Modified Coronally Advanced Tunnel Technique with Site-Specific Application of Connective Tissue Graft for the Treatment of Multiple Adjacent Maxillary Gingival Recessions: A Case Series

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The aim of the present case series was to evaluate the outcomes of the modified coronally advanced tunnel technique (MCAT) using the width of keratinized tissue (KTW) as an indicator to apply the connective tissue graft (CTG) specifically. Seven patients requiring treatment for the presence of multiple gingival RT1 recession defects in the maxilla were enrolled in the study. A total of 36 recessions were treated with MCAT, and the CTG was applied in 16 sites presenting < 2 mm of KTW at baseline. The mean root coverage from baseline to 1 year postsurgery was 90% for the sites treated with MCAT alone and 93.7% for those treated with MCAT+CTG. The increase of KTW was higher in the sites treated with CTG than in the sites treated without it. Within the limitations of the present case series, it can be concluded that the proposed surgical technique is extremely effective in gaining root coverage and reducing the amount of connective tissue harvested from the donor site.


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the most appropriate root-coverage procedure.\textsuperscript{6,7}

Results from the aforementioned articles support the rationale to restrict the use of CTGs only to instances where the marginal tissue is thin or where the KT is insufficient, thus enhancing the esthetic outcome\textsuperscript{8} while simultaneously reducing patient discomfort by diminishing the dimension of the harvesting area.

Observation of the results obtained with and without additional CTG use might help clinicians in the decision-making process for MAGR treatment, suggesting restricting the use of CTG only to sites with thin residual phenotype or reduced width of KT. In fact, the same patient may present with different phenotypes, both thick and thin, as well as different KT dimensions in different sites of the same mouth.

The tunnel approach for the treatment of MAGR without additional CTG in patients with thick and very thick phenotype was described first in a case series by Rasperini et al.\textsuperscript{9} The goal of the present case series was to evaluate the outcomes of the MCAT,\textsuperscript{2,10} utilizing the KT width (KTW) as an indicator to apply the CTG only at sites where it was considered insufficient.

Materials and Methods

Study Design and Population

This case series was performed in accordance with the Helsinki Declaration of Human Studies.

A total of seven consecutive patients requiring root coverage procedures for esthetic or hypersensitivity reasons were treated in the same private practice (Paris, France) between October 2017 and December 2018.

The inclusion criteria were as follows: the presence of at least three gingival recessions > 1 mm in depth (RT1)\textsuperscript{11} on adjacent teeth in the maxilla; the presence of identifiable cementoenamel junction (CEJ); age > 18 years; periodontally and systemically healthy; full-mouth plaque score (FMPS) < 20%; and full-mouth bleeding score (FMBS) < 20%. Exclusion criteria were as follows: smoking; contraindications for periodontal surgery; and pregnancy.

Pretreatment Procedures

Initially, cause-related therapy was completed on all patients. In particular, patients received oral hygiene instructions with non-traumatic brushing technique (roll technique) to eliminate incorrect habits related to the etiology of the recessions. Prior to surgery, FMPS and FMBS were assessed as the percentage of total surfaces (four per tooth) that revealed the presence of plaque and bleeding, respectively. The following parameters were measured as follows:

- Gingival recession depth (REC): measured in millimeters as the distance from the CEJ to the gingival margin
- KTW: measured in millimeters as the distance from the gingival margin to the mucogingival junction (MGJ)
- Pocket probing depth (PPD):
- Percentage of root coverage (%RC): calculated as (REC reduction × 100) / (REC at baseline)
- Complete root coverage (CRC): scored dichotomously

The total number of teeth where the CTGs were applied was recorded. Measurements were performed using a manual probe (PCP-UNC 15 probe tip, Hu-Friedy) at the mid-aspect of the involved teeth at baseline and 12 months postoperatively, recorded to nearest millimeter.

Surgical Procedures

The same experienced periodontist (S.A.) performed all surgeries. The surgical procedure was performed as described in previous study by the same author.\textsuperscript{2,10}

Before surgery, composite stops were placed at the contact points to perform suspended sutures at the interproximal spaces, allowing the coronal position of the gingival margin to be maintained.

After local anesthesia, root planing of the exposed root surface was performed by means of hand instruments.

