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Cervical restoration and the amount of soft tissue coverage achieved by coronally advanced flap: A 2-year follow-up randomized-controlled clinical trial

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Abstract

Background: The aim of this study was to evaluate the 2-year follow-up success of the treatment of gingival recession associated with non-carious cervical lesions by a coronally advanced flap (CAF) alone or in combination with a resin-modified glass ionomer restoration (CAF+R).

Material and Methods: Sixteen patients with bilateral Miller Class I buccal gingival recessions, associated with non-carious cervical lesions, were selected. The defects received either CAF or CAF+R. Bleeding on probing (BOP), probing depth (PD), relative gingival recession (RGR), clinical attachment level (CAL) and cervical lesion height (CLH) coverage were measured at the baseline and 6, 12 and 24 months after the treatment.

Results: Both groups showed statistically significant gains in CAL and soft tissue coverage. The differences between groups were not statistically significant in BOP, PD, RGR and CAL, after 2 years. The percentages of CLH covered were $51.57 \pm 17.2\%$ for CAF+R and $53.87 \pm 12.6\%$ for CAF ($p > 0.05$). The estimated root coverage was $80.37 \pm 25.44\%$ for CAF+R and $83.46 \pm 20.79\%$ for CAF ($p > 0.05$).

Conclusion: Within the limits of the present study, it can be concluded that both procedures provide acceptable soft tissue coverage after 2 years, with no significant differences between the two approaches.

Key words: cemento-enamel junction; gingival recession/surgery; glass ionomer cement; surgical flap; tooth abrasion

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Conflict of interest and source of funding statement

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Owing to the reduction of caries prevalence in several populations, teeth are functional for longer periods. This may expose the teeth to conditions other than caries and, as a consequence, different problems can arise. Gingival recession is an apical shift of the gingival margin with exposure of the root surface (Wennström 1996, Cairo et al. 2008). This is a common finding in patients with a high standard of oral hygiene, as well as in periodontally untreated populations with poor oral hygiene, especially in elderly people (Löe et al. 1992, Serino et al. 1994).

The absence of the gingival tissue protecting the root surface may facilitate the occurrence of other problems, such as aesthetic complaints, dentin sensitivity, root caries and cervical wear (Goldstein et al. 2002). Sangnes & Gjermo (1976) reported that gingival recession and a wedge-shaped defect in the cervical area were often seen affecting the same tooth. Another report mentions that no signs of the cemento-enamel junction (CEJ) were observed in about 50% of the examined teeth showing gingival recession, due to cervical abrasion (Zucchelli et al. 2006). Despite this close association between gingival recession and non-carious cervical lesions, restorative procedures such as composite restoration are frequently selected as the single therapy to treat this condition (Terry et al. 2003a). However, optimal functional and aesthetic results may require the combined use of periodontal and restorative procedures (Terry et al. 2003b).

As shown previously, gingival recessions associated with non-carious cervical lesions can be successfully treated by glass ionomer restoration combined with the coronally advanced flap (CAF), with or without connective tissue graft (Santamaria et al. 2007, 2008). After the healing period, good aesthetic outcome and gingival health with no signs of inflammation, such as redness and bleeding on probing (BOP), were observed despite the subgingival location of part of the restoration. These and other reports (Thanik & Bissada 1999, Lucchesi et al. 2007) showed successful outcomes when root coverage surgery was performed on the restored root surface. However, there is a lack of information about the long-term results of this type of therapy. Therefore, the aim of the present study is to present the 2-year follow-up results of a split-mouth, randomized-controlled clinical trial in which gingival recession, associated with a non-carious cervical lesion, was treated by the CAF combined or not with resin–glass ionomer restoration. The hypothesis that the sites treated with the associated approach (CAF+R) could present more recession over time was addressed.

Material and Methods

Before the beginning of the study, the consent form and the protocol of the study were approved by the Institutional Review Board of the State University of Campinas (CEP-UNICAMP 104/2005). Informed consent was signed by each subject after a thorough explanation of the nature, risks and benefits of the clinical investigation and associated procedures.

