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

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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.4 Treatment and coverage of perimplant 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.5 Long-term data on the success of these grafting techniques is limited.6–8

Thoma, et al, conducted a systematic review9 and reported that the combination of apically positioned flap/ventriloquyoplasty 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.9 A recent systematic review10 did not find a single acceptable randomized clinical trial (RCT) in the world literature to recommend the best incision designs, suturing techniques or materials to correct or augment peri-implant soft tissues.

One of the aims of soft-tissue augmentation procedures is to correct mucosal recession. To address bone loss and associated gingival recession around implants in the aesthetic zone, a combination of guided bone regeneration (GBR)11 and soft-tissue augmentation are often performed. When multiple implants are placed in the aesthetic 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 is sometimes jeopardize the aesthetic appearance of the treatment site by altering the colour and thickness of the transplanted tissues.13

Fig. 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)

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

Case report
The patient was a healthy 20-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 (Bi-omet 31; Dental, Palm Beach Gardens, Fla). Three years after the implant 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 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 to the mucogingival junction was made, and a combination of better papilla fill and higher marginal mucosal levels were generated; the transplanted tissues.13

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.

The “screw tentpole” technique was described by Le, et al, and consists of additional vertical augmentation of the maxillary right central incisor position using a titanium screw placed 3–4 mm below the gingival margin (Fig. 8). 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 11 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 definitive restorations.

Fig. 3: Flap elevation illustrating labial bone dehiscence and implant exposure.

Fig. 4: Screw ‘tent-pole’ grafting technique: placement of three titanium tenting screws placed 3–4 mm below the gingival margin.

Fig. 5: Flap elevation illustrating labial bone dehiscence and implant exposure.

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 pericellular membrane.
The definitive restoration (Fig. 14).

The final restoration with soft-tissue prominence is shown at eight years (Figs. 19-20) and 13 years (Fig. 17) follow-ups, along with CBCT and periapical views (Figs. 18-20). There were no complications or adverse events during the surgery or postoperative healing. The periodontal crestal bone thickness for both implants increased to 1.4 and 2.0 mm, respectively, approximately one year after treatment. Significant increases in soft-tissue thickness, keratinised tissue width and gingival height were also unexpectedly achieved and maintained through 12 years of follow up.

Discussion
This clinical case report on unexpected improvements in peri-implant soft-tissue dimensions after GBR procedures to correct labial dehiscences around implants in the maxillary anterior area. Peri-implant bone loss can result in soft-tissue resorption followed by plaque attachment at near the implant-abutment interface. This, in turn, can trigger soft-tissue inflammation with additional bone loss and gingival recession. It has been reported that gingival margin levels may be affected by the thickness of the gingival tissue and that a thin tissue type may favour apical displacement of the soft tissue margins. To maintain gingival health, maintaining an adequate width (~2 mm) of keratinised gingiva around dental implants has been suggested. However, this has been disputed. A correlation has been reported between the presence of keratinised tissue and plaque levels and the incidence of mucositis. It has been suggested that sites with minimal keratinised tissue might be prone to a lower incidence of periodontal pocket formation.

In the anterior maxilla, as labial bone thickness decreases, there is a corresponding loss in gingival soft tissue height and the implant-abutment distance. 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 unintended metal exposure above the gingival margin. In general, implants caused significant bone resorption and alveolar com pulsions when placed in thin tissue biotypes or with labial inclinations when the labial plate thickness was less than 2 mm. Use of an opaque abutment, such as zirconia, has been reported to produce the least amount of gingival colour change when gingival thickness was less than 2 mm, whereas any abutment material used in factory aesthetics when gingival tissue weakness was 1.5 mm.

The goal of the GBR procedures in the present case was to treat the facial bone defects as well as restore the aesthetic gingival margin. The efficacy of allografts and GBR surgical protocols in repairing alveolar defects is documented in the dental literature. While some allogeneic and xenogeneic tissues have demonstrated efficacy in soft-tissue augmentation, the use of collagen membranes with a mineralized allograft for soft-tissue augmentation is not well documented. In the present case, use of a collagen membrane with the mineralized 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 keratinised tissue width and soft-tissue thickness. The use of mineralized allograft placed around 1.5 mm titanium screws (“screw template”) to tent out the soft-tissue matrix and periosteum has been previously reported for successful alveolar ridge reconstruction. 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 have reported an increase in soft-tissue thickness around dental implants primarily in the anterior maxilla after increasing the thickness of the facial bone through GBR.

Furthermore, the membrane placed over the particular 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. 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, implant placed outside of the alveolar housing or with significant labial inclination associated with labial bone loss should be excluded.

Zucchelli et al. reported on a surgical-esthetic treatment for implants with buccal soft-tissue deficiencies 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. After one year, mean soft-tissue deficiency coverage was 95.3 percent with complete coverage in 75 percent of the treatment sites. While patients were satisfied during the short-term follow-up, the ability to camouflage a bony defect with or without implant-threading implants is highly limited without the support of the underlying bone, which is the main cause of soft-tissue recession.

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. If left untreated, increased stresses can result in screw loosening, metal fatigue and component fracture over time. Implants placed in the anterior maxillary jaw with thin buccal plates are highly susceptible to the adverse effects of marginal bone loss.

In summary, the use of a mineralized bone allograft and a collagen membrane effectively increased alveolar hard- and soft-tissue dimensions in the aesthetic zone of the anterior maxilla. Restoring the missing bone grafts and decreased the risk of developing peri-implantitis from bacterial biofilm attachment to the implant surface and roughened implant surface. Secondly, the soft-tissue thickness was increased, which made the restored tissues more resistant to future recession and reduction of the underlying titanium components. Thirdly, guided bone regeneration also expectedly increased the width of keratinised tissue, which has also been reported to help provide a peri-implant soft-tissue seal against bacterial invasion, in addition to protecting resistance against recession. While increases in soft-tissue thickness and keratinised tissue width have been reported after placement of connective tissue and free gingival grafts, this phenomenon 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.

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, 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

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