER 5,65 %

**RISULTATI**

Diversi autori hanno dimostrato che la dentina demineralizzata può mantenere intatta la struttura dell'innesto autogeno ed indurre la formazione ossea. In linea teorica anche lo smalto è dotato di buone capacità di osteoconduttività ma, avendo una componente minerale inorganica superiore (98 % rispetto al 60-70 % della dentina) risulta meno facilmente riassorbibile anche dopo la demineralizzazione. Tramite l'impiego del TT è stata stimata una quantità di circa 1,4 - 2,8 gr, ottenuti da un dente molare a seconda dello stato di idratazione dello stesso, da cui è possibile ottenere molecole che promuovono la guarigione e il rimodellamento osseo. La BMP2 è una delle molecole osteoinduttive più efficaci in grado di stimolare la formazione e la riparazione ossea. Già in uno studio degli anni novanta, condotto su animali, veniva studiato il ruolo osteoinduttivo di molecole presenti a livello dentale, la BMP presente nella matrice extracellulare della dentina umana è stata estratta, purificata e trasferita sperimentalmente nei ratti. Indagini effettuate successivamente all'impianto nell'animale hanno dimostrato che le BMP, ricavate dalla matrice dentinale, hanno indotto a distanza di tre settimane nuova formazione ossea. La BMP derivata da matrice dentinale è simile alla BMP derivata dalla matrice ossea, entrambi i tipi di molecole hanno dimostrato di avere la stessa azione in vivo. E' stato inoltre visto che alcuni fattori di crescita come BMP2, IGF, TGF-β si conservano a lungo nel tempo permettendone l'impiego a distanza di tempo. Negli studi revisionati è stata riscontrata una capacità rigenerativa, a volte migliore, rispetto ad altri sostituti ossei ed è stato riportato un riempimento con tessuto duro neofornato confermato dall'osservazione clinica e radiografica. La guarigione dei tessuti dopo le procedure di innesto era priva di complicazioni o processi infettivi cronici e l'aspetto dell'osso rigenerato è apparso omogeneo rendendo indistinguibili le particelle dell'innesto dall'osso nativo, è stata inoltre rilevata assenza di segni di infiammazione indice di assoluta biocompatibilità. Ulteriori studi hanno valutato, dal punto di vista istologico e istomorfometrico, il tessuto osseo ottenuto dopo la guarigione dell'innesto, sono state osservate trabecole ossee di nuova formazione, indice di rimodellamento tessutale, differenti dal surrogato osseo riscontrato con l'impiego di biomateriali deantigenizzati di origine animale.

**CONCLUSIONI**

Tale revisione ci porta a concludere che l'uso della matrice ossea demineralizzata di origine dentale, ottenuta tramite l'uso del TT, porta ad una buona guarigione e neofornazione ossea. Il TT prevede più fasi: pulizia, decontaminazione, triturazione e demineralizzazione offrendo la possibilità di utilizzare anche elementi decidui sebbene dotati di una minore componente dentinale. Il TT aumenta la biodisponibilità delle BMP dentali altrimenti vincolate dall'alto grado di cristallinità dell'idrossiapatite che viene quindi ridotta. Questa tecnica potrebbe essere una ragionevole alternativa ai materiali attualmente impiegati nel trattamento dei difetti ossei dei mascellari, offre il vantaggio di avere un basso costo clinico, non richiede un secondo sito di prelievo, impiego di elementi decidui e l'innesto viene completamente sostituito da nuovo osso.

1) Anitha E, Orive G (2009). Finite Element Analysis of the Influence of the Offset Placement of an Implant-supported Prosthesis on Bone Stress Distribution. *J Biomed Mater Res Part B: Appl Biomater*. 89:275-281(2) Anitha E, Alkhrdaji MH, Pitas L, Begeja L, Orive G (2014). Implant survival and crestal bone loss around extra-short implants supporting a fixed denture: the effect of crown height space, crown-to-implant ratio, and offset placement of the prosthesis. *Int J Oral Maxillofac Implants*. 29(3):682-9(3) Anitha E, Prado R, Orive G, Tegner R (2015). Effects of calcium-modified titanium implant surfaces on platelet activation, clot formation, and osseointegration. *J Biomed Mater Res Part A*. 103:969-80(4) Bevilacqua M, Tealdo T, Pera F, Memini M, Mossolov A, Drago C, Pera P (2008). Three-dimensional finite element analysis of load transmission using different implant inclinations and cantilever lengths. *Int J Prosthodont*. 21(6):539-42(5) Byrne G (2016). Outcomes of one-stage versus two-stage implant placement. *J Am Dent Assoc*. Oct;147(10):1257-8(6) Cavallo FB, Gonzalez M, Tassanovich M (2007). Evaluation of chronic periapical lesions by digital subtraction radiography by using Adobe Photoshop CS: a technical report. *J Endod*. 33(4):653-7(7) Charvát S, Levin L (2018). Human Studies of Vertical and Horizontal Alveolar Ridge Augmentation Comparing Different Types of Bone Graft Materials: A Systematic Review. *J Oral Implantol*. 44(1):74-84(288) Dias DR, Leles CR, Lindh C, Ribeiro-Rotta RF (2015).





INCONTRO DELLE SCUOLE DI SPECIALIZZAZIONE IN CHIRURGIA ORALE (Sapienza Università di Roma, 24-26 giugno 2021)

## TRATTAMENTO NON CHIRURGICO DELLA MUCOSITE PERI-IMPLANTARE TRAMITE STRUMENTAZIONE MANUALE ASSOCIATA ALL'UTILIZZO DI UN AGENTE ANTISETTICO CON PROPRIETA' IGROSCOPICHE

Signoriello Annarita<sup>1</sup>, Sinigaglia Stefano<sup>1</sup>, Alberti Christian<sup>1</sup>, Lombardo Giorgio<sup>1</sup>, Albanese Massimo<sup>1</sup>

<sup>1</sup> Sezione di Odontoiatria e di Chirurgia Maxillo-Facciale - Dipartimento di Scienze Chirurgiche, Odontostomatologiche e Materno-Infantili - Università di Verona, Piazzale L.A. Scuro 10, 37134 Verona, Italia

### INTRODUZIONE E SCOPO DELLO STUDIO

Le evidenze riguardanti l'applicazione di protocolli predicibili per il trattamento delle malattie peri-implantari, definite e classificate soltanto recentemente<sup>1</sup>, rimangono ad oggi limitate<sup>2</sup>. E' stato dimostrato come il trattamento non chirurgico, coadiuvato da mezzi sperimentali di disinfezione, possa rivelarsi appropriato per il trattamento di quadri infiammatori reversibili come la mucosite peri-implantare<sup>3-6</sup>. Scopo del presente studio è stato quello di comparare dal punto di vista clinico l'efficacia di due diversi antisettici locali (Hybenx agente liquido decontaminante<sup>7</sup>, gruppo test HBX; Clorexidina Digluconato gel 1%, gruppo controllo CHX), associati alla strumentazione manuale con curettes in teflon, in siti peri-implantari caratterizzati da infiammazione (sanguinamento e sondaggio maggiore di 4 mm) e da assenza di perdita ossea radiografica<sup>9,10</sup>.



### MATERIALI E METODI

Sono stati inclusi nello studio 12 pazienti, per un totale di 30 impianti, assegnati casualmente al gruppo test (6 pazienti e 15 impianti) o al gruppo controllo (6 pazienti e 15 impianti) per il trattamento iniziale (T0). La procedura è stata ripetuta a distanza di 7 (T1) e 14 (T2) giorni, con rivalutazione clinica a distanza di 3 mesi (T3) dei tessuti molli peri-implantari [profondità di sondaggio (PPD), sanguinamento al sondaggio (BOP), indice di placca (VPI)].



### Caso clinico:

Pz maschio, 55 anni, mucosite su impianto 22 trattata con HBX.

Fig.1 (da sx verso dx): valutazione radiografica e clinica a T0, con rilevazione di PPD, BOP, VPI.



Fig.2 (da sx verso dx): applicazione di HBX (a T0, T1 e T2).



Fig.3 (da sx verso dx): valutazione clinica a T3, con rilevazione di PPD, BOP, VPI.



### RISULTATI

Nonostante entrambi gli agenti si siano dimostrati validi, l'agente decontaminante (HBX) ha evidenziato una maggiore efficacia del punto di vista clinico, con una riduzione complessiva, a distanza di 3 mesi, di PPD, BOP e VPI rispettivamente di 0.55 mm, 27% e 35%, rispetto al gruppo CHX (0.16 mm, 11% e 20%). La riduzione BOP si è rivelata statisticamente significativa, per quanto riguarda i siti più profondi, nel gruppo HBX (57%) rispetto al gruppo CHX (44%).



### CONCLUSIONI

In base ai dati ottenuti da questo studio clinico a 3 mesi, sull'associazione di due differenti agenti antimicrobici con la strumentazione meccanica manuale, per il trattamento di impianti affetti da mucosite possiamo concludere che entrambe le terapie danno risultati efficaci in termini di riduzione dell'infiammazione peri-implantare. Per quanto riguarda il gruppo di pazienti trattato con HBX sembra esserci una maggiore tendenza alla riduzione dei parametri di infiammazione rispetto al gruppo trattato con CHX. Ulteriori studi con campioni più numerosi e con follow-up più lunghi sono auspicabili a sostegno dei nostri risultati.

### BIBLIOGRAFIA

1. Berglundh T et al. Peri-implant diseases and conditions. Consensus report of workgroup 4 of the 2017 World Workshop on the Classification of Periodontal and Peri-implant Diseases and Conditions. J Clin Periodontol. 2018 Jun;45 Suppl 20:S286-S291.
2. Lee, C.T.; Huang, Y.M.; Zhu, L.; Wehman, R. Prevalences of peri-implantitis and peri-implant mucositis: Systematic review and meta-analysis. J. Dent. 2017, 62, 3-12. doi:10.1016/j.jdent.2017.04.011.
3. Romert, S.; Lennart, L.; Dahlén, G.; Lindahl, C.; Jansson, M. Topical minocycline microspheres versus topical chlorhexidine gel as an adjunct to mechanical debridement of incipient peri-implant infections: A randomized clinical trial. J. Clin. Periodontol. 2006, 33, 362-369.
4. Heitz-Mayfield, L.J.; Savi, G.E.; Botticelli, D.; Monbelli, A.; Faddy, M.; Lang, N.P. Implant Complication Research Group. Anti-infective treatment of peri-implant mucositis: A randomized controlled clinical trial. Clin. Oral Implants Res. 2011, 22, 237-241. doi:10.1111/j.1600-0501.2010.02078.x.
5. Jepsen, S.; Berglundh, T.; Jensen, R.; Aas, A.M.; Donnell, K.; Derks, J.; Figuero, E.; Giovannoli, L.; Goldstein, M.; Larrabee, F.; et al. Primary prevention of peri-implantitis: Managing peri-implant mucositis. J. Clin. Periodontol. 2015, 42, S102-S107. doi:10.1111/jcpp.12269.
6. Thone-Klotz, M.; Swierkot, K.; Himmelscheit, C.; Klumpp, R.; Fioresi de Saccis, L.; Mengi, R. Comparison of two full-mouth approaches in the treatment of peri-implant mucositis: A pilot study. Clin. Oral Implants Res. 2020, 21, S06-S12. doi:10.1111/clir.13311. PMID:30910381.
7. Porter, S.R.; Al-Johani, K.; Fedriz, S.; Miller, D.R. Randomized controlled trial of the efficacy of Hybenx in the symptomatic treatment of recurrent aphthous stomatitis. Oral Dis. 2009, 15, 155-161. doi:10.1111/j.1601-0825.2008.01503.x.
8. Varro, E.; Sano, M.; Lodi, G.; Carraro, A. Chlorhexidine (CHX) in dentistry: state of the art. Medicina (Bari). 2012, 81, 399-430.
9. Lombardo, G.; Signoretto, C.; Corrocher, G.; Parfio, A.; Pighi, J.; Rovera, A.; Cecchi, G.; Nacini, P.F. A topical desiccant agent in association with ultrasonic debridement in the initial treatment of chronic periodontitis: A clinical and microbiological study. New Microbiol. 2013, 28, 393-407.
10. Lombardo, G.; Signoretto, C.; Corrocher, G.; Signoretto, C.; Barlacchini, G.; Parfio, A.; Nacini, P.F. A Topical Desiccant Agent in Association with Manual Debridement in the Initial Treatment of Peri-implant Mucositis: A Clinical and Microbiological Pilot Study. Antibiotics 2019, 8, 82. https://doi.org/10.3390/antib8020082.



Poster per il Congresso Internazionale della Società Italiana di Chirurgia Orale, Roma - luglio 2021

**NEW TECHNOLOGIES FOR COMMON PATHOLOGIES AND TREATMENTS**

Unità Area di Specializzazione in Chirurgia Orale alla Sapienza Università di Roma  
Incollaborazione con il Centro di Specializzazione in Chirurgia Orale

**SAPIENZA**  
UNIVERSITÀ DI ROMA

ROMA 8-10 LUGLIO 2021

## IMPLANTOLOGIA ZIGOMATICA IUXTA SINUSALE: LA TECNICA CHIRURGICA

Alberti Christian\* - Tealdo Tiziano - Bevilacqua Marco




















● Aleksandrowicz P. et al. Extra-Sinus Zygomatic Implants to Avoid Chronic Sinusitis and Prosthetic Arch Malposition: 12 Years of Experience. J Craniofac Surg. 2017;28(8):797-799.

● Maló P. et al. Five-year outcome of a retrospective cohort study on the rehabilitation of completely edentulous atrophic maxillae with immediately loaded zygomatic implants placed extra-maxillary. Eur J Oral Implantol. 2014;7(3):267-281.

● D'Agostino A. et al. Complications related to zygomatic implants placement: A retrospective evaluation with 5 years follow-up. J Craniomaxillofac Surg. 2021;49(7):620-627.

— CLINICAL CASE REPORT

### RIABILITAZIONE IMPLANTOPROTESICA MEDIANTE IMPIANTI UNIPLANT® E IMPIANTI PTERIGOIDEI NEL RITRATTAMENTO DEL MASCELLARE MODERATAMENTE ATROFICO

di Tiziano TEALDO  
Marco BEVILACQUA  
Christian ALBERTI  
Luca SCAGLIONE  
Piercarlo SEGHESSIO

**Caso clinico**

**R**isultamenti funzionali in paziente ASA I con dentatura totale e ridotta lussazione implantare, in questi casi è fondamentale seguire un protocollo valido (EVCH-CE, IMSCO, DENTEST) nelle sue fasi chirurgiche e protetiche garantendo un adeguato biomimetismo adeguato.

**IL COLUMBUS BRIDGE** PROTOCOLLO di garanzia di successo sovrapponibile al carico dell'implanto in questi casi di edentolismo complesso chirurgico-protetico.

Le immagini estrattive della paziente indicano una perdita della dimensione verticale di occlusione (Fig. 1-2) e del sostegno del labbro superiore.

L'ortopantomografia e la visione laterale a tempo 0 confermano la non prevedibile prognosi negli elementi residui. La templa proposta prevede l'impiego degli elementi dentali residui e l'impiego di impianti per estrazione con riabilitazione full arch Columbus Bridge® superiore e inferiore (Fig. 3-4).
















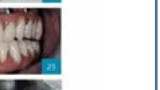












La pneumatizzazione moderata di entrambi i seni mascellari (Fig. 5-6) necessita di un appoggio distale per

avviare i carterivoli di almeno 2 elementi (per ogni quadrante) che rappresentino un potenziale fattore di rischio protetico. vengono pertanto inseriti 2 impianti distali stereotipici (Niva Medical) da 20 mm e 4 impianti Uniplant® (Niva Medical) da 13 mm per 4.5 mm di diametro in regione pre-massellare. Questi impianti, grazie al loro neuroscopio, garantiscono elevata stabilità negli archi inferiori ed, permettendo di seguire il protocollo di carico immediato, senza precludere il raggiungimento dell'osteointegrazione (Fig. 8-9-10-11-12-13).

Le fasi protetiche di lavorazione (Fig. 14-15-16) per la realizzazione del framework permanente sono progettate in ambiente CAD/CAM. Lo spazio intermaxillare, la distanza interforame e, l'alterazione dei cuspidi succedanei sono valutati e progettati al CAD, comprese le riparazioni e il trasporto per il compimento di lussazioni e collaudi, secondo la tecnica della stratificazione incrementale in multipla lussazione. I volumi protesi di disegno CAD indicano come scelta di elevazione il tipo frame di Coltitan® in sua alleve a bloccare l'attività nel contatto mucoso-bridge. Il sesso, peso specifico, la resistenza e l'adesione metallo-composito (Fig. 19-20-21-22-23).

L'ortopantomografia di controllo (Fig. 24) e la CBCT (Fig. 25) evidenziano la corretta distribuzione full arch degli impianti intra ed extraorali. la corretta morfologia del framework e il fit sui sei punti dentali avallati sugli impianti Uniplant® e Niva® (Fig. 26). Nella visione superiore destra e sinistra è possibile osservare l'inclinazione reale medio-distale dei due impianti extra-massellari distali da 20 mm ancorati nei processi pterigoidei delle sinfisi.

Nella figura 27 è possibile apprezzare il risultato della riabilitazione definitiva e il nuovo sorriso della paziente.



# 02 CLINICAL CASE REPORT



Tiziano  
TEALDO



Marco  
BEVILACQUA



Maria  
MENINI



Francesco  
PERA



Christian  
ALBERTI



Paolo  
PESCE



Paolo  
PERA

*in collaborazione con il Laboratorio Odontoterapico Scaglione Luca & Seghesio Piercarlo*

## Riabilitazione fissa del mascellare atrofico con tecnica *hybrid zygoma extrasinusale*

### Quali i vantaggi per il paziente e per il clinico?

#### CASO CLINICO

Paziente maschio di 59 anni, ASA 1, edentulo totale da 3 anni con grave atrofia del mascellare superiore (che rende impossibile il posizionamento di impianti nelle zone distali del mascellare senza importanti cantilever o utilizzo di chirurgia rigenerativa) richiede un trattamento fisso completo (foto 1).

Dopo una valutazione intra ed extraorale si procede all'esame CBCT e allo studio 3D per la pianificazione chirurgica e protesica con software Exocad (foto 2-4). L'impiego di tecnologie digitali consente di eseguire un'attenta analisi prechirurgica valutando il tessuto osseo residuo a disposizione per l'inserimento degli impianti. Questa scelta sarà guidata non solo da considerazioni di tipo anatomico, disponibilità o meno di quote ossee, ma anche dal progetto protesico condiviso con il laboratorio odontotecnico. Tutte le informazioni contenute nel montaggio virtuale verranno utilizzate per la realizzazione della ponte provvisorio e per la progettazione del ponte definitivo.

I due impianti zigmatici vengono inseriti secondo il protocollo extrasinusale. Questo approccio è molto meno invasivo di quello intrasinusale originariamente proposto dalla scuola svedese perché rispetta l'integrità del seno, non essendo necessario aprire una botola sulla parete laterale per controllare il posizionamento dell'impianto. Il protocollo extrasinusale della Noris Medical prevede l'utilizzo di una fresa a pallina per definire il punto di ingresso dell'impianto nel processo zigmatico e il punto di emergenza sulla cresta alveolare residua.

Lo slot sulla parete laterale del seno che collega i due reperi precedenti tracciati viene preparato con una fresa diamantata un ca nel suo genere: consentirà di bypassare il seno mascellare evitando danni alla membrana di Schneider e creerà un alloggiamento anatomico

dell'impianto (foto 5).

Nel caso illustrato sono stati inseriti due impianti zigmatici da 45 mm di lunghezza con un inserto torque di 70 Ncm.

L'asse implantare viene correttamente avvitato a 20 Ncm due pilastri tipo MUA con un'inclinazione di 52 gradi (foto 6).

Clinicamente la procedura chirurgica è facilitata dal razionale con cui è concepito il kit implantare e dalla vasta gamma di fixture zigmatiche a disposizione.

La procedura protesica è altresì semplificata dalla possibilità di scegliere pilastri preangolati con diverse angolazioni e altezze per poter compensare le spiccate angolazioni implantari.

La sistemica Noris Medical dispone di impianti zigmatici con una lunghezza compresa tra i 30 e i 60 mm (con incrementi di 2,5 mm) e monconi angolati da 17 a 60 gradi.

Questo ampio catalogo di prodotti consente di avere grande versatilità chirurgica e protesica.

Data la scarsa qualità ossea, nella premaxilla vengono inseriti 4 impianti UNIPLANT che con il loro macrodesign aggressivo consentono il raggiungimento di una stabilità primaria importante anche in casi di qualità D3 e D4.

Nel mascellare inferiore, dove la mineralizzazione è ottima, vengono inseriti quattro impianti corici Biomet 3i di lunghezza adeguata secondo il protocollo chirurgico Columbus Bridge.

Anche la procedura protesica relativa all'impronta in gesso e alla rilevazione della DVO in relazione centrica segue scrupolosamente i principi del Columbus Bridge Protocol (foto 7).

Il paziente viene dimesso lo stesso giorno dell'intervento con i provvisori fissi avvitati (foto 8,9).



Fig 1 Visione extraorale del paziente edentulo.



Fig 2 Serzioni assiali CBCT.



Fig 3 Valutazione ossea 3D in rapporto alla regione zigmatica.



Fig 4 Pianificazione protesica con Exocad.



Fig 5 Preparazione dello slot per l'alloggiamento dello zigmatico.

L'utilizzo di impianti zigmatici nella riabilitazione del mascellare reso atrofico dalla iper pneumatizzazione dei seni mascellari rappresenta una procedura altamente predicibile, con elevato tasso di successo soprattutto se applicata con carico immediato.

Il caso clinico qui di seguito illustrato, con l'inserimento di un impianto zigmatico per emiarcata con tecnica extrasinusale e impianti standard posizionati nella premaxilla, può rappresentare un'opzione terapeutica interessante per il trattamento delle gravi atrofie posteriori del mascellare superiore.

Il posizionamento di due impianti zigmatici a sostegno di un ponte fisso full-arch contribuisce a ridurre i cantilever distali e ad ottimizzare il comportamento biomeccanico della riabilitazione.

Gli step chirurgici e protesici sono oggi ben protocollati tali da rendere la riabilitazione veloce, sicura e più predicibile rispetto a procedure alternative con implementazione ossea.



Si procede dopo circa 14 settimane alla realizzazione del definitivo utilizzando nuovamente un protocollo che miscela attentamente il know-how analogico e digitale. In primis viene realizzata una nuova impronta tradizionale in gesso (foto 10,11). Il modello viene digitalizzato in laboratorio con uno scanner da banco e su questa acquisizione, con un software CAD dedicato (Exocad), si recuperano tutte le informazioni utilizzate precedentemente per meglio progettare l'estetica definitiva e il relativo framework (foto 12-15). Prima dell'invio dei file al centro di fresaggio è indispensabile realizzare a stampa 3D in resina del progetto definitivo per poter effettuare le prove cliniche su paziente e gli eventuali aggiustamenti necessari (foto 16). Questa fase è molto importante perché il paziente può apprezzare la forma e i volumi dei denti definitivi ed esprimere la propria valutazione: si procederà alla realizzazione del manufatto definitivo solo quando sarà stato raggiunto un risultato condiviso tra paziente, protesista e odontotecnico (foto 17).



Fig 6 Connessione del MUA all'impianto zigomatico.



Fig 7 Impronta pick-up in gesso secondo il Columbus Bridge Protocol.



Fig 8 Provvisorio rinforzato con fibra di vetro.



Fig 9 Consegna provvisori avvittati.



Fig 10 Guarigione dei tessuti molli a 3 mesi.

La riabilitazione protesica definitiva prevede come materiale estetico di rivestimento il composito stratificato in muffola trasparente. Questa tecnica permette di ottenere un triplice vantaggio: mantenimento delle forme e dei volumi precedentemente valutati sul paziente, stratificazione ottimale delle masse per un risultato estetico di eccellenza ed infine un ottimo connubio tra robustezza strutturale e capacità di shock absorption (foto 18-21).

La Tecnica HYBRID ZYGOMA EXTRASINUSALE permette di riabilitare pazienti con gravi atrofie mascellari in una sola seduta chirurgica gestibile ambulatorialmente. Tecniche alternative richiedono più interventi chirurgici e un intervallo di tempo maggiore prima della finalizzazione del caso generando un importante aggravio dei costi e una diminuzione del grado di accettazione del piano terapeutico da parte del paziente.

La difficoltà del presente protocollo è in parte chirurgica, dal momento che l'inserimento degli impianti zigomatici richiede una profonda conoscenza dell'anatomia di pertinenza, e in parte protesica per le necessarie competenze nel trattamento del paziente edentulo che l'operatore deve conoscere.



Fig 11 Impronta in gesso per la realizzazione del definitivo.



Fig 12 Recupero della simulazione estetica del ponte provvisorio (azzurro).



Fig 13 Nuova simulazione estetica con il progetto del ponte definitivo (avorio).



Fig 14/15 Visione occlusale delle arcate con i due progetti sovrapposti.



Fig 18/19 Visione del progetto del framework in accordo con il set-up estetico approvato dal paziente.



Fig 20 Stampaggio in muffola trasparente del composito su framework in titanio realizzato al CAD CAM.

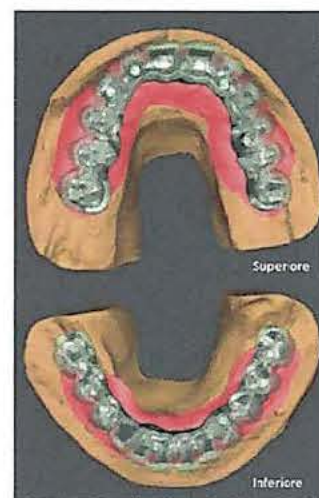


Fig 21 Protesi fissa bimascellare su impianti ultimata.



Fig 22 Risultato estetico finale con la protesi fissa bimascellare su impianti.





## Columbus Bridge Protocol®

### RIABILITAZIONE PROTESICA DEL MASCELLARE GRAVEMENTE ATROFICO: APPROCCIO COMBINATO BIOMECCANICO/ESTETICO

L'utilizzo degli impianti zigomatici nella riabilitazione del mascellare atrofico rappresenta una procedura altamente predicibile con elevato tasso di successo soprattutto se applicata nel carico immediato.

#### CASO CLINICO

Paziente di anni 59, ASA 1, parzialmente edentula da 23 anni. Dopo valutazione intra ed extraorale si procede come da protocollo all'esame CBCT e allo studio 3D per la pianificazione chirurgica e protesica.

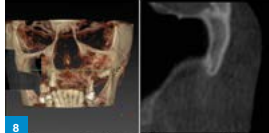
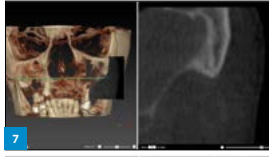
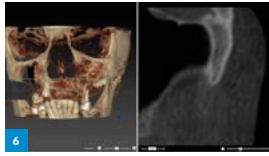
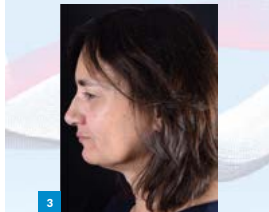
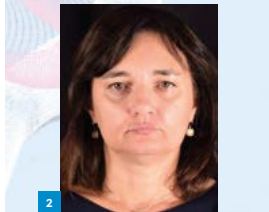
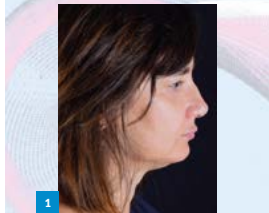
La procedura protesica in 48 ore consente di realizzare un ponte fisso provvisorio mediante impronta di precisione in gesso e rilevazione della DVO in relazione centrica. Il provvisorio a carico immediato (4) segue scrupolosamente i principi del COLUMBUS BRIDGE PROTOCOL®.

La fase finale della riabilitazione protesica viene eseguita mediante Exocad a 12 settimane. Si realizza il Framework in accordo con il progetto estetico definitivo e si procede ai relativi aggiustamenti prima di inviare il file al centro di fresaggio.

L'utilizzo di un impianto tradizionale in posizione pre-maxillare in aggiunta alla tecnica classica del Quad-Zigoma consente di ridurre il cantilever antero-posteriore che si crea con un ancoraggio esclusivamente zigomatico per via dell'conseguenza non solo all'atrofia sinistra del mascellare e della classe scheletrica relativa.

Il progetto estetico finale si basa sui canoni classici dell'estetica in protesi totale per cui la scelta della forma e posizione del gruppo frontale superiore è pianificata secondo i principi della teoria Embriogenetica di Gerber come si evidenzia dal sorriso finale della paziente in armonia con il sorriso della figlia.

In collaborazione con il Laboratorio Odontotecnico Scaglione Luca & Seghesio Piercarlo Santo Stefano Belbo



1-Davó R, Malevez C, Rojas J, Rodríguez J, Regoff J. Clinical outcome of 42 patients treated with 81 immediately loaded zygomatic implants: a 12-to-42 month retrospective study. *Eur J Oral Implantol*. 2008;1:141-150.

2-Davó R, Malevez C, López-Orellana C, Pastor-Bevia F, Rojas J. Sinus reactions to immediately loaded zygomatic implants: a clinical and radiological study. *Eur J Oral Implantol*. 2008;1:53-60.

3-COLUMBUS BRIDGE PROTOCOL Book, Ed Quintessenza 2008

4-Preti G e coll Approccio Biologico del paziente edentulo Ed Quintessenza

5-Wen H, Guo W, Llang R, et al. Finite element analysis of three zygomatic implant techniques for the severely atrophic edentulous maxilla. *J Prosth Dent* 2014;111(3):203-15. <https://www.ncbi.nlm.nih.gov/pubmed/24314571>

6-Romeed SA, Malik R, Dunne SM. Zygomatic implants: the impact of zygoma bone support on biomechanics. *J Oral Implantol* 2014;40(3):231-7. <https://www.ncbi.nlm.nih.gov/pubmed/24914908>

7-Romeed SA, Hays RN, Malik R, Dunne SM. Extranasal zygomatic implant placement in the rehabilitation of the atrophic maxilla: three-dimensional finite element stress analysis. *J Oral Implantol* 2015;41(2):e1-6 <https://www.ncbi.nlm.nih.gov/pubmed/24007531>

8-Korkmaz FM, Korkmaz YT, Yalug S, Korkmaz T. Impact of dental and zygomatic implants on stress distribution in maxillary defects: a 3-dimensional finite element analysis study. *J Oral Implantol* 2012;29(5):557-67 <https://www.ncbi.nlm.nih.gov/pubmed/20925533>

9-Ishak MI, Kadir MR, Sulaiman E, Kasim NH. Finite element analysis of zygomatic implants in intranasal and extramaxillary approaches for prosthetic rehabilitation in severely atrophic maxillae. *Int J Oral Maxillofac Surg* 2013;28(3):e151-60 <https://www.ncbi.nlm.nih.gov/pubmed/23748334>

10-Ishak MI, Abdul Kadir MR, Sulaiman E, Abu Kasim NH. Finite element analysis of different surgical approaches in various occlusal loading locations for zygomatic implant placement for the treatment of atrophic maxillae. *Int J Oral Maxillofac Surg* 2012;41(9):1077-89 <https://www.ncbi.nlm.nih.gov/pubmed/22575179>

11-Freedman M, Ring M, Stassen LF. Effect of alveolar bone support on zygomatic implants in an extra-sinus position-a finite element analysis study. *Int J Oral Maxillofac Surg* 2015;44(6):785-90 <https://www.ncbi.nlm.nih.gov/pubmed/25748609>

12-Akay C, Yalug S. Biomechanical 3-dimensional finite element analysis of obturator protheses retained with zygomatic and dental implants in maxillary defects. *Med Sci Monit* 2015;21:604-11. <https://www.ncbi.nlm.nih.gov/pubmed/25748609>

13-Ujigawa K, Kato Y, Kito Y, et al. Three-dimensional finite element analysis of zygomatic implants in craniofacial structures. *Int J Oral Maxillofac Surg*. 2007; 36(7): p. 620-5 <https://www.ncbi.nlm.nih.gov/pubmed/17517497>



Poster per il Congresso Internazionale di Terapia Implantare, Verona - ottobre 2021



# Ritrattamento implantare chirurgico e protesico full-arch secondo il Columbus Bridge Protocol® mediante la tecnica QUAD zygoma



DR TIZIANO TEALDO



DR MARCO BEVILACQUA



DR CHRISTIAN ALBERTI

In collaborazione con il Laboratorio Odontotecnico Scaglione Luca & Seghesio Piercarlo S.Stefano Belbo



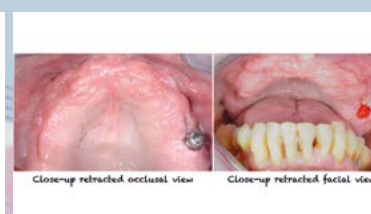
1



4



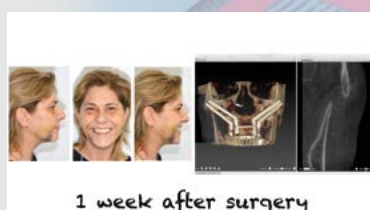
5



3



6



7



8



9



10



11



12

**I bisogni espressi e latenti del paziente nell'era digitale**  
Implantologia e Ortodonzia invisibile





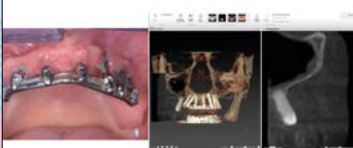


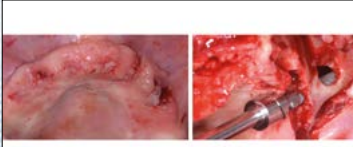
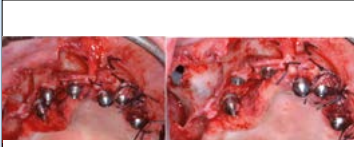



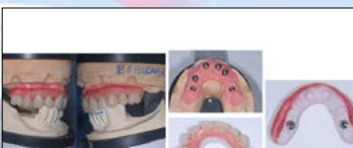
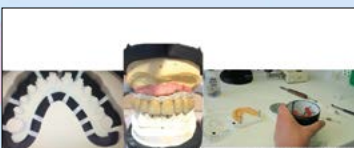
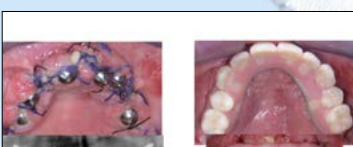

**23° Congresso Internazionale di Terapia Implantare**

**Verona Palazzo della Gran Guardia**

**Nuova data 21 - 22 - 23 Ottobre 2021**



## RITRATTAMENTO IMPLANTARE IMMEDIATO CHIRURGICO E PROTESICO FULL-ARCH SECONDO IL PROTOCOLLO COLUMBUS BRIDGE® MEDIANTE LA TECNICA HYBRID ZYGOMA

<b>1</b>	<p><b>Clinical and testimonial case</b> Female Retired 64 yo Medical History: none ASA I Patient request: fixed rehabilitation "Implant treatment failure"</p> 	<b>2</b>	<p><b>Close-up retracted occlusal view</b></p>  <p><b>Close-up retracted facial view</b></p> 		 <b>DR TIZIANO TEALDO</b>
<b>3</b>		<b>4</b>			 <b>DR MARCO BEVILACQUA</b>
<b>5</b>		<b>6</b>			 <b>DR CHRISTIAN ALBERTI</b>
<b>7</b>		<b>8</b>			<p>In collaborazione con il Laboratorio Odontotecnico Scaglione Luca &amp; Seghesio Piercarlo Santo Stefano Belbo</p>
<b>9</b>		<b>10</b>	 <p style="text-align: right;"><b>Pektkon®</b></p>		
<b>11</b>		<b>12</b>			





**Zygomatic Implants Education Academy**  
presents  
**Il Zygoma Day**  
Grand Hotel Baglioni, Florence  
July 15-16th, 2022

**AUTORI**

DR TIZIANO TEALDO  
DR MARCO BEVILACQUA  
DR CHRISTIAN ALBERTI  
DR FABRIZIO GRIVETTO  
DR FRANCESCO GRECCHI

## Impianti zigomatici e pterigoidei a connessione conometrica e a connessione esagonale interna: osservazioni al microscopio elettronico a scansione dell'interfaccia Fixture - Abutment

Sono state eseguite osservazioni al microscopio elettronico a scansione su impianti pterigoidei e zigomatici da accoppiare ad un moncone conico (caso A) e ad uno esagonale (caso B) con lo scopo di verificarne le caratteristiche morfologiche. In particolare è stata valutata la finitura meccanica delle parti da accoppiare degli impianti e dei monconi e, per quanto osservabile, la qualità dell'accoppiamento risultante tra le parti.

### Materiali e Metodi

La valutazione al microscopio elettronico a scansione (SEM) con modalità detector normale è stata eseguita mediante uno strumento EVO MA 10 (ZEISS).

I parametri salienti dell'analisi (potenziale di accelerazione degli elettroni=EHT, working distance=Wd, ingrandimento=Mag, tipologia di detector=Signal A, data di realizzazione delle immagini) sono riportati direttamente sulle fotografie.

I materiali forniti sono stati sottoposti all'analisi microscopica riducendo al minimo le manipolazioni ed evitando ogni contatto con la superficie.

### Risultati

I principali risultati ottenuti nell'osservazione al SEM sono riportati nelle immagini fornite come singoli files tif.

### IMPIANTI ZIGOMATICI E PTERIGOIDEI A CONNESSIONE CONOMETRICA

L'accoppiamento conico (A) presenta una buona finitura meccanica, la quale dovrebbe garantire clinicamente stabilità e resistenza allo svitamento se sottoposto a cicli masticatori ripetuti.

La qualità delle aree interne, quindi, delle aree di accoppiamento dell'impianto zigomatico e pterigoideo appare buona e adatta all'uso clinico previsto.

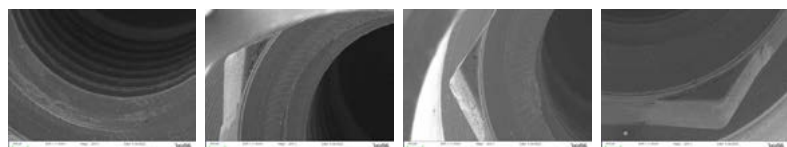
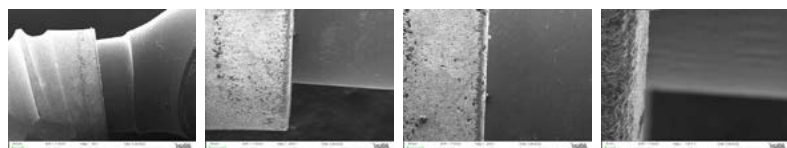
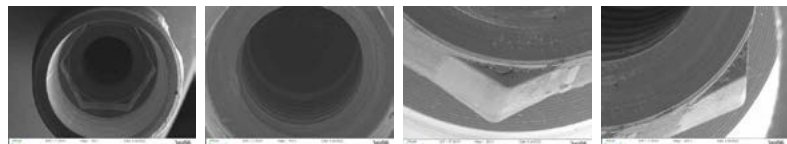
Per quanto possibile osservare dopo avvistamento, l'accoppiamento tra moncone conico e impianto pterigoideo presenta una buona precisione, senza distanze apprezzabili tra le 2 parti.

### IMPIANTI ZIGOMATICI E PTERIGOIDEI A CONNESSIONE ESAGONALE INTERNA

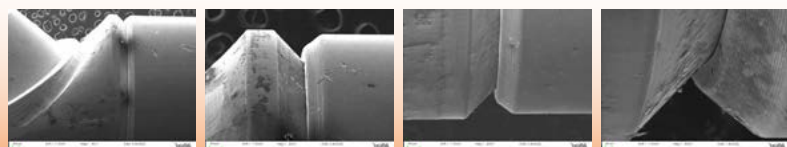
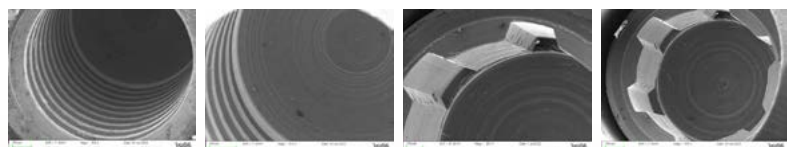
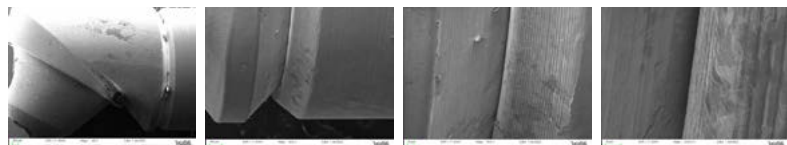
Sia il moncone che gli impianti zigomatici e pterigoidei non presentano particolari difetti di finitura meccanica, del tipo bave ed accumuli di materiale.

Per quanto possibile osservare dopo avvistamento, l'accoppiamento tra moncone e impianti pterigoidei a connessione esagonale interna (B) sembra buono, senza distanze apprezzabili tra le 2 parti o da altre anomalie. La qualità delle aree interne, quindi, delle aree di accoppiamento, analogamente alla connessione conometrica dell'impianto zigomatico e pterigoideo, appare buona e adatta all'uso clinico previsto.

