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Management of midfacial recession defects around adjacent maxillary implants using 'screw tent-pole' technique

Author_Bach Le, DDS, MD, FICD, FACD

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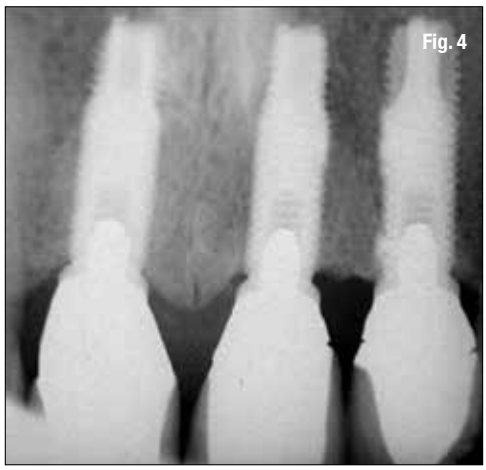
_Soft-tissue recession around dental implants often results in metal exposure and can present a major esthetic challenge.[1,2,3] Unfortunately, soft-tissue recessions around implants have been frequently observed,[4] with one study reporting midfacial recessions greater than 1 mm were present in 61 percent of the cases.[5] Treatment and coverage of periimplant soft-tissue recessions can be challenging despite reports in the literature indicating that recessions up to 2 mm can be successfully grafted with a combination of coronally advanced flap and subepithelial connective tissue grafts.[1,3] Long-term data on the success of these grafting techniques is limited.[3, 6-7]

Thoma, et al, conducted a systematic review[8] and reported that the combination of an apically positioned flap/vestibuloplasty and soft-tissue augmentation using a free gingival graft, subepithelial connective tissue graft or collagen matrix resulted in a 1.4-3.3 mm increase in keratinized tissue. Overall, soft-tissue connective tissue augmentation resulted in the best gains in soft-tissue volume at implant and partially edentulous sites, and a combination of better papilla fill and higher marginal mucosal levels as compared to non-grafted sites around immediately placed dental implants.[8] A recent systemic review[9] did not find a single acceptable randomized clinical triall (RCT) in the world literature to recommend the best incision designs, suturing techniques or materials to correct or augment periimplant soft tissues.

One of the aim of soft-tissue augmentation procedures is to correct mucosal recession. To address bone loss and associated gingival recession around implants in the esthetic zone, a combination of guided bone regeneration (GBR)[10] and soft-tissue augmentation[11] are often performed. When multiple implants are placed in the esthetic zone, vertical and horizontal bone augmentation of more than 2 mm from the implant platform is often necessary to overcome the normal pattern of bone remodeling and soft-tissue recession.[12] The use of coronally advanced flaps and connective tissue grafts can sometimes jeopardize the esthetic appearance of the treatment site by altering the color and thickness of the transplanted tissues.[13]

The use of a particulate mineralized bone allograft covered with a collagen membrane (GBR) for the correction of gingival recession has been reported in the dental literature by Le, et al.[14] This case report demonstrates an innovative surgical technique to restore hard tissue and increase mucosal width and keratinized gingival height around maxillary implants in the esthetic zone without the color discrepancy associated with soft-tissue grafts.

Figs. 1-2_ Patient with gingival recession and discoloration due to exposure of the underlying dental implants (teeth No. 7, 8, 9) three years after implant placement. Note the lack of keratinized peri-implant mucosa. (Photos/Provided by Dr. Bach Le)



Figs. 3-4_ Patient with gingival recession and discoloration due to exposure of the underlying dental implants (teeth No. 7, 8, 9) three years after implant placement. Note the lack of keratinized peri-implant mucosa.

Fig. 5_Flap elevation illustrating labial bone dehiscence and implant exposure.

