Soft and Hard Tissue Revision Around an Implant: Case Report with a 10-Year Follow-up

Dental implants are the most promising modality of tooth replacement in the modern era. Of late, peri-implant architecture has gained significant importance and forms the basic foundation for success of an implant restoration, with both the hard and soft tissue components around an implant playing vital roles in the osseointegration process. A 23-year-old man reported with a titanium membrane exposure around tooth site 16 (FDI tooth-numbering system) along with decreased attached gingival width and thickness. To gain soft tissue thickness, a rotated connective tissue graft was harvested, as was a “sticky bone” graft to gain bone volume. Connective tissue is one of the most promising modalities for soft tissue augmentation around both the natural tooth and implants. “Sticky bone,” which is a more advanced form of bone grafting techniques, was implemented to achieve the benefits of injectable platelet-rich fibrin. This case report describes the hard and soft tissue augmentation procedure and successful results at the 10-year follow-up, as well as fabrication of an implant-supported fixed partial denture.


Dental implant surgery is a safe surgical procedure that has a high success rate. However, like any other surgery, a number of considerable complications can occur, ranging from improper placement to complete implant failure. Amongst them, implant thread exposure is one of the most common treatment challenges that often requires an unconventional treatment option. The exposed threads not only pose a challenge to the patient’s oral maintenance (as a result of persistent inflammation due to impaired hygiene and plaque accumulation on exposed implant thread), but they also may not be amenable to regenerative therapy. The etiology behind implant thread exposure may be attributed to excessive implant loading, localized periodontal infection, and other causes. Still, the quality of keratinized gingiva is one of the most important factors that determines implant success. Not only does an adequate soft tissue volume provide a good emergence profile for the implant restoration, but it also masks the underlying metal implant. Of the two gingival biotypes (thick and thin), thick soft tissue is a desirable characteristic that will positively affect the esthetic outcome of an implant-supported restoration. The keratinized gingiva improves the patient’s oral hygiene maintenance and aids in esthetics.
by hiding the grayish hue of implants, especially in esthetic zones, as gingiva forms a major part of the esthetic appearance of any implant-supported restoration, which serves as the peri-implant architecture. The tissue biotype contributes to the esthetics of an implant restoration and helps prevent future mucosal recession, thereby improving immediate implant success.

The anatomical peri-implant characteristics, the soft tissue response to the implant material, and clinician skill are the key elements for soft tissue augmentation. Connective tissue grafts are considered to be the gold standard for enhancing and augmenting the gingival architecture around implants, despite needing a secondary donor area and having associated complications.

Case Report

A 23-year-old Caucasian man had an implant placed in the maxillary right first molar location (site 16; FDI tooth-numbering system) in 2011. Four months after placement, when the patient reported for a second-stage procedure, one to two macrothreads of the implant were exposed. An attempt was made to cover the macrothreads using a guided bone regeneration procedure, after which the patient refrained from attending the dental office once the sutures were removed. Instead, the patient returned 18 months after the second-stage implant placement, presenting with titanium mesh exposure and reporting discomfort during mastication. A clinical evaluation revealed a bulge in the gingiva at site 16, disturbing the normal contour (Fig 1). Surgical intervention was then planned.

Surgical Treatment

Flap exposure was performed from site 15 to site 17 in an attempt to have a full view of the exposed titanium mesh. Additionally, in order to increase the width of attached gingiva that was compromised due to the titanium mesh exposure, a connective tissue graft was planned for placement. The harvesting site for the connective tissue graft was prepared on the palatal side, wherein an incision extended from the distal margin of tooth 12 to the distal margin of tooth 15 (Fig 2). The pedicled connective tissue graft (approximately 15 × 10 mm) was harvested by a single-incision technique and was rotated onto the surgical site (Fig 3).

Not only is the soft tissue around an implant important, but bone augmentation should also be included in the treatment plan if a stable soft tissue result must be achieved. To enhance the bone volume around the implant site, a “sticky bone” graft was prepared using a 50:50 ratio of allograft (Rocky Mountain Tissue Bank) and xenograft (Bio-Oss, Geistlich) along with injectable platelet-rich fibrin (made using the Choukroun DUO Quattro PRF Centrifuge) (Figs 4 to 6). The surgical sites were closed using 5-0 prolene sutures (Fig 7).
Follow-up

After the surgery, the patient was periodically evaluated over 3 weeks, at which time the patient did not complain of any untoward events, and successful healing was evident (Fig 8). Two months after initial healing, a temporary fixed partial denture was fabricated and delivered to the patient. A healing abutment (5.5 × 5 mm) was placed during the second stage, after a period of 6 months (Fig 9). Radiographically, successful bone augmentation was clearly evident up to the microthread level (Fig 10). Nine months after implant placement, a screw-retained prosthesis was given to the patient, and site 16 was restored (Fig 11).

In the present case, the titanium mesh exposure can be attributed to the deficient soft tissue thickness. It can also be a result of

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Fig 4 The “sticky bone” comprised a 50:50 mixture of allograft (Rocky Mountain) and xenograft (Bio-Oss, Geistlich), as well as injectable platelet-rich fibrin (made using the Choukroun DUO Quattro PRF Centrifuge).  
Fig 5 The “sticky bone” was augmented onto the implant site.  
Fig 6 The rotated pedicled connective tissue graft was placed on the augmented area.  
Fig 7 Suturing with prolene 5-0 sutures.
a sharp/rough margin due to a lack of burnishing. Ten years after completing treatment in the maxillary posterior region, the case had remained stable.

