Treatment of Multiple Mandibular Gingival Recession Defects Using MCAT Technique and SCTG With and Without rhPDGF-BB: A Randomized Controlled Clinical Trial

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The aim of this randomized controlled trial was to compare the clinical outcomes of modified coronally advanced tunnel technique (MCAT) with subepithelial connective tissue graft (SCTG) with and without recombinant human platelet-derived growth factor-BB (rhPDGF-BB) for mandibular multiple recessions. Twenty-four Miller Class I and III recessions were randomly assigned to a group: test (MCAT+SCTG+rhPDGF-BB) or control (MCAT+SCTG). After 6 months, mean recession-depth reduction was higher in the test group (2.08 ± 0.90 mm) than the control (1.83 ± 0.93 mm). Mean root coverage was achieved, favoring the test group (82.6% ± 23.69%) instead of the control (56.2% ± 28.55%). Complete root coverage for the test group was 58.3%, which was significantly superior to control (16.7%). The use of rhPDGF-BB+SCTG using MCAT offered an advantage of a minimally invasive, predictable method for achieving optimal outcomes.


Apical displacement of the soft tissue margin, beyond the cemento-enamel junction, that affects either isolated/multiple root surfaces is defined as gingival recession.¹ The migration of the marginal tissue to an apical position may lead to esthetic concerns, dentin hypersensitivity, root caries, and cervical wear.²

Compared to an isolated recession, root coverage of multiple recessions is daunting due to a large and anatomically variable surgical field.³ Mandibular gingival recession defects present additional significant therapeutic challenges, such as shallow vestibule, abnormal frenal attachments, thin gingiva resulting in a thin coronally positioned flap, lack of keratinized gingiva, and thin (often dehisced) labial bone.⁴ These conditions preclude a difficulty in achieving satisfactory flap reflection and passive coronal positioning as compared to maxillary recessions. A recent systematic review referred tooth location in the mandibular region as a critical factor in determining the success of root coverage procedures.⁵

Even with a proven efficacy, coronally advanced flap (CAF) with connective tissue graft (CTG) has certain shortcomings. The need for a vertical-releasing incision hampers the blood supply to grafted tissue. Another limitation is the limited regenerative ability of the CAF+CTG
when used to treat recession defects, as it either heals through repair with a long junctional epithelium or through firm connective tissue adhesion with the root areas. The objective of regenerating and integrating the lost apparatus is not realized.

Surgical options that do not sacrifice the continuity of the interdental papilla, such as tunnel technique, are preferred on account of their improved esthetic outcomes, undisturbed blood supply and graft nutrition, and limited flap opening, resulting in quicker healing and reduced postoperative morbidity.

Biologic modifiers have emerged as an advantage in periodontal regenerative surgery to facilitate regeneration and thus predictable clinical outcomes. Technological advancements in recombinant growth factor technology create environments that are amenable to true regeneration in gingival recession management. The predictability of mandibular recession treatment outcomes may be greater with the improved recombinant growth factor technology.

Recombinant human platelet-derived growth factor-BB (rhPDGF-BB) may orchestrate regenerative outcomes in recession defects due to its critical role in promoting neovascularization and efficacious mitogenicity and chemotaxis of the periodontal ligament cells. PDGF stimulates both the proliferation and recruitment of alveolar bone and periodontal ligament cells. Maxillary recession defects treated with rhPDGF-BB and CTG+CAF demonstrated faster wound healing when compared to CTG+CAF alone. rhPDGF-BB with beta tricalcium phosphate (β-TCP) + collagen membrane in the treatment of mandibular recession defects has shown favorable tissue responses. PDGF promotes regeneration of cementum, insertion of connective tissue fibers, osteogenesis, and has positive effects on chemotaxis and the proliferation of the periodontal ligament. However, there is limited literature that evaluated combining CTG with rhPDGF-BB for the treatment of multiple mandibular recession defects. Hence, the objective of this clinical trial was to evaluate the added advantage, if any of rhPDGF-BB with MCAT in combination with subepithelial CTG (SCTG) in the root coverage of multiple mandibular recessions.

