

Root Coverage with Enamel Matrix Derivatives



Before



After



Before



After

Root Coverage with Enamel Matrix Derivatives

CE 2

Abstract: Different root coverage procedures have been used to treat cases of gingival recession defects involving single or multiple exposed root surfaces. A therapeutic advantage may be gained if periodontal regeneration is obtained in addition to coverage of the root with gingiva. This article describes the treatment of gingival recession by combining a surgical technique with an enamel matrix derivative.

Gingival recession is defined as the partial denudation of the root surface caused by apical migration of the gingiva.¹ Miller's classification for marginal tissue recession is shown in Table 1.²

Many factors have been implicated in the etiology of marginal tissue recession, including accumulation of plaque, malpositioning of teeth in the dental arch, and improper tooth brushing and restorative procedures.³ Gingival recession may be generalized to the entire dentition or localized to a single tooth or group of teeth in a particular quadrant, resulting in esthetic problems, root sensitivity, and root caries. Several possible reasons, such as esthetic problems, severe root sensitivity, and prevention of caries, might indicate treatment of the gingival recession with a surgical technique that would replace the lost gingiva (ie, cover the root).

Several surgical techniques have been described to cover the root. Grupe and Warren introduced the lateral or pedicle sliding flap,⁴ a procedure that has several limitations. It can be used only if there is an adequate dimension of gingival tissue lateral to the site of recession and if the area to be treated is localized. Studies of the lateral sliding flap have shown that about 1 mm of recession occurs at the donor site.⁵ The advantage of this procedure is in the esthetics because the color match is ideal.

The coronally positioned flap is another surgical technique used with many variations. This technique is limited by the amount of height and thickness of the gingival tissues;⁶ however, the resulting esthetics are usually very good.⁷ This procedure can be used to treat localized or generalized recession defects.

The free gingival graft has added another dimension to the treatment of gingival recession.⁸ Typically, a gingival graft is obtained from the palate and placed in the area of recession. Disadvantages include the discomfort associated with the palatal graft site and the revascularization problems that sometimes occur at the site where the graft is being placed. In addition, the color match of the tissues is often less than ideal. A coronally positioned flap with an adjunctive subepithelial connective tissue graft is also used in treating gingival recession. Typically, such a connective tissue is obtained from the palate. The removal of a connective tissue graft results in only minor palatal denudation. Furthermore, this technique usually results in a good color blend of the augmented area and increased graft vascularization from the underlying periosteum and the overlying flap to the graft.⁹

Guided tissue regeneration (GTR) or guided bone regeneration are

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Learning Objectives:

After reading this article, the reader should be able to:

- recognize the different techniques for root coverage.
- identify the potential of using an enamel matrix derivative in root coverage techniques.
- describe how to attach the gingiva to the previously exposed root after each technique.

Table 1—Miller's Classification for Marginal Tissue Recession

Class I—Marginal gingival recession that does not extend to the mucogingival junction. There is no bone loss or soft tissue loss in the periodontal area and 100% root coverage can be achieved predictably.

Class II—Marginal gingival recession that extends to or beyond the mucogingival junction. There is no bone loss or soft tissue loss in the interdental area and 100% root coverage can be achieved predictably.

Class III—Marginal gingival recession that extends to or beyond the mucogingival junction. There is bone or soft tissue loss or there is malpositioning of teeth, which prevents predictable root coverage.

Class IV—Marginal gingival recession that extends to or beyond the mucogingival junction. The bone or soft tissue in the interproximal area and/or malpositioning of teeth is so severe that root coverage cannot be achieved.

Adapted from the American Academy Glossary of Periodontology.¹

based on the principle of guiding various cells to proliferate and to form new periodontal tissues during healing through the use of a resorbable or nonresorbable membrane.^{10,11} GTR is capable of regenerating destroyed periodontal tissues. These techniques have been used to treat localized gingival recession defects.¹² The use of nonresorbable membranes requires a second procedure for the removal of the barrier. A nonresorbable barrier tends to maintain its rigidity and will not adapt to the underlying tissue as a resorbable barrier would. This rigidity may contribute to exposure of the barrier and may lead to plaque accumulation on the barrier and the tissue, possibly resulting in the recurrence of recession.¹³ The use of a resorbable material eliminates the need for a barrier-retrieving second surgery. However, results with a resorbable barrier (65% root coverage) appear to be less successful than with a nonresorbable barrier (73% root coverage).¹⁴

Enamel matrix derivatives (EMDs) are present immediately before and during the formation of cementum. A major component of the EMDs, amelogenin, has been shown by immunohistochemistry to be expressed in human teeth not only in enamel formation, but also in root formation.¹⁵ When mesenchymal cells of the dental follicle are exposed to the enamel matrix, a noncellular hard tissue matrix is formed on the enamel surface.¹⁶

A commercially available product,

Emdogain[®], consists of amelogenins that are extracted from developing embryonal tooth buds of porcine origin. Application of the product to experimentally created defects in monkey root incisors has indicated acellular cementum, as well as the formation of other tissues of regeneration.¹⁷ Human histological data confirm that all the tissues of the periodontium are formed after application of the enamel matrix product.¹⁸ Based on the regenerative potential of the EMDs, a therapeutic advantage may be obtained when Emdogain[®] is used in the treatment of gingival recession.

