

Minimally invasive surgical and prosthetic management of a failed implant in the esthetic zone

Sherif Said

INTRODUCTION

Management of the peri-implant soft tissue contours is a critical component of esthetic implant therapy. In patients with high esthetic demands, minimally invasive surgical techniques and prosthetic soft tissue development are important in achieving a seamless, naturally appearing implant supported restoration.

Prosthetic tissue conditioning and accurate translation of the restorative contours to the final restoration helps maintain the peri-implant tissue volume and architecture.

This case report demonstrates the management of a previously failed implant site with minimally invasive hard and soft tissue augmentation followed by the prosthetic sequence for development of the soft tissue architecture.

Replicating the natural soft tissue frame may present challenges for the clinician considering implant therapy in the esthetic zone. A harmonious gingival form and architecture are fundamental aspects of achieving peri-implant pink esthetics and for simulating a natural emergence for the future restoration. When adequate tissue architecture and volume are present, preservation of the available support may provide an improved esthetic outcome with less morbidity and no additional treatment required. Nevertheless, reconstruction of atrophic sites due to lost hard and soft tissue volume is often inevitable in the anterior zone. This may necessitate more complex grafting procedures with varying degrees of predictability.

Due to the inherent alveolar anatomy in the anterior zone, post-extraction ridge dimension alterations are more pronounced than in posterior segments. Tomographic studies have demonstrated that the average buccal bone thickness is less than 1 mm in 90% of anterior teeth.¹ This is compounded by the fact that the buccal plate (bundle bone)

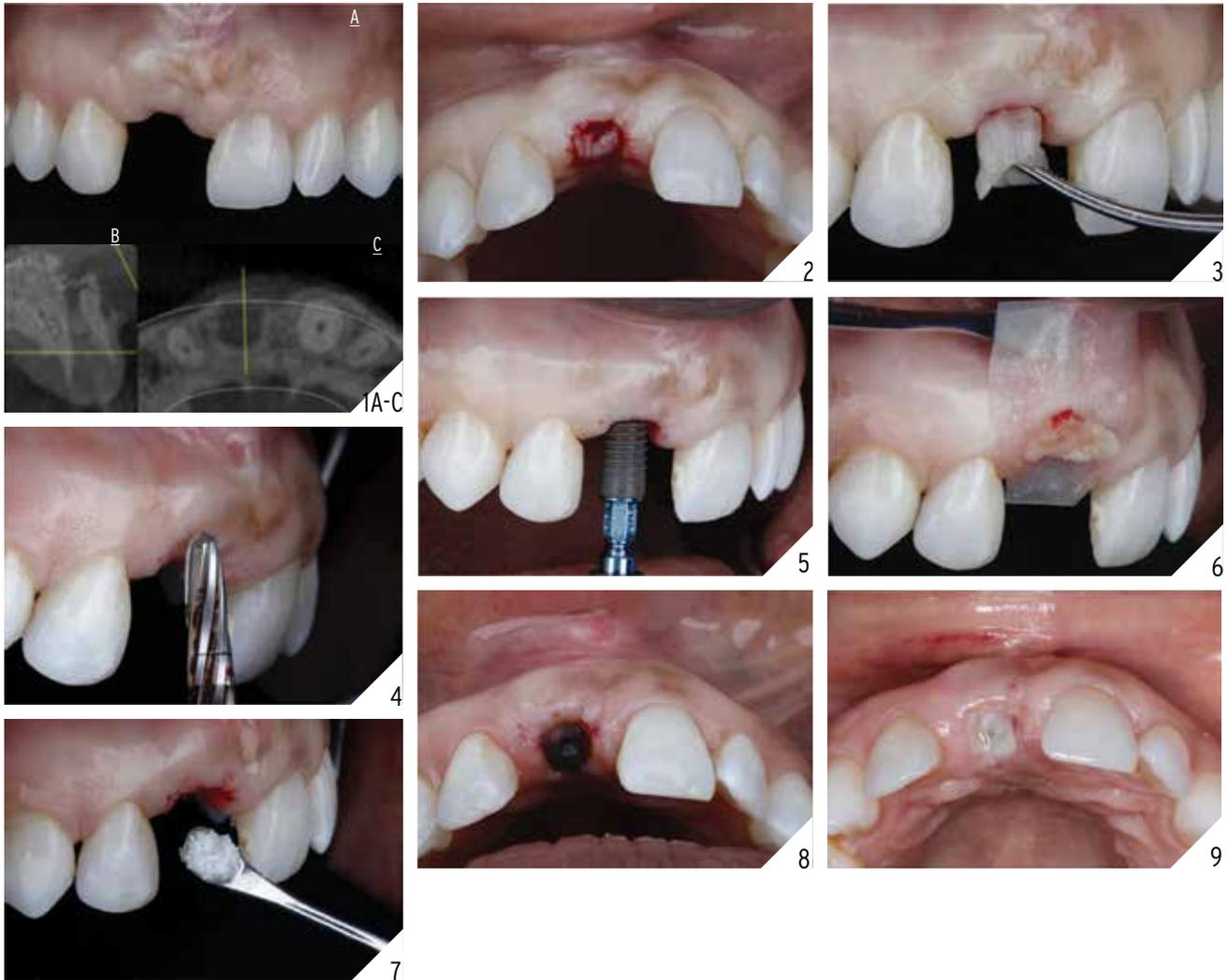
stems from the periodontal ligament of the tooth and inevitably undergoes remodeling once the tooth is extracted. Araujo et al.^{2,3} demonstrated a 40% reduction in ridge width following tooth extractions in dogs. Similar to extraction sites, alveolar ridge remodeling due to complications resulting from failed surgical procedures can result in significant tissue alterations with the subsequent need for more invasive procedures. Therefore, efforts to preserve the available tissue architecture and pre-emptively augment tissue volume should be attempted. If residual deficiencies are still present, further augmentation may be required at the time of implant placement and/or second stage uncovering.

