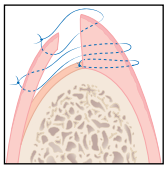
A Modified Tensionless Gingival Grafting Technique Using Acellular Dermal Matrix



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Conventional surgical procedures designed for autogenous tissue material may not be appropriate when using acellular dermal matrix (ADM) for the treatment of gingival recessions. This article describes a new surgical technique that addresses the unique and sensitive aspects of ADM specifically to improve esthetic outcomes and gain increased clinical predictability when treating Miller Class I and II gingival recession defects. In this paper, a root coverage case is described and the specific steps and rationale for this new technique are explained. This technique has been predictable clinically, with results comparable to those achieved using autogenous tissue. (Int J Periodontics Restorative Dent 2010;30:513–521.)

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Gingival recession is characterized by the apical displacement of the gingival margin in relation to the cementoenamel junction (CEJ). Since the introduction of the free gingival graft by Björn,[1] a number of different gingival grafting techniques have emerged to treat marginal tissue recession defects and to increase the zone of attached gingival tissue.[1–5] Common examples include the lateral pedicle flap, coronally positioned flap, tunnel preparation, double papilla, palatal rotational pedicle flap, and sliding rotational flaps.[6–12] Of the available techniques, the most widely used procedure to address marginal tissue recession defects is the subepithelial connective tissue graft (SCTG), combined with either a pedicle or pouch-type flap.[13,14]

Although the SCTG has achieved high levels of success and predictability for the root coverage of Miller Class I and II recession defects, it does have some relevant limitations. For example, in some patients, sufficient amounts of autogenous tissue may not be available for harvesting.[15] Furthermore, when adequate amounts of tissue do exist, some patients elect not to undergo

Fig 1 (left) *Initial presentation and* (right) *18-month posttreatment clinical photographs of a patient with multiple gingival recession sites treated with ADM.*

additional surgical procedures or incur additional wound sites to harvest the tissue. Addressing these limitations, acellular dermal matrix (ADM) has emerged and is gaining popularity as an alternative grafting material in root coverage procedures.[16–18]

ADM is a dermal allograft where component cells, which are the target source of rejection, and the epidermis are removed from cadaver skin, while the collagenous scaffolding, including the existing vascular channels, is retained. ADM integrates with the host tissue, maintains structural integrity, and demonstrates enhanced revascularization via preserved vascular channels.[19–21] The use of ADM as an allograft material eliminates the need for additional surgical sites, as well as the pain and morbidity associated with intraoral tissue harvesting. Another important advantage of using ADM is that both the extent of the recession defect and number of teeth to be treated are no longer dependent on the quantity of autogenous SCTG tissue procured, potentially allowing a greater number of recession defects to be treated in a single visit (Fig 1). Consequently, ADM allows treatment planning based on the dental needs of the patient and surgical requirements of the clinician, without facing limitations because of the volume or extent of the autogenous grafting tissue available for harvesting.

It must be noted, however, that while ADM has some tangible benefits to both the provider and patient, its application has been shown to be more technique-sensitive than autog - enous material. During root coverage procedures, ADM has been used primarily with a traditional coronally positioned flap (with or without vertical incisions) or a tunnel technique.[8,9,18–24] However, conventional surgical techniques designed for autogenous tissue may not be appropriate for ADM and appear to diminish clinical outcomes. These factors, combined with the specific and unique handling characteristics of ADM, may be responsible for reducing the overall effectiveness and predictability of this material.

Therefore, the purpose of this article is to describe a modified surgical approach that details key surgical principles when using ADM in the treatment of Miller Class I and II recession defects. The intent is to present a modification of previous methods that focuses more on the anchoring, stretching, tailoring, and securing of the ADM material. These principles, when employed correctly, will improve the overall success, esthetics, and predictability of ADM when treating both single and multiple recession defects.

Fig 2 *The maxillary left canine and first premolar presented with a thin gingival biotype, inadequate zones of attached gingiva, and Miller Class I gingival recessions.*

Fig 3 *Special consideration was given to the initial scalloped incision to create a unified and balanced gingival front. This was accomplished with broad, scalloped incisions originating from the base of the recession defect to the line angle of the adjacent teeth. Vertical releasing incisions were created to allow for flap reflection.*

Surgical technique

The following case presentation describes a modified surgical technique that has been adopted successfully by the authors on numerous patients presenting with Miller Class I or II recession-type defects. A typical clinical case study follows.