Discussion

With the introduction of osseointegrated implants by Dr P. I. Brånemark in the late 1990s, there has been a paradigm shift in implant placement, first from bone-driven placement to prosthetic placement and, lately, to soft tissue-driven placement. A variety of local anatomical and systemic factors influence the architecture of the peri-implant mucosa. Genetics, metabolic diseases, and habits (ie, smoking, bruxism, and excessive alcohol consumption) can play a role in the peri-implant architecture; further, tissue biotype, keratinized attached mucosa, biologic width, interdental osseous topography, and thickness are local anatomical factors that influence the architecture of peri-implant mucosa. The clinical significance of keratinized mucosa around implants has been well-established in the literature, as it has advantages such as preventing the spread of inflammation, preventing marginal tissue recession, and providing a tight collar around implants, thereby enabling patients to maintain good oral hygiene.5 Alternatively, the absence of keratinized mucosa has an increased susceptibility towards infection and tissue destruction in implant sites. Regardless, the peri-implant soft tissues should always be handled with exceptional care by the clinician, as they have a compromised blood supply owing to their delicate nature.

In the present case, the probable reasons for titanium mesh exposure include a deficient soft tissue thickness and a lack of adequate burnishing of the sharp titanium mesh. To enhance the peri-implant mucosal thickness, various soft tissue augmentation procedures have been advocated in the literature. Guided bone regeneration, which was introduced in implant dentistry over 40 years ago, is based on the principal that the bone-inducing osteogenic cells have the capacity to grow and prevent the growth of...
undesired cells by providing space over the defect, thereby ensuring blood clot protection and the exclusion of gingival connective tissue.⁶

Among the various commercially available nonresorbable membranes, such as expanded polytetrafluoroethylene (ePTFE) and titanium-reinforced ePTFE, titanium mesh has the advantages of preventing collapse caused by pressure from the overlying soft tissue, allowing for bone regeneration that is more predictable. However, the promotion of bone regeneration is enhanced by angiogenesis and a good vascular supply,⁶ and the combined use of a membrane with bone graft material can potentially maximize the regenerative outcomes. Autografts, allografts, xenografts, and alloplasts have all successfully been used alone and have shown additive advantages when used in combination. As xenografts comprise natural hydroxyapatite and anorganic bone matrix, which are inert osteoconductive filler materials that serve as a scaffold for new bone formation, the three-dimensional microstructure of natural bone is highly biocompatible to the adjacent hard and soft tissues. Dahlin et al⁷ demonstrated the migration of cells from the neighboring bone/bone marrow into the defect: When a barrier membrane was placed in direct contact with the surrounding bone, there was no ingrowth of competing soft tissue cells from the overlying mucosa; the barrier membrane also presented additional advantages, such as protection of the wound from mechanical disruption and salivary contamination. The blood supply from the underlying periosteum was maintained and undisturbed due to the holes within the titanium mesh, making it the preferred material of choice. The titanium mesh is also completely biocompatible to oral tissues and can be placed before implant insertion in an attempt to gain bone volume (in either a staged or nonstaged approach).⁷

Based on the fact that connective tissue carries the genetic message for keratinization of the overlying epithelium, the subepithelial connective tissue graft that was first described by Langer and Langer in 1980⁸ has become a reliable treatment modality for root coverage, increasing the width of keratinized gingiva, and management of peri-implant abnormalities.⁹,¹⁰ Among the various flaps advocated to enhance soft-tissue thickness, vascularized rotated pedicle connective tissue flaps are the choice of treatment, as (1) the vascular connectivity with the adjacent tissues can be maintained; and (2) pedicle grafts¹¹ have a better prognosis than free grafts, as they have multiple advantages, including preservation of the flap blood supply and maintaining harmony between the color of the postoperative tissue and the adjacent tissues, thereby enhancing esthetics.¹²,¹³ However, the bone loss in the present case report can likely be attributed to inadequate bone width on the buccal side, as well as too much compressive stress on the bone, caused by heat.
generation during the osteotomy. Therefore, increases in bone and soft tissue volumes were needed. Thus, the present case utilized an advanced-generation platelet-rich fibrin, also known as “sticky bone” (bone graft matrix enriched with growth factors, introduced in 2010), because of its good graft stability, therefore accelerating tissue healing and minimizing bone loss during the healing period. Because the autologous thrombin in the red blood cell layer is used in the preparation of thrombin, it does not migrate—even upon smoking—and thereby reinforces stability. Thus, the present case documented considerable gains in soft tissue and bone height throughout the long-term follow-up. To the best of the present authors’ knowledge, this case is the first of its kind: A soft tissue graft positioned along a novel “sticky bone” preparation to enhance the gingival thickness and thus attain a gingival biotype that could be well maintained. Fabrication of a fixed restoration, proper healing after augmentation surgery, and a long-term follow-up are the key factors for the success and predictability of this treatment.

Conclusions

Implant thread exposure is a complication that can predispose implant failure. The bone around an osseointegrated implant plays a critical role in implant success, but the soft tissue also needs to be critically analyzed, both clinically and functionally. Further, the procedure is highly technique-sensitive and requires excellent surgical expertise, and for some clinicians, this method may require some training before utilization. However, the clinician’s consistent motivational measures in reinforcing the patient’s oral hygiene maintenance, as well as the patient follow-ups over a long-term period, do play a vital role in the stability and success of implant therapy. This case with a long-term follow-up (10 years) provides sound data for an evidence-based treatment approach for peri-implant soft tissue enhancement.

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References