Materials and Methods

Study Design

Patients aged between 21 and 58 years old who presented at least two or more teeth with Miller Class I, Class III, or combined Class I and III recession defects in the anterior mandible were included in the study if they had intact periodontium, an absence of uncontrolled medical conditions, and a full-mouth plaque score ≤ 10%. Exclusion criteria were: history of tobacco smoking; current pregnancy or lactation; uncontrolled medical/periodontal conditions; pharmacotherapy within the past 3 months; use of drugs producing gingival enlargements; drug and alcohol abuse; and known hypersensitivity to rhPDGF-BB. All patients were informed about the nature of the study, the surgical procedure involved, and the potential benefits and risks associated with the surgical procedure. Written informed consent was obtained from all patients.

Twenty-four Miller Class I and III recessions were included in this study. All patients underwent a modified coronally advanced tunnel (MCAT) procedure and received SCTG. Control groups received no further treatment, whereas test groups also received rhPDGF-BB. Reccessions were randomly assigned to the test (MCAT+SCTG+rhPDGF-BB) or control (MCAT+SCTG) group.

Sample Size

Expecting a difference of 2.6 mm and a standard deviation of 0.5 mm (reduction in recession depth) between the test and control groups (as previously observed by Rubins et al) and an assumed 95% confidence interval and 95% power, the sample size was determined to be 12 recession sites per treatment. Calculations were obtained using PASS software version 15 (NASS).

Trial Registration

The trial is in accordance with the Consolidated Standards of Reporting Trials (CONSORT) criteria, revised in 2010 (Fig 1). The study procedure was reviewed and approved by the institutional ethical committee and review board (REF:KCDS/984/2016-2017) of Krishnadevaraya College of Dental Sciences and Hospital in Bengaluru.
India, affiliated to Rajiv Gandhi University of Health Sciences. The ClinicalTrials.gov identifier is NCT03676088.

Randomization

A computer-generated randomization sequence was obtained by the assistant (S.P.). Recessions (n = 24) were randomly assigned to the test or control group. Allocation concealment was done with the help of sealed, opaque envelopes coded with the treatment allocation of the specific subject (ie, test or control) and was opened immediately during the surgery, prior to the placement of SCTG on the recipient site to prevent surgeon bias.

Clinical Evaluation

The primary clinical outcomes assessed at baseline, 6 weeks, 3 months, and 6 months were: difference in gingival recession depth (GRD), mean root coverage (MRC), complete root coverage (CRC), width of keratinized tissue (KTW; the distance from the mucogingival junction to the gingival margin), and root coverage esthetic score\textsuperscript{14} (RES).

Pocket probing depth (PPD; distance from the gingival margin to the base of gingival sulcus) and clinical attachment level (CAL; gingival recession depth + probing depth) were assessed as secondary outcomes. The above-mentioned clinical parameters were recorded using a periodontal probe (Hu-Friedy) and measuring occlusal stents.

Surgical Procedure

At the beginning of the surgery, composite stops were placed interdentally to avoid the collapse of the final suspended sutures. Following the administration of local anesthesia (2% lignocaine hydrochloride; Lignox 2%, Indoco Remedies), root surfaces in the region between the bottom of the sulcus and cementoenamel junction were scaled and planed, the roots received no further biomodification.

The surgical technique (MCAT) as described by Azzi et al\textsuperscript{15} and modified by Zuur et al\textsuperscript{16} was followed (Fig 2). Intrasulcular incisions were made around the necks of the affected and adjacent teeth using microsurgical blades (MB69, Hu-Friedy). The reflection was extended into the mucosal tissues, and pouch preparations were interconnected through the sulcular incisions using an intrasulcular knife (KPA, Hu-Friedy). The buccal aspect of the flap was raised as a partial-thickness flap. At this stage, all buccal tissues were undermined and connected; interdental papillae were not detached. Attached papillae would resist the coronal displacement of the flap, and thus a full-thickness flap in the papillary region was elevated (PPAELA, Hu-Friedy).\textsuperscript{16}

To obtain the subepithelial SCTG, a second surgical site was prepared using the single-incision technique as described by Hürzeler and Weng.\textsuperscript{17} For the control group, after SCTG removal, the graft was placed on saline-soaked gauze and kept wet until its transfer to the

Fig 1  CONSORT 2010 flowchart.

