

Case Report

Root Coverage Technique with Enamel Matrix Derivative

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Abstract

Various periodontal plastic surgical techniques are employed in obtaining root coverage. Recently, the use of an enamel matrix derivative (EMD) has been reported in such treatment. We report 2 cases of root coverage surgery with a coronally positioned flap in combination with EMD (CPF + EMD) and connective tissue graft in combination with EMD (CTG + EMD). Case 1: The patient was a 25-year-old woman referred to Suidobashi Hospital, Tokyo Dental College for root coverage surgery on the lower right first premolar. Gingival recession was classified as Miller Class II, as no alveolar bone loss or loss of attachment was observed in the interdental area, although recession had progressed to the mucogingival junction. The patient was diagnosed with local gingival recession caused by excessive tooth brushing. Primary conservative treatment failed to reduce the gingival recession. Subsequently, root coverage surgery with CPF + EMD was carried out. As observation at the 1-year follow-up revealed complete root coverage and no recurrence of root exposure or subjective symptoms, the postoperative course was considered to be favorable. Case 2: The patient was a 39-year-old woman referred to Suidobashi Hospital, Tokyo Dental College for root coverage surgery on the lower left canine. Gingival recession was classified as Miller Class II. Root coverage surgery with CTG + EMD was carried out. As observation at the 2-month follow-up revealed complete root coverage and no recurrence of root exposure, the postoperative course was considered to be favorable. These 2 cases indicate the effectiveness of root coverage surgery with CPF + EMD and CTG + EMD.

Key words: Root coverage—Coronally positioned flap—Connective tissue graft—Enamel matrix derivative (EMD)—Periodontal plastic surgery

Introduction

Gingival recession and root exposure can cause problems such as hypersensitivity, esthetic disorder, loss of attachment, and root caries. Underlying factors causing gingival recession include loss of attached gingiva, traction of the

frenum, malposition of teeth, and dehiscence and fenestration of alveolar bone; factors promoting this condition include tooth brushing-induced trauma, localized plaque-induced inflammatory lesion, generalized forms of destructive periodontal disease, faulty dental restoration, and occlusal trauma.



Fig. 1 Case 1 at first examination
A 4-mm gingival recession was observed on buccal side of lower right first premolar.



Fig. 2 3 months after first examination
Gingival inflammation was improved, but gingival recession remained unresolved.

The first strategy for improving gingival recession is to remove the above-mentioned causative and promoting factors. If this does not provide improvement, periodontal plastic surgery will be performed. One of the options for periodontal plastic surgery is the use of root coverage techniques, including laterally sliding flap, coronally positioned flap, free gingival graft, connective tissue graft and the GTR technique¹⁰. Recently, the use of an enamel matrix derivative (EMD) has been reported in such treatment^{9,14,19}.

We report successful outcomes in 2 cases of root coverage surgery with a coronally positioned flap in combination with EMD (CPF+EMD) and connective tissue graft in combination with EMD (CTG+EMD).

Cases

1. Case 1

The patient was a 25-year-old woman referred to us (Clinic of Conservative Dentistry, Suidobashi Hospital, Tokyo Dental College) for root coverage surgery on the lower right first premolar. She was a non-smoker with no significant previous systemic condition and in good physical condition.

At first examination, a 4-mm gingival recession was observed on the buccal side of the lower right first premolar, with marked gingi-

val inflammation and accumulation of plaque (Fig. 1). Gingival recession was classified as Miller Class II, as no alveolar bone loss or loss of attachment was observed in the interdental area, although recession had progressed to the mucogingival junction¹³. X-ray images revealed no apparent alveolar bone loss in the dentition. The patient was diagnosed with local gingival recession caused by excessive tooth brushing.

