Comparative evaluation of platelet-rich fibrin membrane and connective tissue graft in the treatment of multiple adjacent recession defects: A clinical study

Ahu Uraz, Yasemin Sezgin, Mehmet Yalim, I. Levent Taner, Deniz Cetiner*

Department of Periodontology, Faculty of Dentistry, Gazi University, Ankara, Turkey

Received 4 August 2012; Final revision received 17 October 2012
Available online 22 March 2013

Abstract Background/purpose: The expanded mesh connective tissue graft (e-MCTG) is an effective method for the treatment of multiple adjacent recession-type defects (MARD). Platelet-rich fibrin (PRF) is a second-generation platelet concentrate. The aim of the present study was to assess the effectiveness and the predictability of the PRF membrane (PRF-M) for the treatment of MARD, and also to compare it with e-MCTG.

Materials and methods: A total of 106 buccal gingival recessions were treated with coronally advanced flap (CAF) + (e-MCTG) or with (CAF) + (PRF-M). Clinical measurements recorded at baseline and 6 months after surgery included plaque index and gingival index, probing depth, recession depth, recession width, apicocoronal width of keratinized tissue, and clinical attachment level.

Results: Six months after the surgery, statistically significant gain in root coverage, recession width, clinical attachment level, and keratinized tissue were assessed in both groups. No statistically significant difference was found between the two groups for all of these parameters.

Conclusion: The results of this study indicate that the use of PRF allowed the treatment of MARD with adequate wound healing and highly predictable root coverage. More expanded clinical studies are needed to confirm these findings.

Copyright © 2013, Association for Dental Sciences of the Republic of China. Published by Elsevier Taiwan LLC. All rights reserved.
Introduction

Gingival recession (GR) is defined as the partial denudation of the root surface due to the apical migration of the soft tissue to the cemento–enamel junction (CEJ).1,2 There are varied etiologic and predisposing factors related to GR, including trauma from tooth brushing, malposition of teeth, frenillia, and muscle attachments.3 GR is a typically common clinical condition4–6 and may result in esthetic problems, inadequate plaque control, root caries, and dentin hypersensitivity.4,7

The treatment of multiple adjacent recession-type defects (MARD) with different surgical procedures depends on many factors, such as defect size, presence or absence of keratinized tissue adjacent to the defect, and thickness of the gingiva, which are related to the defect and/or the patient. Numerous surgical procedures have been described to achieve root coverage (RC) based on coronally positioned flaps, pedicle grafts, free gingival grafts; subepithelial connective tissue grafts (CTG); and guided tissue regeneration.8–10

MARD presents a further challenge because several recessions must be treated at a single surgical session to minimize patient discomfort.11 For these reasons, recent studies have aimed to develop new techniques for RC of multiple adjacent recessions.

The CTG technique is currently one of the most predictable and reproducible techniques to achieve RC and a high degree of esthetics. Although excellent esthetic results have been reported and RC has ranged from 69% to 97% in many studies, this technique requires a suitable donor site. Inherent problems with RC grafting are a limited quantity of available graft, the need for two surgical sites, compromised patient esthetics, postoperative discomfort, and complications.

The quality of healing after RC has been examined in a few histological studies.12–15 Although the formation of long junctional epithelium is generally expected after conventional mucogingival surgery,14,15 a limited amount of regeneration can be achieved with conventional techniques.12,13 Therefore, various adjunctive agents have been used to accelerate healing and further enhance clinical outcomes. These include root conditioners,16 enamel matrix proteins,17 recombinant human growth factors, and platelet-rich plasma (PRP).18 PRP has become a focus of current studies because of its potential to accelerate wound healing.19,20

