IMMEDIATE IMPLANT PLACEMENT

Ridge Augmentation Simultaneous With Immediate Implant Placement: The Subperiosteal Tunneling Technique

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Abstract: The efficacy of immediate implant placement has made it an appealing treatment modality in dentistry. Over the past several decades various surgical techniques to minimize the ridge collapse and other adverse changes that occur after tooth extraction have been advocated. This case series proposes a method of soft-tissue augmentation when multiple implants are being immediately placed. The authors describe a subperiosteal tunneling technique that achieves the dual purpose of graft containment/guided bone regeneration and soft-tissue augmentation around maxillary anterior implants.

Immediate implant placement is becoming increasingly common in current implant practice. The expediency and efficiency this treatment modality offers makes it attractive to both patients and clinicians. The early belief or philosophy that placement of an implant into a fresh extraction socket would preserve dentoalveolar contours[1,2] has been disproven,[3-5] as implants do not alter the wound healing process in the extraction socket after tooth removal. More currently, many authors have advocated various surgical techniques to minimize the ridge collapse and negative changes that occur after extraction. These techniques include implant placement without reflection of mucoperiosteal flaps[6,7] and with the use of bone augmentation,[8,9] soft-tissue grafting,[10] guided bone regeneration (GBR), or various combinations of these procedures.[11,12]

When anterior single-tooth implants are placed, it is not uncommon for surgeons to use autogenous connective tissue grafts for soft-tissue augmentation. The size of these grafts is relatively small and the morbidity associated with their procurement is mild to moderate in most cases, though Chung et al reported on the possibility of graft failure.[13] When multiple immediate implants are placed, the relative size of these grafts can be significant, and the surgical time and morbidity are typically increased. Alternatives to this approach often include the use of allogeneic dermal grafts. A drawback to these materials, however, is their inert, avascular composition.[14] Though these grafts are capable of being incorporated into native tissues,[15] time is required for adequate revascularization; the exact amount of time needed for incorporation to occur is speculative, though clinically this usually takes place over several weeks. Therefore, these grafts must be covered with the overlying soft tissues to prevent premature exposure and consequent sloughing of the graft.

In flapless immediate implant placement, soft tissues cannot be coronally advanced significantly, and, therefore, a resultant void usually exists between the implant and hard/soft-tissue socket walls.[16] This void can be obturated with particulate bone graft materials, collagen membranes, and/or soft-tissue grafts. It may also be "sealed" with provisional restorations[17,18] or anatomically shaped healing abutments.[19] The size of the gap is also important.[20] It has been demonstrated that sites with larger gaps, ie, greater than 1 mm, result in significantly greater osseous regeneration.[21] Recently, a technique to augment peri-implant soft tissues at the time of immediate implant placement and temporization was introduced for single-tooth replacement.[22] When multiple implants are being placed, another method of soft-tissue augmentation is proposed, as discussed herein.

This case series describes a subperiosteal tunneling technique for the dual purpose of graft containment/GBR and soft-tissue augmentation around multiple maxillary anterior implants.

Clinical Technique

This procedure, illustrated in Figure 1 through Figure 5, is indicated for flapless immediate implant placement in maxillary anterior sites where implants are placed to the palatal aspect of the extraction sockets. Implant diameter is deliberately selected to preserve a "gap" between the inner aspect of the buccal wall of the socket and implant

