*Case Series*

# HETEROLOGOUS BONE LAMINA AND UMBRELLA SCREW TECHNIQUE FOR SINGLE-TOOTH PREMOLAR ALVEOLAR DEFECTS PREVENTION AFTER THE EXTRACTION: A CASE SERIES

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**ABSTRACT**

The post-extraction alveolar defect could represent a clinical challenge for dental implant rehabilitation in the aesthetic area. The aim of the present study was to investigate the effectiveness of heterologous bone lamina supported by an umbrella screw for the prevention of bone defect collapse after tooth extraction in the maxillary aesthetic region. A total of 2 male patients were treated in the present case series. The heterologous bone lamina supported by a screw was applied at the level of the premolar region to maintain the bone peaks. After 6 months, a full flap thickness flap was elevated, and the fixation screw was removed. A dental implant has been positioned to support a single crown fixed rehabilitation. An excellent maintenance of the buccal and interproximal bone peaks was obtained. No signs of early exposure and inflammation were reported during the healing period and dental implant positioning. Within the limits of the present study, the heterologous bone lamina showed an optimal mechanical stability and space-maintaining capability.

**KEYWORDS:** *regeneration, dental, implant, therapy, bone, lamina*

## INTRODUCTION

Treating single-tooth extraction in the aesthetic region of the jaws could represent a clinical challenge for successful dental implant rehabilitation (1). As a consequence of the avulsion, compartmental bone resorption is contemplated, considering both horizontal and vertical vectors that can determine an alteration of the bone volume balance (2, 3). This condition could produce two critical points concerning the possibility of dental implant rehabilitation: the positioning of an implant fixture adequate in length and diameter and maintaining the aesthetic impact of the crown emerging profile in case of bone peak loss (4). Conversely, the correct prosthetic profile also determines prosthesis maintenance and plaque biofilm control (5). Several techniques and biomaterials have been proposed for this scope, including bone graft positioning, titanium mesh, and membrane bone regeneration procedure (6, 7). Autologous graft

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represents the gold standard for bone augmentation procedures due to the space-maintaining capacity and intrinsic osteogenic capability (7).

On the other hand, the xenograft procedure takes advantage of the space-maintaining and scaffolding capability of the biomaterial, which can create a favorable environment for blood clot stability (8, 9). Autologous bone graft use is often limited by donor site accessibility and its healing period management (7). In the alternative literature, the socket shield technique has also been proposed to preserve the buccal bone plate (10). The heterologous bone lamina is a xenograft characterized by a dual-layer structure composed of a double cortical and cancellous side (11). This biomaterial is characterized by a high wettability with the blood and body fluids that confer remarkable graft plasticity and adaptability to the recipient site (11). The clinical rationale of heterologous lamina is associated with the creation of a regenerative compartment through the stabilization of the blood clot. This technique has also been used to produce bone graft augmentation without using graft materials in several clinical occurrences including sinus augmentation (11). The aim of the present study was to evaluate the clinical efficacy of the heterologous lamina for preventing single-tooth alveolar defect collapse after extraction in the aesthetic region.

## CASE SERIES

The present study has been conducted in accordance with the Declaration of Helsinki and the Good Clinical Practice Guidelines. Two patients were visited for the extraction of the upper premolar and delayed dental implant positioning. The treatment planning considered a delayed approach for dental implant surgery and bone volume preservation after the tooth extraction. The subjects underwent a clinical and occlusal examination at the initial visit, and panoramic radiographs were evaluated. A radiographic scan was performed before the procedure to conduct the preliminary assessment of the surgical site. Before the procedure, the chlorhexidine digluconate solution rinse 0.2% was administered for 1 minute. The local anesthesia was conducted by Articaine® (Ubistesin 4%-Espe Dental AG Seefeld, Germany) with epinephrine 1:100.000. A full-thickness mucoperiosteal flap was elevated, and the premolar was extracted, preserving the bone level peaks. At the base of the palatal cortical wall, a specially designed bone fixation screw has been applied (Ustomed, Tuttlingen, Germany) to support the heterologous bone lamina (Osteobiol, Tecnoss Dental S.R.L., Turin, Italy) during the healing period of 6 months. A second phase of surgical access has been realized at 6 months for bone fixation screw removal and dental implant positioning. The surgical site has been prepared atraumatically in accordance with the manufacturer protocol using a surgical motor (300 Plus Intrasurg, Kavo, Germany). The healing abutment positioning and provisional phases were performed at six months, with the prosthetic finalization of a single crown rehabilitation.