_Case report

The patient was a healthy 22-year-old male non-smoker with a history of traumatic fracture of the maxillary right lateral incisor and two central incisors. The teeth were extracted with immediate placement of three external hex dental implants (Biomet 3i Dental, Palm Beach Gardens, Fla.). Three years after definitive restoration, the patient presented with a chief complaint of, "I can see the metal portion of my implants." Examination at this time revealed long unesthetic maxillary crowns with visible abutment metal and a dark shadow along the gingival sulcus (Figs. 1-4). Clinical and radiographic evaluations were conducted to assess the patient's soft-tissue health, position and emergence profile of the implant relative to the alveolar housing and adjacent teeth, gingival contour, amount of gingiva visibility when the patient smiled, and the shapes of the prosthetic and clinical crowns. There were no active signs of inflammation or infection around the peri-implant mucosa and all three implants appeared to be in good three-dimensional position. A two-stage surgical approach was planned. The first stage would involve augmentation of the missing labial bone using guided bone regeneration with tenting screws ("screw tent-pole" technique described by Le, et al), followed by a second stage surgery to remove the middle implant with additional bone augmentation to develop a pontic site. Following a healing period, provisional restorations would be used to sculpt the soft-tissue architecture prior to definitive restorations.

On the day of surgery, the patient was asked to rinse with 0.12 percent chlorhexidine gluconate (15 mL) prior to IV sedation. A crestal incision and distal, curvilinear, vertical incision that followed the gingival margin of the distal proximal tooth were made. A full-thickness, subperiosteal flap[15] was elevated to expose two to three times the treatment area (Figs. 5-6). Significant labial bone loss was noted in the anterior maxilla with moderate thread exposure on two adjacent implants. Decontamination of the implant surfaces was not performed because the patient did not exhibit signs of mucositis, periimplantitis-related infection or purulence around the peri-implant gingival sulci. The soft tissue was generously released and advanced to ensure tension-free closure.

Prior to graft placement, three roughened titanium tenting screws were placed 3-4 mm below the implant platforms to create a tenting effect over the graft site and help reduce tension over the graft (Fig. 6). Mineralized bone allograft was placed over the defect sites and over-contoured by approximately 20-30 percent to compensate for the anticipated

At the AO

Dr. Bach Le will be one of the Academy of Osseointegration's 'Morning with the Masters' presenters at AO's upcoming annual meeting on Friday, March 2, at the Los Angeles Convention Center. His presentation is titled, 'Strategies for Managing Severe Implant Failures in the Esthetic Zone.'

Fig. 6 _Screw 'tent-pole' grafting technique; placement of three titanium tenting screws placed 3-4 mm below the gingival margin.

Fig. 7_Placement of a mineralized allograft material over the defect site with coverage with a pericardial membrane.

Fig. 8_Re-entry at four months after grafting showing excellent graft healing and consolidation over the previous defect.

Fig. 9_The middle implant at the maxillary right central incisor position was removed in the second surgery to create a pontic site.

apical migration and partial resorption of the augmentation material during remodeling (Fig. 7). Prior to use, the allograft material was hydrated according to the manufacturer's directions and mixed with the patient's blood, which served as a coagulant. After graft placement, the material was covered with a percardial membrane.

The mucoperiosteal flap was approximated and sutured in place. The patient was provided with an interim prosthesis to be worn during four months of healing and was dismissed with postoperative instructions, antibiotics and analgesics until the follow-up visit seven to 10 days later.

After a four-month healing period, a second-stage surgery was performed to remove the middle implant in the maxillary right central incisor position to create a pontic site (Figs. 8-9). The "screw tent-pole" technique was again utilized with mineralized allograft and a collagen membrane for additional vertical augmentation of the pontic site (Figs. 10-11). A consolidation period of 12 months was allowed to ensure proper maturation of the bone and overlying soft tissue (Fig. 12). Screw-retained provisional restoration were utilized (Fig. 13) for six months to develop the soft-tissue architecture prior to the delivery of the definitive restoration (Fig. 14).

The final restoration with soft-tissue profile is shown at eight years (Figs. 15-16) and 13 years (Fig. 17) follow-up, along with CBCT and periapical views (Fig. 18-20). There were no complications or adverse events during surgery or postoperative healing. The preoperative crestal bone thickness for both implants increased to 1.8 mm and 2 mm, respectively, approximately one year after treatment. Significant increases in soft-tissue thickness, keratinized tissue width and gingival height were also unexpectedly achieved and maintained through 12 years of follow-up.