Platelet-rich fibrin (PRF), which was introduced by Choukroun et al in 2001, can be considered a second-generation platelet concentrate. Using PRF requires very simple techniques because, unlike other platelet concentrates, it does not require anticoagulants or bovine thrombin. Blood is collected in dry glass tubes or glass-coated plastic tubes and centrifuged immediately, and the fibrin clot is formed in the middle of the tube.21 Unlike the other platelet concentrates, PRF was defined as an autologous leukocyte and PRF biomaterial, because in this method, platelets and leukocytes are collected with high efficiency such that the growth factors will able to release gradually during at least 1 week.22–24 It has been shown in different studies that PRF has a proliferative effect on different types of cells such as dental pulp cells,25 human osteoblasts,26 human gingival and periodontal ligament fibroblasts,27 dermal prekeratinocytes, and preadipocytes.26,28,29 This homogeneous fibrin network is considered a healing biomaterial and is used to enhance bone regeneration and soft tissue healing in implant and periodontal plastic surgery procedures,30 healing of extraction sockets,31 and treatment of intrabony defects32 and radicular cysts.33

The aims of the present study were to assess the effectiveness and the predictability of PRF membrane (PRF-M) with coronally advanced flap (CAF) + (PRF-M) for the treatment of MARD, and also to compare it with (CAF) + expanded mesh connective tissue graft (e-MCTG).

Materials and methods

Patient selection

This study is a split-mouth, randomized, controlled clinical trial designed to compare the outcomes of two surgical procedures for RC. The study protocol was reviewed and approved by the Ethical Board of Gazi University (2010/78). The 20 patients were consecutively referred to the Department of Periodontology, University of Gazi. The study was conducted in accordance with the Helsinki Declaration of 1975, as revised in 2000. Written informed consent was obtained from all patients after a thorough explanation of the nature, risks, and benefits of the clinical investigation and associated procedures. The individuals who reported between November 2010 and June 2011 were included in the study.

The patient selection was based on the following criteria: at least three adjacent maxillary or mandibular Miller Class I and/or Class II GR defects ≥2 mm in depth; systemic health; presence of identifiable CEJ; good plaque control [full-mouth plaque index (PI) <20%]; vital teeth; no caries or restoration on the selected teeth; absence of bleeding on probing at the surgical sites; and probing depth (PD) of ≤2 mm. All participants were in good health and were not aware of any systemic conditions.

Exclusion criteria were as follows: previous surgical attempt to correct gingival recession; fixed orthodontic or removable appliance; current smoking or chewing of tobacco; endodontically treated sites or root surface restorations on sites; systemic disease; coagulation defect or current anticoagulation treatment; and pregnancy.

All participants met the aforementioned inclusion criteria before enrollment in this study.

Twenty patients aged 23–48 [33.7 ± 7.12 (mean ± SD)] years complaining of esthetic problems or dentinal hypersensitivity were enrolled in the study. Five female patients were excluded because they did not comply with the study protocol. A total of 106 buccal gingival recessions were treated in 15 individuals (9 men, 6 women). Patients had recession defects, thus allowing test (CAF) + (PRF-M) and control (CAF) + (e-MCTG) procedures to be undertaken in the upper and lower arches. Test and control sides were determined by tossing a coin.

The test group included 54 buccal gingival recessions (21 teeth on maxilla, 33 teeth on mandibula) (Table 1). Test
sides were treated with (CAF) + (PRF-M). The control group included 52 buccal gingival recessions (20 teeth on maxilla, 32 teeth on mandibula) (Table 1). Control sides were treated with (CAF) + (e-MCTG).

Clinical measurements

The following clinical measurements were recorded to the nearest millimeter on the midbuccal aspect of each of the selected sites immediately after the initial therapy and again 6 months after surgery with the aid of an acrylic stent to determine the exact measurement site: (1) recession depth (RD) measured from the CEJ to the gingival margin; (2) recession width measured across the buccal surface at the CEJ level (the tangent of lowest of CEJ was used as reference point); (3) PD measured from gingival margin to the bottom of the gingival sulcus; (4) clinical attachment level (CAL) measured from CEJ to the bottom of the gingival sulcus; (5) apicocoronal width of keratinized tissue (KT) measured from gingival margin to mucogingival junction: the location of the mucogingival junction was established using a visual method; PI sup3 and gingival index sup3 (GI) scores were also documented. All clinical measurements were performed by the same blinded and calibrated examiner (YS).

