Minimally Invasive Treatment of Soft Tissue Deficiency Around an Implant-Supported Restoration in the Esthetic Zone: Modified VISTA Technique Case Report

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The horizontal and vertical soft tissue dimension around an implant-supported restoration in the maxillary anterior is one of the determining factors for achieving an esthetic result. In this case report, the patient presented with a deficiency in both dimensions around a single-tooth implanted-supported restoration in the anterior maxilla. The soft tissue defects were augmented with a connective tissue graft that was placed underneath the buccal peri-implant tissue using a frenum access incision and a supraperiosteal tunneling approach (modified vestibular Incision supraperiosteal tunnel access [VISTA] technique). This novel technique resulted in an increase in tissue height and width, which suggests its potential use around implant-supported restorations.

Key Words: soft tissue augmentation, recession, dental implant, soft tissue deficiency

Introduction

Treating a soft tissue defect around an implant-supported restoration in the esthetic zone is still a challenging problem for today's clinicians. So far, there is no predictable way of correcting a soft tissue defect around an implant-supported crown. Currently, only one prospective cohort study[1] and a couple of case reports[2,3] describe successful treatment of soft tissue defects around implant-supported restorations. Burkhardt et al[1] treated 10 patients with mucosal defects around implant-supported restorations in the maxillary anterior with coronally advanced flaps in combination with connective tissue grafts.

Over the course of 6 months, soft tissue thickness and initial recession coverage decreased from 75% to 66%. In contrast, performing the same procedure on natural teeth can achieve 78% to 89% root coverage.[4,5] These numbers demonstrate that a connective tissue graft in combination with a coronally advanced flap around implant-supported restorations is not as successful as it would be around natural teeth.

Several factors might negatively influence healing around implant-supported restorations after soft tissue grafting. For example, there are structural differences between soft tissue around dental implants and natural teeth. In comparison to healthy tissue around teeth, soft tissue around dental implants has decreased vascularity[6] and a reduced collagen to fibroblast ratio.[7] The appearance of soft tissue around implant-supported restorations has been compared with that of scar tissue that forms after a surgical intervention,[1] and its structural support and vascularization come solely from underlying bone. Soft tissue around natural teeth is characterized by supracrestal fibers that insert into the cementum, high vascularity, periodontal ligament space, and alveolar bone where periodontal fibers are inserting. In addition, cementum is more biocompatible than metal abutments or porcelain crowns and, therefore, soft tissue can form connective attachment[8] to a tooth instead of only a long junctional epithelium.[9] All this might explain the challenge associated with successful soft tissue grafting around dental implants because structural support and vascularization are prerequisites for achieving a sufficient amount of augmentation.

Zadeh[10] described a surgical flap technique for root coverage around maxillary teeth called VISTA (vestibular incision subperiostal tunnel approach). A midline frenum access incision is used to access the buccal tissue and prepare a tunnel. This tunnel preparation toward the gingival margin of the maxillary anterior teeth releases flap tension, preserves vascularization, and, therefore, might positively affect clinical outcome.[11] A graft can be placed through the frenum incision line underneath the flap and moved coronally to cover the recession. Because a conventional tunneling approach uses only a small intrasulcular incision, through which the soft tissue graft can be placed, the access through a frenum incision is broader and might, therefore, result in less trauma to the soft tissue collar due to tearing of the sulcular tissue.

Taking into account the nature of soft tissue around implant-supported restorations, we altered this minimally invasive technique and used it to address a soft tissue defect

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Figures 1 and 2. Figure 1. (a) Patient presents with a high smile showing all gingival margins and papillae. (b and c) The left upper maxillary incisor (#9) had a fistula and a horizontal fracture (periapical radiograph). Keratinized tissue was approximately 4 mm wide, and the patient's periodontal tissue type was determined to be thin. In addition, #9 had a facial recession of 0.5 mm.The papilla between #8 and #9 was slightly deficient due to interproximal bone loss visible on the periapical radiograph. **Figure 2.** Clinical presentation before soft tissue augmentation. (a) Before the modified VISTA (vestibular incision subperiostal tunnel approach) procedure, the gingival margin was more than 1 mm apical to the margin of the adjacent tooth. (b) The horizontal tissue dimension was reduced and appeared sunken in, especially in the coronal aspect. Both deficiencies were severe enough to be noticeable when the patient smiled.

around an implant-supported restoration. Furthermore, we modified VISTA to a supraperiosteal flap design instead of the original full-thickness approach and combined it with a connective tissue grafting procedure to augment deficient soft tissue around an implant-supported restoration. In the current case report, we describe the surgical and restorative steps associated with the treatment.