### CARATTERISTICHE MORFOLOGICHE DI SUPERFICIE E DELL'ACCOPIAMENTO DEI MONCONI PROTESICI: IMPIANTI ZIGOMATICI E PTERIGOIDEI A CONNESSIONE CONOMETRICA (A)

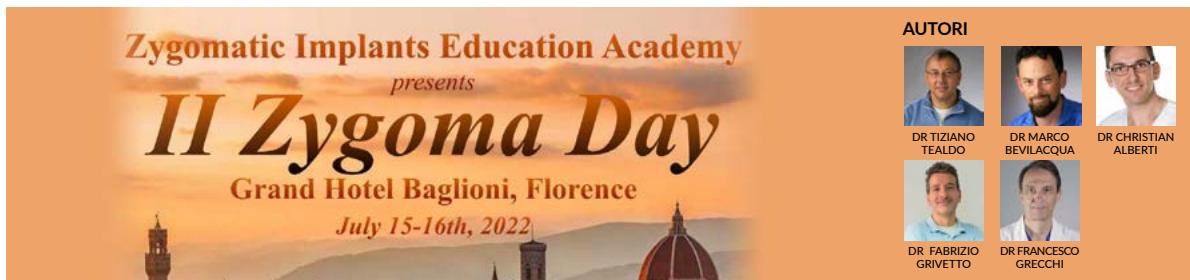


### CARATTERISTICHE MORFOLOGICHE DI SUPERFICIE E DELL'ACCOPIAMENTO DEI MONCONI PROTESICI: IMPIANTI ZIGOMATICI E PTERIGOIDEI A CONNESSIONE ESAGONALE INTERNA (B)



Valutazioni eseguite da:  
Dr.ssa Clara CASSINELLI  
Dr. Marco MORRA

**NOBIL**  
DISTRIBUCIONE



## Zygoma breakdown in a bruxer female patient: surgical & prosthetic management

1. Planing	2. Zygoma FAILURE	3. New PLANING	4. Temporary RESTORATION	5. Final RESTORATION

This case report shows a zygomatic rehabilitation massive breakdown. Bruxism was considered the main factor affecting implant osseointegration. A new maxillary treatment was carried out after one year. The number and the length of supporting implants were enhanced adopting a quad zygoma technique plus a central short implant. Overload was managed by a provisional mandibular overdenture replacing a preexisting fixed bridge. Immediate loading of zygomatic implants can be a safe approach if load is under control.



# Riabilitazione dei mascellari atrofici mediante impianti zigomatici, nasali, pterigoidei e tecnica piezochirurgica: studio clinico osservazionale.

**Le attuali aspettative, estetiche e riabilitative, del paziente adulto**

24<sup>o</sup> Congresso Terapia Implantare e Ortodontica Biomax

22 | 23 | 24 Settembre 2022

VERONA Palazzo della Gran Guardia Piazza Bra 1

**DR TIZIANO TEALDO**

**DR MARCO BEVILACQUA**

**DR CHRISTIAN ALBERTI**

**AUTORI**

**Background:** gli impianti zigomatici sono dispositivi biomedici ideati da P. I. Brånemark negli anni '90 per riabilitare pazienti oncologici che avevano subito maxillectomie; dal 2010 la loro applicazione si è estesa al trattamento delle atrofie mascellari gravi. Gli impianti Nasali e Pterigoidei nelle riabilitazioni full arch mascellari sono spesso utilizzati come ulteriore supporto alla riabilitazione protesica al fine di ottimizzare la distribuzione dei carichi soprattutto in presenza di arcate antagoniste fisse su elementi naturali o su impianti.

**Scopo della ricerca:** lo scopo di questo studio osservazionale è valutare la sopravvivenza implantare e l'incidenza di complicanze delle riabilitazioni mediante impianti zigomatici, pterigoidei, nasali e la soddisfazione dei pazienti con riabilitazioni full-arch a carico immediato.

**Materiali e Metodi:** lo studio è stato sviluppato retrospettivamente raccogliendo i dati clinici di **32 pazienti** trattati da settembre 2021 a giugno 2022 con il protocollo PIEZOCHIRURGICO per la preparazione del sito osseo: in totale sono stati inseriti 28 impianti ZIGOMATICI, 42 PTERIGOIDEI e 18 NASALI (**fase 1**). 7 pazienti sono stati riabilitati mediante 4 impianti zigomatici con protocollo QUAD ZYGOMA, mentre 25 pazienti con un protocollo ibrido che prevedeva da 1 a 3 impianti zigomatici, da 1 a 2 impianti NASALI / PTERIGOIDEI e da 2 a 4 impianti standard. Ciascun caso clinico è stato riabilitato con un minimo di 4 impianti e un massimo di 6. Per ogni paziente sono state analizzate le ortopantomografie pre e post operatorie. Sono stati registrati i fallimenti implantari e le complicanze protesiche riportate nelle cartelle cliniche. Di questi 32 pazienti, **18** sono stati **rivalutati a 6 MESI rimuovendo la protesi fissa avvitata** per valutare la stabilità implantare, la condizione dei tessuti perimplantari ed è stato valutato il design protesico (**fase 2**). A questi 18 pazienti è stato sottoposto un questionario di gradimento della riabilitazione.

**Risultati:** lo studio in esame ha avuto un **follow up di 10 mesi**. I tassi di fallimento implantare sono simili a quelli riportati in letteratura per il campione nella fase 1 e nella fase 2. Sono falliti 2 impianti su 88 presi in esame. I valori di stabilità (2,8%), incidenza di sinusiti (2,8%), condizioni dei tessuti perimplantari e valutazione protesica sono paragonabili a quelli riportati in letteratura per questo tipo di riabilitazione (Tabella 1). È stato inoltre paragonato il gradimento della nuova riabilitazione rispetto alla precedente da parte dei pazienti. Tutti i soggetti hanno confermato un miglioramento della propria qualità di vita.

**Conclusioni:** gli **impianti Zigomatici associati agli Pterigoidei e Nasali** nelle riabilitazioni full arch a carico immediato dei mascellari atrofici, utilizzando la preparazione del sito mediante **Piezochirurgia**, sono dispositivi affidabili con una sopravvivenza implantare paragonabile a quella degli impianti dentali convenzionali. Questa tecnica necessita di un'accurata pianificazione delle fasi chirurgiche e protesiche per garantire un'adeguata predicibilità del risultato clinico relativo alla riabilitazione protesica definitiva.

	Numero	Successo	Complicanze protesiche	Complicanze implantari	Insediamento del carico	Stabilità	Insediamento protesico	Insediamento protesico
Chirurgico 2018	4356	2811	1,30%	2,40%	2%	1%	0,40%	4,0%
Campione nella fase 1	168	32	1,2%	1%	0%	2%	0%	0%
Campione nella fase 2	88	18	0%	1%	0%	1%	0%	2%

**Tabella 1:** Tabella riassuntiva che mette a confronto i risultati della revisione sistematica della letteratura con quelli dello studio osservazionale.

**LEGENDA immagini cliniche:**

- Fig. 1:** possibili combinazioni di utilizzo di impianti zigomatici, pterigoidei e nasali.
- Fig. 2,3,4:** pianificazione con DTXSTUDIO® per l'inserimento anatomicamente corretto nelle aree nasali, zigomatiche e pterigoidee.
- Fig. 5,6,7:** foto intraoperatorie per l'inserimento dell'impianto zigomatico e pterigoideo mediante gli inserti dedicati Escam® con procedura PIEZOCHIRURGICA.
- Fig. 8:** impianto zigomatico Aon® inserito e moncone a connessione conometrica Aon® correttamente orientato e utilizzo di PRGF.
- Fig. 9,10:** immagini viso e sorriso pre e post trattamento.
- Fig. 11,12:** ortopantomografia pre e post operatoria.
- Fig. 13,14:** smontaggio full bridge a 6 mesi relativamente alla FASE 2 dello studio osservazionale.

**BIBLIOGRAFIA**

1. Christiani, S., Sbrana, S., Amis, V., et al. (2016). Survival and Complications of Zygomatic Implants: An Updated Systematic Review. *J Oral Maxillofac Surg* 2016;74(10):1944-54.

2. Christiani, S., Sbrana, S., Amis, V., et al. (2018). Survival and Complications of Zygomatic Implants: An Updated Systematic Review. *J Oral Maxillofac Surg* 2018;76(10):1944-54.

3. Christiani, S., Sbrana, S., Amis, V., et al. (2020). Survival and Complications of Zygomatic Implants: An Updated Systematic Review. *J Oral Maxillofac Surg* 2020;78(10):1944-54.

4. Christiani, S., Sbrana, S., Amis, V., et al. (2022). Survival and Complications of Zygomatic Implants: An Updated Systematic Review. *J Oral Maxillofac Surg* 2022;80(10):1944-54.

5. Christiani, S., Sbrana, S., Amis, V., et al. (2022). Survival and Complications of Zygomatic Implants: An Updated Systematic Review. *J Oral Maxillofac Surg* 2022;80(10):1944-54.

6. Christiani, S., Sbrana, S., Amis, V., et al. (2022). Survival and Complications of Zygomatic Implants: An Updated Systematic Review. *J Oral Maxillofac Surg* 2022;80(10):1944-54.

7. Christiani, S., Sbrana, S., Amis, V., et al. (2022). Survival and Complications of Zygomatic Implants: An Updated Systematic Review. *J Oral Maxillofac Surg* 2022;80(10):1944-54.

8. Christiani, S., Sbrana, S., Amis, V., et al. (2022). Survival and Complications of Zygomatic Implants: An Updated Systematic Review. *J Oral Maxillofac Surg* 2022;80(10):1944-54.

9. Christiani, S., Sbrana, S., Amis, V., et al. (2022). Survival and Complications of Zygomatic Implants: An Updated Systematic Review. *J Oral Maxillofac Surg* 2022;80(10):1944-54.

10. Christiani, S., Sbrana, S., Amis, V., et al. (2022). Survival and Complications of Zygomatic Implants: An Updated Systematic Review. *J Oral Maxillofac Surg* 2022;80(10):1944-54.

11. Christiani, S., Sbrana, S., Amis, V., et al. (2022). Survival and Complications of Zygomatic Implants: An Updated Systematic Review. *J Oral Maxillofac Surg* 2022;80(10):1944-54.

12. Christiani, S., Sbrana, S., Amis, V., et al. (2022). Survival and Complications of Zygomatic Implants: An Updated Systematic Review. *J Oral Maxillofac Surg* 2022;80(10):1944-54.

13. Christiani, S., Sbrana, S., Amis, V., et al. (2022). Survival and Complications of Zygomatic Implants: An Updated Systematic Review. *J Oral Maxillofac Surg* 2022;80(10):1944-54.

14. Christiani, S., Sbrana, S., Amis, V., et al. (2022). Survival and Complications of Zygomatic Implants: An Updated Systematic Review. *J Oral Maxillofac Surg* 2022;80(10):1944-54.

15. Christiani, S., Sbrana, S., Amis, V., et al. (2022). Survival and Complications of Zygomatic Implants: An Updated Systematic Review. *J Oral Maxillofac Surg* 2022;80(10):1944-54.

# Impianti zigomatici e pterigoidei a connessione conometrica e a connessione esagonale interna: osservazioni al microscopio elettronico a scansione dell'interfaccia Fixture - Abutment

Le attuali aspettative, estetiche e riabilitative, del paziente adulto

24<sup>o</sup> Congresso Terapia Implantare e Ortodontica **Biomax**

22 | 23 | 24 Settembre 2022

VERONA Palazzo della Gran Guardia Piazza Bra 1



DR TIZIANO TEALDO



DR MARCO BEVILACQUA



DR CHRISTIAN ALBERTI



**AUTORI**

**Introduzione**

Sono state eseguite osservazioni al microscopio elettronico a scansione su impianti pterigoidei e zigomatici da accoppiare ad un moncone conico e ad uno esagonale con lo scopo di verificarne le caratteristiche morfologiche. In particolare è stata valutata la finitura meccanica delle parti da accoppiare degli impianti e dei monconi e, per quanto osservabile, la qualità dell'accoppiamento risultante tra le parti.

**Materiali e Metodi**

La valutazione al microscopio elettronico a scansione (SEM) con modalità detector normale è stata eseguita mediante uno strumento EVO MA 10 (ZEISS). I parametri salienti dell'analisi (potenziale di accelerazione degli elettroni=EHT, working distance=WD, ingrandimento=Mag, tipologia di detector=Signal A, data di realizzazione delle immagini) sono riportati direttamente sulle fotografie. I materiali forniti sono stati sottoposti all'analisi microscopica riducendo al minimo le manipolazioni ed evitando ogni contatto con la superficie.

**Risultati**

I principali risultati ottenuti nell'osservazione al SEM sono riportati nelle immagini fornite come singoli files tif.

**IMPIANTI ZIGOMATICI E PTERIGOIDEI A CONNESSIONE CONOMETRICA**

La qualità delle aree interne dell'impianto, quindi delle aree di accoppiamento, appare buona e adatta all'uso previsto. Il moncone conico presenta molti difetti di finitura meccanica - bave e accumuli di materiale metallico - soprattutto a livello delle porzioni interne di avvitaamento. Le immagini mostrano in modo molto chiaro frammenti di bave fluttuanti, destinati a staccarsi facilmente a seguito di sollecitazione anche di debole intensità. Sono presenti accumuli di materiale non asportato dall'utensile. Per quanto possibile osservare dopo avvitaamento, l'accoppiamento tra moncone conico e impianto sembra buono, senza distanze apprezzabili tra le due parti.

**IMPIANTI ZIGOMATICI E PTERIGOIDEI A CONNESSIONE ESAGONALE INTERNA**

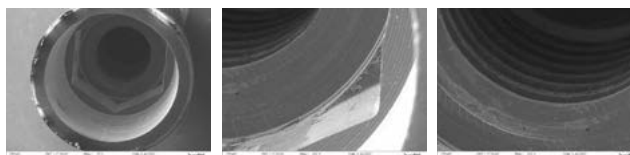
Sia il moncone che gli impianti zigomatici e pterigoidei non presentano particolari difetti di finitura meccanica, del tipo bave ed accumuli di materiale. Per quanto possibile osservare dopo avvitaamento, l'accoppiamento tra moncone e impianti a connessione esagonale interna sembra buono, senza distanze apprezzabili tra le due parti o altre anomalie e pertanto adatta all'uso clinico previsto.

**Conclusioni**

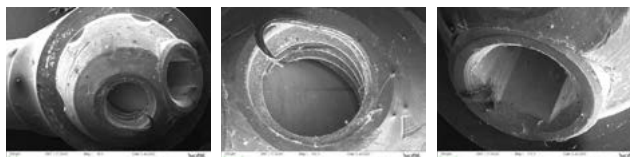
Dall'analisi microscopica si evince che, a prescindere dal tipo di connessione fixture-abutment utilizzata (conometrica o esagonale interna), la bontà di fabbricazione degli impianti e soprattutto degli abutment è fondamentale per l'ottenimento di un perfetto accoppiamento tra le componenti intraossee e protesiche, tra quest'ultime e il bridge e la stabilità delle varie interfacce nel tempo. Appare nondimeno difficile, per il clinico, saggiare la precisione dei dispositivi industriali presenti sul mercato in assenza di strumenti idonei di analisi.

**CARATTERISTICHE MORFOLOGICHE DI SUPERFICIE E DELL'ACCOPIAMENTO DEI MONCONI PROTESICI: IMPIANTI ZIGOMATICI E PTERIGOIDEI A CONNESSIONE CONOMETRICA**

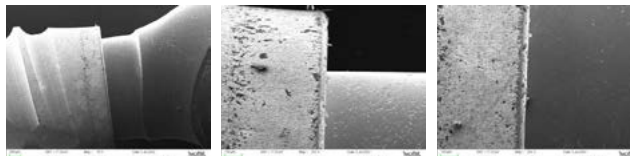
**IMPIANTO**



**MONCONO**

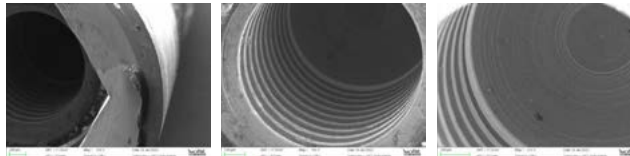


**CONNESSIONE**

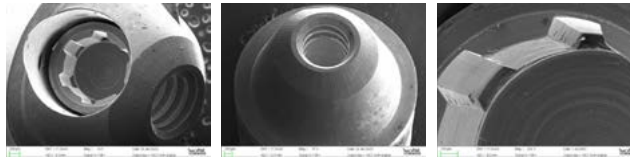


**CARATTERISTICHE MORFOLOGICHE DI SUPERFICIE E DELL'ACCOPIAMENTO DEI MONCONI PROTESICI: IMPIANTI ZIGOMATICI E PTERIGOIDEI A CONNESSIONE ESAGONALE INTERNA**

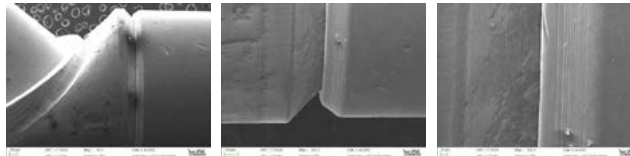
**IMPIANTO**



**MONCONO**



**CONNESSIONE**



Valutazioni eseguite da:  
**Dr.ssa Clara CASSINELLI**  
**Dr. Marco MORRA**





# I 5 step per l'intercettazione e la gestione delle complicanze in implantologia Zigomatica, Nasale e Pterigoidea (ZNP) durante il mantenimento professionale

Le attuali aspettative, estetiche e riabilitative, del paziente adulto

24<sup>th</sup> Congresso Terapia Implantare e Ortodonta Biomax

22 | 23 | 24 Settembre 2022

VERONA Palazzo della Gran Guardia Piazza Bra 1



DR. CONSUELO SANAVIA



DR. EDOARDO VALLERGA



DR. FANNY ALESSI



DR. TIZIANO TEALDO



DR. MARCO BEVILACQUA



DR. CHRISTIAN ALBERTI



AUTORI

## Introduzione

Gli impianti Zigomatici, insieme ai Nasali e Pterigoidei, sono dispositivi alloplastici che si stanno consolidando nel trattamento di pazienti con gravi atrofie mascellari. Queste tecniche non sono prive di complicanze e richiedono una certa esperienza chirurgica, ma al contempo stanno dimostrando un tasso di successo paragonabile alle tecniche convenzionali e per questo sono sempre maggiormente applicate in campo implanto-protetico.

Una recente revisione della letteratura evidenzia che le deiscenze dei tessuti molli, le rinosinusiti e le rotture protesiche sono le complicanze più frequenti (1) e, come viene suggerito da Aparico (2), il controllo della salute sinusale dovrebbe fare parte del programma di mantenimento.

Durante il follow-up si rilevano ipertrofe/iperplasie gengivali, ulcere da decubito, fistole e fessurazioni gengivali orizzontali.

Le alterazioni dei tessuti molli aumentano il rischio di avere una mucosite batterica. La prevenzione e il controllo della mucosite batterica sono di rilevante importanza per scongiurare la perimplantite (3). Studi microbiologici su impianti zigomatici dimostrano una correlazione tra sanguinamento al sondaggio e batteri patogeni parodontali (4). Gli impianti zigomatici presentano una differente anatomia perimplantare in quanto la porzione vestibolare è in relazione solo con tessuti molli e talvolta manca anche l'osso mediale. Questo impedisce l'utilizzo dei parametri parodontali tradizionali ed impone l'uso di una tecnica di sondaggio delicata per non alterare l'adesione desmosomica. Il sondaggio servirà solo a verificare il buon attacco dei tessuti e prevenire le complicanze come suggerito nello studio prospettico di Agliardi (5). La mancanza di gengiva aderente vestibolare e il posizionamento palatale con tecnica intra-sinusale rendono difficoltoso l'esame obiettivo e le manovre igieniche perimplantari quando la protesi è in situ. Malgrado il sondaggio risulti difficile intorno agli ZNP, esso rimane l'unico atto clinico utile ad intercettare l'infiammazione dei tessuti perimplantari.

Considerando invece il complesso implanto-protetico nella sua interezza, un'attenta osservazione del manufatto protesico sarà necessaria per intercettare linee di frattura o usure anomale da segnalare allo specialista. L'esame dell'ATM dovrebbe entrare di routine per intercettare eventuali modifiche occlusali o dolore riferito dal paziente. Chi si occupa del mantenimento potrà fornire utili suggerimenti per la progettazione di accessi idonei al controllo della placca batterica.

Gli autori di questo lavoro, dopo una disamina della letteratura (6) e grazie alla loro esperienza maturata durante una pluriennale collaborazione con chirurghi specialisti in queste complesse riabilitazioni, si propongono di offrire una guida per intercettare le possibili complicanze e mantenere al meglio la salute dei pazienti con ZNP. Questo è il primo step di un lavoro che si propone di stilare protocolli mirati anche al mantenimento professionale e domiciliare dei pazienti con ZNP.

## Obiettivo

Mettere in evidenza gli step e i materiali necessari per effettuare un esame intra ed extra orale completo e utile all'intercettazione delle alterazioni biologiche, protesiche e meccaniche al fine di prevenire le possibili complicanze nei pazienti con grave atrofia ossea sottoposti a tecniche implantoprotesiche avanzate con impianti ZNP.

## Conclusioni

Le riabilitazioni implantoprotesiche con ZNP sono sempre più diffuse e necessitano di nuove conoscenze per gli operatori che si occupano del mantenimento. Le maggiori complicanze sono date dalle alterazioni dei tessuti molli, le rino-sinusiti ed i fallimenti protesici. Al fine di prevenire le complicazioni si richiede un attento esame intra ed extra orale che comprenda il controllo del seno mascellare e dell'ATM, un set di foto iniziali, la palpazione e il sondaggio perimplantare, l'attenta osservazione dei tessuti molli e dei manufatti protesici con l'uso di sistemi ingranditori. Si attendono studi clinici e nuove linee guida dalla comunità scientifica per operare al meglio.

## BIBLIOGRAFIA

- Alexis Solà Pérez, David Pastorino, Carlos Aparicio, Marta Piqueres Neyra, Ruba Samam Khan, Simon Wright, Cemal User Success Rates of Zygomatic Implants for the Rehabilitation of Severely Atrophic Maxilla: A Systematic Review. *Dent J (Basil)* 2022 Aug 12; 166(8):151.
- Aparicio, C., Ozanami, W., Garcia, R., Arredondo, X., Morla, R. and Fortes, V. A Prospective Clinical Study on Titanium Implants in the Zygomatic Arch for Prosthetic Rehabilitation of the Atrophic Edentulous Maxilla with a Follow-Up of 6 Months to 5 Years. *Clinical Implant Dentistry and Related Research*, 2006, 8: 114-122.
- Søren Jespers, Toad Berglundh, Robert Genco, Anne Mette Aas, Koruk Demirel, Jan Derks, Elena Figueroa, Jean Louis Giovannoli, Moshe Goldstein, France Lambert, Alberto Ortiz-Vigón, Ioanna Polyzos, Giovanni E Sahn, Frank Schwarz, Giovanni Serino, Cristiano Tortasi, Nicola U Zitzmann. Primary prevention of peri-implantitis: managing peri-implant mucositis. *J Clin Periodontol* 2015 Apr; 42 Suppl 16:S12-7.
- Al-Nawas, B., Wignner, J., Bender, C., and Wignner, W. Soft tissue critical parameters of the zygomatic implant. *Journal of Clinical Periodontology*, 2004, 31: 497-500.
- E. I. Agliardi, D. Romo, S. Pignatelli, M. de Arango Nohier, P. Maló. Immediate full arch rehabilitation of the severely atrophic maxilla supported by zygomatic implants: a prospective clinical study with minimum follow-up of 6 years. *Int J Oral Maxillofac Surg* 2017 Dec; 46(12):1392-1399.
- Aparicio, C., Manresa, C., Francisco, K., Claros, P., Alánder, J., González-Martín, O. e Albertsson, T. Impianti zigomatici: indicazioni, tecniche e risultati e il codice di successo zigomatico. *Parodontologia* 2014; 66: 41-58.

## I 5 STEP DELLA FASE INTERCETTIVA

L'operatore che si occupa del mantenimento in pazienti trattati con ZNP e protesi provvisorie o definitive deve, come prima cosa, avere a disposizione e visualizzare gli esami radiografici eseguiti dallo specialista dopo la consegna dei manufatti. Questo gli permetterà di conoscere il numero degli impianti utilizzati, la posizione, le connessioni e il tragitto transmucoso.

Esame radiologico post-operatorio a finalizzazione protesica ultimata.



### 1

#### ESAME INTRA/ESTRAORALE E ATM

Esame dell'ATM per click o dolore riferito Fig.1.1

Palpazione dei linfonodi sotto e collo Fig.1.2

Pericuzione digitale extraorale dei seni nasali Fig.1.3

Esame della lingua per eventuali lesioni da trauma

Esame della zona gengiva per eventuali traumi masticatori

Osservazione e palpazione del palato e della musca masticatoria

Osservazione e palpazione del forame, dolore riferito alla palpazione, presenza di fistole o suppurazioni Fig.1.4 e 1.5

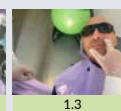
Alitosi persistente riferita o percepita dall'operatore



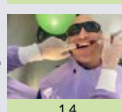
1.1



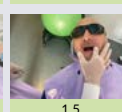
1.2



1.3



1.4



1.5

### 2

#### OSSERVAZIONE DEI TESSUTI MOLLI E DEL TRAGITTO TRANSMUCOSO CON INGRANDITORI

Segni di decubito Fig.2.1

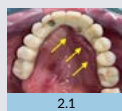
Fenestrazione Fig.2.3

Ipertrafia Fig.2.4

Fistola Fig.2.5

Deiscenza Fig.2.6

Materiali: set attore ortografico, garza, ingranditori ottici Fig.2.7



2.1



2.2



2.3



2.4



2.5



2.6



2.7

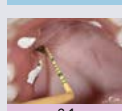
### 3

#### STIMOLAZIONE DEI TESSUTI MUCOSI CON SONDE C/O DIGITALE SOTTO INGRANDITORI

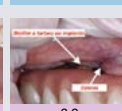
Sondaggio delicato con sonda flessibile per il controllo del sigillo mucosale e BpF Fig.3.1

Presenza di biofilm e tartaro Fig.3.2-3.5

Digitipressione apico/coronale dei tessuti perimplantari per rilevare la presenza di essudato e/o suppurazione Fig.3.4



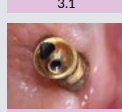
3.1



3.2



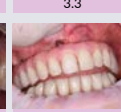
3.3



3.4



3.5



3.6

### 4

#### ESAME DELLE STRUTTURE PROTETICHE CON INGRANDITORI

Usura occlusale Fig.4.1

Chipping Fig.4.2-4.4

Linee di frattura Fig.4.5

Mobilità orizzontale e verticale Fig.4.6

Verifica accesso igienico Fig.4.7



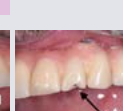
4.1



4.2



4.3



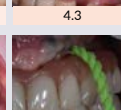
4.4



4.5



4.6



4.7

### 5

#### FOTOGRAFIE INIZIALI

Si consiglia un set fotografico completo con prototipo definitivo a TO per il monitoraggio nel tempo dei tessuti e del manufatto protesico Fig.5.1-5.3



5.1



5.2



5.3

# Riabilitazione implantoprotetica mediante impianti Uniplant® e impianti pterigoidei nel ritrattamento del mascellare moderatamente atrofico

Le attuali  
aspettative,  
estetiche e  
riabilitative,  
del paziente  
adulto

24<sup>o</sup> Congresso Terapia  
Implantare e Ortodontica  
Biomax

22 | 23 | 24  
Settembre  
2022

VERONA  
Palazzo della  
Gran Guardia  
Piazza Bra 1

DR. TIZIANO  
TEALDO

DR. MARCO  
BEVILACQUA

DR. CHRISTIAN  
ALBERTI

LUCA  
SCAGLIONE

PIERCARLO  
SEGHESSIO

AUTORI

## CASO CLINICO

Ritrattamento full-mouth in paziente Asa 1 con dentatura terminale e fallimenti implantari. In questi casi clinici è indispensabile seguire un protocollo validato (EVIDENCE BASED DENTISTRY) nelle sue fasi chirurgiche e protesiche garantendo un supporto biomeccanico adeguato.

**Il COLUMBUS BRIDGE PROTOCOL ci garantisce una percentuale di successo sovrapponibile al carico differito in questi casi di elevata complessità chirurgico-protesica.**

Le immagini extraorali della paziente indicano una perdita della dimensione verticale di occlusione (Fig. 1-2) e del sostegno del labbro superiore. L'ortopantomografia e la visione intraorale a tempo 0 confermano la non predicibilità protesica degli elementi residui. La terapia proposta prevede l'estrazione degli elementi dentari residui e l'inserimento implantare post estrattivo con riabilitazione full arch "Columbus Bridge" superiore e inferiore (Fig. 3-4).

La pneumatizzazione moderata di entrambi i seni mascellari (Fig. 5-6-7) necessita di un appoggio distale per evitare cantilever di almeno 2 elementi per ogni quadrante che rappresenterebbero un potenziale fattore di rischio protesico. Vengono pertanto inseriti 2 impianti distali pterigoidei (Noris Medical) da 20 mm e 4 impianti Uniplant (Biomax) da 13 mm per 4.5 mm di diametro in regione pre-maxillare. Questi impianti, grazie al loro macrodesign, garantiscono elevata stabilità negli alveoli post estrattivi, permettendo di seguire il protocollo di carico immediato senza precludere il raggiungimento dell'osseo-integrazione (Fig. 8-9-10-11-12-13-14-15).

Le fasi protesiche di laboratorio (Fig. 16-17-18), per la realizzazione del framework permanente, sono progettate in ambiente EXOCAD. Lo spazio intermascellare, la distanza interimplantare, l'altezza dei canali mucosi sono valutati e progettati al CAD, comprese le ritenzioni e i supporti per il composito di rivestimento utilizzato secondo la tecnica della stratificazione incrementale in muffola trasparente. I volumi protesici disponibili ci indicano come scelta di elezione il titanio fresato al CAM per la sua elevata biocompatibilità nel contatto mucosa-bridge, il basso peso specifico, la resistenza e l'adesione metallo-composito (Fig. 19-20-21-22-23).

L'ortopantomografia di controllo finale (Fig. 24) e la CBCT (Fig. 25-26) evidenziano la corretta distribuzione full arch degli impianti intra ed extraorali, la corretta morfologia del framework e il fit sui sei pilastri conici avvitati sugli impianti Uniplant e Noris Pteryfit. Nelle visioni sagittali destra e sinistra è possibile osservare l'inclinazione reale mesio-distale dei due impianti extramascellari distali da 20 mm ancorati nei processi pterigoidei dello sfenoide.

Nella Fig. 27 è possibile apprezzare il risultato della riabilitazione definitiva e il nuovo sorriso della paziente.











EDIZIONE SPECIALE

2023

05 —

— 06

07 —

OTTOBRE

VERONA

PALAZZO DELLA GRAN GUARDIA

PIAZZA BRA 1

www\_biomax\_it

25<sup>X</sup>

Congresso di Terapia Implantare e Ortodontica Biomax

AUTORI



DR TIZIANO TEALDO



DR MARCO BEVILACQUA



DR CHRISTIAN ALBERTI



DR FEDERICO GELPI



DR PIETRO MONTAGNA



DOT ROBERTO LAZZARI

## FACIAL EPITHESES

### A TREATMENT SOLUTION FOR POST ONCOLOGICAL RESECTIVE SURGERY

#### AIM

To report the case of a patient who received facial reconstruction through a nasal epithesis after ablation of midface vestibulo nasal squamous cell carcinoma.

#### METHODS

Ablative surgery of the midface region glabella area of the frontal bone, the upper part of the right and left side of the alveolar crest, and the lateral side of the maxillary bone, which forms the left lateral wall of the nose, respectively, was performed.

#### RESULTS

After a 4 months healing period, the defect was imprinted with polyvinylsiloxane impression material (Technovent CoForm Hard and Soft Impression Material).

The M517 CoForm Soft shows a Hardness Shore A10, while M518 CoForm Hard shows a Hardness Shore A50. The final epithesis was delivered in few dates. Epithesis was anchored to the edges of residual skin and bone structures; it provides retention and stability.

Otherwise nasal or zygomatic implants could improve individually stability. At the control examinations after 1, 3, 6 respectively, there were no signs of recurrence of the tumor or any complications related to the epithesis.

#### CONCLUSIONS

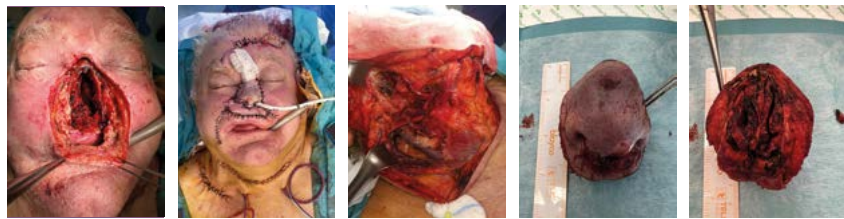
In elder midface oncological ablation patients, epithesis represents a valid and reliable rehabilitation after the ablation surgery. This represents the pinnacle of dental prosthetic rehabilitations: in few dates patient could be treated in our clinical dental box, too. Nowadays only 4 centers are accredited as anaplastologist reference facilities in Italy.

#### KEY WORDS

Extraoral implants, zygomatic implants, nasal implants, epithesis, post oncological rehabilitation, oncological ablation surgery.



### SURGICAL CLINICAL CASE



### PROSTHETIC CLINICAL CASE



2023

EDIZIONE SPECIALE

05 —  
— 06  
07 —  
OTTOBRE

www\_biomax\_it

**25** X

Congresso di Terapia Implantare e Ortodontica Biomax

Celebriamo con voi la **Venticinquesima Edizione del Congresso** e siamo lieti di avervi come nostri graditissimi ospiti, pertanto **il congresso è gratuito per tutti.**

# Il ripristino delle funzioni orofacciali

L'EVOLUZIONE DELLA PROFESSIONE ODONTOIATRICA

V  
E  
R  
O  
N  
A

PALAZZO DELLA GRAN GUARDIA  
PIAZZA BRA 1

## Impianti zigomatici e pterigoidei nel trattamento del mascellare atrofico

Relatori

**Tiziano Tealdo - Christian Alberti - Roberto Cappè**

Verona, sabato 7 ottobre 2023 - ore 9.00/12.30

I pazienti stanno cambiando e i dentisti si devono confrontare sempre più spesso con **casi limite, dentature in fase terminale** o veri e propri ritrattamenti implantoprotesici complicati e complessi. Il workshop presenterà delle **tecniche chirurgiche d'avanguardia, predicibili e ripetibili.**

**PROGRAMMA DEL WORKSHOP**

- Introduzione con cenni di anatomia
- Tecniche riabilitative in implantologia zigomatica e pterigoidea
- Odontoiatria legale e forense in implantologia avanzata
- Prove cliniche hands on su modello anatomico

05 —  
GIOVEDÌ

06 —  
VENERDÌ

07 —  
SABATO

03  
MAR — 12/21  
TIZIANO TEALDO  
CHRISTIAN ALBERTI  
ROBERTO CAPPÈ  
IMPIANTI ZIGOMATICI E PTERIGOIDEI NEL TRATTAMENTO DEL MASCELLARE ATROFICO



Poster per Congresso San Giovanni in Fiore - Maggio 2023



**COIRIS** CENTRO  
ODONTOIATRICO

Sede  
del  
corso

Studio Dr. Rizzuto  
Via Roma 135  
SAN GIOVANNI IN FIORE

# LA METODICA FR

DALLE BASI SCIENTIFICHE  
ALLA REALIZZAZIONE CLINICA

---

**12-13**  
MAGGIO 2023

Relatori  
**Tiziano TEALDO**  
**Christian ALBERTI**

CORSO TEORICO-PRATICO

Prof. Tiziano **Tealdo**  
Dr. Christian **Alberti**



Corso di Chirurgia avanzata

## “Riabilitazioni protesiche su pazienti con gravi atrofie ossee”

VERRANNO TRATTATI 8 PAZIENTI CON IMPIANTI ZIGOMATICI E PTERIGOIDEI E RIABILITATI CON COLUMBUS BRIDGE A CARICO IMMEDIATO.

