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Original Research Article

# Comparative evaluation of coronally advanced flap with platelet rich fibrin versus sub-epithelial connective tissue graft in the treatment of gingival recession with quasi-experimental design

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## Abstract

**Background:** Platelet-rich fibrin (PRF) has been found to intensify soft-tissue healing and its use in the management of gingival recession eliminates the requirement of a donor site.
**Aims & Objectives:** The aim of this study is to compare the clinical effectiveness of Coronally advanced flap with PRF (CAF+PRF) and Sub-epitelial connective tiisue graft (SCTG) in the treatment of gingival recession.
**Materials and Methods:** Thirty subjects were treated by SCTG technique on control side and CAF+PRF technique on the test side. Simplified oral hygiene index (OHI-S), gingival index (GI) Probing depth (PD), clinical attachment level (CAL), keratinized gingival width (KTW), gingival thickness (GTH), Vertical recession depth (VRD), wound healing index were measured at baseline and regular intervals. Post-surgical discomfort levels were assessed by patients through VAS scale at 1 week, 2 week, and 1 month intervals across both sides of the arch. Esthetic outcomes were evaluated using the root coverage esthetic score (RES).
**Results:** The study showed a statistically significant improvement in CAL, GTH and VRD on both sides. Intergroup analysis showed that there were no significant differences between the test and control side with respect to PD, CAL, KTW, GTH and VRD except for VRD at 1 month. There was significant difference in HI, VAS, AP and RES value.
**Conclusion:** Within the limits of this study, PRF mimics SCTG functionality, serving as a bioactive scaffold that enables gingival recession treatment while eliminating donor site morbidity.

**Keywords:** Gingival recession, Gingival diseases, Chronic periodontitis, Platelet rich fibrin.

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## 1. Introduction

Gingival recession is defined as the exposure of the root surface caused by an apical migration of the gingival margin beyond the cemento-enamel junction (CEJ). It has been estimated that more than two-thirds of the population worldwide was affected by gingival recession.[1] Primary etiological drivers of gingival recession include mechanical trauma from aggressive brushing, anatomical anomalies in frenal attachments, and iatrogenic factors like orthodontic misalignment or surgical complications. Not only does this condition elevate risks for root surface pathologies, but it also heightens dentin hypersensitivity through unprotected cementum exposure. When confronting unpleasant aesthetic changes or progressive tissue loss, surgical intervention becomes clinically warranted. However, recent meta-analyses caution against overreliance on root coverage procedures for hypersensitivity management, citing insufficient predictive efficacy data.[2] Among the various surgical techniques sub-epithelial connective tissue graft is found to give predictable results and is considered as the gold standard. But its disadvantages and limitations made researchers to think about another novel approach with predictable results. This study also concentrates on a search for such a technique using coronally advanced flap with

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platelet rich fibrin and comparing the results with the gold standard with the help of a split mouth research design.

## 2. Materials and Methods

This study was designed as a non-randomised controlled trial with Quasi–experimental design conducted in a tertiary dental care centre, Kerala, India. The sample size was estimated to be 30.

### *2.1. Recruitment of study subjects*

Study subjects were recruited from the department of Periodontics. Those systemically healthy individuals aged between 18-45 years having bilateral localized Miller's Class I or II recession defects were included in the study. Those with previous surgical attempt to correct gingival recession, smoking habit, poor Oral hygiene index, psychiatric disorders, pregnancy, pathologic mobility of teeth and uncooperative were excluded from the study.

All the ethical principles were maintained in the study. Informed consent was obtained from participants and were given full autonomy to withdraw from the study at any point if found uncomfortable. The ethical clearance was obtained from the Institutional Ethics Committee (PMS/IEC/2011/07 dated 19/03/2011).

### *2.2. Clinical parameters*

Before surgery, patients were received oral hygiene instructions, oral prophylaxis and occlusal adjustment as indicated. Full-mouth prophylaxis was scheduled 1 month prior to surgery. Pre-operative radiographs were taken to assess the integrity of interdental bone. The following measurements were taken using Williams Graduated Probe:

1. Vertical gingival recession depth (VRD): distance from the CEJ to the free gingival margin
2. Clinical attachment level (CAL): distance from the CEJ to the base of the gingival crevice
3. Clinical probing depth (PD): distance between free gingival margin to the base of the gingival crevice;
4. Width of keratinized tissue (KTW): distance from the free gingival margin to the mucogingival junction assessed by roll technique.
5. Gingival/mucosal thickness (GTH): GTH was measured using a #15 endodontic reamer with a disk stop.[3] Using slight pressure the mucosal surface was pierced at a 90$^{o}$ angle 3 mm below the gingival margin until hard tissue is reached. The stop on the reamer was slid until it is in close contact with the gingiva. The distance between the tip of the reamer and the inner border of the silicone stop is measured after removal of the reamer

These parameters were measured and recorded separately by two investigators and level of agreement measured. CAL, GTH, PD and KTW were measured at baseline, 4 months and at the 9-month follow-up. VRD was measured at baseline, and at the 1-week, 2-week, 1-month, 4-month, and 9-month follow-ups.

Simplified oral hygiene index (OHI-S) and gingival index (GI) were also recorded at baseline as well as 9 months post surgically. Indices were recorded to assess oral hygiene maintenance of the patient. A wound healing index was recorded both at 1 week & 2 week post operatively. Clinical measurements as well as indices were recorded by 2 examiners. Routine blood test including blood cell count, blood sugar, bleeding time & clotting time were done before surgery.

