Coronally Advanced Flap With or Without Subepithelial Connective Tissue Graft for the Treatment of Single Recession: 5-Year Outcomes from a Comparative Study

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Gingival recession can cause an esthetic impairment or dentin hypersensitivity due to root surface exposure to the oral cavity. These conditions may require specific surgical interventions to achieve root coverage. This controlled clinical trial on 20 subjects compared coronally advanced flap (CAF) technique and CAF plus subepithelial connective tissue graft (CTG) for the treatment of single maxillary gingival recession. Recession height (REC) and complete root coverage (CRC) were considered as primary outcomes. The residual REC was 2.90 ± 0.99 mm at baseline, 1.10 ± 0.99 mm after 1 year, and 1.15 ± 1.06 mm after 5 years in the CAF group and 2.70 ± 0.48 mm at baseline, 0.55 ± 0.69 mm after 1 year, and 0.44 ± 0.62 mm after 5 years in the CAF + CTG group. The differences between groups at 5 years of follow-up was statistically significant. CRC was obtained in 60% of teeth in the CAF group and in 70% of teeth in the CAF + CTG group at the 5-year follow-up. The results showed a significant difference between CAF and CAF + CTG techniques for the treatment of single recession with regard to REC; no significant difference was found in the percentage of teeth presenting CRC after 5 years.


The apical migration of the gingival margin of the cementoenamel junction (CEJ) in the absence of active periodontal disease is a relatively frequent occurrence that may cause dentin hypersensitivity, root caries or abrasions, and concerns about esthetics.1,2 Though the etiology of gingival recession is not completely understood or described, some factors have been found to be related to its incidence and progression over time.1,3,4 Orthodontic appliances and forces, oral piercing, anatomical factors, gingival biotype, and oral hygiene habits and instruments could be causal factors for the initiation and progression of gingival recession.5–9

The prevalence of gingival recessions and related conditions, such as dentin hypersensitivity, is high,10–12 potentially affecting more than 50% of the population in at least one site.10 Moreover, the presence of gingival recession could be associated with other clinical conditions, such as increased risk of cervical lesions (caries and noncaries), esthetic problems, and an impairment in the maintenance of oral hygiene.13

Surgical treatment of gingival recession aims at coronally advancing the gingival margin to its natural position and covering the exposed root surface, without increasing periodontal probing depth after treatment. With regard to esthetic
appearance, the treatment should not result in scar formation or inadequate integration of the treated portion with the surrounding gingival tissues in terms of texture and chromatic characteristics.\textsuperscript{1,14,15}

However, a recent investigation of 96 patients presenting 783 recessions reported that up to 72% of recessions were completely unperceived by the subjects, while 160 of the 218 perceived recessions were asymptomatic and the patients did not declare any discomfort related to them.\textsuperscript{16}

In spite of the relatively low request for treatment, several surgical techniques have been described to achieve root coverage. Coronally advanced flap (CAF) and other flap repositioning techniques have been widely described in the literature. These techniques are aimed aimed at root coverage via displacement of gingival tissues without soft tissue graft.\textsuperscript{14,17,18} The addition of a connective tissue graft (CTG) to obtain a thicker tissue on the exposed root was related to better outcomes over the medium and long term compared with CAF alone.\textsuperscript{19,20} Guided tissue regeneration (GTR) techniques have also been described in conjunction with CAF, but a number of studies and systematic reviews of the literature did not show a significant beneficial effect compared to CAF alone.\textsuperscript{21,22} Moreover, several authors evaluated the use of enamel matrix derivatives with CAF, describing a significant enhancement of the healing processes and consequently the clinical results.\textsuperscript{23}

The aim of this study was to present interim results (5 years) of a controlled study that compared the CAF technique to CAF + CTG for the treatment of single recessions.

**Materials and Methods**

This article presents the results of a controlled nonrandomized study with a parallel group design. The study population was composed of all the patients that presented to a single university clinic (Dental Clinic, IRCCS Istituto Ortopedico Galeazzi, Milan, Italy) for treatment of a single gingival recession. All patients treated between 2009 and 2010 were enrolled consecutively and alternately assigned to one group or the other.

