



Coronally Advanced Flap Associated with a Connective Tissue Graft for the Treatment of Multiple Recession Defects in Mandibular Posterior Teeth



Massimo de Sanctis, MD, DDS, MS*/Nicola Baldini, DDS**
Cecilia Goracci, DDS***/Giovanni Zucchelli, DDS****

The coronally advanced flap has been documented as an effective surgical technique for the treatment of gingival recessions in cases of multiple adjacent recession defects, obtaining stable long-term results after 5 years of follow-up. The aim of the present study was to test the coronally advanced flap, in association with a connective tissue graft, in a case series of 10 patients presenting at least two gingival recessions on adjacent teeth in the posterior mandibular area. Periodontal parameters were recorded on teeth involved in the surgeries at baseline and 1 year. A total of 26 recessions were treated. No significant complication affected the surgeries, and no patient abandoned the study. Recession depth was reduced from 3.40 ± 0.83 mm at baseline to 0.28 ± 0.32 mm at the 1-year control, while differences in pocket depth were not significant. Keratinized tissue increased from 0.57 ± 0.46 mm to 3.05 ± 0.71 mm. Greater reductions in recession depth were observed in cases where the initial conditions were worse. A mean $91.2\% \pm 4.1\%$ recession coverage was obtained. The coronally advanced flap in association with a connective tissue graft can be proposed as a valid therapeutic approach for multiple recession defects in mandibular posterior areas. (Int J Periodontics Restorative Dent 2011;31:623–630.)

*Professor and Chair, Department of Periodontology, Siena University, Siena, Italy

**Lecturer, Department of Periodontology, Siena University, Siena, Italy.

***Professor, Department of Dental Materials and Fixed Prosthodontics, Siena University, Siena, Italy.

****Professor, Department of Odontostomatology, Bologna University, Bologna, Italy.

Correspondence to: Prof Massimo de Sanctis, Via Gustavo Modena 10, 50121 Firenze, Italy; fax: +39-055-5058104; email: massimodesanctis@tin.it.

Gingival recession is defined as the apical displacement of the gingival margin¹ resulting from the destructive effect of plaque accumulation, trauma from tooth brushing, or both.²

It has been established that several surgical techniques are equally effective in reconstructing the lost gingival tissue, provided that the recession is of Miller Class I or II, ie, without loss of interdental attachment.^{3–5} Zucchelli and De Sanctis⁶ proposed a modification of the coronally advanced flap (CAF), an envelope flap without vertical incisions, for the treatment of multiple recessions. In a case series of 22 patients, 88% of Class I and II gingival defects were covered successfully at the 1-year posttreatment examination. This technique yielded optimum root coverage, good color blending of the treated area with the adjacent soft tissue, and complete recovery of the presurgical soft tissue marginal morphology with minimal patient discomfort.

However, this procedure is limited because of the need for the presence of a residual amount of

marginal keratinized tissue. Therefore, if there is no residual keratinized tissue on the marginal gingiva or if an immediate increase in keratinized tissue is needed, a bilaminar technique involving the use of a connective tissue graft (CTG) under the CAF is recommended. Zucchelli et al⁷ performed a randomized clinical trial on bilaminar CTGs of different thicknesses and dimensions associated with CAFs for single recession coverage on maxillary anterior teeth. In this investigation, results varying from 94.77% ± 11.21% to 97.37% ± 7.01% for root coverage and from 80.0% to 86.7% for complete root coverage were reported. In the study by da Silva et al⁸ on 11 patients with bilateral Miller Class I recessions, CAFs with or without a CTG were compared in a split-mouth design. A significant reduction in recession depths was obtained with both procedures, and no statistically significant differences were found between test and control groups in terms of recession and clinical attachment length. Mean root coverage was 75% for CAF + CTG and 69% for CAF alone. No data regarding complete root coverage were reported.

In a multicenter randomized clinical trial on 85 patients with single recession defects, 43 patients receiving a CAF alone were compared with 42 patients receiving a CAF associated with a CTG.⁹ Statistically comparable outcomes in the two groups were reported with regard to recession reduction, while a significantly greater probability of complete root coverage

was observed when the CAF was associated with a CTG. Complete root coverage for the CAF alone was 42% and 37% at 3 and 6 months, respectively, while complete root coverage for the CAF + CTG was 60% at both 3 and 6 months. The authors concluded that the additional application of a CTG under a CAF increased the probability of achieving complete root coverage in maxillary Miller Class I and II defects.

In a recent systematic review,¹⁰ the positive clinical outcome of the CAF alone and in conjunction with a CTG was demonstrated. In the same work, the authors reported that gain in keratinized tissue was greater in cases of CAFs in conjunction with CTGs, as compared with other mucogingival techniques.