A total of 24 sites were eligible for inclusion and randomized into the test or control group

- Allocated to the test group (MCAT+CTG+rhPDGF-BB) (n = 12 sites)
- All patients completed 6-month follow-up (n = 12 sites)
- Total of 12 test sites analyzed

- Allocated to the control group (MCAT+CTG) (n = 12 sites)
- All patients completed 6-month follow-up (n = 12 sites)
- Total of 12 control sites analyzed
recipient bed. For the test group, the harvested SCTG was hydrated with 0.5 mL of rhPDGF-BB gel for a minimum of 15 minutes. A support suture (4-0 Vicryl, Ethicon) was performed to guide the SCTG into the recipient site. After sutures entered the tunneled interdental area, the needle passed through the SCTG before being redirected through the undermined tissues. The graft was guided into the pouch with an instrument and by tugging the support suture. The entire gingival papillary complex was moved coronally using a vertical mattress suture anchored in the lingual gingiva with nonresorbable sutures (3-0 Mersilk, Ethicon). The anchorage in the lingual gingiva was placed very apically to establish coronal movement of the gingiva papillary unit. The suture captured the buccal flap and graft to avail optimal stabilization.

Surgical sites were protected with a non-eugenol periodontal dressing (Coe-Pack, GC America).

**Postsurgical Care**

Postoperative instructions consisted of 0.2% chlorhexidine gluconate mouth rinse twice a day for at least 2 weeks. Postoperative pain and edema was controlled with a non-
Steroidal anti-inflammatory drug (Flexon, Aristo Pharma) and an antibiotic (500 mg; Almox, Alkem Laboratories). If the patient was allergic to penicillin, clindamycin (300 mg, four times daily for 7 days) after meals was prescribed. Patients were recalled after a period of 14 days for suture removal. The patient’s mechanical plaque control was reinforced with the use of roll technique and use of a soft toothbrush. Patients were recalled every 12 weeks for reinforcement of oral hygiene instructions, and light debridement with ultrasonic scalers supragingivally was carried out.

Statistical Analyses

Repeated measures one-way analysis of variance was used to test differences between time points for the intragroup assessment. Intergroup analyses of GRD, MRC, KTW, RES, PPD, and CAL were compared using Student t test. A P value less than .05 was determined to indicate statistical significance. SPSS version 10.5 (IBM) was used for data analysis. Logistic regression analysis was used to evaluate the influence of some patient- and site-related factors on the achievement of sites with CRC at 6 months posttreatment. The binary dependent variable was CRC (yes, coded 1; no, coded 0), and the independent variables were age (continuous data), baseline GRD (> 3 mm, coded 1; ≤ 3 mm, coded 0) and baseline PPD (< 1 mm, coded 1; ≥ 1 mm, coded 0). For CRC, proportions were compared using chi-square test of significance.

Results

All patients included in the clinical trial completed the study. No patient reported any postoperative complications or adverse effects, such as severe oedema, pain, or sensitivity. Healing was noted to be uneventful in all cases (Fig 3). Results of subgroup analyses are shown in Table 1.

MRC and CRC

The mean recession depth in the control group decreased significantly from 3.25 ± 1.055 mm at baseline to 1.42 ± 0.90 mm at 6 months, corresponding to an MRC of 56.2% ± 28.55% (GRD reduction of 1.83 ± 0.93 mm). In the test group, GRD reduced from 2.58 ± 0.9 mm at baseline to 0.50 ± 0.674 mm at 6 months (reduction of 2.08 ± 0.90 mm), corresponding to an MRC of 82.6% ± 23.69%. Statistically significant reductions were noted within the
Two out of 12 control sites achieved CRC at the 6-month follow-up (17%) compared to 7 of 12 sites in the test group (58%) (chi-square = 4.444; \( P = .035 \)) (Table 2).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>OR</th>
<th>SE</th>
<th>Z</th>
<th>P</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.912</td>
<td>0.187</td>
<td>0.241</td>
<td>.623</td>
<td>0.632, 1.316</td>
</tr>
<tr>
<td>Baseline GRD</td>
<td>0.243</td>
<td>1.014</td>
<td>1.952</td>
<td>.162</td>
<td>0.033, 1.769</td>
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<tr>
<td>Baseline PPD</td>
<td>3.372</td>
<td>1.076</td>
<td>2.777</td>
<td>.006</td>
<td>0.409, 27.782</td>
</tr>
<tr>
<td>Constant</td>
<td>20.125</td>
<td>6.835</td>
<td>0.193</td>
<td>.661</td>
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</tr>
</tbody>
</table>

CRC = complete root coverage; OR = odds ratio; SE = standard error; CI = confidence interval; GRD = gingival recession depth; PPD = pocket probing depth. Logistic regression analysis was used. For Z scores, Wald test was used to measure the ratio between the coefficient and its standard error.