To be included in the study sample, patients had to meet the following criteria:

- Aged older than 18 years and able to understand and sign a written informed consent form
- Free from systemic conditions that were relative or absolute contraindications to surgical interventions (American Society of Anesthesiologists classification ASA-1 or ASA-2)
- Periodontally healthy (defined as absence of any form of periodontitis or gingivitis, having a full-mouth bleeding score < 20% and a full-mouth plaque score < 20%)
- Having at least one maxillary tooth (except molars) with a gingival recession classified as Miller Class I or II\textsuperscript{24} and at least 2 mm deep
- Presenting a step at the level of the CEJ < 1 mm deep

Exclusion criteria were as follows:

- Periodontal surgery at the sites selected for the surgical interventions within 5 years prior to enrollment in the study
- Presence of a prosthetic crown or cervical restoration at the tooth selected for surgery

All patients enrolled in the study were treated following the principles included in the Helsinki Declaration as modified in 2000.\textsuperscript{25} The research protocol was approved by the Review Board of the IRCCS Istituto Ortopedico Galeazzi in 2009. Exhaustive information about the study was given to all patients, who were required to sign an informed consent form before enrollment. The present report was written following the principles described in the CONSORT statement.\textsuperscript{26}

**Surgical Procedure**

Patients belonging to the control group were treated with CAF alone, while patients in the test group were treated with CAF + CTG. The surgical procedure was performed following a protocol similar to the one described in details elsewhere.\textsuperscript{27} All surgeries were performed by the same surgeon (L.F.), who had more than 10 years of experience in this particular field.

Briefly, after local anesthesia with articaine 4% + epinephrine 1:100,000, a trapezoidal flap was elevated. The flap was made with two beveled and slightly divergent vertical incisions extending beyond the
mucogingival junction. One sulcular incision connected the two vertical ones, extending into the gingival sulcus of the affected tooth. A split-thickness flap was carefully elevated, extending beyond the mucogingival junction, leaving the periosteum untouched. In the region of the mesial and distal papilla of the treated tooth, the epithelium was removed, leaving the vascular connective tissue in place. The exposed root surface was accurately debrided using a sharp curette.

In the CAF + CTG group, a CTG was harvested from the palate (1 to 2 mm thick, measured with a periodontal probe) in the region extending from the second premolar to the second molar. The graft was placed to cover the recession defect at the level of the CEJ and stabilized using resorbable sutures (Vicryl 5-0/6-0, Ethicon, Johnson & Johnson) anchored to the periosteum.

In both groups, the previously elevated flap was released through partial-thickness incisions of muscular insertions to the periosteum deep apically to allow coronal repositioning of the flap without tension. The flap was then sutured with one sling suture and interrupted sutures for vertical release incisions (Vicryl 5-0/6-0, Ethicon, Johnson & Johnson; Gore-Tex 6-0, W. L. Gore & Associates).

Patients were instructed to avoid any trauma in the region of surgical intervention and not to consume hard food during the first 3 days. Moreover, they were prescribed 80 mg ketoprofen + lysine salt twice a day for 2 days for inflammation and pain control. Tooth brushing in the surgical region was avoided for 3 weeks, and plaque control was obtained via 0.5% chlorhexidine digluconate spray, applied twice a day. After this period, all patients were instructed to resume tooth brushing using ultrasoft bristles for 3 more weeks. Subsequently, standard oral hygiene procedures were reintroduced.

Outcomes

Measures were taken by one experienced operator (S.C.) masked to the treatment performed. All clinical measurements were performed using a standardized periodontal probe (UNC-15) and referring to a resin stent made at baseline.

The primary outcomes were gingival recession (REC), measured as the distance between the CEJ and the gingival margin, and percentage of teeth with complete root coverage (CRC) at each follow-up visit. CRC was defined as absence of gingival recession with the CEJ not visible. The secondary outcomes were width of keratinized gingiva (KG), evaluated by measuring the distance between the gingival margin and the mucogingival junction; percentage of root coverage (RC); tooth hypersensitivity (SEN) after application of air-flow for 3 seconds (patients were asked to give a dichotomous response [yes/no]); and clinical attachment level (CAL), calculated as the sum of REC and probing depth.

Statistical Methods

The statistical analysis was performed by a single operator (S.C) masked to the surgical treatment. Normality of distributions was assessed using Shapiro-Wilk test.

Descriptive statistics were applied to all outcomes presenting mean values and standard deviations. Analysis of variance was used to evaluate one parameter modification over time (intragroup comparison) while unpaired Student t test was used to compare the two treatment groups (intergroup comparison) at baseline and at 1, 3, and 5 years after the surgeries. Fisher exact test was used to assess the intergroup differences at baseline for dichotomous variables. The level of significance was posed at $P < .05$.

