Modified Lateral Positioned Flap with Platelet-Rich Fibrin Graft for Treatment of Denuded Root Surfaces: A Clinical Study

Abstract

Background: Root coverage (RC) procedures such as lateral positioned flap (LPF) have been used since long time but with limited success and specific indications. Aim: This prospective clinical study was designed to evaluate clinically the effect of modified LPF (mLPF) with platelet-rich fibrin (PRF) graft for the treatment of denuded root surfaces. Materials and Methods: Fifteen isolated Miller’s Class I and II gingival recession of single-rooted teeth were selected for the study. Scaling and root planing was done, and oral hygiene instructions were given to the patients. Plaque index, gingival index, and recession parameters (probing depth, gingival recession height, clinical attachment level [CAL], and width of keratinized tissue [WKT]) were assessed at baseline. Following this, mLPF with PRF was done at the recession sites, and parameters were assessed at 3 and 6 months. Statistical Analysis: To analyze the posttreatment effect, paired t-test was performed at relevant degrees of freedom and 95% confidence level. Results: The mean percentage of RC attained was 72.2% at 3 months and 73.5% at 6 months. The WKT shows a mean gain of 2.93 mm at 3 months and 3 mm at 6 months. Conclusion: mLPF with PRF produced statistically significant reduction in recession depth and gain in both CAL and WKT by the end of 6 months.

Keywords: Isolated denuded root surfaces, modified lateral positioned flap, platelet-rich fibrin graft

Introduction

Gingival recession is defined as the displacement of marginal tissue apical to cemento-enamel junction (CEJ). Labial gingival recession in the anterior region represents one of the most important challenges for periodontal patients. There are different etiological factors responsible for contributing to the condition apart from periodontal diseases such as traumatic toothbrushing, thin gingival tissue, tooth malposition, and frenum pull near gingival margin.[1,2] The main indications for root coverage (RC) procedures are esthetic concern, root hypersensitivity, prevention or management of root caries and cervical abrasion, enhancement of restorative outcomes, and facilitation of plaque control efforts.

A variety of surgical techniques have been proposed to achieve successful and predictable RC. They include coronally positioned flap, lateral positioned flap (LPF), free gingival graft, free gingival graft with coronally positioned flap, free connective tissue autograft, subepithelial connective tissue graft, guided tissue regeneration, and acellular freeze-dried dermal matrix allografts.[3] A summary with regard to the average amount of initial Miller Class I–II recession defects that were successfully covered following treatment shows that an average of 63%–86% RC may be expected.[4]

The predictability of the lateral pedicle graft can be increased using a newer material such as platelet-rich fibrin (PRF).[5] It hastens healing as well as increases the predictability to complete RC. PRF, developed in France by Choukroun et al. (2001), is a second-generation platelet concentrate widely used to accelerate soft and hard tissue healing. PRF has many advantages over platelet-rich plasma (PRP). It eliminates the redundant process of adding anticoagulant as well as the need to neutralize it. The addition of bovine-derived thrombin to promote conversion of fibrinogen to fibrin is also eliminated in PRF.[6]

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PRF production protocol attempts to accumulate platelets and released cytokines in a fibrin clot. It contains concentrated suspension of the growth factors found in platelets. These growth factors are involved in wound healing and are postulated as promoters of tissue regeneration.[7] Platelet concentrate contains platelet-derived growth factor (PDGF), transforming growth factor β (TGF-β), and many other unidentified growth factors that modulate and upregulate one growth factor function in the presence of second or third growth factor.

This specific feature influenced the decision to use platelet concentrates as the test material of choice. Hence, the aim of this prospective clinical study was to evaluate clinically the effect of PRF along with LPF for the treatment of denuded root surfaces. Objectives of this study were to assess the coverage of the denuded root surfaces, the gain in keratinized gingiva and to evaluate the increase in the width of attached gingiva.

Materials and Methods

Thirteen systemically healthy patients with Miller’s Class I or Class II facial gingival recession of single-rooted teeth (15 sites) were selected. The other inclusion criteria were the presence of adequate band of keratinized gingiva of adjacent teeth, adequate depth of vestibule, patients having a good level of oral hygiene, and absence of pulpal pathology.