_Discussion

This clinical case reports on unexpected improvements in peri-implant soft-tissue dimensions after GBR procedures to correct labial dehiscences around implants in the maxillary anterior jaw. Peri-implant bone loss can result in soft-tissue resorption followed by plaque attachment at or near the implant-abutment interface. This, in turn, can trigger soft-tissue inflammation with additional bone loss and gingival recession.[16-20] It has been reported that gingival margin levels may be affected by the thickness of the gingival tissues and that a thin tissue biotype may favor apical displacement of the soft tissue margin.[21] To maintain gingival health, maintaining an adequate width (~2 mm) of keratinized gingiva around dental implants has been suggested;[16,19,21] however, this has been disputed.[22] A correlation has been reported between the presence of keratinized tissue and plaque levels and the incidence of mucositis.[20] It has been

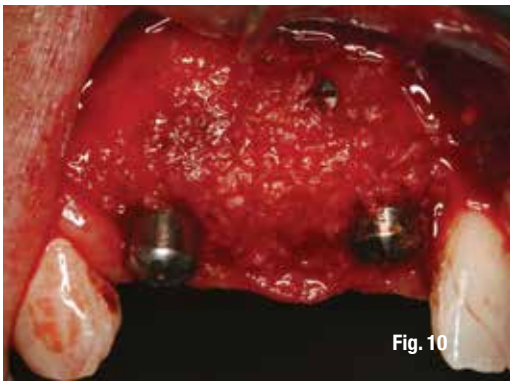


Fig. 10


Fig. 11


Fig. 12


Fig. 13


Fig. 14


Fig. 15

Figs. 10-11 _Screw tent-pole grafting technique was again employed to enhance the vertical dimension of the pontic site. The mineralized allograft was covered with a cross-link collagen membrane.

Fig. 12_Healing at 12 months after implant removal. Note improvement in the vertical height of the ridge and soft tissue dimensions around the implants at the pontic site.

Fig. 13_Screw-retained provisional restoration.

Fig. 14_Delivery of definitive restoration.

Fig. 15_Eight years follow-up.

suggested that sites with minimal keratinized tissue might be prone to a lower incidence of periodontal pocket formation.[20,23]

In the anterior maxilla, as labial bone thickness resorbs, there is a corresponding loss in labial soft-tissue thickness around the implant.[24] Moderate recession can make thin, pink gingival tissues appear dark because of the presence of the underlying metal abutment and implant, and further bone loss can cause unsightly metal exposure above the gingival margin. In general, implants carry a higher risk of soft-tissue complications when placed in thin tissue biotypes or with labial inclinations when the labial plate thickness is <2 mm.[24-25] Use of an opaque abutment, such as zirconia, has been reported to produce the least amount of gingival color change when gingival thickness was <2 mm, whereas any abutment material resulted in satisfactory esthetics when gingival tissue thickness was >2 mm.[24,26]

The goal of the GBR procedures in the present case was to treat the facial bone defects as well as restore the esthetic gingival margin. The efficacy of allografts and GBR surgical protocols in repairing alveolar defects is documented in the dental literature.[27-29] While some allogenic[30-31] and xenogenic[32] tissues have demonstrated efficacy in soft-tissue augmentation, the use of a collagen membranes with a mineralized allograft for soft-tissue augmentation is not well-documented. In the present case, use of a collagen membrane in combination with a mineralized bone allograft resulted in gain in keratinized tissue width and gingival height.

While the goal of the GBR procedure was to treat the bone defect in the present case, improvements were coincidentally observed not only in the soft-tissue dehiscence, but also in the keratinized tissue width and soft-tissue thickness. The use of mineralized allograft placed around 1.5 mm titanium screws ("screw tentpole") to tent out the soft-tissue matrix and periosteum has been previously reported for successful alveolar ridge reconstruction.[33] Although there are no reports of a GBR procedure resulting in clinical increases in both of the latter soft-tissue dimensions, a limited number of retrospective studies[14,24,34] have reported an increase in soft-tissue thickness around dental implants primarily in the

