COMPLEX CASE

Rehabilitation of an Esthetic Compromise in a Patient Previously Treated With Maxillary Anterior Implants

Barry P. Levin, DMD; and Brian L. Wilk, DMD

Abstract: Over time, patients treated in developmental stages of implantology may need additional treatment, as teeth adjacent to implants may fail and require replacement themselves with new implants. Blending newer implant rehabilitations into a dentition with existing implant-supported restorations can be challenging. The use of implants with a subcrestal angle correction (SAC) enables predictable screw-retained anchorage of temporary and definitive restorations. An SAC implant often can be placed into the palatal bone of an extraction socket, along the incisal angle of the crown, allowing screw retention of the prosthesis. This case report demonstrates the use of both straight and SAC implants combined with hard- and soft-tissue augmentation and serial provisionalization to replace hopeless teeth adjacent to pre-existing implants and improve esthetics in the anterior maxilla.

The manner in which dental implant therapy is performed in the esthetic zone has evolved significantly over the past two decades. Much of this evolution is related to a more comprehensive understanding of the behavior of hard and soft tissues post-extraction. The concept that implant placement at the time of extraction will maintain alveolar bone dimensions[1] has been refuted in animal and human studies.[2-4] This enhanced knowledge of physiologic modeling and remodeling has led to numerous strategies geared toward preserving 3-dimensional ridge morphology resulting in stability of esthetic outcomes.[5,6] Along with surgical methods of preservation and augmentation, prosthetic treatment plays a significant role in achieving and maintaining soft-tissue harmony.[7,8]

Over time, patients treated in the developmental stages of implantology may need additional treatment. Teeth adjacent to implants may fail, requiring extraction and replacement with implants.

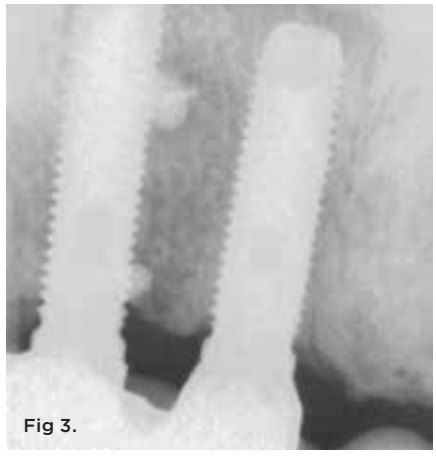

Fig 1. Preoperative condition. Pink ceramics had been used to compensate for hard- and soft-tissue deficiencies in the esthetic zone. **Fig 2 and Fig 3.** Preoperative radiographs depicting failing natural teeth Nos. 5 and 6 due to apical root resorption and hypermobility (Fig 2). Two 3.75-mm-diameter external hex implants along with fixation tacks that were utilized in a previous bone augmentation were evident in the No. 7 and 8 positions (Fig 3).

Blending newer implant-supported restorations into a region of the dentition where existing and sometimes unesthetic prostheses are already present can be challenging. This often requires multiple procedures, including the use of fixed provisional restorations to facilitate the development of soft-tissue profiles and to avoid pressure on the dentition that can be caused by removable prostheses. Ensuring that these temporary restorations are easily retrievable simplifies treatment.

Abutments with an "angle correction" that provide screw retention of definitive restorations were recently introduced. A drawback of using these abutments for provisional restorations, in addition to expense, is the inability to maintain screw tightening.[9] Another option, which allows anchorage of temporary and definitive restorations to be predictably screw retained, is the use of implants with a subcrestal angle correction (SAC). In addition to practicality, these unique implants eliminate potential complications caused by undetected submucosal cement. This implant concept is not new; Vandeweghe et al demonstrated its efficacy in a 1-year study.[10] Often, the anatomy of the anterior maxilla is such that implant placement along the long axis of the extracted root or alveolus dictates implant placement with a coronal emergence angle directed through the incisal or facial aspect of the prosthetic crown.[11] On the contrary, placing an implant with its long axis emerging through the cingulum of the restoration may result in perforation of the facial bone.[12] An SAC implant often can be placed into the palatal bone of an extraction socket, along the incisal angle of the crown, and allow screw retention of the prosthesis.[11]

The following case report demonstrates the use of straight and SAC implants combined with hard- and soft-tissue augmentation and serial provisionalization to replace hopeless teeth adjacent to pre-existing implants and improve the overall esthetic appearance in the anterior maxilla.

Case Report

A 43-year-old male patient presented to his restorative dentist with two chief complaints. First, he was aware of two failing teeth in the No. 5 and 6 positions. Second, he was displeased with the esthetics provided by an implant restoration supported by two implants in the No. 7 and 8 locations, replacing teeth Nos. 7 through 9. The patient objected to the appearance of pink porcelain utilized to compensate for hard- and soft-tissue deficiencies and he expressed a desire to improve his overall appearance (Figure 1). Radiographs demonstrated failing teeth Nos. 5 and 6 as well as previously placed 3.75-mm-diameter external hex implants in the No. 7 and 8 positions (Figure 2 and Figure 3).