Very little information is available in the literature on the treatment of adjacent gingival recessions with a bilaminar approach. This procedure yielded complete coverage of between 61% and 88% of treated recessions.¹¹⁻¹³ In the study by Carvalho et al¹¹ on 10 patients and 29 recessions, the mean root coverage was 96.7%, and complete root coverage was observed in 93.1% of defects.

All previously reported studies refer to unspecified recession defects without differentiating between maxillary and mandibular sites, and no investigation has specifically addressed the predictability of this technique in mandibular areas. The aim of this study was to clinically evaluate the effectiveness and predictability of root coverage at adjacent root recessions in man-

dibular premolars using a modified multiple CAF associated with a subepithelial CTG.

Method and materials

Ten subjects ranging in age between 20 and 38 years who were systemically and periodontally healthy with multiple adjacent gingival recession-type defects in the mandibular posterior area were enrolled in this study. Participants were selected on a consecutive basis among patients consulting the Department of Periodontology at the University of Siena, Siena, Italy. A screening examination revealed that all subjects showed a normal medical history and none had a loss of periodontal support at tooth surfaces other than those showing recession defects.

To be included in the study, patients had to have at least two recession defects with the following characteristics: multiple defects (recessions present at adjacent teeth), Miller Class I or II recession (no loss of interdental soft and hard tissue height), and recession depth greater than 2 mm.

Following the screening examination, all subjects received a session of prophylaxis including instructions in proper oral hygiene measures, scaling, and professional tooth cleaning with the use of a rubber cup and a low-abrasive polishing paste. At teeth with recession-type defects, a coronally directed roll technique was prescribed to minimize brushing trauma to the gingival margin. Surgical treatment

of the recession defects was not scheduled until the patient could demonstrate an adequate standard of supragingival plaque control.

Clinical characterization of patients and selected sites

Full-mouth and local plaque scores were recorded as the percentage of total surfaces (four locations per tooth) that revealed the presence of plaque.¹¹ Bleeding on probing was assessed dichotomously at a force of 0.3 N with a manual pressure-sensitive probe (PCP-UNC 15 [Hu-Friedy] equipped with a Brodentic spring device [Dentramar]). Full-mouth and local bleeding scores were recorded as the percentage of total surfaces (four locations per tooth) that revealed the presence of bleeding on probing.

The following clinical measurements were taken 1 week before surgery and at the 1-year follow-up visit at all treated teeth: recession depth (RD), measured from the cemento-enamel junction to the most coronal extension of the gingival margin; probing pocket depth (PPD), measured from the gingival margin to the bottom of the gingival sulcus; clinical attachment level (CAL), measured from the cemento-enamel junction to the bottom of the gingival sulcus; and keratinized tissue height (KTH), measured from the most coronal extension of the gingival margin to the mucogingival line.

The same single investigator, who did not perform the surgery and was unaware of the goals of the

study, performed the clinical measurements at baseline and at the end of the study. All measurements were performed by means of a manual probe and were rounded to the nearest 0.5 mm.

Surgical technique

All surgeries were performed by the same operator. A modified design of the envelope flap was performed, as proposed by Zucchelli and De Sanctis.⁶ Briefly, a horizontal marginal incision, consisting of oblique submarginal incisions in the interdental areas continuing with the intrasulcular incision at the recession defect, was performed.

The envelope flap was raised with a split-full-split approach in the apicocoronal direction. The root surfaces were treated mechanically with the use of curettes. The remaining tissue of the anatomical interdental papilla was de-epithelialized to create connective tissue beds to which the surgical papilla was sutured. A sharp dissection into the vestibular mucosa lining was then carried out to eliminate muscle tension. Only when anterior teeth were included in the flap design was a vertical releasing incision performed. The incision was placed at the mesial line angle of the most mesial tooth.

The CTG was harvested from the palate and trimmed to remove all visible epithelium.¹² The dimension of the graft was adequate to cover only the root surfaces up to the cemento-enamel junction, without covering the bone apical to the

root exposure. In other words, the connective tissue was lying over only the root surfaces and the interdental bone. No periosteal bed was prepared to augment the vascularity of the graft since the buccal flap was considered adequate to ensure vascular support. This was done to reduce the dimension of the graft, thus limiting patient discomfort.

The graft was held in position by means of sutures passing through the connective tissue of the de-epithelialized papillae. The buccal flap was advanced coronally to cover the cemento-enamel junction, taking care to stabilize each surgical papilla over the interdental tissue bed, and secured in position using sling sutures (Figs 1 and 2).

Postsurgical infection control

Patients were instructed not to brush in the treated area but to rinse with chlorhexidine solution (0.12%) twice daily for 1 minute. In case of pain, patients were instructed to take ibuprofen 600 g three times a day.