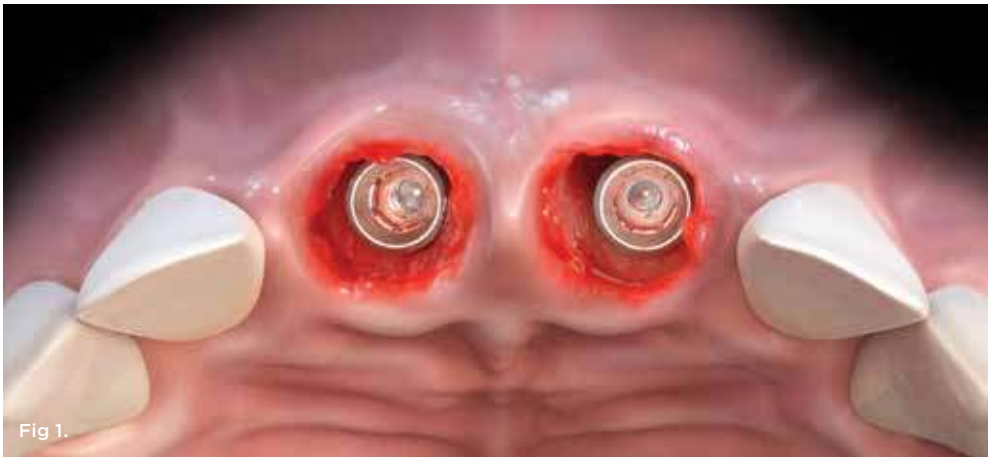
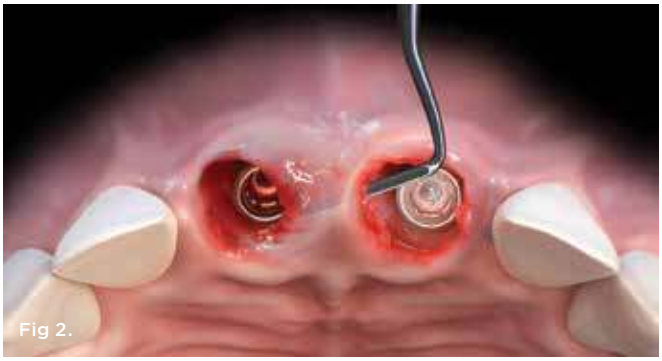
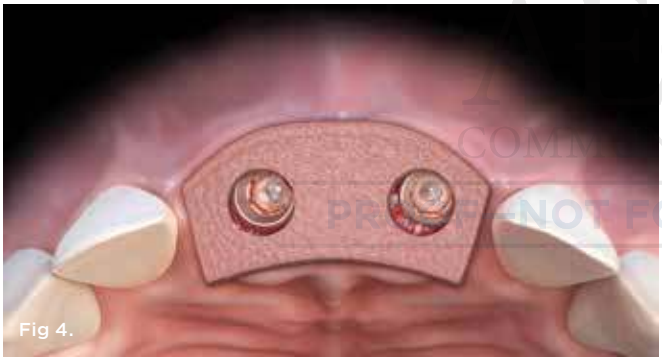
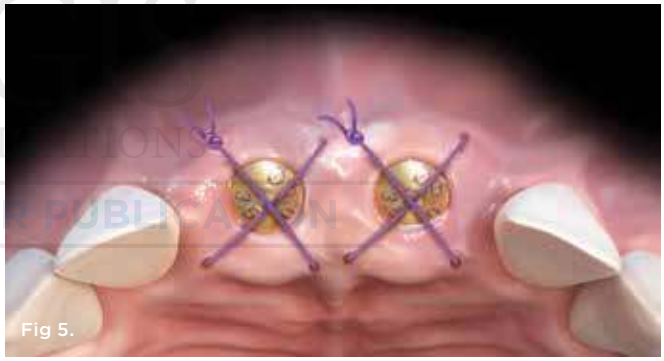


Fig 1. Implants are placed to the palatal aspect of extraction sockets. **Fig 2.** A gap is deliberately preserved between inner aspect of buccal wall of socket and implant surface. **Fig 3.** Gap is obturated with composite bone graft material consisting of mineralized FDBA and DBBM. **Fig 4.** Dermal allograft is trimmed to match subperiosteal zone and perforated according to position of abutments. **Fig 5.** Graft is advanced via suture under papillae. Additional sutures are used to secure allograft to the soft tissues facially and palatally and to compress detached soft tissue.







surface. The gap is obturated with a composite bone graft material consisting of mineralized freeze-dried bone allograft (FDBA) and deproteinized bovine bone mineral (DBBM) in a ratio of 4:1. Implants are sealed with appropriately sized stock healing abutments.