Case Report and Material and Methods

Initial surgical and restorative phase

A 25-year-old woman presented for evaluation of tooth #9 in June 2010. The patient was systemically healthy, was a nonsmoker, and had a high smile line (Figure 1a). Tooth #9 had been endodontically treated after sustaining a trauma in 2007. A fistula on the buccal of #9 developed during the following months, and the root canal was subsequently retreated. However, the fistula remained, and examination using gutta percha markings and a periapical radiograph revealed a horizontal fracture (Figure 1a and c). Because of the apical location of the fracture line, the tooth was deemed nonrestorable, and it was decided to replace it with an implant-supported restoration.

An atraumatic flapless extraction was performed to preserve tooth-supporting bone. Nevertheless, a large buccal fenestration (around 4 mm $\times$ 6 mm) was detected in the area of the previous fistula. The extraction socket was grafted with an allograft (FDBA, AlloGraft cancellous, Straumann, Andover, MA). The lesion within the socket and the socket orifice were covered with a collagen membrane (Dynamatrix Extracelluar membrane, Keystone Dental, Burlington, Mass).[12] To achieve primary flap closure without releasing a facial mucogingival flap, the socket was sealed with a free gingival graft as previously described by Landsberg et al.[13] This technique facilitates closure after tooth extraction without changing the original location of the mucogingival junction. The #9 space was temporally restored using the natural crown of #9, which was connected to teeth #8 and #10 using Ribbond lingual mesh (Ribbond, Seattle, Wash) and flowable composite (shade A2, Filtek Supreme Ultra Flowable Restorative Refill, 3M ESPE). To avoid interferences during wound healing, the cervical part of the previous crown was reduced to leave a vertical space of 1–2 mm.

The patient was seen 1 week after the procedure to reinforce the composite bonding. During subsequent visits, additional composite was added underneath the pontic and the vertical gap between the edentulous ridge, and the bonded tooth crown was filled in. Seven months after socket preservation, a dental implant was placed (Osseotite Tapered Certain 4 $\times$ 10 mm, Biomet 3i, Palm Beach Gardens, Fla). At this time, the interdental papilla had receded 1 mm, and a reduction of the horizontal tissue dimension (1–2 mm) was detected on the facial aspect. To compensate for the horizontal tissue loss, the facial area was augmented with a xenograft (Endobon, Biomet 3i), and the graft particles were covered with a collagen membrane (Dynamatrix Extracelluar membrane, Keystone Dental). Because the grafted area did not extend toward the coronal part of the ridge and the implant had been placed with a torque $>$40 Ncm, an immediate temporary restoration was placed.

For this purpose, a hexed open-tray impression coping (Certain EP Pick-Up Coping [Non-Hexed] 4.1 mm (D) $\times$ 4.1 mm [P], Biomet 3i) was screwed into the implant and an impression was taken using interocclusal record material (Blue-mousse Impression Material, Parkell, Edgewood, NY). A screw-retained

temporary was fabricated in the laboratory using a PEEK (polyetheretherketone) abutment (Certain PreFormance Temporary Cylinder [Hexed] 4.1 mm (D), Biomet 3i) as a base. The provisional restoration was adjusted to avoid all centric and eccentric contacts. Furthermore, the profile on the labial abutment surface was kept flat to concave to encourage tissue growth into a more coronal position. Also, the subgingival profile in the interproximal space between #8 and #9 was made more convex to mold the tissue toward the proximal surface of the adjacent tooth and, therefore, move the currently deficient papilla coronally.

The patient presented for a follow-up appointment 1 week after surgery and every 2 weeks subsequently to control plaque accumulation and observe the progress in healing. Six months after implant placement, the soft tissue had receded approximately 1 mm on the facial aspect of the crown, and the horizontal tissue dimension was still insufficient in the previously grafted area (Figure 2a and b). Keratinized tissue was approximately 4 mm wide, and the patient's periodontal tissue type was determined to be thin.[14] Periodontal probing of the neighboring teeth revealed readings in the a 1–2 mm range and no bleeding on probing. Because the patient had a high smile line, both tissue defects were visible when the patient smiled. Therefore, it was decided to further augment the soft tissue before placing a permanent restoration.

