

## **“Immediate implant placement and peri-implant augmentation with a porcine-derived acellular dermal matrix and synthetic bone in the aesthetic area.”**

Piero Papi, DDS  
Oral Surgery Unit  
Department of Oral and Maxillo-Facial Sciences  
“Sapienza” University of Rome, Italy

**Introduction:** Dimensional and structural alterations of the alveolar process are well-documented consequences of tooth extraction in the aesthetic zone, with several factors influencing bone modelling, such as flapless extractions, ridge preservation techniques and immediate implant placement.

Over the years, several authors (Misawa et al. 2016, Chappuis et al. 2017a) have investigated bone resorption pattern in maxillary incisors and premolars, concluding that a facial bone wall thickness of 1 mm or less was the main factor affecting the degree of bone alterations.

Furthermore, soft tissue alterations may follow tooth extraction, in particular loss of keratinized mucosa width (KMW), with a significant impact on the aesthetic and functional outcomes of future implant-supported restorations (Buser et al. 2017).

The optimal timing for implant placement and the necessity of alveolar ridge preservation procedures are still debated in literature.

According to the 5<sup>th</sup> ITI Consensus (Morton et al. 2014), post-extraction implants can be divided into four types, the ITI recommends, in absence of ideal conditions, type II early implant placement after 4-8 weeks with simultaneous contour augmentation with guided bone regeneration (GBR), with long-term effectiveness described after 10 years of follow-up (Chappuis et al. 2017b).

A simultaneous or subsequent connective tissue graft (CTG) may be needed in order to prevent/treat mucosal recession (Jung et al. 2018).

Over the years, several bone substitutes have been utilized for GBR procedures and, recently, a porcine derived acellular dermal matrix (Mucoderm®, botiss dental, Berlin, Germany) has been proposed as autogenous graft substitute in order to avoid palatal harvesting and obtain comparable results to CTGs, in term of aesthetics and function (Rothamel et al. 2014, Pabst et al. 2016).

The aims of this study are to present the one-year follow-up results of early implant placement with simultaneous peri-implant augmentation with a porcine derived dermal matrix and a synthetic bone substitute material (Maxresorb®, botiss dental, Berlin, Germany) in the aesthetic area.

**Material and Methods:** This prospective cohort study was conducted between November 2015 and April 2016. In order to be included in the study, patients had to meet the following inclusion and exclusion criteria: need of one dental implant in the upper anterior area, no more than 8 weeks from

tooth extraction, KMW less than 2 mm at the implant site, good oral hygiene (FMPS and FMBS < 25%), absence of uncontrolled systemic diseases, non-smokers (>10 cigarettes/die), no signs of local inflammation.

After raise of a mucoperiosteal flap in the edentulous ridge, a titanium-zirconium dental implant was placed (Bone Level Tapered Roxolid, Institut Straumann AG, Basel, Switzerland) with adoption of a submerged healing protocol.

Simultaneous contour augmentation with GBR was performed using a synthetic bone substitute and an acellular dermal matrix, previously hydrated for 10 minutes in fresh human blood collected after flap elevation in each patient (Kasaj et al. 2015).

The matrix was carefully inserted in the vestibular aspect of the flap to cover the graft and then, after appropriate release incision, the flap was sutured to avoid tension, leaving intentionally exposed around 20% of the matrix in the crestal aspect.

Sutures were removed after 14 days and, then, medical check-ups were scheduled every 15 days, with implant uncovering performed after 3 months and subsequent prosthetic rehabilitations with screw-retained gold-ceramic crowns.

Primary outcome variables were KMW and gingival thickness, recorded at baseline (prior to implant treatment) and after 1, 3, 6 and 12 months.

KMW was measured, after identifying the mucogingival junction (MGJ) with the roll-test, with a rotating movement of the periodontal probe by placing the tip at the MGJ and continuously adapting the probe's axis on the curved surface of the gingiva up to the zenith of the alveolar ridge. Gingival thickness (GT) was assessed by inserting an endodontic file with a rubber stop, perpendicular to tissue surface, 1 mm coronal to the MGJ, with distance obtained measured with a digital caliber.

Marginal bone loss (MBL) was digitally evaluated via standardized periapical x-rays at 3,6 and 12 months and modified Pink Esthetic Score (PES) was recorded after one year from prosthetic loading. Soft tissue parameters analyzed were probing pocket depth (PPD), modified sulcus bleeding index (mSbI) and Plaque Index (PI). Implant success and implant survival were registered as well.