In search of enhanced patient-centered outcomes, clinicians are constantly challenged to identify minimally invasive techniques that can perform comparable to gold standard therapy but ease the treatment process for patients. The need to advance flaps can result in movement of the mucogingival junction and a decreased vestibular depth which themselves may need further surgical corrective procedures. Consequently, the ability to avoid flap surgery for sites with severe bone loss allows a significant reduction to the extent of surgical procedures. Combined with the use of growth factor technology, recent literature demonstrated the potential to reduce patient morbidity while inducing bone growth with limited surgical intervention such as tunneling approaches.^{4,5}

In addition to the surgical aspect of treatment, accurate translation of the restorative contours from the provisional phase to final restoration is important to maintain the peri-implant tissue volume and architecture. This case report highlights the surgical and prosthetic procedures in managing a previously failed implant site with a growth factor mediated, minimally invasive approach for hard and soft tissue augmentation.

Dr. Said maintains private practice in Toronto, Ontario alongside his academic affiliation as clinical assistant professor in Boston University. His focus is on minimally invasive surgical protocols in periodontics & esthetic implant therapy.

Surgical and Prosthetic Reconstruction of a previously failed implant in the esthetic Zone.



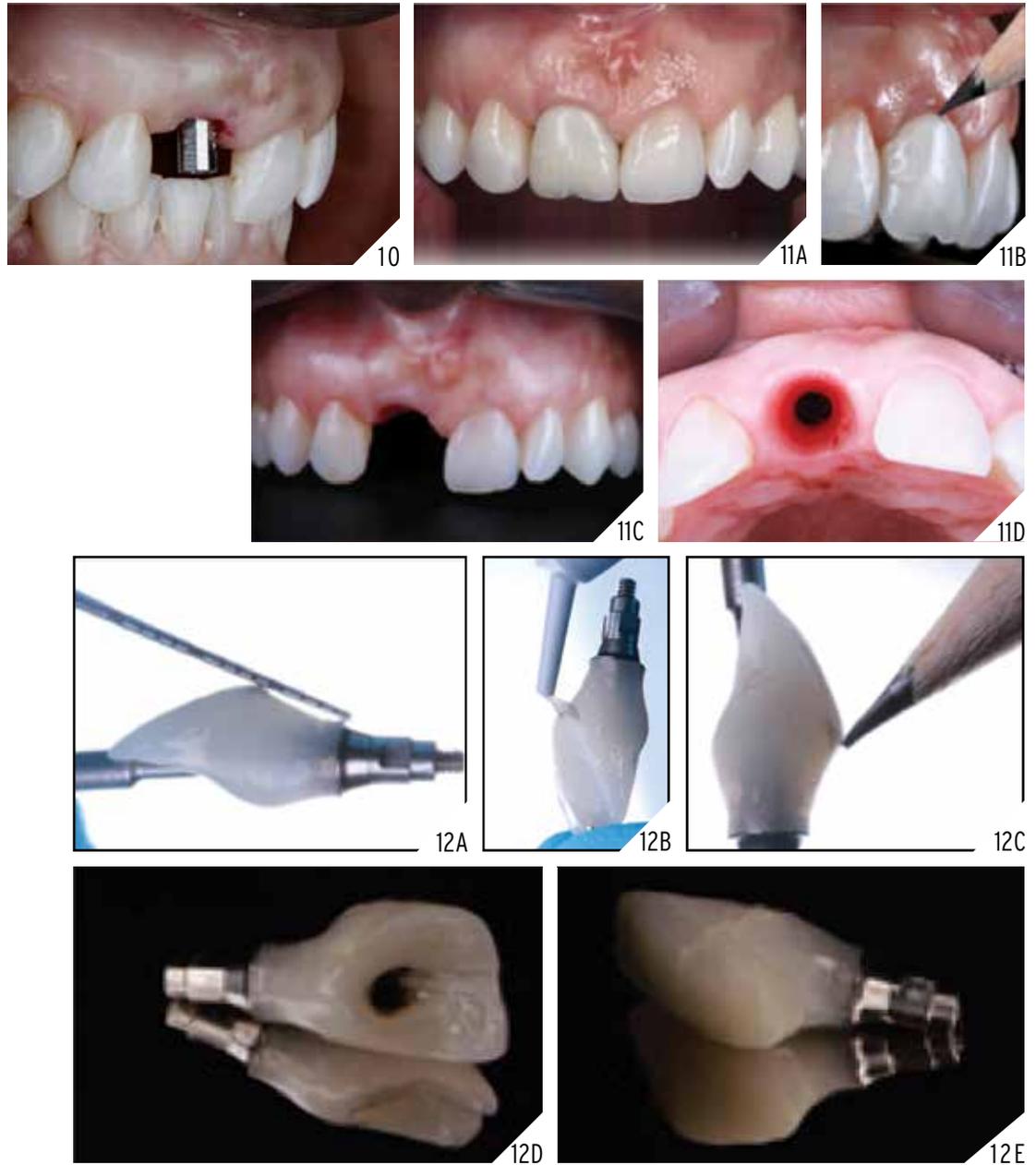