The following cases describe the use of EMD to obtain root coverage in gingival recession defects involving single and multiple teeth.

Case 1

A 22-year-old woman presented with localized recession of 4 mm at the midbuccal of tooth No. 11 (Figure 1A). There was 1 mm of keratinized tissue in the area. The recession defect was classified as Class I. The patient's chief complaint was root sensitivity. The patient was given treatment options that included fluoride, but preferred possible root coverage. An informed consent for the surgical procedure was obtained. One carpule of local anesthesia, Xylocaine[®] with epinephrine (1:100,000), was administered. Vertical incisions were made lateral to the tooth, with recession beginning at a point apical to the papilla tip and extending well into the alveolar mucosa. A sulcular incision in the midbuccal of tooth No. 11 was extended to the mesial and distal line angles. A full-thickness mucoperiosteal flap was raised, which became a partial thickness flap at and beyond the mucogingival junction (Figure 1B). De-epithelialization of the papilla was performed using a diamond bur with a high-speed handpiece. The diamond bur was also used to lightly root plane, ensuring the root surface had no remaining accretions (Figure 1C). The root surface was treated with a 24% solution of ethylenediaminetetraacetic acid (EDTA) in the form of a commercially available product, PrefGel[™]. Rinsing and drying of the root surfaces were performed, followed by the application of EMD (Figure 1D). The flap was coronally positioned without tension and stitched up with 4-0 gut sutures

^aBiora, Inc, Chicago, IL 60610; (888) BIORA-US

^bAstraZeneca Pharmaceuticals, Wilmington, DE 19850-5437; (800) 456-3669



Figure 1A—Tooth No. 11 had a 4-mm recession. There was only 1 mm of keratinized gingiva.



Figure 1B—A full-thickness mucoperiosteal flap was raised, which became a partial-thickness flap at and beyond the mucogingival junction.

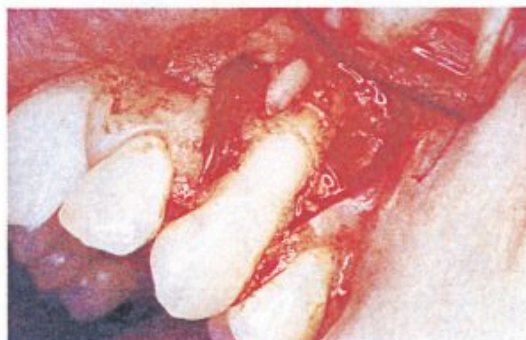


Figure 1C—View of the flap reflection and debridement.



Figure 1D—Emdogain® was applied to the area.

(Figure 1E). Postoperative care included the use of a 0.12% chlorhexidine rinse, Peridex[®], twice daily for 2 weeks. Sutures were removed after 1 week (Figure 1F) and postsurgical care was provided at 2 and 4 weeks. The patient was placed on a quarterly professional prophylaxis program and maintained for 3 years. Complete coverage of the root was observed at all recall visits (Figures 1G and 1H).

Case 2

A 45-year-old woman presented with generalized recession (Miller, Class II) (Table 1) related to the maxillary anterior teeth. The teeth with midbuccal recession measurements included: No. 5 = 1 mm; No. 6 = 6 mm; No. 7 = 2 mm; No. 8 = 2 mm; No. 9 = 3 mm; No. 10 = 2 mm; No. 11 = 5 mm; and No. 12 = 3 mm.

Keratinized gingival tissues of 2 mm or more were present, except in the area of the cuspid (Figure 2A). The patient's chief concern was the esthetic situation.

After being presented with different treatment options, the patient decided on possible gingival coverage of the tooth root and signed a surgical consent form.

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Root planing of all the maxillary anterior teeth was performed after administration of 2 carpules of Xylocaine[®] with epinephrine (1:100,000). Vertical incisions were made at the distals of teeth No. 6 and No. 12, extending well into the alveolar mucosa. Incisions were placed at a point apical to the papilla tip, at the level of the cemento-enamel junction (CEJ), and were followed by sulcular incisions around the maxillary anterior teeth. De-epithelialization of the papilla was accomplished and reflection of a mucoperiosteal flap was followed by a split-thickness flap at and beyond the level of the mucogingival junction. The roots were conditioned with EDTA. After the root surfaces were rinsed and dried, EMD was applied. The flap was coronally positioned without tension. The papilla area was sutured and then the vertical incision area was closed with 4-0 silk sutures. Postoperative care was provided as described in Case 1. The patient has been maintained for 3 years (Figure 2B).

