Esthetic Correction of Gingival Recession Using a Modified Tunnel Technique and an Acellular Dermal Connective Tissue Allograft

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ABSTRACT
Esthetic correction of gingival recession is an important goal of periodontal therapy. This article describes a surgical technique that combines a modified tunnel technique and an acellular dermal connective tissue allograft. With the aid of vertical incisions, a tunnel is created under the buccal mucosa of the affected tooth. These incisions enable easy access for graft placement and create mobility for gingival coronal positioning. The use of an acellular dermal connective tissue allograft eliminates the need for a surgical palatal donor site. This minimizes postsurgical complications.

CLINICAL SIGNIFICANCE
The combination of a modified tunnel technique and an acellular dermal connective tissue allograft permits esthetic root coverage in a manner that reduces postsurgical complications.


Many methods for correcting gingival recession have been developed. Sliding pedicle grafts, free gingival grafts, subepithelial connective tissue grafts, envelope and tunnel techniques, guided tissue regeneration using synthetic membranes, and the use of acellular dermal connective tissue allografts are among the treatment modalities that have been reported.1–16 Each technique attempts to improve on the limitations of the others.

The ideal surgical technique for correcting gingival recession should encompass certain qualities. Results must be predictable and esthetic. Complications, such as pain and bleeding, should be minimal.

The periodontal surgical procedure described, for the esthetic correction of gingival recession, combines the use of a modified tunnel below the buccal mucosa and the placement of an acellular dermal connective tissue allograft (AlloDerm, LifeCell, Branchburg, New Jersey). The tunnel preparation permits predictable and esthetic root coverage. Vertical incisions are the modification of the tunnel technique. These incisions allow the allograft to be placed and the gingiva to be coronally positioned easily. The use of an acellular dermal connective tissue allograft permits treatment without involving a donor tissue surgical site. This reduces postoperative complications.

MATERIALS AND METHODS
Preparation of Treatment Site
A 36-year-old nonsmoking female patient with a nonsignificant medical history presented with a chief concern of progressive gingival recession affecting the maxillary left canine. The tooth was found to have 3 mm of gingival recession

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and a narrow zone of attached keratinized gingiva. A prominent canine eminence was also noted (Figure 1). Gingival tissue must be raised to allow the placement of a connective tissue graft beneath it. The gingiva can then be coronally positioned to achieve complete root coverage. The initial incisions are made into the gingival sulcus using a sharp No. 15 scalpel blade (Hu-Friedy, Chicago, Illinois). These incisions are repeated using an Orban knife (Hu-Friedy). The Orban knife is then used to begin the reflection of the gingival tunnel from the gingival sulcus. Care must be taken not to tear the gingiva. Any tears in the gingival flap or interdental papillae would compromise healing.

The flap is elevated with the Orban knife until the attached keratinized gingiva is completely free and the mucosa begins to be raised. It is the elasticity of the mucosa that allows gingiva to be coronally positioned. The farther the incisions extend into the mucosa, the greater coronal movement of the gingiva that can be achieved.

The next step is to make vertical incisions with a sharp No. 15 scalpel blade mesial and distal to the gingival recession being treated. The incisions should begin in or apical to the middle of the interdental papillae and continue into the buccal mucosa. The vertical incisions create a trapezoidal tunnel, with the mucosal base being the widest point. Care must be taken not to adversely affect the adjacent tooth sites.

The vertical incisions should be repeated with the Orban knife to contact bone. The Orban knife is then used to reflect the tissue, using the vertical incisions as access to create a tunnel. The Orban knife is extended within the tunnel to connect to those areas already reflected.

A periosteal elevator should then be inserted completely through the tunnel (Figure 2). Any tissue tags or areas of binding must be removed. This allows easy placement of the graft material later. The gingiva should be coronally positioned to the ideal location to demonstrate that full flap mobility and complete root coverage can be achieved. Incisions into the mucosa, within the tunnel, may be required to achieve tissue mobility. Minimal tension should exist on the gingival tissues when positioned in the desired position.