**24-25**  
**NOVEMBRE**  
**2023**

SEDE  
CENTRO ODONTOIATRICO ESSEPIORAL  
VILLA SAN GIOVANNI (RC)

Poster per Congresso Alba (CN) - Febbraio 2024



## INTERNATIONAL COURSE

### Immediate Loading on Full Arch: a Valuable Option

16-17 February 2024  
Alba (CN), Italy



DR TIZIANO  
TEALDO



DR MARCO  
BEVILACQUA



DR CHRISTIAN  
ALBERTI



DR FEDERICO  
GELPI



Brought To You By

 **ZimVie**  
Institute

LIVE SURGERY & LECTURE



# HAOMS 2024

από την Αναλογική στην Ψηφιακή εμφυτευματολογία  
**ΑΙΣΘΗΤΙΚΕΣ ΚΑΙ ΛΕΙΤΟΥΡΓΙΚΕΣ  
 ΑΠΟΚΑΤΑΣΤΑΣΕΙΣ ΣΤΗΝ ΠΕΡΙΟΧΗ ΣΤΟΜΑΤΟΣ  
 ΓΝΑΘΩΝ ΠΡΟΣΩΠΟΥ**

**Full arch Prosthetic Solutions for Medium  
 to Severe Maxillary Atrophic Cases  
 Utilizing Various Implant Approaches**

DR TIZIANO TEALDO



DR CHRISTIAN ALBERTI



**26 - 27  
 Ιανουαρίου  
 2024**



**Crowne Plaza Hotel, Αθήνα**

Οργάνωση



**ΕΛΛΗΝΙΚΗ ΕΤΑΙΡΕΙΑ  
 ΣΤΟΜΑΤΙΚΗΣ ΚΑΙ  
 ΓΝΑΘΟΠΡΟΣΩΠΙΚΗΣ  
 ΧΕΙΡΟΥΡΓΙΚΗΣ**

Γραμματεία Οργάνωσης Συνεδρίου



info@mk-premium.com, Tel. +357 99812240  
 Tel. +30 2310226250, www.mk-premium.com





# 26<sup>x</sup>

CONGRESSO DI TERAPIA  
IMPLANTARE E ORTODONTICA

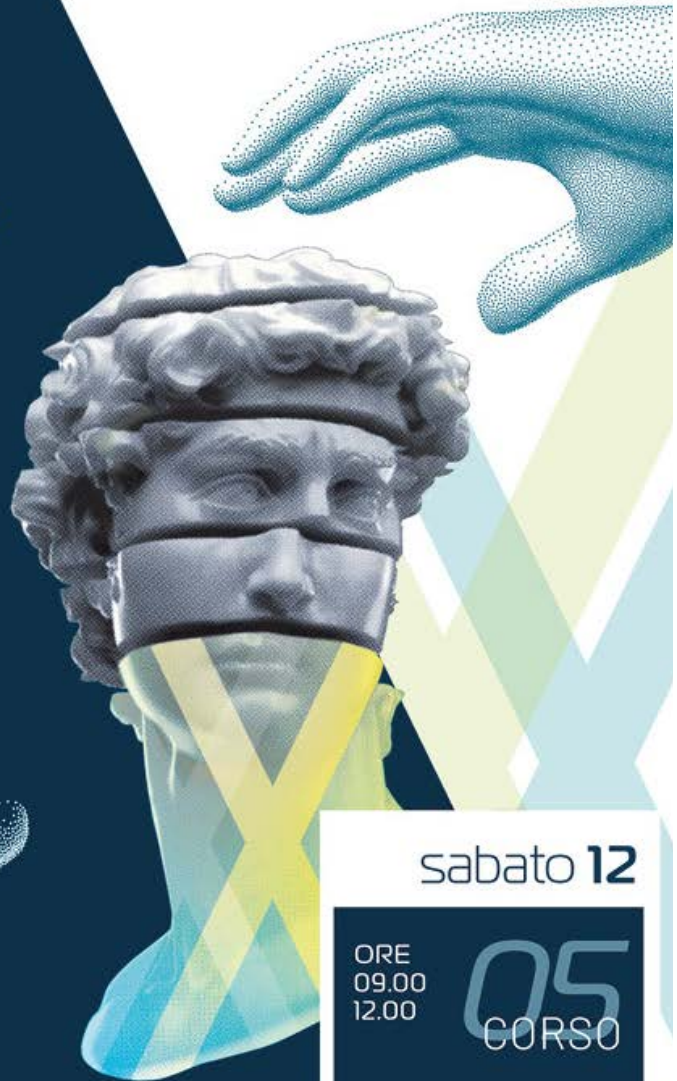
Il trionfo della  
multidisciplinarietà:

**INCLUDERE,  
PREVENIRE,  
CURARE**

## Verona

PALAZZO DELLA GRAN GUARDIA  
PIAZZA BRA, 1

**X BIOMAX**  
avere cura



10 ———  
———— 11  
12 ———  
OTTOBRE  
2024

sabato 12

ORE  
09.00  
12.00

05  
CORSO

MODERATORI  
KARIM LOUMI  
FRANCESCO MARANGIO

Tutto quello che  
vorreste sapere sui  
mezzi digitali nella  
riabilitazione di  
casi complessi e dei  
ritrattamenti

TIZIANO TEALDO  
CHRISTIAN ALBERTI



## Attività corsistica e congressuale

1997				
1	16 Maggio	Verona	<b>Fusione e precisione</b>	Dott. Andrea Maleci
1998				
2	28 Gennaio	Milano	<b>Attacchi dentali e metallurgia</b>	Cendres & Metalux Italia
3	29 - 30 Maggio	Bassano del Grappa, Vicenza	<b>La ricostruzione morfologica e funzionale delle creste mascellari atrofiche</b>	Dott. Paolo Toscano
1999				
4	01 Marzo	Bassano del Grappa, Vicenza	<b>Diploma di Soccorritore</b>	Associazione Italiana Soccorritori
2000				
5	18 Marzo	Padova	<b>Terapia parodontale ricostruttiva</b>	Dott. Andrea Chierico D.ssa Zeina Majzoub Dott. Paolo Vigolo
6	21 Ottobre	Asolo, Torino	<b>Il contributo del Logopedista nella gestione della salute del cavo orale della persona anziana istituzionalizzata</b>	Dott. Gino Redigolo Ing. Silvio Zanus
7	26 - 27 - 28 Ottobre	Bologna	<b>Distraction Osteogenesis of the Facial Skeleton</b>	Dott. Roberto Cocchi
8	25 Novembre	Caerano di S. Marco, Treviso	<b>Nuove prospettive in terapia odontoiatrica: materiali e tecniche.</b>	Prof. Giuseppe Ferronato
9	29 Novembre	Bassano del Grappa, Vicenza	<b>Corso BLS esecutore categoria B</b>	Dott. Maurizio Rizzon L.P. Girolamo Simeoni
10	07 Dicembre	Torino	<b>PHTLS Advanced Provider Course</b>	Dott. Alberto Adducci A.F.D. Stefania Moio
2001				
11	21 - 24 Febbraio	Venezia	<b>3<sup>rd</sup> World Congrress of Osseointegration</b>	Prof. G.A. Favero Prof. N.P. Lang - Prof. J. Lindhe
12	22 Aprile	Bassano del Grappa, Vicenza	<b>Corso di primo soccorso ed educazione sanitaria</b>	Croce Rossa Italiana
13	04 - 05 - 06 Ottobre	Udine	<b>Orthognathic Surgery</b>	Prof. Massimo Politi
14	23 - 24 Novembre	Monselice, Padova	<b>Tecniche di ricostruzione nei tumori della testa e del collo</b>	Dott. Francesco Lunghi

2002				
15	15 - 16 Novembre	Castelfranco Veneto, Treviso	<b>Corso teorico-pratico di chirurgia implantologica con rialzo del seno mascellare</b>	Prof. Ferronato Giuseppe Prof. Giampiero Cordioli Dott. Sergio Dovigo
16	30 Novembre	Como	<b>L'impiego del Medpor nelle ricostruzioni cranio facciali</b>	Dott. Paolo Ronchi Dott. Ernesto Padula
2003				
17	15 Gennaio	Bassano del Grappa, Vicenza	<b>Corso di rianimazione cardiopulmonare e defibrillazione precoce per operatori sanitari</b>	Istruttore BLS Bordignon Emanuela
18	28 - 31 Maggio	Vicenza	<b>XIII Congresso Nazionale SICMF</b>	Dott. Ernesto Padula
19	31 Agosto	Mestre, Venezia	<b>Corso Advances in Heand and Neck Cancer</b>	Dott. Francesco Lunghi
20	06 Settembre	Bassano del Grappa, Vicenza	<b>Ruolo di logopedista nello squilibrio muscolare orofacciale in età evolutiva</b>	Dott. Aurelio Levrini Dott.ssa Laura De Toffol Log. Pasqualina Andretta
21	11-13 Dicembre	Verona	<b>Predicibilità nelle ricostruzioni maxillo-facciali con o senza biomateriali e stato dell'arte nelle grandi ricostruzioni</b>	Prof. Daniel Buser
2004				
22	24 Gennaio	Padova	<b>L'evoluzione delle tecniche chirurgiche a supporto dell'ortodonzia</b>	Dott. Matteo Chiapasco
23	17 Aprile	Monastier di Treviso, Treviso	<b>Giornata di chirurgia orale</b>	Prof. Gian Antonio Favero Dott. Giovanni Mazzolen Dott. Claudio Boato Dott. Amedeo Zirilli
24	15 Maggio	Mestre, Venezia	<b>Pianificazione e realizzazione sinergica nella riabilitazione Implantoprotesica</b>	Dott. Fabio Caine
25	17 - 18 Settembre	Como	<b>Terapia delle II Classi: ortopedia, ortodonzia, chirurgia</b>	Dott.ssa Patrizia Luzzi
26	02 Ottobre	Padova	<b>Simposio Internazionale di chirurgia dell'orbita e della cavità anoftalmica</b>	Dott. Dario Surace
27	14 - 16 Ottobre	Venezia	<b>4<sup>th</sup> World Congress of Osseointegration</b>	Prof. Gian Antonio Favero Prof. Massimo Simion



28	20 Novembre	Limena, Padova	<b>Approcci non convenzionali alle disfunzioni temporo mandibolari</b>	Prof. Ferronato Giuseppe Prof. Giampiero Cordioli Dott. Sergio Dovigo Dott. Guarda Nardini Luca
29	21 Novembre	Padova	<b>Il paziente disfunzionale e ortodontico-chirurgico</b>	Dott. Luca Guarda Nardini Dott. Redento Peretta Dott. Dario Urzi
30	25 - 26 Novembre	Verona	<b>Trattamento dei linfonodi regionali nei tumori della testa e del collo: problemi e controversie.</b>	Dott. Franco Barbieri
<b>2005</b>				
31	05 Febbraio	Due Carrare, Padova	<b>Programma Nazionale per la formazione continua degli operatori della sanità. seminario di chirurgia maxillo-facciale.</b>	Dott. Luigi Clauser
32	10 Febbraio	Bassano del Grappa, Vicenza	<b>Analisi biomeccanica del movimento</b>	Dott.ssa Cristina Smiderle
33	05 Marzo	Legnago, Verona	<b>Traumatologia dentaria e maxillo-facciale</b>	Dott.ssa Antonella Vecchi
34	08 Aprile	Treviso	<b>La chirurgia pre-protetica ambulatoriale dei mascellari superiori</b>	Prof. Pier Francesco Nocini Dott. Daniele De Santis
35	02 Maggio	Padova	<b>Svuotamenti latero-cervicali</b>	Prof. Giuseppe Ferronato
36	04 Maggio	Ferrara	<b>Fissazione rigida 2005 c on intervento live</b>	Prof. J.F. Hoenig
37	06 Maggio	Bassano del Grappa, Vicenza	<b>La contenzione in geriatria: limite o risorsa?</b>	Dott. L. Marinangeli
38	07 Maggio	Vicenza	<b>Tecniche e tecnologie per la personalizzazione del trattamento implantoprotesico</b>	Dott. Castellucci
39	13 Maggio	Cittadella, Padova	<b>Il seno mascellare: in odontoiatria più nostro di prima.</b>	Dott. Roberto Ferro
40	14 Maggio	Limena, Padova	<b>2° One Implant Day</b>	
41	23 Maggio	Vicenza	<b>Corso di aggiornamento in microchirurgia ricostruttiva</b>	Dott. Ernesto Padula
42	06 Giugno	Padova	<b>Chirurgia plastica ricostruttiva ed estetica della regione orbito-palpebrale</b>	Dott. Luigi Chiarelli

43	9 - 10 - 11 Giugno	Parma	<b>XIV Congresso Nazionale della società italiana di chirurgia maxillo-facciale</b>	Relatori vari
44	20 Giugno	Padova	<b>La chirurgia ricostruttiva pre-protetica: multiple metodologiche a confronto.</b>	Dott. Philip J. Pandolfi
45	04 Giugno	Padova	<b>La chirurgia ricostruttiva in traumatologia cranio-maxillo-facciale</b>	Dott. Umberto Zanetti
46	04 Giugno	Padova	<b>Osteogenesi distrazionale in chirurgia cranio-maxillo facciale</b>	Dott. Umberto Zanetti
47	15 - 17 Settembre	Bassano del Grappa, Vicenza	<b>Convegno la chirurgia endoscopica rino sinusale IV corso di chirurgia in diretta</b>	Dott. Paolo Agostini
48	21 Ottobre	Bassano del Grappa, Vicenza	<b>La riabilitazione implantoprotesica: tecniche predicibili di chirurgia e protesi avanzata.</b>	Dott. Roberto Cocchetto Dott. Paolo Toscano Dott. Federico Hernandez Alfaro Dott. Andrea Chierico
49	19 Dicembre	Bassano del Grappa, Vicenza	<b>Corso di informazione/formazione sui rischi specifici, sorveglianza sanitaria, sorveglianza fisica a personale in frequenza equiparato al dipendente ed ai lavoratori autonomi, occupati presso Ospedale S. Bassiano in applicazione Art.7 del D.Lgs 626/94 e S.M.I. ed Art.10 del D.m. 363/98</b>	Per. Ind. Emiliano Bazzan
<b>2006</b>				
50	25 Marzo	Modena	<b>Corso di perfezionamento in posturologia clinica</b>	Prof. Ugo Consolo
51	26 - 27 Maggio	Trieste	<b>Aesthetic Rhinoplasty and Functional Rhinoplasty in Secondary Treatment of Cleft Patients</b>	Dott. Francesco Manna
52	29 Maggio	Bassano del Grappa, Vicenza	<b>Le infezioni ospedaliere in chirurgia: epidemiologia e linee guida.</b>	Dott. Guglielmo Breda
53	29 Maggio	Bassano del Grappa, Vicenza	<b>Le infezioni ospedaliere in chirurgia: l'implementazione delle linee guida nella pratica clinico assistenziale.</b>	Dott. Guglielmo Breda
54	31 Maggio	Udine	<b>Gestione del rischio clinico in ortognatodonzia e chirurgia ortognatica</b>	Dott. Moreno Lirutti
55	16 Giugno	Padova	<b>Traumatologia maxillo-facciale aspetti clinico-diagnostici e medico-legali della traumatologia dento-maxillo-facciale</b>	Dott. Umberto Zanetti

56	19 Giugno	Padova	<b>La ricostruzione del padiglione auricolare</b>	Prof. Giuseppe Ferronato
57	23 Giugno	Padova	<b>Sviluppo e crescita cranio-facciale: diagnosi e programmazione del trattamento in ortognatodonzia.</b>	Prof. Lorenzo Favero
58	26 Giugno	Padova	<b>Sarcomi della testa e del collo in età pediatrica</b>	Prof. Giuseppe Ferronato
59	07 - 08 - 09 Settembre	Treviso	<b>6<sup>th</sup> SVO International Conference on Head and Neck Cancer</b>	Prof. Ashok R. Shaha Prof. Gregorio Babighian Dott. Francesco Lunghi Dott. Roberto Spinato
60	27 - 30 Settembre	Abano Terme, Padova	<b>La condivisione di metodi consolidati per l'ottenimento del successo estetico implantare</b>	Dott. Ernesto Valdesolo
61	07 Ottobre	Bassano del Grappa, Vicenza	<b>Il percorso diagnostico, terapeutico e assistenziale della persona con ulcere degli arti inferiori nell'Azienda ULSS n°3</b>	Relatori vari
62	18 Novembre	Modena	<b>Success by design: integrating biology new implant designs and esthetics in simplified and complex therapy.</b>	Dott. Henry Salama Dmd
63	18 Novembre	Modena	<b>Il successo in estetica nei casi semplici e complessi</b>	Dott. Henry Salama Prof. Ugo Consolo
64	14 Dicembre	Bassano del Grappa, Vicenza	<b>La gestione della persona con dolore: aspetti clinici e relazionali.</b>	Dott. Pietrobon Francesco
<b>2007</b>				
65	20 Gennaio		<b>Indicazioni e programmazione del trattamento ortodontico-chirurgico</b>	Prof. Giuseppe Ferronato Prof. Redento Peretta
66	24 Gennaio	Limena, Padova	<b>Occlusione, equilibrio e postura: realtà, miti e inganni.</b>	Meeting and Service Club
67	14 Febbraio	Ferrara	<b>L'approccio coronale nella patologia dell'ATM</b>	Prof. Paolo Toscano
68	15 - 17 Febbraio	Venezia Lido	<b>5<sup>th</sup> World Congress of Osseointegration</b>	Prof. G.A. Favero Prof. M. Simion
69	24 Febbraio	Vicenza	<b>Guidare il futuro con protocolli creativi ed altamente estetici</b>	Dott. H. Salama
70	31 Marzo	Cavenago Brianza, Monza Brianza	<b>Tecniche semplificative nella chirurgia preimplantare dei mascellari atrofici</b>	Dott. Alejandro Padros Fradera Dott. Francesco Epifani

71	13 Aprile	Bassano del Grappa, Vicenza	<b>Incontri oftalmologici bassanesi</b>	Dott. Salvatore Carlantini Dott. Giovanni Rappo
72	05 Maggio	Milano	<b>Consensus conference sul carico immediato</b>	Dott. Tiziano Testori
73	14 Maggio	Bassano del Grappa, Vicenza	<b>Scienza e tecnologia a servizio dello sport</b>	Dott. Guglielmo Stecchini
74	20 - 23 Giugno	Bologna	<b>XV Congresso Nazionale della società italiana di chirurgia maxillo-facciale</b>	Relatori vari
75	20 - 22 Settembre	Verona	<b>Convergenze operative cliniche e tecnologiche per un moderno piano di trattamento implantare</b>	Dott. Ernesto Valdesolo
76	27 Settembre	Bassano del Grappa, Vicenza	<b>Il dolore toracico e l'infarto</b>	Dott. Ivan Gallio
77	29 Settembre	Ferrara	<b>Reconstructive Surgery after Oncologic Resection of the Cranio Maxillofacial Skeleton</b>	Prof. Julio Acero Prof. Luigi Clauser
78	19 - 20 Ottobre	Verona	<b>Progettare e realizzare il successo in terapia implantare utilizzando metodiche attuali e innovative</b>	Prof. Pier Francesco Nocini
79	03 Dicembre	Mestre, Venezia	<b>La chirurgia delle palpebre</b>	Dott. Leonardo Priore
<b>2008</b>				
80	17 Gennaio	Bassano del Grappa, Vicenza	<b>Come funziona la comunicazione che porta a capirsi</b>	Dott.ssa Antonella Mosele
81	29 Marzo	Monastier di Treviso, Treviso	<b>Terapia parodontale e rigenerazione ossea nella chirurgia implantare</b>	Dott. Gianfranco Dotto
82	19 Aprile	Vicenza	<b>Sviluppo del sito e posizionamento Implantare nei casi complessi: principi e tecniche.</b>	Dott. Tiziano Testori Dott. Giovanni La Scala Dott. Paolo Toscano Dott. Vittorio Ferri Dott. Domenico Beldi
83	17 Maggio	Agrate Brianza, Monza Brianza	<b>Chirurgia implantare guidata: una sfida per il team.</b>	Relatori vari
84	21 Giugno	Padova	<b>Dalla chirurgia alla protesi per un risultato di successo: una visione interdisciplinare.</b>	Relatori vari
85	18 Ottobre	Padova	<b>12° Workshop di implantologia computer assistita</b>	Prof. G. Ferronato Dott. G. Schirolì Dott. S. Fabbro



2009				
86	07 Maggio	Bassano del Grappa, Vicenza	<b>Chirurgia tiroidea e chirurgia oncologica: cavo orale-orofaringe.</b>	Dott. Luigi Barzan
87	26 Settembre	Treviso	<b>L'aspetto protesico come guida all'Implantologia</b>	Relatori vari
88	21 Ottobre	Bassano del Grappa, Vicenza	<b>Basic Life Support Defibrillation Tipo B Esecutore BLS-D secondo linee guida internazionali (IRC)</b>	Dott. Marconi Fabio Inf. Moro Gabriele
89	23 - 24 Ottobre	Verona	<b>Implantologia osteointegrata: evidenze cliniche e prospettive future.</b>	Relatori vari
90	14 Novembre	Padova	<b>Simposio avanzato: aggiornamenti in chirurgia maxillo-facciale.</b>	Prof. Giuseppe Ferronato Dott. Stefano Fusetti
91	28 Novembre	Padova	<b>L'ausilio del computer in Implantoprotesi: dal software diagnostico al Cad-Cam.</b>	Dott. Giuseppe Luongo
2010				
92	05 Marzo	Bologna	<b>XVI Congresso Nazionale parodontologia 2010</b>	Prof. Luca Francetti
93	12 - 13 Marzo	Abano Terme, Padova	<b>Recenti innovazioni di successo in terapia implantare: dalla chirurgia guidata al carico immediato.</b>	Dott. Ernesto Valdesolo
94	17 Aprile	Bassano del Grappa, Vicenza	<b>Chirurgia mininvasiva: è sempre il Gold Standard?</b>	Dott. Simonetta Morselli Dott. Romeo Altafin Dott. Giovanni Rappo Dott. Claudio Spadaro Dott. Antonio Toso Dott. Danise Zanotto
95	22 Maggio	Vicenza	<b>La chirurgia implantare post-estrattiva</b>	Dott. Briccoli Dott. Menini Dott. Padovan
96	11 - 13 Giugno	Verona	<b>International Association of Dental Traumatology 16<sup>th</sup> World Congress</b>	Dott. Mitshiro Tsukiboski Prof. Giacomo Cavalleri
97	22 Giugno	Padova	<b>Concetti avanzati di fisiopatologia e di riabilitazione funzionale dei disordini temporo-mandibolari non chirurgici</b>	Dott. Redento Peretta Dott. Dario Urzi

98	23 Giugno	Bolzano Vicentino, Vicenza	<b>Impianti post-estrattivi a carico immediato senza l'ausilio di tecnologie computer guidate nei pazienti parzialmente edentuli</b>	Dott. Paolo Filippini
99	30 Giugno	Padova	<b>Metodiche per il mantenimento e per l'accrescimento dei volumi ossei</b>	Dott. Antonio Lapi Dott. Ian Paul Cardarelli
100	11 Settembre	Ancona	<b>Diagnosi morfologica del paziente disgnatico: 2D Versus 3D.</b>	Dott.ssa Maria Cristina Bellardinelli
101	18 Settembre	Treviso	<b>Il paziente: professioni in dialogo.</b>	Relatori vari
102	25 Settembre	Verona	<b>Congresso Internazionale di terapia implantare corsi post-congressuali con accreditamento ECM</b>	Dott. Ernesto Valdesolo
103	01 Ottobre	Rimini	<b>Nobel Biocare Symposium</b>	Dott.ssa Alizia Trambaiolo
104	02 Ottobre	Verona	<b>Corso sul materiale d'impronta</b>	Fabrizio Sambugar
105	29 - 30 Ottobre	Torino	<b>Approccio integrato ai disordini temporo-mandibolari: occlusodonzia, psicologia e riabilitazione funzionale.</b>	Dott. Dario Urzi
106	19 - 20 Novembre	Padova	<b>Incontro di chirurgia ortognatica</b>	Prof. Giuseppe Ferronato Dott. Redento Peretta
107	01 Novembre	Bassano del Grappa, Vicenza	<b>Corso base primo soccorso</b>	Mascotto Giorgio
108	11 Novembre	Bassano del Grappa, Vicenza	<b>Nuove acquisizioni in tema di terapia antalgica: controllo del dolore acuto post-operatorio, cronico oncologico e non oncologico.</b>	Dott. Vittorio Bernardi
<b>2011</b>				
109	12 Febbraio	Verona	<b>Corso sul materiale d'impronta</b>	Fabrizio Sambugar
110	26 Febbraio	Verona	<b>Corso di Traumatologia Dento-maxillo-facciale</b>	Giacomo Cavalleri
111	17 - 19 Marzo	Abano Terme, Padova	<b>La tecnologia come fattore determinante di ogni fase della vita dell'impianto: l'orologio implantare.</b>	Dott. Ernesto Valdesolo
112	26 Marzo	Verona	<b>Corso di Traumatologia Dento-maxillo-facciale</b>	Giacomo Cavalleri
113	02 Aprile	Garda, Verona	<b>Elevazione del seno mascellare a scopo Implantologico</b>	Dott. Marco Sanguigni

114	30 Aprile	Verona	<b>Corso di Traumatologia Dento-maxillo-facciale</b>	Prof. Giacomo Cavalleri
115	14 Maggio	Verona	<b>Corso di Traumatologia Dento-maxillo-facciale</b>	Prof. Giacomo Cavalleri
116	08 Giugno	Alte Montecchio Maggiore, Vicenza	<b>Seminario Nobel clinician TM</b>	Relatori vari
117	11 Giugno	Verona	<b>Corso di traumatologia dentale</b>	Dott. Piero Alessandro Marcoli
118	16 Giugno	Verona	<b>Corso di Traumatologia Dento-maxillo-facciale</b>	Prof. Giacomo Cavalleri
119	02 Luglio	Verona	<b>Corso di Traumatologia Dento-maxillo-facciale</b>	Prof. Giacomo Cavalleri
120	15 - 17 Settembre	Verona	<b>14° Congresso Internazionale di terapia implantare corsi monotematici post-congressuali l'estetica implantare nell'era digitale</b>	Dott. Ernesto Valdesolo
121	23 - 24 Settembre	Sirmione del Garda, Brescia	<b>Il privilegio della funzione</b>	Dott. Giuseppe Stefanelli Dott. Mario Mosconi
122	28 Settembre	Pavia	<b>Predicibilità e mini-invasività nell'approccio chirurgico implantare</b>	Dott. Gioacchino Cannizzaro
123	05 Novembre	Vicenza	<b>Simposio accademia italiana CAMLOG</b>	Prof. Carlo Maiorana
<b>2012</b>				
124	13 Febbraio	Vicenza	<b>Semplifica il trattamento e proteggilo nel tempo</b>	Dott. Fabio Mazzocco
125	01 Marzo	Bassano del Grappa, Vicenza	<b>Informazione sui rischi presenti nell'ambiente di lavoro connessi all'attività a personale in frequenza, equiparato al lavoratore, in applicazione del D.lgs. 81/08 e S.M.I.</b>	Ing. Emiliano Bazzan
126	02 Aprile	Vicenza	<b>Semplifica il trattamento e proteggilo nel tempo</b>	Dott. Stefano Mega
127	24 Maggio	Padova	<b>Chirurgia pre-implantologica nella riabilitazione stetica delle gravi atrofie dei mascellari</b>	Prof. Giuseppe Ferronato
128	30 Maggio	Vicenza	<b>Alternative chirurgiche mini-invasive in chirurgia implantare</b>	Dott. Stefano Sivilella Dott. Paolo Toscano
129	20 Giugno	Pavia	<b>Predicibilità e mini-invasività nell'approccio chirurgico implantare</b>	Dott. Gioacchino Cannizzaro

130	21 Giugno	Padova	<b>Chirurgia pre-implantologica nella riabilitazione estetica delle gravi atrofie dei mascellari</b>	Prof. Giuseppe Ferronato
131	20 Settembre	Padova	<b>Chirurgia pre-implantologica nella riabilitazione statica delle gravi atrofie dei mascellari</b>	Prof. Giuseppe Ferronato Dott. Stefano Fusetti
132	27 - 29 Settembre	Verona	<b>Complicanze, problematiche e loro risoluzioni in terapia implantare</b>	Dott. Ernesto Valdesolo
133	23 - 24 Novembre	Santo Stefano Belbo, Cuneo	<b>Funzionalità immediata dell'impianto osteointegrato</b>	Dott. Tiziano Tealdo
<b>2013</b>				
134	19 Febbraio	Vicenza Sede Biomax Spa	<b>Casi complessi di terapia implantare risolti con chirurgia piezoelettrica, chirurgia muco-gengivale ed ortodonzia cercando di risolvere al minimo l'invasività ed il disagio del paziente</b>	Dott. Italo Menini Dott. Alberto Padovan
135	01 - 02 Marzo	Buttrio, Udine	<b>Easymyo Friends Meeting: principi di elettromiografia standardizzata dei muscoli masticatori ed interpretazione degli indici P.O.C.</b>	Dott. Riccardo Rosati Dott. Redento Peretta Dott. Carmelo Condorelli
136	22 - 23 Marzo	Montecatini Terme, Pistoia	<b>Outcome estetico e funzionale mediante il trattamento del tessuto duro e molle</b>	Dott. Ernesto Valdesolo Relatori Vari
137	19 Aprile	Santo Stefano Belbo, Cuneo	<b>Procedure di laboratorio per la protesizzazione immediata a carico implantare</b>	Luca Scaglione Piercarlo Seghesio
138	20 Aprile	Padova	<b>Strategie in impianto-protesi</b>	Dott. Stefano Longoni Prof. Giuseppe Ferronato Dott. Redento Peretta Dott. Giorgia Saia
139	16 - 17 Maggio	Padova	<b>XVIII Congresso Nazionale della società italiana di chirurgia maxillo-facciale</b>	Dott. Olindo Procopio Dott. Maurizio Franco Prof. Giuseppe Ferronato Dott. Redento Peretta
140	18 Maggio	Padova	<b>Convegno odontoiatri nuove tecnologie in implantologia avanzata</b>	Dott. Giorgia Saia Dott. Olindo Procopio Dott. Maurizio Franco
141	01 Giugno	Vicenza	<b>L'impegno della ricerca. Diamo una risposta alle persone con sclerosi multipla.</b>	Dott. Carlo Adelchi Castrignano



142	06 Giugno	Padova	<b>Treatment Strategies for the Mutilated Dentition. Rapporto tra contorno protesico e tessuti gengiva.</b>	Prof. Niklaus P. Lang Dott. Ignazio Loi
143	07 - 08 Giugno	Padova	<b>International Congress on Implant Prosthodontics</b>	Prof. Niklaus P. Lang Dott. Ignazio Loi
144	17 Giugno	Bassano del Grappa, Vicenza	<b>Basic Life Support Defibrillation</b>	I. P. Fabio Cecchin
145	19 - 20 - 21 Settembre	Verona	<b>16° Congresso Internazionale di Terapia Implantare</b>	Dott. Ernesto Valdesolo
146	05 Ottobre	Genova	<b>Estetica e funzione nell'Implantologia moderna</b>	Prof. Paolo Pera Prof.ssa Maria Menini
147	08 - 09 Novembre	Genova	<b>Columbus Bridge Protocol 5° Forum Columbus Bridge</b>	Dott. Tiziano Tealdo Dott. Marco Bevilacqua Prof. Paolo Pera
148	10 Novembre	Bassano del Grappa, Vicenza	<b>Corso di formazione su cenni di primo soccorso e rianimazione cardiopolmonare</b>	Dott. Leka Enkelej
<b>2014</b>				
149	25 Gennaio	Padova	<b>Il carico immediato con l'impronta digitale</b>	Dott. M. De Francesco
150	27 Marzo	Torino	<b>Attestato di partecipazione criticità della zona tra impianto e pilastro per assicurare successo estetico, preservazione del tessuto molle e prevenzione della perimplantite</b>	Dott. Ernesto Valdesolo
151	14 Maggio	Vicenza	<b>Carico immediato funzionale: quali sono i fattori che influenzano il risultato?</b>	Dott. Marco Bevilacqua Presidente Dott. Federico Zanetti
152	02 - 04 Ottobre	Verona	<b>Attestato di partecipazione 17° Congresso Internazionale di terapia implantare</b>	Dott. Ernesto Valdesolo
153	07 Novembre	Santo Stefano Belbo, Cuneo	<b>Corso Columbus Bridge Protocol</b>	Dott. Tiziano Tealdo Dott. Marco Bevilacqua Prof. Paolo Pera
154	15 Novembre	Genova	<b>Attestato di partecipazione al Congresso Advances in Clinical Prosthodontics</b>	Prof. Paolo Pera

2015				
155	26 Marzo	Venezia	<b>Affidabilità nel tempo del trattamento Implantare mediante strategie efficaci e predicibili</b>	Relatori vari
156	27 Giugno	Milano	<b>Corso di economia e management per dentisti 2015</b>	Dott. Gabriele Vassura
157	24 - 26 Settembre	Verona	<b>Attestato di partecipazione 18° Congresso Internazionale di terapia implantare</b>	Dott. Ernesto Valdesolo
158	06 Novembre	Santo Stefano Belbo, Cuneo	<b>VII Forum sul Columbus Bridge Protocol</b>	Prof. Paolo Pera Dott. Marco Bevilacqua Dott. Tiziano Tealdo
159	14 Novembre	Bassano del Grappa, Vicenza	<b>Prevenzione delle patologie del cavo orale e monitoraggio della salute bucco dentale in età pediatrica</b>	Prof.ssa Laura Strohmenger Prof.ssa Stefania Zampogna
160	28 Novembre	Genova	<b>Attestato di partecipazione Convegno Advances in Clinical Prosthodontics</b>	Prof. Paolo Pera
2016				
161	30 Gennaio	Rosà, Vicenza	<b>BLDS - Basic Life Support - Defibrillation</b>	I.P. Fabio Cecchin
162	11 - 12 Marzo	Udine	<b>Attestato di frequenza Easymyo</b>	Odt. Francesco Rosati
163	07 - 08 Aprile	Lazise, Verona	<b>XVI Closed Meeting Boston University Italian Alumni</b>	Dott. Ernesto Valdesolo
164	15 Aprile	Roma	<b>Dalla salute orale alle strategie operative per il paziente Implantare: la persona attorno alla bocca.</b>	Dott. Ernesto Valdesolo
165	25 Maggio	Treviso	<b>Le roncopatie e le apnee notturne ostruttive nel sonno (OSAS) Approccio clinico - terapeutico multidisciplinare</b>	Dott. Luigino Guarini
166	13 - 14 Maggio 25 Giugno	Milano	<b>Corso di economia e management per dentisti</b>	Dott. Gabriele Vassura
167	09 - 10 Settembre	Santo Stefano Belbo, Cuneo	<b>VIII Forum sul Columbus Bridge Protocol</b>	Prof. Paolo Pera Dott. Marco Bevilacqua Dott. Tiziano Tealdo
168	07 Ottobre	Padova	<b>Preparazioni a finire con tecnica SPP</b>	Dott. Fabio Scutellà
169	29 - 30 Settembre 01 Ottobre	Verona	<b>19° Congresso Internazionale di terapia implantare</b>	Dott. Ernesto Valdesolo
170	13 - 14 Maggio 25 Giugno	Milano	<b>Corso di economia e management per dentisti</b>	Dott. Gabriele Vassura
171	25 - 26 Novembre	Genova	<b>Advances in Clinical Prosthodontics</b>	Prof. Paolo Pera Prof.ssa Maria Menini

2017				
172	27-28 Gennaio	Udine	Incontro scientifico TFR technology srl	Odt. Francesco Rosati
173	20 Febbraio	Vicenza	Attestato di partecipazione AON implants - cavo orale e patologie sistematiche - considerazione e diagnosi	Prof. Luca Viganò
174	23 Febbraio	Genova	Attestato ECM Advances in Clinical Prosthodontics	Prof. Paolo Pera
175	20 Marzo	Vicenza	Attestato di partecipazione AON implants - implantologia complessa -	Dott. Bruno De Santis
176	27 Marzo	Verona	Attestato di partecipazione - corso per utilizzatori Cone-Beam SL3D	Dott. Gianluca Battipaglia
177	01 Aprile	Trieste	Attestato di riconoscimento per il contributo offerto in qualità di moderatore	Dott. Ernesto Valdesolo
178	03 Aprile	Vicenza	Attestato di partecipazione AON implants - come migliorare l'estetica di denti ed impianti: la chirurgia mucogengivale cosmetica -	Dott. Alberto Fonzar
179	04 Maggio	Bassano del Grappa	Corso di formazione dei lavoratori	Ing. Emiliano Bettin
180	12 - 13 Maggio	Trieste	Attestato di partecipazione Congresso di patologia e chirurgia oro-maxillo-facciale	Prof. R. Di Lenarda
181	23 Maggio	Bassano del Grappa	Corso per addetti alla prevenzione incendi – lotta antincendio Gestione emergenze	Ing. Emiliano Bettin
182	25 Settembre	Vicenza	Diagnosi delle terapie Peri-implantite con accenni sul ruolo delle superfici macchinate e irruvidite	Dott. Marco Esposito
183	12 - 13 - 14 Ottobre	Verona	XX Congresso Internazionale Terapia Implantare	Relatori vari
184	16 Ottobre	Vicenza	Attestato di partecipazione AON Implants - il carico immediato in implantologia -	Dott. F. Tura Odt. P. Smaniotto
185	23 Ottobre	Vicenza	Soluzioni implantoprotesiche: Tradizione VS Innovazione. Risoluzione di impianti disparalleli	Dott. Flavio Tura Odt. Paolo Smaniotto
186	27 - 28 Ottobre	Santo Stefano Belbo, Cuneo	IX Forum Internazionale sulla metodica Columbus Bridge Protocol	Prof. Paolo Pera Dott. Marco Bevilacqua Dott. Tiziano Tealdo
187	23 Novembre	Vicenza	“Uso del Putty Sintetico Bioattivo in chirurgia rigenerativa: dall'alveolo al seno mascellare e oltre”	Dott. Sebastiano Andreana
188	01 - 02 Dicembre	Genova	Advances in Clinical Prosthodontics	Prof. Paolo Pera Prof.ssa Maria Menini

2018				
189	10 Gennaio	Rosà, Vicenza	<b>Corso di abilitazione Operatore BLS-D Retraining</b>	Inf. Prof. Fabio Cecchin
190	18 Gennaio	Bassano del Grappa	<b>Basic life support defibrillation per sanitari -retraining-</b>	Fabio Cecchin
191	20 Gennaio	Bassano del Grappa	<b>Basic life support defibrillation per sanitari</b>	Fabio Cecchin
192	26 Gennaio	S. Martino di Castrozza, Trento	<b>Corso di aggiornamento di Implantologia orale</b>	Dott. Antonio Maria Miotti
193	27 Gennaio	S. Martino di Castrozza, Trento	<b>Corso di aggiornamento in Chirurgia ortognatica</b>	Dott. Antonio Maria Miotti
194	28 Gennaio	Bassano del Grappa	<b>Attestato di partecipazione formazione lavoratori – aggiornamento – valutazione rischi aziendali</b>	Ing. Emiliano Bettin
195	19 Febbraio	Vicenza	<b>La rigenerazione dei tessuti duri e molli in area ad alta valenza estetica</b>	Dott. Marzio Todisco
196	23 - 24 Febbraio	Santo Stefano Belbo, Cuneo	<b>Corso Columbus Bridge Protocol</b>	Prof. Paolo Pera Dott. Marco Bevilacqua Dott. Tiziano Tealdo
197	06 - 07 Aprile	Santo Stefano Belbo, Cuneo	<b>Chirurgia Implantare avanzata per il paziente gravemente atrofico</b>	Prof. Paolo Pera Dott. Marco Bevilacqua Dott. Tiziano Tealdo
198	08 Maggio	Vicenza	<b>Estetica in Implatoptesi</b>	Dott. Giuseppe Castorina
199	24 Maggio	Padova	<b>Le Agenesie dentali sindromiche e non sindromiche: implicazioni multidisciplinari.</b>	Prof. Antonio Gracco
200	07 Giugno	Oviglio, Alessandria	<b>I Ritrattamenti implantari: casistica e soluzioni terapeutiche.</b>	Dott. Tiziano Tealdo
201	16 - 17 Giugno	Vienna	<b>Corso Hands on Cadaver Course: oral Surgery and Implantology.</b>	Prof. Amerigo Giudice Prof. Hermann Traxler Dott. Giovanni Giorgetti
202	04 - 06 Ottobre	Verona	<b>XXI Congresso Internazionale Terapia Implantare</b>	Relatori vari
203	27-28-29 Settembre	Torino	<b>Congresso Internazionale Osteology 2018</b>	Relatori vari
204	29 Settembre	Santo Stefano Belbo, Cuneo	<b>Corso teorico pratico su paziente per igienisti dentali sul mantenimento del Columbus Bridge Protocol</b>	Dott. Edoardo Vallerga Prof. Tiziano Tealdo
205	03 Ottobre	Vicenza	<b>Corso di Chirurgia Ortognatica 2018 Live Surgery</b>	Prof. Antonio Gracco Prof. Laura Siviero Dott. Ugo Baciliero



206	04-05-06 Ottobre	Verona	<b>Congresso Internazionale di Terapia Implantare</b>	Relatori vari
207	24-25-26-27 Ottobre	Santo Stefano Belbo, Cuneo	<b>X Forum Internazionale sulla Metodica Columbus Bridge Protocol</b>	Prof. Paolo Pera Dott. Marco Bevilacqua Dott. Tiziano Tealdo
208	30 Novembre 01 Dicembre	Genova	<b>Advances in Clinical Prosthodontics</b>	Prof. Paolo Pera Prof. Tiziano Tealdo Dott. Marco Bevilacqua Prof. Maria Menini Dott. Francesco Pera
209	30 Novembre 01 Dicembre	Genova	<b>Advances in Clinical Prosthodontics</b>	Prof. Paolo Pera Prof. Tiziano Tealdo Dott. Marco Bevilacqua Prof. Maria Menini Dott. Francesco Pera
<b>2019</b>				
210	26 Gennaio	San Martino di Castrozza	<b>Incontro di chirurgia ortognatica</b>	Relatori vari
211	01 - 02 Febbraio	Catania, Avola, Siracusa	<b>Corso di implantologia secondo la tecnica NTA</b>	Relatori vari
212	18 Marzo	Vicenza	<b>Il tooth transformer: sistema di trasformazione del tessuto dentale in osso autologo</b>	Prof. Elio Minetti
213	21 Marzo	Verona	<b>Le reazioni avverse da farmaci ed il sistema di segnalazione</b>	Prof. Ugo Moretti
214	29 - 30 Marzo	Roma	<b>Congresso Nazionale di primavera 3i: Il nuovo rinascimento odontoiatrico italiano</b>	Relatori vari
215	10 Aprile	Verona	<b>EMA e farmaci orfani</b>	Dott. Mario Ricciardi
216	17 Aprile	Verona	<b>Appropriatezza prescrittiva: come coniugare ricerca, qualità dell'assistenza e sostenibilità</b>	Dott. Enrico Costa
217	03 Maggio	Verona	<b>Congresso di Odontoiatria e Chirurgia Maxillo-Facciale Giornate veronesi</b>	Prof. Pier Francesco Nocini Dott. Mauro Marincola Dott. Mauro Labanca Dott. Haral Huskens Dott. Vincent J. Morgan
218	11 Maggio	Santo Stefano Belbo, Cuneo	<b>Corso sul mantenimento implantare del Columbus Bridge Protocol</b>	Prof. Tiziano Tealdo Dott. Marco Bevilacqua Dott. Edoardo Vallerga Dott. Emanuela Butera
219	14 Maggio	Vicenza	<b>Il paziente digitale</b>	Dott. Marco Annucci Dott. Alessio Franchina
220	30 Maggio	Vicenza	<b>La tossina botulinica nella pratica clinica odontoiatrica</b>	Prof. Seong-Taek Kim (Yonsei University Seoul, Corea del Sud)

221	07 - 08 Giugno	Modena	<b>Primo Congresso Nazionale delle scuole di specializzazione in chirurgia orale</b>	Relatori vari
222	14 - 15 Giugno	Vicenza	<b>Closed meeting IAO</b>	Relatori vari
223	19 Giugno	Limena, Padova	<b>Conferenza: Prime Time Tour, estetica e funzione con materiali del 3° millennio</b>	Dott. Francesco Mintrone Odt. Stefan Strigl
224	16 - 19 Settembre	Parigi	<b>w18° Congress of International Society of Craniofacial Surgery</b>	Relatori vari
225	20 Settembre	Como	<b>Updates in chirurgia oro-maxillo-facciale Memorial Giuseppe Ferronato</b>	Relatori vari
226	21 Settembre	Verona	<b>21° Congresso Internazionale di Implantologia 3i</b>	Relatori vari
227	28 Settembre	Verona	<b>Il trattamento implantare con impianti Rex Piezoimplant</b>	Prof. Tiziano Testori
228	01 Ottobre	Limena, Padova	<b>Guida step by step alla cementazione corretta</b>	Patrizio Giovannetti
229	03-05 Ottobre	Catania	<b>Congresso Nazionale della Società Italiana di chirurgia orale: frontiere in chirurgia orale</b>	Relatori vari
230	12 Ottobre	Vicenza	<b>La tecnologia digitale al servizio dell'estetica: CAD-CAM, impronta ottica, chirurgia computer assistita, stampa 3D</b>	Dott. Alessandro Motta Odt. Aldo Zilio
231	25 - 26 Ottobre	Santo Stefano Belbo e Calosso, Asti, Cuneo	<b>11° Forum Internazionale sulla metodica Columbus Bridge Protocol</b>	Relatori vari Relatore Dott. Christian Alberti
232	22 Novembre	Torino	<b>Corso di dissezione cranio-facciale Università degli studi di Torino Cattedra di chirurgia maxillo-facciale</b>	Prof. Guglielmo Ramieri Prof. Giovanni Gerbino
233	23 Novembre	Santo Stefano Belbo, Cuneo	<b>Chirurgia implantare avanzata per il paziente gravemente atrofico</b>	Prof. Tiziano Tealdo Prof. Paolo Pera Dott. Marco Bevilacqua Dott. Francesco Pera Odt. Feliciano Maggi
234	25 Novembre	Padova	<b>Il Tooth Transformer nella pratica clinica quotidiana. Serata informativa</b>	Prof. Elio Minetti
235	13 Dicembre	Padova	<b>Lezione al master di ortodonzia Face Xp: Ortodonzia Pre-Chirurgica e Chirurgia Ortognatica</b>	Dott. Renato Cocconi