Subsequent to bone grafting, a subperiosteal dissection of the facial, palatal, and proximal soft tissues is performed. This is accomplished with periodontal knives and small periosteal elevators. Great care is necessary to avoid soft-tissue dehiscence and perforation. The procedure requires serial and circumferential elevation moving the elevator mesial-distally as well as coronal-apically beneath the papillae. Singular focus in one area can lead to unwanted soft-tissue tearing; patience is needed to widen the zone of subperiosteal elevation, slowly and gradually moving the reflection.

Once a zone of at least 4 mm to 5 mm of facial and palatal elevation is confirmed, the dermal allograft is trimmed to match the subperiosteal zone created by elevation. A soft-tissue punch is used to perforate the dermal graft according to the position of the healing abutments. It is critical to orient the dermal allograft in a manner in which the connective tissue surface is facing "up" to be in direct contact with the periosteum of the overlying soft tissues. This is done to facilitate and ensure integration of the graft within the soft tissues.

A monofilament, resorbable suture is passed through the distofacial aspect of the mucosa relative to one of the terminal implants. It is "tucked" under the detached papilla or papillae to engage the dermal allograft in both facial and palatal positions and passed back through the initial path. A C-3 needle is then passed through the distal-palatal mucosa. With careful manipulation, the graft is advanced via the suture under the papillae and adapted between the facial and palatal bone and periosteum, and the initial suture is tied on the palatal aspect of the ridge. Additional sutures are used to secure the allograft to the soft tissues facially and palatally.


Fig 6.

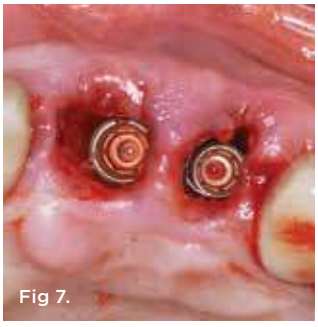


Fig 7.

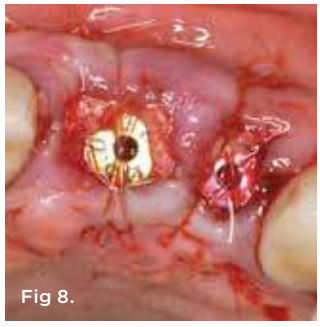


Fig 8.


Fig 9.


Fig 10.

Fig 6. Clinical situation with mobile crowns on teeth Nos. 9 and 10. **Fig 7.** Immediate implants placed in the palatal aspect of both extraction sockets. **Fig 8.** Monofilament sutures used for dermal allograft stabilization and soft-tissue compression. **Fig 9.** At 2 months healing, preserved ridge dimensions and healthy peri-implant mucosa were demonstrated. **Fig 10.** Final cement-retained crowns on both implants (restorative therapy performed by Ralph C. Attanasi, DDS, MS, and Ethan A. Pansick, DDS, MS).

"Figure 8" design sutures are used to compress the detached soft tissue to minimize clots between the periosteum and dermal allograft and dermal allograft and coronal/proximal bone.

Case Reports

Case 1

Clinical case No. 1 involves an 89-year-old female patient with a history of implant therapy. She presented with mobile crowns on teeth Nos. 9 and 10, which were placed only 1 year prior (Figure 6). Both teeth had a history of endodontic and restorative therapy and demonstrated significant recurrent caries.