Study population

Sixteen patients, nine males and seven females, aged 26–58 years (mean age 37.4 ± 8.8 years), were included. The subjects were selected from the group of patients referred for periodontal treatment to the Graduate Clinic of the Piracicaba Dental School, University of Campinas – UNICAMP. The patients were selected from May to December 2005, according to the following eligibility criteria:

(1) Presence of bilateral Class I Miller gingival recession associated with non-carious cervical lesion 1–2 mm deep in maxillary canines or premolars. The pair of recessions associated with the cervical wear in each patient must be comparable (same size).
(2) Non-smokers.
(3) Systemically and periodontally healthy.
(4) No contraindication for periodontal surgery.
(5) Had not taken medications known to interfere with periodontal tissue health and healing.
(6) Probing depth (PD) of <3 mm without BOP.
(7) Tooth vitality, absence of restoration on cervical area and absence of severe occlusal interferences in the area to be treated.
(8) No previous periodontal surgery in the area.

The patients were referred for periodontal treatment based on their complaints (dentin sensitivity and/or aesthetic concerns). Considering that a non-carious cervical lesion may be the consequence of a multifactorial process, including tooth structure loss caused by nonbacterial acids (erosion), traumatic tooth brushing (abrasion) and occlusal loading (abfraction), all the patients were included in a pre-treatment programme in order to eliminate the possible aetiologic factors related to a non-carious cervical lesion and gingival recession, as follows: oral hygiene instructions using a non-traumatic brushing technique and a soft toothbrush were given to each patient. Patients were also encouraged to avoid excessive consumption of acidic beverages or acidic foods. When necessary, selective grinding was performed to remove occlusal interferences on the teeth included in the study. Scaling, root planing and crown polishing were performed as necessary.

Clinical assessments

After this initial therapy, the following parameters were recorded: (1) full-mouth visible plaque index (Ainamo & Bay 1975) full-mouth visible plaque index (FMPI) and presence or absence of visible plaque (VPS) at the site included in the study; (2) full-mouth sulcus bleeding index (FMBI) (Mühlemann & Son 1971) and presence or absence of BOP at the site included in the study; (3) PD, assessed as the distance from the gingival margin to the apical end of the gingival sulcus; (4) relative gingival recession (RGR) measured as the distance from the gingival margin to the incisal border of the tooth; (5) relative clinical attachment level (CAL) as PD+RGR; (6) non-carious cervical lesion height (CLH), as the distance between the coronal and apical margins of the non-carious cervical lesion; (7) height of the non-carious cervical lesion located on the root surface (CLH-R): the CEJ was estimated by the method described by Zucchelli et al. (2006) using digital photographs obtained with a camera positioned perpendicular to the buccal surface of the experimental teeth at a magnification ratio of 1:1. The distance from the estimated CEJ to the incisal border of the tooth and RGR was measured using an image analysis software. CLH-R was calculated by subtracting the distance from the estimated CEJ to the incisal border from RGR. This parameter allowed the calculation of the percentage of root coverage. The subtraction of the non-carious CLH on the root from the total CLH provided the amount of cervical lesion located on the crown (CLH-C); (8) keratinized tissue width (KTW), measured as the distance from the gingival margin to the mucogingival junction; and (9) keratinized tissue thickness (KTT).

PD was measured using a manual periodontal probe. The RGR, non-CLH and KTW were measured using a pair of dividers and a digital caliper with 0.01-mm precision. The KTT was measured

using a pierced endodontic spreader, perpendicular to a mid-point location between the gingival margin and the mucogingival junction, and through the soft tissue with light pressure until a hard surface was felt. The silicone stop was then placed in tight contact with the external soft tissue surface. After carefully removing the spreader, penetration depth was measured with a digital caliper. PD, RGR, CAL, visible plaque at the site (VPS) included in the study and BOP were measured at the baseline and 6 months, 1 and 2 years after surgery. The KTW and KTT were obtained at the baseline and at 2 years post-operatively. The restorations were also analysed after 2 years in function. The presence or absence of retention of the restoration in the cavity, marginal adaptation and colour match were observed.