Soft tissue augmentation using modified VISTA technique

To facilitate the grafting procedure, the contour and length of the temporary crown needed to be adjusted before surgery. The artificial cement enamel junction (CEJ) was moved 2 mm coronally to the CEJ of the adjacent teeth and contour of the temporary abutment below that artificial CEJ was kept flat to allow for good flap adaptation. The area was anesthetized with lidocaine 2% 1:100 000 epinephrine and marcaine 0.5% 1:200 000 epinephrine using local infiltration. A frenectomy was performed with a triangular incision using a scalpel with a 15c blade (Figures 3a and 4a).

The resulting tissue opening was used to access the facial area and to prepare a split-thickness flap using an Allen end cutting intrasulcular knife (Hu-Friedy, Chicago, IL) and an Allen modified Orban knife (Hu-Friedy) (Figures 3b and 4b). The dissection tunnel was extended toward the gingival sulcus ,and care was taken not to perforate the flap. Periosteum was left intact on the bony surface of the facial plate to protect the previously placed graft material and to provide better vascularity.[15] To mobilize the flap, the tunnel was extended toward the lateral incisor. Afterward, we used a periodontal probe to test whether the flap could be easily moved 2 mm more coronally than the CEJ of adjacent teeth to allow for overbuilding soft tissue.

After preparing the recipient bed, a connective tissue graft was harvested from the palate using a 2-incision technique.[16] Measurements of the graft took into consideration the amount of recession and adjusted for sufficient overlap to the lateral into the papilla area. The graft was placed underneath the tunnel flap and stabilized with interrupted sutures (Vicryl 5-0, Ethicon) on the periosteum (Figure 3c). Afterward, the split thickness flap was advanced 2 mm coronal to the CEJ of the adjacent teeth with a modified sling suture (Vicryl 5-0). Knots were tightened in the middle of the buccal gingiva instead of the interdental gingiva to secure the underlying graft. The graft was left partially exposed in the frenectomy area (Figure 3d).

The patient was given pain medication (ibuprofen 800 mg, 1 tablet every 8 hours as need for pain) and was asked to rinse with 0.5 oz of Peridex Chlorhexidine Gluconate 0.12% (3M ESPE) for 30 seconds twice a day until the follow up appointment 1 week later. In addition, the patient was instructed to eat a soft diet and not to pull on her upper lip. Brushing in this area was restricted for 3 weeks.

The patient came back for follow up at 1, 2, 4, 6, 12, and 24 weeks (Figure 5a). Soft tissue dimension was stable during those 6 months. Six months after the surgical procedure, an implant level impression (open tray hexed 4.1 mm engaging impression coping, BioMet 3i) was taken to fabricate the final restoration in the laboratory. After evaluating study models, implant angulation and soft tissue thickness (>3 mm), it was decided to fabricate a porcelain-fused to metal crown cemented on a hexed type IV gold custom abutment. During subsequent appointments, the abutment was tried in to verify that its margins were located 1 mm subgingivally (Figure 5b and c). Using a manual prosthetic wrench, the custom abutment was torqued to 20 Ncm following the manufacturer's recommendation. During subsequent visits, the crown was evaluated until shape, color, and tissue appearance were satisfactory. At this point, the crown was cemented using Temp-bond temporary cement (Kerr, Orange, Calif).

After insertion, the patient was seen for follow-up visits to check tissue health and occlusion. One year after soft tissue augmentation and 4 months after crown placement, tissue levels remained stable (Figure 6). We offered to perform gingivoplasty on the site to further improve the color match to #8. The patient declined. She was satisfied with the esthetic result.

Discussion

Maxillary implant placement in patients with a high smile line is challenging because of esthetic considerations. We used soft tissue grafting to treat a soft tissue deficiency around a single implant-supported restoration. The original tooth had been removed atraumatically without raising a mucogingival flap. This extraction technique might cause less soft tissue recession and subsequent change in ridge dimensions than elevating a facial flap.[17] It has been shown in previous studies that flap elevation can cause bone resorption[18] and concomitant soft tissue recession.[19] Nevertheless, in the patient in the present case, the mesial papilla of #9 receded 1 mm and the soft tissue on the buccal aspect of #9 lost 2 mm in the horizontal dimension after tooth extraction and simultaneous socket grafting. The compromised horizontal tissue dimension was especially visible when the patient smiled as it affected tissue coloration.