Logistic Regression Analysis

The achievement of CRC was not significantly associated with the following baseline conditions: (1) age (odds ratio [OR]: 0.912, \( P = .623 \)); (2) recession depth \( \geq 3 \) mm (OR: 0.243, \( P = .162 \)); or (3) PPD (OR: 3.372, \( P = .259 \)) (Table 3).

| Width of Keratinized Tissue | Mean KTW in the control group changed from 3.25 ± 1.13 mm at baseline to 3.83 ± 1.19 mm at 6 months. In the test group, mean KTW increased from 3.58 ± 1.24 mm at baseline to 4.33 ± 0.98 mm at 6 months. Mean KTW gains of 0.58 and 0.75 mm were noted for the control and test groups, respectively. The \( P \) values obtained for different intervals were not statistically significant.

Esthetic outcomes assessed objectively at the 6-month follow-up for the control group were 7.58 ± 1.505 and for the test group were 8.75 ± 1.545. The \( P \) value for both the groups at the 6-month follow-up was .074, which was statistically insignificant.

PD and CAL

PPD was not statistically different between the two study groups. The CAL in the control group was 4.67 ± 1.073 mm at baseline and 2.42 ± 1.240 mm at 6 months. In the test group, CAL at baseline was 3.83 ± 0.937 mm and at 6 months was 1.5 ± 0.674 mm. The changes from baseline to 6 months were statistically significant in both groups at different time intervals, although they were statistically insignificant between the groups.

Table 2 Clinical Parameters at Baseline and 6 Months

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test</th>
<th>Control</th>
</tr>
</thead>
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<tr>
<td></td>
<td>Mean, mm</td>
<td>SD</td>
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<tr>
<td>GRD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>2.58</td>
<td>0.900</td>
</tr>
<tr>
<td>6 months</td>
<td>0.50</td>
<td>0.674</td>
</tr>
<tr>
<td>P</td>
<td>&lt; .001*</td>
<td>&lt; .001*</td>
</tr>
<tr>
<td>KTW</td>
<td></td>
<td></td>
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<tr>
<td>Baseline</td>
<td>3.58</td>
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<tr>
<td>P</td>
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<td>.560</td>
</tr>
<tr>
<td>PPD</td>
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<td>6 months</td>
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<tr>
<td>P</td>
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<td>.098</td>
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<tr>
<td>CAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>3.83</td>
<td>0.937</td>
</tr>
<tr>
<td>6 months</td>
<td>1.50</td>
<td>0.674</td>
</tr>
<tr>
<td>P</td>
<td>&lt; .001*</td>
<td>&lt; .001*</td>
</tr>
<tr>
<td>RES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 months</td>
<td>8.75</td>
<td>1.545</td>
</tr>
</tbody>
</table>
| SD = standard deviation; GRD = gingival recession depth; KTW = width of keratinized tissue; PPD = pocket probing depth; CAL = clinical attachment level; RES = root coverage esthetic score. Intragroup comparisons performed with one-way analysis of variance. Intergroup comparisons performed with Student t test. *Statistically significant.
Discussion