Before the beginning of the study, the examiner (M. P. S.) measured the PD and RGR of all the patients, two times, within 24 h, with at least a 1-h interval between the examinations. The examiner was judged to be reproducible after fulfilling the pre-determined success criteria. The κ index was calculated for PD, resulting in 91% reproducibility, and the intra-class correlation was calculated for RGR, resulting in 89% agreement. The examiner was not masked because it was possible to observe whether the glass ionomer restoration had been applied at the site.

Surgical procedures

All the surgical procedures were carried out by one operator (E. A. S.). The sites were randomly assigned, by the flipping of a coin (F. F. S.), to the control group or to the test group. A second coin flip was carried out to define the sequence of treatments to be performed. The control group received the CAF (CAF group) and the test group was subjected to a coronally advanced flap plus a resin-modified glass ionomer restoration (CAF+R group). The pair of recessions and non-carious cervical lesions of each patient was treated in the same surgical session.

Briefly after local anaesthesia (Lidocaine with 1:100,000 Epinephrine), an intra-sulcular incision was made at the buccal aspect of the involved tooth. Two horizontal incisions were made at right angles to the adjacent interdental papillae, 1 mm apical to the level of the coronal border of the non-carious cervical lesion, without interfering with the gingival margin of neighbouring teeth. Two oblique vertical incisions were extended beyond the mucogingival junction and a trapezoidal mucoperiosteal flap was raised up to the mucogingival junction. After this point, a split-thickness flap was extended apically, releasing the tension and favouring coronal positioning of the flap. In the CAF group, the root and non-carious cervical lesion were planed with a finishing bur (KG Sorensen 9803FF, São Paulo, Brazil) and curettes until the tooth surface became smooth. In the CAF+R sites, a sterile rubber dam was placed to isolate the operative field and complete restoration of the non-carious cervical lesion was performed with resin-modified glass ionomer cement (Vitremer – 3M ESPE, St. Paul, MN, USA), following the manufacturer's instructions. The restoration was performed in order to re-establish the entire defect caused by the cervical wear. Later, the epithelium on the adjacent papillae was stripped away and the flap was coronally positioned and sutured (6.0 Polyglactin 910 (Vicryl), Ethicon INC, São José dos Campos, Brazil) to completely cover the non-carious cervical lesion in the CAF group and the restoration in the CAF+R group.

Post-operative care

Patients were instructed to take analgesics (500 mg sodium dipyrone every 6 hours for 2 days) and were instructed to discontinue toothbrushing around the surgical sites during the initial 30 days after surgery. During this period, plaque control was achieved with a 0.12% chlorhexidine solution rinse used twice a day. After this period, gentle toothbrushing with a soft-bristle toothbrush was allowed.

Sutures were removed after 7 days and the patients were enrolled in a periodontal maintenance programme (professional plaque control and oral hygiene instruction) weekly during the first month, monthly during the first 6 months and every 4 months until the end of the study period.

Statistical analysis

Descriptive statistics were expressed as means $\pm$ standard deviation (SD). The PD, RGR and relative CAL were examined by the Friedman test to evaluate differences within groups, followed by a *post hoc* non-parametric test for multiple comparisons and by the Wilcoxon signed rank test to evaluate differences between the groups. The CLH, and the height of the non-carious cervical lesion located on the root (CLH-R) and on the crown (CLH-C) surfaces were examined by the Wilcoxon test to evaluate differences between groups. The VPS and the BOP at the site included in the study were examined by the McNemar test to evaluate differences within groups and by the χ^2 test to evaluate differences between groups. The KTW and the KTT were examined by the Wilcoxon test to evaluate differences within and between groups. A significance level of 0.05 was adopted for all statistical comparisons.

Power calculation

The study power was calculated using the SAS 9.01 software (Release 9.1, 2003, SAS Institute Inc., Cary, NC, USA), considering the SD of each group of the present study. A difference of 1.0 mm between CAF and CAF+R groups was considered as clinically significant. The power value was evaluated for RGR and relative CAL in the final period of the evaluation. A minimum power value of 77% was achieved (for the relative CAL parameter at 2 years).

Results

A flow diagram of participants in the study is provided (Fig. 1). Table 1 shows the patients' characteristics at baseline. No adverse event was observed in any patient during the study.