2020				
236	18 Gennaio	Rosà, Vicenza	<b>Corso BLSD-D Retraining</b>	I.P. Giovanni Cerantola I.P. Fabio Cecchin
237	08 Febbraio	Verona	<b>Terapie Antitrombotiche nel paziente odontoiatrico: attuali trend in chirurgia orale</b>	Prof. Antonio D'Agostino
238	08 Febbraio	Verona	<b>La gestione delle complicanze in chirurgia orale</b>	Prof. Lorenzo Trevisiol
239	10 Febbraio	Vicenza	<b>Carico immediato in digitale con tecnica della sovrapposizione dei files</b>	Dott. Francesco Zingari Odt. Marco Genovese
240	10 Febbraio	Verona	<b>Il paziente in medicina estetica</b>	Prof. Dario Bertossi
241	16 Marzo	Padova	<b>Tecnica Invisalign in ortodonzia</b>	Dott. Alessandro Greco
242	17 Marzo	Padova	<b>La sindrome delle apnee ostruttive nel sonno</b>	Dott. Francesca Milano
243	18 Marzo	Padova	<b>Traumatologia dentale</b>	Dott. Patrizia Lucchi
244	18 Marzo	Treviso	<b>L'articolazione temporo-mandibolare vista dal chirurgo orale e maxillo-facciale</b>	Dott. Luca Guarda Nardini
245	19 Marzo	Padova	<b>La correzione delle II classi in dentatura permanente: tecnica linguale</b>	Dott. Mariano Gallone
246	19 Marzo	Vicenza	<b>Il flusso digitale protesico</b>	Sig. Claudio Schellino
247	19 Marzo	Padova e Massa Carrara	<b>L'artrocentesi dell'articolazione temporo-mandibolare</b>	Dott. Luca Guarda Nardini Dott. Daniele Manfredini
248	20 Marzo	Padova	<b>Oltre l'allineamento. Tecnica FACE</b>	Dott. Valerio Maccagnola
249	21 Marzo	Padova	<b>Pianificazione ortodontica in base a parametri estetici – FACE</b>	Dott. Nicola Preda
250	22 Marzo	Padova	<b>La gestione delle discrepanze verticali mediante digital orthodontics con aligners - INVISALIGN</b>	Dott. Alessandro Greco

251	23 Marzo	Padova	<b>Sbiancamento dentale. Metodi per il successo</b>	Dott. Pietro Sibilla
252	24 Marzo	Padova	<b>Riabilitazioni estetiche nel settore anteriore</b>	Dott. Nikolaos Perakis
253	25 Marzo	Padova	<b>Esthetic guided restoration: il restauro conservativo guidato nei settori anteriori</b>	Dott. Patrizia Lucchi
254	26 Marzo	Padova	<b>Tecnica WIN: ortodonzia linguale</b>	Dott. Dirk Wiechmann
255	27 Marzo	Padova	<b>Ortodonzia Digitale: un'occasione imperdibile</b>	Dott. Renato Cocconi
256	28 Marzo	Padova	<b>Agenesia dei laterali. Chiusura spazi, profilo ed estetica del sorriso</b>	Dott. Marco Rosa
257	30 Marzo	Padova	<b>Ortodonzia linguale: bellezza ed estetica di trattamento</b>	Dott. Federico Saverio
258	31 Marzo	Verona	<b>Updates in parodontologia: the free gengiva graft</b>	Prof. Giorgio Lombardo
259	31 Marzo	Padova	<b>Pianificazione ortodontica in base a parametri estetici: applicazioni cliniche</b>	Dott. Nicola Preda
260	31 Marzo	Padova	<b>Diagnosi e opzioni terapeutiche nella riabilitazione di arcata</b>	Dott. Alessandro Perini
261	01 Aprile	Padova	<b>L'ancoraggio scheletrico</b>	Dott. Patrizia Lucchi
262	01 Aprile	Verona	<b>L'estetica nei settori anteriori</b>	Dott. Andrea Chierico
263	01 Aprile	Padova	<b>Sistematiche di Ancoraggio Scheletrico Palatino Palatal anchorage</b>	Dott. Riccardo Riatti
264	02 Aprile	Milano	<b>GBR: la rivoluzione digitale mediante griglie in titanio customizzate Yxoss CBR</b>	Prof. Matteo Chiapasco
265	02 Aprile	Padova	<b>Il laser in odontoiatria</b>	Dott. Giuseppe Chiodera
266	02 Aprile	Padova	<b>Integrated Straight Wire Approach: razionale ed applicazione clinica</b>	Dott. Gualtiero Mandelli
267	03 Aprile	Padova	<b>Patologia orale pediatrica</b>	Dott. Christian Bacci
268	03 Marzo	Padova	<b>Estrazioni: Modulare l'ancoraggio per la migliore occlusione estetica.</b>	Dott. Silvia Rapa



269	03 Aprile	Roma	<b>Il metabolismo del tessuto osseo</b>	Prof. Francesco Riva
270	03 Aprile	Bologna	<b>Il fallimento implantare in zona estetica</b>	Dott. Paolo Casentini Prof. Massimo Simion Prof. Giovanni Zucchelli
271	04 Aprile	Padova	<b>Early Orthodontic Treatment</b>	Dott. Marco Rosa
272	04 Aprile	Ferrara	<b>Lingual straight wire</b>	Dott. Giuseppe Scuzzo
273	05 Aprile	Massa Carrara	<b>Linee guida IADR sui disordini temporo-mandibolari</b>	Dott. Daniele Manfredini Dott. Arturo Fortini Dott. Alvis Caburlotto
274	06 Aprile	Padova	<b>Patologia orale pediatrica</b>	Dott. Christian Bacci
275	06 Aprile	Padova	<b>Approccio interdisciplinare con aligners: the digital vision</b>	Dott. Alessandro Greco Dott. Federico Migliori
276	06 Aprile	Verona	<b>Intervallo di confidenza di una media o di una proporzione. Criteri per la scelta del test statistico. Test t per dati non appaiati e per dati appaiati, verifica dell'assunto di omoschedasticità.</b>	Prof. Giuseppe Verlatto
277	06 Aprile	Milano	<b>Socket shield: preserving nature</b>	Dott. Fabio Manuel Filannino
278	07 Aprile	Padova	<b>Anatomia del seno mascellare posteriore e prevenzione delle complicanze nella terapia implantare della mascella posteriore</b>	Dott. Alessandro Perini
279	07 Aprile	Padova	<b>Trattamento delle III classi e degli open bite con tecnica linguale customizzata</b>	Dott. Dirk Wiechmann Dott. Mariano Gallone
280	07 Aprile	Roma	<b>Linee guida ministeriali per la diagnosi ed il trattamento delle osas in età pediatrica</b>	Dott. Valeria Luzzi
281	07 Aprile	Verona	<b>Demineralizzazione e remineralizzazione dello smalto dentale</b>	Paola Brghi
282	07 Aprile	Vicenza	<b>Implantologia a carico immediato</b>	Dott. Luca Lepidi
283	07 Aprile	Roma	<b>Terapia intercettiva elastodontica</b>	Dott. Gaetano Ierardo
284	08 Aprile	Padova	<b>Il trattamento ortodontico orientato alla funzione occlusale</b>	Dott. Nicola Preda Dott. Valerio Maccagnola
285	09 Aprile	Ferrara	<b>Perforazione della membrana schneideriana: come prevenirla?</b>	Prof. Leonardo Trombelli

286	09 Aprile	Padova	<b>Valutazione genetica nel paziente sindromico con alterazioni di numero e forma dei denti. Parte I.</b>	Dott. Daniela Zuccarello
287	09 Aprile	Venezia	<b>I vantaggi della surgical guide e della prosthetic guide nella riabilitazione full arch</b>	Dott. Rocco Borrello
288	09 Aprile	Treviso	<b>Miniscrew revolution: bases and show case</b>	Dott. Nicola Derton
289	09 Aprile	Verona	<b>Analisi della varianza. Regressione e correlazione</b>	Prof. Giuseppe Verlatto
290	09 Aprile	Ferrara	<b>Complex cases. New possibilities in the correction of skeletal discrepancies</b>	Dott. Giuliano Bortolo Maino
291	09 Aprile	Ferrara	<b>Interdisciplinary synergies and targeted approach with TAD's</b>	Dott. Paolo Manzo
292	10 Aprile	Verona	<b>Le enucleazioni e le estrazioni seriate</b>	Dott. Andrea Compri
293	10 Aprile	Padova	<b>I disturbi respiratori del sonno nei bambini e nell'adulto. Approccio clinico odontoiatrico al paziente OSAS</b>	Prof. Antonio Gracco Dott. Francesca Milano
294	14 Aprile	Padova	<b>La gestione dello smalto e tecniche infiltrative</b>	Dott. Stefano Ferraro Dott. Giuseppe Allocca
295	14 Aprile	Vicenza	<b>Il significato dell'insertion torque e la preparazione implantare</b>	Dott. Michele Stocchero
296	14 Aprile	Brescia	<b>Diagnosi ortodontica</b>	Dott. Raffello Cortesi
297	14 Aprile	Roma	<b>Osteogenesi imperfetta</b>	Prof. Gaetano Ierardo
298	15 Aprile	Padova	<b>Endodonzia in odontoiatria pediatrica. Parte II</b>	Dott. Enrico Semenzato
299	15 Aprile	Roma	<b>Endodonzia del dente permanente</b>	Prof. Maurizio Bossù
300	15 Aprile	Ferrara	<b>Casi complessi: soluzioni razionali per trattamento ortodontici efficienti</b>	Dott. Paolo Manzo
301	16 Aprile	Roma	<b>Le germectomie</b>	Prof. Gianluca Sfasciotti
302	16 Aprile	Verona	<b>Test del chi-quadrato, misura kappa di concordanza di Cohen. Calcolo della numerosità campionaria</b>	Prof. Giuseppe Verlatto

303	16 Aprile	Lodi	<b>Tutela degli interessi personali e dello studio dentistico in corso di emergenza COVID-19</b>	Dott. Gabriele Vassura
304	16 Aprile	Roma	<b>Le germectomie selettive</b>	Dott. Antonio Barone Dott. Fortunato Alfonsi Dott. Guido Galletti
305	17 Aprile	Padova	<b>La lettura di un articolo scientifico</b>	Dott. Sabrina Mutinelli
306	17 Aprile	Parma	<b>Digital Orthodontics and interdisciplinary dentistry</b>	Dott. Renato Cocconi Dott. Nikolaos Perakis
307	17 Aprile	Verona	<b>Soluzione di fallimenti in area estetica</b>	Dott. Marzio Todisco
308	17 Aprile	Padova	<b>Razionale scientifico per l'uso degli impianti di diametro ridotto in zone estetiche</b>	Dott. Giuseppe Bavetta
309	17 Aprile	Ferrara	<b>Intrusione o estrusione degli incisivi nei pazienti con severa perdita di tessuto parodontale</b>	Dott. Marco Rosa
310	17 Aprile	Verona	<b>Soluzioni di fallimenti in area estetica su denti naturali e impianti</b>	Dott. Marzio Todisco
311	18 Aprile	Roma	<b>Le asimmetrie dento-facciali in chirurgia ortognatica</b>	Prof. Piero Cascone
312	20 Aprile	Bologna	<b>Quali attenzioni per la ripresa dell'attività professionale? Stato dell'arte delle prescrizioni e delle norme</b>	Avv. Silvia Stefanelli Sig. Roberta Pegoraro
313	20 Aprile	Milano	<b>Epidemiologia della carie: nuovi approcci</b>	Prof. Guglielmo Campus
314	20 Aprile	Verona	<b>Analisi della sopravvivenza: curve di Kaplan-Meier</b>	Prof. Giuseppe Verlato
315	20 Aprile	Milano	<b>La ricerca dell'occlusione stabile in ortodonzia</b>	Dott. Valerio Maccagnola
316	21 Aprile	Milano	<b>La terapia non invasiva della carie</b>	Prof. Maria Grazia Cagetti
317	21 Aprile	Milano	<b>La radioprotezione in odontoiatria pediatrica: dalle linee guida alla pratica clinica</b>	Prof. Maria Cristina Firetto
318	21 Aprile	Padova	<b>Diagnosi ed opzioni terapeutiche nella riabilitazione implantare della mascella posteriore atrofica</b>	Dott. Alessandro Perini
319	21 Aprile	Padova	<b>I dolori oro-facciali e loro implicazioni in medicina del sonno</b>	Dott. Massimiliano Di Gioiosa

320	21 Aprile	Ferrara	<b>Aligners: the key to success</b>	Prof. Giuseppe Siciliani Prof. Luca Lombardo
321	21 Aprile	Genova	<b>Il razionale delle suture in GBR: tecniche, timing, materiali</b>	Dott. Marco Ronda
322	22 Aprile	Milano	<b>Approccio psicologico al paziente pediatrico</b>	Dott. Vincenza Birardi
323	22 Aprile	Milano	<b>Le malattie ulcerative della mucosa orale in età pediatrica</b>	Prof. Andrea Sardella
324	22 Aprile	Padova	<b>La gestione dei tessuti molli facciali in funzione della crescita cranio-facciale</b>	Dott. Nicola Preda
325	22 Aprile	Ferrara	<b>Canini inclusi: clinical case discussion</b>	Dott. Daniele Cantarella Dott. Luca Sabato Dott. Ivano Maltoni
326	22 Aprile	Padova	<b>B.O.P.T. e gestione dei tessuti molli</b>	Dott. Ignazio Loi
327	23 Aprile	U.S.A. Boston	<b>Modern Strategies for Tooth Replacement in the Esthetic Zone - Implants or Bridges?</b>	Prof. German Gallucci Dott. Ronald Jung Dott. Nikolaos Perakis Dott. Daniel Edelhoff
328	23 Aprile	Milano	<b>Valutazione del rischio di carie attraverso modelli standardizzati</b>	Dott. Giuliana Bontà
329	23 Aprile	Milano	<b>Sedazione cosciente ed uso degli anestetici locali nel paziente pediatrico</b>	Prof. Concezione Tommasino
330	24 Aprile	Milano	<b>L'espansione rapida tridimensionale del palato</b>	Prof. Cinzia Maspero
331	24 Aprile	Milano	<b>Traumi dentari</b>	Prof. Roberto Biagi
332	24 Aprile	Padova	<b>Procedure di simulazione in chirurgia ortognatica</b>	Prof. Valerio Maccagnola
333	24 Aprile	Milano	<b>I frenuli labiali e linguali</b>	Dott. Luca Creminelli
334	24 Aprile	Milano	<b>Surgery first: un approccio chirurgico da conoscere</b>	Prof. Giuseppe Salvato Prof. Giorgio Gastaldi Dott. Gualtiero Mandelli Dott. Gianluigi Fiorillo
335	24 Aprile	Torino	<b>Protesi fissa su denti naturali ed impianti: workflow operativo digitale ed analogico</b>	Dott. Roberto Abundo Dott. Stefano Lombardo



336	24 Aprile	Catania	<b>Ricostruzioni osseo-gengivali in zona estetica: dalla socket preservation alle grandi ricostruzioni tridimensionali mascellari</b>	Dott. Sandro Marcoli Dott. Marco Csonka
337	25 Aprile	Roma	<b>Ortodonzia pre-chirurgica e chirurgia ortognatica</b>	Dott. Valerio Ramieri
338	27 Aprile	Brescia	<b>Radiologia pediatrica 3.0</b>	Dott. Maria Pia Bondioni
339	27 Aprile	Padova	<b>Valutazione genetica nel paziente sindromico con alterazioni di numero e forma dei denti. Parte II</b>	Dott. Daniela Zuccarello
340	27 Aprile	Roma	<b>Aspetti di laboratorio determinanti nel raggiungimento del risultato bio-estetico</b>	Odt. Antonello di Felice
341	27 Aprile	Padova	<b>Osas in odontoiatria: dai dispositivi mandibolari di avanzamento, MAD, alla chirurgia ortognatica</b>	Prof. Antonio Gracco Dott. Francesca Milano
342	28 Aprile	Brescia	<b>Approccio clinico al bambino con patologia delle mucose orali</b>	Prof. Alessandra Majorana
343	28 Aprile	Brescia	<b>La lesioni delle mucose non ulcerative</b>	Dott. Elena Bardellini
344	28 Aprile	Brescia	<b>Gestione delle problematiche orali nel bambino in terapia oncologica</b>	Prof. Alessandra Majorana Dott. Elena Bardellini
345	28 Aprile	Brescia	<b>Prevenzione primaria della carie e delle gengiviti con polveri di eritritolo</b>	Dott. Magda Mensi
346	28 Aprile	Brescia	<b>Avulsione traumatica e reimpianto del dente avulso</b>	Dott. Stefania Pasini
347	28 Aprile	Padova	<b>Master FACE</b>	Dott. Nicola Preda
349	29 Aprile	Brescia	<b>Protocollo di pronto soccorso nel trauma oro-facciale</b>	Dott. Anna Ferri
350	29 Aprile	Brescia	<b>Prevenzione ed igiene orale nella gravida e nel bambino</b>	Dott. Ignazia Casula
351	29 Aprile	Padova	<b>Il torque di inserzione implantare nel carico immediato e nel full arch</b>	Dott. Rocco Borrello
352	29 Aprile	Brescia	<b>Web e salute orale</b>	Prof. Umberto Gelatti

353	29 Aprile	Padova	<b>Correlazione tra crescita e morfologia cranio-facciale ed osas</b>	Dott. Redento Peretta
354	29 Aprile	Verona	<b>La medicina estetica cervico-facciale</b>	Prof. Dario Bertossi
355	30 Aprile	Brescia	<b>Gestione clinica dei pazienti con bisogni speciali</b>	Prof. Alessandra Majorana
356	30 Aprile	Brescia	<b>Prevenzione e salute orale negli sportivi, nei bambini ed adolescenti</b>	Dott. Ignazia Casula
357	30 Aprile	Trieste	<b>Impiego della tecnologia laser in odontoiatria pediatrica</b>	Prof. Milena Cadenaro
358	30 Aprile	Brescia	<b>Salute orale e qualità di vita nel bambino</b>	Prof. Alessandra Majorana
359	30 Aprile	Ferrara	<b>Restauri indiretti posteriori: punti essenziali</b>	Dott. Nikolaos Perakis
360	30 Aprile	Verona	<b>Cambio di paradigmi nelle riabilitazioni implantoprotesiche nelle aree estetiche di pazienti con storia di paradontiti</b>	Prof. Giorgio Lombardo
361	30 Aprile	Padova	<b>Master OSAS</b>	Prof. Antonio Gracco Dott. Francesca Milano
362	30 Aprile	Gais, Tn	<b>Importazione ed utilizzo dei files intraorali nei software zirkonzahn</b>	Odt. Antonio Corradini
363	01 Maggio	Milano	<b>Labiopalatoschisi: il ruolo dell'odontoiatra</b>	Prof. Maria Costanza Meazzini
364	02 Maggio	Milano	<b>Attuali strategie nella riabilitazione dei settori posteriori del mascellare superiore</b>	Dott. Claudio Stacchi Prof. Raffaele Vinci Prof. Giacomo Oteri Prof. Carlo Maiorana
365	02 Maggio	Padova	<b>Ortodonzia linguale. Approccio sistematico</b>	Prof. Antonio Graccio Dott. Mariano Gallone
366	02 Maggio	Parma	<b>Ancoraggio scheletrico palatale</b>	Dott. Renzo De Gabriele Odt. Gianluca Dalla Tana
367	09 Maggio	Trieste	<b>L'impiego della tecnologia laser in odontoiatria pediatrica</b>	Prof. Milena Cadenaro
368	09 Maggio	Cagliari	<b>Traumatologia dentale: fini, confini clinici e medico-legali in cui agire</b>	Prof. Enrico Spinis Prof. Claudio Buccelli Prof. Raoul D'Alessio
369	13 Maggio	Parma	<b>Traumatologia dentale</b>	Prof. Silvia Pizzi

370	15 Maggio	Genova	<b>One on one discussion: Jovanovic and Ronda</b>	Dott. Sasha Jovanovic Dott. Marco Ronda
371	15 Maggio	Mexico City	<b>Modification of the occlusal plane in orthognathic surgery</b>	Dott. Rodrigo Liega-Reyes
372	15 Maggio	Gais, Trento	<b>Prettau z e Prettau z dispersive: tecniche e metodi per grandi riabilitazioni implantari</b>	Odt. Federico Presicci
373	18 Maggio	New Delhi	<b>Management of tooth avulsion: clinician's perspectives</b>	Prof. Nitesh Tewari
374	20 Maggio	Roma	<b>Aumenti di cresta mediante tessuti molli in chirurgia plastica parodontale e perimplantare</b>	Dott. Francesco Cirillo
375	20 Maggio	Verona	<b>La misura delle malattie nella popolazione umana: incidenza, incidenza cumulativa, prevalenza</b>	Prof. Elisabetta Zanoli
376	21 Maggio	Padova	<b>Prevention by regeration: una nuova prospettiva per il clinico</b>	Dott. Paolo Ghensi
377	21 Maggio	Bologna	<b>Le linee guida ERC per la rianimazione cardiopolmonare durante la pandemia COVID-19</b>	Relatori vari
378	22 Maggio	Lodi	<b>S.O.S. dentista manger: la gestione dello studio dentistico post pandemia COVID-19</b>	Dott. Gabriele Vassura Dott. Pietro Paolo Mastinu Dott. Gianluca Zanetti
379	22 Maggio	Verona	<b>Profiloplasty: lines and countours to achieve facial rejuvenation and beautification</b>	Prof. Dario Bertossi Prof. Thierry Besins
380	23 Maggio	Catanzaro	<b>Dalle lesioni potenzialmente maligne al cancro orale</b>	Prof. Amerigo Giudice
381	23 Maggio	Trieste	<b>Le seconde classi subdivisione: diagnosi accurate per terapie efficaci</b>	Dott. Fabio Giuntoli
382	26 Maggio	Roma	<b>L'Italia a 50 anni dallo statuto dei lavoratori: CNEL e CIU</b>	Prof. Francesco Riva
383	28 Maggio	Berna	<b>L'acido ialuronico nella chirurgia muco gengivale e parodontale</b>	Prof. Anton Sculean
384	28 Maggio	Verona	<b>Misura della relazione tra esposizione e malattia: modelli di rischio assoluto e modelli di rischio relativo. Stima del rischio e disegno dell'indagine</b>	Prof. Elisabetta Zanolin

385	30 Maggio	Trieste	<b>Maxillary expansion: different approach according to patient's individual skeletal maturation</b>	Prof. Luca Contardo
386	30 Maggio	New York, MSKCC	<b>Consideration in pediatric mandible reconstruction</b>	Dott. Farooq Shahzad
387	30 Maggio	New Delhi	<b>Cleft deformities – a masterclass</b>	Dott. Robert Mann Dott. Maria Meazzini Dott. Nassir Nasser
388	30 Maggio	Stoccolma	<b>Vertical bone augmentation in esthetic zone using non-resorbable membranes</b>	Prof. Massimo Simion Prof. Christer Dahlin Dott. David Gonzales
389	30 Maggio	Trieste	<b>Odontoiatria consercatica diretta e semi-diretta in odontoiatria pediatrica</b>	Dott. Monaldo Saracinelli
390	04 Giugno	Verona	<b>Stima del rischio e disegno dell'indagine: concetto di base dell'epidemiologia moderna. Determinante. Modificatore d'effetto. Confondente</b>	Prof. Elisabetta Zanolin
391	04 Giugno	Vicenza	<b>Implantologia iuxta-ossea nella risoluzione delle gravi atrofie</b>	Dott. Carmine Cuomo
392	06 Giugno	Torino	<b>Gli impianti parzialmente e totalmente ceramici: dalla biologia alla clinica</b>	Dott. Michele Nannelli Dott. Riccardo Scaringi Dott. Roberto Crespi
393	06 Giugno	Roma	<b>Asimmetrie facciali</b>	Prof. Piero Cascone
394	06 Giugno	Roma	<b>Alternative al rialzo sinusale nel trattamento del mascellare atrofico</b>	Dott. Marco Finotti Dott. Antonio Ligabue Prof. Massimo Albanese Dott. Luigi Laino
395	06 Giugno	Trieste	<b>Maturazione scheletrica ed espansione del palato</b>	Dott. Bruno di Leonardo
396	07 Giugno	Messina	<b>Nuovi orizzonti in chirurgia ortognatica</b>	Prof. Francesco Saverio de Ponte
397	07 Giugno	Padova	<b>Implantologia zigomatica</b>	Dott. Matteo Giorgi
398	07 Giugno	Bologna	<b>Toronto bridge dentistry evolution</b>	Odt. Carlo Borromeo

399	08 Giugno	Milano	<b>Principali aspetti legati alla ripresa dell'attività odontoiatrica ai tempi del covid-19</b>	Prof. Massimo Clementi
400	08 Giugno	Verona	<b>Non-Suegical Rhinoplasty</b>	Prof. Dario Bertossi
401	11 Giugno	Napoli	<b>Nonsurgical option to adress periodontal and peri-implant diseases</b>	Dott. Vincenzo Iorio-Siciliano
402	11 Giugno	Vicenza	<b>Implant design: what, where, when, why</b>	Dott. Alessandro Cucchi
403	11 Giugno	Bologna	<b>La gestione dei tessuti molli peri-implantari per ottimizzare il risultato estetico</b>	Prof. Giovanni Zucchelli
404	11 Giugno	Verona	<b>Tecniche per il controllo dei confondenti nel disegno e nell'analisi</b>	Prof. Elisabetta Zanoli
405	11 Giugno	Ginevra	<b>Horizontal bone augmentation using GBRconfondenti nel disegno e nell'analisi</b>	Prof. Daniel Buser
406	12 Giugno	Verona	<b>Non-surgical profileplasty</b>	Prof. Dario Bertossi
407	12 Giugno	Milano	<b>Compositi flowable tips and tricks in restaurativa</b>	Dott. Riccardo Becciani
408	12 Giugno	Roma	<b>Bopt in studio ed in laboratorio. Il valore del team in protesi fissa</b>	Dott. Stefano Lombardo Odt. Antonello di Felice
409	12 Giugno	Bologna	<b>Quello che c'è da sapere sulla cementazione adesiva</b>	Prof. Roberto Scotti
410	12 Giugno	Milano	<b>Parodontite e peri-implantite: strategie terapeutiche mini invasive nella fase non chirurgica</b>	Dott. Fabio Currarino
411	12 Giugno	Padova	<b>Endocrinologia: osteoporosi, bifosfanati, cortisonici, diabete, acromegalia Parte 1</b>	Dott. Pietro Maffei
412	20 Giugno	Pisa	<b>Ancoraggi ossei alternativi nelle atrofie dei mascellari</b>	Dott. Michele Nannelli
413	20 Giugno	Bologna	<b>Corso master di protesi fissa</b>	Dott. Marco Montanari



414	20 Giugno	Bologna	<b>OT bridge: nuove opportunità in protesi fissa</b>	Odd. Fabio Damiano
415	20 Giugno	Milano	<b>Implantologia avanzata. Progettazione digitale guidata e protesica per impianti tradizionali e zigomatici</b>	Dott. Francesco Gallo Dott. Francesco Zingari Dott. Alessandro Bolzoni
416	20 Giugno	Milano	<b>I laser in odontoiatria pediatrica</b>	Prof. Claudia Caprioglio
417	20 Giugno	Foggia	<b>Il controllo dell'occlusione in protesi su impianti</b>	Dott. Rosario V.E. Prisco
418	20 Giugno	Vicenza	<b>La chirurgia computer guidata come strumento per la pianificazione ed il trattamento dell'edentulia totale</b>	Dott. Alessio Franchina
419	20 Giugno	Modena	<b>Digitalesperienze</b>	Dott. Maurizio De Francesco Odd. Carlo Baroncini Odd. Gilberto Galletti Odd. Enrico Ferrarelli
420	20 Giugno	Vicenza	<b>Lattualità nella chirurgia guidata: sicurezza ed efficienza per il paziente, l'operatore e tutto lo studio odontoiatrico</b>	Dott. Alberto de Chiesa Dott. Roberto Gallone Dott. Cesare Robello Dott. Luca Salvaggio
421	20 Giugno	Taormina	<b>Congresso Isomed</b>	Relatori Vari
422	20 Giugno	Trento	<b>Programmazione estetico-parodontale dei canini e degli incisivi inferiori</b>	Dott. Marco Rosa
423	20 Giugno	New Mexico	<b>Ricostruzione del terzo medio facciale e del mascellare superiore</b>	Dott. Carlos Navarro Vila
424	20 Giugno	Verona	<b>Il paziente virtuale</b>	Dott. Antonio Zani
425	19 Giugno 20 Giugno	Sydney	<b>Osteology Symposium</b>	Relatori Vari
426	20 Giugno	Padova	<b>Endocrinologia, osteoporosi, bifosfonati, cortisonici, diabete, acromegalia. Parte II</b>	Dott. Pietro Maffei
427	20 Giugno	Padova	<b>Farmacologia. Parte I</b>	Dott. Morena Zusso
428	24 Giugno	U.S.A.	<b>Emerging technologies for orthognathic surgery</b>	Dott. Brian B.Farrell

429	24 Giugno	Bologna	<b>Il digitale come strumento di marketing impianto-protetico nell'era post-covid</b>	Dott. Andrea Agnini De. Alessandro Agnini
430	26 Giugno	Fiuggi	<b>L'innovazione: motore di sviluppo e benessere</b>	Prof. Francesco Riva
431	26 Giugno	Genova	<b>Nuova tecnica di espansione crestale</b>	Prof. Tomaso Vercellotti
432	26 Giugno	Milano	<b>Il ruolo del chirurgo oro-maxillo-facciale in ortodonzia nell'era digitale</b>	Dott. Giuseppe Salvato
433	27 Giugno	Santo Stefano Belbo, Cuneo	<b>Immediate function in the atrophic maxilla using digital workflow in zygomatic implant therapy</b>	Prof. Tiziano Tealdo
434	27 Giugno	Chieti	<b>Dalla ricerca clinica impianti dentali: passato, presente e futuro</b>	Prof. Adriano Piattelli
435	27 Giugno	Udine	<b>Precisione in protesi fissa</b>	Dott. Mario Cattaruzza Odt. Stefano Martina
436	27 Giugno	Salt lake City	<b>Zygomatic implants and alveolar reconstruction</b>	Prof. Ole T. Jensen
437	28 Giugno	S.I.O.I	<b>Il dente da latte: age of webinar. Part I</b>	Dott. Matteo Beretta Dott. Fabio Federici Canova
438	28 Giugno	S.I.O.I	<b>Il dente da latte: age of webinar. Part II</b>	Dott. Matteo Beretta Dott. Fabio Federici Canova
439	28 Giugno	U.S.A.	<b>Normal and abnormal growth of the mandible</b>	Prof. Per Rank
440	29 Giugno	Adria	<b>Conico on Prama: nuovo approccio alla riabilitazione dell'edentulia (attuale e potenziale) alternativo alla toronto</b>	Dott. Lionello Biscaro Odt. Massimo Soattin
441	29 Giugno	Adria	<b>Conico on Prama: nuovo approccio alla riabilitazione dell'edentulia (attuale e potenziale) alternativo alla toronto</b>	Dott. Lionello Biscaro Odt. Massimo Soattin
442	29 Giugno	Padova	<b>Farmacologia. Parte II</b>	Dott. Morena Zusso
443	29 Giugno	Milano	<b>La gestione farmacologica del dolore odontoiatrico in età pediatrica</b>	Prof. Maria Grazia Cagetti

444	30 Giugno	Bassano del Grappa	<b>Disturbi respiratori ostruttivi nel sonno</b>	Dott. Luigi Romano Log. Pasqualina Andretta
445	30 Giugno	Vicenza	<b>Digital dentistry era</b>	Dott. Alessandro Cucchi
446	30 Giugno	Boston	<b>Facial augmentation: osteotomy vs implants</b>	Dott. Faisal A. Queresyl
447	30 Giugno	Vicenza	<b>Trattamento di grave atrofia del mascellare superiore con chirurgia iuxtaossea digitale customizzata</b>	Dott. Stefano Negrini
448	01 Luglio	Milano	<b>La salute orale dei pazienti dopo covid-19</b>	Prof. Silvio Abati
449	01 Luglio	Milano	<b>Carboidrati e salute orale</b>	Prof. Maria Grazia Cagetti
450	02 Luglio	Padova	<b>La radiologia in odontoiatria</b>	Dott. Cicchiello Andrea
451	03 Luglio	Trento	<b>Sviluppo armonico delle arcate: come, quando e perché intervenire precocemente. I reali vantaggi dell'intervento precoce. Perché utilizzare gli elementi decidui. Ancoraggio agli elementi decidui: come utilizzare in maniera efficace. Recupero conservativo degli elementi decidui compromessi o anchilosati</b>	Dott. Patrizia Lucchi
452	03 Luglio	Padova	<b>Disturbi respiratori in età evolutiva</b>	Prof. Antonio Gracco Dott. Francesca Milano
453	04 Luglio	Milano	<b>Semeiotica ortodontica: la capacità di osservare per capire</b>	Dott. Sandro Spigarelli
454	04 Luglio	Padova	<b>Approccio psicologico in odontoiatria pediatrica</b>	Dott. Anna Manente
455	06 Luglio	Vicenza	<b>L'espansione del mascellare: tips e suggerimenti clinici</b>	Dott. Giuliano Maino
456	06 Luglio	Torino	<b>La chirurgia ultrasonica</b>	Dott. Marco Mozzati
457	09 Luglio	Berlino	<b>Basic aspects in trauma surgery and midface</b>	Dott. Harald Essig
458	11 Luglio	Padova	<b>Implantologia zigomatica: nuovi orizzonti della tecnica extrasinusale</b>	Dott. Pietro Salvatori Dott. Gianni Pecorilli

459	13 Luglio	Roma	<b>B.O.P.T. in lab</b>	Odt. Antonello di Felice
460	13 Luglio	Buffalo	<b>Jaw in a day: complex implant dentistry combined with facial reconstructive surgery</b>	Dott. Ashish Patel Dott. Allen Cheng Dott. Babek Khatib Dott. Brian Bray
461	14 Luglio	Napoli	<b>....E quando un dente smette di erompere?</b>	Dott. Raffele Spena
462	15 Luglio	Roma	<b>La sedazione cosciente nell'odontoiatria moderna</b>	Dott. Manuele Basili Dott. Andrea Rizzacasa
463	16 Luglio	Lima	<b>Controversias terapeuticas y reconstruccion en cancer de via aerodigestiva superior</b>	Dott. Dante De Paz
464	17 Luglio	Milano	<b>Soft tissue 4.0 Implantologia e tessuti molli: come, quando, perché?</b>	Dott. Matteo Invernizzi
465	22 Luglio	Genova	<b>Management of full arch immediate loading rehabilitation using a reduced number of implants</b>	Prof. Maria Menini
466	23 Luglio	Bassano del Grappa	<b>Attestato di partecipazione addetto antincendio</b>	Ing. Emiliano Bettin
467	24 Luglio	Chicago	<b>Uneasy lies the head that wears the crown</b>	Dott. Sreenivas Koka
468	24 Luglio	U.S.A.	<b>Oral cancer early detection: strategies and technologies</b>	Relatori vari
469	25 Luglio	U.S.A.	<b>Advanced oral cancer management: controversies to consensus</b>	Relatori vari
470	25 Luglio	Roma	<b>Infezioni odontogene e vie di diffusione: il punto di vista dell'odontoiatra</b>	Dott. Massimo Galli
471	25 Luglio	Roma	<b>Infezioni odontogene e vie di diffusione: il punto di vista dell'otorinolaringoiatra</b>	Dott. Marco de Vincentiis
472	26 Luglio	Roma	<b>Complicanze endodontiche correlate al seno mascellare</b>	Dott. Luca Testarelli Dott. Gianluca Gambarini
473	26 Luglio	Roma	<b>Gestione dei corpi estranei sinusali</b>	Dott. Vittorio Rinaldi

474	27 Luglio	Chieti	<b>Complicanze implantari della chirurgia del seno mascellare</b>	Prof. Antonio Scarano
475	27 Luglio	Chieti	<b>Complicanze del rialzo del seno crestale e laterale della chirurgia del seno mascellare</b>	Prof. Antonio Scarano
476	27 Luglio	Padova	<b>Come semplificare le problematiche chirurgiche e protesiche nella terapia implantare</b>	Dott. Michele Perelli Prof. Mario Semenza
477	28 Luglio	Brescia	<b>Prevenzione e terapia delle malattie parodontali e peri-implantari</b>	Prof. Magda Mensi
478	28 Luglio	Padova	<b>Traumi dentali</b>	Dott. Marta Nocent
479	28 Luglio	Padova	<b>La lettura dell'opt</b>	Dott. Anna Manente
480	28 Luglio	Brescia	<b>L'isolamento del campo operatorio</b>	Dott. Marco Cardinali
481	29 Luglio	Bologna	<b>Immediate implantation and loading in the esthetic zone: risk or benefit?</b>	Dott. Marco Degidi
482	29 Luglio	Parma	<b>Tip and tricks nel trattamento delle terze classi borderline</b>	Dott. Renato Cocconi
483	30 Luglio	Catania Cagliari	<b>Slow implantology vs fast implantology: diverse filosofie di approccio ai casi complessi. Quando, come e perchè</b>	Dott. Marco Csonka Dott. Ignazio Lio
484	30 Luglio	Padova	<b>Basi immunologiche delle malattie allergiche</b>	Dott.ssa Maria Angiola Crivellaro
485	31 Luglio	Bologna	<b>Riabilitazioni protesiche nel settore anteriore nei pazienti in crescita</b>	Dott. Nikolaos Perakis
486	31 Luglio	Guatemala city	<b>Management of panfacial fractures. Central american perspective</b>	Dott. Jaime Matta
487	03 Agosto	New York	<b>Arthroscopic surgery: how to diagnose and treat TMJ dysfunction with minimal invasive procedures</b>	Dott. Rafael Martin Granizo
488	04 Agosto	Penn university dental medicine	<b>Bonding procedures for minimally invasive esthetic and functional rehabilitations</b>	Dott. Neimar Sartori
489	08 Agosto	Roma	<b>Chirurgia orale pediatrica</b>	Prof. Gianluca Sfasciotti
490	08 Agosto	Roma	<b>Endodonzia del dente deciduo</b>	Prof. Maurizio Bossù



491	11 Agosto	Univerdidad de Chile	<b>Manejo de las deformidades dentofaciales en pacientes fisurados</b>	Dott. Adaia Valls Dott. Roberto Pantoja
492	11 Agosto	Penn University School of Dental Medicine	<b>Adhesive oral rehabilitation: minimally invasive indirect restorations</b>	Dott. Oswaldo Scopin de Andreade
493	13 Agosto	University of Witwatersrand	<b>Maxillofacial prosthetic needs: a growing south african concern</b>	Dott. Meriting Thokoane
494	17 Agosto	Hospital nacional " Dos de Mayo " servicio de cirugía de cabeza, cuello y maxillofacial	<b>Controversias en el diagnostico y manejo de la hiperplasia condilea</b>	Dott. Rodrigo Farina
495	18 Agosto	European federation of periodontology	<b>Diabetes and periodontitis: the bidirectional relationship</b>	Dott. Lior Shapira Dott. Reena Waida
496	18 Agosto	Utah University, oral and maxillofacial surgery	<b>Patient specific microvascular head and neck recontruction</b>	Dott. James Melville Dott. Jonathan Shum
497	20 Agosto	Universidad de Chile	<b>Trauma facial de alta energia</b>	Dott. Marcelo Maradones
498	20 Agosto	Universidad de Chile	<b>Implantes customizados de orbita</b>	Dott. Christian Pedemonte
499	21 Agosto	Roma Lodi	<b>La gestione economica dello studio odontoiatrico</b>	Dott. Gabriele Vassura Dott. Pietro Paolo Mastinu
500	24 Agosto	Israel University	<b>Arthrocentesis of disorders: when and why?</b>	Dott. Dorrit W. Nitzan
501	25 Agosto	Università di Firenze	<b>Soft-tissue reconstruction at implant site</b>	Dott. Francesco Cairo
502	25 Agosto	Universidad de Chile	<b>Distraction osteogenica en el tratamiento de las dismorfosis faciales en pacientes pediatricos</b>	Dott. Loreto Castillon Zirpel
503	27 Agosto	Universidad de Chile	<b>Is the position of tmj disc really the problem and/or the solution to the management of temporomandibular joint disorders?</b>	Dott. Louis G. Mercuri
504	29 Agosto	Universidad de Chile	<b>Aplicaciones de la fibrina rica en plaquetas en cirugía bucal y maxillofacial</b>	Dott. Osvaldo Gahona Gutierrez
505	29 Agosto	Universidad de Chile	<b>Oxidative stress: the mechanism that destroys the bone around implats. Growth factors can be used as prevention or treatment?</b>	Dott. Joseph Choukroun
506	29 Agosto	Mediterranean academy of esthetic dentistry	<b>Maxillary sinus grafting: what i did and i do now?</b>	Dott. Pascal Valentini

507	29 Agosto	National Taiwan university	<b>Strategies for mandibular reconstruction in head and neck cancer</b>	Dott. Tong Mei Wang
508	30 Agosto	National university of medical sciences, Pakistan	<b>Managing orthodontic surgical cases</b>	Dott. Haris Khan
509	30 Agosto	Penn dental medicine, Univeristy of Pennsylvania	<b>Esthetics with multiple implants, periodontal reconstruction and ceramic restoration</b>	Dott. Victor Clavijo
510	30 Agosto	AO Foundation, Davos	<b>Virtual planning in ankylosis surgery</b>	Dott. Dong Mei He
511	31 Agosto	University of Albama at Birmingham, school of dentistry	<b>Are bone allografts the material of choice in ridge preservations and augmentations?</b>	Dott. Ramzi Abou-Arraj
512	31 Agosto	America academy of maxillofacial prosthetics	<b>Contemporary maxillofacial prosthetics</b>	Dott. Thomas Salinas
513	31 Agosto	El Paso children hospital, Oral and facial surgery	<b>Evaluation and treatment of the unilateral and bilateral cleft nasal deformity</b>	Dott. David M.Yates
514	01 Settembre	Roma	<b>Implantopotesi biomimetica nei settori ad alta valenza estetica. Concetti e strategie operative per il trattamento dei deficit tissutali</b>	Dott. Gaetano Calesini Dott. Stefano Coppè
515	01 Settembre	Roma	<b>Short implant e chirurgia maxillo-facciale</b>	Prof. Andrea Cicconetti
516	01 Settembre	Roma	<b>Asimmetrie facciali</b>	Prof. Piero Cascone
517	02 Settembre	Torino	<b>Hyaluronic acid threads and skin quality improvement</b>	Dott. Alberto Diaspro
518	02 Settembre	Como	<b>Trattamento dei siti compromessi e carico immediato. Influenza della macro e micro geometria implantare nel trattamento dei siti compromessi e nel carico immediato</b>	Prof. Tiziano Testori
519	02 Settembre	Chile	<b>Urgencias y emergencias en cirugía bucco-maxillofacial</b>	Prof. Adrian Carlos Bencini
520	02 Settembre	Penn University, school of dental medicine	<b>The excellence in restorative dentistry</b>	Prof. Lorenzo Breschi
521	03 Settembre	Penn Univesity, school of dental medicine	<b>Bonding time. Tips and tricks for bonding</b>	Prof. Markus b. Blatz