1A-C. Pre-operative condition following implant failure in site of a maxillary right central incisor. **2.** A tissue punch is performed to allow for sufficient room for implant and tissue manipulation based on the anticipated implant position. In this case the tissue is not discarded as it will be used for future soft tissue development later in the procedure. **3.** The tissue punch is removed from the base with a periosteal elevator. Note the whitish color of the tissue indicative of the dense collagenous nature owing to the minimal amounts of adipose and glandular content. **4.** The implant osteotomy is prepared through the created access utilizing Densah/Versah systems to aid in densifying the osteotomy and maximizing the preservation of the remaining alveolar bone for implant placement. **5.** Implant placement is performed utilizing a Straumann bone level tapered 4.1x12 mm with insertion torque value of >40Ncm. **6.** Full thickness tunnel preparation is performed utilizing tunneling instruments to allow for adequate room for membrane insertion. A Cross-linked collagen membrane is placed onto the buccal aspect of the implant and adjusted to extend 2-3 mm circumferentially around the buccal peri-implant osseous defect. The previously utilized tissue punch is dissected and used to augment the volume of the supra-implant soft tissue following placement of the bone graft material. **7.** A Growth factor enhanced bone matrix is introduced to the level of the implant platform to reconstitute the lost buccal bone topography. Following which the soft tissue graft is inserted coronal to the implant and secured in place with a pre-fabricated healing abutment. **9.** Immediate Post surgical view and 5 days post-operative view of the surgical site.