Cervical lesion

The mean CLH was 2.54 ± 0.5 mm for the test group and 2.58 ± 0.42 mm for

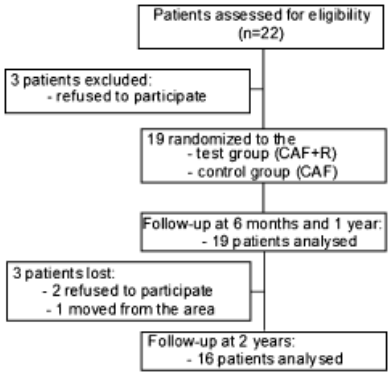

Fig. 1. Flowchart for the study patients. CAF, coronally advanced flap group; CAF+R, coronally advanced flap plus restoration group.

Table 1. Patients' characteristics at the baseline ($N = 16$)

Age	26–58 (mean age 37.4 ± 8.8 years)
Gender	Nine males and seven females
	Canines: 4 (12.5%)
Teeth	1PM: 26 (81.25%)
	2PM: 2 (6.25%)
FMPI	16.5%
FMBI	18.82%

FMPI, full-mouth visible plaque index; FMBI, full-mouth sulcus bleeding index.

the control group ($p > 0.05$). Using the method described by Zucchelli et al. (2006), it was possible to estimate the place where the lost CEJ was located. Consequently, it was possible to identify the total amount of root (CLH-R) and crown (CLH-C) affected by the non-carious cervical lesion. CLH-R was 1.7 ± 0.42 for the test group and 1.68 ± 0.36 for the control group, representing 67.19 ± 11.81% and 65.68 ± 7.52% of the total CLH, respectively. CLH-C was 0.84 ± 0.32 mm for the test group and 0.9 ± 0.21 mm for the control group. The differences observed between the groups were not statistically significant for these parameters ($p > 0.05$).

Gingival recession

All sites presented a reduction of 1.31 ± 0.37 mm in the RGR for the test group and of 1.39 ± 0.41 mm for the control group ($p > 0.05$). The coverage obtained at 6 months remained stable over time for both the groups. These reductions in the RGR represent 51.57 ± 17.2% CLH coverage for the test group and 53.87 ± 12.6% for the control group. This difference was not statistically significant ($p > 0.05$). No site in either group had achieved complete CLH coverage after 2 years of observation. The maximum CLH coverage was 78.18% for the CAF+R group and 76.66% for the CAF group.

The percentage of root coverage was calculated at the end of the study period. The test group showed a mean root coverage of 80.37 ± 25.44% and the control group showed 83.46 ± 20.79%. The difference between the groups was not statistically significant ($p > 0.05$). Table 1 shows the characteristics of the cervical lesion in each group and the total amount of coverage achieved. Figures 2–9 show the clinical aspect at the baseline and the post-operative periods of the control and the test groups.

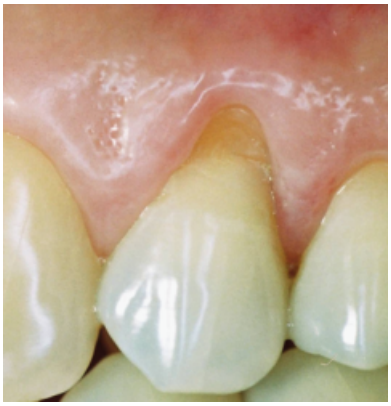

Fig. 2. Pre-operative view of the coronally advanced flap site.

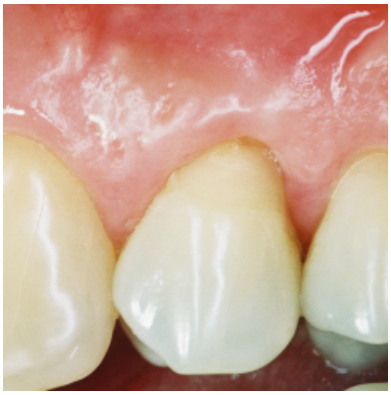

Fig. 3. Coronally advanced flap site after 6 months of the treatment.

