Peri-Implant Soft Tissue Augmentation Using the Tunneling Technique and Xenogeneic Grafting: A Clinical Case Report

Abstract

Background
Peri-implant soft tissue deficiencies may compromise both the aesthetic outcome and long-term stability of implant-supported restorations. Modern augmentation techniques, such as tunneling combined with xenogeneic grafting, provide minimally invasive solutions for restoring the contour and functional integrity of the peri-implant mucosa.

Case Presentation
A 30-year-old female patient (V.D.) presented with a vestibular defect in the left posterior maxilla (quadrant 2), characterized by exposure of the collar of a multi-unit abutment. A full-thickness tunneling technique was performed, followed by the insertion of a xenogeneic graft and stabilization of the soft tissue with sutures. Healing was evaluated at 7 and 21 days postoperatively.

Results
Healing was uneventful, with complete re-epithelialization, increased vestibular volume, and reformation of the interproximal papilla. The final aesthetic and functional outcomes were satisfactory, with no postoperative complications.

Conclusion
The tunneling technique with xenogeneic grafting represents a predictable and minimally invasive method for peri-implant soft tissue augmentation, providing stable and aesthetic results in cases with minor vestibular defects.

Keywords
dental implant; soft tissue augmentation; tunneling technique; xenogeneic graft; peri-implant mucosa; case report

Introduction

Peri-implant soft tissue deficiency represents a frequent clinical challenge in implant-prosthetic rehabilitation, directly influencing both aesthetics and long-term stability. An adequate volume of keratinized mucosa contributes to maintaining the biological seal and preventing marginal bone resorption.

Several studies (Zucchelli, 2015; Cairo, 2020) have demonstrated the importance of soft tissue augmentation in optimizing functional and aesthetic outcomes.
This case report describes a minimally invasive soft tissue augmentation technique performed through tunneling and xenogeneic grafting, applied in a clinical situation characterized by vestibular recession and exposure of a multi-unit abutment collar.

Case Presentation

Patient Information

A 30-year-old female patient, systemically healthy, non-smoker, and without any comorbidities, presented to the Clinic with aesthetic discomfort in the left posterior maxillary region (quadrant 2).

Clinical Examination and Diagnosis

The case involved implant-supported prosthetic rehabilitation in both the maxilla and mandible. In the maxilla, four dental implants were placed and restored; in the mandible, a single implant was inserted and restored.

In the upper right quadrant (Q1), a three-unit screw-retained metal-ceramic bridge was present. In the upper left quadrant (Q2), a two-unit screw-retained prosthesis was supported by multi-unit abutments.

In the mandible, a single screw-retained metal-ceramic restoration was directly connected to the implant.

The radiographic situation is illustrated in **Fig. 1**.

The implants used were **Neobiotech IS-II**, which feature a 0.5 mm cervical area known as **BioSeal**, designed to promote the formation of a soft-tissue seal and minimize crestal bone loss. This characteristic guided the selection of an appropriate surgical technique to correct the vestibular soft tissue defect.

Fig. 1

The area of interest in this case is **quadrant 2**, where the patient reported that “the dental implant is visible.” The clinical objective was to correct this aesthetic concern (**Fig. 2** and **Fig. 3**). Upon removal of the prosthetic restoration, it was observed that the prosthesis was screw-retained on **multi-unit abutments**.