522	03 Settembre	The University of Alabama at Birmingham	<b>Endotracheal tube fixation via a modified Ivy Loop in a pediatric patient with facial burns</b>	Dott. Brian Kinard
523	03 Settembre	U.C.L.A. Craniofacial group, U.S.A.	<b>Radiology aspects of cleft palate</b>	Dott. Mohammed A. Husain
524	03 Settembre	University of Witwatersand, Suoth Africa	<b>The rationale for appropriatech in prosthodontics: additional roles for the prothodontist?</b>	Dott. Peter Owen
525	03 Settembre	Loma Linda University, School of dental medicine, Oral and Maxillofacial surgery	<b>What patients teach us abuot heda and neck cancer?</b>	Dott. Chi Viet
526	04 Settembre	Universidad de Chile	<b>Curso de cirurgia ortognatica minimamente invasiva</b>	Dott. Jonathan Daniel Claus Dott. Matheus Spinella
527	04 Settembre	Universidad Nacional de La Plaza	<b>Cirurgia ortognatica: anomalies de desarrollo facial</b>	Prof. Dott. Adrian Carlos Bencini
528	04 Settembre	Santo Stefano Belbo	<b>Zygomatic implants</b>	Prof. Tiziano Tealdo
529	05 Settembre	Universidad de Chile	<b>Malformaciones craniofaciales</b>	A.A.
530	10 Settembre	Royal college of surgeon	<b>Surgiacal site infections and outcomes in surgiacal oncology</b>	A.A.
531	10 Settembre	Roma	<b>Le riabilitazioni complesse in pazienti di interesse maxillo-facciale</b>	Dott. Martina Cerroni
532	11 Settembre	Padova	<b>Gli impianti tiltati nelle riabilitazioni parziali dei mascellari: l'importanza dell'osso basale</b>	Dott. Marco Finotti
533	11 Settembre	Milano	<b>Le espansioni crestali</b>	Prof. Raffele Vinci
534	16 Settembre	Roma	<b>Impianti post-estrattivi a carico immediato in area estetica: tessuti duri e molli</b>	Dott. Marco Talocco
535	17 Settembre	Verona	<b>Peri-implantiti e gli impianti Bicon</b>	Prof. Giorgio Lombardo
536	18 Settembre	Padova	<b>Approccio comportamentale al bambino in odontoiatria</b>	Dott. Vincenza Birardi
537	18 Settembre	Padova	<b>Procedure di sedazione nel paziente pediatrico odontoiatrico</b>	Prof. Gastone Zanette
538	19 Settembre	Verona	<b>Non-surgical rhinoplasty</b>	Prof. Dario Bertossi

539	19 Settembre	Padova	<b>Aspetti medico legali in ambito pedodontico</b>	Prof. Dario Betti
540	22 Settembre	Penn University, School of Dental Medicine	<b>Guided surgery, dynamic navigation and full arch guided prostheses: myth and realities over 15 years</b>	Dott. Alessandro Polizzi
541	22 Settembre	Universidad de Chile	<b>Ingeneria tisutal aplicada a la cirurgia maxillofacial</b>	Dott. Mauricio Barreda Hale
542	24 Settembre	Palermo	<b>Criteri di valutazione della qualità degli impianti</b>	Dott. Roberto Romano
543	29 Settembre	Basel	<b>Anterior tooth loss in adolescence. What to do?</b>	Dott. Nicola Zitzmann
544	29 Settembre	University of Alcala	<b>Midfacial recontruction after oncologic excision</b>	Prof. Julio Acero
545	29 Settembre	Vicenza	<b>Tooth transformer e magnetic mallet: la combinazione vincente</b>	Dott. Elio Minetti Dott. Mauro Libertucci
546	29 Settembre	Loma Linda Univesity, School of Dental Medicine	<b>Infection exposure and prevention before, during and after covid-19</b>	
547	30 Settembre	Roma	<b>I tumori della testa e del collo: tecniche demolitive e ricostruttive</b>	Prof. Valentino Valentini
548	30 Settembre	AOCMF	<b>Importance of multidisciplinary treatment of head and neck cancer</b>	Prof. Gregorio Sanchez Aniceto
549	30 Settembre	Firenze	<b>Strategia clinica per il trattamento rigenerativo delle peri-implantiti</b>	Dott. Pierpaolo Cortellini
550	30 Settembre	American academy of implant dentistry	<b>5-Thread guidelines for implant stability</b>	Dott. Robert Stanley
551	02 Ottobre	Riccione	<b>Congresso nazionale delle Società Italiana di Chirurgia Odontostomatologica</b>	Relatori vari
552	02 Ottobre	Riccione	<b>Aspetti endodontico-conservativi in traumatologia dentale</b>	Dott. Pietro Marcoli
553	02 Ottobre	Roma	<b>Ruolo della chirurgia pre-implantare nella implantologia moderna</b>	Prof. Andrea Cicconetti
554	02 Ottobre	Santiago, Chile	<b>Complicaciones en cirurgia ortognatica</b>	Dott. Julio Cifuntes
555	02 Ottobre	Ragusa	<b>Approccio sistematico alla chirurgia orale complessa: strumentario, protocolli operativi, anatomia</b>	Prof. Corrado Toro

556	02 Ottobre	Buffalo, New York	<b>Contemporary customized maxillofacial reconstruction</b>	Dott. James C. Melville
557	02 Ottobre	Santo Stefano Belbo	<b>1° Forum Nazionale "Tealdo Total Face Academy". Columbus bridge protocol e digital dentistry: procedure diagnostiche, operative e sviluppi futuri per l'odontoiatria e per l'odontotecnico</b>	Relatori vari
558	09 Ottobre	Milano	<b>Come fare una meta-analisi</b>	Prof. Guglielmo Campus
559	09 Ottobre	Bari	<b>Albero decisionale nelle serie atrofe dei mascellari: uso degli innesti di osso omologo</b>	Prof. Felice Roberto Grassi
560	09 Ottobre	Padova	<b>Approccio diagnostico e terapeutico alle riniti allergiche</b>	Dott. Maria Angiola Crivellaro
561	09 Ottobre	Bern	<b>Integration of implants in the treatment of elderly patients</b>	Prof. Regina Mericske Stern
562	09 Ottobre	Penn University, School of Dental Medicine	<b>Immediate tooth replacement</b>	Prof. Joseph Kan
563	09 Ottobre	Facultad de Odontologia, Universidad Finis Terrae	<b>Ameloblastoma: actualizacion en el tratamiento quirurgico</b>	Dott. Javier Perez
564	09 Ottobre	Como	<b>La collaborazione tra ortodontista e chirurgo maxillo-facciale: discrepanze sagittali e trasversali</b>	Dott. Marco Bernardi
565	09 Ottobre	Milano	<b>Atraumatic impacted teeth extraction using piezosurgery approach</b>	Prof. Angelo Cardarelli
566	09 Ottobre	Firenze	<b>Interdisciplinary treatment: modern approach to esthetic and functional rehabilitation</b>	Dott. Giano Ricci Dott. Paolo Manzo
567	15 Ottobre	Padova	<b>Concetti di endocrinologia in odontoiatria pediatrica</b>	Dott. Pietro Maffei
568	15 Ottobre	Padova	<b>Cisti radicolari in età pediatrica: diagnosi e terapia. Discussione di casi clinici</b>	Prof. Silvia Pizzi
569	21 Ottobre	Padova	<b>La chirurgia orale pediatrica funzionale all'ortodonzia intercettiva</b>	Dott. Matteo Spigaroli
570	23 Ottobre	Padova	<b>Concetti di endocrinologia</b>	Dott. Pietro Maffei
571	23 Ottobre	Vicenza	<b>Incisor display: un fattore chiave nell'estetica del sorriso. Leading alliance selected lecture</b>	Dott. Giovanna Maino



572	06 Novembre	Padova	<b>Ortodonzia intercettiva: prima parte</b>	Dott. Giovanni Scorpa
573	07 Novembre	Berna	<b>Updates periodontal reconstructive surgery using collagen based products</b>	Prof. Anton Sculean
574	07 Novembre	Udine	<b>Meaningful innovation in personalized care: endoscopic, computer-guided repair of the orbital floor</b>	Prof. Massimo Robiony
575	07 Novembre	Berna	<b>Integration of implants in the treatment of elderly patients</b>	Prof. Regina Mericske Stern
576	11 Novembre	Parma	<b>Evoluzione e precisione in chirurgia ortognatica</b>	Prof. Mirco Raffaini
577	18 Novembre	Padova	<b>Trattamenti in zona estetica e platform switching</b>	Dott. Diego Longhin
578	19 Novembre	Padova	<b>La riabilitazione protesica ed implanto-protesica nell'era digitale</b>	Dott. Gianluca Paniz
579	19 Novembre	Santo Stefano Belbo	<b>L'utilizzo razionale degli short implant nelle procedure di carico immediato nel mascellare atrofico</b>	Prof. Tiziano Tealdo
580	20 Novembre	Milano	<b>Il ruolo dei biomateriali nella gestione dell'alveolo post-estrattivo</b>	Dott. Paolo Casentini
581	21 Novembre	S.O.R.G.	<b>Ricostruzione dei tessuti molli. Algoritmi, indicazioni e risultati</b>	A.A.
582	22 Novembre	S.O.R.G.	<b>Lembi di tessuto molle (radiale, ALT, lat. Dorsi). Indicazioni, tecnica chirurgica e risultati</b>	A.A.
583	23 Novembre	S.O.R.G.	<b>Ricostruzioni Bony. Indicazioni, algoritmi e risultati</b>	A.A.
584	24 Novembre	S.O.R.G.	<b>Lembi DCIA. Indicazioni, tecnica chirurgica e risultati</b>	A.A.
585	25 Novembre	Bologna	<b>Focus on regeneration: dalla preservazione alveolare alle griglie 3D customizzate</b>	Dott. Alessandro Cucchi
586	26 Novembre	Barcellona	<b>Surgical stability in orthognathic surgery</b>	Dott. Orion Haas Junior
587	26 Novembre	Milano	<b>Il trattamento delle terze classi in fase di crescita</b>	Prof. Costanza Meazzini
588	30 Novembre	Bari	<b>Cases reports: riabilitazioni di mascellari superiori ed inferiori con tecnica iuxta-digitale</b>	Dott. Giuseppe Di Biasi

589	30 Novembre	New Delhi	<b>Altering vertical dimension in worm dentition: a prosthodontic physiological perspective</b>	Prof. Veena Jain
590	30 Novembre	S.I.C.P.R.E. Società italiana di chirurgia plastica ricostruttiva ed estetica	<b>Il lifting del volto</b>	Prof. Marco Klinger Prof. Stefano Bruschi
591	01 Dicembre	Padova	<b>I disturbi respiratori del sonno in età evolutiva</b>	Prof. Antonio Gracco
592	01 Dicembre	Padova	<b>Trattamento dei denti con apici immaturi, vital pulp therapy e rigenerativa</b>	Dott. Filippo Cardinali
593	02 Dicembre	Padova	<b>Ortodonzia segmentaria</b>	Dott. Andrea Scarpa
594	02 Dicembre	Ann Arbor	<b>Patient evaluation, data analysis and orthodontic. Virtual surgical planning for orthognathic surgery: overview and live treatment planning session</b>	Dott. Myron Tucker Dott. Sean Edwards
595	03 Dicembre	Società italiana di biomeccanica ed ortodonzia segmentaria	<b>Localization and treatment of asymmetries in class II patients</b>	Dott. Birte Melsen Dott. Morten Godtfredsen Laursen
596	03 Dicembre	Verona	<b>La salute orale nel tabagista: cessazione ed alternative disponibili</b>	Prof. Francesco Riva
597	03 Dicembre	Padova	<b>Odontoiatria pediatrica e dell'età evolutiva</b>	Prof. Patrizia Lucchi Prof. Sergio Mazzoleni
598	03 Dicembre	Genova	<b>Il piano di trattamento integrato nella moderna odontoiatria</b>	Prof. Enrico Conserva
599	03 Dicembre	Orbassano	<b>Come gestire le problematiche delle viti protesiche nella terapia implantare</b>	Prof. Ezio Bruna
600	04 Dicembre	Padova	<b>Cariologia in odontoiatria pediatrica</b>	Prof. Patrizia Lucchi Prof. Sergio Mazzoleni
601	04 Dicembre	Milano	<b>Approccio multidimensionale al paziente edentulo</b>	Prof. Raffaele Vinci Dott. Francesca Cattoni Dott. Michele Manacorda
602	04 Dicembre	Torino	<b>Un percorso coerente dalla diagnosi alla terapia funzionalizzante</b>	Prof. Maria Grazia Piancino
603	04 Dicembre	Società Italiana di Medicina e Patologia Orale - S.I.P.M.O.	<b>Complicanze orali degli inibitori del checkpoint immunitario</b>	Prof. Alessandro Villa
604	04 Dicembre	Palermo	<b>Ortodonzia intercettiva</b>	Dott. Giorgio Garofalo

605	09 Dicembre	Verona	<b>Cefalometria 3D: workflow digitale ed applicazioni cliniche</b>	Dott. Giovanna Perrotti
606	10 Dicembre	Goteborg	<b>Welcome to the muointegration era</b>	Prof. Tomas Albrektsson Dott. Angelines Gasser Dott. Sebastian Bauer
607	10 Dicembre	Trieste	<b>Gestione precoce dell'anchiloglossia</b>	Prof. Milena Cadenaro
608	12 Dicembre	Catanzaro	<b>La chirurgia dei terzi molari inclusi</b>	Prof. Amerigo Giudice
609	12 Dicembre	Milano	<b>Il digitale nell'ottimizzazione della componentistica protesica standard e customizzata</b>	Prof. Raffaele Vinci Dott. Francesca Cattoni Dott. Michele Manacorda
610	14 Dicembre	Pisa	<b>La guarigione dell'alveolo dopo l'estrazione: evoluzione delle conoscenze ed implicazioni cliniche per la ridge preservation</b>	Prof. Ugo Covani
611	15 Dicembre	Roma	<b>Updates in diagnosis and therapy in unilateral condylar hyperplasia</b>	Prof. Piero Cascone
612	18 Dicembre	Palermo	<b>Ortodonzia intercettiva</b>	Dott. Giorgio Garofalo
613	19 Dicembre	Firenze	<b>Accorgimenti per affrontare la chirurgia orale pediatrica in sicurezza</b>	Dott. Roberto Barone
614	19 Dicembre	Roma	<b>La salute orale nel tabagista: cessazione ed alternative disponibili</b>	Prof. Francesco Riva
615	19 Dicembre	Società Italiana di Chirurgia Maxillo-Facciale	<b>Ruolo dell'endodonzia nella risoluzione delle patologie cistiche dei mascellari</b>	Dott. Fabio Gorni
616	20 Dicembre	Rimini	<b>Autotrapianti e re-impianti dentali</b>	Dott. Luca Boschini Dott. Michele Melillo
617	20 Dicembre	Milano	<b>Chirurgia ossea ricostruttiva</b>	Dott. Paolo Casentini
618	21 Dicembre	Accademia Italiana di Ortodonzia	<b>Trattamento dei canini inclusi con TADs diretti</b>	Dott. Nicola Derton
619	22 Dicembre	ITI Italia	<b>La peri-implantite: come diagnosticarla, come guarirla</b>	Dott. Marco Clementini

2021				
620	05 Gennaio	S.I.B.O.S.	<b>Le basi della tecnica bidimensionale: passato, presente e futuro</b>	Dott. Matteo Spigaroli
621	06 Gennaio	Universidad de Chile	<b>3D virtual planning in orthognathic surgery</b>	Prof. Gwen Swennen Dott. Rolando Carrasco
622	06 Gennaio	IAOMS	<b>Artificial intelligence in surgery: will a computer program replace the surgeon?</b>	Dott. Deepak Krishnan
623	06 Gennaio	International College of Prosthodontics	<b>Philosophies and concepts in occlusion: past, present and future with clinical introspections</b>	Dott. Sunjay Sun
624	11 Gennaio	Padova	<b>Align tecnologia</b>	A.A.
625	12 Gennaio	Padova	<b>Approccio innovativo in odontoiatria estetica multidisciplinare: il razionale</b>	Dott. Camilla Molinari
626	19 Gennaio	Milano Brianza	<b>Lavorazioni ed innovazioni nelle tecniche CAD-CAM</b>	Odt. Vito Minutolo
627	19 Gennaio	Salerno	<b>Live streaming full surgery of impacted wisdom tooth close to the ian</b>	Dott. Ruggero Naimoli
628	21 Gennaio	Bologna	<b>Approccio innovativo in odontoiatria estetica multidisciplinare: l'aging e l'analisi dento-facciale</b>	Dott. Camilla Molinari
629	21 Gennaio	Padova	<b>Align tecnologia</b>	A.A.
630	22 Gennaio	Padova	<b>Diagnocam: anatomia ed estetica</b>	Dott. Giuseppe Chiodera
631	22 Gennaio	Lodi	<b>Convenienza ed opportunità offerte dell'esercizio in forma imprenditoriale dell'attività odontoiatrica per il libero professionista odontoiatra. Aspetti normativi, fiscali ed operativi</b>	Dott. Pietro Paolo Mastinu Dott. Gabriele Vassura
632	23 Gennaio	Padova	<b>Le ipoplasie dello smalto: M.I.H.</b>	Dott. Lisa Lardani
633	28 Gennaio	Padova	<b>I disturbi del sonno in età evolutiva</b>	Prof. Antonio Gracco
634	28 Gennaio	Chicago	<b>Artificial intelligence in surgery: will a computer program replace the surgeon?</b>	Dott. Deepak Krishnan
635	02 Febbraio	Bologna	<b>Approccio innovativo in odontoiatria estetica multidisciplinare: l'estetica periorale in odontoiatria</b>	Dott. Camilla Molinari

636	03 Febbraio	SICMF	<b>Il neonato con iperplasia mandibolare: principi di diagnosi e trattamento</b>	Dott. Fabio Mazzoleni Dott. Tiziana Fedeli Dott. Anna Mandelli
637	04 Febbraio	Toronto	<b>Development of occlusion: a pediatric perspective</b>	Dott. Gajanan Kulkarni
638	10 Febbraio	Bologna	<b>Il protocollo Columbus Bridge</b>	Dott. Matteo Furlati
639	11 Febbraio	SICMF	<b>Evolution in head and neck reconstruction</b>	Dott. Nicholas Kalavrezos
640	12 Febbraio	Montreal	<b>Sleep bruxism and its crossing points with sleep apnea, tmd/orofacial pain and insomnia</b>	Dott. Gilles Lavigne
641	12 Febbraio	Trieste	<b>Il trattamento delle lesioni cariose pediatriche</b>	Prof. Milena Cadenaro
642	13 Febbraio	Milano	<b>Implantologia zigomatica con tecnica extrasinuzale</b>	Dott. Francesco Grecchi
643	13 Febbraio	Pordenone	<b>Ortodonzia intercettiva: protocolli clinici efficienti</b>	Dott. Andrea Scarpa
644	15 Febbraio	Lodi Vicenza	<b>Formazione 4.0</b>	Dott. Gabriele Vassura Dott. Gianluca Zanetti Ing. Gabriele Zanon
645	17 Febbraio	Bologna	<b>La chirurgia computer-assistita in oncologia maxillo-facciale</b>	Prof. Claudio Marchetti Dott. Giovanni Badiali Dott. Francesco Ceccariglia Dott. Elisabetta Lucchi Dott. Angelo Pizzigallo Dott. Francesco Ricotta Dott. Achille Tarsitano
646	17 Febbraio	Como	<b>Implantologia osteointegrata</b>	Prof. Tiziano Testori
647	18 Febbraio	Padova	<b>Restauri del settore anteriore: le variazioni di forma</b>	Dott. Giampaolo Drago
648	19 Febbraio	Padova	<b>Odontoiatria conservativa diretta</b>	Dott. Monaldo Saracinelli
649	20 Febbraio	Treviso	<b>Oligodontia, ipodontia ed anodontia: trattamento combinato ortodontico-chirurgico: parte 1</b>	Dott. Patrizia Lucchi
650	20 Febbraio	Treviso	<b>Oligodontia, ipodontia ed anodontia: trattamento combinato ortodontico-chirurgico: parte 2</b>	Prof. Antonio Gracco Dott. Patrizia Lucchi
651	20 Febbraio	Penn Dental Medicine, Oral and Maxillofacial Surgery	<b>The pathophysiology and management of central giant cell lesion of the mandible</b>	Prof. Anthony Pogrel
652	24 Febbraio	University of Toronto	<b>Physical, biomechanical and biochemical consideration when selecting materials for prosthetic rehabilitation</b>	Prof. Yoav Finer



653	25 Febbraio	Padova	<b>Ortodonzia intercettiva: protocolli clinici efficienti. Parte 2</b>	Dott. Gianluca Garofalo
654	26 Febbraio	Nobel Biocare	<b>Peri-implantitis: praventio und therapie</b>	Dott. Holger Zipprich Dott. Urs Brodbeck
655	26 Febbraio	S.I.O.I	<b>Odontoiatria pediatrica moderna</b>	A.A.
656	26 Febbraio	S.I.C.M.F.	<b>Le gestione del collo nelle neoplasie delle ghiandole salivari</b>	Dott. Luigi Solazzo
657	27 Febbraio	Dentalica S.p.a.	<b>La scelta della componentistica implantare</b>	A.A.
658	28 Febbraio	Milano	<b>Nuovi protocolli di gestione delle lesioni del cavo orale</b>	Prof. Federico Biglioli
659	01 Marzo	Berlino	<b>Customized cranial implants: approach to the skull base</b>	A.A.
660	01 Marzo	Madrid	<b>Free flap skull base reconstruction</b>	Prof. Gregorio Sanchez Aniceto
661	01 Marzo	A.P.O.S.	<b>Timing in chirurgia orale pediatrica. Chirurgia estrattiva: decidui infraocclusi, sovranumerari e germi degli ottavi</b>	Dott. Roberto Barone
662	01 Marzo	I.R.C.	<b>Le nuove linee guida della rianimazione cardio-polmonare</b>	A.A.
663	02 Marzo	Vicenza	<b>Chirurgia orale pediatrica: approccio al paziente, problematiche diagnostiche e chirurgiche</b>	
664	03 Marzo	Vicenza	<b>Estetica nelle riabilitazioni implantari: obiettivo perseguibile anche con il flusso digitale?</b>	Dott. Alessio Franchina
665	03 Marzo	Udine	<b>Le ricostruzioni customizzate 3D dello scheletro cranio-facciale</b>	Prof. Massimo Robiony
666	04 Marzo	Torino	<b>Gestione dei difetti per sede: mascellare superiore</b>	Prof. Chiara Copelli
667	04 Marzo	Torino	<b>Gestione dei difetti per sede: lingua e pavimento orale</b>	Dott. Emanuele Zavattero
668	04 Marzo	Torino	<b>Gestione perioperatoria: preparazione ed aspetti anestesilogici</b>	Dott. Enzo Marchello
669	05 Marzo	Padova	<b>Elementi di cariologia: diagnostica e trattamento dei settori posteriori</b>	Dott. Marco Calabrese
670	06 Marzo	England	<b>Erosive tooth wear, occlusion in treatment planning, occlusion and cognition and neuroplasticity</b>	Dott. David Barlett
671	10 Marzo	Rimini	<b>Il ruolo chiave dei tessuti molli e duri nel risultato estetico</b>	Prof. Mauro Merli

672	10 Marzo	Roma	<b>L'approccio combinato perio-implantare</b>	Dott. Marco Talocco
673	11 Marzo	Torino	<b>Aspetti radiologici in chirurgia ricostruttiva</b>	Dott. Paolo Balercia
674	11 Marzo	Torino	<b>Gestione dei difetti per sede: mandibola</b>	Dott. Paolo Balercia
675	11 Marzo	Torino	<b>Gestione dei difetti per sede: cute</b>	Dott. Paolo Balercia
676	11 Marzo	Cagliari	<b>Aggiornamenti in traumatologia dentaria: diagnosi e trattamento delle lussazioni dentarie nei denti decidui e permanenti. Parte 1</b>	Prof. Enrico Spinis
677	12 Marzo	Padova	<b>Restauro indiretto dei denti permanenti coronalmente compromessi</b>	Dott. Marco Calabrese
678	13 Marzo	Madrid	<b>State of the art in mandibular reconstruction</b>	Prof. Julio Acero Sanz
679	14 Marzo	Catanzaro	<b>Le patologie autoimmuni dei bambini: come riconoscerle e trattarle</b>	
680	14 Marzo	Cagliari	<b>La progettazione funzionale, la risoluzione dei casi complessi e l'ortodonzia intercettiva con il sistema Nuvola OP system</b>	Dott. Simonetta Bussu
681	16 Marzo	Vicenza	<b>Trattamento delle grandi atrofie mascellari con impianti zigomatici</b>	Dott. Andrea Tedesco
682	18 Marzo	Monza	<b>Forearm: anatomia ed indicazioni</b>	Dott. Davide Sozzi
683	18 Marzo	Napoli	<b>Forearm: allestimento</b>	Dott. Paolo Iacoviello
684	18 Marzo	Milano	<b>Il lembo laterale di braccio</b>	Dott. Davide Sozzi
685	18 Marzo	Budapest	<b>Chirurgia ricostruttiva e rigenerativa maxillo-mandibolare</b>	Prof. Istvan Urban
686	19 Marzo	Parma	<b>Agenesia unilaterale degli incisivi superiori. Soluzioni interdisciplinari</b>	Dott. Renato Cocconi
687	19 Marzo	Milano	<b>Il trattamento multidisciplinare delle labiopalatoschisi</b>	Prof. Maria Costanza Meazzini Dott. Luca Auteliano Dott. Angela Rezzonico
688	24 Marzo	Padova	<b>Odontoiatria di comunità ed epidemiologia</b>	Dott. Barbara Isaia
689	25 Marzo	Ferrara	<b>Ricostruzioni estetiche del settore frontale: procedure operative</b>	Dott. Pietro Sibilla
690	25 Marzo	Udine	<b>Il lembo libero di fibula: anatomia ed indicazioni</b>	Prof. Massimo Robiony

691	25 Marzo	Perugia	<b>Il lembo libero di fibula: allestimento</b>	Dott. Antonio Tullio
692	25 Marzo	Bologna	<b>Applicazioni tecnologiche in chirurgia ricostruttiva</b>	Dott. Antonio Tarsitano
693	26 Marzo	Trento	<b>Traumatologia dentale: parte 1</b>	Dott. Patrizia Lucchi
694	26 Marzo	Trento	<b>Traumatologia dentale: parte 2</b>	Dott. Patrizia Lucchi
695	27 Marzo	Treviso	<b>Odontoiatria pediatrica ed epidemiologia</b>	Dott. Chiara Terrazzani
696	27 Marzo	Vicenza	<b>Proroga della cassa integrazione, blocco dei licenziamenti e contratti a termine. Le novità del "Decreto Sostegni"</b>	Dott. Ernesto Boschiero
697	27 Marzo	Bologna	<b>Le nuove linee guida della rianimazione cardio-polmonare 2020-2025: congresso nazionale IRC</b>	Italian Resuscitation Council
698	29 Marzo	ITI STUDY CLUB Friuli Venezia Giulia	<b>Razionale clinico ed ergonomico delle procedure di carico immediato nelle edentulie totali o parziali. Analisi clinica e tecnica di due casi clinici</b>	Dott. Leonello Biscaro Sig. Massimo Soattin Sig. Daniele Zampieri
699	30 Marzo	Lodi	<b>Formazione 4.0: agevolazioni importanti anche per il settore odontoiatrico privato</b>	Dott. Gabriele Vassura Dott. Pietro Paolo Mastinu
700	01 Aprile	Roma	<b>Cresta iliaca: anatomia ed indicazioni</b>	Prof. Valentino Valentini
701	01 Aprile	Roma	<b>Cresta iliaca: sistemi di allestimento</b>	Prof. Valentino Valentini
702	01 Aprile	Milano	<b>Riabilitazione implantoprotesica post-oncologica</b>	Prof. Albo Bruno Gianni
703	07 Aprile	Aquila	<b>La sedazione cosciente e l'ansiolisi in odontoiatria pediatrica</b>	Prof. Marco Moscati
704	08 Aprile	Torino	<b>Il lembo ALT: anatomia ed indicazioni</b>	Prof. Chiara Copelli
705	08 Aprile	Torino	<b>Il lembo ALT: video di allestimento</b>	Prof. Chiara Copelli
706	08 Aprile	Torino	<b>Il percorso foniatrico-riabilitativo nel lembo ALT</b>	Prof. Maria Rita del Zompo
707	09 Aprile	Catania	<b>Ortodonzia indiretta e digitale: SWM ed F22</b>	Dott. Davide Mirabella
708	12 Aprile	Milano	<b>Il ruolo della dissezione extra-capsulare delle lesioni benigne della parotide</b>	Dott. Marco Cucurullo
709	13 Aprile	Napoli	<b>Mascellare atrofico: soluzioni per riabilitazioni immediate fisse</b>	Dott. Antonio Mallardo
710	13 Aprile	Pisa	<b>Total approach concept: zygoma implants</b>	Dott. Andrea Tedesco

711	14 Aprile	Ferrara	<b>Surgical decompression in thyroid eye disease: guidelines and current evidence</b>	Dott. Manlio Galiè
712	14 Aprile	Milano	<b>Teledentistry for the early detection in oral lesions: a lesson from the covid-19 pandemic</b>	Dott. Giorgia Capocasale
713	14 Aprile	Vicenza	<b>La dentina: un materiale da innesto osteoconduttivo</b>	Dott. Elio Minetti
714	15 Aprile	Parma	<b>La scapola: anatomia ed indicazioni chirurgiche</b>	Prof. Silvano Ferrari
715	15 Aprile	Parma	<b>Il lembo libero di scapola: video di allestimento</b>	Prof. Silvano Ferrari
716	15 Aprile	Brescia	<b>Gestione delle complicanze del lembo libero di scapola</b>	Dott. Karim Tewfik
717	15 Aprile	Padova	<b>Endopedodonzia: dai decidui ai permanenti</b>	Dott. Enrico Semenzato
718	16 Aprile	Cagliari	<b>Traumatologia dentale</b>	Dott. Enrico Spinas
719	16 Aprile	Genova	<b>Implantologia zigomatica: il trattamento del mascellare atrofico</b>	Prof. Tiziano Tealdo
720	16 Aprile	Genova	<b>Principi di guarigione ossea e stabilità primaria</b>	Dott. Marco Bevilacqua
721	17 Aprile	Genova	<b>Il punto di vista dell'anestesista: il paziente complesso in chirurgia orale</b>	Dott. Lorenzo Ball
722	19 Aprile	Verona	<b>Tecniche chirurgiche e risultati delle plastiche di chiusura delle perforazioni settali</b>	Dott. Riccardo Nocini
723	20 Aprile	Brescia	<b>La chirurgia maxillo-facciale pediatrica</b>	Dott. Karim Tewfik
724	21 Aprile	S.I.C.M.F.	<b>Approccio multidisciplinare alla Sindrome di Eagle: attualità diagnostiche e terapeutiche</b>	Prof. Francesco Saverio de Ponte Prof. Valentino Valentini Prof. Antonio D'Agostino
725	22 Aprile	Padova	<b>Elementi di traumatologia dentaria</b>	Dott. Patrizia Lucchi
726	22 Aprile	Roma	<b>Hpv: un futuro senza il papilloma virus</b>	Prof. Tiziano Treu Prof. Francesco Riva
727	22 Aprile	Padova	<b>Diagnostica ortognatodontica</b>	Dott. Raffaello Cortesi
728	23 Aprile	Padova	<b>Diagnostica ortognatodontica: 2</b>	Dott. Raffaello Cortesi
729	23 Aprile	Padova	<b>Endodonzia in età evolutiva</b>	Dott. Pio Bertani

730	24 Aprile	Padova	<b>Endodonzia in età evolutiva: 2</b>	Dott. Pio Bertani
731	24 Aprile	Società Italiana di Chirurgia Orale Pediatrica A.P.O.S.	<b>Le lesioni cistiche delle ossa mascellari in età pediatrica</b>	Dott. Roberto Barone
732	24 Aprile	Verona	<b>Seminario di implantologia: short implants nel trattamento delle atrofie mascellari</b>	Prof. Giorgio Lombardo
733	24 Aprile	Verona	<b>Mandibular osteotomies</b>	Prof. Lorenzo Trevisiol
734	26 Aprile	Torino	<b>Il lembo di gracile: anatomia ed indicazioni</b>	Prof. Federico Biglioli
735	26 Aprile	Torino	<b>Il lembo di gracile: video di allestimento</b>	Prof. Federico Biglioli
736	26 Aprile	Torino	<b>Refinements di chirurgia ricostruttiva</b>	Prof. Chiara Copelli
737	28 Aprile	Padova	<b>Malattie genetiche con manifestazioni orali</b>	Prof. Daniela Zuccarello
738	28 Aprile	Milano	<b>Ricostruzioni orbitarie: uso razionale della tecnologia</b>	Prof. Alberto Bozzetti
739	28 Aprile	Milano	<b>Le lesioni cariose in odontoiatria pediatrica</b>	Prof. Maria Grazia Cagetti
740	29 Aprile	Padova	<b>GBR nella pratica quotidiana: risoluzione di casi più o meno complessi</b>	Dott. Fabio Mazzocco
741	29 Aprile	Roma	<b>Lesioni ossee mascellari: diagnosi e terapia</b>	Prof. Francesco Riva
742	29 Aprile	Ankara S.O.R.G.	<b>Genioplasty in orthognathic surgery</b>	Prof. Hakan Tuz
743	04 Maggio	Padova	<b>Patologia orale pediatrica</b>	Prof. Christian Bacci
744	05 Maggio	Firenze	<b>Ortodonzia v/s chirurgia nella III classe</b>	Dott. Massimo Lupoli
745	05 Maggio	Napoli	<b>Considerazioni sulla chirurgia estetica e funzionale dell'unità nasale</b>	Prof. Andrea Castellani
746	05 Maggio	Goteborg	<b>Global osseointegration day</b>	Prof. Tomas Albrektsson
747	06 Maggio	Padova	<b>La traumatologia dentaria: aspetti endodontici su elementi decidui e permanenti</b>	Dott. Enrico Semenzato
748	07 Maggio	Milano	<b>National osteology italian meeting: la rigenerazione nella soluzione dei problemi quotidiani in odontoiatria. Come affrontarli in modo semplice e predicibile</b>	Dott. Giulio Rasperini Dott. Giorgio Pagni Dott. Filippo Fontana Dott. Luca Gobbato



750	08 Maggio	Dallas	<b>Simultaneous tmj and orthognathic surgical procedures</b>	Prof. Larry M. Wolford
751	11 Maggio	Amsterdam	<b>Complications in orthognathic surgery</b>	Prof. Alfred Becking
752	12 Maggio	Napoli	<b>Hot topics nei tumori maligni della parotide</b>	Prof. Luigi Califano
753	13 Maggio	Verona	<b>Le enucleazioni dentarie</b>	Dott. Andrea Compri
754	13 Maggio	Milano	<b>Edentulie dei mascellari: strategie terapeutiche alternative – Decision making</b>	Prof. Raffaele Vinci
755	13 Maggio	Lodi	<b>Organizzazione dello studio odontoiatrico per processi: parte 1</b>	Prof. Gabriele Vassura Dott. Pietro Paolo Mastinu
756	14 Maggio	Lodi	<b>Organizzazione dello studio odontoiatrico per processi: parte 2</b>	Prof. Gabriele Vassura Dott. Pietro Paolo Mastinu
757	15 Maggio	Lodi	<b>Organizzazione dello studio odontoiatrico per processi: parte 3</b>	Prof. Gabriele Vassura Dott. Pietro Paolo Mastinu
758	15 Maggio	Roma	<b>La gestione multidisciplinare dei traumi dentari</b>	Dott. Simone Grandini
759	16 Maggio	Bassano del Grappa	<b>Mininvasività in patologia epato-pancreatico-biliare</b>	Dott. Michele Antoniutti
760	17 Maggio	Milano	<b>Orientamenti diagnostici e terapeutici in ortognatodonzia</b>	Dott. Cinzia Maspero
761	17 Maggio	Padova	<b>Le malattie della tiroide</b>	Dott. Pietro Maffei
762	17 Maggio	Roma	<b>Fondamenti di chirurgia endoscopica dei seni paranasali e della base cranica in chirurgia maxillo-facciale</b>	Dott. Danilo Di Giorgio
763	18 Maggio	Santo Stefano Belbo	<b>Il flusso digitale nelle riabilitazioni full-arch a carico immediato</b>	Prof. Tiziano Tealdo Odt. Luca Scaglione
764	19 Maggio	Milano	<b>Estrazione chirurgica del terzo molare incluso</b>	Dott. Alberto Pispero
765	19 Maggio	Vicenza	<b>I nuovi anticoagulanti orali</b>	Prof. Damiano Rizzoni
766	19 Maggio	Verona	<b>Impianti ultracorti: indicazioni cliniche ed analisi biomeccanica</b>	Prof. Luciano Malchiodi
767	20 Maggio	Cleveland	<b>Outcomes – surgical relapse: orthognathic surgery</b>	Prof. Faisal A. Quereshy
768	21 Maggio	Milano	<b>Terapia ortodontica in dentatura mista: 1 parte</b>	Dott. Gualtiero Mandelli

769	21 Maggio	Milano	<b>Terapia ortodontica in dentatura mista: 2 parte</b>	Dott. Gualtiero Mandelli
770	21 Maggio	Milano	<b>Il bandaggio ortodontico in chirurgia ortognatica</b>	Dott. Niccolò Cenzato
771	22 Maggio	Parma	<b>Semeiotica ortodontica</b>	Dott. Matteo Spigaroli
772	26 Maggio	Vicenza	<b>Rigenerazione ossea guidata ed implantologia protesicamente guidata</b>	Dott. Alessandro Cucchi
773	5 Giugno	Como	<b>Trattamento chirurgico delle MRONJ: mininvasivo vs invasivo</b>	Dott. Luigi Colombo
774	5 Giugno	Treviso	<b>Gravidanza, allattamento e salute orale in età perinatale: la prevenzione inizia dal pancione</b>	Dott. Anna Franco
775	5 Giugno	Milano	<b>Principi contributivi, giuridici e fiscali delle società e dei professionisti: normative legislative prevenzione inizia dal pancione</b>	Dott. Pietro Paolo Mastinu
776	8 Giugno	Parma	<b>Chirurgia guidata e pianificazione digitale in area estetica</b>	Dott. Federico Rivara
777	9 Giugno	Milano	<b>I lembi locali e loco regionali in chirurgia maxillo-facciale</b>	Prof. Alberto Bozzetti
778	10 Giugno	Padova	<b>Le agenesie dentarie: inquadramento diagnostico e scelta terapeutica</b>	Prof. Antonio Luigi Gracco
779	15 Giugno	Roma	<b>Principi di crescita cranio-facciale in chirurgia ortognatica: fisiologia e fisiopatologia della crescita delle strutture facciali</b>	Prof. Piero Cascone
780	17 Giugno	Verona	<b>Il dentista digitale: le tecnologie cone-beam</b>	Dott. Guido Bellabona
781	17 Giugno	Milano	<b>Medicina legale in chirurgia orale e maxillo-facciale</b>	Prof. Gian Aristide Novelli
782	21 Giugno	Napoli	<b>Le osteonecrosi delle ossa mascellari farmaco-ralata (ONJ)</b>	Dott. Cristiana Germano
783	22 Giugno	Santo Stefano Belbo	<b>La riabilitazione con carico immediato del mascellare gravemente atrofico: strategie chirurgiche e protesiche</b>	Prof. Tiziano Tealdo
784	23 Giugno	Padova	<b>Ozonoterapia e protocollo in odontoiatria pediatrica</b>	Dott. Dejda Kokici
785	30 Giugno	Padova	<b>Approccio psicologico in odontoiatria infantile</b>	Dott. Maria Manente
786	30 Giugno	Toronto	<b>Prosthetic reconstruction following head and neck surgeries</b>	Prof. Caroline Tram Nguyen
787	30 Giugno	Santo Stefano Belbo	<b>Il trattamento chirurgico-protesico delle atrofie estreme dei mascellari</b>	Prof. Tiziano Tealdo
788	30 Giugno	Alicante, Spagna	<b>Dissezione ragionata delle logge anatomiche del collo e del cavo orale</b>	Dott. Alessandro Nisii Dott. Roberto Pistilli
789	01 Luglio	Alicante, Spagna	<b>Dissezione ragionata delle logge anatomiche del collo e del cavo orale</b>	Dott. Alessandro Nisii Dott. Roberto Pistilli