PRE-OPERATIVE SITUATION

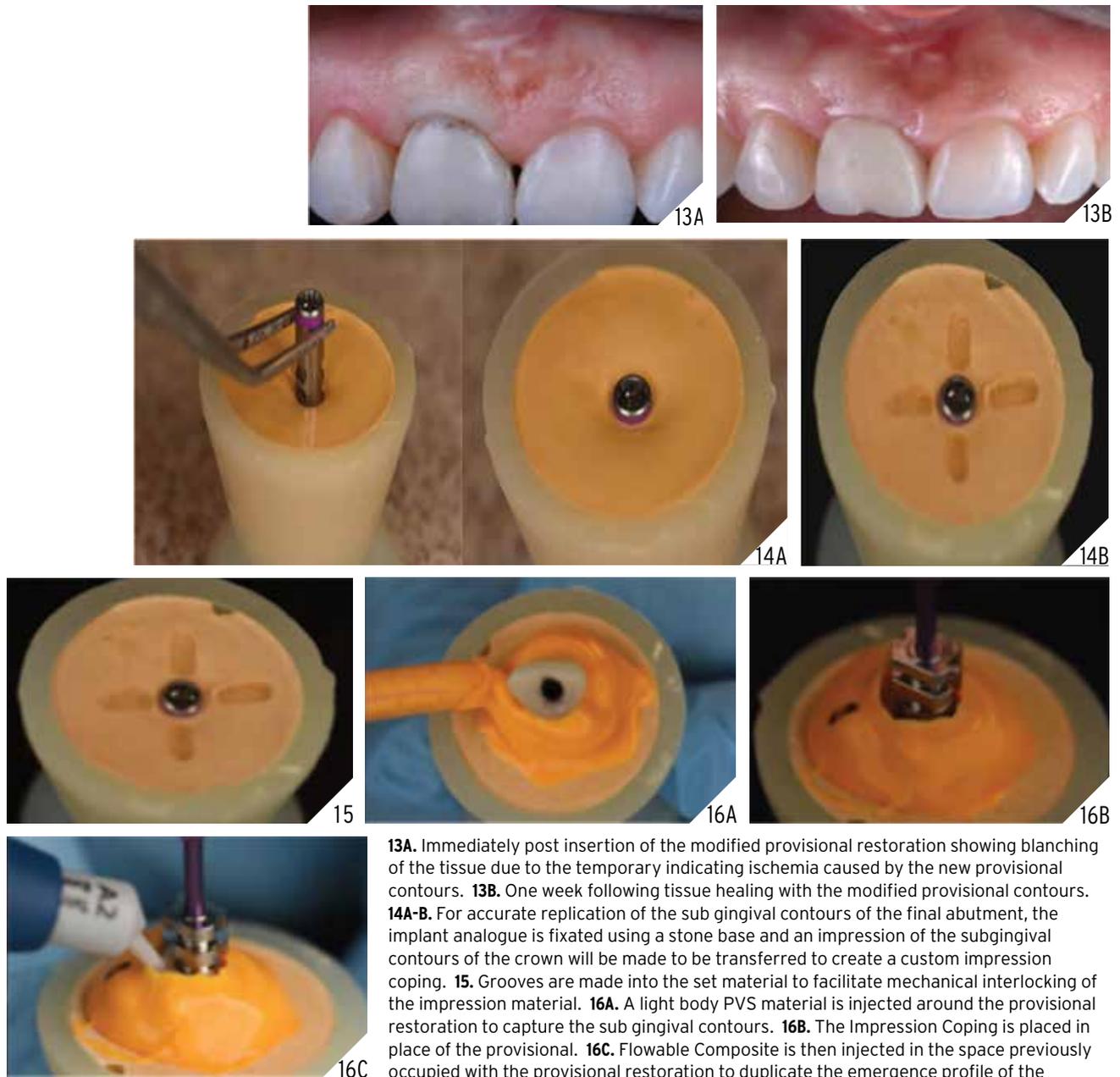
A 34-year-old, medically healthy patient presented four days after a failing implant was removed in the 1.1 site, de-

spite previous bone grafting attempts. Clinical evaluation revealed a thick tissue biotype with a moderate horizontal ridge deficiency. CBCT analysis re-

vealed an intact facial plate of bone and significant compromise of the remaining alveolus. A clear apical fenestration of the facial plate was noted with



10. Following implant integration, try-in of a provisional temporary abutment is performed and adjusted. **11A.** Following tissue maturation, fine tuning of the provisional restoration is performed to have a symmetrical length and gingival zenith for both central incisors. Note the gingival margin level discrepancy between the two central incisors. **11B.** The Gingival Zenith is outlined to allow for extra-oral adjustments to be performed. **11C-D.** Note the quality of the tissue following initial tissue conditioning. **12A-E.** Extra-oral Adjustments to the provisional restoration are made based on the predetermined gingival zenith adjustments. Flowable composite is added at the gingival contours to apically displace the gingival margin at the area desired. Subgingival contours of the provisional restoration are left straight or under-contoured to avoid tissue compression and allow space for adequate space for maintenance of the peri-implant soft tissue thickness.