The investigator in charge of the clinical assessments was calibrated for intraexaminer repeatability before the trial began. Four patients were enrolled for this purpose. Duplicate measurements for clinical records were obtained with an interval of 24 hours between the first and the second recording. The intraclass correlation coefficient, used as a measure of intraexaminer reproducibility, was 0.95.

Presurgical procedures

All participants received initial therapy including oral hygiene instructions, scaling, professional tooth cleaning using a rubber tip with a low-abrasive polishing paste, occlusal adjustment if indicated, and elimination of habits related to the etiology of recession. The participants were instructed to use the modified Stillman brushing technique. One month after the initial therapy, clinical measurements were recorded, and the participants underwent the surgical procedure.

Surgical procedures

After baseline recordings, both surgical operations (test and control) were performed by the same clinicians. The same clinician (DC) always performed the operation, whereas the other surgeon (AU) assisted in the procedure.

The facial skin all around the oral cavity was scrubbed with a 7.5% povidone–iodine solution. Local anesthesia was obtained by regional blocks with 2% lidocaine with 1:100,000 epinephrine. Next, an intrasulcular incision was made corresponding to the number of adjacent gingival recession, extending to the line angles of both adjacent teeth that had no defect. When needed, slightly oblique releasing incisions were made starting at least 0.5 mm from the gingival margin of the adjacent teeth and extending to the alveolar mucosa. A full-thickness flap was elevated 3 to 4 mm apical to the bone dehiscence. This was followed by split thickness sharp dissection further apically to allow coronal positioning of the flap as described previously. All papillae were de-epithelialized to create a recipient bed.

Recession defects were thoroughly scaled using Gracey curettes (Hu-Friedy Inc., Chicago, IL, USA). No root conditioning was used. In the test group, just before the surgery, intravenous blood was collected in 10-mL glass-coated plastic tubes without anticoagulants and, as recommended by the manufacturer, immediately centrifuged at 2700 rpm for 12 minutes. After the centrifugation, the fibrin clot was removed from the tube with sterile tweezers, and the attached red blood cells were shaved off and discarded.

### Table 1 Location and number of recessions in each patient.

<table>
<thead>
<tr>
<th>Patient number</th>
<th>Sex</th>
<th>(CAF) + (PRF-M) group</th>
<th>(CAF) + (e-MCTG) group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Female</td>
<td>n = 5, maxilla, left + right side</td>
<td>n = 3, mandibula, left side</td>
</tr>
<tr>
<td>2</td>
<td>Female</td>
<td>n = 5, maxilla, left + right side</td>
<td>n = 4, mandibula, left side</td>
</tr>
<tr>
<td>3</td>
<td>Male</td>
<td>n = 4, maxilla, left side</td>
<td>n = 3, mandibula, right side</td>
</tr>
<tr>
<td>4</td>
<td>Male</td>
<td>n = 4, maxilla, right side</td>
<td>n = 4, maxilla, right side</td>
</tr>
<tr>
<td>5</td>
<td>Female</td>
<td>n = 3, mandibula, left side</td>
<td>n = 4, maxilla, left side</td>
</tr>
<tr>
<td>6</td>
<td>Male</td>
<td>n = 3, mandibula, left side</td>
<td>n = 4, maxilla, left side</td>
</tr>
<tr>
<td>7</td>
<td>Male</td>
<td>n = 4, mandibula, right side</td>
<td>n = 4, maxilla, left + right side</td>
</tr>
<tr>
<td>8</td>
<td>Female</td>
<td>n = 4, mandibula, right side</td>
<td>n = 4, maxilla, left side</td>
</tr>
<tr>
<td>9</td>
<td>Male</td>
<td>n = 3, mandibula, left side</td>
<td>n = 3, mandibula, right side</td>
</tr>
<tr>
<td>10</td>
<td>Female</td>
<td>n = 3, mandibula, right side</td>
<td>n = 3, mandibula, left side</td>
</tr>
<tr>
<td>11</td>
<td>Female</td>
<td>n = 3, mandibula, left side</td>
<td>n = 4, maxilla, left + right side</td>
</tr>
<tr>
<td>12</td>
<td>Male</td>
<td>n = 3, maxilla, right side</td>
<td>n = 3, mandibula, left side</td>
</tr>
<tr>
<td>13</td>
<td>Male</td>
<td>n = 4, mandibula, right side</td>
<td>n = 3, mandibula, left side</td>
</tr>
<tr>
<td>14</td>
<td>Male</td>
<td>n = 4, mandibula, right side</td>
<td>n = 3, mandibula, right side</td>
</tr>
<tr>
<td>15</td>
<td>Male</td>
<td>n = 4, mandibula, right side</td>
<td>n = 3, mandibula, left side</td>
</tr>
</tbody>
</table>