The patient expressed a desire to avoid the use of removable transitional restorations throughout the treatment process. The proposed treatment plan involved an implant-borne, fixed prosthesis supported by three implants in the locations of teeth Nos. 5, 6, and 9. The existing No. 7 and 8 implants would not be used to support the prosthesis, but would function via submergence only to provide support for underlying bone and soft tissues. Considering primary stability and placement within the osseous envelope of the alveolar ridge, adequate bone volume was present to facilitate implant placement in all three aforementioned positions, Nos. 5, 6, and 9. The two upper right implants, Nos. 5 and 6, were selected for immediate temporization. The implant in the No. 9 position would be placed in a submerged manner to allow the patient to continue wearing the existing restoration until osseointegration had occurred.

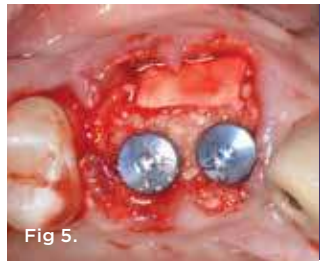

Fig 4. Two directional indicators, one straight (No. 5) and one with a 12-degree angle correction, were placed following 2-mm twist drill preparation. **Fig 5.** FDBA particulate was grafted into the residual extraction sockets and contained with a ribose cross-linked collagen matrix. **Fig 6.** After impression-taking, a dermal allograft was trimmed and adapted over the healing abutments and bone graft. **Fig 7.** Transmucosal healing was selected, and the patient was immediately temporized by the restorative dentist via the impression obtained prior to closure.

After disconnection of the prosthesis, teeth Nos. 5 and 6 were extracted, revealing extraction sockets that were deficient in buccal wall. A straight, tapered 4 mm x 11 mm implant (Deep Conical [DC], Southern Implants, southernimplants.com) was placed in the No. 5 position. The root of tooth No. 6 was replaced with a 4 mm x 13 mm tapered DC implant with a 12-degree subcrestal angle correction engineered into the coronal portion of the implant. This facilitated parallelism of the prosthetic connections of the two adjacent implants as depicted by 2 mm direction indicators in Figure 4.

Following implant placement with primary stability determined by insertion torque above 35 Ncm, hard- and soft-tissue augmentation was performed with a layered approach. The internal socket walls and buccal deficiencies were obturated with a particulate composed of mineralized freeze-dried bone allograft (FDBA) (Symbios®, Dentsply Sirona, dentsplysirona.com). The bone graft was contained with a ribose cross-linked collagen matrix (Ossix® Volumax, OraPharma, ossixusa.com) (Figure 5). A pick-up impression was taken with a polyvinyl siloxane material (Position™ Penta™, 3M Oral Care, 3m.com) to facilitate fixed temporization. Then a thin (0.4 mm to 0.8 mm) dermal allograft (Symbios® PerioDerm, Dentsply Sirona) was adapted via tissue punches over the two healing abutments and transmucosal closure was obtained (Figure 6 and Figure 7).

Tooth No. 9 was replaced with a tapered, 12-degree SAC implant, and a flat cover screw was placed to permit submerged healing and allow the existing, screw-retained prosthesis to be re-attached.

The patient presented to the restorative dentist's clinic immediately post-surgery for fabrication of splinted, fixed temporary crowns supported by the implants in the No. 5 and No. 6 locations (Figure 8). This was facilitated via the cast produced from the surgical impression and a vacuum-formed template obtained from the pretreatment situation. These restorations were not in occlusal contact with their mandibular antagonist teeth, and the patient was instructed to perform all mastication on his left side for 8 weeks. Screw retention was simplified by combining a straight implant and an SAC implant to align the long access of the prosthetic insertion.

Approximately 10 weeks after surgery, the anterior restoration was removed to allow the No. 9 implant to be uncovered and a transmucosal healing abutment to be attached (Figure 9). A chairside, screw-retained fixed partial denture (FPD) was fabricated and supported by the three internal-connection implants. The pre-existing prosthetic abutments on the No. 7 and 8 implants were removed and replaced with two flat cover screws. To avoid passage of air and saliva, the pontics over the two cover screws were relatively long (Figure 10).

The patient then returned several weeks after insertion of the new transition FPD for soft-tissue surgery. Two new sterile cover screws were placed and a subepithelial connective tissue graft that was harvested from the palatal mucosa was utilized to submerge the two original implants and increase horizontal and vertical soft-tissue volume (Figure 11). The No. 7 and 8 pontics were relieved to prevent pressure from being applied to the soft-tissue graft, and highly polished ovate forms were created to aid in the development of proximal papillae between the adjacent implants and the pontics, which was evident after 4 weeks of healing (Figure 12).

Tissue maturation was allowed for approximately 3 months prior to the initiation of definitive restorative therapy. By this point, physiologic scalloping of the mucosa had occurred to a significant extent (Figure 13). A definitive porcelain-fused-to-metal bridge, supported by the implants in the Nos. 5, 6, and 9 positions, was delivered after approximately 9 months of total treatment time (Figure 14 and Figure 15). The screw retention of the bridge was facilitated by the two SAC implants in the No. 6 and 9 locations and the straight implant in the


Fig 8.