Patients excluded from the study were those contraindicated for periodontal therapy, those on medication which affects the coagulation, tooth mobility, those showing radiographic evidence of interdental bone loss, carious or noncarious cervical defect of tooth, malaligned teeth at a site of interest, current smokers or tobacco chewer, and pregnant and lactating females. Informed consent of all the participants of the study was obtained, after the nature of the procedure and possible discomfort and risks had been fully explained.

Prestudy patient preparation

A planned case history, including medical and complete dental history and periodontal evaluation, was done for all the participants and the necessary laboratory investigations done. Following the screening examination, all the participants received a session of prophylaxis including instructions in proper oral hygiene measures.

A brushing technique was prescribed that minimized apically directed forces to the soft tissues. University of North Carolina Probe was used to assess the different clinical parameters which were recorded to the nearest millimeter.

Clinical parameters

The clinical parameters evaluated were plaque index (PI), gingival index (GI), and recession parameters (assessed on the buccal aspects of all study teeth) at baseline, 3 months, and 6 months [Figure 1]. Recession parameters included:

a. Probing depth (PD): Measured at the point of defect from the crest of the marginal gingiva at the mid-buccal point of the involved tooth to the location of the tip of the probe inserted into the base of sulcus
b. Gingival recession height (GRH): Measured with a probe from the CEJ to the most apical point of the free gingival margin on the mid-facial region of the tooth
c. Clinical attachment level (CAL): Calculated by adding recession depth and the PD
d. Width of keratinized tissue: Measured between the most apical point on the gingival margin and the mucogingival junction (MGJ), with the identification of the MGJ facilitated by staining the tissues with Lugol’s iodine solution.

The assessed recession parameters were used to obtain:

a. Recession reduction (RR): Calculated as: Preoperative GRH – Postoperative GRH
b. Percentage of RC: Calculated as: (RR/preoperative GRH) × 100.

Study procedure

Preparation of platelet-rich fibrin

Ten milliliters of blood was drawn into test tubes without an anticoagulant and centrifuged immediately using a tabletop centrifuge for 12 min at 2800 rpm. The resultant product consisted of three layers, topmost layer of acellular platelet-poor plasma, PRF clot in the middle, and red blood cells at the bottom [Figure 2]. PRF was obtained in the form of a membrane by squeezing out the fluids in the fibrin clot.[6]

Surgical procedure

The surgical procedure was performed under local anesthesia. This technique involved the reflection of a

Figure 1: Comparative evaluation of mean probing depth, gingival recession height, clinical attachment level, keratinized tissue width
full/partial thickness flap at the donor area adjacent to the defect and subsequent displacement of this flap to cover the exposed root surface.[5] A reverse bevel “V” shape incision was made along the soft tissue margin of the recipient site to remove the epithelium around the root surface.[8] The root surface was mechanically treated with the use of Gracey curettes. Root planing was terminated when a clean and hard surface was obtained.

Then, the donor site was prepared by giving a crevicular incision using a #15 Bard-Parker blade and vertical incisions were made from the gingival margin to outline the flap adjacent to the donor site [Figure 3]. Then, a full thickness flap was reflected till MGJ by blunt dissection using periosteal elevator. This was followed by partial thickness flap elevated by sharp dissection. Flap was then displaced laterally, and if tension was observed in the flap after displacement, a cutback incision was placed on lateral border of pedicle flap.[9]

The prepared PRF membrane was placed over the denuded roots as well as donor site [Figure 4]. The flap was then displaced to completely cover the membrane and secured using sling sutures.[6] Pedicle flap was also sutured by direct loop suture [Figure 5].

