Coronally Advanced Flap for the Treatment of Buccal Gingival Recessions With and Without Enamel Matrix Derivative. A Split-Mouth Study*

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Background: The coronally advanced flap (CAF) is a predictable method for achieving root coverage in buccal gingival recessions. The use of enamel matrix derivative (EMD) has already been tested in treating intrabony defects. No clinical comparative study has been published evaluating the CAF in combination with EMD in treating buccal gingival recessions.

Methods: This split-mouth study was performed to assess the efficacy of EMD to improve the results of a root coverage procedure. Fourteen pairs of Miller Class I and II bilateral comparable defects were selected in 12 patients. In each patient, one site was randomly assigned to the test group and the contralateral site to the control group. The treatment consisted of a CAF procedure with (test) or without (control) EMD. Gingival recession (REC), clinical attachment level (CAL), probing depth (PD), and extension of keratinized tissue (KT) were recorded at baseline and 6 months postsurgery.

Results: The average initial REC was 3.71 mm (SD ± 1.68) for the test group, and 3.50 mm (SD ± 1.56) for the control group. The 2 groups were statistically homogeneous. The mean root coverage was 3.36 mm (SD ± 1.55), corresponding to a value of 91.2% for the test group, and 2.71 mm (SD ± 1.20), equal to 80.9% for the control group. The differences between the 2 groups were not statistically significant. The mean CAL gain was 3.57 mm (SD ± 1.55) for the test group and 2.79 mm (SD ± 1.19) for the control group. No changes of PD and KT were found.

Conclusions: This study suggests that EMD does not seem to significantly improve the clinical outcomes of gingival recession treated by means of CAF, even though the test group showed slightly better results in terms of root coverage and CAL. Further studies with a larger number of teeth and higher statistical power are needed to support this conclusion. J Periodontol 2000;71:1693-1698.

KEY WORDS
Gingival recession/surgery; protein, enamel matrix; surgical flaps; tooth root.

One of the most important goals of periodontal plastic surgery is to eliminate gingival recessions when a patient complains of dental hypersensitivity and/or lack of esthetics of an exposed root. Periodontists can choose among many surgical techniques to achieve predictable optimal results. In recent years, several authors have proposed the use of the coronally advanced flap (CAF) as a relatively easy technique that can produce optimal results. CAF fulfills a patient’s expectation in terms of preventing discomfort to the palate, as happens with free gingival or connective tissue grafts, and avoids a second surgery. The results of this procedure present a mean root coverage that ranges from 55% to 99%. The percentage of complete success of the procedure, with no final residual recession, varies from 9% to 95%. The discrepancies of these values depend mainly on the selection of the defects, Miller class, and mean depth.

CAF has been performed with or without the use of root conditioners such as citric acid or tetracycline. However, no clinical studies have confirmed any additional benefit from the use of these products. Moreover, Trombelli et al. were able to demonstrate the absence of any advantage in fibrin glue application in association with CAF.

The role of enamel matrix derivative (EMD) in periodontal regeneration has...
recently been presented in one experimental human recession defect by Heijl. Following creation of a buccal dehiscence in a mandibular incisor and the application of EMD, he was able to histologically observe that the new cementum covered 73% of the original defect and that bone gain was 65%. The author suggests that placing EMD on a root surface mimics the cementogenesis of nascent root development. Histologic confirmation of new cementum, after the application of EMD, was also reported by Mellonig in the treatment of intrabony periodontal pockets.

Rasperini et al. demonstrated the formation of new cementum, new attachment, and new bone after the treatment of a gingival recession with subepithelial connective tissue graft plus EMD.

Based on this evidence, it seems reasonable to propose using EMD to improve the clinical outcomes of treating recession defects using the coronally advanced flap. To the best of our knowledge, no investigations comparing the results of CAF with and without EMD are available in the literature.

The aim of this prospective, controlled, randomized, clinical study was to assess the usefulness of EMD to enhance the clinical results of root coverage with CAF at a 6-month follow-up.

MATERIALS AND METHODS

Study Population

Twelve non-smoking patients (7 male and 5 female; age ranging from 20 to 50; mean 33.8 years) with similar bilateral Miller Class I or II gingival recession were selected among those seeking care at the Periodontal Department of the University of Torino, Italy, between January and October 1998. The patients agreed to participate in this study and gave their informed consent, in accordance with the Helsinki Declaration on human experimentation.