Fig 9.


Fig 10.


Fig 11.


Fig 12.

Fig 8. The original prosthesis in place; the two implants on the right side were immediately provisionalized via screw retention. **Fig 9.** Ten weeks after surgery, a minor incision was utilized to remove the cover screw from and attach a healing abutment to the No. 9 implant. **Fig 10.** The original abutments supporting the fixed prosthesis were removed and cover screws placed. A chairside provisional FPD was fabricated and supported by the three implants placed in the No. 5, 6, and 9 positions, with screw retention. **Fig 11.** Healing abutments were temporarily placed on the three implants to prevent soft-tissue collapse during mucogingival surgery. A subepithelial connective tissue graft, harvested from the maxillary right mucosa, was used to submerge the two original implants (Nos. 7 and 8) and augment ridge volume. **Fig 12.** Four weeks after soft-tissue grafting. The pontics in the provisional FPD had been relieved and a highly polished ovate intaglio surface created, fostering papilla development in the site.

No. 5 position. This one-piece restoration was directly attached to the implants, negating the need for stock or custom abutments and cement retention.

Discussion

This case presented several challenges for the dental team to overcome. First, a pre-existing prosthesis, supported by implants and lacking adequate support from hard and soft tissues, was already present. Second, the patient wished to avoid the use of a removable prosthesis for any length of time. All surgical procedures needed to be performed with the understanding that retrievability of the original and transitional restorations was required. The reliance on screw retention played a critical role in the execution of this treatment plan. Immediately temporizing the No. 5 and 6 implants eliminated the need for a removable prosthesis during the osseointegration period. The pre-existing restoration allowed for undisturbed healing/integration of the implant in the No. 9 location. Although immediate temporization of these three implants may have been possible, it was not plausible to avoid occlusal loading of this long span.

Therefore, a more conservative approach was selected. The use of the three implants after successful osseointegration to support a fixed, transitional FPD allowed the original No. 7 and 8 implants to be maintained to support the hard tissues and the soft-tissue graft in a "tent pole" manner. This provided the surgeon the opportunity to augment the pontic region of the new, fixed prosthesis in both horizontal and vertical dimensions. Because the patient's desire to have a fixed restoration at all times was satisfied, time was able to be allowed for graft maturation and manipulation of the ovate pontics to achieve optimal soft-tissue scalloped architecture. Also, in the event of an unforeseen future complication associated with the two submerged implants, the screw-retained prosthesis could be removed and immediately replaced. Such an endeavor may not be predictable with a cement-retained bridge.

The selection of the implants in this case played a critical role in achieving success. The use of a tapered design, especially in the extraction sites, increased the probability of attaining the stability necessary for immediate temporization. Implants with a subcrestal angle correction allowed for screw retention of provisional and definitive prostheses directly to the implants. This not only eliminated the need for an intermediate abutment, thereby reducing cost, but also allowed a standard abutment screw to be used rather than an angle-correction system that may be less predictable regarding the maintenance of screw pre-load.[9]

Augmentation is another important element in these types of cases. Sufficient bone volume, especially on the facial aspect of implants, is crucial for long-term success.[13,14] The use of bone grafting around immediate implants has been proven to better maintain horizontal alveolar ridge dimensions compared to sites without bone grafts.[15] Thickness of the peri-implant soft tissues plays a role in the maintenance of crestal bone.[16] One of the current authors (BPL) described a method of increasing soft-tissue thickness around immediate implants utilizing the same dermal allograft used around the immediate implants in this case report.[17] From an esthetic perspective, thicker soft tissue conceals the underlying color of abutments regardless of their composition, such as gold, titanium, or white ceramic.[18] Ferrari et al showed that at least 2 mm soft-tissue thickness is necessary to avoid detectable changes in the color of mucosa caused by the underlying abutment.[19]


Fig 13.


Fig 14.


Fig 15.

Fig 13. After 12 weeks of tissue maturation, a scalloped architecture of the interproximal tissues had occurred. **Fig 14 and Fig 15.** Delivery of the screw-retained FPD (Nos. 5 through 9), retracted (Fig 14) and occlusal (Fig 15) views.

Selection of the proper implant–abutment connection also plays a vital role in bone maintenance[20] after osseointegration and soft-tissue thickness development.[21] Interestingly, the SAC implant demonstrates a larger platform-switch on the facial aspect compared to conventional platform-switched implants. This is termed the "variable platform-switch." Recently, this connection was used to improve soft-tissue thickness of the facial mucosa.[22]

Conclusion

As with any complex treatment plan, management of these types of multifaceted cases requires meticulous clinical and radiographic

examination. Proper diagnosis, treatment planning, and discussion of patient and doctor expectations must take place before the initiation of treatment. Envisioning the final outcome and working "backwards" to ensure all steps are accounted for is necessary.

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