Then, a full-thickness flap was raised using a microelevator placed...
intrasulcularly. The mucoperiosteal dissection extended beyond the MGJ and under each papilla to allow passive, tension-free mobilization in coronal direction. Muscle fibers and any remaining collagen bundles on the inner aspect of the flap and alveolar mucosa were severed with extreme care utilizing Gracey curettes in order to obtain a passive coronal position of the flap and papilla and to avoid flap perforation.

For each gingival recession included in the surgery, the decision whether to add a CTG was made according to baseline KTW: When KTW > 2 mm, only MCAT was performed; when KTW < 2 mm, a CTG was added.

The CTG was harvested from the palate using the single incision technique. A single incision was made on the palate between the distal aspect of the canine and the mesial aspect of the second molar. The CTG had a height of 4 mm and length of 6 mm and was greater than the mesiodistal dimension of the recession in order to facilitate its insertion, with the help of sutures, under the tunnelized flap.

Immediately after harvesting the graft, pressure was applied to the donor area. Afterward, the donor site was sutured with modified horizontal mattress sutures. The grafts were then inserted in an apical direction and retracted laterally by sutures at each concerned recession defect.

Finally, the flap was advanced in a coronal position, slightly coronal to the CEJ, with horizontal suspended mattress sutures around the contact points.

Figures 1 to 3 show examples of site-specific application of CTG under the MCAT as well as a comparison of baseline and 1-year clinical outcomes.

Postoperative Infection Control Procedures

Postsurgically, all patients were given analgesics and amoxicillin (500 mg) three times a day for 6 days. Patients were instructed to rinse their mouth with a 0.2% chlorhexidine...
solution three times a day for 1 minute for 15 days and to avoid brushing in the operated area until 4 weeks after surgery. At the 4-week follow-up appointment, they were instructed to initiate mechanical tooth cleaning using a soft toothbrush. All patients were recalled after 1, 2, and 4 weeks, and at 3, 6, and 12 months after surgery for professional oral hygiene procedures and control.

Data Analysis

Statistical analysis was performed using R software version 3.2.4 (R Core Team).

The primary outcome was CRC. Descriptive statistics were calculated and expressed as mean ± SD and percentages.

The treated sites were categorized in two groups: The MCAT group comprised all defects treated without CTG, and the others were grouped as the MCAT+CTG group. Considering the small study population, Wilcoxon and Mann-Whitney tests were used for intra- and intergroup comparisons, respectively. CRC was compared using Fisher test. A significance level (P value) of .05 was adopted.

Results

All seven treated patients (mean age: 55 ± 17 years; range: 34 to 83 years) completed the 12-month evaluation. Patient characteristics at baseline are summarized in Table 1.

A total of 36 maxillary RT1 recession defects were treated: 13 recessions (36%) affected the premolars, 9 (25%) the incisors, 9 (25%) the canines, and 5 (14%) the first molars. The mean number of such defects in each subject was 5 (range: 3 to 10).

Sixteen recessions were treated with MCAT+CTG, while 20 were treated with MCAT only. The CTG

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was added on 7 canines, 4 premolars, 3 first molars, and 2 incisors.

Some differences between the two groups at baseline were observed. In the MCAT+CTG group, the mean REC was statistically significantly higher (MCAT+CTG: 2.62 ± 1.01 mm; MCAT: 1.92 ± 1.16 mm; \( P = .053 \)), while mean KTW was statistically significantly lower (MCAT+CTG: 1.22 ± 0.58 mm; MCAT: 2.67 ± 0.82 mm; \( P < .001 \)), when compared with the MCAT group (Table 2).

At the 12-month follow-up, CRC was obtained in 91.7% of sites (33 of 36 recession defects). No statistically significant difference was found between sites treated with and without CTG for rate of CRC (MCAT: 90%; MCAT+CTG: 93.7%; \( P = 1 \)), REC reduction (MCAT: 1.88 ± 1.18 mm; MCAT + CTG: 2.5 ± 0.95 mm; \( P = .066 \)), and %RC (MCAT: 94.17% ± 22.47%; MCAT + CTG: 96.88% ± 12.50%; \( P = 0.7 \)) (Table 3).