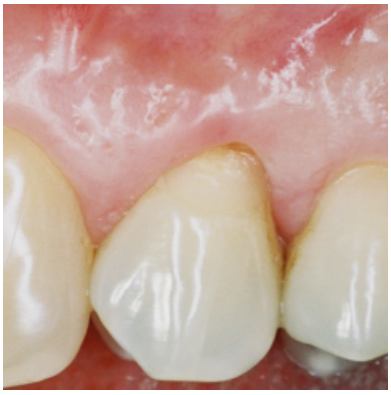

Fig. 4. Coronally advanced flap site after 1 year of the treatment.

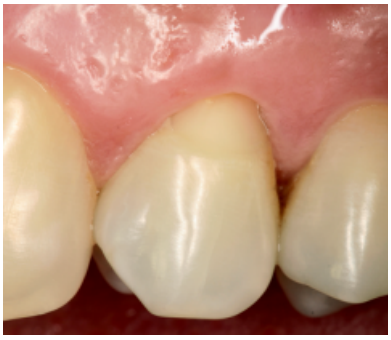

Fig. 5. Coronally advanced flap site after 2 years of the treatment. Note that the coronal part of the cervical lesion is supragingival.

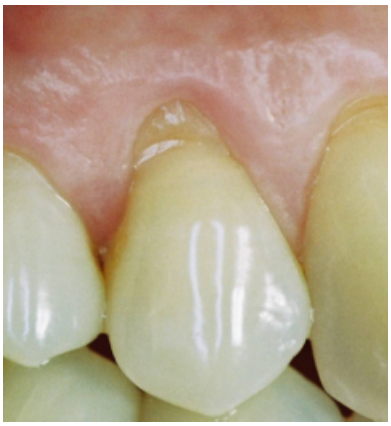

Fig. 6. Pre-operative view of the coronally advanced flap plus restoration group site.

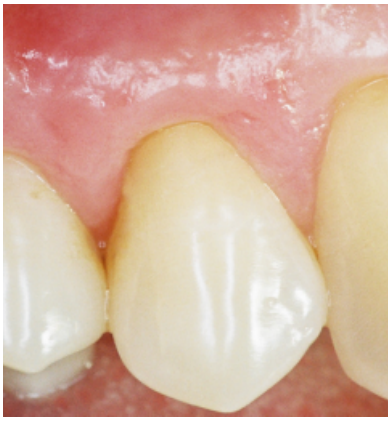

Fig. 7. Coronally advanced flap plus restoration group site after 6 months of the treatment.

PD and CAL

The PD did not change significantly during the baseline to the 2-year follow-up. In the test group, this parameter did not change significantly between baseline and 2 years after surgery (1.25 ± 0.44 mm for both the periods) in the control group; it was 1.31 ± 0.47 mm at the baseline and 1.5 ± 0.51 mm at the 2-year evaluation. The differences between and within groups were not statistically significant ($p > 0.05$).

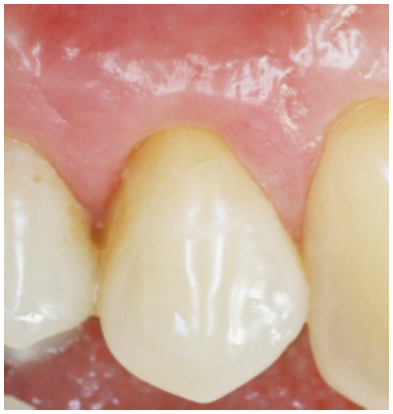

Fig. 8. Coronally advanced flap plus restoration group site after 1 year of the treatment.

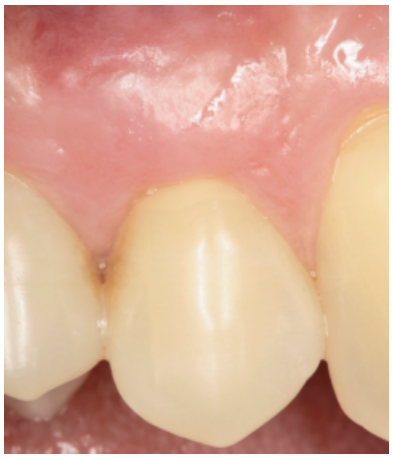

Fig. 9. Coronally advanced flap plus restoration group site after 2 years of the treatment. Note the aesthetic appearance of the restoration and the health of the gingival tissue.