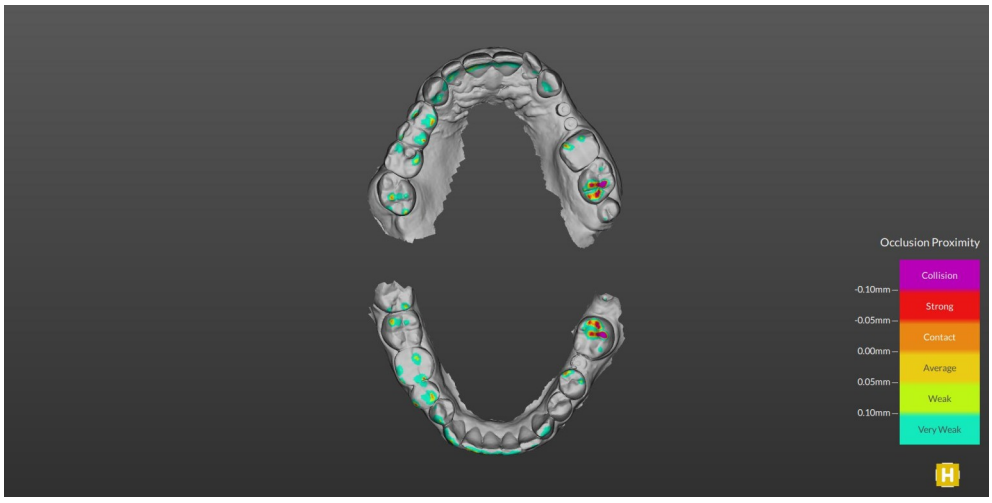
A vestibular soft tissue volume deficiency was evident, with the visible portion corresponding to the **collar of the multi-unit abutment**, rather than the implant body itself.

Fig. 2

Fig.3

To achieve a stable and predictable long-term outcome, the case was analyzed using a **digital intraoral scan of the initial situation**, as illustrated in **Fig. 4**.

Fig.4



This analysis revealed an area of excessive occlusal contact, while the remaining contacts were evenly distributed. Through proper **occlusal equilibration**, a stable and functional long-term occlusion can be achieved.

It is crucial to ensure a correct distribution of occlusal forces to obtain an optimal and predictable clinical outcome.
During the initial consultation, a **visible soft tissue defect** and the **absence of the interproximal papilla** were identified. The papilla lacked the biological capacity for spontaneous regeneration; therefore, a treatment plan was established involving **xenogeneic grafting** and **full-thickness tunneling** to reposition and augment the peri-implant soft tissue.

Surgical Procedure

Reconstruction of the vestibular soft tissue wall represents both an aesthetic and functional solution.
The use of a **xenogeneic graft** allows for an increase in soft tissue volume; the graft remains dimensionally stable over time and integrates predictably with the surrounding soft tissues, being well tolerated biologically. This approach promotes the development of favorable conditions for **interdental papilla regeneration**, representing the result of a properly executed and biologically guided treatment.

The technique employed consisted of **tunneling of the peri-implant area**, with **full-thickness elevation of the soft tissue**, **placement of a xenogeneic graft**, and **stabilization with sutures** to achieve optimal tissue contour and long-term stability.

Local anesthesia was achieved using **articaine hydrochloride with epinephrine** (Ubistesin Forte, 4% articaine, 1:100,000 epinephrine), administered in one to two carpules — one for the initial anesthesia and a second if supplementation was required. The **plexus anesthesia technique** was used.

Excessive anesthesia was intentionally avoided in order to maintain adequate tissue perfusion and hydration during the surgical procedure, as well as to ensure a properly vascularized operative field. The total duration of the intervention did not exceed **40 minutes**.

A **#15 surgical blade** was selected to perform an incision extending to the periosteum, in the area of the **mobile-passive mucosa**, to allow **re-epithelialization with fixed mucosa**, thereby increasing the stability of the peri-implant soft tissue and the implant itself.

The incision was made from **implant 24** to the **mesial root of tooth 26** (Fig. 5), enabling tension-free repositioning of the soft tissue. The incision was performed in a single, controlled motion, maintaining firm contact with the bone surface to prevent unnecessary tissue trauma.

Gentle traction was applied to the mobile mucosa to better identify the incision line and its anatomical limits.

Fig.5

Bleeding was minimal due to the use of **articaine with epinephrine anesthesia**. The **elevation of the soft tissue** began at the **mesial root of the first molar** (Fig. 6). The dissection was performed in a **full-thickness manner**, proceeding gradually and carefully to preserve tissue integrity.