The last step to preparing the graft site is thorough scaling and planing of the root surfaces. Prominent root eminences should be reduced. This can be done with sharp curettes, bone chisels, or rotary burs. Access to the root surfaces is limited, owing to the inability to fully reflect the gingival flap. Again, care must be taken not to damage the gingiva.

Figure 1. Presurgical view of the maxillary left canine demonstrates 3 mm of gingival recession and a narrow zone of attached keratinized gingiva.

Figure 2. A periosteal elevator is passed through the buccal flap. This demonstrates that the modified tunnel preparation is completed and the interdental papillae are completely intact.
Preparation and Placement of Allograft
Rehydration of the acellular dermal connective tissue allograft (AG) in saline for 5 to 10 minutes is required. The AG is trimmed to size using a sharp No. 15 surgical blade. The length of the AG is determined by the length of the site to be treated. A width of 5 mm is typically sufficient.

A sharp surgical blade must be used to trim the AG; AG has a tougher consistency than connective tissue retrieved from the palate and easily dulls a surgical blade. The consistent thickness of AG tissue is 1 to 1.5 mm.

The vertical incisions represent the open ends of the tunnel preparation. Access through the vertical incisions makes placement of the AG simple. The AG can be placed through the tunnel with an Orban knife, a periosteal elevator, or cotton pliers. It is not necessary to use a suture to drag the AG through the tunnel. The AG is placed with the connective tissue side adjacent to the gingival flap. The connective tissue side of the AG appears rough when stained with blood (Figure 3).

Suturing Technique
The first suture is used to secure the AG in position (Figure 4). A continuous 5-0 plain gut suture is employed. The suture first engages the buccal gingiva one tooth distal to the surgical site. A knot is tied and the needle is then passed through the gingiva and between the teeth. The suture travels around the lingual of the teeth in a mesial direction. It is then passed again interproximally to engage the AG on the buccal. This is repeated until the AG is held tightly to the recipient bed. The intact interdental papillae prevent the graft from being pulled too far coronally. The suture is then ended with a knot on the buccal gingiva one tooth mesial from the surgical site.

The purpose of the second suture is to position the gingiva over the graft and root surfaces. A continuous 4-0 plain gut is used. It is
placed in a manner similar to that for the first suture. A vertical mattress technique aids in achieving complete graft and root coverage. If complete root coverage is not achieved, this suture can be run again distally. The final knot would then be tied over the initial knot.

The vertical incisions are closed last. Continuous or interrupted 5-0 plain gut suture can be used to close the vertical incisions and to help maintain the coronal position of the gingiva (Figure 5). At completion of the procedure, the root surfaces and AG should be completely covered by the gingiva with minimal tension from the sutures. Bunching of the gingiva in the area of the interdental papillae is sometimes noticed but should be of no concern (Figure 6).

**Postsurgical Instructions**

Postsurgical instructions are the same as those given for other periodontal grafting procedures but with one noticeable exception. Since no palatal surgical site exists, this area does not require postoperative care. Application of an ice pack is recommended (10 minutes on, 10 minutes off) for the remainder of the day to minimize postoperative swelling. Pressure is applied on the surgical site with moist sterile gauze for 15 to 20 minutes if bleeding occurs. The patient is instructed not to brush the surgical site for 1 to 2 weeks following the procedure. A 0.12% chlorhexidine rinse is prescribed for 30-second rinses twice daily during this period. During the next 4 weeks, only gentle toothbrushing with a soft-bristle toothbrush is permitted. The use of dental floss is discontinued during the entire 5- to 6-week healing period. The plain gut sutures resorb and fall loose on their own. The patient is instructed not to pull out loose sutures. However, the patient is advised to cut loose sutures with a sharp scissor. Non-steroidal anti-inflammatory drugs are usually sufficient for pain control. However, narcotic medications can be used for breakthrough pain.