After 2 years, both the groups showed statistically significant changes from baseline for CAL: 1.31 ± 0.6 mm for the test group ($p = 0.0001$) and 1.2 ± 0.72 mm for the control group ($p = 0.0001$). The difference between the two groups was not statistically significant ($p > 0.05$) (Table 2).

Keratinized tissue

No significant changes regarding the thickness (KTT) and the width (KTW) of the keratinized tissue were observed. Table 3 shows the means and the SDs of PD, CAL, RGR, KTT and KTW of the test and control groups.

Table 2. Mean values and standard deviation for CLH and CLH-R

	Test group	Control group	*p*-value
CLH	2.54 ± 0.5 mm	2.58 ± 0.42 mm	0.93
CLH-R	1.7 ± 0.42 mm (67.19 ± 11.81%)	1.68 ± 0.36 mm (65.68 ± 7.52%)	0.8
CLH-C	0.84 ± 0.32 mm	0.9 ± 0.21 mm	0.67
CLH coverage	51.57 ± 17.2%	53.87 ± 12.6%	0.13
Root coverage	80.37 ± 25.44%	83.46 ± 20.79%	0.8

p-values were calculated by the Wilcoxon test to evaluate differences between the groups.
CLH, non-carious cervical lesion height; CLH-R, non-carious cervical lesion height located on the root; CLH-C non-carious cervical lesion height located on the crown

Table 3. Clinical results (mean ± SD; $N = 16$ patients)

	Baseline	6 months	1 year	2 years
PD				
CAF+R	1.25 ± 0.44	1 ± 0.36	1.12 ± 0.5	1.25 ± 0.44
CAF	1.31 ± 0.47	1.37 ± 0.5	1.5 ± 0.51	1.5 ± 0.51
CAL				
CAF+R	11.73 ± 1.15	10.14 ± 0.95*	10.30 ± 1.26*	10.42 ± 1.0*
CAF	11.56 ± 0.72	10.21 ± 0.83*	10.37 ± 0.95*	10.36 ± 0.97*
RGR				
CAF+R	10.48 ± 1.09	9.14 ± 1.0*	9.17 ± 0.99*	9.17 ± 1.0*
CAF	10.25 ± 0.81	8.84 ± 0.77*	8.87 ± 0.81*	8.86 ± 0.8*
KTT				
CAF+R	1.16 ± 0.13	–	–	1.07 ± 0.2
CAF	1.12 ± 0.16	–	–	1.04 ± 0.33
KTW				
CAF+R	3.16 ± 0.85	–	–	3.11 ± 0.91
CAF	3.24 ± 0.4	–	–	3.25 ± 0.56

*Statistically significant difference within the groups ($p < 0.05$) by the Friedman test.
†Statistically significant difference between the groups ($p < 0.05$) by the Wilcoxon test.
CAF, coronally advanced flap group; CAL, clinical attachment level; CAF+R, coronally advanced flap plus resin-modified glass ionomer restoration group; KTT, keratinized tissue thickness; KTW, keratinized tissue width; PD, probing depth; RGR, relative gingival recession; SD, standard deviation.

Bleeding on probing

FMBI remained low during the entire study period, being 16.5% at the baseline and 19.2% at the 2-year evaluation ($p > 0.05$), demonstrating that the patients had performed acceptable oral hygiene. Additionally, low levels of FMPI were observed: 18.82% at the baseline and 21.3% at the 2-year evaluation. No BOP was observed at any site included in the study in any evaluated period.

Restorations

After 2 years in function, the restorations were analysed. All the restorations (16 out of 16) were retained at the sites and no restoration was lost. Seven of the 16 restorations (43.75%) presented a colour change and their colours did not match the tooth colour. When the colour of the restoration changed, it became darker than the colour of the tooth (Fig. 10). Only one out of the 16 presented a marginal discrepancy.

