The Influence of Cementoenamel Restorations in the Treatment of Multiple Gingival Recession Defects Associated with Noncarious Cervical Lesions: A Prospective Study

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The multiple coronally advanced flap (MCAF) is a technique demonstrated to be very effective for the treatment of multiple recession defects affecting teeth in esthetic areas of the mouth.1 Many studies have shown the advantages of connective tissue grafts (CTGs) in conjunction with CAF,2–5 such as better long-term complete root coverage (CRC) outcomes in the treatment of multiple recession defects. Although literature reports the success of the bilaminar technique, recently a site-specific application of CTG has been demonstrated to be a treatment modality as effective as others.6,7

Based on the new classification of mucogingival conditions from the 2017 AAP World Workshop, a treatment-oriented classification should include not only gingival phenotype and gingival recession severity, but also associated cervical lesions.8 The development of noncarious cervical lesions (NCCLs) occurs frequently on exposed root surfaces.9,10 Several studies showed that these lesions are associated with deeper gingival recessions10,11 and with a reduced probability of obtaining CRC.12 The presence of NCCLs can cause the disappearance of the CEJ and/or the formation of concavities (steps) on the teeth surface.13 If an NCCL is present in a site with a gingival recession, the

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mucogingival condition is defined as combined defect (CD). A multidisciplinary approach should be considered in the treatment of CDs, which includes mucogingival surgery for root coverage and CEJ reconstruction. A limited number of studies have evaluated the clinical outcomes of this combined treatment for the management of only single gingival recessions, which included the use of resin-modified glass ionomers or composite resin to restore the NCCL, followed by CAF either alone or associated with a CTG. There is no evidence of a negative impact of restorative materials on periodontal tissues, and a higher reduction of dentin hypersensitivity was recorded in sites with restorations. However, since glass ionomers presented modification of superficial color, most clinicians shifted to the use of composite resin to improve the long-term esthetic outcome. The various restorative approaches discussed in the literature were different also in terms of placement of the apical margin of the restoration. In previous studies, it was positioned at the level of the anatomical CEJ; however, due to dentin sensitivity and/or esthetic problems, which can occur if CRC is not achieved, some authors proposed to perform restorations extending apically to the anatomical CEJ. Moreover, Santa Maria et al. compared partial restoration (PR)+CAF+CTG treatment with the CAF+CTG only, and the sites with PR showed higher reduction of dentin hypersensitivity and better gingival contour, even though both treatments were efficient in terms of CRC.

Despite the extensive evidence related to CAF with or without CTG for the treatment of multiple recession defects, the clinical outcomes of this procedure for the treatment of recessions associated with NCCLs are not completely reported in literature.

The aim of the present prospective study was to evaluate the clinical outcomes of the MCAF with a site-specific application of CTG for the treatment of multiple gingival recession defects with or without the presence of NCCLs. Analysis of periodontal conditions was performed in order to determine if CEJ restorations could affect adequate plaque control as well as maintenance over time.

Materials and Methods

Study Design and Patient Sample

This study was a prospective study, performed in accordance with the Helsinki Declaration of Human Studies. Twenty-three patients were selected for this study on a consecutive basis among patients who attended the Dental Department of San Raffaele Hospital between September 2017 and April 2018 requiring a treatment for multiple gingival recessions. All patients signed a specific informed consent and presented the following inclusion criteria: aged > 18 years; presence of at least two adjacent teeth with recession type 1 (RT1) gingival recessions with NCCLs; systemically healthy; and full-mouth plaque score (FMPS) and bleeding score (FMBS) ≤ 20%. Exclusion criteria were as follows: untreated periodontitis; smoking more than 10 cigarettes a day; and systemic contraindications for surgery (heart attack within last 6 months, pregnancy, IV bisphosphonates, cancer, previous radiotherapy, chemotherapy in place).

Restorative and Surgical Procedures

Initial periodontal therapy was performed prior to surgical treatment. Oral hygiene instructions were given to patients (roll technique) at least 2 months before surgery.