(CAF) + (PRF-M) = treatment with coronally advanced flap and platelet-rich fibrin membrane; (CAF) + (e-MCTG) = treatment with coronally advanced flap and expanded mesh connective tissue graft.
using scissors. The clots were placed on a grid in the PRF-BOX and compressed by a cover to create a fibrin membrane. The fibrin clots were positioned over the recession defects, just below the CEJ with sling 5–0 bioabsorbable sutures. The mucogingival flap was repositioned as coronally as possible and sutured with 4–0 silk sutures (Fig. 1).

In the control group, donor connective tissue was harvested from the molar—premolar area of the palate using a three-sided partial thickness flap to reach the CTG. Alternating incisions were then made on each edge to expand the “mesh” graft so that it would cover the recipient bed, which was 1.5 times larger than the graft. Subsequently, the graft was positioned at the CEJ with sling or interrupted 5–0 bioabsorbable sutures. Then, the mucogingival flap was repositioned as coronally as possible without tension to cover the e-MCTG with 4–0 silk sutures (Fig. 2).

Postoperative care

Patients were advised to abstain from brushing and flossing around the surgical area until suture removal (14 days after surgery) and to consume only soft foods and drinks during the 1st week after surgery. They were also advised to avoid any other mechanical trauma to the treated sites. For 4 weeks, all patients rinsed twice a day for 1 minute with a 0.12% chlorhexidine solution, and analgesics were administered as needed. Two weeks after surgical treatment, all patients were instructed in mechanical tooth cleaning in the operated areas using a soft toothbrush. All patients were examined weekly for the 1st month and once a month for the next 6 months for oral hygiene motivation.

Statistical analysis

Statistical analysis was performed using a Statistical Package for Social Sciences software (SPSS Inc., Chicago, IL, USA). Mean ± SD were calculated for both test and control groups for all clinical parameters. One-way analysis of variance was used to compare pre- and postoperative clinical measurements within the same group. Student t-test was used to test the significance of change between the two treatment groups. The significance level was determined as 0.05.

Results

Healing was uneventful for all patients, and no patient was excluded or dropped out of the study. There were no

Figure 1  PRF membrane (PRF-M). (A) Preoperative view of recessions. (B) A full-thickness flap was elevated. (C) Platelet-rich fibrin (PRF) clots were transformed into strong PRF-M with PRF BOX. (D) PRF-M was placed to cover the exposed roots and stabilized by sutures. (E) A full-thickness flap was replaced and sutured. (F) Six months after surgery.
Complications. In most sites, complete RC, as well as an excellent color match and esthetics, was achieved.

Full-mouth PI and GI were maintained at <20%, and the study teeth were free of biofilm and gingival inflammation throughout the study.

There were no statistically significant differences between baseline and postoperative PI and GI scores within and between groups (P > 0.05). The recession-type defects were not statistically significant among groups at baseline (P > 0.05).

