The Bilateral Pedicle Flap-Tunnel Technique: A New Approach to Cover Connective Tissue Grafts

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A new surgical technique for the treatment of adjacent soft tissue marginal recession is presented. This technique combines the use of a tunnel procedure with double lateral pedicle flaps to cover a connective tissue graft. This approach combines the advantages of the tunnel technique with the increased blood supply and protection provided by pedicle flaps. Indications include adjacent Class I and II deep, wide recessions; however, the procedure may also be applied to mild Class III recessions. Two case reports are presented to illustrate this new technique. (Int J Periodontics Restorative Dent 1999;19:471-479.)

The ultimate goal in the treatment of the soft tissue marginal recession is the complete coverage of the denuded root, resulting in an esthetic and natural appearance of the newly gained tissue. To accomplish this objective, many surgical techniques have been described. The first approach, the lateral sliding flap by Grupe and Warren, dates back to 1956. Although innovative, the technique did not provide predictable root coverage, with only 65% to 75% mean root coverage reported. Furthermore, it was inadequate in cases with a shallow vestibule or insufficient gingival dimensions lateral to the site of recession.

Langer and Calagna introduced a new approach to treat marginal tissue recession, the subepithelial connective tissue graft. This technique used a connective tissue graft covered with a repositioned split-thickness flap. The success reported with this surgical approach was attributed to the double blood supply at the recipient site from the underlying...
connective tissue base and the overlying recipient flap. Modifications of this technique have been reported, with alterations in the connective tissue flap coverage. Raetzke designed the "envelope" technique, in which the connective tissue graft was seated in an envelope that is created in the tissue around the denuded root surface with an undermining partial-thickness incision. The author reported 80% mean root coverage. Allen proposed a coronally positioned split-thickness flap in 1993. Nelson, in 1987, described a full-thickness-double papilla flap to cover the graft. This method was modified in 1992 by Harris, who performed a split-thickness-double papilla flap. In a later publication the same author reported the use of the technique in 100 consecutively treated defects with a mean root coverage of 97.7%. The advantages of the latter 2 techniques include highly predictable root coverage and the possibility of covering the connective tissue graft in situations in which the coronally positioned flap may be contraindicated, such as in sites with a shallow vestibular depth. Allen, in a modification of Raetzke's technique, described the "tunnel" technique, in which no horizontal or vertical incisions are made. In sites with 2 adjacent recessions a tunnel underneath the interproximal papilla is created and the connective tissue graft is drawn through the tunnel and sutured to the recipient bed. The use of this technique enabled the author to accomplish predictable root coverage in shallow, narrow recessions with 97% mean root coverage, but as the depth and width of the recession increased the predictability decreased. Mean root coverage decreased to 75% when the depth was > 4 mm and to 76% when the width was greater than 3 mm. Reasons for this incomplete root coverage might be related to the lack of blood supply over the exposed coronal portion of the connective tissue graft. The collateral blood supply provided by the envelope may be sufficient in shallow, narrow recessions but not in wider and deeper recessions.

The purpose of this article is to describe a periodontal plastic surgery procedure where a bilateral pedicle flap and a tunnel are combined to compensate for the lack of blood supply that the tunnel technique offers in deep or wide adjacent recessions.
Surgical procedure

Recipient and donor site preparation

Two adjacent Class III soft tissue marginal recessions are presented as an example. Initially, the root surfaces are planed, followed by citric acid application for 30 seconds. After saline irrigation, two horizontal incisions are placed at the level of the cemento-enamel junction distal to the teeth with recession, extending toward the adjacent tooth. Vertical incisions are placed at each end of the horizontal incisions, extending approximately 10 to 12 mm apically into the alveolar mucosa.

Sulcular incisions are made, stopping at the interproximal papilla. Split-thickness lateral pedicle flaps are elevated by sharp dissection without disturbing the midline interproximal papilla. Next, the midline interproximal papilla is undermined by sharp dissection to create a tunnel (Fig 1a).