While placing a dental implant, guided bone regeneration was performed to augment the horizontal dimension and address the loss of ridge width. A temporary crown was delivered to support the coronal soft tissue. The crown was adjusted during healing to improve soft tissue contour. Adjusting the critical contour (area close to gingival margin)

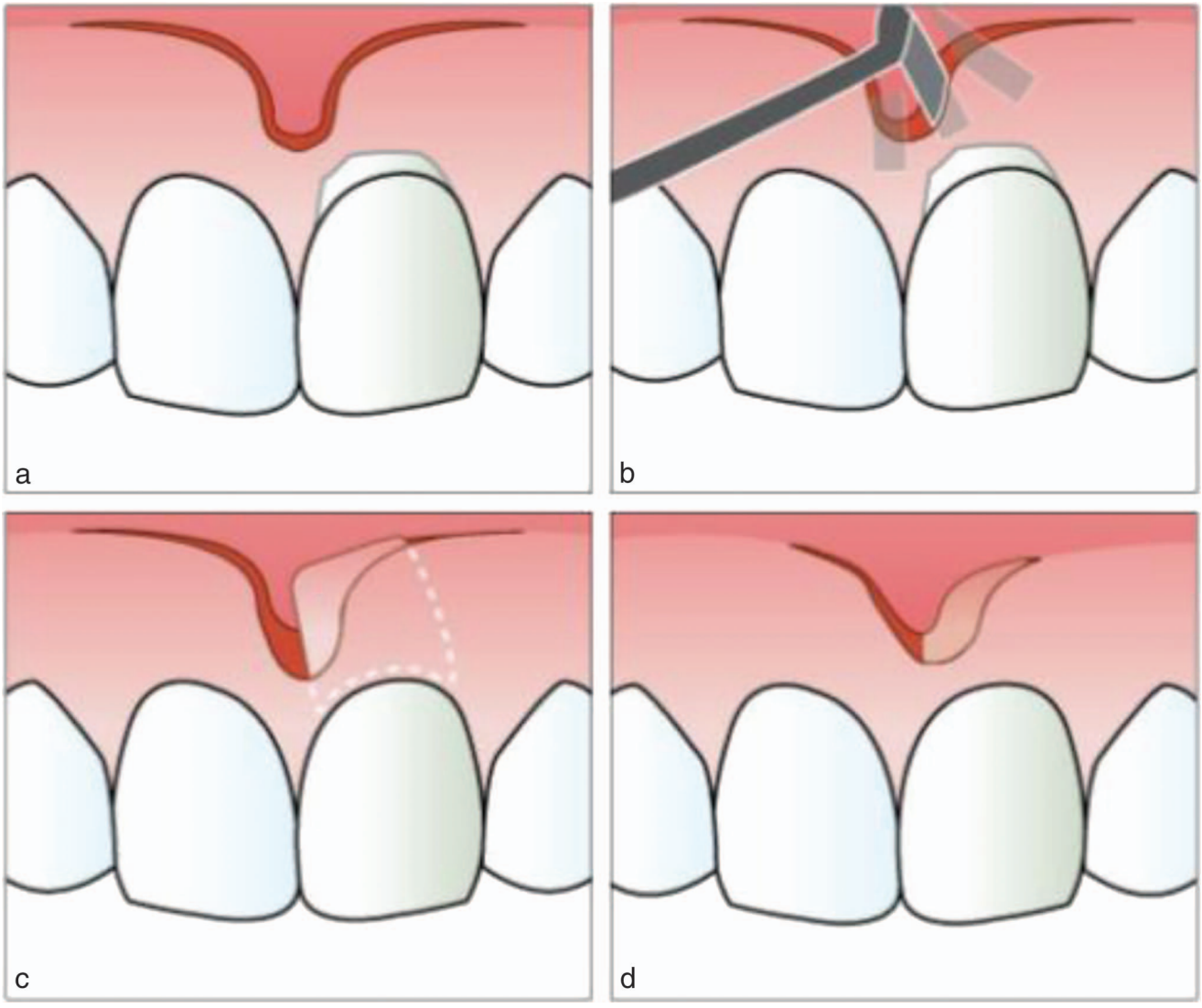

Figure 3. Modified VISTA (vestibular incision subperiostal tunnel approach) soft tissue augmentation procedure. (a) A frenectomy was performed with a triangular incision using a scalpel with a 15c blade. (b) The buccal area was accessed through the frenum incision in the vestibule, and a split thickness tunnel flap was prepared. The tunnel flap extended toward the gingival sulcus and the lateral incisor. (c) A connective tissue was harvested and placed underneath the split thickness flap envelope. (d) The connective graft was stabilized with interrupted sutures, and the mucogingival flap was advanced coronally.

and subcritical contour (area apical to the critical contour) during the healing phase can improve soft tissue appearance, whereas inappropriate contours of a temporary crown may cause further soft tissue recession.[20] However, despite contouring the temporary restoration and augmenting the facial area, the horizontal tissue dimension remained compromised, and the gingival margin remained 1 mm apical to the margin of #8. Both deficiencies were severe enough to be noticeable when the patient smiled. Therefore, a soft tissue augmentation procedure was planned to correct those defects before a permanent implant-supported restoration was fabricated.