All CEJ restorations were performed by the same restorative specialist (D.G.) and all surgical procedures by the same experienced operator (M.d.S.).

For all class B defects (absence of a CEJ), the restorative procedure was performed 1 week before surgery in order to reconstruct the coronal portion of the NCCL (Fig 1). After local anesthesia, a rubber dam was positioned in order to obtain isolation of the field, demineralized and/or hypermineralized exposed dentin was removed with the use of a round diamond bur as well as carbide round slow speed burs. To ensure a correct composite-resin stratification, good esthetic outcome, and to reduce the step of the lesion (if needed), a coronal bevel was made using an Arkansas stone. The apical margin of the restoration was determined to be 1 mm apical to the estimated position of the CEJ.
method described by Zucchelli et al. At this level, a light butt joint was made to create an accurate finishing line as a specific guidance for the layering of the restorative material. After cavity preparation, acid etching with 37% phosphoric acid was performed for 30 seconds on enamel and 15 seconds on dentin, then washed with a water jet. An etch-and-rinse three-step adhesive system (Futurabond U, VOCO) was used following the manufacturer’s instructions. Flowable composite resin was applied on the center of the NCCL, avoiding the marginal area of the cavity, followed by stratification of a maximum 2 mm layer of nano-filled composite resin (Enamel plus HRi, Micerium) in an apico-coronal direction. Finishing and polishing were carried out with fine and extra-fine diamond burs, silicon and soft silicon rubber bur points, aluminum oxide abrasive discs, and oscillating tips.

The surgical procedure used for the MCAF was proposed by Zucchelli and de Sanctis, with or without one vertical releasing incision, utilizing a site-specific application CTG. The flap was elevated with a split-full-split approach in the coronal-apical direction: the surgical papillae were elevated split-thickness, the soft tissue apical to the base of the recessions was elevated full-thickness to include the periostuem for 3 mm. Apical to bone exposure, the flap elevation continued split-thickness, and muscle insertions were eliminated. The split-full-split approach in flap elevation was in fact recently evidenced to be more effective than the traditional split-thickness approach.

Coronal mobilization of the flap was considered “adequate” when the marginal portion of the flap was able to passively reach a level coronal to the CEJ of the teeth with recession defects. The portion of the root exposed due to the recession and the sulcus depth was mechanically treated with the use of curettes, while the other surfaces were not treated to avoid losing connective tissue fibers still attached to the root cementum. The connective tissue graft was added in sites showing inadequate amount of keratinized tissue and/or when the phenotype was evaluated as thin (< 1 mm). The CTG was positioned at the level of the anatomical CEJ (a-CEJ) or the restored CEJ (r-CEJ). Sling sutures were performed to stabilize the surgical papillae over the interdental connective tissue bed, and the vertical releasing incisions were stabilized with interrupted sutures.

Examples of multiple recession defects associated with NCCLs and a comparison of baseline and 1-year clinical outcomes are shown in Figs 2 to 6.

![Fig 1](a) The NCCL before restoration. (b) The composite resin restoration of the NCCL before surgery.
Postoperative Protocol

Anti-inflammatory medication was prescribed after surgery and every 6 hours as needed. During the first 2 weeks, patients rinsed with chlorhexidine 0.2% for 1 minute, 3 times a day, and were asked to stop brushing the operated area, avoiding also chewing and any traumatic action. Sutures were removed 14 ± 4 days after surgery.

Clinical Assessment

The following clinical parameters were measured at baseline and at 6 and 12 months after the surgical procedure:

- Probing depth (PPD), measured as the distance from the bottom of the pocket to the gingival margin
- Plaque Index (PI), measured as the presence/absence of visible plaque at tooth sites
- Presence/absence of bleeding on probing (BoP) at tooth sites
- Recession depth (REC), measured as the distance from the gingival margin to the CEJ
- Keratinized tissue width (KTW), measured as the distance from the gingival margin to the mucogingival junction
- Keratinized tissue thickness (KTT), measured as the distance from the anesthesia needle tip to an endodontic silicone stop, determined at 2 mm apical to the gingival margin