**Appearance of the Surgical Site during Healing**

Healing of the surgical site typically occurs uneventfully. Most patients report minimal discomfort. The lack of a palatal donor site is one important reason for this. Small areas of inflammation may be noted in the areas of the incisions and sutures. Most of the plain gut sutures will have been lost by 1 week. The remaining should be removed. If no significant complications have occurred, the chances of an ideal result are excellent.

By 8 weeks, the final result of treatment should be known (Figure 7). Under close inspection, the incision lines may be noted. However, the surgical site should have a healthy and esthetic appearance. At this
time, normal oral hygiene methods can be resumed.

DISCUSSION

Many soft tissue grafting procedures have been developed to cover root surfaces and increase the zone of attached keratinized gingiva.\textsuperscript{1-16} The subepithelial connective tissue graft is a predictable treatment modality with excellent results.\textsuperscript{5,6} However, the raising of an envelope flap often leads to a cosmetic defect with healing. This defect is seen as a horizontal groove through the base of the papillae or as a reduction in the size of the papillae. These defects are not always correctable. A tunnel technique maintains the integrity of the interdental papillae with results that are highly esthetic.\textsuperscript{11,16-18}

In the traditional tunnel technique, the tunnel is created with only the access provided by the gingival sulcus.\textsuperscript{11} This is technically difficult and time consuming. The space provided by the gingival sulcus is small. Tearing of the buccal gingiva or the papillae is not uncommon when the access is small. The small access through the gingival sulcus also makes placement of the connective tissue graft extremely difficult. The use of sutures to drag the graft through the tunnel is often required.

In the modified tunnel technique, vertical incisions permit easy access to the gingival tunnel.\textsuperscript{16} This allows releasing incisions within the mucosa to be made with little chance of accidental tears or perforations. By not severing the interdental papillae and providing a wide base to the gingival tunnel, excellent blood flow to the gingiva is maintained. Circulation to the gingiva is required for good healing.\textsuperscript{17,18} Mobility of the gingival tissues is easily achieved.

The vertical incisions also make placement of the graft within the modified tunnel easier than in the traditional tunnel technique. The vertical incisions allow the graft to be placed into the tunnel preparation directly from the side. A suture is not required to pull the graft through the tunnel, and the position of the graft is easily verified with direct visual inspection. Finally, the vertical incisions make it easier to detect and correct any tissue tags that impinge on tissue mobility and the placement of the graft.

The use of the acellular dermal connective tissue AG has been described in both the dental and medical literature.\textsuperscript{13,14,19-22} Plastic surgeons have used AG for various procedures, including lip augmentations.\textsuperscript{22} In the dental literature, AG has been shown to give predictable root coverage and an esthetic result equal to that of a connective tissue graft harvested from a patient’s palate,\textsuperscript{14} without the need for a second surgical site. Especially in large grafting cases, the donor site is the primary site of complications, such as bleeding and postoperative pain.\textsuperscript{23-25} In addition, palatal donor tissue is limited and may be insufficient for the needs of the patient.

The size, shape, and quality of the AG are standardized. The AG is harvested from the skin from organ donors and is supplied in a variety of lengths and heights, with a width of 1 to 1.5 mm. Unlike connective tissue retrieved from the palate,
AG does not have fatty tissue or epithelium attached to it. The final shape of the AG is easily determined by the surgeon who trims it on the surgical tray. Finally, the AG has an even and tough consistency. This makes it easy to manipulate and position in the modified tunnel preparation.

CONCLUSION

Esthetic correction of gingival recession is an important goal of periodontics. The modified tunnel technique with the use of an acellular dermal connective tissue allograft achieves this goal. It is relativelyatraumatic to the patient because a palatal donor site is not required. The modified tunnel technique makes graft placement and coronal positioning of the gingival tissue simple. The cosmetic results of treatment are highly esthetic.

DISCLOSURE

The author has no financial interest in any of the companies or products mentioned in this article.

REFERENCES


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