A 25-year-old nonsmoking woman was referred for cosmetic treatment of the maxillary left canine and first premolar. Her chief complaint was having long teeth on the left side that were sensitive. The patient's medical history was noncontributory. The Miller Class I recession defects were attributed to a thin tissue biotype and inadequate zones of attached gingiva (Fig 2). The patient presented with a 2-mm recession at the canine, a 1-mm recession at the first premolar, and approximately 1 mm of keratinized attached gingiva on each tooth. ADM, in association with a coronally advanced flap, was proposed for root coverage.

Surgical site preparation

Initially, intraoral antisepsis was performed using a 0.12% chlorhexidine gluconate rinse for 30 seconds. Following local anesthesia, scalloped incisions were designed to equalize the recession defects and create a uniform gingival front across the surgical site. In this particular patient, scalloped incisions extended from the distal line angle of the lateral incisor posteriorly to the mesial line angle of the second premolar (Fig 3). Vertical releasing incisions were made at the end of the scalloped incisions at the proximal line angles. The use of horizontal transverse incisions across the papillae are not recommended with

Fig 4 *A full-thickness flap was elevated to approximately 5 mm past the most apical extent of the recession defect.*

Fig 5 *The facial halves of the papillae were removed leaving the lingual residual papillae intact. The root surfaces were planed thoroughly with rotary and hand instrumentation to eliminate any root irregularities and to create a definitive CEJ.*

this technique since they frequently cause epithelial invaginations that can impede healing.[25]

The full-thickness surgical flap was reflected just below the base of the papillae and extended to approximately 5 mm past the most apical extent of the recession defect (Fig 4). The gingival papillae were split mesiodistally and the facial halves of the papillae were removed. Tissue coronal to the scalloped incisions was removed easily with a sharp back-action chisel, fully deepithelializing the papillary areas (Fig 5). The exposed root surfaces were root planed with a 12-fluted carbide finishing bur (Brassler) and refined using hand instrumentation to eliminate prominent root ridges and irregularities. Care was taken to create a definitive CEJ to permit intimate ADM adaptation to the root surface (Fig 5). Before placement, the ADM was cleaned of all cryoprecipitate and hydrated completely per the manufacturer's instructions. Width determination of the ADM material was accomplished by measuring the distance from the CEJ to 5 mm past any of the exposed root surfaces.

ADM management and placement

Using a sharp surgical scissor (SC iris CU, Salvin), the ADM was thinned from the connective tissue side (dermal side) to reduce graft thickness to approximately 1 mm. The modified surface was then placed against the prepared roots. Starting at the distal aspect, a single interrupted suture (5-0 chromic gut with a T28 needle, LOOK) secured the inferior end of the ADM to the base of the remaining palatal interproximal papillae (Figs 6 and 7). Next, the ADM was pulled apically and sutured approximately 5 mm from the first interrupted suture with an internal horizontal mattress suture angled under the vertical incision borders to promote apical stretching of the graft (Fig 6). This suture was designed to "tuck" the ADM under the borders of the vertical releasing incision. Tissue forceps (8-905DD, Hu-Friedy) were used to grasp the ADM, stretching it over each root surface. The tissue forceps

Fig 6 *ADM was thinned to a uniform thickness of approximately 1 mm. The ADM was initially sized and anchored interproximally with an interrupted suture and then stretched apically using an angled horizontal mattress suture.*