The total number of teeth where the CTGs were applied was recorded. Clinical parameters were recorded by two calibrated examiners using a manual probe (PCP-UNC 15 probe tip, Hu-Friedy). The calibration was performed on 10 patients and again 1 week later. After repeated measurements, the interclass correlation coefficients for intra-examiner reliability were 0.884 (95% confidence interval [CI]: 0.664, 0.955) for Examiner 1 and 0.877 (95% CI: 0.664, 0.955) for Examiner 2.
Fig 3 (a) Baseline situation showing multiple gingival recession defects in the maxilla. (b) The composite resin restorations of NCCLs were performed on the central and lateral incisors and on the first premolar. (c) The CTG was positioned at the level of the lateral incisor and first premolar according to KTW (< 1 mm). (d) Clinical outcome at 1 year: CRC was obtained in all treated teeth.

Fig 4 (a) Baseline situation showing multiple gingival recession defects in the mandible. (b) The composite resin restorations of NCCLs were performed on all teeth. (c) The CTG was positioned only at the level of the lateral incisor according to the baseline KTW (< 1 mm). (d) Clinical outcome at 1 year: CRC was obtained in all treated teeth.
Data Analysis

Statistical analysis was performed with SPSS version 24.0 (IBM). Descriptive statistics are presented as means and standard deviations for PPD, REC, KTW, and KTT, and as frequencies for BOP, PI, and NCCL. Intergroup analysis of REC, KTW, KTT, PPD, recession reduction (RECred), and percentage of root coverage (%RC) were performed using t test, while frequencies of BOP, PI, and CRC were compared using chi-square test. Two-way repeated measures analysis of variance was performed to determine the effect of the surgical technique over time on REC, PPD, %RC, and KTW.
Results

A total of 23 patients (11 women and 12 men; mean age: 46.2 ± 10.6 years) with multiple recession defects were included in the study, and 93 recession defects were treated. The mean number of such defects in each subject was 4.04 (range: 2 to 6). Of these, 59 recessions (63%, 14 patients) were located in the maxilla and 34 (37%, 9 patients) in the mandible. The presence of NCCLs was detected on 57 teeth showing gingival recessions (61%). Among these, 36 (63%) were located in the maxilla (7 incisors, 8 canines, 15 premolars, 6 molars) and 21 (37%) were located in the mandible (1 incisor, 3 canines, 12 premolars, 5 molars).

The restorative treatment was performed for every NCCL, since all defects involved both the crown and the root of the teeth. The surgical treatment involved MCAF+CTG for 54 sites (of which 35 had a restored CEJ) and MCAF alone for 39 sites (of which 22 had a restored CEJ).

Some differences between MCAF+CTG and MCAF alone at baseline were observed. At MCAF-treated sites, the mean REC was statistically significantly lower (MCAF: 1.97 ± 0.87 mm; MCAF+CTG: 2.91 ± 1.01 mm; P < .001), while mean KTW was statistically significantly higher (MCAF: 2.39 ± 1.02 mm; MCAF+CTG: 1.74 ± 0.89 mm; P = .002) when compared with MCAF+CTG–treated sites (Table 1).

No differences in REC were found between teeth with r-CEJ and those with a-CEJ at baseline, while KTW was statistically significantly higher at a-CEJ sites when compared with r-CEJ sites (Table 2). At the 12-month follow-up examination, CRC was observed in 90% of all treated sites (84 of 93 recession defects), with no statistically significant differences in KTW between MCAF and MCAF+CTG sites (MCAF: 3.67 ± 1.52 mm; MCAF+CTG: 3.85 ± 1.51 mm; P = .26), while a statistically significant KTW increase was observed in both groups when compared to baseline (P = .01). No statistically significant differences were found between teeth with r-CEJ and those with a-CEJ in terms of CRC.

