Root Coverage by Modified Coronally Advanced Flap with and Without Platelet-Rich Fibrin: A Clinical Study

Abstract

Background: Marginal gingival recession can cause major functional and esthetic problems. Advanced flaps are the simplest, yet unpredictable procedures for managing these conditions. The predictability of root coverage can be increased by combining coronally advanced flap (CAF) or its modified approach with other regenerative techniques. Objective: To ascertain the potential benefits of platelet-rich fibrin (PRF) on modified CAF for the treatment of gingival recession. Materials and Methods: Study comprised of 12 patients with Miller’s class I and class II gingival recessions in two non-adjacent anterior teeth having a minimum 3 mm width of attached gingiva. Following split-mouth design, one tooth with gingival recession was subjected to modified CAF, while another was treated by CAF with PRF. The clinical parameters, i.e., plaque index, modified sulcular bleeding index, vertical gingival recession depth (VGRD), gingival recession width (GRW), clinical attachment level (CAL), and gingival thickness (GT) were recorded at baseline, 1 month, 3 months, and 6 months. Results: VGRD, GRW, CAL, and GT improved significantly from baseline to 1 month in both test and control groups. However, change in these parameters from 1 month to 3 months and 3 months to 6 months were statistically nonsignificant in both groups. On intergroup comparison, only the change in GT was found to be statistically significant (P < 0.05) at all three post-treatment visits. Conclusion: Benefits of the combined technique in terms of increased GT appear to justify the use of PRF along with modified CAF for the treatment of mild to moderate gingival recessions.

Keywords: Gingival recession, pedicled flap, periodontitis, platelet-derived growth factor

Introduction

Gingival recession is as great an esthetic problem as it is a periodontal concern. It has been clinically related to a higher incidence of root caries, attachment loss, and hypersensitivity. Various root coverage procedures have been successfully performed to correct this common periodontal problem. However, achieving a predictable outcome of such procedures is still a challenge for periodontists. Pedicled flaps are probably the simplest procedures for managing gingival recession. Norberg first proposed coronally positioned flap in 1926 as an esthetic surgical procedure for root coverage. Optimum root coverage, good color blending of the treated area with adjacent tissues, and complete recovery of original soft tissue morphology can be accomplished by this procedure. Although being less predictable in terms of successful outcome, the postoperative healing in pedicled flaps is less troublesome for the patient as compared to free gingival or connective tissue grafts.

Initial designs of coronally advanced flap (CAF) have been frequently modified by several clinicians to obtain more predictable results. However, it appears that CAF alone is a less than optimal technique to achieve root coverage despite its advantage of low morbidity. The predictability can be increased by combining CAF or its modified approach with other techniques which may involve the use of connective tissue graft, enamel matrix derivative, synthetic allograft, platelet-rich plasma, and platelet-rich fibrin (PRF).

PRF is a second generation platelet concentrate. It is prepared as a single fibrin membrane, containing constituents of blood which are favorable for healing and immunity. PRF consists of a fibrin matrix polymerized in a tetra-molecular structure with incorporation of platelets, leukocytes, cytokines, and circulating stem cells.

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However, to the best of our knowledge, there is limited data on the use of PRF in combination with modified CAF for the treatment of gingival recession, and this is uncertain whether a combination of PRF and modified CAF enhances the clinical outcome compared to treatment with modified CAF alone. The aim of this study was to compare the clinical outcomes obtained with the modified CAF alone or in combination with PRF in the management of mild to moderate gingival recession.