At 6 months, both treatments resulted in significant improvements in the percentage of RC compared with baseline values. The sites treated with (CAF) + (PRF-M) had a mean RC of 95%. For (CAF) + (e-MCTG), the mean RC was 96.1%. A greater and statistically significant reduction in recession width was achieved at 6 months with both treatments (P < 0.05). Both procedures resulted in a significant CAL gain at 6 months (P < 0.05).

There were no significant differences in CAL between the two groups at baseline and 6 months after surgery. We also observed a decrease in PD in the two groups from baseline to 6 months. However, the differences within groups and between groups were not statistically significant (P > 0.05). Both groups showed a significant increase in KT from baseline to 6 months (P < 0.05) (Table 2).

In multiple recession defects affecting maxillary teeth, RD decreased from 4.04 ± 1.22 to 0.2 ± 0.44 and from 2.76 ± 1.36 to 0.1 ± 0.17 following (CAF) + (PRF-M) and (CAF) + (e-MCTG) treatment, respectively. Pre- and postoperative differences within groups were statistically significant (P = 0.02). The difference between the two groups was not statistically significant. KT increased from 4.2 ± 0.83 to 5.2 ± 0.83 and from 4.26 ± 0.66 to 5.6 ± 0.81 following (CAF) + (PRF-M) and (CAF) + (e-MCTG) treatment, respectively. The mean changes in KT during the study period were statistically significant between groups (P = 0.002). Group (CAF) + (PRF-M) had a statistically significant change in KT (4.2 to 5.2, P = 0.000) and CAL (5.6 to 1.6, P = 0.000). Group (CAF) + (e-MCTG) had a statistically significant change in KT (4.26 to 5.6, P = 0.000) and CAL (4.43 to 1.1, P = 0.000) (Table 3).

In multiple recession defects affecting mandibular teeth, RD decreased from 5.09 ± 1.11 to 1.55 ± 2.06 and 3.21 ± 0.87 to 0.10 ± 0.29 following (CAF) + (PRF-M) and (CAF) + (e-MCTG) treatment, respectively. The RD measurements at initial examination and final examination were statistically significant between groups (P = 0.000 and P = 0.026, respectively). However, mean changes in RD were not statistically significant between groups (P > 0.05). KT increased following both treatments. Initial and final examinations of KT were statistically significant within groups (P = 0.000). The results of KT obtained in the (CAF) + (e-MCTG) group after 6 months of surgery were superior in a statistically significant manner in relation to

![Figure 2](https://example.com/fig2.jpg)  
**Figure 2** Expanded mesh connective tissue graft (e-MCTG). (A) Preoperative view of recessions. (B) The connective tissue graft was harvested from palatal mucosa. (C) The expanded mesh connective tissue graft. (D) e-MCTG was placed to cover the exposed roots and stabilized by sutures. (E) A full-thickness flap was replaced and sutured. (F) Six months after surgery.
the data recorded in the (CAF) + (PRF-M) group (P = 0.040). Regarding the initial and final examinations of CAL, statistically significant differences were observed within groups (P = 0.000) (Table 4).

In teeth with RD < 4 mm [n = 16 in the PRF-M group, n = 30 in the (CAF) + (e-MCTG) group], the mean defect coverage was 59.2% and 93.5% following (CAF) + (PRF-M) and (CAF) + (e-MCTG) treatment, respectively. There was a statistically significant difference between the groups (P = 0.012). A significant reduction in GR length was noticed at the end of the study for both groups (P < 0.05). KT increased following both treatments. Results of initial and final examinations of KT and CAL were statistically significant within groups (P = 0.000). Statistically significant differences were observed between groups in the initial and final examinations of CAL parameter (P = 0.022 and P = 0.002, respectively) (Table 5).