Biomaterials with the addition of recombinant growth factor technology (rhPDGF-BB) may enhance the regenerative outcome achieved with CTG. Both tested approaches achieved a statistically significant recession reduction (Table 2). Inter-group differences were not significant; however, the group receiving rhPDGF-BB showed greater recession depth reduction. Bozkurt Doğan et al\textsuperscript{10} observed an MRC of 79.6% with CAF and 2.47 ± 0.54 mm for CAF with concentrated growth factor; Lafzi et al\textsuperscript{16} showed 2.7 mm for the SCTG + platelet-rich fibrin group and 2.4 mm for the SCTG group. Rubins et al\textsuperscript{10} (2014) noted a reduction of 2.29 ± 0.56 mm for CAF and 2.47 ± 0.54 mm for CAF with concentrated growth factor; Lazi et al\textsuperscript{16} showed 2.7 mm for the SCTG + platelet-rich fibrin group and 2.4 mm for the SCTG group. Rubins et al\textsuperscript{10} (2014) noted a recession reduction of 2.6 ± 1.4 mm for the CAF+SCTG+rhPDGF-BB protocol. Deshpande et al\textsuperscript{20} showed a recession reduction of 2.0 ± 0.6 mm in the PDGF+β-TCP group and 2.6 ± 0.9 mm in the SCTG group. None of the above-mentioned randomized controlled clinical trials showed any intergroup difference. The adjunctive use of growth factors was not beneficial, and the results of the current study reiterate those findings. The recession reduction in the current trial is relatively smaller than most of the above-mentioned outcomes with the exception of Aroca et al\textsuperscript{21} who reported a recession reduction of 1.3 ± 0.1 mm for MCAT+SCTG. This could be due to the fact that most of the above-mentioned trials were conducted in the maxillary anterior area with CAF procedures. However, the current trial is similar to that of Aroca et al\textsuperscript{21} wherein MCAT with CTG was performed.

Satisfactory MRC values (56.2% ± 28.55% for MCAT+SCTG and 82.6% ± 23.69% for MCAT+SCTG+rhPDGF-BB) were achieved in the current trial. A statistically significant difference was seen at the 6-month follow-up. The hypothesis that an enhanced outcome is due to the adjunctive use of rhPDGF-BB can be confirmed. Deshpande et al\textsuperscript{20} reported an MRC of 87.7% for the rhPDGF-BB group and 91.3% for the SCTG group. In the current trial, however, a lower outcome was noted with MCAT+SCTG (56.2%), but a similar outcome was noted in the rhPDGF-BB group (82.6%). The difference in the control group’s outcome can be attributed to the different surgical approach (MCAT vs CAF). Rubins et al\textsuperscript{10} observed an MRC of 79.6% with rhPDGF-BB, which is similar to the current trial. MRC achieved in the control group was not comparable to the above studies. It should be noted that the current trial was conducted in mandibular recession sites, with sites (75% control and 83.3% test) showing Class III recessions; in the above studies, Class I and II maxillary recessions were reported.

Total root coverage is the desired outcome in the treatment of gingival recessions. Results from the present trial showed that CRC was achieved in 58.3% and 16.7% of the patients treated with MCAT+SCTG+rhPDGF-BB and MCAT+SCTG, respectively. The outcomes were statistically significantly different. The use of rhPDGF-BB has shown beneficial clinical outcomes compared to MCAT+SCTG alone. However, a strategic inference cannot be made until the stability of the results is evaluated over a long-term follow-up period of at least 3 to 4 years. A similar CRC outcome (56.7% of cases) was obtained by Bozkurt Doğan et al\textsuperscript{18} for CAF+CGF. Chaparro et al\textsuperscript{22} reported CRC achievements of 52.5% in the mandible and 67.9% in the maxilla for tunnel technique + acellular dermal matrix. For MCAT+CTG treatments, Aroca et al\textsuperscript{23} reported CRC in 22% of cases. This outcome is similar to the current trial for the control group (16.7%). da Silva et al\textsuperscript{24} also noted CRC of 18% when CAF+SCTG was used.

In a systematic review and meta-analysis, Tavelli et al\textsuperscript{27} evaluated the efficacy of tunneling technique in the treatment of localized and multiple gingival recessions. The MRC and CRC of tunneling for mandibular multiple recession type defects was 85.9% and 61.4%. The results of the present study in terms of MRC (82.6%) and CRC (58.3%) are in agreement with Tavelli et al’s findings.

The current study was similar to those of Aroca et al\textsuperscript{23}, Aroca et al\textsuperscript{23}, and Cieslak-Wegemund et al\textsuperscript{28} (2016), which did not demonstrate any difference in the KTW gain. The present KTW gain of 0.58 ± 1.08 mm and 0.75 ± 0.62 mm for MCAT+SCTG and MCAT+SCTG+rhPDGF-BB, respectively, was similar to that of Aroca et al\textsuperscript{23} (0.3 mm for MCAT + collagen matrix [CM]; 0.7 mm for MCAT + CTG) and Cieslak-Wegemund et al\textsuperscript{28} (0.8 mm for CM; 0.1 mm for CTG). McGuire et al\textsuperscript{29} observed a KTW gain of 1 mm when rhPDGF-BB was used with CM.