790	02 Luglio	Padova	<b>Innovazione tecnologica: nuove prospettive ortodontiche nelle terze classi</b>	Prof. Antonio Gracco Dott. Renato Cocconi Dott. Valerio Maccagnola Dott. Nicola Preda
791	08 Luglio	Padova	<b>Le dermatiti da contatto in odontoiatria pediatrica</b>	
792	08 Luglio	Padova	<b>Riabilitazione restaurativa post-ortodontica dei settori anteriori con tecniche adesive</b>	Dott. Niko Perakis
793	09 Luglio	Roma	<b>New technologies for common pathologies and treatments</b>	Relatori Vari
794	13 Luglio	Roma	<b>Fibrin sealant academy: l'utilizzo della colla di fibrina nella rigenerazione tissutale a scopo implantare</b>	Dott. Roberto Abundo Prof. Francesco Riva Dott. Vincenzo Foti Dott. Michele Perelli
795	14 Luglio	Modena	<b>Il rischio neurologico dell'anestesia generale nei bambini</b>	Prof. Luigi Chiarini
796	15 Luglio	Padova	<b>Isolamento del campo operatorio ed infection control in endodonzia</b>	Dott. Filippo Cardinali
797	15 Luglio	Verona	<b>Traumatologia dento-facciale</b>	Dott. Andrea Compri
798	21 Luglio	Brescia	<b>Il columbus bridge protocol che non ti aspetti</b>	Dott. Diego Cattina Dott. Danilo Braghini
799	29 Luglio	Padova	<b>Laser a diodi: utilizzo clinico in odontoiatria pediatrica</b>	Dott. Giuseppe Chiodera
800	08 Agosto	Groningen	<b>Secondary reconstruction after facial trauma</b>	Dott. Baucke Van Minnen
801	04 Settembre	Verona	<b>Corso di dissezione anatomica su cadavere</b>	Prof. Tiziano Tealdo Dott. Marco Bevilacqua
802	10 Settembre	Padova	<b>Endocrinologia pediatrica</b>	Prof. Pietro Maffei
803	15 Settembre	Ravenna	<b>Allineatori e crescita cranio-facciale</b>	Dott. Alessandro Carraffello
804	23 Settembre	Gubbio	<b>Trattamenti combinati ortodontico-chirurgici</b>	Dott. Marco Pironi
805	23 Settembre	Gubbio	<b>Corticotomie alveolari: basi biologiche, indicazioni, procedure chirurgiche, management ortodontico</b>	Dott. Raffaele Spena
806	24 Settembre	Gubbio	<b>Interdisciplinarietà in chirurgia orale: congresso nazionale SIDCO</b>	Relatori vari
807	25 Settembre	Gubbio	<b>Interdisciplinarietà in chirurgia orale: congresso nazionale SIDCO</b>	Relatori vari
808	25 Settembre	SORG	<b>Osteodistraktion for smile rehabilitation</b>	Relatori vari
809	28 Settembre	Roma	<b>La riforma delle professioni sanitarie</b>	Dott. Francesco Saverio Proia
810	29 Settembre	Padova	<b>Patologie delle mucose orali in odontoiatria infantile: dalla diagnosi alla terapia</b>	Dott. Rolando Crippa
811	29 Settembre	Milano	<b>Implantologia zigomatica</b>	Dott. Francesco Grecchi

812	01 Ottobre	SORG	<b>CO<sub>2</sub>-laser in ENT: Transoral laser-assisted microsurgery for treatment of laryngeal cancer</b>	Relatori vari
813	01 Ottobre	Padova	<b>Il trattamento dei denti con apice immaturo: vital pulp therapy e terapia rigenerativa</b>	Dott. Corrado Cardinali
814	04 Ottobre	Bologna	<b>L'arresto cardiaco nel paziente cardiocirurgico</b>	Italian Resuscitation Council
815	08 Ottobre	Padova	<b>Disturbi respiratori ostruttivi nei bambini</b>	Dott. Francesca Milano
816	08 Ottobre	Padova	<b>La pedodonzia in ortodonzia</b>	Dott. Francesco Perri
817	08 Ottobre	Genova	<b>Advances in clinical prosthodontics: estetica e funzione nella riabilitazione full-arch a carico immediato</b>	Prof. Tiziano Tealdo Dott. Marco Bevilacqua Dott. Ivan Calimodio Prof. Francesco Pera
818	09 Ottobre	Genova	<b>Advances in clinical prosthodontics</b>	Relatori Vari
819	14 Ottobre	Padova	<b>Inquadramento diagnostico e terapia dei disordini temporo-mandibolari</b>	Dott. Luca Guarda Nardini
820	15 Ottobre	Padova	<b>Disturbi respiratori ostruttivi nel bambino: terapia</b>	Dott. Francesca Milano
821	21 Ottobre	Verona	<b>23° congresso internazionale di terapia implantare 3i</b>	Relatori Vari
822	21 Ottobre	Verona	<b>23° congresso internazionale di terapia implantare Biomax 3i</b>	Relatori Vari
823	22 Ottobre	Verona	<b>23° congresso internazionale di terapia implantare 3i</b>	Relatori Vari
824	22 Ottobre	Verona	<b>23° congresso internazionale di terapia implantare Biomax 3i</b>	Relatori Vari
825	23 Ottobre	Verona	<b>23° congresso internazionale di terapia implantare Biomax 3i</b>	Relatori Vari
826	27 Ottobre	Fidenza	<b>La chirurgia orale pediatrica funzionale all'ortodonzia</b>	Dott. Spigaroli Matteo
827	13 Novembre	Verona	<b>La gestione dei tessuti molli intorno a denti ed impianti</b>	Relatori Vari
828	13 Novembre	SORG	<b>Advances in orthognathic surgery</b>	Relatori Vari
829	18 Novembre	Palermo	<b>Ortodonzia intercettiva: protocolli clinici efficienti. Parte III</b>	Dott. Giorgio Garofalo
830	18 Novembre	Lodi	<b>Igienista dentale: quali alternative?</b>	Dott. Gabriele Vassura Dott. Pietro Paolo Mastinu
831	19 Novembre	Teramo	<b>La semeiotica ortodontica nel paziente pediatrico: cosa, dove e perché è importante osservare</b>	Dott. Mara Manente Dott. Azzurra di Ventura
832	10 Dicembre	Padova	<b>Ortodonzia intercettiva: protocolli operativi clinici efficienti. Parte IV</b>	Dott. Giovanni Scarpa
833	10 Dicembre	Vicenza	<b>Corso BLS-D Retraining</b>	I.P. Gianni Cerantola

2022				
834	07 Gennaio	Lodi Vicenza Milano	<b>I crediti d'imposta 2022: agevolazioni fiscali e debiti. Il punto della situazione</b>	Dott. Gabriele Vassura Dott. Pietro Paolo Mastinu Dott. Gianluca Zanetti Dott. Paolo Bernorio
835	11 Gennaio	Modena	<b>Approccio innovativo in odontoiatria estetica multidisciplinare</b>	Dott. Camilla Molinari
836	15 Gennaio	Roma	<b>Le gravi atrofie dei mascellari</b>	Prof. Sandro Pelo
837	15 Gennaio	Roma	<b>Linee guida in implantoprotesi</b>	Dott. Antonio D'Addona
838	15 Gennaio	Roma	<b>Chirurgia implantare computer guidata: aspetti clinici e medico-legali</b>	Dott. Antonio Guida
839	15 Gennaio	Roma	<b>Introduzione alla chirurgia guidata: flusso di lavoro, applicazioni cliniche e vantaggi, nuovi materiali e nuove tecnologie</b>	Dott. Roberto Mosca
840	15 Gennaio	Roma	<b>Computer assisted surgery a carico immediato</b>	Dott. Stefano Loghi
841	19 Gennaio	Padova	<b>La fisiologia degli stati di coscienza: parte 1</b>	Prof. Carla Mucignat
842	19 Gennaio	Zurigo	<b>Empowering surgeons with virtual in-hiuse planning in CMF: how to create predictable surgiac outcomes</b>	Prof. Joachim Obwegeser Prof. Massimo Robiony Dott. Alessandro Tel
843	20 Gennaio	Verona	<b>Pianificazione virtuale in chirurgia ortognatica</b>	Prof. Lorenzo Trevisiol
844	20 Gennaio	Padova	<b>Approccio innovativo in odontoiatria estetica multidisciplinare</b>	Dott. Camilla Molinari
845	22 Gennaio	Santa Barbara	<b>Arnett orthognathic surgery forum</b>	Prof. William Arnett Dott. Alejandro Martinez Dott. Mike Gunson Dott. Jeff McClendon
846	23 Gennaio	Santa Barbara	<b>Arnett orthognathic surgery forum</b>	Prof. William Arnett Dott. Alejandro Martinez Dott. Mike Gunson Dott. Jeff McClendon
847	26 Gennaio	Padova	<b>La fisiologia degli stati di coscienza: parte 2</b>	Prof. Carla Mucignat
848	27 Gennaio	Padova	<b>Principi e gestione di una srl odontoiatrica</b>	Dott. Gabriele Vassura Dott. Pietro Paolo Mastinu
849	28 Gennaio	Padova	<b>Principi e gestione di una srl odontoiatrica</b>	Dott. Gabriele Vassura Dott. Pietro Paolo Mastinu
850	29 Gennaio	Padova	<b>Principi e gestione di una srl odontoiatrica</b>	Dott. Gabriele Vassura Dott. Pietro Paolo Mastinu
851	02 Febbraio	Padova	<b>Invisalign first</b>	Dott. Camilla Molinari
852	15 Febbraio	Napoli	<b>8° webinar S.I.P.M.O.</b>	Prof. Gaetano de Rosa
853	25 Febbraio	Lodi	<b>Come trasformare le recensioni in una risorsa di business</b>	Dott. Gabriele Vassura Sig. Valerio Salvi Sig. Francesco Orlandini



854	16 Marzo	Padova	<b>Odontoiatria di comunità ed epidemiologia</b>	Dott. Barbara Isaia
855	17 Marzo	Verona	<b>Istvan urban regeneration italt tour</b>	Prof. Istvan Urban
856	18 Marzo	Alba	<b>Columbus bridge protocol</b>	Prof. Tiziano Tealdo Dott. Marco Bevilacqua
857	19 Marzo	Alba	<b>Columbus bridge protocol</b>	Prof. Tiziano Tealdo Dott. Marco Bevilacqua
858	29 Marzo	Padova	<b>Endocrinologia in odontoiatria pediatrica</b>	Dott. Pietro Maffei
859	31 Marzo	Ferrara	<b>Restauri anteriori, criteri di scelta e modalità operative</b>	Dott. Pietro Sibilla
860	14 Aprile	Padova	<b>Isolamento del campo operatorio e infection control in endodonzia</b>	Dott. Roberto Cardinali
861	21 Aprile	Padova	<b>Il campione dello studio: lettura e interpretazione dei dati</b>	Dott. Franco Mutinnelli
862	26 Aprile	Padova	<b>Genetica clinica e molecolare</b>	Dott. Daniela Zuccarello
863	26 Aprile	Treviso	<b>Imprenditoria ed odontoiatria</b>	Dott. Francesco D'Amelio
864	30 Aprile	Ravenna	<b>Trattamento del mascellare gravemente atrofico mediante l'uso di impianti zigomatici</b>	Prof. Claudio Marchetti Dott. Fausto Pasqualini Galliani
865	02 Maggio	Padova	<b>Patologia orale in odontoiatria pediatrica</b>	Dott. Christian Bacci
866	11 Maggio	Santo Stefano Belbo	<b>Il trattamento del mascellare gravemente atrofico con metodica di successo</b>	Prof. Tiziano Tealdo
867	12 Maggio	Verona	<b>Le enucleazioni dentarie</b>	Dott. Andrea Compri
868	12 Maggio	Brescia	<b>Radiologia digitale</b>	Dott. Andrea Borghesi
869	13 Maggio	Brescia	<b>Digital technology changing historic dental workflows and materials</b>	Dott. Carlo Marinello
870	13 Maggio	Padova	<b>La gestione contrattuale nello studio odontoiatrico</b>	Dott. Gabriele Vassura Dott. Pietro Paolo Mastinu
871	17 Maggio	Brescia	<b>Anatomia e CBCT</b>	Prof. Ramon Boninsegna
872	19 Maggio	Madrid	<b>Osteotomy design</b>	Dott. Veronica Martinez
873	19 Maggio	Brescia	<b>Clinical photographic documentation protocols for a proper treatment plan evaluation</b>	Dott. Alessandro Devigus
874	24 Maggio	Brescia	<b>Gli scanner intraorali nella pratica clinica quotidiana</b>	Dott. Nicola Barambati
875	24 Maggio	Padova	<b>Endocrinologia pediatrica</b>	Dott. Pietro Maffei

876	01 Giugno	Venezia	<b>I parametri da rispettare per raggiungere un'elevata valenza estetica nella riabilitazione implantare</b>	Dott. Diego Longhin
877	03 Giugno	Roma	<b>Contratto collettivo nazionale e gestione sindacale di aso e dipendenti</b>	Dott. Pietro Paolo Mastinu
878	09 Giugno	Brescia	<b>Face hunter ed integrazione con lo scanner facciale</b>	Dott. Antonello Appiani
879	14 Giugno	Brescia	<b>Comunicazione con il laboratorio: flusso digitale in protesi nei casi complessi</b>	Dott. Giovanni Pisoni
880	14 Giugno	Milano	<b>La rigenerazione ossea guidata. Protocolli operativi 2.0</b>	Prof. Raffaele Vinci
881	16 Giugno	Brescia	<b>Endodonzia digitale</b>	Dott. Riccardo Tonini
882	17 Giugno	Verona	<b>Acquisizione delle immagini radiografiche in 2d e 3d</b>	Dott. Antonio Cerutti
883	17 Giugno	Verona	<b>Soluzioni per l'impronta digitale</b>	Dott. Antonio Cerutti
884	18 Giugno	Verona	<b>Razionale clinico e protocolli per la corretta scansione</b>	Dott. Nicola Barabanti
885	21 Giugno	Brescia	<b>Il corretto uso della CBCT in endodonzia</b>	Dott. Roberto Fornara
886	24 Giugno	Padova	<b>I materiali dentali in odontoiatria pediatrica</b>	Dott. Dejedja Kokici
887	28 Giugno	Brescia	<b>I valori del digitale per la qualità odontoiatrica</b>	Dott. Michele Rossini
888	05 Luglio	Brescia	<b>Odontoiatria 4-0</b>	Dott. Marco Belardi
889	07 Luglio	Padova	<b>New perspectives in anterior aesthetics: the bonded way</b>	Dott. Niko Perakis
890	08 Luglio	Brescia	<b>Acquisizione, montaggio e condivisione dei video intra ed extra orali</b>	Dott. Luigi Rubino
891	13 Luglio	Brescia	<b>Diagnostica e decisione clinica: metodi digitali a supporto del team medico. La day medicine applicata all'odontostomatologia. Strategie di design protesico e restaurativo orientate all'applicazione dei materiali dentali di ultima generazione</b>	Dott. Alessandro Preti
892	13 Luglio	Padova	<b>Genetica in odontoiatria pediatrica</b>	Dott. Daniela Zuccarello
893	15 Luglio	Padova	<b>Sedazione cosciente in odontoiatria pediatrica</b>	Dott. Anna Franco
894	19 Luglio	Brescia	<b>Diagnostica e decisione clinica: metodi digitali a supporto del team medico. La day medicine applicata all'odontostomatologia. Strategie di design protesico e restaurativo orientate all'applicazione dei materiali dentali di ultima generazione</b>	Dott. Alessandro Preti

895	19 Luglio	Milano	<b>Marketing digitale in odontoiatria</b>	Dott. Gabriele Vassura
896	21 Luglio	Brescia	<b>Arts of smiles: digital process</b>	Dott. Roberto Molinari
897	22 Luglio	Padova	<b>Genetica in odontoiatria pediatrica</b>	Dott. Daniela Zuccarello
898	26 Luglio	Brescia	<b>Scansione e progettazione delle riabilitazioni implantari</b>	Dott. Pierfrancesco Mondina
899	27 Luglio	Padova	<b>Utilizzo del laser in odontoiatria pediatrica</b>	Dott. Giuseppe Chiodera
900	29 Luglio	Teramo	<b>L'approccio psicologico in odontoiatria pediatrica</b>	Dott. Mara Manente
901	02 Agosto	Brescia	<b>Diagnocat</b>	Dott. Marcus Cedric
902	06 Settembre	Brescia	<b>Evoluzione del CAD-CAM in odontoiatria</b>	Dott. Franco Brenna
903	06 Settembre	Verona	<b>Mrna technology-from cancer therapy to infectious disease prevention</b>	Prof. Ozlem Tureci
904	13 Settembre	Brescia	<b>I materiali per le tecniche CAD-CAM e le loro strategie adesive</b>	Dott. Andrea Fabianelli
905	13 Settembre	Bassano del Grappa	<b>Il ruolo dell'otorinolaringoiatra e dell'odontoiatra nella diagnosi e terapia delle osas pediatriche</b>	Dott. Luigi Romano
906	14 Settembre	Lodi	<b>Brand per lo studio dentistico</b>	Dott. Gabriele Vassura
907	15 Settembre	Brescia	<b>La cementazione dei restauri adesivi</b>	Dott. Dino Re
908	20 Settembre	Brescia	<b>Clinical photography documentation protocols for color lab/dentist</b>	Dott. Luca Conoscenti
909	22/24 Settembre	Verona	<b>Congresso internazionale di implantologia Biomax 3i</b>	Relatori vari
910	27 Settembre	Brescia	<b>Il piano di trattamento estetico-funzionale in protesi fissa: integrazione di tradizione ed innovazione alla luce delle nuove tecnologie</b>	Dott. Giacomo Fabbri
911	28 Settembre	Padova	<b>Patologia orale in odontoiatria pediatrica: approccio terapeutico laser assistito</b>	Dott. Rolando Crippa
912	29 Settembre	Brescia	<b>Il flusso di lavoro digitale in protesi: dal piano di trattamento alla comunicazione con il gruppo di lavoro e con il paziente, dalla pre-visualizzazione alla finalizzazione del caso</b>	Dott. Fernando Zanone
913	29 Settembre	Brescia	<b>Caratteristiche, indicazioni cliniche e selezione razionale delle ceramiche dentali e dei cementi ad uso protesico</b>	Dott. Fernando Zanone Dott. Roberto Sorrentino
914	04 Ottobre	Padova	<b>Il trattamento dei denti con apice immaturo: vital pulp therapy e terapia rigenerativa</b>	Dott. Corrado Cardinali

915	04 Ottobre	Brescia	<b>Management tissutale morfogenetico</b>	Dott. Gaetano Calesini
916	05 Ottobre	Padova	<b>La pedodonzia in ortodonzia</b>	Dott. Alessandro Perri
917	06 Ottobre	Brescia	<b>La riabilitazione estetica del paziente totalmente edentulo: protocolli digitali</b>	Dott. Piero Venezia
918	11 Ottobre	Brescia	<b>Full digital workflow laboratorio</b>	Dott. Giuseppe Daniele Rondoni
919	13 Ottobre	Brescia	<b>Il columbus bridge protocol nel trattamento delle atrofie mascellari</b>	Dott. Diego Cattina
920	19 Ottobre	Padova	<b>Terapia intercettiva, crescita, espansione e maschera di Delaire</b>	Dott. Alessandro Perri
921	20 Ottobre	Brescia	<b>Full digital workflow in laboratorio</b>	Giuseppe Romeo
922	20 Ottobre	Bardolino Verona	<b>Interdisciplinarietà in chirurgia orale: congresso nazionale SIDCO</b>	Relatori vari
923	25 Ottobre	Brescia	<b>Le preparazioni dentali nell'era digitale</b>	Dott. Mario Semenza
924	25 Ottobre	Roma	<b>La gestione assicurativa dello studio dentistico</b>	Simone Turrini
925	24 Novembre	Reggio Emilia	<b>La gestione delle holding odontoiatriche</b>	Dott. Gabriele Vassura Dott. Pietro Paolo Mastinu
926	25 Novembre	Reggio Emilia	<b>La gestione delle holding odontoiatriche</b>	Dott. Gabriele Vassura Dott. Pietro Paolo Mastinu
927	26 Novembre	Reggio Emilia	<b>La gestione delle holding odontoiatriche</b>	Dott. Gabriele Vassura Dott. Pietro Paolo Mastinu
928	26 Novembre	Brescia	<b>Il workflow digitale nel trattamento dell'eruzione passiva alterata. Parte 1</b>	Dott. Eugenio Longo
929	29 Novembre	Brescia	<b>Il workflow digitale nel trattamento dell'eruzione passiva alterata. Parte 2</b>	Dott. Eugenio Longo
930	01 Dicembre	Brescia	<b>La logica della funzione: uno sguardo al futuro</b>	Dott. Domenico Massironi Odt. Giuseppe Rampulla
931	06 Dicembre	Brescia	<b>Il flow chart digitale: dalla valutazione clinica alla diagnosi, dalla scelta del metodo e della tecnica al management delle fasi operative. Le procedure digitali per la finalizzazione del caso in chirurgia implantare e protesi su impianti</b>	Dott. Salvatore D'Amato
932	06 Dicembre	Brescia	<b>Il supporto del laboratorio digitale nella pianificazione, nella diagnosi e nelle scelte operative</b>	Dott. Giancarlo Cozzolino
933	12 Dicembre	Lodi	<b>Il welfare per i dipendenti</b>	Dott. Pietro Paolo Mastinu
934	13 Dicembre	Brescia	<b>Il flusso di lavoro digitale completo dalla diagnosi 3D alla progettazione digitale chirurgica e delle parti protesiche con approccio multi-disciplinare</b>	Dott. Luigi Rubino
935	14 Dicembre	Padova	<b>La progettazione e realizzazione dell'ambulatorio odontoiatrico</b>	Arch. Mario Radaelli

936	16 Dicembre	Brescia	<b>La stampa 3d nella pratica clinica</b>	Dr. Francesca Capelli
937	16 Dicembre	Brescia	<b>Pianificazione chirurgica per chirurgia chairside</b>	Dr. Nicola Barabanti
938	17 Dicembre	Brescia	<b>Dall'esame diagnostico alla pianificazione chirurgica</b>	Daniele Montaneri
939	17 Dicembre	Brescia	<b>Chirurgia implantare computer guidata. Basi di pianificazione digitale su siti guariti e siti post estrattivi. Approccio flapless, a tutto spessore ed a mezzo spessore. Flusso di lavoro full digital e flusso di lavoro misto</b>	Giovanni Greco
940	20 Dicembre	Brescia	<b>Diagnosi, pianificazione e progettazione digitale del caso implantare</b>	Prof. Tiziano Testori

## 2023

941	09 Gennaio	Brescia	<b>Pianificazione chirurgica e protesica computer assistita</b>	Dr. Sergio Piano
942	17 Gennaio	Brescia	<b>Il flow chart digitale: dalla valutazione clinica alla diagnosi, dalla scelta del metodo e della tecnica al management delle fasi operative. Le procedure digitali per la finalizzazione del caso in chirurgia implantare e protesi su impianti</b>	Dr. Salvatore D'Amato
943	17 Gennaio	Brescia	<b>Il supporto del laboratorio digitale nella pianificazione, nella diagnosi e nelle scelte operative</b>	Odt. Giancarlo Cozzolino
944	18 Gennaio	Lodi	<b>La legge di riforma della crisi d'impresa</b>	Dr. Pietro Paolo Mastinu Dr. Gianluca Zanetti
945	24 Gennaio	Brescia	<b>La chirurgia plastica parodontale su denti naturali ed impianti</b>	Dr. Roberto Abundo
946	31 Gennaio	Brescia	<b>Autotrapianti dentali: evoluzione del protocollo alla luce delle tecnologie digitali</b>	Dr. Luca Boschini
947	02 Febbraio	Brescia	<b>Digital era in endodontics: how useful is CBCT in clinical practice</b>	Dr. Andreas Krokidis
948	07 Febbraio	Brescia	<b>Faccette flusso digitale. Introduzione alla diagnosi ortodontica ed alla pianificazione del piano di trattamento. La rivoluzione digitale. Biomeccaniche razionali convenzionali e sequenze virtuali. Comparazione e scelte terapeutiche</b>	Dr. Mario Imburgia Dr. Aldo Giacotti
949	09 Febbraio	Milano	<b>Video strategy per lo studio dentistico</b>	Dr. Gabriele Vassura Sig Valerio Salvi
950	22 Febbraio	Bologna	<b>Columbus bridge: un protocollo sempre più efficace e documentato per il carico immediato</b>	Dr. Matteo Furlati
951	23 Febbraio	Brescia	<b>La moderna odontoiatria multidisciplinare</b>	Dr. Ignacio Faus Dr. Vicente Faus



952	02 Marzo	Roma	<b>La gestione del consenso informato e prevenzione del contenzioso</b>	Dr. Silvio Accardo
953	04 Marzo	Vicenza	<b>Gli amici del Pino: memorial Prof. Giuseppe Ferronato</b>	Relatori vari
954	07 Marzo	Brescia	<b>Restaurative dirette ed indirette dei settori anteriori</b>	Dr. Massimo Veneziani
955	09 Marzo	Brescia	<b>Trattamenti interdisciplinari con particolare attenzione all'estetica</b>	Dr. Camilla Molinari Dr. Tommaso Mascetti
956	09 Marzo	Milano	<b>Fisco, diritto d'autore e marchio industriale</b>	Dr. Giovanni d'Ammassa
957	16 Marzo	Brescia	<b>Allineatori in ortodonzia e protesi dentale</b>	Prof. Luca Levrini
958	23 Marzo	Brescia	<b>Dalla ortodonzia invisibile alla sistematica degli allineatori</b>	Dr. Massimo Ronchin
959	28 Marzo	Brescia	<b>The new boundaries of dentistry</b>	Prof. Miguel Stanley
960	30 Marzo	Brescia	<b>Il razionale utilizzo della CBCT in ortodonzia: la cefalometria 3d come opzione diagnostica insostituibile anche in riabilitazione implantoprotesica</b>	Prof. Giovanna Perrotti
961	04 Aprile	Brescia	<b>Approcci digitali in implantologia moderna Digital treatment of full mouth rehabilitation cases</b>	Dr. Alfonso Coscarella Dr. Mahamood Ezzat Ghazi
962	11 Aprile	Brescia	<b>Full digital workflow nella gestione dei casi interdisciplinari</b>	Dr. Carlo Poggio
963	13 Aprile	Brescia	<b>Digital tools for implants dentistry</b>	Dr. Tali Chackartchi
964	20 Aprile	Brescia	<b>L'applicazione clinica del digitale in odontoiatria</b>	Dr. Mattia Fontana
964	26 Aprile	Rosà	<b>Corso di primo soccorso e rianimazione cardio-polmonare</b>	I.P. Fabio Cecchin
966	2ww8 Aprile	Brescia	<b>The new boundaries of dentistry</b>	Dr. Miguel Stanley
967	10 Maggio	Zelo Buon Persico	<b>La prima visita: la sua importanza</b>	Dr. Gabriele Vassura
968	14 Giugno	Alba	<b>Il trattamento del mascellare gravemente atrofico con i nuovi metodi tecnologici</b>	Dr. Tiziano Tealdo
969	24 Giugno	Padova	<b>Sedazione o anestesista nello studio odontoiatrico? Problematiche amministrative e medico-legali della sedazione cosciente odontoiatrica</b>	Prof. Christian Bacci Dr. Paola Mariuzza
970	08 Luglio	Vicenza	<b>Itaka: la logica della funzione</b>	Odt. Giuseppe Rampulla Sig. Luca Pighin
971	14 Luglio	Firenze	<b>III° Zygoma day</b>	Dr. Andrea Tedesco
972	15 Luglio	Firenze	<b>III° Zygoma day</b>	Dr. Andrea Tedesco

973	24 Luglio	Alba	<b>Utilizzo dei farmaci in odontoiatria</b>	Dr. Giuseppe Artuffo
974	18 Settembre	Lodi	<b>La stp odontoiatrica: sottoprodotto della srl odontoiatrica, ma molto meglio dello studio tradizionale</b>	Dr. Pietro Paolo Mastinu Dr. Gabriele Vassura
975	20 Settembre	Treviso	<b>Le malformazioni vascolari possono mimare un disordine temporo-mandibolare</b>	Dr. Luca Guarda Nardini Dr. Matteo Val
976	22 Settembre	Lodi	<b>Contributo enpam 0,5 delle società odontoiatriche: il punto della situazione temporo-mandibolare</b>	Dr. Gabriele Vassura Dr. Gioacchino De Luca
977	26 Settembre	Milano	<b>La corretta gestione delle complicanze e delle sequele in implantologia zigomatica temporo-mandibolare</b>	Dr. Francesco Grecchi
978	26 Settembre	Santo Stefano Belbo	<b>La terapia farmacologica in odontoiatria</b>	Dr. Tiziano Tealdo
979	05 Ottobre	Verona	<b>Congresso internazionale di terapia implantare 3i</b>	Relatori vari
980	06 Ottobre	Verona	<b>Congresso internazionale di terapia implantare 3i</b>	Relatori vari
981	07 Ottobre	Verona	<b>Congresso internazionale di terapia implantare 3i</b>	Relatori vari
982	08 Ottobre	Verona	<b>Corso nazionale di dissezione anatomica su cadavere</b>	Prof. Antonio Barone Dr. Andrea Tedesco
983	09 Ottobre	Lodi	<b>Rete d'impresa in odontoiatria</b>	Dr. Gabriele Vassura Dr. Pietro Paolo Mastinu
984	07 Novembre	Lodi	<b>Sedazione cosciente in odontoiatria</b>	Dr. Gabriele Vassura Dr. Livio Galottini Dr. Simone Turrini
985	09 Novembre	Bassano del Grappa	<b>Corso BLS-D per operatori sanitari</b>	I.P. Fabio Cecchin
986	17 Novembre	Grisignano di Zocco	<b>Il cambio di paradigma in odontoiatria protesica</b>	Dr. Ezio Bruna Dr. Andrea Fabianelli Dr. Mario Semenza
987	21 Novembre	Napoli	<b>Guarigione precoce e biologicamente guidata delle ferite in chirurgia parodontale ed implantare</b>	Prof. Luigi Laino Prof. Pietro Felice Prof. Andrea Pilloni
988	23 Novembre	Reggio Calabria	<b>Riabilitazioni protesiche in pazienti con gravi atrofie osee</b>	Prof. Tiziano Tealdo
989	24 Novembre	Reggio Calabria	<b>Riabilitazioni protesiche in pazienti con gravi atrofie osee</b>	Prof. Tiziano Tealdo
990	21 Dicembre	Lodi	<b>Come rendere efficace il tuo sito web per lo studio odontoiatrico</b>	Dr. Gabriele Vassura

2024				
991	15 Gennaio	Lodi	<b>Milinge center al servizio dello studio dentistico</b>	Dr. Gabriele Vassura Sig. Andrea Papa
992	26 Gennaio	Atene	<b>Hellenic association of oral and maxillofacial surgery</b>	Relatori vari
993	27 Gennaio	Atene	<b>Hellenic association of oral and maxillofacial surgery</b>	Relatori vari
994	12 Febbraio	Lodi	<b>Intelligenza artificiale: il nuovo orizzonte dell'odontoiatria moderna</b>	Dr. Gabriele Vassura Dr. Francesco Gallo Dr. Diego Pasqua
995	20 Febbraio	Padova	<b>Il movimento mandibolare libero</b>	Odt. Giuseppe Rampulla
996	13 Marzo	Treviso	<b>Qual è la vera chiave del successo delle preparazioni verticali? La gestione dei tessuti molli</b>	Dr. Fabio Scutellà
997	14 Marzo	Lodi	<b>La medicina estetica nello studio dentistico</b>	Dr. Michele Cassetta
998	14 Marzo	Rosà	<b>Corso rischio antincendio</b>	Ing. Emiliano Bettin
999	10 Aprile	Lodi	<b>I cambiamenti importanti nel rischio sanitario: arriva il nuovo decreto Gelli-Bianco</b>	Dr. Pietro Paolo Mastinu Sig. Simone Turrini



## Certificazioni Universitarie



UNIVERSITÀ  
DEGLI STUDI  
DI PADOVA

Matricola 439850

N. Certif.  
2010337185/CTIT\_S\_NEW

Si certifica che ALBERTI CHRISTIAN , nato a Bassano del Grappa (VI) il 15/09/1979 , ha conseguito la Laurea in ODONTOIATRIA E PROTESI DENTARIA presso questa Università degli Studi in data 28/07/2005 con voto 102/110.

Ai sensi del D.M. 270/2004 compete la qualifica accademica di Dottore Magistrale.

La durata legale del suddetto corso di studio è di cinque anni .

Padova, 03/09/2011





## UNIVERSITÀ DEGLI STUDI DI PADOVA

CES36

SERVIZIO FORMAZIONE POST-LAUREAM

Prot. 00001398

Il Dott. ALBERTI CHRISTIAN , nato a BASSANO DEL GRAPPA (VICENZA) il giorno 15/09/1979 , laureato in ODONTOIATRIA E PROTESI DENTARIA presso l'UNIVERSITA' DI PADOVA il giorno 28/07/2005 con punti 102/110 , ha presentato in data odierna domanda per sostenere, presso questa sede, l'Esame di Stato per l'abilitazione all'esercizio della professione di ODONTOIATRA nella seconda sessione dell'anno 2005 che avra' inizio a partire dal giorno 29/11/2005 .

Padova, li 08/11/2005

L'ADDETTO AL RILASCIO

A handwritten signature in black ink, appearing to be 'AS' or similar initials.



## UNIVERSITÀ DEGLI STUDI DI PADOVA

CE032

Servizio Segreteria Studenti

Cert. n. 2005665192

Matr. 439850-OP

Si certifica che ALBERTI CHRISTIAN, nato a Bassano Del Grappa (Vicenza) il giorno 15/09/1979, ha superato la prova finale di laurea in Odontoiatria e Protesi Dentaria il giorno 28/07/2005 riportando punti CENTODUE sopra CENTODIECI (102/110) ed e' stato proclamato Dottore in Odontoiatria e Protesi Dentaria, con il seguente piano di studio:

	Voto	Val
! 10/02/2000 CHIMICA	22/30	1.00
! 25/02/2000 FISICA MEDICA	20/30	1.00
! 19/06/2000 ISTOLOGIA ED EMBRIOLOGIA (COMPRESA CITO	24/30	1.00
! 06/09/2000 BIOLOGIA GENERALE APPL. AGLI STUDI MEDI	22/30	1.00
! 18/04/2001 ISTIT.DI ANATOMIA UM.NORM.E DELL'APP.ST	23/30	1.00
! 24/09/2001 CHIMICA BIOLOGICA	20/30	1.00
! 23/10/2001 FISILOGIA UMANA E DELL'APP.STOMATOGNAT	25/30	1.00
! 31/01/2002 MICROBIOLOGIA	18/30	0.50
! 05/02/2002 PATOLOGIA GENERALE	25/30	1.00
! 03/04/2002 MATERIALI DENTARI	30/30	1.00
! 11/04/2002 IGIENE E ODONTOIATRIA PREV.E SOC.CON EP	27/30	0.50
! 10/07/2002 FARMACOLOGIA	23/30	0.50
! 29/07/2002 TOSSICOLOGIA	25/30	0.50
! 24/09/2002 ANESTESIA GEN. E SPECIALE ODONTOSTOMATO	28/30	1.00
! 28/01/2003 ISTIT. DI ANATOMIA ED ISTOLOGIA PATOLOG	24/30	1.00
! 18/02/2003 MEDICINA INTERNA	18/30	1.00
! 23/06/2003 PATOLOGIA SPEC.LE CHIRURGICA E PROP. CL	26/30	1.00
! 04/07/2003 RADIOLOGIA GEN.E SPEC.ODONTOSTOMATOLOGI	30/30	0.50
! 21/07/2003 DIAGNOSTICA ISTO E CITO-PATOLOGICA	28/30	0.50
! 24/07/2003 PATOLOGIA SPECIALE ODONTOSTOMATOLOGICA	28/30	1.00
! 17/02/2004 ONCOLOGIA	20/30	1.00
! 26/02/2004 FARMACOLOGIA CLINICA	26/30	0.50
! 02/02/2004 CHIRURGIA SPECIALE ODONTOSTOMATOLOGICA	30/30	2.00
! 03/02/2004 CLINICA OTORINOLARINGOIATRICA	30/30 E LODE	1.00
! 22/06/2004 OFTALMOLOGIA	30/30 E LODE	0.50
! 22/06/2004 NEUROLOGIA	27/30	1.00
! 01/07/2004 DERMATOLOGIA E VENEREOLOGIA	30/30	0.50
! 09/09/2004 ODONTOIATRIA CONSERVATRICE	30/30	3.00
! 31/01/2005 MED.LEGALE E D.ASSIC.E DEONTOL.IN ODONT	18/30	0.50
! 02/02/2005 CHIRURGIA MAXILLO-FACCIALE	30/30 E LODE	1.00
! 14/02/2005 ORTOGNATODONZIA E GNATOLOGIA (FUNZ.MAST	27/30	2.00
! 15/02/2005 PROTESI DENTARIA	26/30	3.00
! 03/03/2005 PSICHIATRIA	28/30	0.50
! 21/05/2005 PEDODONZIA	30/30 E LODE	0.50
! 20/06/2005 PEDIATRIA	30/30	0.50
! 21/06/2005 CLINICA ODONTOSTOMATOLOGICA	29/30	2.00
! 21/06/2005 PARODONTOLOGIA	25/30	2.00

Il valore si intende espresso in annualita'.

La durata legale del suddetto corso e' di cinque anni.

SEGUE A PAG. 2



## UNIVERSITÀ DEGLI STUDI DI PADOVA

PAG. 2 DEL CERTIFICATO N. 2005665192

Si rilascia in esenzione dall'imposta di bollo ai sensi del D.P.R. 26.10.72 n. 642 e 30.12.82 n. 955 (tabella B).

Il presente certificato viene rilasciato a norma dell'art.3 comma 2 del D.L.vo 12.02.1993 n.39.

Padova, li 19/01/2006

IL CAPO SERVIZIO  
VITTORIO MOLENA



# UNIVERSITÀ DEGLI STUDI DI PADOVA

CES37

SERVIZIO FORMAZIONE POST-LAUREAM

Cert. 2005024417

Matr. 439850-OP

Si certifica che il Dott. ALBERTI CHRISTIAN , nato a BASSANO DEL GRAPPA (VICENZA) il giorno 15/09/1979 , laureato in ODONTOIATRIA E PROTESI DENTARIA presso l'UNIVERSITA' DI PADOVA ha sostenuto in questa sede l'Esame di Stato per l'abilitazione all'esercizio della professione di ODONTOIATRA nella seconda sessione dell'anno 2005 con esito POSITIVO .

Si rilascia in esenzione dall'imposta di bollo ai sensi del D.P.R. 26.10.72 n.642 e 30.12.82 n.955 (tabella B).

Il presente certificato viene rilasciato a norma dell'art.3 comma 2 del D.L.vo 12.02.1993 n.39.

Padova, li 19/12/2005

IL CAPO SERVIZIO  
DOTT.SSA MARIA ZANATO



## UNIVERSITÀ DEGLI STUDI DI PADOVA

CES38

SERVIZIO FORMAZIONE POST-LAUREAM

Cert. 2005024563

Matr. 439850-OP

Si certifica che il Dott. ALBERTI CHRISTIAN , nato a BASSANO DEL GRAPPA (VICENZA) il giorno 15/09/1979 , laureato in ODONTOIATRIA E PROTESI DENTARIA presso l'UNIVERSITA' DI PADOVA ha sostenuto in questa sede l'Esame di Stato per l'abilitazione all'esercizio della professione di ODONTOIATRA nella seconda sessione dell'anno 2005 con esito POSITIVO (54/60) .

Si rilascia in esenzione dall'imposta di bollo ai sensi del D.P.R. 26.10.72 n.642 e 30.12.82 n.955 (tabella B).

Il presente certificato viene rilasciato a norma dell'art.3 comma 2 del D.L.vo 12.02.1993 n.39.

Padova, li 19/12/2005

IL CAPO SERVIZIO  
DOTT.SSA MARIA ZANATO



**AZIENDA  
SANITARIA**

• UNITÀ LOCALE SOCIO-SANITARIA N° 3 •

• REGIONE DEL VENETO •

**ULSS-3**SERVIZIO PER  
IL PERSONALE

12 LUG. 2001

prot. 35047

8.5.6.

Sede:  
Via Carducci, 2  
36061 BASSANO DEL GRAPPA  
(Vicenza)Tel. (0424) 888 111  
Fax (0424) 885 223Cod. Fisc. e Part. I.V.A.  
00913430245Conto Corrente Postale  
12966362Codice S.I.S.  
050 - 103

Vs. n. del

Oggetto: Frequenza presso il presidio ospedaliero di Bassano del Grappa.

Egr. Sig.  
ALBERTI CHRISTIAN  
Via Concordia, 13  
36027 ROSA' (VI)

e, p. c.:

AL DIRETTORE SANITARIO  
AL DIRETTORE MEDICO DEI PRESIDI OSPEDALIERI  
AL DIRETTORE DEL DIPARTIMENTO DI CHIRURGIA SPECIALISTICA  
AL DIRETTORE DELLA STRUTTURA COMPLESSA DI ODONTOIATRIA E  
CHIRURGIA MAXILLO FACCIALE

LORO SEDI

Si comunica che con atto deliberativo esecutivo n. 754 del 30.5.2001 la S.V. è stata autorizzata a frequentare la struttura complessa di odontoiatria e chirurgia maxillo facciale del presidio ospedaliero di Bassano del Grappa per un periodo di sei mesi a decorrere dal 4.6.2001.

Come da Sua dichiarazione nessuna responsabilità potrà ricadere su questa Azienda Sanitaria a seguito della frequenza in argomento.

Tuttavia la frequenza medesima è subordinata alla stipulazione di idonea polizza assicurativa contro gli infortuni che la S.V. dovrà provvedere a proprie spese ed esibire all'inizio della frequenza stessa alla competente Direzione Medica dell'Ospedale.

Si precisa inoltre che non viene instaurato alcun rapporto di impiego, né Lei avrà diritto ad alcun rimborso.

Distinti saluti.

IL DIRETTORE GENERALE  
(ing. Ermanno Angonese)LO/al  
frequenza

**AZIENDA  
SANITARIA**

● UNITÀ LOCALE SOCIO-SANITARIA N° 3 ●

● REGIONE DEL VENETO ●

**ULSS 3**Sede:  
Via Carducci, 2  
36061 BASSANO DEL GRAPPA  
(Vicenza)SERVIZIO PER  
IL PERSONALE

20/11/2002 prot. n. 4425 / 8.5.6.