### Postsurgical care and follow-up

Postoperative instructions were given, and the patients were prescribed antibiotics (amoxicillin, 500 mg, TDS × 5 days) and analgesics (ibuprofen 400 mg, TDS × 5 days). Toothbrushing was discontinued at the site of surgery for 4 weeks. Chlorhexidine gluconate (0.2%) mouth rinse was prescribed twice daily for 4 weeks [Figure 6]. Sutures were removed after 2 weeks. One month after surgery, the patients were instructed to resume mechanical toothbrushing of the treated area using brushing technique that minimized apically directed trauma to the soft tissue of the treated teeth.[10]

### Results

All the clinical parameters (viz., PI, GI, PD, GRH, CAL, and KTW) were recorded at baseline, 3 months, and 6 months after surgery. To analyze the posttreatment effect, paired t-test was performed at relevant degrees of freedom and 95% confidence level. For statistical analysis “GraphPad Prism 5” software (California, San Diego) was used. The participants (n = 13) in the study were in the age group of 22–58 years. The mean age of the participants was 33.30 years of the study population; 46.15% were males and 53.85% were females.
The GRH showed a mean reduction of 2.9 mm at 3 months and 3 mm at 6 months. CAL showed a mean gain of 2.47 mm at 3 months and 2.67 mm at 6 months [Figure 7]. Furthermore, KTW showed a mean gain of 2.933 mm at 3 months and 3.003 mm at 6 months. The differences for all parameters between baseline and 3 months and baseline and 6 months were statistically significant [Table 1 and Figure 8].

**Discussion**

Gingival recession is often associated with impaired esthetics and/or dentinal hypersensitivity. Various surgical procedures are performed for coverage of denuded roots among which LPF is one of the most commonly performed RC techniques. Furthermore, increasing evidence suggests that PRF, a second-generation platelet concentrate, accelerates soft and hard tissue healing.[7] Hence, in the present study, coverage of localized recession was attempted using a combination of LPF with PRF graft so as to overcome the drawbacks associated with LPF technique such as incomplete RC and recession at the donor area.

Grupe and Warren introduced LPF, and later, the procedure was modified by various authors. Staffileno (1964) and Pfeifer and Heller[11] advocated the use of a split thickness flap to minimize the potential risk for the development of dehiscence at the donor tooth. In a clinical human study, Wood et al.[12] used reentry procedures to compare crestal radicular bone responses to full and partial thickness flaps. They concluded that regardless of the flap procedure, loss of crestal bone depended on the thickness of radicular bone, with the thinnest bone associated with greater postoperative bone loss.

Pfeifer and Heller (1971)[11] reported that reattachment on the exposed root surface is more likely to occur with full thickness flaps. Therefore, full thickness flaps are appropriate for RC, and partial thickness LPF is suitable for increasing the width of the attached gingiva. Hence, in the present study, a full thickness flap was reflected till MGJ and cut back incision was used to relieve tension in the pedicle flap which was used in the present study (modified LPF).[9]

As an optimized natural blood clot, PRF is a complex biomaterial with a specific biology. It is organized as a dense fibrin scaffold with a high number of leukocytes concentrated in one part of the clot,[13] with a specific slow release of growth factors (such as TGF-β 1, PDGF-AB, and vascular endothelial growth factor) and glycoproteins (such

| Table 1: Comparison of mean±standard deviation of all the parameters at different intervals |
|---------------------------------------------|-------------|-------------|-------------|
| Baseline | 3 month | 6 months |
| PI       | 0.289±0.11 | 0.675±0.15* | 0.662±0.10* |
| GI       | 0.345±0.08 | 0.622±0.15* | 0.662±0.11* |
| PD       | 0         | 0.467±0.5*  | 0.333±0.47* |
| GRH      | 4.2±0.9   | 1.267±0.85* | 1.2±0.75*   |
| CAL      | 4.2±0.9   | 1.73±1.12*  | 1.53±0.88*  |
| KTH      | 0.667±0.59 | 3.6±0.71*   | 3.67±0.6*   |