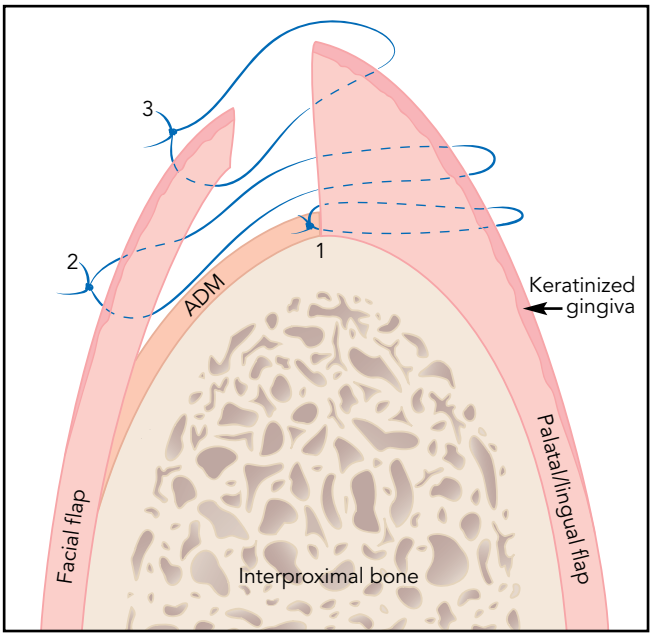

Fig 7 (1) *Simple interrupted sutures secured the coronal edge of the ADM,* (2) *a vertical mattress suture was placed to position the tissue coronally and eliminate dead space over the graft material, and* (3) *a single interrupted suture was used to approximate papilla tips. Note: Tooth and root surfaces were removed to simplify this illustration.*

were readjusted to reach the mid-buccal aspect of each root, allowing for precise contouring of the ADM around the tips of the forceps (Fig 8). This contouring allows for intimate adaptation of the ADM to the CEJ of each tooth. The stretched ADM was secured at each interproximal area using simple interrupted sutures. This series of steps was repeated across the entire row of recession defects. Once completed, the excess ADM was trimmed away and the last single interrupted suture was placed securely. An additional internal, horizontal, stabilizing mattress suture was placed approximately 5 mm apical to the final interrupted suture to ensure apical stretching and secure placement of the ADM (Fig 9). A periosteal release was performed to facilitate coronal advancement of the overlying flap.

Flap management and contoured closure

The overlying facial flap was evaluated to ensure full coverage of the ADM in a tension-free manner. Care was taken to not disturb the periosteum apical to the ADM material, which serves to anchor the subperiosteal sutures. Next, two subperiosteal sutures (single interrupted) were applied to stretch the ADM 5 mm past the most apical extension of the recession defect (not shown). Internal vertical mattress sutures were used to position the overlying flap coronally (Figs 7 and 10).

Fig 8 *Once anchored, the ADM was stretched across the root surface and bone. This unique stretching technique eliminates dead space and creates an intimate adaptation of the ADM to the root surface and bone. The ADM was trimmed to fit the contours of the CEJ for each tooth precisely.*

Fig 9 *ADM was secured further by anchoring the mesial end to ensure a stable, secure, and well-contoured graft. A periosteal release was performed to facilitate coronal advancement of the overlying flap. Two subperiosteal sutures were placed to stretch the ADM 5 mm past the most apical extent of the recession defect.*

Fig 10 *The flap was advanced coronally and secured using an internal vertical mattress suture. This technique stabilizes the facial flap, places additional downward pressure on the grafted ADM, and reduces tension on the papillae.*

Fig 11 *Facial and lingual papillae tips were approximated and sutured with a single interrupted suture, and bilateral vertical incisions were closed with interrupted sutures.*

The suture passed through the facial flap at the approximate level of the mucogingival junction and then passed over the ADM, penetrating the base of the palatal interproximal papilla. The suture was returned through the palatal interproximal papilla and passed through the lingual aspect of the facial flap, emerging approximately 2 mm coronal to the initial needle penetration, and was tied securely. After this suturing procedure was completed for all interproximal areas, a simple interrupted suture was used to approximate the tips of the facial and palatal interproximal papillae (Figs 7 and 11). In areas where interproximal bone loss is evident, a vertical mattress suture may be indicated. Vertical releasing incisions were closed with single interrupted sutures. No periodontal dressing was applied. The 1-year postsurgical photograph demonstrates complete root coverage compared to the initial presentation (Figs 2 and 12).

Fig 12 *Clinical photograph 1-year postoperative demonstrating complete root coverage and the creation of a wide zone of attached gingiva.*

Table 1 Key surgical principles

• Site-directed, broad scalloped incisions that result in a unified gingival front
• ADM thickness reduction to approximately 1 mm
• ADM initial anchoring
• ADM stretching and tailoring
• ADM securing
• Periosteal releasing incision 5 mm past the most apical extent of the recession defect
• Contoured final closure using a sequential layer of sutures

Postoperative instructions

Direct pressure with dampened gauze was applied directly to the grafted areas for 3 to 5 minutes to allow for initial clot formation. The patient was instructed to rinse with 0.12% chlorhexidine gluconate twice daily for 2 weeks. Additionally, a narcotic analgesic and a nonsteroidal anti-inflammatory agent were prescribed as needed for pain control. The patient was seen at 10 days, 6 weeks, 6 months, and 1 year postoperative for evaluation. Healing was uneventful. During the first month following surgery, the patient was instructed to clean only the enamel portion of each grafted tooth with a cotton swab and water. Light flossing was permissible after 2 weeks; care was taken to ensure that the floss did not contact the interproximal tissues. The use of a soft bristle brush for home care was allowed at the surgical site after the fourth week postoperative. Oral hygiene was evaluated at each visit and during recall appointments.

