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

By Dr Bach Le, USA

Soft-tissue recession around dental implants often results in metal exposure and can present a major aesthetic challenge.1-3 Unfortunately, soft-tissue recessions around implants have been frequently observed, with one study reporting midfacial recessions greater than 1 mm were present in 64 percent of the cases.1 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 treated 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.1-3

Thoma, et al, conducted a systematic review4 and reported that the combination of apically positioned flap/ventriloquial and soft-tissue augmentation using a free gingival graft, subepithelial connective tissue graft or collagen matrix resulted in a 1.4-3 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 immediately placed dental implants.4 A recent systematic review5 did not find a single acceptable randomised clinical trial (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 main goals of soft-tissue augmentation procedures is to correct mucosal recession. To address bone loss and associated gingival recession implants in the aesthetic zone, a combination of guided bone regeneration (GBR)6 and soft-tissue augmentation7 are often performed. When multiple implants are placed in the aesthetic zone, vertical and horizontal bone augmentation of more than 3 mm from the implant platform is often necessary to overcome the normal pattern of bone remodeling and soft-tissue recession.7 The use of coronally advanced flaps and connective tissue grafts sometimes jeopardize the aesthetic appearance of the treatment site by altering the colour and thickness of the transplanted tissues.8

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.9 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 aesthetic zone without the colour discrepancy associated with soft-tissue grafts.

Case report

The patient was a healthy 70-year-old male nonsmoker 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 implantation, the patient presented with a chief complaint of, “I can see the metal portion of my implant.” Examination at this time revealed long unesthetic maxillary crowns with viable 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 (0.12 percent) prior to IV sedation. A crestal incision and distal, curvilinear, vertical incisions followed by the gingival margin of the distal proximal tooth were made. A full-thickness, subperiosteal flap 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 more moderate thickness exposure on two adjacent implants. Decontamination of the implant surfaces was not performed because the patient did not exhibit signs of mucositis, perimplantitis 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 to create a vertical effect over the graft site and help reduce tension over the graft (Fig. 6). Mineralized bone allograft was placed over the defect sites and covered with a pericardial membrane to allow for proper maturation of the bone and overlying soft tissue. The “screw tentpole” 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 21 months was allowed to ensure proper maturation of the bone and overlying soft tissue (Fig. 12). Screw-retained provisional restorations were utilized (Fig. 13) for six months to develop the soft-tissue architecture prior to the delivery of the final restoration. 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 surgical procedure was performed to remove the middle implant in the maxillary right central incisor position to create a pontic site (Figs. 8-9). The “screw tentpole” technique was again utilized with mineralized allograft and a collagen membrane for additional vertical augmentation of the pontic site.

Figs. 1-2: Patient with gingival recession and discolouration 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 discolouration 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.

Fig. 6: Screw ‘tent-pole’ grafting technique; placement of three titanium tenting screws 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.
the definitive restoration (Fig. 14).

Discussion
This clinical case reports on unex-
eted improvements in peri-implant soft-tissue dimensions after GBR procedures to correct labial dehiscences around implants in the maxillary anterior area. Premolar-implant bone loss can result in soft-tissue resorption followed by plaque at-
tachment at or near the implant abutment interface. This, in turn, can trigger soft-tissue inflammation with additional bone loss and gingi-
val recession.20,23 It has been reported that gingival margin levels may be affected by the thickness of the gingi-
val tissues and that a thin tissue biotype may favor apical replace-
ment of the soft tissue margin.21 To maintain gingival health, maintain-
ing an adequate width (~2 mm) of keratinised tissue on either side of the gingival margin is essential.6,7 As a result, significant increases in soft-
tissue thickness may result in gingival inflammation.34