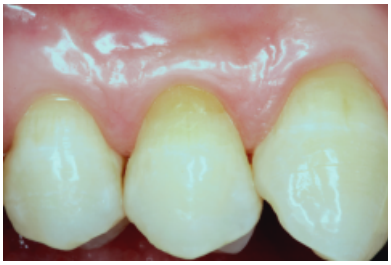

Fig. 10. Coronally advanced flap plus restoration group site after 2 years of the treatment presenting alteration of the restoration colour.

Discussion

The CAF has shown predictable results in terms of root coverage for intact root Miller Class I gingival recessions (Allen & Miller 1989, Wennström & Zucchelli 1996, Pini-Prato et al. 2000, Cairo et al. 2008). However, the long-term success of the CAF to treat gingival recession, associated with a non-carious cervical lesion, combined with a cervical restora-

tion or not, has not been addressed in the literature. Thus, the goal of this split-mouth, randomized-controlled clinical trial was to compare the 2-year follow-up of gingival recession, associated with a non-carious cervical lesion, treated by CAF plus glass ionomer restoration (test – CAF+R group) and the CAF alone (control – CAF group).

The change observed in the RGR after 2 years was 1.31 ± 0.37 and 1.39 ± 0.41 mm for CAF+R and CAF, respectively ($p > 0.05$). This change in the position of the gingival margin to a more coronal level provided a comparable percentage of CLH coverage ($51.57 \pm 17.2\%$ in the CAF+R group and $53.87 \pm 12.6\%$ in the CAF group, $p > 0.05$) and a gain of CAL (1.2 ± 0.72 mm in the CAF group and 1.31 ± 0.6 mm in the CAF+R group, $p > 0.05$) after the two treatment approaches. Therefore, it could be assumed that the presence of the restoration on the cervical area may not prevent soft tissue coverage by theCAF. It is important to note that the CLH coverage reported in the present study should not be directly compared with other studies that included gingival recession on intact roots. This comparison is not possible because the non-carious cervical lesion simultaneously affects parts of the root and the crown of the tooth and, with its progression, the CEJ generally disappears (Zucchelli et al. 2006). This could explain why no site, neither in the CAF group nor in the CAF+R group, achieved complete CLH coverage and only the part of the non-carious cervical lesion located on the root could be predictably covered by soft tissue after a coronally positioned flap.

In order to explore the hypothesis that the uncovered part of the non-carious cervical lesion was mainly composed by the crown portion of the lesion, an estimation of the position of the CEJ by the method described by Zucchelli et al. (2006) was performed and it was possible to estimate the part of the CLH located on the root (CLH-R). The CLH-R was 1.7 ± 0.42 mm (67.19% of the CLH) for the CAF+R group and 1.68 ± 0.36 (65.68% of the CLH) for the CAF group. Based on these values, the mean root coverage (CLH-R coverage) was calculated and reached $80.37 \pm 25.44\%$ for the CAF+R group and $83.46 \pm 20.79\%$ for the CAF group ($p > 0.05$). The mean values of root coverage observed in the present study are comparable to those reported in other studies for this procedure (Allen & Miller 1989, Harris & Harris 1994, Wennström & Zucchelli 1996, Pini-Prato et al. 2000). However, caution should be exercised due to the subjective component of the method used to estimate the CEJ in the present study, which differs from the direct measurement obtained in studies with intact roots. This method does not allow precise determination of complete root coverage achieved by each procedure. Another consideration is that the present study included small Miller Class I gingival recessions. In spite of the small size of the recessions, they were considered sufficiently important by the patients. Therefore, this associated lesion is a common clinical finding that requires further investigation to establish a treatment protocol that could deal with the dentin sensitivity and aesthetic complaints of the patients.

The first clinical trial aimed to evaluate the coverage achieved on restored roots was performed by Thanik & Bissada (1999). They concluded that similar coverage could be obtained regardless of the presence of the restoration. Later reports (Lucchesi et al. 2007, Santamaria et al. 2007, 2008) showed similar results. However, all these previous studies were short-term reports. Long-term studies are strongly recommended to show the stability of soft tissue coverage over time on restored roots achieved after periodontal surgery. The findings of the present 2-year follow-up study corroborate previous findings (Santamaria et al. 2008) suggesting that gingival margin stability may be obtained after the CAF is performed on cervical lesions restored with resin–glass ionomer cement.