Discussion

The modified tensionless gingival grafting technique is a surgical option detailing the use of ADM in the treatment of single or multiple Miller Class I and II gingival recession defects. This surgical technique provides a step-by-step approach, applying key surgical principles to improve the clinical predictability and esthetic outcomes of ADM when used as a subepithelial graft. Once mastered and incorporated routinely, these principles will improve the early healing and esthetic outcomes of ADM cases, which may not have been observed commonly when ADM was used with traditional surgical approaches for root coverage.[18]

Key surgical principles of this technique (Table 1) are centered on anchoring the ADM securely within the graft site to allow for proper stretching and tailor-fitting of the material to the definitive CEJs of each tooth. Careful adaptation and complete stabilization of the material serve as the bases for using ADM successfully in this approach. The initial incision design includes broad scalloped incisions combined with two vertical releasing incisions. This design creates an ideal unified gingival front for the overlying gingival flap that will allow complete coverage of the ADM and improve esthetic outcomes. A full-thickness flap is elevated to approximately 5 mm past the most apical extent of the recession defect. Additionally, a periosteal releasing incision is created approximately 5 mm beyond the most apical extent of the recession defect to aid in the tension-free release of the flap and to minimize

perforation, especially at the coronal/esthetic zone. The ADM is thinned to a uniform thickness of approximately 1 mm. The ADM is tailored to fit the contours of the CEJ of each tooth precisely and is stretched to create an intimate adaptation of the ADM to the root surface and bone. The ADM is extended to approximately 5 mm beyond the most apical extent of the recession defect. Precise, layered interproximal suturing serves to *(1)* secure the graft, *(2)* compress the ADM, *(3)* eliminate "dead space," and *(4)* encourage clot adherence of the graft to the surgical site. These specific interproximal sutures, beginning with an internal vertical mattress suture and followed by an interrupted suture, are also used to allow for papilla juxtaposition within the interproximal space. This suturing method reduces tension on the papilla tips and helps eliminate the papillary "slumping" that is sometimes seen in other approaches.[18]

The intent of this article is to describe a predictable technique utilizing ADM for use with Miller Class I and II gingival recession defects, not to focus on a direct comparison of clinical parameters over a period of time. However, it may be helpful to share the limited findings found in a restricted study over a period of 8 years (un - published data, 2009). The primary author and developer of this technique, Dr John B. Taylor, has performed more than 2,700 procedures in a limited criterion study using the modified tensionless gingival grafting technique with a success rate of > 99% (success was defined as ≥ 3 mm of attached gingiva present at the 6-month follow-up with cosmetic results). Twelve ADM graft failures were observed: 9 because of patient-induced trauma, 1 was attributed to severe vomiting, and 2 were of unknown etiology. The primary author has also performed more than 1,500 SCTGs using autogenous tissue with a success rate of > 99%. These results suggest that this ADM grafting technique has been predictable clinically, with results comparable to those achieved using autogenous tissue.

The common benefits of using this technique with ADM are demonstrated in the outcomes of the case study presented, which include: creation of a large zone of attached gingiva, root coverage, reduction or elimination of root sensitivity, and enhanced cosmetic results for the patient. Although the technique appears to be highly predictable and cosmetic, there are limitations to this procedure. The extent of root coverage using this technique appears to be limited by the height of the interproximal bone available for gingival attachment. Patient-induced trauma is also a limiting factor to the success of the graft and correlates highly with cases where graft failure is present. Postoperative instructions should be followed and reasonable care given to protect the healing tissues.

Conclusion

As stated, this article details a modified tensionless gingival grafting technique for the use of ADM as a subepithelial graft during root coverage procedures. Although the clinically observed results of this technique appear to be superior to and more predictable than what has been observed previously with other techniques, further studies including more expansive clinical parameters should be considered to determine the extent of improvement and limitations that this technique may offer.

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