In teeth with RD ≥ 4 mm [n = 38 in the (CAF) + (PRF-M) group, n = 22 in the e-MCTG group], the mean coverage was 75% and 100% following (CAF) + (PRF-M) and (CAF) + (e-MCTG) treatment, respectively. A statistically significant difference was noticed between the groups (P = 0.030). Both groups showed statistically significant results in KT and CAL at 6 months after surgery, compared to the baseline value (P = 0.000). The (CAF) + (e-MCTG) group showed statistically better results than the (CAF) + (PRF-M) group for CAL parameter at baseline (P = 0.035) (Table 5).

**Discussion**

Several surgical techniques have been described to achieve a predictable RC of exposed root surfaces. The CTG procedure is the "gold standard" as far as predictability and esthetic results are concerned. It was demonstrated that e-MCTG is also an effective and predictable treatment modality for the management of MARD in terms of RC, increase in keratinized tissue, and gain in CAL.

PRF is a second-generation platelet concentrate, because it has several advantages over PRP. Using PRF requires a simpler technique and requires less chair-side time than PRP; it does not require the addition of bovine thrombin-like PRP. Second, the preparation process conceives a gel-like matrix that contains a high concentration of platelets enmeshed in a fibrin matrix, which releases a high concentration of growth factors over a long time. Third, it can be squeezed to form a membrane and can be used as fibrin bandage acting as a matrix to promote the healing of wound edges. PRF is considered a healing biomaterial and is used to enhance bone regeneration and soft tissue healing in implant and periodontal plastic surgery procedures.

It was demonstrated that the platelets in PRF released a high concentration of growth factors over a long time. Furthermore, PRF induced a significant and continuous stimulation and proliferation of all these cell types. Furthermore, PRF induced a strong differentiation in the osteoblasts.

Thus, the aim of this split-mouth randomized clinical study was to evaluate the results of (CAF) + (PRF-M) for the treatment of MARD, and also to compare these results with those obtained with e-MCTG (CAF) + (e-MCTG).

At baseline, none of the measured clinical variables showed any statistical difference between the test and control groups, thus ensuring the same starting point for both procedures tested.

There were also no statistically significant differences between the recession-type defects in the two groups at baseline. Although the silk sutures remained in place for 14 days, as expected there was no plaque accumulation over the sutures because the patients were advised to use chlorhexidine solution two times a day. In the present study, there were no statistically significant differences between the (CAF) + (e-MCTG) and (CAF) + (PRF-M) groups in terms of gingival recession, gain in CAL at 6 months. This similar amount of recession reduction indicates that both surgical techniques are highly effective in achieving RC.

At 6 months, the amount of recession reduction obtained with PRF-M was similar to that obtained with (CAF) + (e-MCTG). The mean percentage of RC was 95% in the test group and 96.1% in the control group. This result was clinically relevant and statistically significant. Furthermore, complete RC was achieved in the majority of treated cases:
Table 3  Measurements of RD, KT and CAL in maxilla at baseline and 6 months for (CAF) + (PRF-M) and (CAF) + (e-MCTG) treated sites.

<table>
<thead>
<tr>
<th></th>
<th>Maxilla</th>
<th></th>
<th>Maxilla</th>
<th></th>
<th>Maxilla</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RD</td>
<td>KT</td>
<td>CAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Initial examination (mean ± SD) (mm)</td>
<td>Final examination (mean ± SD) (mm)</td>
<td>Mean changes in RD (in mm) at baseline and at 6 mo</td>
<td>Initial examination (mean ± SD) (mm)</td>
<td>Final examination (mean ± SD) (mm)</td>
</tr>
<tr>
<td>(CAF) + (PRF-M)</td>
<td>n = 21</td>
<td>4.04 ± 1.22</td>
<td>0.2 ± 0.44</td>
<td>3.84 ± 1.65</td>
<td>4.2 ± 0.83</td>
</tr>
<tr>
<td>(CAF) + (e-MCTG)</td>
<td>n = 20</td>
<td>2.76 ± 1.36</td>
<td>0.1 ± 0.17</td>
<td>2.66 ± 1.35</td>
<td>4.26 ± 0.66</td>
</tr>
<tr>
<td>P</td>
<td>0.221</td>
<td>0.730</td>
<td>0.342</td>
<td>0.911</td>
<td>0.534</td>
</tr>
</tbody>
</table>

*Statistically significantly different between groups (P < 0.05).
**Statistically significantly different within groups (P < 0.05).