A connective tissue graft is harvested from the premolar region of the right palate following the technique described by Bruno.15

Graft placement

The graft is positioned over the recipient site to evaluate adequate fit. The graft is trimmed as needed. The graft is then drawn underneath the papilla with the aid of a suture placed in the distal end of the connective tissue graft and a tissue forceps at the other end. Interrupted sutures placed both apically and coronally are used to secure the graft to the recipient bed (Fig 1b). Sling sutures are used to adapt the graft coronally. The lateral pedicle flaps are rotated mesially and sutured with chromic # 5-0 sling sutures to cover the entire connective tissue graft (Fig 1c). Interrupted sutures may be used to secure the pedicle flaps to the interproximal papilla and to reduce the lateral graft exposure.
Case 1

A 56-year-old Caucasian woman presented to the Department of Periodontics at Baylor College of Dentistry suffering from discomfort upon brushing the mandibular central incisors. Oral examination revealed a 3-mm Class II recession facial to these teeth. There was inadequate attached gingiva and plaque deposits over the root surfaces of both teeth (Fig 2a). The etiology of the recession was related to a history of inflammatory periodontal disease in the presence of a thin periodontium. Initial therapy, which included scaling, root planing, and polishing, with the introduction of the modified Stillman brushing method, did not resolve the patient's discomfort. A connective tissue graft combined with a bilateral pedicle flap-tunnel technique was used to correct the mucogingival problem (Figs 2b to 2e). Post-operative care included chlorhexidine as a mouthrinse and in a topical application with a cotton swab twice a day. The patient was followed up every 2 weeks during the first month and monthly thereafter up to 8 months. Each recall included removal of plaque deposits with a prophy cup and evaluation of healing. One week after the surgery the
Fig 3a  Case 2: mandibular central incisors with Class III marginal tissue recession and a lack of attached gingiva in a 45-year-old patient.

Fig 3b  Recipient site preparation.

Fig 3c  Placement of the graft and closure of the flaps.

Fig 3d  No retraction of the flap or graft has occurred 2 weeks postoperative.

Fig 3e (right)  Complete root coverage has been achieved 6 months postoperative.

grafted area showed the typical postsurgical edema. The results at the 8-month evaluation disclosed almost complete root coverage and an adequate band of attached gingiva facial to both teeth (Fig 2f). The patient reported more comfortable toothbrushing and a satisfactory esthetic result. Since thickened gingival contours were present at the final follow-up, a gingivoplasty was offered to the patient to accomplish a more natural appearance. However, the patient was satisfied with the results and declined further treatment.

Case 2

A 45-year-old female dentist presented in private practice complaining of a progressive recession of the marginal tissue facial to the mandibular central incisors (Fig 3a). Oral examination showed 3-mm Class III recession with
insufficient attached gingiva on the facial aspects of these teeth. Oral hygiene was excellent and the tissues were free of inflammation. A connective tissue graft harvested from the tuberosity region was used with the bilateral pedicle flap-tunnel technique to treat this problem (Figs 3b and 3c). The patient was advised to avoid brushing and mastication at the grafted site for 3 weeks and was evaluated at 2 weeks and 1, 2, 3, and 6 months postsurgical. Complete survival of the graft without retraction of the flap was noted at 2 weeks (Fig 3d) and complete root coverage was apparent and remained through 6 months (Fig 3e).

Discussion

Predictable root coverage in shallow (< 3 mm), narrow Class I to II recessions with the supraperiosteal pouch technique has been shown to be excellent, with 97% mean root coverage. However, as the depth and width of the recession increased the predictability decreased. Mean root coverage decreased to 75% when the depth was greater than 4 mm and to 76% when the width was greater than 3 mm. The technique described in this article is a modification of the supraperiosteal pouch technique to provide a greater blood supply to the graft and thus more predictable root coverage. This modification includes the use of 2 lateral pedicle flaps distal to the adjacent recessions. This alteration in the technique provides blood supply to the entire surface of the graft; the original supraperiosteal pouch technique provides double blood supply in the apical portion of the graft, but no blood supply for the exposed portion of the graft overlying the root surface. The present article presents a combined bilateral pedicle-tunnel connective tissue graft that has resulted in approximately 95% root coverage in 6 patients followed for at least 6 months. This new approach to cover connective tissue grafts offers the following advantages:

- Increased blood supply to the connective tissue graft by covering the graft completely with bilateral pedicle flaps
- Better adaptation and stability of the graft to the recipient site as a result of the compressing effect of the tunneled interproximal papilla
- Complete coverage of the graft when the coronally positioned flap is contraindicated, such as in a shallow vestibule
- Prevention of apical retraction of the overlying flap, as is commonly seen in the mandibular incisor region and other sites with a shallow vestibule
- Less surgical trauma and more rapid healing by preserving the interproximal papilla
After the palatal harvesting of the connective tissue graft a collar of epithelium normally remains as part of the graft. In our cases we left the epithelium undisturbed. Some authors have hypothesized that when covering the epithelium with the flap there is a possibility of cyst formation. On the other hand, Bouchard and Etienne studied the effect of leaving the epithelium exposed compared to removing the epithelium and covering the entire graft with the facial flap. They found better esthetic results with the latter approach, although more keratinized tissue was gained by leaving the epithelium exposed. No data were presented when the epithelium was left intact and entirely covered by the facial flap, as presented in this study. Since there is no evidence-based data on the esthetic and histologic impact of this epithelium remnant on the final outcome of the grafting procedure, it is the opinion of the authors that the elimination of the epithelium is not a necessary surgical step. In addition, there is not certainty that the entire epithelium has been removed when using a blade for removal.

A partial-thickness dissection of the recipient site was used in these cases because it was considered to offer a better blood supply and therefore faster revascularization of the connective tissue graft.

Allen expressed concern with the use of vertical and horizontal incisions because they could interfere with the nourishment of the facial flap. He suggested that lateral and, to a lesser extent, papillary blood supply may be enough to enhance graft nutrition to the exposed portion of the graft when using the tunnel technique. However, further blood supply may be needed in deep and wide recessions to achieve a complete root coverage, and for that reason the tunnel procedure may benefit from the use of a pedicle flap. A coronally positioned flap has the disadvantage of being more difficult to combine with a tunnel procedure and still achieve complete coverage of the graft, especially in deep recessions with a shallow vestibule. Lateral pedicle flaps seem to be a better selection since they are easy to combine with the tunnel technique and require minimal periosteal release, which facilitates their use in a shallow vestibule.

It could be argued that a double pedicle flap would be a more simple procedure to achieve root coverage. However, the use of double pedicle flaps alone in adjacent recessions could be contraindicated in cases where the interproximal papilla is too narrow. In these clinical situations the creation of the mesial pedicle flaps may leave the flaps more slender, which may complicate suturing and jeopardize their blood supply. By combining a tunnel and distal pedicle flaps, trauma to the interproximal
papilla is minimized, providing better blood supply to the graft. "Butt joint" incisions are preferred to the beveled graft edges that were advocated in the supraperiosteal envelope technique. According to that author, beveled incisions provide intimate bilaminar contact with the involved tissues, ensuring better lateral blood supply to the graft. The use of beveled graft edges seems to be important in the supraperiosteal envelope technique since the only blood supply arises from the edges of the graft. With the modification presented in this article there is no need to bevel the edges of the graft since bilaminar blood supply is provided over the entire graft. In addition, a butt joint relationship to the recipient site was preferred to achieve better marginal adaptation of the graft to the recipient bed, to ensure uniform connective tissue thickness throughout the graft, and to prevent any tearing of the graft at the time of suturing.

Thickening of the recipient site after connective tissue grafting has been documented. That effect was seen to some degree in this study. A gingivoplasty procedure was offered to one patient to smooth the gingival contours. The patient, however, declined that alternative since her concerns were resolved with the first surgical procedure.

The indications for the use of the bilateral pedicle flap-tunnel technique are: (1) Class I to II deep and wide adjacent soft tissue marginal recession with shallow vestibular depth; (2) Class I to II deep and wide adjacent soft tissue marginal recession with a narrow interproximal papilla; or (3) Class III adjacent soft tissue marginal recession where some gain in papillary height may be attempted—this is accomplished by undermining the interproximal tissue and raising it with a sling suture.

Soft tissue marginal recessions in the mandibular anterior teeth represent an excellent clinical indication for this surgical technique. The mandibular anterior sextant normally displays a shallow vestibule, a thin periodontium, and multiple adjacent soft tissue marginal recessions. The disruption of the interproximal papillae could jeopardize wound healing by early flap retraction and therefore jeopardize graft survival. The use of a conservative approach such as the bilateral pedicle flap-tunnel technique could improve the clinical predictability of complete root coverage. The results of these six cases warrant further research to evaluate the predictability of this technique in Class I to II deep and wide recessions and early Class III soft tissue marginal recessions using a larger sample population.

A modification of the previously described supraperiosteal envelope connective tissue graft technique is presented, where bilateral pedicle flaps are used to completely cover the connective tissue graft. This approach offers a better blood supply to the graft, which could enhance the predictability of the technique in treating Class I and II recessions ≥ 3 mm deep and ≥ 2 mm wide.
References


