Allograft Augmentation Of The Soft Tissue

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An inadequate zone of attached keratinized tissue around the anterior natural dentition has been well documented in the Periodontal literature as a complication associated with the esthetics and long term maintenance.[1] The absence of a zone of attached keratinized tissue can lead to apical migration of the free gingival margin from the cervical position on the natural tooth/ implant. This can result from an inadequate thickness or height of the attached keratinized tissue. The clinical result of these soft tissue defects may lead to; cervical root caries, root surface sensitivity, reduced home care (secondary to sensitivity during home oral hygiene), resulting bone loss leading to esthetic compromises which may lead ultimately potential tooth loss[2]. The clinician needs to be cognizant that the connection between the soft tissue and dental implant is different than found associated with the natural dentition.[3] The soft tissue connection histologically differs between the implant and natural tooth with fiber orientation and attachment differences. Fiber orientation with natural teeth has the fibers attached perpendicular to the long axis of the teeth, providing a naturally resistant zone to help preserve the soft tissue attachment. Whereas, fiber orientation between the soft tissue and implant, orients these fibers parallel to the long axis of the implant fixture. This provides a weaker zone with a greater potential for attachment loss. Potentially this may lead to peri-implant mucositis when there is inadequate attached soft tissue.[4] Additionally, this may lead to loss of the implant fixture secondary to inflammation related bone loss.[5]

A common clinical situation requiring soft tissue manipulation and/or augmentation occurs in conjunction with reconstruction of both dental implants and natural tooth. The problem arises when there is an inadequate volume of soft tissue to yield a convex ridge form or inadequate tissue thickness. Excessive tissue translucency may fail to mask the transmission of the implant collar or metal substructure under the porcelain prosthetics on natural tooth/teeth. The gray discoloration transmitting through the surface of the gingival/ peri-implant tissues creates the appearance of dark zone at the crestal area. These deficiencies can lead to esthetic failures despite adequate bone volume, proper implant placement, implant integration into the surrounding osseous bed or proper implant restoration.[6] Typically, soft tissue grafts utilized to reconstruct inadequate soft tissue have been accomplished using the patient's own palatal tissue harvested at the time of soft tissue augmentation surgery. The clinical goal of this treatment is to cover the exposed implant surface or to thicken and widen the band of attached keratinized tissue.[7] Patient morbidity at the donor site has been the major disadvantage of this source of soft tissue.

This includes: pain, bleeding and tenderness at the donor site. Accompanying interference with eating, swallowing and phonation secondary to donor site surgery increase the impact of the surgery on the patient. When palatal mucosal tissue is selected for soft tissue onlay grafting, an esthetic liability may result due to the different comparative surface texture and color between the donor tissue and the recipient bed tissue. Because palatal tissue has a higher collagen content then the tissue in the recipient site there is a possibility of a color mismatch and a more keloid/scar like appearance following healing.[8] More importantly, the amount of soft tissue available to reconstruct a defect is limited by the amount of soft tissue the clinician is able to harvest at a single surgery, or in the authors experience possibly a decision to complete the reconstruction using multiple surgeries. Human Acellular Dermal Matrix (ADM), has demonstrated when being placed under a coronally positioned facial/buccal gingival flap to show similar clinical results as a connective tissue autologous graft procedure in terms of root coverage and predictability of gaining 100% coverage.[9] Also providing an increase in tissue thickness[10] and histologically attaches in a similar fashion to the patients own harvested connective tissue.[11]

When treating gingival recession, the safety and efficacy of ADM has been shown in numerous studies to match host harvested connective tissue as ADM is an allograft of human dermis.[12,13] The processing of the ADM material removes the cells from the connective tissue eliminating the possibility of graft rejection due to an immune response to residual cells. The remaining extracellular matrix remains structurally intact, the vascular channels acting as a scaffold for the body to reestablish vascularity through the graft. With time the grafted tissue becomes indistinguishable from the patients surrounding tissue.[14] This allows the healing process to incorporate the ADM material so that it resembles tissue regeneration that is due to graft incorporation and replacement rather than the scar tissue formation that occurs when the extracellular matrix is structurally damaged.[15]

Allogenic soft tissue is expected to offer the same surgical performance as autogenous tissue, but with some caveats. Since ADM has no living cells within its structure, it serves as a tissue scaffold into which the patient's own cells proliferate. Therefore, a lag time between graft placement and graft maturation is to be expected, which is not experienced when using autogenous tissue.[16] Additionally, as ADM has a lower density of collagen fibers within its matrix then does autogenous palatal tissue the final tissue tonicity of ADM is less like palatal tissue and more like the surrounding

soft tissue in the recipient area.[17] The surgeon is also not restricted to how much tissue can be harvested from a donor site and more extensive grafting can be accomplished in the same surgical appointment. Surgical instrumentation required for the techniques to be discussed in the clinical cases presented are the same as utilized in traditional periodontal flap surgery.[18] The required items for these procedures include sterile saline (for rehydration of the ADM) and sterile stainless steel graft prep cups (3.5" x 2") to hold the saline and ADM for rehydration. Different manufacturers of ADM have different rehydration protocols and the authors recommend that these instructions be followed to achieve predictable surgical results. Resorbable sutures for graft stabilization and flap closure eliminates the need for suture removal during the post surgical visits improving patient comfort. This also eliminates wicking of bacteria that is observed with silk sutures. As Gut and Chromic Gut sutures may not retain their tensile strength long enough to allow for wound stabilization and graft integration it is suggested that these materials be avoided for these procedures.[19] Whereas, Polyglycolic Acid (PGA) sutures retain the bulk of their tensile strength for up to 3-4 weeks and will provide adequate wound stabilization during graft integration.[20]