After extractions were done without flap elevation, the sockets were debrided with ultrasonic (Piezotome, Acteon, acteongroup.com) and manual instrumentation. Implants were intentionally placed toward the palatal aspect of the extraction sockets with primary stability, confirmed with an insertion torque exceeding 25 Ncm (Figure 7).[23] The gaps between the implants and inner walls of the extraction sockets were obturated with a composite particulate bone graft composed of FDBA/DBBM in a 4:1 ratio. The dermal allograft (PerioDerm™, Dentsply Sirona, dentsplysirona.com), with a thickness of 0.4 mm to 0.8 mm, was trimmed as described earlier and pierced with tissue punches to correspond with the positions of the healing abutments. It was then placed beneath the periosteal aspect of the elevated soft tissues. Extreme care was taken to avoid detachment of the interproximal papillae. Monofilament sutures (Monocryl® 5-0, Ethicon, ethicon.com) were used to secure the allograft and gently compress the overlying soft tissues (Figure 8).

After 8 weeks of healing, the site appeared healthy with preservation of the alveolar ridge in three dimensions (Figure 9). The patient was referred to the restorative dentist to begin esthetic treatment at approximately 10 weeks after surgery. Both implants were restored with custom CAD/CAM abutments and cement-retained single crowns (Figure 10).

Case 2

The second case demonstrates a 76-year-old female patient with a failing three-unit fixed dental prosthesis (FDP) from teeth Nos. 7 through 9 (Figure 11). After flapless extraction, immediate implant placement toward the palatal aspect of the sockets was performed. Healing abutments were placed, and the void between the implant surface and socket walls was filled with the same particulate bone graft as in the previous clinical situation (Figure 12). The overlying soft tissues, including the pontic space of tooth No. 8, was reflected and the same dermal allograft was carried via suture through the field and secured as previously described. This was meant to augment the coronal and buccal aspect of the future ovate pontic site, as well as the peri-implant mucosa (Figure 13).

After 5 weeks, the site appeared healthy, and facial contours were improved compared to the presurgical situation. The concavity in the edentulous site of No. 8 was convex and peri-implant bone levels were unchanged. After another 4 weeks, radiographic bone levels remained unchanged (Figure 14 and Figure 15). The healing abutment on the implant in the No. 9 position was changed to a taller (4 mm height versus 3.5 mm height) but narrower (4

mm diameter versus 5 mm diameter) abutment to facilitate easier restorative therapy and encourage coronal migration of soft tissue prior to provisional restoration (Figure 16). The final cement-retained FPD from Nos. 7 through 9 is shown in Figure 17.

Case 3

The third and final case involves treatment of a 60-year-old male patient, whose restorative dentist had deemed teeth Nos. 7 and 8 unrestorable (Figure 18). Both teeth were extracted without flap reflection and implants were placed palatally with primary stability confirmed by resonance frequency analysis (Osstell Mentor, Osstell, osstell.com). Bone grafting was performed as previously described.

Prior to subperiosteal tunneling, an open-tray impression was taken, which facilitated indirect fabrication of splinted screw-retained temporary restorations that would be delivered the same day as surgery. Healing abutments were placed and tunneling as described earlier was performed. Again, caution was used to avoid separation or detachment of the interproximal papillae. A thin (0.4 mm to 0.8 mm) dermal allograft was advanced through the subperiosteal space and secured with 5-0 monofilament sutures. The patient presented immediately to the restorative dentist for delivery of the splinted screw-retained restorations (Figure 19). Care was taken to prevent any occlusal contact with these restorations, and the patient was advised to avoid mastication on the surgical site for about 6 weeks.

After approximately 12 weeks of healing, definitive restorative therapy was performed, comprising custom abutment fabrication and two individual cement-retained crowns (Figure 20).