We instructed the patient to exercise gentle brushing with a soft bristled brush and improve stroke size and brushing pressure in order to eliminate the influence of trauma. Scaling and root planing were performed on the entire dentition. Although these interventions resulted in improvements in gingival inflammation and plaque control, no change was observed in root recession, even 3 months after first examination (Fig. 2). We decided to surgically treat the root recession by root coverage surgery, specifically CPF + EMD. We informed the patient of the need for the surgical procedure, provided a description of the risks associated with the procedure, and obtained her consent.

A partial thickness flap was made in the lower right first premolar under infiltration anesthesia (Fig. 3) and it was confirmed that the flap could be adequately moved to the coronal side. After root planing, the root surface was conditioned with 36% orthophos-



Fig. 3 Preparation of partial thickness flap

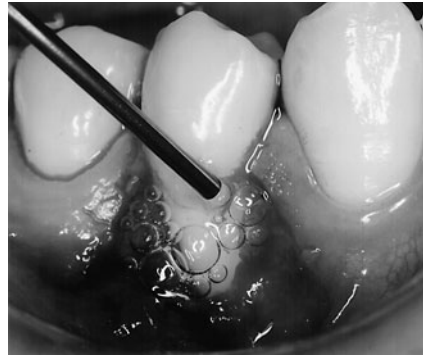


Fig. 4 Application of EMD solution

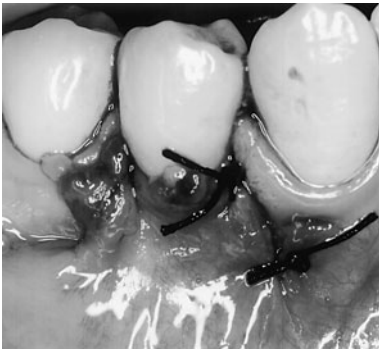


Fig. 5 Flap was moved to coronal side and then sutured



Fig. 6 Oral view at 5 months after surgery
Signs of gingival recession due to movement of
buccal frenum remaining at lower right canine.

phonic acid gel (Dentsply, Dentrey) and then thoroughly rinsed with saline. The EMD solution (Emdogain® Gel; Biora AB, Malmö, Sweden) was applied immediately (Fig. 4). The flap was moved to the coronal side to cover the exposed root, and a double-sling suture was placed at the papillae of the flap (Fig. 5). The suture was removed 3 weeks after surgery. During follow-up, the patient showed a favorable course of healing, with gradual formation of attached gingiva.

Five months after surgery, the patient showed signs of recurrence of gingival recession due to movement of the buccal frenum remaining at the lower right canine (Fig. 6). Frenectomy was, therefore, performed as an additional surgery. Under infiltration anes-

thesia, a partial thickness flap was raised following a transverse incision extending from the lower right second premolar to the lower right canine along the mucogingival junction. After the raised partial thickness flap was extended sufficiently to reach the periapical region, another transverse incision reaching the periosteum was made in the periapical region to separate the buccal frenum from the lower right canine. A full thickness flap was also raised from the site of the transverse incision to the periapical region. The flap was moved to the periapical side and fixed by periosteum suturing using an absorbable suture (5-0 Vicryl®, Ethicon, Johnson & Johnson) (Fig. 7).

At a follow-up examination 6 months after



Fig. 7 Oral view at after-frenectomy

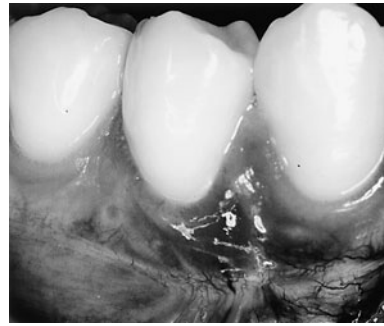


Fig. 8 Oral view at 1 year after surgery with CPF + EMD



Fig. 9 Case 2 at first examination
A 5-mm gingival recession was observed on buccal side of lower left canine.