CASE 1: SUBMUCOSAL SOFT TISSUE AUGMENTATION

Local anesthesia is administered. It is recommended that local anesthetics with high concentrations of vasoconstrictors be avoided as they may compromise the blood supply to the overlying flap. Following administration of the local anesthetic while awaiting anesthesia to develop, the ADM is rehydrated according to manufacturer's instructions. (Figure 1)

Figure 1: Preoperative view of implant site at the maxillary central incisor demonstrating adequate bone volume but inadequate soft tissue contour.

A 15c surgical blade creates a split thickness buccal flap extending between the proximal line angles of the adjacent teeth. Initiation of the incision begins along the alveolar crest. The dissection extends beyond the mucogingival junction (MGJ) to create a buccal pouch to receive the ADM. The blade is angled towards the bone to reduce the risk of flap perforation. (Figure 2)

Figure 2: Sulcular incisions and a crestal incision allowing elevation of a buccal pouch without the need for vertical releasing incisions. The buccal flap was extended beyond the mucogingival junction to prepare for reception of an ADM soft tissue graft. Adequate bone volume to accommodate a dental implant is present.

Utilizing a new 15c blade, while holding the flap with tissue forceps, the periosteum is scored to increase its stretchability with care being taken not to perforate the flap. The periosteum is incised to a depth of no more than 2 mm. The tips of a pair of closed Iris scissors are inserted into the periosteal score and opened with the blades of the scissors perpendicular to the incision line. This blunt dissection allows for expansion of the buccal flap to accommodate the ADM.

This technique requires that the basement membrane side of the ADM face in a particular direction. Depending on manufacturer of the ADM the allograft may or may not have a basement membrane present. Alloderm (BioHorizons Birmingham, AL, USA) presents with a basement membrane side whereas Purous Dermis (Zimmer, Carlsbad, CA USA) does not. Identification of the basement membrane side may be assisted by contacting the ADM to blood in the recipient bed. The basement membrane side will not absorb blood ("white" side) and the non basement membrane side will absorb the blood and turn red ("red" side). Orientation of the reconstituted ADM with the basement membrane side towards the alveolar bone and its connective tissue side is facing the flap (Figure 3).

Figure 3: ADM rolled following reconstitution that has been tacked with 5-0 PGA sutures to stabilize the graft.

The ADM is inserted into the pouch and secured with a 5-0 PGA interrupted or mattress suture and is tied with surgeon's knots. (Figure 4)

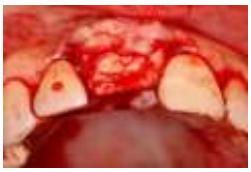

Figure 4: ADM inserted into the buccal pouch to augment the deficient buccal aspect of the ridge.

The mucosal flap is coronally positioned over the ADM graft and secured with 4-0 PGA suture using a 3/8 circle reverse cutting needle, and placed with an interrupted or mattress suture technique. Releasing incisions, if any were placed, are secured with 5-0 PGA (1/2 circle reverse cutting needle) sutures. (Figure 5)

Figure 5: Flap closure obtained with 5-0 PGA interrupted and mattress sutures.

Moist gauze is placed over the site and light digital pressure is applied for 3 minutes. This will help prevent hematoma formation under flap and graft. Triple antibiotic ointment is applied to the incision and periodontal surgical dressing is placed. (Figures 6-10).

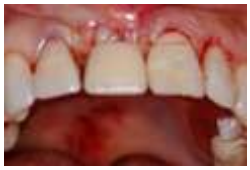

Figure 6: Adjustment of the provisional prosthesis over the graft site.

Figure 7: 7 day post surgical with the provisional prosthesis present allowing for significant post surgical swelling.

Figure 8: 7 day post surgical demonstrating some delayed healing along the alveolar crest.

Figure 9: 8 weeks post surgical demonstrating good healing.

Figure 10: Implant uncovery demonstrating an adequate zone of gingival to allow for a restoration that is harmonious with the adjacent soft tissue contour.

CASE 2: SOFT TISSUE RIDGE AUGMENTATION

Local anesthesia is administered. As in the prior case it is not recommended that local anesthetics with high concentrations of vasoconstrictors be used as they may compromise the blood supply to the overlying flap. The ADM materials are rehydrated according to manufacturer's instructions while awaiting onset of anesthesia.