*Significant difference between baseline and 3 months (P≤0.05),
#Significant difference between baseline and 6 months (P≤0.05).
Paired t-test was applied to assess results from 3 months and 6 months to baseline. PI=Plaque index, GI=Gingival index, PD=Platelet derived, GRH=Gingival recession height, CAL=Clinical attachment level, KTH=Keratinized tissue height
as thrombospondin-1) during the span of 7 days or more. Leukocytes seem to have a strong influence on growth factor release, immune regulation, anti-inflammatory activities, and matrix remodeling during healing.[14] Another experimental study used osteoblast cell cultures to investigate the influence of PRP and PRF on proliferation and differentiation of osteoblasts. In this study, the affinity of osteoblasts to the PRF membrane appeared to be superior.[15]

PRF can be used as unaltered mass, i.e., as a clot or can be compressed into membrane without losing its properties. PRF membranes prepared with compresses have to be used very quickly because they will dehydrate. An excessive waiting period on dry compresses influences the growth factor content.[16] In the present study, PRF was kept ready in test tube till its application on root surface. Hence, dehydration of PRF was avoided by quick utilization of this biomaterial. Part of PRF having a high concentration of platelets (nearer to red cells end) was placed on denuded root surface since PRF membranes are inhomogeneous and leukocytes and platelet aggregates are concentrated within one end of the membrane.[17]

In the present study, PI (Silness and Loe, 1964) was used to assess oral hygiene and for GI for gingival condition (Loe and Silness, 1963). Although there was an increase in values of both PI and GI score from baseline to 3 and 6 months, there was statistically no significant difference between 3 and 6 months. Furthermore, both values were low (<1) throughout the study process suggesting adequate maintenance of oral hygiene and lack of gingival inflammation at baseline, postsurgical, and recall visits.

Treatment effectiveness was determined as a function of relative RC and periodontal tissue health at 3 and 6 months. The percentage of coverage of a previously exposed root surface was the primary clinical outcome used to evaluate the effectiveness of the surgical procedure. In the present study, the mean percentage of RC attained was 72.2% at 3 months and 73.5% at 6 months (range: 50%–100%). Results obtained in the present study suggest that the mean RC of LPF + PRF was higher compared to mean RC mentioned for LPF alone.[18,19]

The mean recession height at baseline was 4.2 mm which reduced to 1.26 mm at 3 months and 1.2 mm at 6 months, showing a mean reduction of 2.9 mm at 3 months and 3 mm at 6 months. In the Academy Report (2005), it was stated that mean initial recession height of 3.9 was reduced to 1.3 mm after LPF. Thus, mean reduction in recession height was 2.6 mm.[18] The present study suggests that LPF along with PRF results in more RC compared to LPF alone.[19]

Postoperative recession at treated sites in the present study was 1.2 mm after 6 months as compared to 1.3 mm for above-mentioned studies.[18] This is lesser considering the fact that, in the present study, initial recession height was more that above-mentioned studies.

The present study is the first study of its kind which considered application of PRF along with LPF. Hence, results obtained in this study cannot be compared to ascertain the inference deduced from the study.

One of the observations of the study was that the maximum change in parametric values for both the sites occurred at 3 months and these were maintained for 6 months [Table 2]. The change in values between 3 and 6 months were statistically not significant for all the parameters recorded indicating that healing must have been complete by the end of 3 months.[20]

### Conclusion

This prospective study was designed to evaluate clinically, the treatment of denuded root surface with LPF with PRF graft. Results indicated that LPF along with PRF resulted in significant improvement in all clinical parameters.

LPF along with PRF (LPF + PRF) produced statistically significant reduction in GRH and both gain in CAL and KTW by the end of 6 months. There was also statistically significant percentage of RC. The treatment produced an excellent color match and restored the esthetic contours of gingiva. Healing at experimental sites was completed by 3 months, and results were maintained till the end of the experimental period.

The results of the present study are encouraging enough, to further explore combined type of treatment procedures, to treat isolated denuded root surfaces.

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### Conflicts of interest

There are no conflicts of interest.

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### Table 2: Mean percentage of root coverage

| Time interval (months) | Root coverage (%) |
|------------------------|-------------------|
| 3                      | 72.22             |
| 6                      | 73.55             |

[20]
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