We selected the VISTA technique, which had been originally used for the treatment of root recession, and customized it to address the specific soft tissue defects in our patient. The technique has several advantages over a conventional tunneling approach. Entering the surgical site through the vestibule by dissecting the frenum is less technique sensitive than preparing a tunnel flap from the sulcus because of the thick fibrous tissue of the frenum and accessibility of the area. In contrast to the original VISTA flap technique, we prepared a split thickness tunnel flap instead of a full thickness subperiosteum tunnel flap.[10] The split thickness flap did not interfere with the previously placed graft and might have prevented further bone loss by leaving the periosteum intact and, therefore, preserving vascularity.[15]

We used the patient's own connective tissue for this grafting procedure. Connective tissue is an established treatment option for general root coverage.[5] Criticism usually involves patient discomfort and tissue morbidity due to tissue harvest from a second surgical site. Therefore, Mareque-Bueno[3] used acellular dermal matrix and a coronally advanced flap to graft a recession around an implant-supported restoration. Six

Figures 4–6. Figure 4. (a) Before the start of the surgical procedure, the cement enamel junction of the crown was moved 2 mm coronally and the crown profile was flattened to create additional space for the advancement of the flap. A frenectomy was performed with a triangular incision using a scalpel with a 15c blade. (b) Using an Allen end cutting intrasulcular knife, the buccal area was accessed and a split thickness tunnel flap was prepared. **Figure 5.** Healing after soft tissue augmentation and prosthetic phase. (a) The patient was seen 6 months after soft tissue augmentation. The picture depicts uneventful healing and a stable gingival margin. (b and c) The final abutment was tried in and the fit verified. **Figure 6.** Follow-up after placement of final restoration (frontal and occlusal view). (a and b) The patient was seen 1 year after soft tissue augmentation and 4 months after crown placement. The gingival margins remained stable. The overall soft tissue architecture was now close to the one before removal of tooth #9.

months after the procedure, 67% of the recession was covered. Nevertheless, in the current patient we used a connective tissue graft as previous studies showed that acellular dermal matrix can shrink significantly over time, resulting in a recurring recession during long term follow-up.[21]

Immediately after surgery, we detected an increase in the soft tissue horizontal dimension by 1–2 mm (within 5 mm from the gingival margin). During the healing phase, contour and contact points of the temporary crown were continuously adjusted, and an additional increase in papilla height (around 0.5 mm) was measured. It has to be taken into account, that one of the most determining factors in papilla presence and height is the amount of interproximal bone. This dictates, and might therefore limit, the amount of papilla regeneration.[22,23]

Several publications used placement of connective tissue grafts at different stages of implant therapy to increase and

preserve horizontal tissue dimensions. Grunder[24] showed that buccal placement of connective tissue at the time of immediate implant placement can increase horizontal soft tissue dimension by 1 mm in comparison with a control group. Burkhardt et al[1] evaluated recession coverage around implant-supported restorations 6 months after a conventional coronally advanced flap in combination with a connective tissue graft. They detected that an average of 2/3 of the original recession was covered. In line with these studies, Schneider et al[25] and Lee et al[25] used soft tissue grafting at dental implant sites immediately at the time of placement or at the second-stage procedure when a healing abutment was attached to improve soft tissue architecture. Stability of the gingival level[27–29] and the changes in soft tissue dimensions[30] after crown delivery are similar to that of other reports. There is still a slight deficiency of the mesial papilla height. However, the overall soft tissue architecture was very close to the pre-extraction situation, and the patient was very satisfied with the clinical outcome.

Conclusion

Modification of the VISTA technique seems to be a promising method for enhancing soft tissue dimensions around implant-supported restoration in the anterior maxilla.

Abbreviations

CEJ: cement enamel junction

VISTA: vestibular incision subperiosteal tunnel access

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