A crestal incision is made using a 15c blade across the edentulous ridge and connected with intrasulcular incisions around the adjacent teeth, if teeth are present in the field to be treated. (Figures 11, 12) A full thickness buccal flap is elevated atraumatically. Elevation is initiated with a Woodson #1 periosteal elevator. Beginning with the interdental papillae elevation begins at one end of the crestal incision and progresses slowly across the crestal incision. An envelope flap elevation is extended beyond the mucogingival junction elevating towards the mucobuccal fold. It is critical to not puncture or tear the periosteum, as damage to the periosteum increases postoperative pain and swelling. Any vital structures are identified and protected that may be present within the surgical field, such as neurovascular bundles. Retraction of the buccal flap is aided with Adson tissue forceps. Utilizing a new 15 blade the periosteum is scored at the most apical portion of the buccal pouch. The periosteum is incised to a depth of no more than 2 mm. Next insert the tips of a pair of closed Iris scissors into the periosteal score and spread open the blades of the scissors perpendicular to the incision line to increase the

Figure 11: Presurgical view of a buccal defect in the pontic site of the maxillary central incisor.

Figure 12: Provisional restoration removed, demonstrating the defect on the buccal aspect of the ridge.

mobility of the flap. The blunt dissection of the flap base allows for expansion of the flap to accommodate the ADM and achieve primary closure of the site. Unlike a sharp dissection, neither collagen bands nor blood vessels are cut, minimizing bleeding and post-operative edema.[21]

The exposed recipient site is isolated from oral fluids by placing 2x2 sterile unwoven gauze sponges soaked in tetracycline & saline, this is performed to decease oral bacteria in the surgical site upon closure of the flap. To further reduce saliva exposure, pack dry 2x2 sterile unwoven gauze sponges into the mucobuccal fold and under the patient's tongue. The ADM is picked up from the rehydration bath. The ADM is rolled to the desired thickness and any excess material trimmed. (Figure 13) In this clinical situation when placed submucosally, the orientation of the basement membrane of the ADM is not important and does not affect the final result. A simple interrupted tacking suture is placed using a 5-0 PGA suture which is placed through the rolled tissue and tied with a surgeon's knot. (Figure 14)

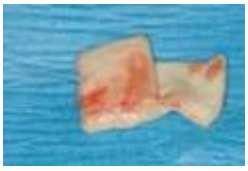

Figure 13: ADM rehydrated and saturated in platelet rich plasma.

Figure 14: Rolled ADM with a 5-0 PGA tacking suture present ready for insertion intraorally.

The tetracycline soaked sponges are remove from the buccal pouch, using cotton pliers. Lateral traction is applied to the buccal flap using Adson tissue forceps. Cotton pliers, place the ADM into the pouch, between the buccal alveolar bone and the periosteum. The graft material is inserted to the apical extent of the recipient pouch. (Figure 15) The graft material should not impinge upon neurovascular bundles (Mental Nerve, Artery & Vein) as this may lead to issues during healing.

Figure 15: ADM inserted into the buccal pouch. Note the fuller buccal contour.

A ½ circle reverse cutting needle is used with a 5-0 Polyglycolic Acid (PGA) suture placing interrupted sutures to secure the buccal flap at the crestal flap margins and tied using a surgeon's knot. (Figure 16)

Figure 16: Closure of the site with 5-0 PGA interrupted sutures.

Light digital pressure through saline soaked gauze is applied for three minutes over the closed site to allow fibrin tacking of the flap, ADM and osseous bed and eliminates any potential spaces in the surgical site which may allow hematoma formation. Triple antibiotic ointment is applied over the incision line, if not medically contraindicated. Relieve and adjust any provisional restorations so that they do not touch the surgical site as some post operative swelling is to be expected. (figure 17)

Figure 17: Provisional restoration following relief of the pontic area and reinsertion.

Specific post-operative instructions to these techniques include avoiding brushing with toothpaste for the first three weeks and avoiding granular “crunchy” foods as this may allow particles to work under the healing flap margins and compromise incision closure. It is also recommended that the patient avoid alcohol and alcohol containing oral rinses. Rinsing five times daily with warm salt water for the first 7 days following surgery is recommended and aids in site healing.

CONCLUSION

Treatment of implants or natural teeth the amount of attached keratinized gingival tissue not only impacts the esthetics but also influences the long-term maintenance of the area. It is important to access this prior to the prosthetics being finalized and not addressed as an after thought when issues arise at a later date. Edentulous spaces that will accommodate a pontic should also be accessed. This is to determine if the ridge contours on the buccal aspect of the ridge reflect the contours at the abutments. When a defect is noted, filling the area with connective tissue will help create the illusion that a root is present at the pontic and provide a more natural appearance to the fixed prosthetics.

ADM offers a good alternative to the use of patient donor connective tissue as it decreases morbidity. Additionally it provides an unlimited supply of tissue that may not be available when the patients own tissue is harvested. When utilized in the cases illustrated in this article no difference can be detected following healing when comparing donor tissue to ADM as has been reported in the literature.

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