Fig. 10 Preparation of recipient bed

the frenectomy (1 year after surgery with CPF + EMD), the exposed root was completely covered, with a gain of 3 mm attached gingiva and no recurrence of gingival recession or subjective symptoms such as root sensitivity. The patient experienced no problems during brushing and was, therefore, considered to show a favorable clinical course (Fig. 8).

2. Case 2

The patient was a 39-year-old woman referred to our hospital (Clinic of Conservative Dentistry, Suidobashi Hospital, Tokyo Dental College) for root coverage surgery on the lower right first premolar. She was a non-smoker with no significant previous systemic

condition and in good physical condition.

At first examination, a 5-mm gingival recession was observed on the buccal side of the lower left canine, with gingival inflammation and accumulation of plaque (Fig. 9). Gingival recession was classified as Miller Class II and she was diagnosed with local gingival recession caused by excessive tooth brushing. Primary conservative treatment failed to reduce the gingival recession. Subsequently, root coverage surgery involving CTG + EMD was carried out.

Under infiltration anesthesia, a partial thickness flap was raised on the buccal side of the lower left canine in order to prepare a recipient bed (Fig. 10). A free connective tissue graft was harvested using the "trap-door" technique



Fig. 11 Application of EMD solution



Fig. 12 Covering exposed root with connective tissue



Fig. 13 Flap was moved to coronal side and then sutured



Fig. 14 Oral view at 2 months after surgery with CPF + EMD

from the palatal side of the upper right premolars. After root planing of the recipient tooth, the root surface was conditioned with 36% orthophosphoric acid gel (Dentsply, Dentrey) and then thoroughly rinsed with saline. The EMD solution (Emdogain® Gel; Biora AB) was applied immediately (Fig. 11). The exposed root was covered by connective tissue and sutured and fixed with an absorbable suture (5-0 Vicryl®, Ethicon, Johnson & Johnson) (Fig. 12). The flap was moved to the coronal side, the connective tissue graft was covered by this flap, and a double-sling suture was placed at the papillae of the flap (Fig. 13).

The suture was removed 3 weeks after surgery. At a follow-up examination 2 months after surgery, the exposed root was completely

covered, with no subjective symptoms such as root sensitivity (Fig. 14).

Discussion

Various periodontal surgical techniques, including laterally positioned flap, coronally positioned flap (CPF), free gingival graft, connective tissue graft (CTG) and the GTR technique, are currently performed for treatment of gingival recession. Among these techniques, CTG has been conventionally and widely performed. Paolantonio *et al.*¹⁷⁾ compared clinical results obtained in gingival recession correction treatment using free gingival grafts and CTG, and concluded that

CTG was expected to provide more reliable root coverage than free gingival graft. A study comparing the GTR technique using an absorbable membrane and CTG also suggested that CTG is more likely than the GTR to achieve complete root coverage⁸⁾. CTG is associated with many advantages, such as expected gain of attached gingiva and favorable esthetic outcomes, with little gingival scar formation. At the same time, the technique is also associated with problems such as the fact that it requires graft collection, thereby creating a wound at the donor side, and that it is technically demanding.

In contrast, CPF involves no grafting and, therefore, does not require tissue collection, making the procedure technically easier than CTG. However, the technique is associated with such drawbacks as unreliable attachment gain and frequent recurrence of gingival recession. A meta-analysis of CPF and CTG revealed that the mean percentage of root coverage and mean percentage of patients with complete root coverage following CPF were 80% and 50%, respectively, while the corresponding values for CTG were 86% and 61%, respectively, indicating the superiority of CTG¹⁰⁾. Cortellini *et al.*⁴⁾ compared the clinical outcomes of CPF and CTG in single Miller Class I and II gingival recession in a multicenter, double-blind, randomized-controlled clinical trial and similarly concluded that CTG increased the probability of achieving complete root coverage.