Results

A total of 20 patients (10 in the CAF + CTG group and 10 in the CAF group) were treated and attended the last follow-up visit 5 years after the surgical procedure. Figures 1 and 2 show two cases treated in the CAF + CTG and CAF groups, respectively. Baseline demographic characteristics are summarized in Table 1. Both groups were statistically comparable at baseline for all considered parameters. Tables 2 and 3 show outcome modifications over time. Recession width decreased after 1 year and remained substantially stable up to 5 years. Recession height was significantly different after 3 and 5 years, favoring
the CAF + CTG group, while the percentage of CRC was lower in the CAF group 5 years after the surgery, though this difference was not statistically significant (P > .05). Regarding the secondary outcomes, the width of KG remained stable over time, while CAL, as expected, significantly decreased at 1 year. Patients reporting hypersensitivity are more heavily represented in the CAF group. The RC percentage was significantly higher in the CAF + CTG group after 1 year.

Discussion
The present study rejected the null hypothesis that CAF and CAF + CTG techniques lead to comparable improvements in clinical parameters (REC, KG, and CAL) over the
medium term when used for surgical treatment of gingival recessions. In fact, recession height values were significantly better in the CAF + CTG than in the CAF group at 3 and 5 years of follow-up. Moreover, self-reported outcomes related to the presence of dentin hypersensitivity were demonstrated to improve.

### Table 1 Baseline Characteristics of the Sample

<table>
<thead>
<tr>
<th></th>
<th>CAF group (n = 10)</th>
<th>CAF + CTG group (n = 10)</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men/Women</td>
<td>5/5</td>
<td>4/6</td>
<td>NS&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Age (y)</td>
<td>32.8 ± 4.9</td>
<td>34.2 ± 7.8</td>
<td>NS</td>
</tr>
<tr>
<td>Smokers (n)</td>
<td>2 (6.5)</td>
<td>3 (6.7)</td>
<td>NS</td>
</tr>
<tr>
<td>REC (mm)</td>
<td>2.90 ± 0.99</td>
<td>2.70 ± 0.48</td>
<td>NS</td>
</tr>
<tr>
<td>KG width (mm)</td>
<td>2.89 ± 1.05</td>
<td>2.30 ± 0.82</td>
<td>NS</td>
</tr>
<tr>
<td>CAL (mm)</td>
<td>4.22 ± 0.83</td>
<td>4.11 ± 0.78</td>
<td>NS</td>
</tr>
<tr>
<td>SEN (n)</td>
<td>5</td>
<td>4</td>
<td>NS&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>Fisher exact test.

NS = not significant.

### Table 2 Clinical Parameters over Time: Primary Outcomes

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>1 y</th>
<th>3 y</th>
<th>5 y</th>
</tr>
</thead>
<tbody>
<tr>
<td>REC (mm)</td>
<td>Value</td>
<td>Difference</td>
<td>Value</td>
<td>Difference</td>
</tr>
<tr>
<td>CAF</td>
<td>2.90 ± 0.99</td>
<td>NS</td>
<td>1.10 ± 0.99</td>
<td>NS</td>
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<tr>
<td>CAF + CTG</td>
<td>2.70 ± 0.48</td>
<td>0.55 ± 0.69</td>
<td>0.36 ± 0.55</td>
<td>NS</td>
</tr>
</tbody>
</table>

% CRC

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>1 y</th>
<th>3 y</th>
<th>5 y</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAF</td>
<td>–</td>
<td>70%</td>
<td>NS</td>
<td>60%</td>
</tr>
<tr>
<td>CAF + CTG</td>
<td>–</td>
<td>80%</td>
<td>NS</td>
<td>70%</td>
</tr>
</tbody>
</table>

REC = recession; CRC = complete root coverage; CAF = coronally advanced flap; CTG = connective tissue graft; NS = not significant.

### Table 3 Clinical Parameters over Time: Secondary Outcomes

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>1 y</th>
<th>3 y</th>
<th>5 y</th>
</tr>
</thead>
<tbody>
<tr>
<td>KG (mm)</td>
<td>Value</td>
<td>Difference</td>
<td>Value</td>
<td>Difference</td>
</tr>
<tr>
<td>CAF</td>
<td>2.89 ± 1.05</td>
<td>NS</td>
<td>3.11 ± 0.60</td>
<td>NS</td>
</tr>
<tr>
<td>CAF + CTG</td>
<td>2.30 ± 0.82</td>
<td>3.20 ± 1.32</td>
<td>3.00 ± 1.15</td>
<td>NS</td>
</tr>
</tbody>
</table>