Discussion

These two cases were designated Class I and Class II in which total root coverage might be obtained. However, in cases of Class I and

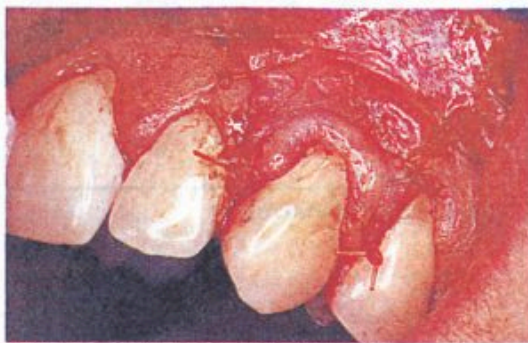


Figure 1E—The flap was coronally positioned to cover the recession.



Figure 1G—Complete coverage of the root 6 months postsurgery. Notice the increase in keratinized gingiva.



Figure 1F—Sutures were removed 1 week after the procedure. Notice the amount of keratinized gingiva (1 mm).



Figure 1H—View of area 4 years postoperative. The zone of keratinized gingiva is even with the adjacent gingiva. The probing depth is only 1 mm.

Class II gingival recession, long-term maintenance of the tissue may not be predictable if the cause for the defect was not corrected (eg, improper toothbrushing and anatomical problems might still persist). In addition, healing by epithelial downgrowth or connective tissue adhesion, rather than by periodontal regeneration, may make a site more vulnerable for recurrent progressive loss of tissue height.

By using this coronally positioned flap technique and an EMD, root coverage of almost 100% was achieved, and the results have been maintained for more than 3 years. Animal studies have demonstrated that recession defects that are treated with pedicle flaps and connective tissue grafts heal with a combination of connective tissue attachment and long junctional epithelium.¹⁹⁻²¹ A limited amount of cementum and bone deposition is observed at the apical portion of the recession defect when a connective tissue graft is used.²¹

The evaluation of healing for previously detached root surfaces after root coverage procedures cannot be studied in humans except in isolated case reports, as a result of patients not wanting to expose a healthy tooth. Few case reports with human block sections after treat-

ment of recession defects with pedicle, free gingival, connective tissue grafts, or GTR procedures, are available in the literature. Two cases treated with laterally positioned flaps showed that about 26% of the covered root surface had resulted in a connective tissue attachment; however, evidence of new cementum formation was minimal.²²

Histological evaluation 42 weeks after treatment of a recession defect with a free gingival graft is reported. The authors estimated that 3.6 mm of new attachment formed in the apical-coronal dimension on the previously detached root portion.²³ However, histological reference for the apical extension of the original defect was unavailable and the new attachment was based on extrapolations from pretreatment probing assessments.

Histological assessment of 2 cases treated with subepithelial connective tissue graft has shown two different healing patterns.²⁴ The first was characterized by a long junctional epithelium that extended well beyond the original margin of the tooth with minimal connective tissue adjacent to the tooth. The other pattern was a short junctional epithelium that stopped at the previously exposed root surface.



Figure 2A—Keratinized gingival tissues of 2 mm or more were present, except in the area of the cuspid.



Figure 2B—The patient has maintained for 3 years.

In this pattern, there was predominantly connective tissue adjacent to the root surface with some isolated areas of epithelium. However, neither new bone nor cementum was seen in either case. Histological evaluation of a gingival recession defect treated with GTR demonstrated connective tissue attachment formation amounting to 74% of the length of the successfully covered root portion and the remaining portion, with newly formed cementum and new bone.²⁵ However, this technique

is used only in single-site recession defects.

Heiji surgically created a defect on a mandibular incisor by removing the buccal bone and the cementum to the apex of the tooth, resulting in a defect resembling a recession defect.²⁶ The root was treated with an EMD. After 4 months, the tooth and the adjacent periodontal tissues were removed in a block section, processed, and histological specimens were analyzed. It was shown that 65% of the bone height was restored and 73% of the root was covered with new cementum.²⁶

The cementum formed after treatment with an EMD has been described as being of both an acellular and cellular type and is always firmly attached to the underlying root surface. Sculean and colleagues have demonstrated that EMDs have the potential to stimulate new connective tissue attachment formation in human intrabony defects.²⁷ Because of its regenerative potential, EMDs are advantageous when used to treat recession defects. The defect area might contain newly regenerated periodontal tissues, such as cementum, periodontal ligament, and alveolar bone, under the coronally repositioned flap. Clinically, it has not been possible to verify if new cementum, bone, and connective tissue attachment formed after the EMD application in these 2 cases of recession defects, however, the results have been maintained for more than 3 years. A larger clinical study has been planned to examine the surgical technique with adjunctive use of EMDs in more detail.

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