*Case 1*

A male patient with an age of 45 years old was visited for upper premolar 2.5 affected by periodontal probing and teeth mobility with a mean PPD of 5.6±1.4. No significant pathologies and risk factor conditions were reported at the anamnesis (Fig. 1-2).

**Fig. 1**. *Occlusal view of the surgical site.*

**Fig. 2**. *Lateral view of the surgical site.*

The bone fixation screw was positioned in accordance with the manufacturer protocol (Fig. 3-7) (Ustomed, Tuttlingen, Germany).

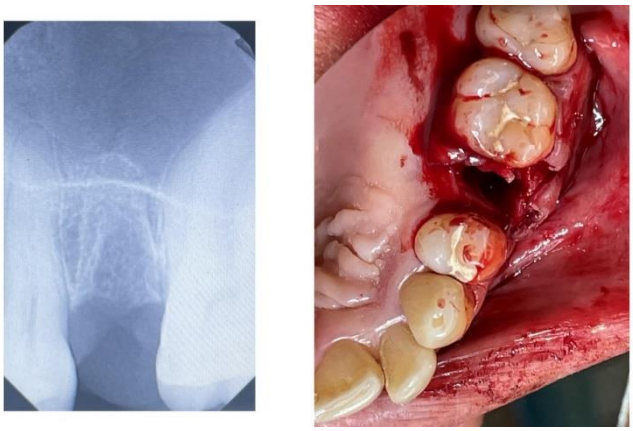

**Fig. 3**. *Detail of the post-extraction site.* ***Left****: A periapical radiograph was taken after the procedure.* ***Right****: Occlusal view of the surgical site.*

**Fig. 4**. *Fixation screw positioned in the palatal region of the residual defect.*

**Fig. 5**. *Heterologous lamina segment morphologically adapted.*

**Fig. 6**. *Lateral view of the site after the healing period.*

**Fig. 7**. *Occlusal view of the site after the dental implant positioning.*

The post-operative period was uneventful, and no significant complications were reported after the 14-day healing phase and 6 months from the first phase of surgery. The implant surgery was performed by elevating the total thickness of the mucoperiosteal flap to expose the bone ridge. The buccal bone wall, as did the mesial and distal peak profiles, appeared well preserved. A 3.5 diameter and 12mm length implant fixture (Isomed Implant, Due Carrare, Italia) was positioned in accordance with the manufacturer protocol.

*Case 2*

A male patient (36 years old) was visited for an upper premolar 2.4 bone defect resulting from a tooth fracture and previous bone regenerative procedure failure relapses. No significant diseases and risk factors were reported during the initial visit. A buccal bone collapse was present, and the mesial and distal bone peaks were partially preserved. The chlorhexidine digluconate solution rinses 0.2% was administered for 1 minute, and a total thickness mucoperiosteal flap was elevated. A specially designed bone fixation screw has been applied on the top of the bone ridge (Ustomed, Tuttlingen, Germany) to support the heterologous bone lamina (Osteobiol, Tecnoss Dental S.R.L., Turin, Italy) during the healing period of 6 months (Fig. 8).