All patients were healthy, not taking any medication, and presented with esthetic and/or dental hypersensitivity problems. Ten patients each presented 2 bilateral gingival recessions, and the other 2 were treated for 2 symmetrical pairs of adjacent lesions, suitable for a split-mouth study. The teeth were in good occlusal relationship, vital and free from decay or restorations, and had not received previous periodontal surgical treatment.

Full-mouth plaque score (FMPS) and full-mouth bleeding score (FMBS) were recorded as the percentage of surfaces, 4 per each tooth, which revealed the presence of plaque and of bleeding on probing.

Following selection, all patients were monitored in oral hygiene and instructed in proper toothbrushing with the roll-stroke technique, until they reached satisfactory plaque control. In order to achieve a regular and smooth surface, scaling and selective root planing were performed if necessary. At the end of the therapy, before the surgical procedures, all patients had a FMPS <20% and FMBS <20%.

Randomization for test and control treatment was performed by coin toss.

Surgical Procedure

The surgical procedure was identical in both treated sites. After local anesthesia (mepivacain with epinephrine 1:100,000), an intrasulcular incision was made with a #15 blade on the buccal aspect of the involved tooth, and 2 oblique releasing incisions were made from the mesial and distal extremities of the horizontal incision beyond the mucogingival junction. The trapezoidal flap was full-thickness to expose the marginal bone of the dehiscence on the root surface for at least 3 mm, without involving the adjacent papillae in order to preserve most of the connective tissue and leave the gingival margin of the adjacent teeth intact. The continuous partial-thickness portion extended apically, as far as necessary, so that it could be coronally repositioned at the cemento-enamel junction (CEJ) without tension. The exposed root surface was additionally planed in the most coronal area using curets. On the test sites only, the roots were treated according to the manufacturer's instruction. First, they were conditioned with EDTA 24%† for a maximum of 2 minutes to remove the smear layer and then rinsed with sterile saline to obtain a surface devoid of organic debris. EMD‡ was then applied, starting from the most apical bone level and covering the entire root surface. The flap was repositioned slightly above the CEJ and sutured with 4-0 non-resorbable sutures in both test and control sites.

Postsurgical Care

No periodontal dressing was used for either technique. Immediately after surgery, the patients applied ice packs to the treated area and were advised to keep them in place for at least 4 hours. All patients were placed on therapy with azithromycin§ 500 mg/day for 3 days and 0.12% chlorhexidine digluconate rinse 1 minute 3 times a day for 3 weeks. Patients were told to avoid toothbrushing at surgical sites for the first 6 weeks and to avoid chewing or any trauma at the surgical site. Patients were seen at 1, 2, 4, 6, 12, and 18 weeks to monitor their oral hygiene conditions. If necessary, a professional supragingival tooth cleaning was performed. Sutures were removed after 2 weeks.

Healing proceeded without complications at test and control sites and with minimal postoperative discomfort in all patients.

† Prefgel, Biora AB, Malmö, Sweden.
‡ Emdogain, Biora AB.
§ Zithromax, Pfizer, Rome, Italy.
Clinical Assessments
One calibrated examiner, blinded to the surgical treatment, collected the following data at baseline and 6 months postoperatively: gingival recession (REC), probing depth (PD), clinical attachment level (CAL), and keratinized tissue width (KT). All measurements were done by the same operator using a periodontal probe rounded off to the nearest millimeter.

Statistical Analysis
The Kolmogorov-Smirnov test ($P = 0.05$) was used to confirm the normal distribution for homogeneous initial conditions. When the conditions were not met, a non-parametric test (Wilcoxon for paired test or Mann-Whitney for unpaired) was employed.

The Student $t$ test for paired data was utilized for the changes after treatment within groups and Wilcoxon test ($P = 0.05$) if one of the samples failed the KS test.

Evaluation of changes after treatment between groups was performed by means of Student $t$ test ($P = 0.05$) for unpaired data when both samples did not deviate from Gaussian distribution and by Mann-Whitney test ($P = 0.05$) when at least 1 of the samples failed the KS test.