### Table 1 Clinical Parameters (Mean ± SD, mm) of MCAF- and MCAF+CTG–Treated Sites at Baseline and 12 Months

<table>
<thead>
<tr>
<th></th>
<th>MCAF (n = 39)</th>
<th>MCAF+CTG (n = 54)</th>
<th>P*</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Baseline 12 mo</td>
<td>Baseline 12 mo</td>
<td></td>
</tr>
<tr>
<td>REC</td>
<td>1.97 ± 0.87</td>
<td>0.05 ± 0.22bc</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>KTW</td>
<td>2.39 ± 1.02</td>
<td>3.67 ± 1.52b</td>
<td>.002</td>
</tr>
<tr>
<td>KTT</td>
<td>0.54 ± 0.23</td>
<td>2.1 ± 0.5bc</td>
<td>.04</td>
</tr>
<tr>
<td>PPD</td>
<td>1.73 ± 0.42</td>
<td>1.76 ± 0.48</td>
<td>.88</td>
</tr>
</tbody>
</table>

SD = standard deviation; MCAF = multiple coronally advanced flap; CTG = connective tissue graft; REC = recession depth; KTW = keratinized tissue width; KTT = keratinized tissue thickness; PPD = probing pocket depth.

*Student t test.

### Table 2 Clinical Parameters (Mean ± SD, mm) of a-CEJ and r-CEJ Sites at Baseline and 12 Months

<table>
<thead>
<tr>
<th></th>
<th>a-CEJ (n = 36)</th>
<th>r-CEJ (n = 57)</th>
<th>P*</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Baseline 12 mo</td>
<td>Baseline 12 mo</td>
<td></td>
</tr>
<tr>
<td>REC</td>
<td>2.42 ± 0.90</td>
<td>2.58 ± 1.15</td>
<td>.47</td>
</tr>
<tr>
<td>KTW</td>
<td>2.32 ± 1.05</td>
<td>1.82 ± 0.93</td>
<td>.02</td>
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<tr>
<td>KTT</td>
<td>0.51 ± 0.25</td>
<td>0.47 ± 0.21</td>
<td>.45</td>
</tr>
<tr>
<td>PPD</td>
<td>1.19 ± 0.47</td>
<td>1.21 ± 0.49</td>
<td>.88</td>
</tr>
</tbody>
</table>

SD = standard deviation; CEJ = cementoenamel junction; a-CEJ = anatomical CEJ; r-CEJ = restored CEJ; REC = recession depth; KTW = keratinized tissue width; KTT = keratinized tissue thickness; PPD = probing pocket depth.

*Student t test.
Table 3 Changes in Clinical Parameters at 12 Months

<table>
<thead>
<tr>
<th></th>
<th>a-CEJ (n = 36)</th>
<th>r-CEJ (n = 57)</th>
<th>P</th>
<th>MCAF (n = 39)</th>
<th>MCAF+CTG (n = 54)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>RECred, mm</td>
<td>2.19 ± 0.92</td>
<td>2.53 ± 1.12</td>
<td>.97a</td>
<td>1.92 ± 0.87</td>
<td>2.74 ± 1.05</td>
<td>&lt; .001a</td>
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<td>%RC</td>
<td>92.13 ± 18.47</td>
<td>98.48 ± 6.67</td>
<td>.02a</td>
<td>97.86 ± 9.5</td>
<td>94.7 ± 14.83</td>
<td>.24a</td>
</tr>
<tr>
<td>CRC, %</td>
<td>83</td>
<td>93</td>
<td>.07b</td>
<td>95</td>
<td>87</td>
<td>.207b</td>
</tr>
</tbody>
</table>

CEJ = cementoenamel junction; a-CEJ = anatomical CEJ; r-CEJ = restored CEJ; MCAF = multiple coronally advanced flap; CTG = connective tissue graft; RECred = recession reduction; %RC = percentage of root coverage; CRC = complete root coverage. RECred and %RC reported as mean ± standard deviation.

aStudent t test.
bChi-square test.