(CAF) + (PRF-M) = treatment with coronally advanced flap and platelet-rich fibrin membrane; (CAF) + (e-MCTG) = treatment with coronally advanced flap and expanded mesh connective tissue graft; RD = recession depth; KT = keratinized tissue; CAL = clinical attachment level.

Table 4  Measurements of RD, KT and CAL in mandibula at baseline and 6 months for (CAF) + (PRF-M) and (CAF) + (e-MCTG) treated sites.

<table>
<thead>
<tr>
<th></th>
<th>Mandibula</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RD</td>
<td>KT</td>
</tr>
<tr>
<td></td>
<td>Initial examination (mean ± SD) (mm)</td>
<td>Final examination (mean ± SD) (mm)</td>
</tr>
<tr>
<td>(CAF) + (PRF-M)</td>
<td>n = 33</td>
<td>5.09 ± 1.11</td>
</tr>
<tr>
<td>(CAF) + (e-MCTG)</td>
<td>n = 32</td>
<td>3.21 ± 0.87</td>
</tr>
<tr>
<td>P</td>
<td>&lt;0.001*</td>
<td>0.026*</td>
</tr>
</tbody>
</table>

*Statistically significantly different between groups (P < 0.05).
**Statistically significantly different within groups (P < 0.05).

(CAF) + (PRF-M) = treatment with coronally advanced flap and platelet-rich fibrin membrane; (CAF) + (e-MCTG) = treatment with coronally advanced flap and expanded mesh connective tissue graft; RD = recession depth; KT = keratinized tissue; CAL = clinical attachment level.
Table 5: Measurements of defect coverage (mm and %), KT and CAL in RD greater than 4 mm and RD between 2.5 and 3.54 mm. The table shows the mean and SD of the measurements at baseline and 6 months after surgery.

<table>
<thead>
<tr>
<th>RD &gt; 4</th>
<th>Recession defect coverage (%)</th>
<th>KT (mean ± SD) (mm)</th>
<th>CAL (mean ± SD) (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial examination</td>
<td>Final examination</td>
<td>Initial examination</td>
</tr>
<tr>
<td>(CAF) + (PRF-M)</td>
<td>4.5 ± 1.3</td>
<td>5.7 ± 1.3</td>
<td>3.0 ± 1.4</td>
</tr>
<tr>
<td>(CAF) + (e-MCTG)</td>
<td>5.27 ± 1.3</td>
<td>6.42 ± 0.66</td>
<td>3.65 ± 0.4</td>
</tr>
<tr>
<td>P</td>
<td>0.722</td>
<td>0.012†</td>
<td>0.126</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RD &lt; 4</th>
<th>Recession defect coverage (%)</th>
<th>KT (mean ± SD) (mm)</th>
<th>CAL (mean ± SD) (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Initial examination</td>
<td>Final examination</td>
<td>Initial examination</td>
</tr>
<tr>
<td>(CAF) + (PRF-M)</td>
<td>4.5 ± 1.3</td>
<td>5.7 ± 1.3</td>
<td>3.0 ± 1.4</td>
</tr>
<tr>
<td>(CAF) + (e-MCTG)</td>
<td>5.27 ± 1.3</td>
<td>6.42 ± 0.66</td>
<td>3.65 ± 0.4</td>
</tr>
<tr>
<td>P</td>
<td>0.722</td>
<td>0.012†</td>
<td>0.126</td>
</tr>
</tbody>
</table>

*Statistically significantly different between groups (P < 0.05).
**Statistically significantly different within groups (P < 0.05).