Materials and Methods

This split-mouth, single-blinded study was approved by the institutional ethics committee of Maulana Azad Institute of Dental Sciences, New Delhi, and conducted according to the principles outlined in the declaration of Helsinki (1975), on experimentation involving humans as revised in 2000. Study comprised of 12 adult patients (age, 18–50 years) of either sex with localized chronic periodontitis who met the inclusion criteria and agreed to sign the informed consent. The patients were selected randomly from the Outpatient Department of Periodontics based on the following inclusion criteria: (1) Miller’s Class I or II gingival recession with depth ≥2 mm on at least two nonadjacent anterior teeth. (2) Selected teeth were ensured to have a minimum 3 mm width of attached gingiva (WAG), measured from the most apical extension of gingival margin to the mucogingival junction. Periapical radiographs were taken to check the levels of interproximal bone, which were then correlated with clinical findings to confirm the diagnosis of Miller’s Class I or II recession defect. Exclusion criteria included generalized chronic periodontitis and aggressive periodontitis, malaligned teeth, Miller’s class III and IV gingival recession defects, teeth with class V carious lesion or restoration, and current or former smokers. Pregnant or lactating women or those planning a pregnancy or having systemic conditions such as uncontrolled diabetes mellitus which could have modified the outcome of the treatment were also excluded.

Following the screening examination, all patients received a session of phase I periodontal therapy including oral hygiene instructions. They were trained in sulcular brushing technique. Surgical treatment was not scheduled until the patient could demonstrate an adequate standard of plaque control (full mouth plaque index [PI] <1). Following clinical measurements were recorded on the day of surgery: PI (Sillness and Loe), mSBI (Mombelli et al.), VGRD, measured from the Cementoenamel junction (CEJ) to the gingival margin at mid-facial point, GRW, measured at the CEJ, width of attached gingiva (WAG), measured from free gingival groove to mucogingival junction (MGJ), CAL, measured from the CEJ to the base of gingival sulcus, GT, measured at midfacial point, 3 mm below gingival margin using a No. 15 endodontic reamer with a silicone disc stop. The mucosal surface was pierced at a 90° angle with slight pressure until hard tissue was reached. The silicon stop on the reamer was slid until it was in close contact with the gingiva. After removal of the reamer, the distance between tip of the reamer and the inner border of silicone stop was measured to the nearest 0.1 mm with digital Vernier Calipers.

The decision for the management of gingival recession with either modified CAF on one side (Control) or with modified CAF and PRF on other side (Test) was made by flip of coin.

Examiner calibration

All clinical measurements were performed by the same investigator. The examiner was calibrated previously by assessing 30 recession defects in 10 patients, with 72 h duration between successive assessments. Calibration was accepted when 90% of measurements of recession were within range of 1 mm using the periodontal probe and within range of 0.2 mm for measurements of GT using the #15 endodontic reamer.

Surgical procedure

The area to be operated was anesthetized using 2% lignocaine with 1:200,000 adrenaline by mucosal infiltration. A sulcular incision was made at the gingival margin including mesial and distal papillae with two slightly divergent incisions at the end of the sulcular incision extending into the alveolar mucosa. The resulting trapezoidal-shaped flap was elevated in the coronal-apical direction. A coronal full-thickness flap was raised up to mucogingival junction followed by apical split thickness flap. All muscle fiber insertions present in the flap were eliminated. The root surface was planed with the Gracey curettes. Coronal mobilization of the flap was done till the marginal portion of the flap was able to passively reach a level up to the CEJ and the flap was stable in its final coronal position even without sutures. The mesial and distal interdental papillae were trimmed obliquely to avoid overlapping of flap over the interproximal area.

In test group, PRF was prepared by taking 5 ml of patient’s blood from median cubital vein in a 6 ml vacuum container, followed by centrifugation at 2700 rpm for 12 min. Out of three different layers obtained on centrifugation, middle layer of PRF was taken out, and membrane was prepared from it by squeezing it between two pieces of moist gauze. PRF was placed over the recession defect just apical to CEJ. Flap was adapted at the CEJ and secured using sling sutures. Vertical releasing incisions were closed with 4-0 resorbable interrupted sutures followed by placement of periodontal dressing (COE-PAK™). Steps of surgical procedure and pre- and post-treatment views have been presented in Figure 1a-h for test group and Figure 2a-h for control group.
Postoperative protocol

Patients were advised to take soft diet and to avoid biting on the operated site for 2 weeks. They were also instructed to avoid brushing in the operated area for 2 weeks. Chlorhexidine mouth rinse (0.2%) and ibuprofen 400 mg tablets were prescribed twice daily for 1 week. Postoperative healing was uneventful. Periodontal dressing was removed 1 week after surgery, while sutures were removed after 2 weeks. Patients were then instructed to gently brush the operated area using Chartier’s technique for the next 1 month.