Fourteen days after surgical treatment, the sutures were removed. Plaque control in the surgically treated area was maintained by chlorhexidine rinses for an additional 2 weeks. After this period, patients were again instructed in mechanical tooth cleaning of the treated region using a soft toothbrush and the roll technique. All patients were recalled for prophylaxis 1, 3, and 5 weeks after suture removal and, subsequently, once every 3 months until the 1-year examination.

Fig 1 Patient 1.



Fig 1a Presurgical clinical aspect of the mandibular right premolars.



Fig 1b Envelope flap raised with a split-full-split approach.



Fig 1c The CTG sutured at the base of the de-epithelialized anatomical papillae. The graft tissue did not reach the apical extension of the bone dehiscence.



Fig 1d The flap advanced coronally and anchored with sling sutures.



Fig 1e Occlusal aspect of the suture. The soft tissue is tightly adapted around the teeth.



Fig 1f One year postoperative. The increase in keratinized tissue is evident.

Fig 2 Patient 2.



Fig 2a Gingival recessions affecting the mandibular first molar (mesial and distal roots) and second premolar. The depth of the vestibulum is shallow, and the residual keratinized tissue apical to the root exposures is small in height and thickness.



Fig 2b Flap elevation. Only one vertical releasing incision was performed mesial to the premolar.



Fig 2c Two distinct CTGs were sutured because of the different apicocoronal levels of the cemento-enamel junctions of the two treated teeth.



Fig 2d The flap advanced coronally to cover the CTGs completely.



Fig 2e Suture removal. Complete coverage of the grafts was maintained during the first healing period (14 days).



Fig 2f One-year follow-up. Complete root coverage, increased buccal soft tissue thickness, and good color blending was achieved at both treated teeth.

Data analysis

Statistical analysis was performed using statistical application software (SPSS 12.0, SPSS). The percentage of root coverage was defined as follows:

$$(100 \times (\text{baseline recession depth} - \text{1-year follow-up recession depth})) / \text{baseline recession}$$

Descriptive statistics were computed for measurements of each parameter at baseline and after 1 year, as well as for the difference in each parameter between the 1-year and baseline values. The proportion of complete success (100% root coverage) was also computed.

The significance of changes ($\alpha = .05$) in gingival recession, CAL, and PPD at the 1-year follow-up was tested by paired-samples *t* tests. An ordinary least square multiple linear regression model was applied to the entire sample to explore the relative contribution of different predictors on the amount of root coverage; in particular, the predictive variables included the initial RD and the presurgical KTH. Ordinary least square linear regressions were used to evaluate the relationship between the root coverage outcomes (mean percentage of root coverage and percentage with complete root coverage) and the number of recessions treated in each surgery.

Results

No significant complications affected the surgeries or postoperative healing of the patients. No patient abandoned the study. At the 14-day recall, clinical healing and re-epithelialization at the palatal donor site were present in all patients. A significant improvement in terms of root coverage was obtained at the end of the procedure in all patients.

RD was reduced from 3.40 ± 0.83 mm at baseline to 0.28 ± 0.32 mm at the 1-year control, while differences in PPD were not significant and KTH increased from 0.57 ± 0.46 mm to 3.05 ± 0.71 mm.

The ordinary least square multiple linear regression model showed that the final results in terms of amount of root coverage were significantly affected by the initial recession depth. Greater reductions in RD were observed in cases with the worst initial conditions.

The ordinary least square linear regression model showed a significant inverse relationship ($P = .005$) between increase in KTH at 1 year and the presurgical amount of keratinized tissue. The same analysis did not show a statistically significant relationship between the root coverage results (mean percent root coverage [$P = .7$], percentage with complete coverage [$P = .3$]) and the number of recession defects treated in each patient.

Discussion

CAF treatment has been documented as an effective therapy for recession coverage, obtaining stable long-term results that have been demonstrated by 5-year follow-up data.¹³ In preceding studies, the technique was applied to maxillary recessions, while in the present work, its application was extended to mandibular posterior recessions in association with a CTG. In the present study, a vertical releasing incision was placed to reduce tissue tension only when the most mesial tooth involved in the surgery belonged to the anterior group. The variable thickness determined by the split-full-split approach creates a thicker flap in the marginal portion, providing better tissue stability during the healing phase, which in turn permits the use of small CTGs. At the same time, the split-full-split approach allows for coronal flap displacement and stabilization on the connective beds of the de-epithelialized anatomical papillae.