The **interdental papillae were intentionally avoided** in order to preserve all existing anatomical structures. The dissection continued until communication with the **vestibular incision** was achieved. Once this connection was established, the **extent of the elevated soft tissue** was measured using a **periodontal probe** (Fig. 7).

Fig. 6

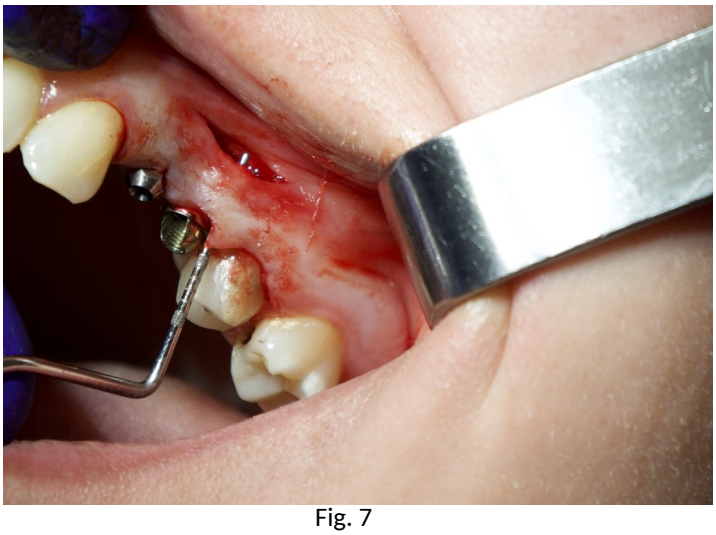


Fig. 7

In this case, a **papilla release** was necessary, achieved through a **preservation incision** that allowed the papilla to remain intact and repositioned for optimal future integration.

After completing the **tunneling of the free gingival margin** and the **vestibular mucoperiosteal incision** with full-thickness soft tissue elevation, **tissue mobility was assessed**. The desired final position of the flap was simulated to verify adequate extension of the dissection; if insufficient, the tunneling was extended toward the **implant at site 24** (Fig. 8).

Once the desired flap mobility and coverage were confirmed, **anchorage points for sutures** were identified using a **periodontal probe**, and the **thickness of the soft tissue** was measured to facilitate improved surgical management (Fig. 9).

Fig. 8

Fig. 9

The **sutures were positioned** using adjacent anatomical elements, such as the **prosthetic abutment of tooth 26**, to stabilize the soft tissue in the desired position. Care was taken **to avoid anchoring sutures on the multi-unit abutment**, as this component was required for the subsequent reattachment of the prosthetic restoration (Fig. 10).

After placement of the stabilizing sutures, a **hemostatic sponge impregnated with colloidal silver**—appropriate for such clinical situations—was applied over the incision line to enhance hemostasis and protect the surgical site (Fig. 11).

Fig.10

Fig.11

After placement of the **hemostatic sponge**, the **prosthetic restoration** supported by the **multi-unit abutment** was reinserted into position (Fig. 12).

The prosthetic restoration allowed for **controlled traction of the soft tissue**, enabling its repositioning to achieve optimal coverage of the **aesthetic defect caused by the exposed multi-unit abutment** (Fig. 13).

Fig. 12

Fig. 13

At this stage, the **soft tissue was tractioned and positioned** to cover the aesthetic defect caused by the prosthetic component; however, a **vestibular depression** remained in the peri-implant area, which could potentially compromise the long-term outcome.

To stabilize the soft tissue and increase the **vestibular volume**, **xenogeneic grafting** was performed.

The **hemostatic sponge was removed**, and the **xenogeneic graft** was placed within the **gingival pocket**, being gently pressed toward the **free gingival margin**. This approach allowed for the augmentation of vestibular contour and ensured long-term soft tissue stability and aesthetics (Fig. 14 and Fig. 15).

