



Clinical and Histologic Evaluation of Human Gingival Recession Treated with a Subepithelial Connective Tissue Graft and Enamel Matrix Derivative (Emdogain): A Case Report



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A mandibular canine with significant gingival recession was selected for a pilot study to measure the attachment modalities resulting from mucogingival surgery. The tooth had 6 mm of recession as measured from the cemento-enamel junction to the gingival margin, minimal pocketing, and no keratinized gingiva. The treatment regimen consisted of a subepithelial connective tissue graft (SCTG) plus Emdogain applied to the root surface. The tooth was extracted en bloc 6 months after surgery and processed histologically in a buccolingual plane. The tooth demonstrated a 2-mm gain of attachment and a 3-mm gain in keratinized tissue. The histologic study evidenced the migration of the junctional epithelium 1.2 mm apical to the sulcus. New cementum, evidence of newly formed woven bone, and connective tissue fibers anchored in the new cementum were evident. (Int J Periodontics Restorative Dent 2000;20:269–275.)

There is considerable interest in finding the most predictable method of gaining a connective tissue attachment to a root surface exposed to the oral cavity because of gingival recession.^{1–3} Although many surgical techniques have been proposed, the subepithelial connective tissue graft (SCTG) appears to offer a significant improvement in predictability.^{1,2,4,5} Reports to date have demonstrated clinical results without histologic information, so the exact modality of attachment of the soft tissues to the root surface remains unknown. This histologic case report of a tooth treated with an SCTG in combination with Emdogain offers both clinical and histologic data. The tooth was notched at the apical extent of the recession and then harvested en bloc after healing.

Enamel matrix protein has been described as an effective periodontal regenerative agent for both humans and animal models.^{6,7} Its mode of action is to create a new cementum surface and stimulate fibroblastic migration to the new surface via chemotaxis, resulting in an improved clinical attachment level.⁸

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Thus, the goal of this study was to evaluate the clinical and histologic findings of human gingival recession after treatment with SCTG plus application of enamel matrix derivative (Emdogain, Biora) to the denuded root surface.

Method and materials

A 41-year-old woman in good health presented with 4 remaining mandibular teeth and an aged removable partial denture. Her long-term treatment goal was an implant prosthesis with no natural teeth. The mandibular right canine showed a wide recession of 6 mm in depth, with a pocket depth of 1 mm, probing attachment level of 7 mm, and no keratinized tissue (Fig 1).

Treatment was initiated with conventional debridement, including scaling and root planing, and oral hygiene instruction to test the patient's motivation and dexterity. Baseline documentation was recorded after 1 month, and the treatment plan was presented to the patient. The patient signed an informed consent form for the proposed treatment regimen.

Surgical procedure

A partial-thickness flap was elevated on the buccal surface of the canine, and the root was planed again. A notch was placed 1 mm above the buccal bone crest with a 1-mm-diameter diamond bur (Fig 2). A connective tissue graft was

then harvested from the maxillary palate and positioned with suspensory # 5-0 resorbable sutures (Vicryl, Ethicon/Johnson & Johnson) (Fig 3).

The root surface was washed with sterile saline solution, dried with small pieces of sterile gauze, etched with orthophosphoric acid for 15 seconds, washed, and dried again. Emdogain solution was then placed onto the cleansed root surface (Fig 4), and the graft was meticulously repositioned over the root. The buccal flap was then positioned over the gingival graft with a suspended non-resorbable monofilament suture (Gore-Tex, 3i/WL Gore) and a resorbable suture to optimize its position (Fig 5).

Postsurgical follow-up

A combination of clavulanic acid and amoxicillin (Augmentin [SmithKline Beecham], 2 g per day for 6 days) was prescribed postsurgically. The patient was instructed to rinse twice a day with 0.12% chlorhexidine in the first 4 weeks, and professional tooth cleaning was performed weekly for the first 6 weeks. The patient was instructed to avoid brushing the treated area during the first month after surgery, and was then placed on bimonthly periodontal maintenance until the 6-month reevaluation. No attempt at probing or deep scaling was made during this time.