Follow-up

Patients were recalled at 1, 3, and 6 months after surgery for recording of clinical parameters.

At each follow-up visits, patients’ oral hygiene maintenance was evaluated and instructions were reinforced followed by supragingival ultrasonic scaling. Complete history was recorded to check for any changes in systemic conditions or habits. Fortunately, no such change was observed in any patient over the period of 6 months.

Statistical analysis

The statistical analysis was performed using SPSS version 10.0 (SPSS Inc., Chicago, IL, USA). A subject-level analysis was performed for each parameter. Mean ± standard deviation (SD) for the clinical parameters was calculated separately for both treatment groups.

For comparison of mean values between two treatment groups at baseline, Levene’s test for equality of variances was used. Analysis of variance was used for comparison of mean values within each treatment group at different time intervals. The significance of difference between the groups before and after treatment was evaluated with paired-samples t-test. Differences were considered statistically significant at \( P < 0.05 \).

Results

Clinical outcomes obtained with the modified CAF alone or in combination with PRF in the management of gingival recession were compared at 24 sites in 12 patients (7 males and 5 females). Average age of patients was 37.5 years. All patients complied with the 6 months follow-up visits. No statistically significant difference was found in the mean values of clinical parameters between two treatment groups at baseline [Table 1]. PI was maintained <1 at all-time intervals [Table 2]. Descriptive statistics (mean ± SD) of all parameters for the test and control groups are presented in Tables 3 and 4, respectively. It was interesting to note that significant increase in GT was found at all 3 follow-up visits only in the test group [Tables 3-5].

Discussion

CAF is a simple technique for management of gingival recession. Varying outcome of this technique has been...
reported widely in the literature. The present study showed significant improvement in VGRD, from baseline to 6 months in both groups, similar to many previously reported data.\(^5\)-\(^7\) Gain in CAL in both groups also confirms the findings of previous studies.\(^8\)-\(^12\)

Increase in CAL and decrease in VGRD following modified CAF procedures may be attributed to formation of long junctional epithelium. However, the histological studies regarding the healing of pedicled grafts (e.g., CAF or rotational flap) have shown mixed results which varied from complete long junctional epithelial attachment to partial connective tissue attachment in the apical part and epithelial adaptation in the coronal part.\(^13\)

In the present study, however, exact nature of reattachment could not be known as histologic evaluation of new attachment apparatus was not done.

Combination of full and split flap design has several advantages. Coronal full thickness portion that includes the periosteum confers more thickness and thus better predictability of root coverage, while apical split thickness flap elevation facilitates the coronal displacement of flap.\(^9\)

Most of the earlier techniques of CAF utilized coronal displacement of flap through periosteal incisions, to eliminate the muscle tension on the flap.\(^9\),\(^14\) In the present modified technique, coronal displacement was allowed through elimination of muscle insertions as reported by de Sanctis and Zucchelli.\(^8\) This technique provided simultaneous advantages of eliminating the tension on flap as well as permitting passive displacement of flap till CEJ without sutures because of the absence of the muscle pull, thus achieving the better and stable root coverage.

In the present study, most striking outcome was a clear trend toward an increased thickness of the gingiva at the test sites. This intergroup difference was statistically significant at all 3 posttreatment visits. The clinical benefit of such improvement in thickness is however controversial.\(^15\) In an experimental study in monkeys,

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**Table 1: Comparison of mean values of parameters at baseline**

| Parameters | CAF       | CAF + PRF | P  |
|------------|-----------|-----------|----|
| mSBI       | 0.00±0.00 | 0.00±0.00 | #  |
| VGRD (mm)  | 2.83±1.11 | 2.92±0.90 | 0.842|
| GRW (mm)   | 4.00±0.74 | 4.00±0.95 | 1.00 |
| CAL (mm)   | 4.67±1.30 | 4.50±1.00 | 0.729|
| WAG (mm)   | 3.42±2.96 | 3.28±2.23 | 0.704|
| GT (mm)    | 0.57±0.57 | 0.49±0.31 | 0.570|