Fig. 16

Fig. 17

The **hemostatic sponge was reapplied** (Fig. 18) and stabilized with a suture to ensure its fixation (Fig. 19) until the 7-day postoperative control.

As shown in **Fig. 19**, **two types of sutures** were used, distinguishable by color. The **blue suture** was a **6-0 polypropylene** non-resorbable thread, while the **purple suture** was a **5-0 resorbable** thread.

The **polypropylene sutures were placed under tension** to achieve proper soft tissue stabilization and positioning, whereas the **resorbable sutures were left passive**, serving solely to maintain the hemostatic sponge in place.

Fig. 18

Fig. 19

At this point, the **surgical phase was completed**. The patient was prescribed **prophylactic antibiotic therapy** and scheduled for a **postoperative follow-up** at 7 days.

A **post-surgical hygiene and dietary regimen** was recommended according to standard clinical protocols, along with **anti-inflammatory medication as needed**.

Immediate and Follow-Up Results

A **postoperative follow-up** was performed at **7 days**, during which the **sutures were removed**.

At **14–21 days**, a second follow-up visit was conducted, confirming **complete healing**, **re-epithelialization** of the surgical area, and **mucosal adaptation** (marsupialization).

The **7-day postoperative control** is illustrated in **Fig. 20, Fig. 21, and Fig. 22**.

Fig. 20

Fig. 21

Fig. 22

In **Fig. 20, 21, and 22**, optimal healing can be observed. The **vestibular volume** is harmonious with the rest of the dental arch, there is **reformation of the interimplant papilla**, and the **aesthetic defect caused by the prosthetic components** is successfully covered.

At this stage, the **sutures were removed**, and the **vestibular incision site (marsupialization area)** showed normal healing without any signs requiring reintervention.

Twenty-one-day follow-up (Fig. 23 and Fig. 24).

Fig. 23

Fig. 24

In **Fig. 23 and Fig. 24**, the **21-day follow-up** shows **stable healing** with a fully **re-epithelialized area**. The incision line remains slightly perceptible but is expected to disappear over time.

The **vestibular contour** demonstrates sufficient soft tissue volume to ensure an optimal aesthetic outcome.

The case will remain under observation for **one year**, with a **follow-up evaluation at six months**. After the initial six-month review, **replacement of the prosthetic restoration** may be considered if deemed clinically necessary.

Results

Healing was favorable and uneventful, with no postoperative complications. At **7 days**, complete **primary healing** was observed, and at **21 days**, stable **re-epithelialization** and a noticeable **increase in vestibular volume** were achieved. The **interdental papilla** reappeared, effectively covering the previously visible prosthetic area (**Fig. 20–24**).

The **final aesthetic outcome** was satisfactory, and the patient reported excellent **comfort** and **functional stability**.

Discussion

The **tunneling technique combined with xenogeneic grafting** provides a **minimally invasive alternative** to autogenous connective tissue grafts. This approach reduces morbidity while achieving **long-term stability of vestibular soft tissue volume**.

Compared with conventional techniques (Urban IA, 2014), the described method offers the advantages of **predictable xenograft integration** and **precise control of soft tissue design**.

The limitations of this case include the **small sample size** and the **lack of objective volumetric measurements** of the augmented tissue. Nevertheless, the clinical results are consistent with the current literature on **peri-implant soft tissue management**.

This surgical approach ensures not only **stable aesthetic outcomes**, but also a **more comfortable operative experience** for the patient, eliminating the need for autogenous graft harvesting.

Conclusion

The described technique provides a **simple, reproducible, and effective solution** for **peri-implant soft tissue augmentation**.
The procedure has a **short learning curve** and can be successfully applied in cases involving **minor vestibular defects**, ensuring **stable aesthetic and functional long-term results**.

Ethical Statements

The patient provided **written informed consent** for the publication of this clinical case report and the accompanying images.

The author declares **no conflict of interest** and confirms that **no external financial support** was received for the preparation of this work.

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