The clinical probing measurements were repeated after 6 months. The tooth was then extracted with

the tissues on the buccal aspect following the protocol previously described.⁷ The biopsies were fixed in 10% buffered formalin, dehydrated in step gradients of alcohol, and infiltrated and embedded in methyl methacrylate. Sections were obtained in a buccolingual plane.

Results

Clinical findings

Clinical probing measurements were recorded after 6 months. The gingival margin showed a residual recession of 4 mm (Fig 6), a probing pocket depth of 1 mm, a probing attachment level of 5 mm, and a width of keratinized tissue of 3 mm. This represents a decrease in recession of 2 mm, a gain of attachment of 2 mm, and an increase of 3 mm for keratinized tissue.



Fig 1 Mandibular right canine has a wide, 6-mm-deep recession.



Fig 2 Notch is placed 1 mm above the buccal bone crest.

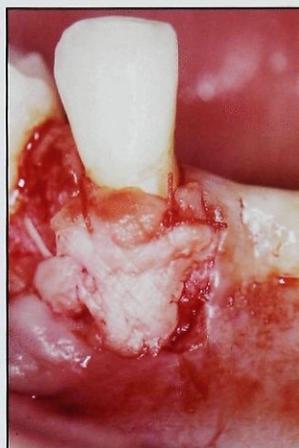


Fig 3 Connective tissue graft is positioned with suspensory resorbable sutures.

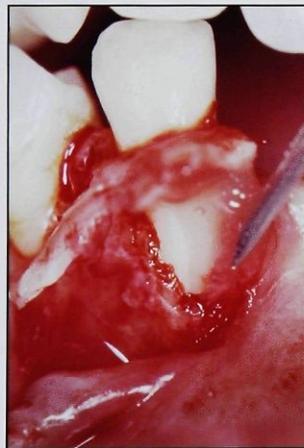


Fig 4 Emdogain solution is placed on the clean root surface.



Fig 5 Buccal flap is secured with a non-resorbable monofilament suture and a resorbable suture for optimal positioning.



Fig 6 Residual gingival recession of 4 mm after 6 months.

Histologic findings

The histologic observations for this mandibular canine treated with SCTG plus Emdogain provided new information to help understand the attachment apparatus that follows the use of connective tissue grafting to cover denuded roots. The junctional epithelium was in close contact with the scaled root surface, extending apically 1.21 mm from the apical component of the sulcus (Fig 7). From there to the coronal margin of the notch, there was a zone of connective tissue contact with fibers running strictly parallel to the root surface, but no attachment to the root was evident.

Deposition of new cementum started within the notch (Figs 8 and 9), and new attachment was found in its apical half. Another interesting feature was found directly apical to the notch: a thin addition to the alveolar wall in the coronal direction consisted exclusively of newly formed woven bone (Figs 8 and 10).

The periodontal ligament began at the level of the tip of alveolar bone; its fibers were anchored in the alveolar bone and were attached to the surface of the cementum. The isolated bony island in the apical part of the notch might have been connected to the newly formed wall in another sectional plane, but this was not found in the present material.

Histometric measurements

This mandibular canine treated with an SCTG in combination with Emdogain exhibited a distance of 3.12 mm between the apical extent of epithelium and the most apical margin of new bone. New connective tissue attachment extended 2.25 mm coronal to the new woven bone. New acellular cementum formed, lining the notch in the tooth and extending 1 mm coronally. Its thickness was 0.06 mm, very similar to the preexisting cementum in the apical portion of the notch. The distance between the most apical and the most coronal levels of newly formed woven bone was 1.87 mm. The length of the epithelium (sulcular and junctional)—the distance between the gingival margin and the most apical extension of junctional epithelium—was 1.96 mm.

Fig 7 (left) Junctional epithelium extends apically 1.21 mm from the apical component of the sulcus; from here to the notch a zone of connective contact is evident with fibers parallel to the root, but no attachment is shown. (Original magnification $\times 8$; hematoxylin-eosin stain.)