13A. Immediately post insertion of the modified provisional restoration showing blanching of the tissue due to the temporary indicating ischemia caused by the new provisional contours. **13B.** One week following tissue healing with the modified provisional contours. **14A-B.** For accurate replication of the sub gingival contours of the final abutment, the implant analogue is fixated using a stone base and an impression of the subgingival contours of the crown will be made to be transferred to create a custom impression coping. **15.** Grooves are made into the set material to facilitate mechanical interlocking of the impression material. **16A.** A light body PVS material is injected around the provisional restoration to capture the sub gingival contours. **16B.** The Impression Coping is placed in place of the provisional. **16C.** Flowable Composite is then injected in the space previously occupied with the provisional restoration to duplicate the emergence profile of the restoration to the lab for custom abutment fabrication.

poorly integrated residual graft particles *Figure 1*. Considering the extensive soft tissue scarring from the previous augmentation procedures, the decision was made to perform flapless implant placement in a more palatal position combined with simultaneous bone and soft tissue augmentations.

SURGICAL TREATMENT

To enhance the soft tissue profile at the time of implant placement without additional morbidity to the patient, the access site for implant placement can be used to procure the soft tissue graft. A tissue punch is performed to allow suf-

ficient room for implant and tissue manipulation based on the anticipated implant position. Whether guided surgery or conventional techniques are used, the outline of the soft tissue punch should be slightly greater than the diameter of the final implant to be used. If a customized healing abutment or provisional crown



17. Prior to seating of the customized impression coping, note the concave subgingival contour mimicking that of the provisional abutment. Additionally, the need to advance flaps can result in alteration of the location of the mucogingival junction and vestibular reduction necessitating further surgical corrective procedures.
18A-B. Final crown insertion. 19. Smile.

is planned, the soft tissue punch may be performed to replicate the cross-section of the restorative component.

The outline of the soft tissue to be excised is done in a partial thickness fashion with the use of a scalpel blade or a pre-standardized tissue punch of the appropriate diameter (Fig. 2). A large round diamond bur is utilized to de-epithelialize within the outline of the punch. The incisions are then continued down to the osseous crest and the soft tissue is removed in a full thickness with the aid of a periosteal elevator. Depending on the shape and thickness of the soft tissue harvested, the tissue can be trimmed to the desired size and thickness.

Note the whitish color of the tissue indicative of the dense collagenous nature owing to the minimal amounts of adipose and glandular content (Fig. 3).

IMPLANT PROCEDURE

With the aid of magnification and piezo-surgical instrumentation, the site is debrided of any granulation tis-

sue and any loose graft particles. The process is repeated until the socket walls are clearly visualized. An osteotomy is then prepared through the punch access utilizing Densah/Versah systems to maximize the remaining alveolar bone for implant placement and enhance implant stability (Fig. 4). A Straumann bone level tapered 4.1 x 12 mm implant is placed towards the palatal with an insertion torque > 40 Ncm (Fig. 5). Following implant placement, a full thickness tunnel preparation is performed. With tunneling instrumentation, the gingiva is elevated 5 mm circumferentially around the peri-implant defect. Important: Over extension of the tunnel may negatively impact the stability of the bone graft and should be avoided. A cross-linked collagen membrane is placed onto the buccal aspect of the implant and adjusted to extend 2-3 mm circumferentially around the buccal peri-implant osseous defect (Fig. 6). High magnification is used to check the membrane adaptation and perform

any necessary adjustments. A growth factor-enhanced bone matrix is then introduced to the level of the implant platform to reconstitute the lost buccal bone topography (Fig. 7). Next, the soft tissue graft is inserted coronal to the implant and secured in place with a pre-fabricated healing abutment. No sutures were used due to the high stability of the surgical site (Fig. 8). Immediate post-surgical view and five days post-operative view of the surgical site showing stable and uneventful healing (Fig. 9).