(r-CEJ: 95%; a-CEJ: 83%; P = .07), as well as in terms of RECred (r-CEJ: 0.05 ± 0.22 mm; a-CEJ: 0.22 ± 0.54 mm; P = .97). Regarding %RC, data indicated statistically significant differences between groups: The %RC was higher in the r-CEJ sites than a-CEJ sites (98.5 ± 6.6% and 92.12 ± 18.46%, respectively; P = .02) (Table 3).

When periodontal parameters were compared, the differences between groups were not significant: 95% of teeth with r-CEJ and 94% of teeth with a-CEJ did not present BoP (P = .959), and 88% of teeth with r-CEJ and 94% of teeth with a-CEJ presented no plaque (P = .28). Both groups did not present a statistically significant PPD increase after 12 months: In r-CEJ sites the PPD varied from 1.21 ± 0.49 mm to 1.42 ± 0.71 mm (P = .051), while in the a-CEJ sites it increased from 1.19 ± 0.47 mm to 1.47 ± 0.77 mm (P = .07) (Table 2).

Discussion

The present prospective study evaluated the clinical outcomes of the CAF with a site-specific application of CTG combined with a restorative procedure for the treatment of multiple recession defects associated with NCCLs.

In the present study, the prevalence of NCCLs was 61% (n = 57). Among these, 63% were located in the maxilla, while the remaining 37% were located in the mandible. The most affected teeth were premolars. These results are in agreement with those of previous studies.11

In all teeth presenting NCCLs, the CEJ was restored prior to surgery using composite resins. To date, there is not a complete agreement regarding the level where to place the restoration nor with which material to use.15,17,23,24 In the present study, the apical margin of the restorations was placed 1 mm apical to the line of root coverage, which was determined using the method presented by Zucchelli et al.21

This combination of mucogingival surgery and restorative treatment has already been evaluated in previous studies.18,19 Nevertheless, only NCCLs associated with single recession defects treated with CAF+CTG were examined. NCCLs affecting multiple recession sites treated with a combined approach were previously described in the literature in a single case series.2

At the 1-year follow-up visit, CRC was observed in 90% of the treated sites, which were all preoperatively classified as RT1 defects. No statistically significant differences were found in CRC between sites with r-CEJ and those with a-CEJ, suggesting that the restoration does not affect the likelihood of CRC. Moreover, it is conceivable that the restorative approach used in the present study can justify the difference in the %RC between the two groups, which is statistically significantly higher in sites with r-CEJ (r-CEJ: 98.5 ± 6.6%; a-CEJ: 92.12 ± 18.46%). The presence of the restoration, whose apical margin will be identified at a subgingival level after the healing period, increases the likelihood not to expose the root surface if a contraction of the flap occurs during postsurgical healing. These results are not in agreement with data reported by Santamaria et al18 and Silveira et al19: Indeed, the authors, who evaluated the clinical outcomes of the combined treatment of single recessions associated with NCCLs, reported a lower %RC of 75% and 70%, respectively. This difference could be explained by the fact that single CAF, characterized by two vertical releasing incisions, has less...
hematic support compared to an envelope flap. As a matter of fact, the augmented dimension of the vascular bed surrounding the multiple avascular root surfaces might be responsible for an increased stability of the flap over it and, thus, better root coverage results.

The secondary objective of the current study was to evaluate if the presence of composite resin restorations had an influence on the periodontal health of tissues. For each treated site, PPD, BoP, and PI were recorded. No statistically significant difference was found between the two groups at the 1-year evaluation. These results are in contrast with those of Santamaria et al., which showed a statistically significant difference between restored and non-restored sites in term of PPD increase. This discrepancy could be related to the surface roughness of the composite resin restoration remaining after finishing and polishing procedures. In fact, plaque accumulation and gingival inflammation has been associated with surface roughness, although details on how finishing and polishing performed by previous authors were not available.

**Conclusions**

Within the limitations of the present study, the use of composite resin restorations for NCCL defects positioned 1 mm apical to the CEJ prior to MCAF or MCAF+CTG does not have any influence on periodontal conditions and on the amount of CRC, producing a satisfactory esthetic result.

**Acknowledgments**

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**References**