Methods involving the concurrent use of an EMD have also been attempted to achieve better clinical outcomes following CPF. Modica *et al.*¹⁴⁾ carried out a split-mouth study on a total of 40 pairs of Miller Class I and II bilateral comparable gingival recessions in 12 patients in order to assess the effect of the concurrent use of an EMD in CPF for 6 months. They obtained slightly better outcomes with CPF + EMD in terms of root coverage and clinical attachment level than with CPF, but the differences were not statistically significant. Other studies^{6,7,20)} involving more cases and longer follow-up periods also found no significant differences between CPF and

CPF + EMD. Meanwhile, several studies^{3,5,18)} have shown significantly better outcomes with CPF + EMD than with CPF in terms of percentage of root coverage, keratinized gingival gain, and attachment gain, revealing substantial variability in the outcomes of long-term studies of CPF + EMD.

Possible reasons for the variability in study results include that the clinical outcome of periodontal plastic surgery depends on the surgeon's skill and that there are differences in the preoperative conditions of each patient such as anatomical conditions. Berlucchi *et al.*¹⁾ more closely analyzed the preoperative conditions of patients. They performed CPF + EMD in 30 patients with gingival recession of Miller Class I or II and assessed percentage of root coverage 12 months after surgery in relation to clinical parameters, including baseline recession depth, papilla height, papilla width, crestal bone height and flap thickness. Among these clinical parameters, baseline recession depth and flap thickness affected postoperative outcome; a baseline recession depth of 4 mm or less and a flap thickness of 1 mm or more was associated with 100% root coverage. In our case 1, the baseline recession depth of 4 mm and rather thick flap, although not precisely measured, might have led to the successful outcome.

Recently, EMD has also been used in CTG and compared with CPF + EMD in many studies. McGuire and Nunn¹²⁾ enrolled 17 patients with bilateral gingival recession of 4 mm or more and performed CTG + EMD on one side and CPF + EMD on the other side so as to compare the two procedures. They found no significant differences with respect to root coverage or keratinized gingival width at 12 months postoperatively between the two groups. They also obtained two tooth samples from one of the study subjects who required tooth extraction, examined them histologically¹¹⁾ and obtained the following results: CTG + EMD was found to have adhered to the root surface primarily by connective tissue attachment with some evidence of root resorption. CPF + EMD was found histologically to

have all the tissues necessary for regeneration, namely, new cementum, organizing periodontal ligament fibers, and islands of condensing bone. On the other hand, when the two procedures were compared in clinical comparative studies in which large numbers of patients from multiple institutions were followed up for long periods of time^{15,16}, CTG+EMD was found to be superior with respect to both percentage of root coverage and keratinized gingival width. Calro *et al.*²⁾ conducted a systematic review of CPF and concluded that CTG or EMD in conjunction with CPF enhanced the probability of obtaining complete root coverage in Miller Class I and II single gingival recession.

The difference between the indications for CPF+EMD and CTG+EMD are as follows. CPF+EMD should be used when connective tissue cannot be harvested and a sufficient size of flap can be moved to the coronal side. CTG+EMD should be used when the flap to cover the root surface is thin and a sufficient size of flap can not be moved to the coronal side. In case 1, the gingiva on the palatal side from which a graft was to be harvested was thin, and harvesting a sufficient amount of connective tissue was expected to be difficult. We, therefore, used CPF+EMD in this case. In case 2, the flap to cover the root surface was thin, causing concern that root exposure could recur. We, therefore, employed CTG+EMD in this case.

The root coverage technique involving CPF+EMD used in case 1 is advantageous in that it is technically easier than the CTG+EMD technique used in case 2 and does not require collection of connective tissue. However, the gained attached gingiva in case 1 appeared to be thinner than that in case 2. This finding suggests that CTG+EMD is currently the most advantageous procedure for root coverage. Nevertheless, both CPF+EMD and CTG+EMD performed for root coverage achieved favorable results, suggesting the usefulness of the application of an EMD in root coverage. Studies are currently underway to verify the effectiveness of CPF+EMD and CTG+EMD.

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