Regarding KTW gain, data reported in Table 3 indicate a statistically significant difference between

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### Table 1 Patient and Site Characteristics at Baseline

<table>
<thead>
<tr>
<th>Patient no.</th>
<th>Gender</th>
<th>Age, y</th>
<th>Recessions, n</th>
<th>Tooth location</th>
<th>CTG location</th>
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<tbody>
<tr>
<td>1</td>
<td>F</td>
<td>34</td>
<td>4</td>
<td>23, 24, 25, 26</td>
<td>23, 26</td>
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<td>2</td>
<td>F</td>
<td>36</td>
<td>3</td>
<td>23, 24, 26</td>
<td>26</td>
</tr>
<tr>
<td>3</td>
<td>F</td>
<td>83</td>
<td>4</td>
<td>23, 24, 25, 26</td>
<td>24</td>
</tr>
<tr>
<td>4</td>
<td>F</td>
<td>61</td>
<td>10</td>
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</tr>
<tr>
<td>5</td>
<td>M</td>
<td>58</td>
<td>4</td>
<td>23-24-25-26</td>
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</tr>
<tr>
<td>6</td>
<td>F</td>
<td>68</td>
<td>6</td>
<td>11, 12, 13, 21, 22, 23</td>
<td>13, 23</td>
</tr>
<tr>
<td>7</td>
<td>F</td>
<td>50</td>
<td>5</td>
<td>12, 13, 14, 15, 16</td>
<td>12, 13, 14</td>
</tr>
</tbody>
</table>

F = female; M = male; CTG = connective tissue graft.
All defects were recession type 1 (RT1). Tooth and CTG locations are listed according to the FDI numbering system.

### Table 2 Clinical Parameters of MCAT and MCAT+CTG Groups at Baseline and 12 Months

<table>
<thead>
<tr>
<th></th>
<th>MCAT</th>
<th>MCAT+CTG</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>REC</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>1.92 ± 1.16</td>
<td>2.62 ± 1.01</td>
<td>.053*</td>
</tr>
<tr>
<td>12 mo</td>
<td>0.05 ± 0.15</td>
<td>0.12 ± 0.50</td>
<td>.765</td>
</tr>
<tr>
<td>( P )</td>
<td>.0001*</td>
<td>.0004*</td>
<td></td>
</tr>
<tr>
<td>KTW</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>2.67 ± 0.82</td>
<td>1.22 ± 0.58</td>
<td>&lt;.0001*</td>
</tr>
<tr>
<td>12 mo</td>
<td>2.90 ± 0.74</td>
<td>2.16 ± 0.62</td>
<td>.006*</td>
</tr>
<tr>
<td>( P )</td>
<td>.0568</td>
<td>.0014*</td>
<td></td>
</tr>
<tr>
<td>PPD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>1.25 ± 0.44</td>
<td>1.19 ± 0.40</td>
<td>0.675</td>
</tr>
<tr>
<td>12 mo</td>
<td>1.25 ± 0.44</td>
<td>1.19 ± 0.40</td>
<td>0.675</td>
</tr>
<tr>
<td>( P )</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>CAL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>3.17 ± 1.28</td>
<td>3.81 ± 1.06</td>
<td>.086</td>
</tr>
<tr>
<td>12 mo</td>
<td>1.30 ± 1.50</td>
<td>1.31 ± 0.60</td>
<td>0.855</td>
</tr>
<tr>
<td>( P )</td>
<td>.0002*</td>
<td>.0004*</td>
<td></td>
</tr>
</tbody>
</table>

MCAT = tunnel treatment group; MCAT+CTG = tunnel treatment + connective tissue graft group; REC = recession; KTW = keratinized tissue width; PPD = probing pocket depth; CAL = clinical attachment level.

Values are reported in millimeters as mean ± SD. The MCAT group comprised 20 sites, and the MCAT+CTG group comprised 16 sites.

*Statistically significant.

**Borderline statistically significant.**
the two groups: The increase of KTW was higher in the sites treated with CTG than in sites treated without it (MCAT: 0.22 ± 0.44 mm; MCAT + CTG: 0.94 ± 0.63 mm; \( P < .001 \)).

### Discussion

The present case series evaluated the clinical outcomes of the MCAT with a site-specific application of CTG. To the present authors’ knowledge, no study was performed previously that involves the specific use of CTG with the tunnel technique for the treatment of MAGR.