\(^a\)P-value could not be calculated. CAF=Coronally advanced flap, PRF=Platelet-rich fibrin, mSBI=Modified sulcular bleeding index, VGRD=Vertical gingival recession depth, GRW=Gingival recession width, CAL=Clinical attachment level, WAG=Width of attached gingiva, GT=Gingival thickness

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**Table 2: Mean values of plaque index at baseline, 1 month, 3 months, and 6 months**

| PI | Baseline | 1 month | 3 months | 6 months |
|----|----------|---------|----------|----------|
| Mean±SD | 0.06±0.04 | 0.04±0.04 | 0.04±0.04 | 0.04±0.38 |

PI=Plaque index, SD=Standard deviation

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**Table 3: Mean values of clinical parameters at baseline, 1 month, 3 months, and 6 months in control group**

| Parameter | Mean±SD | 1 month | 3 months (mean±SD) | 6 months (mean±SD) | P   |
|-----------|---------|---------|--------------------|--------------------|-----|
| mSBI      | 0.00±0.00 | 0.06±0.11 | 0.082              | 0.04±0.10          | 0.166 |
| VGRD      | 2.83±1.12 | 3.33±0.78 | 0.000*             | 0.58±1.00          | 0.42±0.67 |
| GRW       | 4.00±0.73 | 0.80±0.29 | 0.000*             | 0.25±0.45          | 0.000* |
| CAL       | 4.67±1.30 | 2.00±0.85 | 0.000*             | 2.17±0.83          | 0.000* |
| GT        | 0.56±0.56 | 0.64±0.37 | 0.102              | 0.65±0.37          | 0.072 |

\(^*\)Statistically significant. CAF=Coronally advanced flap, SD=Standard deviation, mSBI=Modified sulcular bleeding index, VGRD=Vertical gingival recession depth, GRW=Gingival recession width, CAL=Clinical attachment level, GT=Gingival thickness

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**Table 4: Mean values of clinical parameters at baseline, 1 month, 3 months, and 6 months in test group**

| Parameter | Mean±SD | 1 month | 3 months (mean±SD) | 6 months (mean±SD) | P   |
|-----------|---------|---------|--------------------|--------------------|-----|
| mSBI      | 0.00±0.00 | 0.00±0.00 | #                  | 0.06±0.11          | 0.082 |
| VGRD      | 2.92±0.90 | 0.08±0.29 | 0.000*             | 0.33±0.49          | 0.50±0.52 |
| GRW       | 4.00±0.95 | 0.00±0.00 | 0.000*             | 0.17±0.39          | 0.33±0.65 |
| CAL       | 4.50±1.00 | 1.83±0.72 | 0.000*             | 2.00±0.74          | 0.20±0.67 |
| GT        | 0.49±0.31 | 1.12±0.42 | 0.000*             | 1.12±0.43          | 0.000* |

\(^b\)P-value could not be calculated, *Statistically significant. CAF=Coronally advanced flap, PRF=Platelet-rich fibrin, SD=Standard deviation, mSBI=Modified sulcular bleeding index, VGRD=Vertical gingival recession depth, GRW=Gingival recession width, CAL=Clinical attachment level, GT=Gingival thickness

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it was suggested that gingiva with a thin biotype at sites with alveolar bone dehiscence may serve as a locus minoris resistencia to develop soft tissue recessions. However, even if thick tissue appears to improve clinical results, a systematic review by Hwang and Wang failed to establish conclusively, any requirement for a minimum thickness.

The increase in GT may be attributed to proliferation of gingival and periodontal ligament fibroblasts under influence of growth factors from PRF or to a spacing effect of the PRF membrane. It is yet to be investigated if the additional gain in GT that we found in our test group after 6 months is of clinical value and/or is associated with an improved esthetic outcome in long term.

Results of the present study for treatment of single tooth gingival recessions by CAF indicated that only benefit of the addition of PRF appears to be a significant increase in the thickness of gingiva which may improve the predictability and long-term maintenance of achieved soft tissue root coverage. Clinical significance of this additional improvement in GT needs to be evaluated in larger patient sample over a longer follow-up period.

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Conflicts of interest
There are no conflicts of interest.

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