One important aspect to be evaluated when using the combined approach (periodontal surgery plus restoration) to treat gingival recession associated with non-carious cervical lesion is the gingival margin stability over time. The other aspect is the restoration. In the present study, some interesting observations were made regarding the restoration. After the 2 years of observation, all the restorations were presented at the treated sites. This finding is in accordance with the literature, which shows a low rate of loss of resin–glass ionomer cement when applied to Class V cavities after 2 years (Abdalla & Alhadainy 1997) and after 5 years (Loguercio et al. 2003). There are several factors that may have influenced this result. The utilization of a rubber dam to isolate the operative field might have maintained the cervical lesion cavity dry and decontaminated during the manufacture of the restoration. Additionally, all possible aetiological factors related to the occurrence of the non-carious cervical lesion (e.g. occlusion, acids and traumatic brushing) were controlled, which could have influenced this positive finding (Heymann et al. 1991).

Another observation is the colour alteration of the restorative material used. In the present study, 7 of the 16 (43.75%) of the restorations' colour did not match the teeth's colour after 2 years. This finding is also in accordance with the literature, which shows low colour stability for the resin–glass ionomer over time (Gladys et al. 1999). There are several factors that may influence resin–glass ionomer colour, but alterations in the surface texture are particularly important. Gladys et al. (1999) observed a higher roughness surface of the resin–glass ionomer restoration using a scanning electron microscope, compared with other materials after 18 months of use. However, the increased roughness surface may not have any negative impact on the gingival health. In the present study, no plaque accumulation and no BOP were observed at any site of the test group. Figure 10 shows one tooth allocated to the test group that presented colour alteration of the restoration. Although some restorations presented colour alteration, only one patient complained about it. For this patient, a thin external layer of the supragengival portion of the restoration was worn out using a round diamond bur and a composite resin layer was applied to correct the colour alteration**.** The remaining patients considered that good aesthetics was achieved after the procedures. However, caution must be exercised because the patients were simply asked about it and no visual analogue scale or another method to measure the patients' aesthetic satisfaction was applied.

The presence of restoration margins close to the gingival margin or within the crevicular space has been suggested to cause gingival inflammation (Larato 1972). The results of the present study are not in agreement with this statement. As the amount of soft tissue coverage achieved in the CAF+R group was 51.57%, the restorations present in this group remained approximately 50% covered by the soft tissue and, as a consequence, the apical margin of the restoration located subgingivally. How-

ever, no POB or signs of gingival inflammation were observed during the study period. Dragoo's (1996, 1997) and Alkan et al.'s (2006) studies demonstrated that the periodontal health was maintained when a resin-modified glass ionomer was used for subgingival or transgingival restorations. The biocompatibility of the material, combined with the fact that the patients were followed up every 4 months for prophylaxis, plaque control and oral hygiene instructions, may help to explain the gingival health observed during the study. In addition, flap elevation allowed proper isolation of the operative field and a well-finished filling could be achieved that might have facilitated plaque control.

Despite the fact that this is a 2-year follow-up study, longer periods of observation are recommended to assess the rate of success and the possible complications of this combined approach. It should be recognized that the periodontal surgery associated with the restorative procedure required a longer clinical time compared with the isolated surgical procedure. In addition, the statistical analysis included a power value of 77% to detect a clinical significant difference of 1.0 mm between CAF and CAF+R in RGR and CAL. Therefore, further studies with larger sample sizes are strongly recommended to confirm these results. Other studies testing other different restorative materials and surgical techniques should be performed to achieve the best combination to treat this particular combined lesion. The results of the present study suggest that the combination of CAF for root coverage and cervical lesion restoration using a glass ionomer can provide stable results after 2 years.

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Clinical Relevance

Scientific rationale for the study: Gingival recession is frequently associated with a non-carious cervical lesion. Recent literature has reported short-term successful treatment results when periodontal surgery is combined with glass ionomer restoration.

Principal findings: The present study shows that the combination of CAF for root coverage and cervical lesion restoration using a glass ionomer can provide stable results after 2 years.

Practical implications: The findings of the present study suggest that the combined approach may be considered as a treatment option for the type of lesion included in the study.