|                  | Value    | Difference | Value | Difference | Value | Difference | Value | Difference |
| CAL (mm)         | 4.22 ± 0.83 | NS | 3.11 ± 1.45 | NS | 2.67 ± 1.22 | NS | 2.78 ± 1.39 | NS |
| CAF + CTG        | 4.11 ± 0.78 | 2.50 ± 0.87 | 2.00 ± 0.43 | NS | 2.05 ± 0.96 | NS |

|                  | Value    | Difference | Value | Difference | Value | Difference | Value | Difference |
| % RC             | –        | 62.3 ± 31.9 | <.05 | 65.0 ± 31.6 | .06 | 65.7 ± 32.2 | NS |
| CAF + CTG        | –        | 89.4 ± 15.4 | 87.9 ± 18.4 | NS | 85.4 ± 20.8 | NS |

|                  | Value | Difference | Value | Difference | Value | Difference | Value | Difference |
| SEN (n)          | 5     | NS         | 4     | <.05       | 2     | NS         | 2     | NS         |
| CAF + CTG        | 4     | 1          | 1     | 1          | 1     | 1          | 1     | 1          |

KG = keratinized gingiva; CAL = clinical attachment level; RC = root coverage; SEN = tooth hypersensitivity; CRC = complete root coverage; CAF = coronally advanced flap; CTG = connective tissue graft; NS = not significant.
over time and were not significantly different between the two tested groups. The other secondary outcomes were not significantly different between the two groups.

To adequately interpret the results of the present report, several limitations should be taken into account. First, the nonrandomized study design could have biased the allocation of subjects to one group or another. However, one should consider that the groups were substantially comparable at baseline. Second, all surgical interventions were performed by the same clinician, who has extensive training and experience. This could limit the external validity of the results, as was also found in another study on the same topic. A third issue is related to the sample size. Even though it could be considered comparable to another study, no sample size calculation was performed for the present research.

As stated in a recent systematic review of the literature reporting the conclusions of a European Federation of Periodontology consensus conference, there are few randomized controlled clinical trials comparing CAF and CAF + CTG for the treatment of single recession. Thus, the results of the present report could be discussed in the context of available literature.

One report on long-term outcomes (up to 14 years) following the application of CAF technique for the treatment of single Miller Class I or II maxillary recessions presented data comparable to those obtained in the present study for the CAF group. In fact, the residual gingival recession was 0.9 ± 1.1 mm (for the polishing group) and 0.7 ± 0.8 mm (for the root planing group) 5 years after surgical intervention.

One randomized multicenter study of 85 recession defects treated by CAF or CAF + CTG reported short-term outcomes (6 months). The authors found a residual recession depth of 0.8 ± 0.8 mm (CAF group) and 0.6 ± 0.9 mm (CAF + CTG) as measured 6 months after the surgeries, with a significant reduction in recession from baseline. These findings could be considered comparable to those obtained in the present study.

In 2004, da Silva et al. published the results of a randomized controlled clinical trial comparing CAF and CAF + CTG techniques on 11 patients with Miller Class I recession defects. Though the 6-month outcomes related to residual recession for both groups were significantly higher when compared to the more recent study by Cortellini et al., a substantial and significant reduction in recession depth was observed in the CAF + CTG group compared to the CAF group.

Considering the long-term stability of the results, Pini-Prato et al. reported on a large cohort of patients that were treated with CAF and followed for 8 years. The authors reported that the recession height dropped gradually over time, from 0.3 ± 0.5 mm after 6 months to 0.7 ± 0.7 mm after 5 years and 0.9 ± 0.9 mm after 8 years. The difference was statistically significant between 1 and 5 years and between 5 and 8 years. This increase in recession height could not be confirmed by the present study even though the values at the first follow-up visits (1 year) were substantially higher compared to those reported by Pini-Prato et al. and this could have masked the reduction over time. As a consequence, no significant reduction in the percentage of teeth with CRC could be observed in the present study even though only 70% of cases presented CRC at the first follow-up visit and the smaller sample size of the present investigation was taken into account.

As stated in a recent publication on a large cohort of subjects treated for gingival recessions, complete treatment success in this particular surgical intervention is obtained when the gingival margin position and probing depth are coronal to the CEJ. By this standard, only 60% of teeth in the CAF group and 70% of the teeth in the CAF + CTG group could be considered complete successes after 5 years.

Conclusions

This study found a statistically significant difference between CAF and CAF + CTG techniques for the treatment of single recession with regard to recession height; however, no significant difference was found in the proportion of teeth presenting CRC after 5 years. Both techniques led to a significant reduction in recession height that appeared to remain stable over time.
Acknowledgments

The authors reported no conflicts of interest related to this study.

References