The widely used RES proposed by Cairo et al\textsuperscript{14} to evaluate the esthetic outcome following root
coverage surgeries has been used. This score system evaluates five clinical variables (gingival margin, marginal tissue contour, soft-tissue texture, mucogingival junction alignment, and gingival color) at 6 months following periodontal plastic surgery (pedicle flaps, soft-tissue grafts, or combinations). Each variable received a numerical score, and the aggregate score for maximal esthetics was 10; zero points were assigned if there was a partial or total loss of interproximal papilla (black triangle) and/or if the final position of the gingival margin was at, or apical to, the previous recession depth (failure of root-coverage procedure), irrespective of color, the presence of a scar, marginal tissue contour, or mucogingival alignment. RES scores of 8.75 and 7.58 were noted in the test and control groups. The results corroborate with an RES of 7 that was reported by Pini-Prato et al.27 when CAF with CTG was employed for treatment of multiple maxillary and mandibular recessions.

The overall PPD reduction results were similar, with a 0.27-mm PPD reduction achieved by Thalmai et al.28 for treatment of mandibular recession with MCAT and SCTG. Similar results were obtained by Rubins et al.10 where a PPD reduction of 0.4 mm was noted with the use of SCTG with rhPDGF-BB. CAL gains seen in the present study (2.33 mm and 2.25 mm for test and control groups, respectively) correlate with gains reported by Stimmelmayr et al.29 (2.7 mm) and Rubins et al.10 (2.4 mm) using rhPDGF-BB with SCTG.

Effective results have been reported using MCAT in Class III recessions.22 The outcomes of the current trial further corroborate the above results. In the present study, Class III recessions were present in 75% of the control sites and 83.3% of the test sites (Class I recessions were seen in 25% and 16.7% of test and control sites, respectively). The satisfactory outcomes may be related to: (1) elevation of the tunnel apical to the mucogingival line; (2) dual blood supply to the SCTG enhancing revascularization21 and suspended mattress sutures enabling coronal advancement of the gingival margin and papilla; and (3) full-thickness dissection and elevation of the papilla. An absence of vertical incisions also seems to contribute to better esthetics, better graft survival, and less postoperative discomfort. A microsurgical approach as described by Zuhr et al.16 with the use of a microsurgical blade for incision placement and microsurgical instruments for tunnel preparation, was used to prevent perforating the flap and to minimize trauma.

In the current study, the results in the test group (MCAT+SCTG+rhPDGF-BB) were better than those in the control group (MCAT+SCTG). To the best of the present authors’ knowledge, this study is the first randomized controlled clinical trial that evaluates the added advantage of rhPDGF-BB over MCAT+SCTG. Previous studies10,12,13 evaluated the efficacy of rhPDGF-BB with CTG but lacked a control group. McGuire et al.26 histologically and microcomputed tomographically reported regeneration in sites treated with rhPDGF-BB+TCP whereas neither CTG group showed any evidence of periodontal regeneration for recession defects. Nevins et al.30 histologically showed regeneration of a complete, new attachment apparatus with rhPDGF-BB in furcation defects. The enhanced clinical outcomes noted in the test group may be attributed to the regenerative potential of rhPDGF-BB.

Histologic evidence of periodontal healing was not obtained considering ethical binding, hence the lack of proof on periodontal regeneration. A limitation of this trial is the short-term evaluation of the treatment results. Histologic studies in long-standing recession defects would add to the body of knowledge.

Conclusions

Within the limitations of the present randomized prospective study, the clinical trial showed that the use of rhPDGF-BB with SCTG using MCAT offered an advantage of a minimally invasive, predictable method for achieving optimal outcomes and improved the probability of achieving complete root coverage in Class I and III multiple mandibular recession defects. Long-term (5 years) histologic, randomized controlled clinical trials comparing root coverage of MCAT+SCTG with and without rhPDGF-BB in multiple mandibular recession defects are required to better demonstrate these positive outcomes.

Acknowledgments

The authors declare no conflicts of interest related to this study.
References