Tel. (0424) 888 111  
Fax (0424) 885 223

Vs. rif. del

Cod. Fisc. e Part. I.V.A.  
00913430245

Oggetto: Frequenza.

Conto Corrente Postale  
12966362Codice S.I.S.  
050 - 103Egr. Sig.  
ALBERTI CHRISTIAN  
Via Concordia, 13  
36027 ROSA' (VI)

e, p.c.:

AL DIRETTORE SANITARIO  
AL DIRETTORE MEDICO DEI PRESIDI OSPEDALIERI  
AL DIRETTORE DEL DIPARTIMENTO DI CHIRURGIA SPECIALISTICA  
AL DIRETTORE DELLA S.C. DI ODONTOIATRIA E CH. MAXILLO FACCIALE

LORO SEDI

Si comunica che con atto deliberativo esecutivo n. 1548 del 14.11.2001 la S.V. è stata autorizzata a frequentare la struttura complessa di odontoiatria e chirurgia maxillo facciale del presidio ospedaliero di Bassano del Grappa per un periodo di 12 mesi a partire dal 15.11.2001.

Come da Sua dichiarazione nessuna responsabilità potrà ricadere su questa Azienda Sanitaria a seguito della frequenza in argomento.

Tuttavia la frequenza medesima è subordinata alla stipulazione di idonea polizza assicurativa contro gli infortuni che la S.V. dovrà provvedere a proprie spese ed esibire all'inizio della frequenza stessa alla competente Direzione Medica dell'Ospedale.

Si precisa inoltre che non viene instaurato alcun rapporto di impiego, né Lei avrà diritto ad alcun rimborso.

Distinti saluti.

IL DIRETTORE GENERALE  
(ing. Ermanno Angonese)LO/al  
frequenz

**AZIENDA  
SANITARIA**

• UNITÀ LOCALE SOCIO-SANITARIA N° 3 •

• REGIONE DEL VENETO •

**ULSS-3**

SERVIZIO PER IL PERSONALE

☎ 0424/885312 – fax 0424/885298

Sede:  
Via Corducci, 2  
36061 BASSANO DEL GRAPPA  
[Vicenza]Tel. (0424) 888 111  
Fax (0424) 885 223Cod. Fisc. e Part. I.V.A.  
00913430245Conto Corrente Postale  
12966362Codice S.I.S.  
050 - 103

13 MAR. 2003

13357

prot.

Vs. rif. del

Oggetto: Frequenza.

Egr. Sig.  
ALBERTI CHRISTIAN  
Via Concordia, 13  
36027 ROSA'

e, p.c.:

AL DIRETTORE SANITARIO  
AL DIRETTORE MEDICO DEI PRESIDII OSPEDALIERI  
AL DIRETTORE DEL DIPARTIMENTO DI CHIRURGIA SPECIALISTICA  
AL DIRETTORE DELLA S.C DI ODONTOIATRIA E CHIRURGIA MAXILLO  
FACCIALE  
AL SERVIZIO PER IL PERSONALELORO SEDI

Si comunica che con atto deliberativo esecutivo n. 1256 del 23/10/2002 la S.V. è stata autorizzata a frequentare la Struttura Complessa di Chirurgia Maxillo-Facciale del Presidio Ospedaliero di Bassano del Grappa, per un periodo di 12 mesi a partire dal 14.11.2002.

Come da Sua dichiarazione nessuna responsabilità potrà ricadere su questa Azienda Sanitaria a seguito della frequenza in argomento.

Tuttavia la frequenza medesima è subordinata alla stipulazione di idonea polizza assicurativa contro gli infortuni che la S.V. dovrà provvedere a proprie spese ed esibire all'inizio della frequenza stessa alla competente Direzione Sanitaria.

Si precisa inoltre che non viene instaurato alcun rapporto di impiego, né Lei avrà diritto ad alcun rimborso.

Distinti saluti.

L.O/mz  
frequenza*Il Dirigente Responsabile  
del Servizio per il Personale  
(dott. Lorenzo Onorati)*

**AZIENDA  
SANITARIA**

UNITÀ LOCALE SOCIO-SANITARIA N° 3

REGIONE DEL VENETO

**ULSS-3**

Sede: SERVIZIO PER IL PERSONALE  
Via Carducci, 2 ☎ 0424 - 885312 Fax 0424 - 885298  
36061 BASSANO DEL GRAPPA  
(Vicenza)

7 DIC. 2003 prot. 60012 /

Tel. (0424) 888 111  
Fax (0424) 885 223

Vs. rif. del

Cod. Fisc. e Part. I.V.A.  
00913430245

Oggetto: Frequenza.

Conto Corrente Postale  
12966362

Codice S.I.S.  
050 - 103

Egr. Sig.  
ALBERTI CHRISTIAN  
Via Concordia, 13  
36027 ROSA'



e, p. c.:

AL DIRETTORE MEDICO DEI PRESIDII OSPEDALIERI  
AL DIRETTORE DEL DIPARTIMENTO DI CHIRURGIA  
AL DIRETTORE DELLA S.C. DI ODONTOIATRIA E CHIRURGIA MAXILLO  
FACCIALE DEL P.O. DI BASSANO DEL GRAPPA

LORO SEDI

Si comunica che con atto deliberativo esecutivo n. 1161 del 12.11.2003 la S.V. è stata autorizzata a frequentare la Struttura Complessa di Odontoiatria e Chirurgia Maxillo Facciale del presidio ospedaliero di Bassano del Grappa, per un periodo di mesi dodici a partire dal 15.11.2003.

Come da Sua dichiarazione nessuna responsabilità potrà ricadere su questa Azienda Sanitaria a seguito della frequenza in argomento.

Tuttavia la frequenza medesima è subordinata alla stipulazione di idonea polizza assicurativa contro gli infortuni che la S.V. dovrà provvedere a proprie spese ed esibire all'inizio della frequenza stessa alla competente Direzione Medica.

Si precisa inoltre che non viene instaurato alcun rapporto di impiego, né Lei avrà diritto ad alcun rimborso.

Distinti saluti.



*Il Dirigente Responsabile  
del Servizio per il Personale  
(p.a. Piergianni Rigoni)*

PGR/es

Resp. procedimento p.a. Piergianni Rigoni  
FAX 0424 - 885298 - TEL. 0424 - 885312  
C:\Documenti\Lettere\Frequenze\P.O.doc



**AZIENDA  
SANITARIA**

UNITÀ LOCALE SOCIO-SANITARIA N° 3

REGIONE DEL VENETO

**ULSS 3**Sede:  
Via Carducci, 2  
36061 BASSANO DEL GRAPPA  
(Vicenza)Tel. 0424 888 111  
Fax 0424 885 223Cod. Fisc. e Part. I.V.A.  
00913430245Conto Corrente Postale  
12966362Codice S.I.S.  
05 - 103SERVIZIO PER IL PERSONALE  
☒ 0424 - 885312 Fax 0424 - 885298

Vs. rif. del

Oggetto: **Frequenza.**

prot.

**Azienda ULSS 3  
Prot. N°.. 0053245/04  
Data.....26/11/2004**Egr. Sig.  
Cristian ALBERTI  
Via Concordia, 13  
36027 ROSA'

e, p. c.:

AL DIRETTORE MEDICO DEI PRESIDII OSPEDALIERI  
AL DIRETTORE DEL DIPARTIMENTO DI CHIRURGIA  
AL DIRETTORE DELLA S.C. DI ODONTOIATRIA E CHIRURGIA MAXILLO  
FACCIALE DEL P.O. DI BASSANO DEL GRAPPA  
AL RESPONSABILE DEL SERVIZIO DI PREVENZIONE E PROTEZIONE

LORO SEDI

Si comunica che con atto deliberativo 10/11/2004, n.1305, la S.V. è stata autorizzata a rinnovare la frequenza presso la Struttura Complessa di Odontoiatria e Chirurgia Maxillo facciale del presidio ospedaliero di Bassano del Grappa, per un periodo di dodici mesi a partire dal 14/11/2004.

Come da Sua dichiarazione nessuna responsabilità potrà ricadere su questa Azienda Sanitaria a seguito della frequenza in argomento.

Tuttavia la frequenza medesima è subordinata alla stipulazione di idonea polizza assicurativa contro gli infortuni che la S.V. dovrà provvedere a proprie spese ed esibire all'inizio della frequenza stessa alla competente Direzione Medica.

Si precisa inoltre che non viene instaurato alcun rapporto di impiego, né Lei avrà diritto ad alcun rimborso.

Distinti saluti.

*Il Dirigente Responsabile  
del Servizio per il Personale  
(dott. Luigi Antoniol)*

L.A/es

Resp. procedimento: dott. Luigi Antoniol  
FAX 0424 - 885298 - TEL. 0424 - 885312  
P.O. maxillo.docASIAGO  
BASSANO DEL GRAPPA  
CAMPOLONGO SUL BRENTA  
CARTIGLIANO  
CASSOLA  
CISON DEL GRAPPA  
CONCO  
ENEGO  
FOZA  
GALLIO  
LUSIANA  
MAROSTICA  
MASON VICENTINO  
MOLVENA  
MUSSOLENTE  
NOVE  
PIANEGGIE  
POVE DEL GRAPPA  
ROANA  
ROMANO D'EZELINO  
ROSA  
ROSSANO VENETO  
ROTTOMANOV  
SAN NAZARIO  
SCHIAVON  
SOLAGNA  
TEZZE SUL BRENTA  
VALTAGNANA



**AZIENDA  
SANITARIA**

● UNITÀ LOCALE SOCIO-SANITARIA N° 3 ●

● REGIONE DEL VENETO ●

**ULSS 3**Sede:  
Via Carducci, 2  
36061 BASSANO DEL GRAPPA  
(Vicenza)

SERVIZIO PER IL PERSONALE

☒ 0424 - 885312 Fax 0424 - 885298  
li**Azienda ULSS 3**  
PROTOCOLLO GENERALE

n. 0057651/05 del 09/12/2005

prot. USCITA

Tel. 0424 888111  
Fax 0424 885223

Vs. rif. del

Cod. Fisc. e Part. I.V.A.  
00913430245Oggetto: **Frequenza.**Conto Corrente Postale  
12966362Codice S.I.S.  
05 - 103Egr. Sig.  
Cristian ALBERTI  
Via Concordia, 13  
36027 ROSA' (VI)

e, p. c.:

AL DIRETTORE MEDICO DEI PRESIDII OSPEDALIERI  
AL DIRETTORE DEL DIPARTIMENTO DI CHIRURGIA  
AL DIRETTORE DELLA S.C. DI CHIRURGIA MAXILLO-FACCIALE  
AL RESPONSABILE DEL SERVIZIO DI PREVENZIONE E PROTEZIONE

LORO SEDI

Si comunica che con atto deliberativo 23 novembre 2005, n. 1339, la S.V. è stata autorizzata a frequentare la Struttura Complessa di Chirurgia Maxillo-Facciale del presidio ospedaliero di Bassano del Grappa, per un periodo di dodici mesi a partire dal 01/12/2005.

Come da Sua dichiarazione nessuna responsabilità potrà ricadere su questa Azienda Sanitaria a seguito della frequenza in argomento.

Tuttavia la frequenza medesima è subordinata alla stipulazione di idonea polizza assicurativa contro gli infortuni che la S.V. dovrà provvedere a proprie spese ed esibire all'inizio della frequenza stessa alla competente Direzione Medica.

Si precisa inoltre che non viene instaurato alcun rapporto di impiego, né Lei avrà diritto ad alcun rimborso.

Distinti saluti.

*Il Dirigente Responsabile  
del Servizio per il Personale  
(dott. Luigi Antoniol)*

Resp. procedimento: dott. Luigi Antoniol

Resp. Pratica: dott.ssa Cinzia Oliviero

FAX 0424 - 885298 - TEL. 0424 - 885324

C:\Documents and Settings\cinzia.oliviero\Documenti\UFFICIO DEL PERSONALE\LETTERE FREQUENZA  
VOLONTARIE\P.O.dip.chirurgia ALBERTI.doc

**AZIENDA  
SANITARIA**

● UNITÀ LOCALE SOCIO-SANITARIA N° 3 ●

● REGIONE DEL VENETO ●

**ULSS 3**Sede:  
Via Carducci, 2  
36061 BASSANO DEL GRAPPA  
(Vicenza)Tel. 0424 888111  
Fax 0424 885223Cod. Fisc. e Part. I.V.A.  
00913430245Conto Corrente Postale  
12966362Codice S.I.S.  
05 - 103SERVIZIO PER IL PERSONALE  
☎ 0424 - 885312 Fax 0424 - 885298

Vs. rif. \_\_\_\_\_ del \_\_\_\_\_

Oggetto: **Frequenza.****Azienda ULSS 3**  
PROTOCOLLO GENERALEprot. n. **0059423/06** del **22/12/2006**

USCITA

Egr. Sig.  
Cristian ALBERTI  
Via Concordia, 13  
36027 ROSA' (VI)

e, p. c.:

AL DIRETTORE MEDICO DEI PRESIDI OSPEDALIERI  
AL DIRETTORE DEL DIPARTIMENTO DI CHIRURGIA SPECIALISTICA  
AL DIRETTORE DELLA S.C. DI CHIRURGIA MAXILLO-FACCIALE  
AL RESPONSABILE DEL SERVIZIO DI PREVENZIONE E PROTEZIONE  
LORO SEDI

Si comunica che con atto deliberativo 06 dicembre 2006, n. 1221, la S.V. è stata autorizzata a frequentare la Struttura Complessa di Chirurgia Maxillo-Facciale del presidio ospedaliero di Bassano del Grappa, per un periodo di dodici mesi a partire dal 07 dicembre 2006.

Come da Sua dichiarazione nessuna responsabilità potrà ricadere su questa Azienda Sanitaria a seguito della frequenza in argomento.

Tuttavia la frequenza medesima è subordinata alla stipulazione di idonea polizza assicurativa contro gli infortuni che la S.V. dovrà provvedere a proprie spese ed esibire all'inizio della frequenza stessa alla competente Direzione Medica.

Si precisa inoltre che non viene instaurato alcun rapporto di impiego, né Lei avrà diritto ad alcun rimborso.

Si informa, infine, che nel rispetto delle disposizioni di legge il Servizio di Prevenzione e Protezione organizza "Corsi di Informazione sui rischi specifici, sorveglianza sanitaria, fisica a personale "in frequenza"" la cui partecipazione è obbligatoria. Si invita, pertanto, la S.V. a prendere contatto con il competente Servizio per la definizione delle date dei corsi (Segr. Servizio di Prevenzione e Protezione tel. 0424-889464/5).

Distinti saluti.

*Il Dirigente Responsabile  
del Servizio per il Personale  
(dott. Luigi Antonioli)*Resp. procedimento: dott. Luigi Antonioli  
Resp. Pratica: dott.ssa Cinzia Oliviero

FAX 0424 - 885298 - TEL. 0424 - 885324

C:\Documents and Settings\cinzia.oliviero\Documents\UFFICIO DEL PERSONALE\LETTERE FREQUENZA  
VOLONTARIE\P.O.dip.chirurgia ALBERTI 2.docASIAGO  
BASSANO DEL GRAPPA  
CAMPOLONGO SUL BRENTA  
CARTIGLIANO  
CASSOLA  
CISON DEL GRAPPA  
CONCO  
ENIGO  
FOZA  
GALLIO  
LUSIANA  
MAROSTICA  
MASON VICENTINO  
MOLVENA  
MUSSOLENTE  
NOVE  
PIANEZZE  
POVE DEL GRAPPA  
ROANA  
ROMANO D'EZZELINO  
ROSA  
ROSSANO VENETO  
ROZZO  
SAN NAZARIO  
SCHIAVON  
SOLAGNA  
TEZZE SUL BRENTA  
VALSTAGNA

**AZIENDA  
SANITARIA**

UNITÀ LOCALE SOCIO-SANITARIA N° 3

REGIONE DEL VENETO

**ULSS 3**

SERVIZIO PER IL PERSONALE

☎ 0424 - 885312 Fax 0424 - 885298

Sede:  
Via dei Lotti, 40  
36061 BASSANO DEL GRAPPA  
(Vicenza)Tel. 0424 888111  
Fax 0424 885223Cod. Fisc. e Part. I.V.A.  
00913430245Conto Corrente Postale  
12966362Codice S.I.S.  
05 - 103

Vs. rif. \_\_\_\_\_ del \_\_\_\_\_

Oggetto: **Frequenza.****Azienda ULSS 3**  
PROTOCOLLO GENERALE

n. 0000679/08 del 04/01/2008

prot.

USCITA

Egr. Sig.  
Christian ALBERTI  
Via Concordia, 13  
36027 ROSA'

e, p. c.:

AL DIRETTORE MEDICO DEI PRESIDI OSPEDALIERI  
AL DIRETTORE DEL DIPARTIMENTO DI CHIRURGIA SPECIALISTICA  
AL RESPONSABILE DELLA S.S. CHIRURGIA MAXILLO FACCIALE  
AL RESPONSABILE DEL SERVIZIO DI PREVENZIONE E PROTEZIONE  
LORO SEDI

Si comunica che con atto deliberativo 27 dicembre 2007, n.1165, la S.V. è stata autorizzata a frequentare la Struttura Semplice di Chirurgia Maxillo Facciale del Presidio Ospedaliero di Bassano del Grappa, per un periodo di dodici mesi a partire dal 27 dicembre 2007.

Come da Sua dichiarazione nessuna responsabilità potrà ricadere su questa Azienda Sanitaria a seguito della frequenza in argomento.

Tuttavia la frequenza medesima è subordinata alla stipulazione di idonea polizza assicurativa contro gli infortuni e le malattie che la S.V. dovrà provvedere a proprie spese ed esibire all'inizio della frequenza stessa alla competente Direzione Medica.

Si precisa inoltre che non viene instaurato alcun rapporto di impiego, né Lei avrà diritto ad alcun rimborso.

Si informa, infine, che nel rispetto delle disposizioni di legge il Servizio di Prevenzione e Protezione organizza "Corsi di Informazione sui rischi specifici, sorveglianza sanitaria, fisica a personale in frequenza" la cui partecipazione è obbligatoria. Si invita, pertanto, la S.V. a prendere contatto con il competente Servizio per la definizione delle date dei corsi (Segr. Servizio di Prevenzione e Protezione tel. 0424-889464/5).

Distinti saluti.

*Il Dirigente Responsabile  
del Servizio per il Personale  
(dott. Urbano Brazzale)*Resp. procedimento: dott. Urbano Brazzale  
FAX 0424 - 885298 - TEL. 0424 - 885324  
P O dip chirurgia specASIAGO  
BASSANO DEL GRAPPA  
CAMPOLONGO SUL BRENTA  
CARTIGLIANO  
CASSOLA  
CISON DEL GRAPPA  
CONCO  
ENEGO  
FOZA  
GALLIO  
LUSIANA  
MAROSTICA  
MASON VICENTINO  
MOLVENA  
MUSSOLENTE  
NOVE  
PIANEZZE  
POVE DEL GRAPPA  
ROANA  
ROMANO D'EZZELINO  
ROSA  
ROSSANO VENETO  
ROTZO  
SAN NAZARIO  
SCHIAVON  
SOLAIGNA  
TEZZE SUL BRENTA  
VALSTAGNA



**AZIENDA  
SANITARIA**

• UNITÀ LOCALE SOCIO-SANITARIA N° 3 •

• REGIONE DEL VENETO •

**ULSS 3**

Sede:  
Via Concordia, 13  
36061 BASSANO DEL GRAPPA  
(Vicenza)  
Via dei Lotti, 40  
Tel. 0424 888111  
Fax 0424 885223

Cod. Fisc. e Part. I.V.A.  
00913430245

Conto Corrente Postale  
12966362

Codice S.I.S.  
05 - 103

SERVIZIO PER IL PERSONALE

☎ 0424 - 885312 Fax 0424 - 885298

ii

prot.

Azienda ULSS 3  
PROTOCOLLO GENERALE

n. 0001622/09 del 13/01/2009

USCITA



Vs. rif. del

Oggetto: Frequenza.



Egr. dr.  
Christian Alberti  
Via Concordia, 13  
36027 ROSA' (VI)

e, p. c.:

AL DIRETTORE MEDICO DELL'OSPEDALE AZIENDALE  
AL DIRETTORE MEDICO DEI PRESIDII OSPEDALIERI  
AL DIRETTORE DEL DIPARTIMENTO DI CHIRURGIA SPECIALISTICA  
AL DIRETTORE DELLA S.S. CHIRURGIA MAXILLO FACCIALE  
AL RESPONSABILE DEL SERVIZIO DI PREVENZIONE E PROTEZIONE

LORO SEDI

Si comunica che con atto deliberativo 17 dicembre 2008, n. 1013, la S.V. è stata autorizzata a frequentare la S.S. Chirurgia Maxillo Facciale del P.O. di Bassano per un ulteriore periodo di 12 mesi a partire dal 27 dicembre 2008.

Come da Sua dichiarazione nessuna responsabilità potrà ricadere su questa Azienda Sanitaria a seguito della frequenza in argomento.

Tuttavia la frequenza medesima è subordinata alla stipulazione di idonea polizza assicurativa contro gli infortuni e le malattie che la S.V. dovrà provvedere a proprie spese ed esibire all'inizio della frequenza stessa al Servizio per il Personale.

Si invita la S.V., al fine di documentare la frequenza stessa, a firmare giornalmente l'apposito modulo con l'orario di entrata e di uscita, a disposizione presso la segreteria del servizio da Lei frequentato.

Si precisa inoltre che non viene instaurato alcun rapporto di impiego, né Lei avrà diritto ad alcun rimborso.

Si informa, infine, che nel rispetto delle disposizioni di legge il Servizio di Prevenzione e Protezione organizza "Corsi di Informazione sui rischi specifici, sorveglianza sanitaria, fisica a personale in frequenza" la cui partecipazione è obbligatoria. Si invita, pertanto, la S.V. a prendere contatto con il competente Servizio per la definizione delle date dei corsi (Segr. Servizio di Prevenzione e Protezione tel. 0424-889464/5).

Distinti saluti.



Il Dirigente Responsabile  
del Servizio per il Personale  
(dott. Giovanni Bisinella)

Resp. procedimentale dott. Giovanni Bisinella  
Resp. pratica dott.ssa Chiara Oliviero  
FAX 0424 - 885298 - TEL. 0424 - 885324

ASIAGO  
BASSANO DEL GRAPPA  
CAMPOLONGO SUL BRENTA  
CARTIGLIANO  
CASSOLA  
CISON DEL GRAPPA  
CONCO  
ENEGO  
FOZA  
GALLIO  
LUSIANA  
MAROSTICA  
MASON VICENTINO  
MOLVENA  
MUSSOLENTE  
NOVE  
PIANEGGE  
POVE DEL GRAPPA  
ROANA  
ROMANO D'EZZELINO  
ROSA  
ROSSANO VENETO  
ROTZO  
SAN NAZARIO  
SCHIAVON  
SOLAIGNA  
TEZZE SUL BRENTA  
VALSTAGNA

**AZIENDA  
SANITARIA**

● UNITÀ LOCALE SOCIO-SANITARIA N° 3 ●

● REGIONE DEL VENETO ●

**ULSS 3**

SERVIZIO PER IL PERSONALE

■ 0424 - 885312 Fax 0424 - 885298

Azienda ULSS 3  
PROTOCOLLO GENERALE

n. 0003715/09 del 26/01/2009

USCITA

Sede:  
36061 BASSANO DEL GRAPPA  
(Vicenza)  
Via dei Lotti, 40  
Tel. 0424 888111  
Fax 0424 885223Cod. Fisc. e Part. I.V.A.  
00913430245Conto Corrente Postale  
12966362Codice S.I.S.  
05 - 103

Vs. rif. del

Oggetto: Frequenza.

prot.

Egr. dr.  
Christian Alberti  
Via Concordia, 13  
36027 ROSA' (VI)

e, p. c.:

AL DIRETTORE MEDICO DELL'OSPEDALE AZIENDALE  
AL DIRETTORE MEDICO DEI PRESIDI OSPEDALIERI  
AL DIRETTORE DEL DIPARTIMENTO DI CHIRURGIA SPECIALISTICA  
AL RESPONSABILE DELLA S.S. CHIRURGIA MAXILLO FACCIALE  
AL RESPONSABILE DEL SERVIZIO DI PREVENZIONE E PROTEZIONE

LORO SEDI

Si comunica che con atto deliberativo 17 dicembre 2008, n. 1013, la S.V. è stata autorizzata a frequentare la S.S. Chirurgia Maxillo Facciale del P.O. di Bassano per un ulteriore periodo di 12 mesi a partire dal 27 dicembre 2008.

Come da Sua dichiarazione nessuna responsabilità potrà ricadere su questa Azienda Sanitaria a seguito della frequenza in argomento.

Tuttavia la frequenza medesima è subordinata alla stipulazione di idonea polizza assicurativa contro gli infortuni e le malattie che la S.V. dovrà provvedere a proprie spese ed esibire all'inizio della frequenza stessa al Servizio per il Personale.

Si invita la S.V., al fine di documentare la frequenza stessa, a firmare giornalmente l'apposito modulo con l'orario di entrata e di uscita, a disposizione presso la segreteria del servizio da Lei frequentato.

Si precisa inoltre che non viene instaurato alcun rapporto di impiego, né Lei avrà diritto ad alcun rimborso.

Si informa, infine, che nel rispetto delle disposizioni di legge il Servizio di Prevenzione e Protezione organizza "Corsi di Informazione sui rischi specifici, sorveglianza sanitaria, fisica a personale in frequenza" la cui partecipazione è obbligatoria. Si invita, pertanto, la S.V. a prendere contatto con il competente Servizio per la definizione delle date dei corsi (Segr. Servizio di Prevenzione e Protezione tel. 0424-889464/5).

Distinti saluti.

*Il Dirigente Responsabile  
del Servizio per il Personale  
(dott. Giovanni Bisinella)*Resp. procedimento: dott. Giovanni Bisinella  
Resp. pratica: dott. ssa Cinzia Oliviero  
FAX 0424 - 885298 - TEL. 0424 - 885324ASIAGO  
BASSANO DEL GRAPPA  
CAMPOLONGO SUL BRENTA  
CARTIGLIANO  
CASSOLA  
CISON DEL GRAPPA  
CONCO  
ENEGO  
FOZA  
GALLIO  
LUSIANA  
MAROSTICA  
MASON VICENTINO  
MOLVENA  
MUSSOLENTE  
NOVE  
PIANEZZE  
POVE DEL GRAPPA  
ROANA  
ROMANO D'EZELINO  
ROSA  
ROSSANO VENETO  
ROZZO  
SAN MAZARIO  
SCHIAVON  
SOLAGNA  
TEZZE SUL BRENTA  
VALSTAGNA



**AZIENDA  
SANITARIA**

• UNITÀ LOCALE SOCIO-SANITARIA N° 3 •

• REGIONE DEL VENETO •

**ULSS 3****Azienda ULSS 3**  
PROTOCOLLO GENERALE

n. 0030334/11 del 25/05/2011

USCITA

Sede:  
Via dei Lotti, 40  
36061 BASSANO DEL GRAPPA  
(Vicenza)Tel. (0424) 888 111  
Fax (0424) 885 223Cod. Fisc. e Part. I.V.A.  
00913430245Conto Corrente Postale  
12966362Codice S.I.S.  
050 - 103SERVIZIO PER IL PERSONALE  
■ 0424 - 885312 Fax 0424 - 885298  
IX.5.1.

Vs. rif. \_\_\_\_\_ del \_\_\_\_\_

Oggetto:

**Frequenza.****Dr. Christian Alberti**  
Via Concordia  
36027 Rosà VI

e, p. c.

AL DIRETTORE MEDICO DELL'OSPEDALE AZIENDALE  
AL DIRETTORE DEL DIPARTIMENTO DI CHIRURGIA SPECIALISTICA  
AL RESPONSABILE S.S.D. CHIRURGIA MAXILLO-FACCIALE  
AL DIRIGENTE RESPONSABILE DEL SERVIZIO PER GLI APPROVVIGIONAMENTI  
AL RESPONSABILE DEL SERVIZIO DI PREVENZIONE E PROTEZIONE

LORO SEDI

Si comunica che con atto deliberativo 27.04.2011, n. 358, la S.V. è stata autorizzata a frequentare la S.S.D. di Chirurgia Maxillo-Facciale per un periodo di dodici mesi a partire dal 1° maggio 2011.

Come da Sua dichiarazione nessuna responsabilità potrà ricadere su questa Azienda Sanitaria a seguito della frequenza in argomento.

Ricordiamo che la frequenza medesima è subordinata alla stipulazione di idonea polizza assicurativa contro gli infortuni e le malattie che la S.V. ha esibito al Servizio per il Personale.

Si invita la S.V., al fine di documentare la frequenza, a firmare giornalmente l'apposito modulo con l'orario di entrata e di uscita, a disposizione presso le segreterie dei servizi da Lei frequentati.

Si precisa inoltre che non viene instaurato alcun rapporto di impiego, né Lei avrà diritto ad alcun rimborso.

Si prende atto, infine, che la S.V. ha frequentato, come da autocertificazione ricevuta con prot. 22592 del 15.04.2011, il corso di Informazione sui rischi specifici, sorveglianza sanitaria, fisica a personale in frequenza che, nel rispetto delle disposizioni di legge, è organizzato dal Servizio di Prevenzione e Protezione.

Distinti saluti.

Servizio per il Personale  
Il Dirigente Amm.vo  
(dott.ssa Chiara Prevedello)Resp. procedimento: dott.ssa Chiara Prevedello  
Ref. Ogg.: dott.ssa Eva Faironello  
FAX 0424 - 885298 - TEL. 0424 - 885334ASIAGO  
BASSANO DEL GRAPPA  
CAMPOLONGO SUL BRENTA  
CARTIGLIANO  
CASSOLA  
CISON DI GRAPPA  
CONCO  
ENEGO  
FOZA  
GALLIO  
LUSIANA  
MAROSTICA  
MASON VICENTINO  
MOLVENA  
MUSSOLENTE  
NOVE  
PIANEZZE  
POVE DEL GRAPPA  
ROANA  
ROMANO D'EZZELE  
ROSA  
ROSSANO VENETO  
ROZZO  
SAN NAZARIO  
SCHIAVON  
SOLAGNA  
TEZZE SUL BRENTA  
VALSTAGNA

**AZIENDA  
SANITARIA**

UNITÀ LOCALE SOCIO-SANITARIA N° 3

REGIONE DEL VENETO

**ULSS 3**Sede:  
36061 BASSANO DEL GRAPPA  
(Vicenza)  
Via dei Lotti, 40Tel. 0424 888 111  
Fax 0424 885 223Cod. Fisc. e Part. I.V.A.  
00913430245Conto Corrente Postale  
12966362Codice S.I.S.  
050 - 103SERVIZIO PER IL PERSONALE  
■ 0424 - 885312 Fax 0424 - 885298  
I.R.S.1.

Vs. rif. del

Oggetto: **Frequenza.****Azienda ULSS 3**  
PROTOCOLLO GENERALE - uscitali n. **0007932/12** del **16/02/2012**  
(DA CITARE NELLA RISPOSTA)Egr. dr.  
Christian Alberti  
Via Concordia, 13  
36027 Rosà (VI)

e, p. c.  
AL DIRETTORE MEDICO DELL'OSPEDALE AZIENDALE  
AL DIRETTORE DEL DIPARTIMENTO DI CHIRURGIA SPECIALISTICA  
AL RESPONSABILE S.S.D. CHIRURGIA MAXILLO-FACCIALE  
AL DIRIGENTE RESPONSABILE DEL SERVIZIO PER GLI APPROVVIGIONAMENTI  
AL RESPONSABILE DEL SERVIZIO DI PREVENZIONE E PROTEZIONE

LORO SEDI

Si comunica che con atto deliberativo n. 22 del 25 gennaio 2012 la S.V. è stata autorizzata a frequentare la S.S.D. di Chirurgia Maxillo-Facciale per un periodo di sei mesi a partire dal 26 gennaio 2012.

Come da Sua dichiarazione nessuna responsabilità potrà ricadere su questa Azienda Sanitaria a seguito della frequenza in argomento.

Ricordiamo che la frequenza medesima è subordinata alla stipulazione di idonea polizza assicurativa contro gli infortuni e le malattie che la S.V. ha esibito al Servizio per il Personale.

Si invita la S.V., al fine di documentare la frequenza, a firmare giornalmente l'apposito modulo con l'orario di entrata e di uscita, a disposizione presso le segreterie dei servizi da Lei frequentati.

Si precisa inoltre che non viene instaurato alcun rapporto di impiego, né Lei avrà diritto ad alcun rimborso.

Si prende atto, infine, che la S.V. ha frequentato, come da autocertificazione ricevuta con prot. 1316 del 10 gennaio 2012, il corso di Informazione sui rischi specifici, sorveglianza sanitaria, fisica a personale in frequenza che, nel rispetto delle disposizioni di legge, è organizzato dal Servizio di Prevenzione e Protezione.

Distinti saluti.

*Il Dirigente Responsabile  
del Servizio per il Personale  
(dott.ssa Chiara Prevedello)*



Resp. procedimento: dott.ssa Chiara Prevedello  
Ref. Ogg.: dott.ssa Eva Farronato  
FAX 0424 - 885298 - TEL. 0424 - 885334

ASIAGO  
BASSANO DEL GRAPPA  
CAMPOLONGO SUL BRENTA  
CARTIGLIANO  
CASSOLA  
CISON DEL GRAPPA  
CONCO  
ENEGO  
FOZA  
GALLIO  
LUSIANA  
MAROSTICA  
MASON VICENTINO  
MOLVENA  
MUSSOLENTE  
NOVE  
PIANESSE  
POVE DEL GRAPPA  
ROANA  
ROMANO D'EZELINO  
ROSA  
ROSSANO VENETO  
ROTTO  
SAN NAZARIO  
SCHIAVON  
SOLAGNA  
TEZZE SUL BRENTA  
VALSTAGNA

**AZIENDA  
SANITARIA**

• UNITÀ LOCALE SOCIO-SANITARIA N° 3 •

• REGIONE DEL VENETO •



**ULSS**

OSPEDALE SAN BASSIANO  
Via dei Lotti, 40 - tel. 0424 888111  
36061 Bassano del Grappa (VI)

**Struttura Semplice Dipartimentale di  
CHIRURGIA MAXILLO-FACCIALE E ODONTOIATRIA**  
Responsabile: **Dr. Breda Guglielmo**

Reparto degenza: tel. 0424 888494 - fax 888759  
Segreteria Ambulatorio: tel. 0424 888758

Bassano del Grappa, 08.02.2011

Si certifica che il **Dr. Christian Alberti** ha frequentato la Struttura Complessa di Odontostomatologia e Chirurgia Maxillo-Facciale dal 04-06-2001 al 31-07-2009 in qualità di VOLONTARIO per un totale di 14257 ore.

Il Direttore del  
Dipartimento di Chirurgia Specialistica  
Dr. Guglielmo Breda



**Azienda Ospedaliera ULSS n° 7 Pedemontana**  
**Dipartimento di Chirurgia Specialistica**  
**Unità Operativa Semplice Dipartimentale**  
**di Odontoiatria e Chirurgia Maxillo-Facciale**  
**Responsabile: Dr. Michele Garofolin**  
 Segreteria ambulatoriale: tel. 0424/888758 fax.0424/ 888759  
 Degenze: tel. 0424/888496  
 Segreteria Day Surgery: tel. 0424/888496  
 Degenza Day Surgery: tel. 0424/888566  
 E-mail: maxillo@aulss7.veneto.it

Bassano del Grappa, Febbraio 2022

Si certifica che il **Dr. CHRISTIAN ALBERTI** ha frequentato la U.O.S.D. di Odontoiatria e Chirurgia Maxillo-Facciale della ULSS 7 Pedemontana dal mese di Settembre 2020 a Febbraio 2022 per un totale di **612,5** ore.

Il Direttore della U.O.S.D. di  
 Odontoiatria e Chirurgia Maxillo-Facciale  
 Dr. Michele Garofolin



Regione del Veneto - Azienda ULSS n.7  
 Presidio Ospedaliero Spoke Bassano  
 U.O.S.D. Chirurgia Maxillo-Facciale  
 Responsabile dr. Michele Garofolin  
 cod. RC 003660 CH





**Azienda Ospedaliera ULSS n° 7 Pedemontana**  
**Dipartimento di Chirurgia Specialistica**  
**Unità Operativa Semplice Dipartimentale**  
**di Odontoiatria e Chirurgia Maxillo-Facciale**  
**Responsabile: Dr. Michele Garofolin**  
 Segreteria ambulatoriale: tel. 0424/888758 fax.0424/ 888759  
 Degenze: tel. 0424/888496  
 Segreteria Day Surgery: tel. 0424/888496  
 Degenza Day Surgery: tel. 0424/888566  
 E-mail: maxillo@aulss7.veneto.it

Bassano del Grappa, Febbraio 2022

Si certifica che il **Dr. CHRISTIAN ALBERTI** ha eseguito presso la U.O.S.D. di Odontoiatria e Chirurgia Maxillo-Facciale della ULSS 7 Pedemontana dal mese di Settembre 2020 a Febbraio 2022 un totale di **415** interventi.

Il Direttore della U.O.S.D. di  
 Odontoiatria e Chirurgia Maxillo-Facciale  
 Dr. Michele Garofolin



Regione del Veneto Azienda ULSS n.7  
 Presidio Ospedaliero Spoke Bassano  
 U.O.S.D. Chirurgia Maxillo Facciale  
 Responsabile dr. Michele Garofolin  
 cod. RD 005650 CH



**Università degli Studi di TORINO**

**SCIENZE CHIRURGICHE  
CHIRURGIA ORTOGNATICA E DELLE MALFORMAZIONI  
CRANIO-FACCIALI**

**Piano degli studi dello studente:  
MATRICOLA: 879170 - ALBERTI CHRISTIAN**

**ORDINAMENTO: 2016/2017**  
**PERCORSO: GENERICO**  
**SCHEMA DI PIANO: GEN - GENERICO**  
**STATO DEL PIANO: APPROVATO**  
**DATA VARIAZIONE: 08/03/2018**  
**ANNO REGOLE: 2017/2018**  
**ANNO OFFERTA: 2017/2018**

**ATTIVITÀ DIDATTICHE DEL 1° ANNO**

<b>COD</b>	<b>DESCRIZIONE</b>	<b>CFU</b>	<b>STATO</b>	<b>DATA SUP</b>	<b>VOTO</b>
MAS3352	PROVA FINALE	3	SUP.	28/02/2019	IDO
MAS3530	MALFORMAZIONI CRANIO-FACCIALI IN ETA' PEDIATRICA	1	SUP.	25/01/2019	30
MAS3531	CHIRURGIA CORRETTIVA	1	SUP.	28/01/2019	30
MAS3526	TECNICHE CHIRURGICHE	7	SUP.	16/01/2019	30
MAS3522	ANATOMIA TOPOGRAFICA E RADIOLOGIA	2	SUP.	07/01/2019	30
MAS3523	DIAGNOSI DELLE DEFORMITA' CRANIO-MAXILLO-FACCIALI	5	SUP.	09/01/2019	30
MAS3524	ORTODONZIA	7	SUP.	11/01/2019	30
MAS3525	ANESTESIA E GESTIONE PERIOPERATORIA	1	SUP.	14/01/2019	30
MAS3629	TIROCINIO	30	SUP.	28/01/2019	30
MAS3527	CHIRURGIA ESTETICA MAXILLO-FACCIALE E PROCEDURE ANCILLARI	1	SUP.	18/01/2019	30

MAS3528	GESTIONE E TRATTAMENTO DELLE COMPLICANZE	1	SUP.	21/01/2019	30
MAS3529	ANALISI FUNZIONALE DEL PAZIENTE DISMORFICO	1	SUP.	23/01/2019	30
<b><i>Totale CFU</i></b>		<b>60</b>			
<b><i>Totale CFU del piano di studi</i></b>		<b>60</b>			

MATRICOLA 879170

Codice PA: 31-0001121683-0001892494

DICHIARAZIONE SOSTITUTIVA DI CERTIFICAZIONI  
(DPR 28 DICEMBRE 2000, N. 445, ARTT.46 E SEG.)