In the anterior maxilla, as labial bone thickness resorbs, there is a corresponding loss in labial soft-
tissue thickness at the implant abutment area. Moderate recession can make thin, pink gingival tissues appear dark be-
cause of the presence of the under-
lying metal abutment and implant, and further bone loss can cause un-
expected metal exposure above the gingival margin. In general, implants can develop and be attributed to multiple com-
lications when placed in thin tissue biotypes or with labial inclinations when the labial implant thickness is <2 mm.35,36 Use of an opaque abutment, such as zirconia, has been reported to produce the least amount of gingi-
val colour change when gingival thickness was <2 mm, whereas any abutment material resulted in unsat-
sactory aesthetics when gingival tissue thickness was ≥2 mm.37

The goal of the GBR procedures in the present case was to treat the fac-
tal bone defects as well as restore the aesthetic gingival margin. The efficacy of allografts and GBR surgi-
cal protocols in repairing alveolar defects is well documented in the dental literature.6,16,38 While some allogeneic bone and xenogeneic tissues have demonstrated efficacy in soft-tissue augmentation, the use of collagen membranes with a mineralized allog-
ograft for soft-tissue augmentation is not well documented. In the present case, use of a collagen membrane in conjunction 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 mineral-
ed allograft placed around 1.5 mm titanium screws (“screw template”) to tent out the soft-tissue matrix and periosteum has been previously re-
ported for successful alveolar ridge reconstruc-
tion.39 Although there are no reports of a GBR procedure result-
ing in clinical improvements in both of the latter soft-tissue dimensions, a lim-
ited number of retrospective stud-
ies have reported an increase in soft-tissue thickness around dental implants primarily in the anterior maxilla after increasing the thick-
ness of the facial bone through GBR.40

Furthermore, the membrane placed over the particular graft in the pre-
sent clinical case was essentially a collagen matrix similar to a connec-
tive tissue graft, which adds to the thickness of the overlying tissue. Scoring of the periosteum and un-
derlying bone tissue prior to graft-
ning and foreign body reaction from placement of a graft and membrane may also result in scar tissue forma-
tion that augments the soft-tissue profile. The present technique is not ideal for restoring the gingival mar-
gins for poorly positioned implants or when there is significant thread exposure. For example, implant placed outside of the alveolar hous-
ing or with significant labial inclina-
tion associated with labial bone loss should be excluded.

Zucchelli et al.2 reported on a sur-
gical-prosthetic treatment for im-
plants with buccal soft-tissue dehis-
cence defects in the aesthetic 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.6 After one year, mean soft-tissue de-
hiscence coverage was 96.3 percent with complete coverage in 75 per-
cent of the treatment sites.41 While patients were satisfied during short-
term follow-up, the ability to camou-
flage a bony defect with or without additional implant threads is highly limited without the support of the underlying bone, which is the main-
cause of soft-tissue recessions.6,7

In addition to soft-tissue recession, marginal bone loss has been associ-
ated with increased peri-implant stress concentrations in the crestal bone region. Over time, elevated stress concentrations can trigger ad-
ditional bone loss and further soft-
tissue recession.42 If left untreated, increased stresses can result in screw loosening, metal fatigue and compo-
ment fracture over time.43,44 Implants placed in the anterior maxillary jaw with thin buccal plates are highly susceptible to the adverse effects of marginal bone loss.45

In summary, the use of a mineral-
ed bone allograft and a collagen membrane effectively increased al-
veolar hard- and soft-tissue dimen-
sions in the aesthetic zone of the anterior maxilla. Restoring the missing bony height and decreased the risk of developing peri-implantitis from bacterial biofilm attachment to notching of the abutment crevice and roughened implant surface. Sec-
ondly, the soft tissue thickness was increased, which made the restored tissues more resistant to future re-
modeling and thus less likely to develop underlying components.46-48 Thirdly, guided bone regeneration also expectedly 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 the pro-
viding resistance against recession.49 While increases in soft-tissue thick-
ness and keratinized tissue width have been reported after placement of connective tissue and free gingi-
val grafts,50 this phenomenon has not been previously reported after gui-
ded 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.51

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,52 which are needed to deter-
mine if the present approach will effectively serve as an alternative for soft-tissue augmentation in instanc-
es where tissue thickness is needed.

References
1. Field S. Peri-implant mucosal reces-

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Dental Tribune Middle East & Africa Edition  |  1/2019 17

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