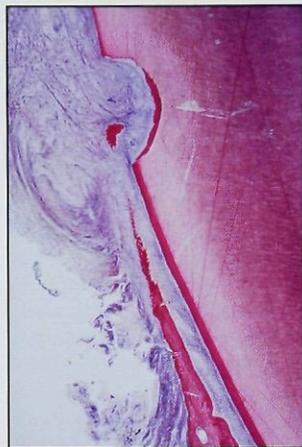
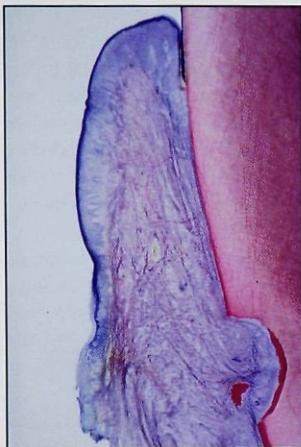


Fig 8 (right) Deposition of new cementum starts within the notch, and new attachment is found in its apical half. Newly formed woven bone is also evident. Periodontal ligament begins at the level of its tip; the fibers are anchored in the alveolar bone and are attached to the cementum. (Original magnification $\times 8$; hematoxylin-eosin stain.)

Fig 9 (left) Higher magnification of notch in Fig 8 shows new acellular cementum, newly formed woven bone, and new periodontal attachment fibers. (Original magnification $\times 32$; hematoxylin-eosin stain.)

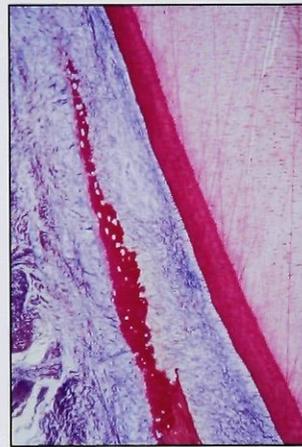
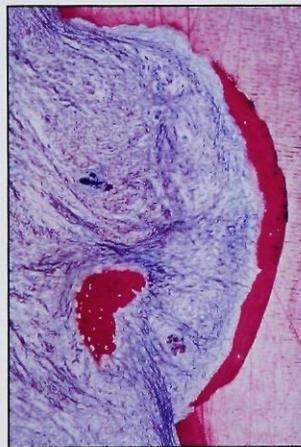


Fig 10 (right) Coronal growth of a thin layer of newly formed woven bone. (Original magnification $\times 32$; hematoxylin-eosin stain.)

Discussion

The introduction of the SCTG into the mucogingival armamentarium significantly improved the predictability of mucogingival surgical procedures aimed at covering exposed root surfaces resulting from gingival recession.⁴ This is especially true for difficult, more compromised teeth. Guided tissue regeneration has also been used with clinical success^{2,10,11}; in fact, similar results have been reported. The treatment selection process is related to variables such as the depth and width of the recession and the treatment of 2 or more adjacent teeth with similar recession defects.¹²

The first recording of root coverage of a denuded root with a laterally positioned flap was reported by Grupe and Warren in 1956,¹³ opening the eyes of the profession to this treatment goal. The publications of P. D. Miller in the early 1980s offered a classification of recession type defects and a remarkable predictability for covering root surfaces, even if they had been previously restored.^{12,14,15} The attachment modality for the traditional gingival graft was demonstrated histologically to include new cementum and attached Sharpey's fiber connection by Pasquinelli¹⁶; however, he did not notch the tooth to record the apical limit of recession.

Cortellini et al¹⁷ used guided tissue regeneration to treat gingival recession on a mandibular canine and histologically demonstrated gain of attachment with new cementum, Sharpey's fiber attachment, and

new bone. It is important to note that the orientation of the fibers was parallel to the tooth rather than perpendicular. This publication reaffirmed clinical data accepted by the community of periodontics. The subepithelial connective tissue graft is generally preferred for many clinical treatments because it is successful for adjacent teeth with similar recession defects and obviates the problems of barrier membrane exposure. In addition, the postsurgical observation period is less cumbersome.

In spite of this progress on both the clinical and academic fronts, it is reasonable and necessary to continue to investigate new strategies to improve the predictability of surgical results. To this end, Emdogain, an enamel matrix protein, was selected for use in combination with the SCTG to learn the methods of reattachment.

It is very difficult to find patients who are compliant with study designs that require harvesting of human block sections. The results of this study suffer from the prominence of the roots, the lack of adjacent teeth, and the width of the recession defects, but the case was selected because of the opportunity to investigate the healed attachment apparatus. The clinical results, although somewhat compromised, were valuable to gain new insight into the healing mechanisms.