Altogether, 36 maxillary recessions were treated in seven patients. Gingival recessions on molar sites were included and treated because of root sensitivity. At the 1-year follow-up, CRC was observed in 90% of the treated sites, which were all classified as RT1 defects. No statistically significant differences were found in CRC between sites with CTG and those without, suggesting that the dimension of the baseline KT is the main factor for obtaining CRC. In this regard, Rasperini et al previously suggested that the main factor in obtaining root coverage with a tunnel technique is the amount of KT, not the use of a CTG.\(^9\)

Recently, some studies\(^3,8,13\) have indicated that in recessions where the phenotype is thick with a wide band of KT, CRC is obtained without the use of a CTG, and the esthetic result is more satisfactory than in sites where connective tissue is applied. According to that data, connective tissue should be added to a coronally displaced flap only in sites presenting with a thin phenotype or a reduced dimension of KT.

The presented surgical approach followed the same principle: Only recessions showing < 2 mm of keratinized tissue were treated by adding a dense CTG beneath the tunnel.

It has been reported that the use of a CTG will enhance the marginal stability of the flap during the first phases of the healing processes,\(^4,15\) while a marginal gingiva with little amount of KT is less stable and thus more prone to undergo recession following a surgery, even when functional stimuli or hygienic maneuvers are applied.\(^16\)

Some authors mentioned the location of the tooth as one of the factors that influences CRC.\(^17,18\) It was stated that posterior teeth were related to poorer outcomes compared to anterior teeth,\(^16,19\) which is in relation to the reduced keratinized gingiva that usually characterizes premolars compared to anterior teeth.\(^20\) The present results reported that 56% (\( n = 9 \)) of teeth presenting KT < 2 mm were incisors and canines. This data emphasizes that location of the tooth should be evaluated in relation to other important local factors, such as gingival thickness, presence of frenuli, and position of the tooth, as mucogingival conditions are site-specific.\(^17,18\)

All treated sites showed a high percentage of root coverage at 12 months, with 93.75% for the sites treated with the adjunct of CTG and 90% for the sites treated with tunnel only, and no statistically significant difference between the two groups was found. These data are compatible with the results of other studies in the literature.\(^3,8,9\)

Within the limitations of the present case series, the results seem to support the concept that the selective insertion of CTG is a sound surgical approach, even when utilizing an MCAT technique.

Both groups experienced an obvious increase in KT. The final widths were 2.16 mm for defects treated with MCAT+CTG and 2.90 mm for the those treated with MCAT only. Although the difference is

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Comparison of 12-Month Clinical Results Between MCAT and MCAT+CTG Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>KTW gain, mm</td>
<td>REC red, mm</td>
</tr>
<tr>
<td>MCAT+CTG</td>
<td>0.94 ± 0.63</td>
</tr>
<tr>
<td>MCAT</td>
<td>0.22 ± 0.44</td>
</tr>
<tr>
<td>( P )</td>
<td>&lt; .001*</td>
</tr>
</tbody>
</table>

KTW gain = gain of keratinized tissue width; REC red = recession reduction; %RC = percentage of root coverage; CRC = complete root coverage; MCAT = tunnel treatment group; MCAT+CTG = tunnel treatment + connective tissue graft group.

All values are reported as mean ± SD except CRC, which is reported as percentages. The MCAT group comprised 20 sites, and the MCAT+CTG group comprised 16 sites.

*Statistically significant.
statistically significant, one must consider that the MCAT group was represented by shallower recessions presenting a wider band of KT than the MCAT+CTG group.

Results from the present case series are in agreement with data from Stefanini et al. At that study’s 3-year follow-up, the authors reported no significant differences between sites treated with CAF and sites treated with CAF+CTG for both amount of root coverage and width of KT.3

However, when evaluating results from the present study, it must be stressed that due to the nature of the study (case series with limited number of patients), no comparison can be made with other treatment options.

Further studies with a randomized approach are required to determine whether MCAT with site-specific application of CTG should become a standard of care for treating multiple gingival recession defects.

Conclusions

Within the limitations of the study design, the results of the present case series indicate that the MCAT combined with specific, selective use of CTG is a valuable surgical approach to treat maxillary MAGR defects presenting a heterogenous amount of KT.

Acknowledgments

The authors declare no conflicts of interest.

References