Descriptive statistics were calculated for each variable of the study and, for intragroup comparison, the nonparametric Mann–Whitney U-test was used with a p value <0.05 considered as statistically significant.

**Results:** A total of 15 subjects were enrolled in this study, they were either males (6) or females (9), with a mean age of  $47.8 \pm 4.45$  years (range= 30-67 years) and each patient was treated with one implant (Table I). Mean values of KMW and GT at baseline were respectively  $1.47 \pm 0.43$  mm and

1.87 ± 0.89 mm. After 12 months, mean gains of 2.5 mm for KMW and 2.1 mm for GT were recorded, with no statistically significant intragroup variations ( $p > 0.05$ ) (Table II).

An initial shrinkage of the matrices, with a loss of around 30%, occurred between the first six months, then, values tended to remain stables at following appointments.

As for secondary variables, mean MBL level was  $0.35 \pm 0.23$  mm after one year of prosthetic loading, with no implant lost at follow-up and values of implant success and survival rates of 100%. No PPD values  $> 5$  mm were registered, with no concomitant signs of inflammation (Table III). Mean PES values were  $8.06 \pm 0.7$ .

**Conclusions:** According to our results, gingival contour and peri-implant attached gingiva can be successfully augmented by using a mucoderm matrix in combination with a synthetic bone graft.

KMW and GT gains were extremely consistent, with all grafts remaining stables after the first six months, with no further shrinkage.

Furthermore, the intentional exposure of a small portion of the matrix did not interfere with its regenerative properties, with no adverse reactions or events reported. Further studies with greater power and longer investigation period are needed to confirm the suggestion for clinical use.

## References

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## Tables

Table I

### Sample Demographics

Study variable	Descriptive statistics
Sample size (n)	15
Male	6
Female	9
Age (y) ± SD (range)	47.8 ± 4.45 years (range= 30-67 years)
Treatment site	
Maxillary central incisor	8
Maxillary lateral incisor	7
Dental Implants Bone Level Tapered	
Diameter 4.1 mm	9
Diameter 3.3 mm	6
Length 10 mm	7
Length 12 mm	8

Table II

Keratinized Mucosa Width (KMW) was measured with a periodontal probe (UNC 15, Hu-Friedy, Chicago, IL, USA) from the zenith of the alveolar ridge to the mucogingival junction, and expressed in mm. Gingival thickness (GT) was assessed by inserting an endodontic file with a rubber stop, perpendicular to tissue surface, 1 mm coronal to the MGJ, with distance obtained measured by a digital caliber and expressed in mm.

Examination Time Point	Mean KMW (mm)	Mean GT (mm)	Intragroup comparison ( $p < 0.05$ )
Pre-Operative	1.47 ± 0.43	1.87 ± 0.89	
1 month	4.86 ± 1.22	4.56 ± 1.11	$p > 0.05$
3 months	4.32 ± 0.98	4.23 ± 1.53	$p > 0.05$
6 months	4.13 ± 1.38	4.05 ± 0.42	$p > 0.05$
12 months	4.02 ± 0.45	3.97 ± 0.56	$p > 0.05$

Table III

Secondary outcome variables

MBL= Marginal bone loss, PPD= Probing pocket depth, mSbI= modified Sulcus Bleeding Index, PI= Plaque Index, PES= Pink Esthetic Score, N/A= Not Assessed

Examination Time Point	MBL (mm)	Implant survival (%)	Implant success (%)	PPD (mm)	PES	mSbI	PI	Intragroup comparison ( $p < 0.05$ )
Baseline	0.12 ± 0.24	100	100	N/A	N/A	N/A	N/A	$p > 0.05$
3 months	0.26 ± 0.14	100	100	3.5	8	0.1	0.28	$p > 0.05$
6 months	0.31 ± 0.12	100	100	3.75	8	0.25	0.56	$p > 0.05$
12 months	0.35 ± 0.23	100	100	3.5	8	0.1	0.92	$p > 0.05$

## Figures

**Fig.1 Pre-Operative clinical situation of the lost gingival convexity of a missing left lateral incisor**



**Fig. 2 Contour augmentation GBR procedure using Maxresorb**



**Fig. 3 Peri-implant augmentation with a Mucoderm matrix left partially exposed**



**Fig. 4 Clinical Post-operative situation after one year of functional loading**