PROSTHETIC STEPS

Following tissue maturation, a provisional restoration is placed to initiate soft tissue shaping. The provisional restoration was fabricated chair side utilizing a composite shell. Extra-oral adjustments of the provisional restoration are made based on the gingival zenith predetermined from the contralateral central incisor. Flowable composite is added to the provisional to apically

displace the gingival margin (*Fig. 11*). Subgingival contours of the provisional restoration are conversely left straight or under-contoured to avoid excessive tissue compression and provide adequate space for maintenance of the peri-implant soft tissue thickness (*Fig. 12*).⁶

The provisional restoration contours are replicated by fixating the implant analogue in a stone model (*Fig. 25*). Opposing grooves are made into the set material to facilitate mechanical interlocking of the impression material (*Fig. 26*). A light body PVS is injected around the provisional restoration to capture the sub-gingival contours (*Fig. 28*). The provisional restoration is then removed and the impression coping is placed. Flowable composite or self-curing acrylic are

used to fill in the gingival space. This is then transferred to the oral cavity for the impression. The resulting shape of the customized impression coping now mimics the sub-gingival contour of the provisional restoration, providing accurate information for the final restoration. This technique can also be performed by scanning the provisional restoration and replicating its contours in a custom-milled implant abutment.

Clinical views of the final restorations and CBCT showing the stability of the gingival margins following one year of loading.

CONCLUSION

Given the advances available to us in modern day medicine, clinicians should

attempt to decrease the level of invasiveness of their procedures and morbidity to their patients. Minimally invasive approaches combined with growth factor technology have demonstrated superior results in periodontal regeneration.^{7,8} Although further investigations are required to better assess the efficacy of tunnel guided bone regeneration procedures, the results from recent literature seems to be promising.^{4,9} This present case report illustrates the potential of minimally invasive approaches to treat compromised sites while maintaining the soft tissue esthetics and peri-implant soft tissue architecture. 

Oral Health welcomes this original article.

REFERENCES

1. Braut V, Bornstein MM, Belsler U, Buser D. Thickness of the anterior maxillary facial bone wall—a retrospective radiographic study using cone beam computed tomography. *Int J Periodontics Restorative Dent* 2011;31:125-131.
2. Araújo MG, Sukekava F, Wennström JL, Lindhe J. Tissue modeling following implant placement in fresh extraction sockets. *Clinical Oral Implants Research* 2006;17:615-624.
3. Araujo M, Linder E, Wennström J, Lindhe J. The influence of Bio-Oss Collagen on healing of an extraction socket: an experimental study in the dog. *International Journal of Periodontics & Restorative Dentistry* 2008;28.
4. Lee EA. Subperiosteal Minimally Invasive Aesthetic Ridge Augmentation Technique (SMART): A New Standard for Bone Reconstruction of the Jaws. *Int J Periodontics Restorative Dent* 2017;37:165-173.
5. Nevins ML, Camelo M, Nevins M, Schupbach P, Friedland B, Camelo JM, et al. Minimally invasive alveolar ridge augmentation procedure (tunneling technique) using rhPDGF-BB in combination with three matrices: a case series. *Int J Periodontics Restorative Dent* 2009;29:371-383.
6. Su H, Gonzalez-Martin O, Weisgold A, Lee E. Considerations of implant abutment and crown contour: critical contour and subcritical contour. *Int J Periodontics Restorative Dent* 2010;30:335-343.
7. Nevins M, Camelo M, Nevins ML, Schenk RK, Lynch SE. Periodontal regeneration in humans using recombinant human platelet-derived growth factor-BB (rhPDGF-BB) and allogenic bone. *J Periodontol* 2003;74:1282-1292.
8. Nevins M, Garber D, Hanratty JJ, McAllister BS, Nevins ML, Salama M, et al. Human histologic evaluation of anorganic bovine bone mineral combined with recombinant human platelet-derived growth factor BB in maxillary sinus augmentation: case series study. *Int J Periodontics Restorative Dent* 2009;29:583-591.
9. Nevins ML, Said S. Minimally invasive esthetic ridge preservation with growth-factor enhanced bone matrix. *J Esthet Restor Dent* 2018;30:180-186.