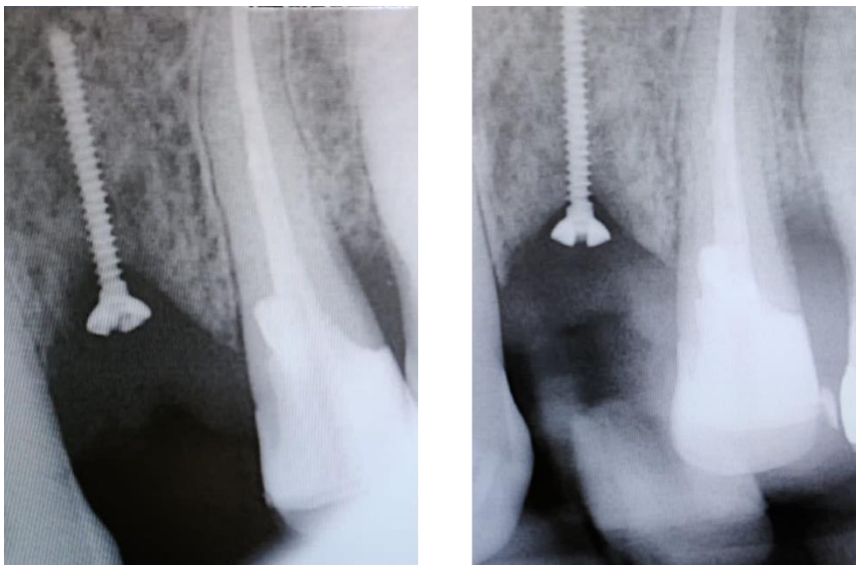

**Fig. 8**. *Radiogram scans taken at the baseline (left) and after 6 months from the surgery.*

The implant site has been prepared in accordance with the manufacturer protocol (Isomed Implant, Due Carrare, Italia) using a surgical motor (300 Plus Intrasurg, Kavo, Germany). The prosthetic finalization has been obtained through a single crown rehabilitation.

## DISCUSSION

Dental implant rehabilitation in the aesthetic region of the jaws represents a challenge in operative dentistry, considering the difficulties determined by the restoration of the emerging design of the prosthesis and the long-term maintenance (12). The tooth loss could significantly impair the bone ridge profile, determining wall defect (13). In addition, the position of the teeth could also play a role in post-extraction bone deficiency. The present investigation aimed to report the use of heterologous bone lamina to prevent the bone defect collapse associated with tooth extraction in the aesthetic region. Both clinical cases reported excellent maintenance of the bone peaks, creating a regenerative compartment without using a bone graft. No marginal exposures and dehiscences were observed after the 6 months healing period. On the other hand, the heterologous bone lamina stabilized with screws reported excellent integration and adaptability. Also, the defect regenerates sites due to the biomaterial's mechanical properties and clinical stability. Yang et al. proposed a classification of dehiscences based on the mesial-distal views (14).

Some reported a 5-8% incidence in the literature observed in cadaver and clinical studies (14-16). Guided bone regeneration procedures are considered highly predictable techniques for this purpose, considering the biomaterials biocompatibility, space maintenance, integration, and adaptability to the defect site (17, 18). Titanium mesh has been

reported as a useful technique for horizontal and vertical bone ridge augmentation (19). The Ti-mesh is a non-resorbable device characterized by excellent mechanical properties and space-maintaining capability. Still, the disadvantage of low flexibility represents a critical factor for its use (20, 21). The exposure tendency of T-mesh membranes is still debated in the literature, and several authors correlate this event to the management of the prevention of sharp angles and consequent mucosal irritation accompanied by bacterial contamination of the site that could produce a potential marginal volume graft resorption of 15-25% (22). The bone lamina is a resorbable and highly biocompatible biomaterial used in several clinical conditions, including treating residual bone defects after jaw cyst enucleation (23). Scarano et al. (23) reported a volume reduction of the residual bone defect of 92.1% after 12 months from the treatment with no addition of bone graft. The same authors reported excellent maintenance of the structure architecture and the anatomical profile of the bone ridge.

## CONCLUSIONS

Within the limitations of the present study, the heterologous bone lamina seems to be effective to prevent the single tooth bone defect collapse with no exposures after the healing period. Further randomized investigations with histologic analysis are necessary to confirm the findings observed by the present case series and to characterize the regenerated bone microscopically.

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