Discussion

When treating hopeless teeth in the maxillary anterior sextant, clinicians face unique challenges. Both hard and soft tissues are relatively thin.[24] These tissues are susceptible to atrophy after tooth extraction. When immediate implants are placed in the esthetic zone, the naturally occurring diminutive changes of the alveolar ridge

Fig 11. Both teeth supporting a failing three-unit bridge from Nos. 7 through 9 were determined to be nonrestorable. **Fig 12.** Particulate bone graft material was placed to obturate the gap between the implants and socket walls. The graft was placed to a vertical level slightly coronal to the facial crest. **Fig 13.** After subperiosteal tunneling was done to completely connect the two implant sites beneath the pontic site (No. 8), the dermal allograft was advanced with a 5-0 monofilament suture through the tunnel and fixed. **Fig 14 and Fig 15.** Proximal bone levels remained unchanged and above the implant-healing abutment junction. **Fig 16.** At 9 weeks post-surgery, the abutment on the No. 9 implant was changed in favor of a taller but narrower abutment to facilitate coronal migration of the soft-tissue margin and easier access for provisionalization. **Fig 17.** Final cement-retained FPD from Nos. 7 through 9.


Fig 18.


Fig 19.


Fig 20.

Fig 18. Pretreatment condition of teeth Nos. 7 and 8 with mobile crowns and recurrent caries. **Fig 19.** Screw-retained, immediate temporization of implants Nos. 7 and 8. These crowns were splinted and out of occlusal contact. **Fig 20.** Final single-unit, cement-retained crowns Nos. 7 and 8 (restorative therapy performed by Brian L. Wilk, DMD).

can compromise esthetic outcomes.[25] Investigators have proposed augmenting soft tissues at the time of implant placement.[26,27]

The subperiosteal tunneling technique is designed to accomplish several goals. First, it eliminates the need to procure relatively large, autogenous connective tissue grafts. This reduces treatment time and surgical morbidity. Second, it allows peri-implant soft tissues to be augmented while they also function as a collagen barrier (ie, GBR). Because the allograft is passed under the interproximal papillae, it has the potential to increase soft-tissue volume between adjacent implants and/or implants and pontics in the esthetic zone.

In the maxillary anterior sextant, where hard and soft tissues are naturally thin, it is difficult or impossible to reflect partial-thickness mucosal tissues. It has been speculated that the retention of minimal connective tissue coverage may be of little benefit compared to subperiosteal reflection, which is easier to perform, in terms of limiting bone resorption.[28] Because the soft-tissue elevation is subperiosteal in nature, some of the benefits of a flapless procedure are compromised, however. Therefore, the zone of elevation is minimized to approximately 4 mm to 5 mm beyond the crestal osseous margins of the extraction sockets.

A similar approach for mucogingival corrective surgery has been documented.[29] In that technique, a subperiosteal elevation is combined with insertion of a dermal allograft between the alveolar bone and periosteum, and the soft tissues are coronally advanced to achieve root coverage secondary to gingival recession. Also, because the proximal tissues are not incised, blood supply from the facial and palatal aspects of the mucosa is not severed. Pressure to minimize the size of the postoperative blood clots and use of compression sutures encourage rapid healing and prevent soft-tissue necrosis and hematoma formation.

Increasing the thickness of peri-implant mucosa is a topic of great interest. Linkevicius et al demonstrated the benefit of augmenting naturally occurring thin mucosa, in terms of crestal bone preservation.[30,31] These authors have exhaustively researched the role of tissue thickness as it relates to crestal bone levels in edentulous sites. Any extrapolation of their findings as they relate to immediate implant placement must be done with caution.

The present author (BPL) has published a case series utilizing the same dermal allograft in an open or flapped immediate implant placement scenario.[32] The dermis is used as both a GBR membrane and tissue-thickening agent. Because the procedure is demonstrated in a case series and not a controlled clinical trial, more research is required to confirm its efficacy.

Conclusion

The present case series described a subperiosteal tunneling technique for the dual purpose of graft containment/GBR and soft-tissue augmentation around multiple maxillary anterior implants. The procedure, featuring flapless immediate implant placement where implants are placed to the palatal aspect of the extraction sockets, was shown to achieve alveolar ridge preservation and improved facial contours while enabling esthetic restoration in a timely fashion. The tunneling procedure is also intended to augment soft tissue volume in proximal and pontic regions; however, controlled studies are necessary to confirm this clinical finding.

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