_about the author

Dr. Bach Le completed specialty training in oral and maxillofacial surgery at Oregon Health Sciences University. He is currently clinical associate professor of oral and maxillofacial surgery at the Herman Ostrow School of Dentistry at USC, where he has been an active faculty member since 2000. Le has lectured internationally on bone regeneration and dental implant-related surgery and has taught on six continents. He has authored or co-authored more than 13 chapters in textbooks on bone regeneration and dental implants and has published extensively in peer-review journals. Le served as editor of the dental implant section of the recognized Fonseca Oral & Maxillofacial Surgery textbook (third edition), released in 2017. His primary focus has been in hard- and soft-tissue regeneration improving esthetic outcomes. He has been a main-podium speaker at numerous organizations, including the American Association of Oral and Maxillofacial Surgeons, the Academy of Osseointegration, the American Academy of Esthetic Dentistry, American Academy of Implant Dentistry, the American College of Prosthodontists, the Greater New York Academy of Prosthodontists and the International Congress of Oral Implantologists. Le was inducted as an honorary member of the American College of Prosthodontists in 2014 and is a recipient of the Charles E. English Award in Clinical Science for "the most significant article" published in the Journal of Implant Dentistry for 2008. He is a diplomate of the American Association of Oral and Maxillofacial Surgeons, the American Dental Society of Anesthesiologist and the International Congress of Oral Implantologists.


Fig. 16


Fig. 17


Fig. 18


Fig. 19


Fig. 20

Fig. 16_Eight years follow-up.
Fig. 17_13 years follow-up, illustrating continued tissue stability.
Figs. 18-20_CBCT and periapical views at eight years after GBR procedure. showing stable bone and healthy tissue thickess around both implants.

anterior maxilla after increasing the thickness of the facial bone through GBR.

Furthermore, the membrane placed over the particulate graft in the present clinical case was essentially a collagen matrix similar to a connective tissue graft, which adds to the thickness of the overlying tissue.[35] Scoring of the periosteum and underlying bone tissue prior to grafting and foreign body reaction from placement of a graft and membrane may also result in scar tissue formation that augments the soft-tissue profile. The present technique is not ideal for restoring the gingival margins for poorly positioned implants or when there is significant thread exposure. For example, implants placed outside of the alveolar housing or with significant labial inclination associated with labial bone loss should be excluded.

Zucchelli et al.[36] reported on a surgical-prosthetic treatment for implants with buccal soft-tissue dehiscence defects in the esthetic zone. The technique involved removing the crown, shortening the abutment and then treating the dehiscence defect with a coronally advanced flap and connective tissue graft.[36] After one year, mean soft-tissue dehiscence coverage was 96.3 percent with complete coverage in 75 percent of the treatment sites.[36] While patients were satisfied during short-term follow-up, the ability to camouflage a bony defect with or without exposed implant threads is highly limited without the support of the underlying bone, which is the main cause of soft-tissue recession.[24, 37-38]

In addition to soft-tissue recession, marginal bone loss has been associated with increased peri-implant stress concentrations in the crestal bone region. Over time, elevated stress concentrations can trigger additional bone loss and further soft-tissue recession.[39] If left untreated, increased stresses can result in screw loosening, metal fatigue and component fracture over time.[39-40] Implants placed in the anterior maxillary jaw with thin buccal plates are highly susceptible to the adverse effects of marginal bone loss.[39-40]

In summary, the use of a mineralized bone allograft and a collagen membrane effectively increased alveolar hard- and soft-tissue dimensions in the esthetic zone of the anterior maxilla. Restoring the missing buccal bone decreased the risk of developing peri-implantitis from bacterial biofilm attachment to the exposed implant-abutment crevice and roughened implant surface. Secondly, the soft-tissue thickness was increased, which made the restored tissues more resistant to future recession and mask the underlying titanium components.[31,40-41] Thirdly, guided bone regeneration also unexpectedly increased the width of keratinized tissue, which has also been reported to help provide a peri-implant soft-tissue seal against bacterial invasion, in addition to providing resistance against recession.[33]

While increases in soft-tissue thickness and keratinized tissue width have been reported after placement of connective tissue and free gingival grafts,[33] this phenomena has not been previously reported after guided bone regeneration procedures around dental implants. The author has reported the results of using this same technique in 11 patients who achieved similar outcomes after short-term follow-up.[14]

The value of individual clinical case reports is that their anecdotal data can provide preliminary evidence for developing new hypotheses that lead to larger randomized clinical trials,[42] which are needed to determine if the present approach will effectively serve as an alternative for soft-tissue augmentation in instances where tissue thickening is needed._

References available upon request from the publisher.

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