RESULTS
Tables 1 and 2 illustrate test and control treatments from baseline to 6 months postoperatively. The 2 groups were homogeneous, at baseline, for all 4 parameters tested.

Gingival Recession
At test sites, gingival recession decreased from $3.71 \pm 1.68$ mm to $0.36 \pm 0.50$ mm, a reduction of $3.36 \pm 1.55$ mm, corresponding to a root coverage of $91.2 \pm 13.2\%$. At the control sites, gingival recession decreased from $3.50 \pm 1.56$ mm to $0.79 \pm 1.05$ mm, a difference of $2.71 \pm 1.20$ mm, equal to root coverage of $80.9 \pm 21.3\%$. Both procedures produced significant changes and no differences were found between the 2 groups.

Root Coverage
Complete root coverage was achieved in 9 out of 14 sites of the test group and in 7 cases of the control

Table 1.
Test Group (CAF + EMD)

<table>
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<th>Patient</th>
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group, representing, respectively, 64% and 50% of the areas treated (Figs. 1 and 2).

**Clinical Attachment Level**
In the test group, clinical attachment level decreased from $4.86 \pm 1.66$ mm to $1.29 \pm 0.47$ mm, meaning a reduction of $3.57 \pm 1.55$ mm. At the control sites, CAL decreased from $4.50 \pm 1.56$ mm to $1.71 \pm 1.07$ mm, corresponding to a reduction of $2.79 \pm 1.19$ mm. The average clinical attachment gains were statistically significant in both groups, with no difference between test and control.

**Probing Depth**
At the test sites, probing depth changed from $1.14 \pm 0.53$ mm to $0.93 \pm 0.27$ mm, representing a reduction of $0.21 \pm 0.58$ mm. In the control group, PD changed from $1.00 \pm 0.00$ mm to $0.93 \pm 0.27$ mm, equal to a reduction of $0.07 \pm 0.27$ mm. The changes were not significant.

**Keratinized Tissue**
In the test group, keratinized tissue changed from $1.71 \pm 1.07$ mm to $1.93 \pm 0.73$ mm, equal to a difference of $0.21 \pm 0.70$ mm. At the control sites, KT changed from $1.36 \pm 1.01$ mm to $1.43 \pm 0.76$ mm, a difference of $0.07 \pm 0.83$ mm. The differences were not statistically significant.

**DISCUSSION**
The aim of the present study was to compare the surgical outcomes of a coronally advanced flap with and without the use of enamel matrix derivative. In order to have a precise method of estimating the possible advantage of EMD, a split-mouth study was considered the most appropriate with test and control sites as similar as possible. Gingival recessions were reduced on average 3.4 mm and 2.7 mm following test and control procedures, respectively, corresponding to an average root coverage of 91.2% and 80.9%. However, these differences between treatments did not reach a statistically significant level.

Complete root coverage was achieved in 64% of the test sites and 50% of the controls. These percentages of root coverage are similar to those found by other investigators who treated similar types of defects.9,10 The apparently better results obtained in some other studies may be related to the selection of only Miller Class I defects.3,5,6
significant differences. In both cases, pockets remained shallow. A minimal increase of the apico-coronal height of the gingiva (KT) was found following both test (0.21 mm) and control (0.07 mm) treatments. The difference was not statistically sufficient to explain a mechanism as described by Karring et al. and Lundberg and Wennström.18-20 It is interesting to note, however, that this is a controversial issue in the literature. Along with some authors4,6 who found an increased gingival height following CAF, several others described a small reduction after an identical procedure.7-9 Further studies are needed to clarify this issue.

From a histological point of view, human biopsies with an artificially created recession defect and with the use of a connective tissue graft12,14 have shown that the application of EMD resulted in the formation of an acellular type of cementum, with insertion of collagen fibers and new alveolar bone. However, the precise biological mechanisms of EMD on the deep periodontal tissues are far from being elucidated.

This study suggests that EMD does not seem to significantly improve the clinical outcomes of gingival recession treated by CAF, even though the test group showed slightly better results in terms of root coverage. Further studies of much higher power are needed to support this conclusion. A longer follow-up and surgical re-entries, to evaluate the conditions of the deep periodontal tissues, would be desirable.

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REFERENCES
Enamel Matrix Derivative in Treatment of Gingival Recession


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