In previous studies on CAF¹² and CAF associated with a bilaminar CTG,⁵ the mean root coverage was 97% and 96.7%, respectively. The amount of root coverage obtained in the present study was comparable to that observed in the maxilla in other clinical reports. In fact, in all patients of this study, a percentage of root coverage greater than 85% was obtained, and the mean value was $91.2\% \pm 4.1\%$. Greater percentages were observed where recession defects were deeper.

In one patient, 100% recession coverage was obtained in all recessions. Overall, 13 of 26 treated recession defects showed complete coverage after 1 year. These data differ from those reported by Carvalho on the CAF and bilaminar graft approach for maxillary recessions.¹¹

In only 2 of 26 recessions present before surgery was the recession clinically appreciable (1 mm). This finding is in line with the results of Carvalho et al.¹¹ Also, the findings of a significant increase in CAL and a nonsignificant variation in PPD are in agreement with the outcomes of previous studies.

The dimensions of the CTG were as reduced as possible. The graft was designed to cover only the exposed area of the root apical to the cemento-enamel junction and the interdental bone crest apical to the de-epithelialized papillae without reaching the bone crest apical to the recession. Therefore, only the exposed root surface was covered by the connective tissue harvested from the palate. The advantage was to be able to place the graft where it was really needed, facilitating soft tissue stabilization in areas where the avascular surface could jeopardize the position of the gingival margin, and, at the same time, avoiding producing a thick, unpleasant gingival contour.

The survival of the CTG is guaranteed by the vascularization of the covering flap. An additional advantage of using a small CTG is that the injury at the donor site is reduced, thus facilitating secondary

healing through a reduction of the distance between incisions.

The increase in KTH from baseline (0.57 ± 0.46 mm) to posttreatment (3.05 ± 0.71 mm) confirms previously reported data regarding the adjunct of connective tissue grafting to root coverage procedures. The graft is expected to provide an increase in the amount of KTH, as well as a gain in soft tissue thickness after healing. The amount of root coverage obtained in the present study is comparable to that observed in the maxilla in other clinical reports.

Conclusions

A CAF in association with a CTG can be proposed as a valid therapeutic approach for multiple recession defects in mandibular premolar areas. Recession coverage of $91.2\% \pm 4.1\%$, a significant reduction in recession, and an increase in CAL and KTH were observed 1 year after the surgical procedure.

References

1. Consensus report. Mucogingival therapy. *Ann Periodontol* 1996;1:702–706.
2. Wennström JL. Mucogingival therapy. *Ann Periodontol* 1996;1:671–701.
3. Miller PD Jr. A classification of marginal tissue recession. *Int J Periodontics Restorative Dent* 1985;5:8–13.
4. Wennström JL, Zucchelli G. Increased gingival dimensions. A significant factor for successful outcome of root coverage procedures? A 2-year prospective clinical study. *J Clin Periodontol* 1996;23:770–777.
5. de Sanctis M, Zucchelli G. Coronally advanced flap: A modified surgical approach for isolated recession-type defects: Three-year results. *J Clin Periodontol* 2007;34:262–268.
6. Zucchelli G, De Sanctis M. Treatment of multiple recession-type defects in patients with esthetic demands. *J Periodontol* 2000;71:1506–1514.
7. Zucchelli G, Amore C, Sforzal NM, Montebugnoli L, De Sanctis M. Bilaminar techniques for the treatment of recession-type defects. A comparative clinical study. *J Clin Periodontol* 2003;30:862–870.
8. da Silva RC, Joly JC, de Lima AF, Tatakis DN. Root coverage using the coronally positioned flap with or without a subepithelial connective tissue graft. *J Periodontol* 2004;75:413–419.
9. Cortellini P, Tonetti M, Baldi C, et al. Does placement of a connective tissue graft improve the outcomes of coronally advanced flap for coverage of single gingival recessions in upper anterior teeth? A multi-centre, randomized, double-blind, clinical trial. *J Clin Periodontol* 2009;36:68–79.
10. Cairo F, Pagliaro U, Nieri M. Treatment of gingival recession with coronally advanced flap procedures: A systematic review. *J Clin Periodontol* 2008;35 (suppl):136–162.
11. Carvalho PF, da Silva RC, Cury PR, Joly JC. Modified coronally advanced flap associated with a subepithelial connective tissue graft for the treatment of adjacent multiple gingival recessions. *J Periodontol* 2006;77:1901–1906.
12. Zucchelli G, Mele M, Stefanini M, et al. Patient morbidity and root coverage outcome after subepithelial connective tissue and de-epithelialized grafts: A comparative randomized-controlled clinical trial. *J Clin Periodontol* 2010;37:728–738.
13. Zuchelli G, De Sanctis M. Long-term outcome following treatment of multiple Miller Class I and II recession defects in esthetic areas of the mouth. *J Periodontol* 2005;76:2286–2292.