In the present study, a significant increase in KT was detected in both groups at 6 months after surgery (from 2.92 ± 0.36 to 0.96 ± 0.62 for the test group and from 3.07 ± 0.65 to 0.11 ± 0.27 for the control group). Moreover, similar amounts of decrease in the width of GR were found for teeth with RD > 4 mm and teeth with RD ≥ 4 mm at the end of the study.

Both procedures resulted in a significant CAL gain at 6 months (from 6.27 ± 1.27 to 2.48 ± 1.41 and from 4.40 ± 0.86 to 1.18 ± 0.35 for the test and control groups, respectively). There were no significant differences in CAL between the two groups at baseline and 6 months after surgery.

Studies showed that the increase in the thickness of gingival tissue is a desired effect in decreasing the possibility of recurrence of GR. In our study, a significant increase in KT was detected in both groups at 6 months after surgery. This increase is statistically significant within groups for both maxillary and mandibular sites.

In our study, we observed statistically significant improvements in all clinical parameters evaluated in this research from baseline to the 6th month of examination with the exception of PD. This was an expected result, because the patient selection criteria excluded the sites with PD > 2 mm, and the patients have good plaque control (full-mouth PI < 20%).

The present study design did not allow a direct comparison between maxillary and mandibular teeth with multiple recession defects. To our knowledge, the initial thicknesses of the flap and the type of dissection have a greater or lesser effect on connective tissue microcirculation. Furthermore, the gingiva on maxilla and mandible has different thickness values. The interposition of PRF may restrict the collateral circulation, which is essential for a thin flap to revascularize and heal. This variation may be attributable to the differences in RC between jaws. By contrast, muscle pull during healing often leads to incomplete RC at relapse of the recession. Different percentage rates of gingival recession coverage may be observed in maxilla and mandibula because of the differences in the muscle pull between the two jaws.

Consideration of optimizing both blood supply and esthetics dictated a vertically placed vestibular incision. In the maxillary esthetic zone, this may be lead to changes in the healing period between the jaws. In our study, a vertically placed vestibular incision was not used. According to our results, the mean changes in RD were 3.84 ± 1.65 and 3.54 ± 2.09 for recession defects on maxillary and mandibular teeth, treated with (CAF) + (e-MCTG), respectively. The recession coverage amounts were 2.66 ± 1.35 and 3.10 ± 0.97 for maxillary and mandibular teeth, treated...
with (CAF) + (e-MCTG), respectively. No statistically significant differences were observed between coverage rate of maxillary and mandibular recession defects treated with both (CAF) + (PRF-M) and (CAF) + (e-MCTG).

To our knowledge, this is the first study to compare the effects of (CAF) + (PRF-M) and (CAF) + (e-MCTG) to treat MARD. Therefore, a direct comparison with other studies is not possible. Aroca et al. evaluated the combination of CAF and PRF-M for the treatment of adjacent multiple gingival recessions and failed to find any additional benefits of PRF-M combined with CAF in terms of the clinical parameters used in this study. This can be attributed to the dehydration of the membrane and the inadequate volume of the membrane. Quick handling is the only way to obtain a clinically usable PRF clot.

In the present study, shallow PD and improved CAL values were observed at the 6th month of evaluation, in agreement with other studies. Those results are associated with the attachment of the graft to the root surface through a combination of epithelial down growth and connective tissue attachment.

In conclusion, the results of this study indicated that both e-MCTG and PRF-M are effective and predictable treatment modalities for the management of multiple recessions-type defects in terms of RC, increase in keratinized tissue, and gain in CAL. Furthermore, PRF-M can be used successfully in the treatment of multiple recessions. More expanded studies with larger numbers of patients and longer evaluation periods are needed to confirm these results.

Conflicts of interest

The authors have no conflicts of interest relevant to this article.

Acknowledgments

This research was funded by Gazi University Research Grant (03/10-12).

References