IL SOTTOSCRITTO ALBERTI CHRISTIAN NATO IL 15/09/1979 A BASSANO DEL GRAPPA, VICENZA

CONSAPEVOLE CHE CHIUNQUE RILASCI DICHIARAZIONI MENDACI È PUNITO AI SENSI DEL CODICE PENALE E DELLE LEGGI SPECIALI IN MATERIA, AI SENSI E PER GLI EFFETTI DELL'ART. 75 E 76 DPR 445/2000

DICHIARA

DI AVER CONSEGUITO IL MASTER DI SECONDO LIVELLO IN CHIRURGIA ORTOGNATICA E DELLE MALFORMAZIONI CRANIO-FACCIALI DM509, DELL'UNIVERSITÀ DEGLI STUDI DI TORINO IN DATA 28/02/2019 CON VOTO CENTODIECI SU CENTODIECI (110/110) E LODE

DICHIARA INOLTRE

CHE SI E' IMMATRICOLATO IN DATA 21/02/2018 NELL'ANNO ACCADEMICO 2017/2018

CHE LA DURATA NORMALE DEL SUDETTO CORSO DI STUDI E' DI 1 ANNO

DICHIARA ALTRESI'

DI AVER SUPERATO I SEGUENTI ESAMI :

Descrizione e Settore Scientifico Disciplinare (SSD)	TAF	CFU	Data	Voto	Anno	Conv
ANATOMIA TOPOGRAFICA E RADIOLOGIA SSD: BIO/16 SSD: MED/36		2 1 1	07/01/2019	30/30	1	
DIAGNOSI DELLE DEFORMITA' CRANIO-MAXILLO-FACCIALI SSD: MED/29 SSD: MED/29 SSD: MED/28 SSD: MED/28		5 1 2 1 1	09/01/2019	30/30	1	
ORTODONZIA SSD: MED/28		7 7	11/01/2019	30/30	1	
ANESTESIA E GESTIONE PERIOPERATORIA SSD: MED/16		1 1	14/01/2019	30/30	1	
TECNICHE CHIRURGICHE SSD: MED/29		7 7	16/01/2019	30/30	1	
CHIRURGIA ESTETICA MAXILLO-FACCIALE E		1	18/01/2019	30/30	1	

Descrizione e Settore Scientifico Disciplinare (SSD)	TAF	CFU	Data	Voto	Anno	Conv
PROCEDURE ANCILLARI SSD: MED/19		1				
GESTIONE E TRATTAMENTO DELLE COMPLICANZE SSD: MED/28		1 1	21/01/2019	30/30	1	
ANALISI FUNZIONALE DEL PAZIENTE DISMORFICO SSD: MED/28		1 1	23/01/2019	30/30	1	
MALFORMAZIONI CRANIO-FACCIALI IN ETA' PEDIATRICA SSD: MED/19		1 1	25/01/2019	30/30	1	
CHIRURGIA CORRETTIVA SSD: MED/29		1 1	28/01/2019	30/30	1	
TIROCINIO		30	28/01/2019	30/30	1	
PROVA FINALE SSD: PROFIN_S		3 3	28/02/2019	Idoneo	1	
<b>Totale CFU:</b>		<b>60.00</b>				

Legenda: RF Riconosciuta Frequenza  
RA Riconosciuta Attività  
CF Convalidata Frequenza  
CA Convalidata Attività

TORINO, li 21/03/2019

CONSAPEVOLE CHE CHIUNQUE RILASCI A DICHIARAZIONI MENDACI È PUNITO AI SENSI DEL CODICE PENALE E DELLE LEGGI SPECIALI IN MATERIA, AI SENSI E PER GLI EFFETTI DELL'ART. 75 E 76 DPR 445/2000

Luogo e data \_\_\_\_\_

DICHIARO, ALTRESI', DI ESSERE INFORMATO, AI SENSI E PER GLI EFFETTI DI CUI ALL'ART. 13 DEL D.LGS. 196/2003 CHE I DATI PERSONALI RACCOLTI SARANNO TRATTATI, ANCHE CON STRUMENTI INFORMATICI, ESCLUSIVAMENTE NELL'AMBITO DEL PROCEDIMENTO PER IL QUALE LA PRESENTE DICHIARAZIONE VIENE RESA.

Firma del dichiarante (per esteso e leggibile)

Esente da imposta di bollo ai sensi dell'art. 37 DPR 445/2000



UNIVERSITÀ  
di VERONA

MATRICOLA VR441552

N. CERTIF. DOC1218932 /ISCR\_ES\_SP

Si attesta che **ALBERTI CHRISTIAN**,  
nato a Bassano del Grappa (VI) il 15 Settembre 1979,  
immatricolato al primo anno di corso nell'anno accademico 2017/2018,  
è iscritto al **secondo anno, regolare**,  
della **SCUOLA DI SPECIALIZZAZIONE DI AREA SANITARIA IN CHIRURGIA ORALE**  
CLASSE SAS-5513 - Classe delle specializzazioni in odontoiatria del Decreto Interministeriale 4  
febbraio 2015 n. 68  
per l'anno accademico 2018/2019.

Si certifica inoltre che la corsista ha sostenuto i seguenti esami ai fini del conseguimento della specializzazione

TIPO	DATA	ESAME	S.S.D.	CFU	VOTO
	14/02/2020	ESAME DI PROFITTO TEORICO-PRATICO 1			50/50
		ORGANIZZAZIONE AZIENDALE	SECS-P/10	1	
		FARMACOLOGIA	BIO/14	1	
		ANATOMIA UMANA	BIO/16	1	
		DIAGNOSTICA PER IMMAGINI E RADIOTERAPIA 1 (TRONCO COMUNE)	MED/36	1	
		ANESTESIOLOGIA 1	MED/41	1	
		CHIRURGIA MAXILLO-FACCIALE 1 (DISCIPLINE SPECIFICHE DELLA TIPOLOGIA)	MED/29	5	
		MALATTIE ODONTOSTOMATOLOGICHE 1	MED/28	40	
		MALATTIE ODONTOSTOMATOLGICHE 1 (TRONCO COMUNE)	MED/28	8	
		CHIRURGIA MAXILLO-FACCIALE 1 (TRONCO COMUNE)	MED/29	1	
		SEMINARI E CONVEGNI 1	-	1	
<b>TOTALE CFU ACQUISITI</b>				<b>60.00</b>	

**LEGENDA:**

C: CONVALIDATO

S.S.D.: SETTORE SCIENTIFICO DISCIPLINARE

CFU: Crediti formativi universitari



La durata normale del suddetto corso è di tre anni.

Si rilascia in carta libera per gli usi consentiti dalla tab. all. B) del D.P.R. 642/72 del 26.10.1972 e successive modificazioni. Ai sensi dell'art. 15, comma 1 della legge 12 novembre 2011, n. 183 il presente certificato non può essere prodotto agli organi della Pubblica amministrazione o ai privati gestori di pubblici servizi. Valido per l'estero. Il certificato è emesso a norma dell'art. 3, comma 2 del Decreto L.vo 12.02.1993, n.39

I dati del presente certificato sono ricavati dal sistema di gestione delle carriere degli studenti.

VERONA, 4 Giugno 2020

LA DIRIGENTE  
*dott.ssa Maja Laetitia Feldt*



UNIVERSITÀ  
di VERONA

MATRICOLA VR441552

N. CERTIF. DOC1362060 /ISCR\_ES\_SP

Si attesta che **ALBERTI CHRISTIAN**,  
nato a Bassano del Grappa (VI) il 15 Settembre 1979,  
immatricolato al primo anno di corso nell'anno accademico 2017/2018,  
è iscritto al **terzo anno, regolare**,  
della **SCUOLA DI SPECIALIZZAZIONE DI AREA SANITARIA IN CHIRURGIA ORALE**  
CLASSE SAS-5513 - Classe delle specializzazioni in odontoiatria del Decreto Interministeriale 4  
febbraio 2015 n. 68  
per l'anno accademico 2019/2020.

Si certifica che, a tutt'oggi, l'interessato ha superato i seguenti esami

TIPO	DATA	ESAME	S.S.D.	CFU	VOTO
	<b>14/02/2020</b>	<b>ESAME DI PROFITTO TEORICO-PRATICO 1</b>			<b>50/50</b>
		ORGANIZZAZIONE AZIENDALE	SECS-P/10	1	
		FARMACOLOGIA	BIO/14	1	
		ANATOMIA UMANA	BIO/16	1	
		DIAGNOSTICA PER IMMAGINI E RADIOTERAPIA 1 (TRONCO COMUNE)	MED/36	1	
		ANESTESIOLOGIA 1	MED/41	1	
		CHIRURGIA MAXILLO-FACCIALE 1 (DISCIPLINE SPECIFICHE DELLA TIPOLOGIA)	MED/29	5	
		MALATTIE ODONTOSTOMATOLOGICHE 1	MED/28	40	
		MALATTIE ODONTOSTOMATOLGICHE 1 (TRONCO COMUNE)	MED/28	8	
		CHIRURGIA MAXILLO-FACCIALE 1 (TRONCO COMUNE)	MED/29	1	
		SEMINARI E CONVEGNI 1	-	1	
	<b>05/03/2021</b>	<b>ESAME DI PROFITTO TEORICO-PRATICO 2</b>			<b>50/50 L</b>
		STATISTICA MEDICA	MED/01	1	
		MICROBIOLOGIA E MICROBIOLOGIA CLINICA	MED/07	1	
		OTORINOLARINGOIATRIA 2	MED/31	1	

TIPO	DATA	ESAME	S.S.D.	CFU	VOTO
		MALATTIE ODONTOSTOMATOLOGICHE 2	MED/28	40	
		DIAGNOSTICA PER IMMAGINI E RADIOTERAPIA 2 (TRONCO COMUNE)	MED/36	1	
		MALATTIE DELL'APPARATO VISIVO	MED/30	1	
		ANESTESIOLOGIA 2	MED/41	1	
		CHIRURGIA MAXILLO-FACCIALE 2 (DISCIPLINE SPECIFICHE DELLA TIPOLOGIA)	MED/29	4	
		MALATTIE ODONTOSTOMATOLGICHE 2 (TRONCO COMUNE)	MED/28	7	
		CHIRURGIA MAXILLO-FACCIALE 2 (TRONCO COMUNE)	MED/29	1	
		SEMINARI E CONVEGNI 2	-	2	

**TOTALE CFU ACQUISITI****120.00****LEGENDA:**

C: CONVALIDATO

S.S.D.: SETTORE SCIENTIFICO DISCIPLINARE

CFU: Crediti formativi universitari

La durata normale del suddetto corso è di tre anni.

Si rilascia in carta libera per gli usi consentiti dalla tab. all. B) del D.P.R. 642/72 del 26.10.1972 e successive modificazioni. Ai sensi dell'art. 15, comma 1 della legge 12 novembre 2011, n. 183 il presente certificato non può essere prodotto agli organi della Pubblica amministrazione o ai privati gestori di pubblici servizi. Valido per l'estero. Il certificato è emesso a norma dell'art. 3, comma 2 del Decreto L.vo 12.02.1993, n.39

I dati del presente certificato sono ricavati dal sistema di gestione delle carriere degli studenti.

VERONA, 7 Maggio 2021

LA DIRIGENTE  
dott.ssa Maja Laetitia Feldt



UNIVERSITÀ  
di VERONA

**MATRICOLA VR441552**

N. CERTIF. DOC1510719 /LAU\_SSD SP

Si attesta che il dott. **ALBERTI CHRISTIAN**,  
nato a Bassano del Grappa (VI) il 15 Settembre 1979,  
il giorno 23/02/2022 ha superato presso questa Università l'esame finale di diploma di specialista in  
**CHIRURGIA ORALE**  
appartenente alla CLASSE SAS-5513 - Classe delle specializzazioni in odontoiatria del Decreto  
Interministeriale 4 febbraio 2015 n. 68, riportando punti 70/70 e lode (settanta/settanta e lode).

Avendo superato i seguenti esami:

TIPO	DATA	ESAME	S.S.D.	CFU	VOTO
	<b>14/02/2020</b>	<b>ESAME DI PROFITTO TEORICO-PRATICO 1</b>		<b>60</b>	<b>50/50</b>
		ORGANIZZAZIONE AZIENDALE	SECS-P/10	1	
		FARMACOLOGIA	BIO/14	1	
		ANATOMIA UMANA	BIO/16	1	
		DIAGNOSTICA PER IMMAGINI E RADIOTERAPIA 1 (TRONCO COMUNE)	MED/36	1	
		ANESTESIOLOGIA 1	MED/41	1	
		CHIRURGIA MAXILLO-FACCIALE 1 (DISCIPLINE SPECIFICHE DELLA TIPOLOGIA)	MED/29	5	
		MALATTIE ODONTOSTOMATOLOGICHE 1	MED/28	40	
		MALATTIE ODONTOSTOMATOLGICHE 1 (TRONCO COMUNE)	MED/28	8	
		CHIRURGIA MAXILLO-FACCIALE 1 (TRONCO COMUNE)	MED/29	1	
		SEMINARI E CONVEGNI 1	-	1	
	<b>05/03/2021</b>	<b>ESAME DI PROFITTO TEORICO-PRATICO 2</b>		<b>60</b>	<b>50/50 L</b>
		STATISTICA MEDICA	MED/01	1	
		MICROBIOLOGIA E MICROBIOLOGIA CLINICA	MED/07	1	
		OTORINOLARINGOIATRIA 2	MED/31	1	



TIPO	DATA	ESAME	S.S.D.	CFU	VOTO
		MALATTIE ODONTOSTOMATOLOGICHE 2	MED/28	40	
		DIAGNOSTICA PER IMMAGINI E RADIOTERAPIA 2 (TRONCO COMUNE)	MED/36	1	
		MALATTIE DELL'APPARATO VISIVO	MED/30	1	
		ANESTESIOLOGIA 2	MED/41	1	
		CHIRURGIA MAXILLO-FACCIALE 2 (DISCIPLINE SPECIFICHE DELLA TIPOLOGIA)	MED/29	4	
		MALATTIE ODONTOSTOMATOLGICHE 2 (TRONCO COMUNE)	MED/28	7	
		CHIRURGIA MAXILLO-FACCIALE 2 (TRONCO COMUNE)	MED/29	1	
		SEMINARI E CONVEGNI 2	-	2	
	<b>03/02/2022</b>	<b>ESAME DI PROFITTO TEORICO-PRATICO 3</b>		<b>60</b>	<b>50/50 L</b>
		PROVA FINALE	MED/28	10	
		MEDICINA LEGALE	MED/43	1	
		ANATOMIA PATOLOGICA	MED/08	1	
		OTORINOLARINGOIATRIA 3	MED/31	1	
		MALATTIE ODONTOSTOMATOLOGICHE 3	MED/28	30	
		CHIRURGIA MAXILLO-FACCIALE 3 (DISCIPLINE SPECIFICHE DELLA TIPOLOGIA)	MED/29	6	
		MALATTIE ODONTOSTOMATOLGICHE 3 (TRONCO COMUNE)	MED/28	7	
		CHIRURGIA MAXILLO-FACCIALE 3 (TRONCO COMUNE)	MED/29	2	
		SEMINARI E CONVEGNI 3	-	2	
<b>TOTALE CFU ACQUISITI</b>				<b>180.00</b>	

**LEGENDA:**

C: CONVALIDATO





UNIVERSITÀ  
di **VERONA**

La durata normale del suddetto corso è di tre anni.

Si rilascia in carta libera per gli usi consentiti dalla tab. all. B) del D.P.R. 642/72 del 26.10.1972 e successive modificazioni. Ai sensi dell'art. 15, comma 1 della legge 12 novembre 2011, n. 183 il presente certificato non può essere prodotto agli organi della Pubblica amministrazione o ai privati gestori di pubblici servizi. Valido per l'estero. Il certificato è emesso a norma dell'art. 3, comma 2 del Decreto L.vo 12.02.1993, n.39

I dati del presente certificato sono ricavati dal sistema di gestione delle carriere degli studenti.

VERONA, 10 Marzo 2022

LA DIRIGENTE

*dott.ssa Maja Laetitia Feldt*



UNIVERSITÀ  
di **VERONA**

**MATRICOLA VR441552**

N. CERTIF. DOC1510363 /LAU\_SP

Si attesta che il dott. **ALBERTI CHRISTIAN**,  
nato a Bassano del Grappa (VI) il 15 Settembre 1979,  
il giorno 23/02/2022 ha superato presso questa Università l'esame finale di diploma di specialista in  
**CHIRURGIA ORALE**  
appartenente alla CLASSE SAS-5513 - Classe delle specializzazioni in odontoiatria del Decreto  
Interministeriale 4 febbraio 2015 n. 68, riportando punti 70/70 e lode (settanta/settanta e lode).

Al titolo conseguito compete la qualifica accademica di "Specialista" (di cui al decreto M.I.U.R. n.  
270/2004, art. 13, comma 7).

La durata normale del suddetto corso è di tre anni.

Si rilascia in carta libera per gli usi consentiti dalla tab. all. B) del D.P.R. 642/72 del 26.10.1972 e successive modificazioni. Ai  
sensi dell'art. 15, comma 1 della legge 12 novembre 2011, n. 183 il presente certificato non può essere prodotto agli organi della  
Pubblica amministrazione o ai privati gestori di pubblici servizi. Valido per l'estero. Il certificato è emesso a norma dell'art. 3,  
comma 2 del Decreto L.vo 12.02.1993, n.39

I dati del presente certificato sono ricavati dal sistema di gestione delle carriere degli studenti.

VERONA, 9 Marzo 2022

LA DIRIGENTE  
*dott.ssa Maja Laetitia Feldt*

Codice PA: 46-0000162679-0000000000

Matricola 740305

Pagina 1 di 2

**DICHIARAZIONE SOSTITUTIVA DI CERTIFICAZIONE**

(DPR 28 DICEMBRE 2000, N.445, ARTT.46 E SGG. E LEGGE NOVEMBRE 2011, N.183, ART. 15)

Il sottoscritto ALBERTI CHRISTIAN, nato a Bassano del Grappa (VI) il 15/09/1979,

**DICHIARA**

di aver superato l'esame di MASTER DI II LIVELLO IN "ODONTOIATRIA DIGITALE" - sede BRESCIA ( D.M. 270/2004) presso Università degli studi di BRESCIA in data 07/07/2023 con voto 110/110 e lode.

La durata normale del corso di studi è di un anno.

**DICHIARA INOLTRE**

che il sottoscritto ha discusso la tesi dal seguente titolo: Valutazione analitica, morfologica e morfometrica dell'anatomia facciale di superficie tramite tecnologia computerizzata. Utilizzo dei sistemi di scansione tridimensionale computer-assistiti per la riproduzione 3D dei tessuti molli del viso.

**DICHIARA INOLTRE**

di essersi immatricolato in data 27/04/2022 al primo anno del MASTER DI II LIVELLO IN "ODONTOIATRIA DIGITALE" ( D.M. 270/2004) presso Università degli Studi di BRESCIA nell'A.A. 2021/2022

**DICHIARA ALTRESI'**

di aver superato I seguenti esami:

DESCRIZIONE	DATA	VOTO	SSD	CFU	CONV	TIPO RIC/CONV
TIROCINIO	01/04/2023	Idoneo		20		
ODONTOIATRIA DIGITALE	05/06/2023	30/30	MED/28	35		
PROVA FINALE	07/07/2023	Idoneo		5		
<b>TOTALE CFU ACQUISITI</b>				<b>60.00</b>		

Codice PA: 46-0000162679-0000000000

Matricola 740305

Pagina 2 di 2

La presente carriera risulta chiusa in data 07/07/2023, per conseguimento titolo.

Consapevole che chiunque rilascia dichiarazioni mendaci è punito ai sensi del Codice Penale e delle leggi speciali in materia, ai sensi e per gli effetti degli ART. 75 e 76 DPR 445/2000.  
Consapevole di quanto previsto dall'ART. 13 del D.LGS 196/03 codice in materia di protezione dei dati personali.

BRESCIA, 13/07/2023

FIRMA DEL DICHIARANTE

Esente da imposta di bollo a sensi dell'art.37 DPR 445/2000



**CONSEGUIMENTO MASTER DI II LIVELLO**  
**Dichiarazione sostitutiva di certificazione**  
 (Art. 46 del DPR 28 dicembre 2000, n.445)

Esente da  
 Imposta da bollo

Il/La sottoscritto/a Dott. Cognome Alberti ..... Nome Christian .....

Nato/a a Bassano del Grappa (Vicenza) ..... il 15/09/1979 .....

Codice Fiscale: LBRCRS79P15A703E .....

consapevole delle responsabilità e delle pene stabilite dalla legge per false attestazioni e mendaci dichiarazioni, sotto la propria personale responsabilità (art. 76 T.U. - DPR 445/2000),


**D I C H I A R A**

ai sensi ed agli effetti dell'art.46 del D.P.R. n.445 del 28/12/2000 recante il Testo Unico delle disposizioni legislative e regolamentari in materia di documentazione amministrativa.

di aver conseguito il Master di II livello in Implantologia Zigomatica .....

presso l'Università di Pisa ..... il 2 dicembre 2023 .....

Data 2 dicembre 2023 .....

Firma del dichiarante  .....

(non soggetta ad autenticazione)

1. ai sensi dell'art. 76 del D.P.R. 445/2000 "chiunque rilascia dichiarazioni mendaci, forma atti falsi o ne fa uso nei casi previsti dal presente Testo Unico è punito ai sensi del Codice Penale e delle leggi speciali in materia". Il dichiarante decade dai benefici eventualmente conseguenti al provvedimento emanato sulla base della dichiarazione non veritiera;
2. Ai sensi degli artt. 46 e 47 del D.P.R. 28 dicembre 2000, n.445, la sottoscrizione non è soggetta ad autenticazione se la dichiarazione sostitutiva di certificazione verrà presentata di persona, direttamente presso l'ufficio competente (in tal caso verrà sottoscritta dinanzi ad uno dei responsabili del procedimento deputato alla ricezione) ovvero inviata per il tramite del servizio postale o tramite fax oppure a mezzo di posta elettronica, unitamente a copia fotostatica, ancorchè non autenticata, di un valido documento di identità del sottoscrittore o, infine, presentata da una terza persona sempre con fotocopia del documento.





**UNIVERSITÀ DI PADOVA**  
**SCUOLA DI SPECIALIZZAZIONE IN**  
**CHIRURGIA MAXILLOFACCIALE**  
*DIR: PROF. G. FERRONATO*

**Chirurgia**  
**Maxillofacciale**



**Padova**

**UOC di CHIRURGIA**  
**MAXILLOFACCIALE**  
*DIR: PROF. G. FERRONATO*



**AZIENDA OSPEDALIERA DI**  
**PADOVA**

Padova, 10 maggio 2013

Conosco il Dr. Christian Alberti dai tempi in cui frequentava il “ Corso di Laurea in Odontoiatria e Protesi Dentaria ” dell’Università degli Studi di Padova, lui come studente, io come suo docente nella disciplina “Chirurgia Maxillo-Facciale”; sono stato il relatore della sua tesi di laurea particolarmente innovativa ma complicata, che divenne una prima pubblicazione sugli studi che stavamo portando avanti sulla diagnosi morfologica e morfometrica in 3D su pazienti disgnatici.

Posso testimoniare che ha sempre lavorato con passione, tenacia ed intelligenza, contribuendo in prima persona a concretizzare tecnicamente e materialmente alcuni ausili per le acquisizioni dei visi mediante scansione laser.

Il Dr. Christian ha sempre manifestato passione per la chirurgia, non solo orale ma anche e soprattutto maxillo-facciale, tanto da desiderare di iscriversi alla Facoltà di Medicina e Chirurgia per poter poi accedere alla specifica Scuola di specializzazione che in Italia è riservata ai laureati in Medicina e Chirurgia; sogno che per le molteplici vicissitudini della vita so essere rimasto nel cassetto.

So però anche che molto viva è rimasta la sua voglia e la passione per la chirurgia odontostomatologica, e che il Dr. Christian intende ulteriormente svilupparla e migliorarla; pertanto, conoscendone il valore, dò il mio incondizionato supporto a tutte le iniziative culturali a cui aderisce per implementare le sue conoscenze professionali.

Prof. Giuseppe Ferronato



## Dr Redento Peretta

M.C., Specialista in Odontostomatologia e Ortognatodonzia. Diplomato I.B.O.

Dottore di Ricerca in Scienze Morfologiche, Ph.D.

Vicenza , 13-06-2011

Ho conosciuto il dr Christian Alberti quando era ancora studente di odontoiatria nella veste di correlatore della sua tesi di laurea.

L'argomento non era dei più semplici: si trattava di definire le metodologie migliori per la riproduzione virtuale mediante scansione laser dei tessuti molli del viso e lo studio morfometrico delle caratteristiche facciali. Si trattava infatti di risolvere una quantità veramente notevole di problemi, nessuno semplice: dal valutare gli strumenti migliori tra quelli disponibili alla progettazione e realizzazione di nuovi strumenti adatti allo scopo ( ad esempio la realizzazione di una pedana rotante portante una seggiola con craniostato per la scansione semiautomatica con il laser di varie viste facciali).

Ebbene in tutte queste situazione Christian si è dimostrato persona concreta, disponibile e sorridente sdrammatizzando situazioni difficili e portando un contributo fattivo alla loro soluzione. Questa la premessa. Dopo della laurea pur occupandosi prevalentemente di chirurgia ha frequentato il mio studio privato di ortodonzia per ampliare i suoi orizzonti culturali e professionali. Ho seguito con ammirazione il suo impegno nell'apprendere sempre il massimo nel minor tempo possibile.

Potrei aggiungere altre considerazioni sulla sua persona e la sua umanità ma penso che ciò traspaia abbastanza rapidamente nelle relazioni che sa intessere.

È persona degna e di valore.

Cordialmente

Dr Redento Peretta





Università degli Studi di Genova  
 SCUOLA DI SCIENZE MEDICHE E FARMACEUTICHE  
 Corso di Laurea Magistrale in Odontoiatria e Protesi Dentaria  
 CATTEDRA DI PROTESI DENTARIA  
 Titolare: **Prof. Paolo Pera**

Genova, 24 Settembre 2014

**OGGETTO:** Relazione attività formative Dottor Christian Alberti

Christian Alberti ha frequentato il Master Universitario di II livello in Implantoprotesi presso l'Università di Genova (Presidente: Prof. Paolo Pera; Coordinatore scientifico: Prof. Maria Menini) dimostrando un vivo interesse e partecipando sempre attivamente e costruttivamente alle attività didattiche teoriche e cliniche.

Le solide competenze dimostrate nell'ambito scientifico e clinico hanno portato il Dottor Alberti al raggiungimento di ottimi risultati nelle discipline affrontate.

Il 19 Settembre 2014 il Dottor Alberti ha presentato brillantemente la Tesi del Master dal titolo: "La ricostruzione tridimensionale del volto con tecnica laser: metodologia operativa e analisi preliminare dei risultati" ricevendo la votazione di 110/110.

Il Dottor Alberti risulta degno di segnalazione per ulteriori progressioni nell'ambito dell'aggiornamento e carriera professionale.

In fede,

Paolo Pera

Maria Menini

---

DI.S.C. Sezione di Odontostomatologia  
 Servizio di Protesi Dentaria e Implantoprotesi  
 Osp. San Martino – PAD. IV 16132 Genova (ITALIA)  
 Telefono: 010/3537421 Fax: 010/3537402  
 E-mail: [paolopera@unige.it](mailto:paolopera@unige.it) [maria.menini@unige.it](mailto:maria.menini@unige.it)



**OSPEDALE SAN BASSIANO-BASSANO DEL GRAPPA  
DIPARTIMENTO DI CHIRURGIA SPECIALISTICA  
STRUTTURA COMPLESSA di OCULISTICA  
Direttore : Dr.ssa SIMONETTA MORSELLI**

**Bassano del Grappa: 29 Novembre 2013**

Conosco il Dr. Christian Alberti da molto tempo, per dieci anni ha collaborato con il Dipartimento di Chirurgia Specialistica da me diretto.

Il Dr. Alberti ha collaborato con il Dr. Paolo Toscano, fondatore della struttura di Odontostomatologia e Chirurgia Maxillo Facciale nel 1989, suo direttore fino al 2010, e successivamente con il Dr. Moschino Terenzio fino all'anno 2012.

Il Dr. Alberti ha collaborato con il Maxillo Facciale di Bassano fin dai tempi in cui frequentava il "Corso di Laurea in Odontoiatria e Protesi Dentaria" dell'Università degli Studi di Padova, ed ha continuato assiduamente con costanza, dedizione, puntualità e professionalità anche dopo la Laurea meritando ampiamente il riconoscimento di borse di studio finalizzate al supporto dell'attività clinica prestata e rinnovate annualmente.

Posso confermare che Christian, oltre ad essere una persona concreta, disponibile e sorridente, ha sempre lavorato con passione, tenacia, capacità professionale, è stato un valido aiuto, sempre disponibile anche in caso di emergenze, nei giorni festivi e in orario notturno, un collaboratore che oltre a lavorare con passione per la chirurgia orale e soprattutto maxillo-facciale, è riuscito ad avviare uno studio dentistico privato con grande successo.

Ha sempre desiderato di iscriversi alla Facoltà di Medicina e Chirurgia per poter poi accedere alla specifica scuola di specializzazione, il Dr. Christian intende ulteriormente sviluppare la chirurgia Odontostomatologica pertanto, conoscendone la tenacia, la passione e la competenza professionale, esprimo il mio supporto e i miei migliori auguri.

Cordialmente

**Il Direttore**  
**Dipartimento di Chirurgia Specialistica**  
**Struttura Complessa di Oculistica**  
**Dr. ssa Simonetta Morselli**



## Lettere di Presentazione e Ringraziamento



*Università degli Studi di Firenze*

### **Scuola di Scienza della Salute Umana**

Ho conosciuto il Dr. Christian Alberti durante la frequenza al “ Corso Master in *Chirurgia Ricostruttiva ed implantologica dei mascellari* ” dell’Università degli Studi di Firenze, e sono stato il relatore della sua tesi di Master particolarmente innovativa.

Posso testimoniare che ha sempre lavorato con passione, costanza ed impegno intellettuale, dedicandoti sia alle attività chirurgiche ambulatoriali che in sala operatorio

Il Dr. Christian ha sempre manifestato passione per la chirurgia, oro- maxillo-facciale, tanto da desiderare di iscriversi alla Facoltà di Medicina e Chirurgia per poter poi accedere alla specifica Scuola di specializzazione che in Italia è riservata ai laureati in Medicina e Chirurgia.

Sono a conoscenza che molto viva è in lui la voglia e la passione per la chirurgia odontostomatologica, e che il Dr. Christian intende ulteriormente svilupparla e migliorarla.

In questa ottica, conoscendone il valore, dò il mio incondizionato supporto a tutte le iniziative culturali a cui aderisce per implementare le sue conoscenze professionali.

**In Fede**

**Prof Roberto Bertolai**



**SEDE LEGALE:** Corso Bramante, 88/90 - 10126 Torino **Centralino:** tel. +39.011.6331633 **P.I./Cod. Fisc.** 10771180014  
 www.cittadellasalute.to.it

**Presidi Ospedali:** - Molinette, Dermatologico S. Lazzaro, S. Giovanni Antica Sede - centr. tel. +39.0116331633  
 - Centro Traumatologico Ortopedico, Istituto Chirurgico Ortopedico Regina Maria Adelaide - centr. tel. +39.0116933111  
 - Infantile Regina Margherita, Ostetrico Ginecologico S. Anna - centr. tel. +39.0113134444

**Presidio – Molinette**  
**S.C. CHIRURGIA MAXILLO – FACCIALE U**  
**Direttore temp Prof. G.Ramieri**  
**C.so A.M. Dogliotti, 14 – 10126 Torino**  
**Segreteria TEL - FAX 0116335125**  
**Reparto TEL 0116335471**  
**Ambulatorio segreteria TEL - 0116336600**  
**TEL 4044 / 4062 fax**

**Torino, 15 dicembre 2019**

Ho conosciuto il dr. Christian Alberti in occasione della sua frequenza al master universitario di II livello “ CHIRURGIA ORTOGNATICA E DELLE DEFORMITA’ CRANIOFACCIALI ” nell’ anno accademico 2017-18.

Nel corso degli incontri periodici e delle attività teoriche pratiche il Dr. Alberti ha dimostrato grande desiderio di apprendimento e ha partecipato attivamente alle discussioni cliniche e alle attività formative, dando prova di una solida preparazione, capacità di interazione e di ascolto con una buona possibilità di crescita professionale.

Sono personalmente molto soddisfatto del contributo, nel rispetto dei ruoli e delle competenze, fornito dal dr Alberti per il buon successo del nostro master.

Giovanni Gerbino



S.C. Chirurgia Maxillo Facciale U.  
 Prof. Associato Matr. 76258Q  
 Prof. Giovanni Gerbino



UNIVERSITA' DEGLI STUDI DI TORINO

**DIPARTIMENTO DI SCIENZE CHIRURGICHE**

*Direttore: Prof. Stefano Carossa*

Scuola di Specializzazione in Chirurgia Maxillo-  
Facciale  
School of Maxillofacial Surgery  
Direttore: Prof. Guglielmo RAMIERI

via Genova 3  
10126 TORINO (Italy)  
Tel. Direzione +39 011 6334057 - 5704  
Fax (011) + 39 0116633658  
e-mail: guglielmo.ramieri@unito.it

LETTERA DI PRESENTAZIONE

Il Dott. Christian Alberti ha frequentato il reparto da me diretto nell'ambito del Master di II livello in "CHIRURGIA ORTOGNATICA E DELLE MALFORMAZIONI CRANIO-FACCIALI", A.A. 2017/18, dal marzo 2018 al febbraio 2019.

Il Dott. Alberti ha partecipato a seminari, attività cliniche su pazienti, frequenza in sala operatoria.

Durante tale periodo, il Dott. Alberti ha dimostrato uno spiccato interesse per la disciplina, una adeguata preparazione di base, e notevoli capacità di apprendimento.

E' stato inoltre apprezzata la sua maturità e la capacità di relazionarsi positivamente, sia con i Colleghi sia con i Pazienti.

Sono certo che queste doti gli permetteranno ottimi risultati professionali.

Torino, 1 marzo 2019

Prof. Guglielmo Ramieri

Professore Ordinario di Chirurgia Maxillo-facciale  
Università degli Studi di Torino  
A.O.U. "Città della Salute e della Scienza di Torino"

Marostica, 21 gennaio 2004

Egregio

**Dr. GIUSEPPE SIMINI**  
DIRETTORE GENERALE ULSS. N. 3  
Via Carducci  
36061 BASSANO DEL GRAPPA

e p.c. Dr. Paolo Toscano  
Reparto Maxillo-Facciale Ulss 3  
Via dei Lotti  
36061 BASSANO DEL GRAPPA

e p.c. Associazione a Tutela dell'Ammalato  
Via dei Lotti  
36061 BASSANO DEL GRAPPA

OGGETTO: Ringraziamento ai medici e agli operatori del reparto MAXILLO-FACCIALE ULSS 3.

Egregio Direttore,

desidero segnalare il caso di mia madre Vialto Zelia curata presso il reparto Maxillo-Facciale ULSS 3 per carcinoma alla mascella sinistra, successivamente degenerata in metastasi linfonodale del collo.

Gli interventi e le terapie avvenuti negli anni 2002-2003 non hanno arrestato la malattia: mia madre è deceduta il 4 gennaio 2004 u.s.

In queste righe desidero sottolineare la professionalità e la grande umanità di tutti gli operatori del reparto.

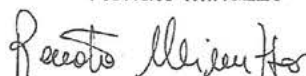
In modo particolare voglio ringraziare il Primario Dr. Paolo Toscano, che ha operato e seguito mia madre fin dall'inizio della malattia, e tutti i suoi collaboratori : Dr. Moschino, Dr. Garofolin , Dr. Alberti e le infermiere Renata, Rosanna, Antonia, Cristina e Franca.

Nella grande sofferenza hanno saputo dare in ogni momento, oltre alle cure necessarie, un importante aiuto con parole , sorrisi, piccoli gesti che rendevano meno dura la "quotidianità" della malattia.

Il mio ringraziamento va anche al Dr. Zarpellon e a tutte le infermiere del reparto oncologico e non posso dimenticare il Dr. Costenaro, nostro medico di base, per la premura e l'attenzione dedicata a mia madre.

Voglia gradire i miei più distinti saluti.

Renato Minuzzo



**Minuzzo Renato e Paola - Via Cà Brusà - 36063 Marostica (Vicenza)**

Al Consiglio Direttivo SIDCO Società Italiana di Chirurgia Odontostomatologica

In qualità di socio attivo della SIDCO con la presente sono a presentare come aspirante a socio attivo della Società il dottor Christian Alberti.


Il dottor Christian Alberti medico odontoiatra si dedica da anni alla chirurgia orale con particolare interesse alla riabilitazione orale implantologica.

Per la competenza e la passione che ha sempre dimostrato negli eventi culturali e clinici che abbiamo condiviso, e per il contributo positivo che potrà portare, reputo che il dottor Christian Alberti possa a pieno titolo essere accettato come socio attivo della SIDCO .

In fede

Genova 03/05/2022

Prof Paolo Pera





**Dr.Prof. Roberto Pistilli**  
**Via Amiterno, 54 00183Roma**  
**Office: 0639732568**  
**Mobile: +39335317394**

Alla cortese attenzione della commissione accettazione soci attivi SIDCO

OGGETTO: Presentazione del candidato ALBERTI CHRISTIAN alla carica di socio attivo della società SIDCO

Il sottoscritto Roberto Pistilli, supporta la candidatura per la nomina di socio attivo della Società SIDCO del collega ALBERTI CHRISTIAN nato a Bassano del Grappa (VC) il 15-09-1979

Infatti il socio si è sempre dimostrato un cultore appassionato della materia nonché una personalità di alto livello in campo scientifico con un Curriculum formativo di notevolissimo.

Cordiali saluti

Roberto Pistilli



DOTT. PISTILLI ROBERTO  
SPECIALISTA IN  
CHIRURGIA MAXILLO FACCIALE  
A.C.O. S. CAMILLO FORLANINI

**MOD**Master II livello  
Odontoiatria  
Digitale0697605619 3480758796 📞  
segreteria@masterodontoiatriadigitale.it @  
www.masterodontoiatriadigitale.it 🌐Master di II° livello in "Odontoiatria Digitale"  
II Edizione - Anni Accademici 2021/2022

Brescia, 4 maggio 2022

Ai Colleghi ammessi al Master di II livello in Odontoiatria Digitale

Carissimo/a,

è con enorme soddisfazione che Ti scrivo per confermare l'avvio della Seconda edizione del Master di II livello in Odontoiatria Digitale che ha registrato ieri la conclusione delle iscrizioni.

Il successo di partecipazione al Master è merito della straordinaria offerta didattica che offre questo panel di docenti di particolare preparazione e fama e che lo rendono unico nel panorama formativo universitario nazionale

Stiamo definendo il programma teorico-pratico definitivo e il calendario didattico inizierà il 10 maggio con la presentazione del Coordinatore del Master e la Lectio Magistralis del Prof. Carlo Marinello.

Sarai quindi contattato nei prossimi giorni dalla Sig.ra Lara Capriotti di Fasi, la nostra segreteria scientifica, che Ti indicherà le date definitive del programma didattico dei mesi prossimi.

Grazie ancora per la Tua partecipazione a cui auguriamo un percorso formativo di assoluta eccellenza e successo.

Con riconoscenza,

Antonio Cerutti





**HAOMS 2024**  
From Analog to Digital Implantology  
**AESTHETIC AND FUNCTIONAL RECONSTRUCTION  
OF THE MOUTH JAW AND FACE**

**26 - 27  
January  
2024**

Organization  
  
HELLENIC ASSOCIATION  
OF MAXILLOFACIAL  
SURGERY

  
Crowne Plaza Hotel, Athens

To: Dr. Christian Alberti

Thessaloniki, 24 November 2023

Dear Christian,

On behalf of the Organizing Committee of the Congress of **HAOMS 2024**, which will be held from **January 26<sup>th</sup> to 27<sup>th</sup> 2024**, at Crowne Plaza Hotel, in **Athens**, organized by the **Hellenic Association for Oral & Maxillofacial Surgery**, we would like to invite you to participate in the scientific program of the Congress as an invited speaker.

Your support will be invaluable and will decisively contribute to the achievement of the scientific and educational goals of the Congress.

We thank you in advance and we remain at your disposal for any further information.

We are looking forward to meeting you in Athens.

Kind Regards,

The President of the Organizing Committee



Professor Lampros Zouloumis



Riga Feraiou & Andreas Zakou, Christina Center  
1st floor, Gr. 101, P.C. 58 256, 3732 Limassol, Cyprus  
Tel.: +357 99812240, Fb: Mk-Premium  
Email: [info@mk-premium.com](mailto:info@mk-premium.com)  
[www.mk-premium.com](http://www.mk-premium.com)

# UNIVERSITÀ DI PISA

Dipartimento di Patologia Chirurgica, Medica, Molecolare e dell'Area Critica

**Prof. Antonio Barone, Professore Ordinario**

Professore di Chirurgia Orale ed Implantologia,

Direttore Scuola di Specializzazione in Chirurgia Odontostomatologica

Direttore Master In Implantologia Zigomatica e Master in Ansiolisi in Odontoiatria

e-mail: [antonio.barone@unipi.it](mailto:antonio.barone@unipi.it) ; barosurg@gmail.com



Pisa, 05 Dicembre 2023

## A CHI DI COMPETENZA

Ho seguito il Dott. Christian Alberti durante l'anno di frequenza al Master di Implantologia Zigomatica presso l'Ateneo di Pisa per l'anno accademico 2022/2023, il Dott. Alberti ha dimostrato di essere sempre molto attento e preciso alle tematiche trattate mettendo in evidenza interesse, spirito critico e grande competenza delle conoscenze possedute. Il Dott. Alberti durante le sessioni pratiche su modello e su cadavere ha inoltre dimostrato una competenza clinica molto elevata, nettamente al di sopra degli standard medi di conoscenza e capacità.

Il mio giudizio sulle capacità professionali del Dott. Christian Alberti è assolutamente positivo, non sarei meravigliato di vederlo ricoprire ruoli di docenza; inoltre, il Dott. Alberti ha mostrato dal punto di vista personale e caratteriale grande serietà e rispetto dei ruoli, che in considerazione dei tempi in cui viviamo rappresentano doti di assoluto valore.

Rimango a completa disposizione per ogni ulteriore richiesta sia utile per una valutazione del Dott. Christian Alberti.

In fede,

Prof. Antonio Barone





ATENEUM PONTIFICUM REGINA APOSTOLORUM

Prot. SG/IS/IT/60/2024

Si certifica che **Christian Alberti**, nato il giorno 15 settembre 1979 a Bassano del Grappa (VI), nell'anno accademico 2024-2025 risulta iscritto, in qualità di studente ordinario, al programma di studio **Diploma in Studi Sindonici** dell'Istituto Scienza e Fede presso l'Ateneo Pontificio *Regina Apostolorum*, con il numero di matricola 00016810.

Si rilascia il presente certificato per gli usi consentiti dalla Legge.

Roma, 19 aprile 2024

  
  
**P. Aarón Robles Amador, L.C.**  
**Segretario Generale**