The tooth demonstrated an increased zone of keratinized gingiva and minimal pocket depth with root coverage in the area of recession. The histologic pictures

illustrated a new connective tissue attachment of 2.25 mm, newly formed bone of 1.87 mm, and a distance between the gingival margin and the most apical extension of junctional epithelium of 1.96 mm. New cementum was found within the notch with a thickness of 0.06 mm, similar to the old cementum apical to the notch.

The histometric measurements of the SCTG plus Emdogain show a healing gain comparable to the gain obtained with a periodontal barrier membrane.¹⁷ Further investigation is needed with this new technique, and the encouraging histologic results are a stimulus to define a surgical root coverage technique that is easy and predictable, with low surgical risk and a simple follow-up.

References

1. Ricci G, Silvestri M, Rasperini G, Cattaneo V. Root coverage: A clinical/statistical comparison between subpedicle connective tissue graft and laterally positioned full thickness flaps. *J Esthet Dent* 1996;8: 66-73.
2. Ricci G, Silvestri M, Tinti C, Rasperini G. A clinical/statistical comparison between the subpedicle connective tissue graft method and the guided tissue regeneration technique in root coverage. *Int J Periodontics Restorative Dent* 1996;16:539-545.
3. Borghetti A, Gardella JP. Thick gingival autograft for the coverage of gingival recession: A clinical evaluation. *Int J Periodontics Restorative Dent* 1990;10: 216-229.
4. Langer B, Langer L. Subepithelial connective tissue graft technique for root coverage. *J Periodontol* 1985;56:715-720.
5. Nelson G. The subpedicle connective tissue graft: A bilaminar reconstructive procedure for the coverage of denuded root surfaces. *J Periodontol* 1987;58:95-102.
6. Hammarström L, Heijl L, Gestrelus S. Periodontal regeneration in a buccal dehiscence model in monkeys after application of enamel matrix proteins. *J Clin Periodontol* 1997;24:669-677.
7. Heijl L. Periodontal regeneration with enamel matrix derivative in one human experimental defect: A case report. *J Clin Periodontol* 1997;24:693-696.
8. Heijl L, Heden G, Svardström G, Östragen A. Enamel matrix derivative (Emdogain) in the treatment of intrabony periodontal defects. *J Clin Periodontol* 1997;24: 705-714.
9. Camelo M, Nevins ML, Schenk RK, Simion M, Rasperini G, Lynch SE, Nevins M. Clinical, radiographic, and histologic evaluation of human periodontal defects treated with Bio-Oss and Bio-Gide. *Int J Periodontics Restorative Dent* 1998;18: 321-331.
10. Tinti C, Vincenzi G, Cortellini P, Pini Prato GP, Clauser C. Guided tissue regeneration in the treatment of human facial recession: A 12 case report. *J Periodontol* 1992;63:554-560.
11. Pini Prato GP, Tinti C, Vincenzi G, Magnani C, Cortellini P, Clauser C. Guided tissue regeneration versus mucogingival surgery in the treatment of human buccal gingival recession. *J Periodontol* 1992;63:919-928.
12. Miller PD. A classification of marginal tissue recession. *Int J Periodontics Restorative Dent* 1985;5(2):9-14.
13. Grupe H, Warren R. Repair of gingival defects by a sliding flap operation. *J Periodontol* 1956;27:92-104.
14. Miller PD. Root coverage using the free soft tissue autograft following citric acid application. III: A successful and predictable procedure in areas of deep-wide recession. *Int J Periodontics Restorative Dent* 1985;5(2):15-37.
15. Miller PD. Root coverage using the free soft tissue autograft following citric acid application. II: Treatment of the carious root. *Int J Periodontics Restorative Dent* 1985;5(2):39-52.
16. Pasquinelli KL. The histology of new attachment utilizing a thick autogenous soft tissue graft in an area of deep recession: A case report. *Int J Periodontics Restorative Dent* 1995;15:248-257.
17. Cortellini P, Clauser C, Pini Prato GP. Histologic assessment of new attachment following the treatment of human buccal recession by means of a guided tissue regeneration procedure. *J Periodontol* 1993;64:387-391.