### *2.3. Surgical procedure*

In this split mouth study, each patient's mouth was divided into two halves- a control side & a test side. The control side was treated with subepithelial connective tissue graft (Langer & Langer technique) & test side with coronally advanced flap together with PRF. Each surgical procedure was done at separate appointments. After local anesthesia, both surgical procedures were performed by the same investigator.

### *2.4. Sub-epithelial connective tissue graft (Langer & Langer technique)*

A partial thickness flap was raised after placing a horizontal crevicular incision (**Figure 1b**). These incisions were extended mesiodistally half to one tooth wider than the area of gingival recession and apico-coronally to the mucobuccal fold so as to make the flap freely movable. The root was thoroughly planed, reducing its convexity. A connective tissue graft was then obtained from the palate using the "Parallel incision technique" introduced by Raetzke. A primary horizontal incision was placed parallel to the surface of gingiva 3-5 mm apical to the gingival margin in the palate. A secondary incision was placed 1-2 mm coronal to the primary horizontal incision line. This incision was perpendicular to the surface of the gingiva and extended to the bone. Then a vertical incision was placed mesiodistally approximating the width and length of the necessary graft. A partial-thickness flap (1.5-mm thick) was raised toward the centre of the palate, parallel to the palatal gingiva through the primary incision exposing the underlying connective tissue. Using a small periosteal elevator a full-thickness periosteal connective tissue graft was raised. By extending the base of the primary incision to the bone the connective tissue graft was separated. The donor tissue was removed with utmost care. Utilizing 3-0 braided silk suture material, a continuous suture was used to approximate the wound on the palate. The width and uniform thickness (1.5 mm) of the graft was modified and stored in saline. A fresh tetracycline solution (125 mg tetracycline/cc of saline) was prepared and applied to the root surfaces immediately before graft placement for 3 minutes. Then the connective tissue graft was placed on the denuded root (**Figure 1b**) and covered with the outer portion of the partial thickness flap & sutured with 3-0 braided silk

suture (**Figure 1c**). The recipient and donor site were then covered with surgical pack.

*2.5. Coronally advanced flap with PRF*

A partial thickness flap was raised after placing a horizontal crevicular incision (**Figure 2**b). These incisions were extended half to one tooth wider mesiodistally than the area of gingival recession and apico-coronally to the mucobuccal fold so as to make the flap freely movable. The root was thoroughly planed, reducing its convexity. A PRF membrane was prepared as follows. Intravenous blood was collected in two 5ml vials without anticoagulant. They are immediately centrifuged at 3,000 revolutions per minute for 10 minutes. The fibrin clot was formed in the middle part of the tube. An acellular plasma and red corpuscles were collected at the upper and bottom part respectively. The fibrin clot was separated from the lower part of the centrifuged blood and spread on a sterile gauze. Then the PRF was gently pressed between two gauze pieces to shape it into a membrane. A fresh tetracycline solution (125 mg tetracycline/cc of saline) is prepared and applied to the root surfaces immediately before PRF membrane placement for 3 minutes. Two PRF membranes were placed on surgical site superimposed in the opposite direction to cover the recessions and were positioned over the edge of the gingival collar above the CEJ to prevent epithelial migration (**Figure 2**b). The flap was coronally advanced and sutured at a level coronal to the pre-treatment position (**Figure 2**c). The surgical area was covered with a periodontal pack.

*2.6. Post-surgical care*

All patients were given analgesics and antibiotics. Patients were instructed to brush only the non-involved teeth during the initial 4 weeks. Plaque control in the affected teeth was instructed to perform with a cotton-tipped applicator. They were instructed to do 1min rinse of their mouth with a 0.2% chlorhexidine solution, three times a daily for 4 weeks. All patients were reviewed four weeks after surgical treatment and instructed in mechanical plaque control in the operated areas using a soft toothbrush and a roll technique. They were recalled for scaling 1, 3 and 6 months after suture removal. Patients were advised to follow routine periodontal mucogingival surgical postoperative instructions. The dressing was repacked after 1 week. Both dressing and sutures were removed 2 weeks after the surgery. Patients were reviewed at 1 week, 2 weeks, 1 month, 4 months, and 9 months for postoperative follow-up.

*2.7. Measurement of post-operative discomfort*

Post-surgical discomfort levels were assessed by patients through VAS scale at 1 week, 2 week, and 1 month intervals across both sides of the arch. A visual analogue scale (VAS) (0 to 10) form is provided with 0 indicating negligible discomfort and 10 indicating unbearable pain.[4] VAS form was given to the patient after explaining about the same & patient marked the score according to the level of discomfort they experienced. Number of analgesic pills taken during the first & second weeks too were recorded.

*2.8. Esthetic outcome measuement*

Clinical photographs were taken throughout the study period. A standardized shooting protocol was applied by placing the target camera perpendicular to the long axis of the experimental tooth after reflecting the cheek so that the experimental tooth, associated gingiva as well as the mucogingival junction can be clearly identified. Two experienced and masked periodontists examined the 9-month clinical photographs. Examiners were totally blind about the surgical technique used in either side of patient's mouth. Esthetic outcomes were assessed using the root coverage esthetic score (RES).[5] Gingival margin level (GM), Marginal tissue contour (MTC), Soft tissue Texture (STT), Muco-gingival junction (MGJ), Gingival color (GC) of the surgical area were compared to the adjacent tissue. Each examiner reviewed and scored all the photographs twice.

*2.9. Statistical analysis*

The values of clinical variables were expressed in terms of mean, median and standard deviation. Both intra-group and inter-group analysis was performed for each parameter. The significance of the difference within and between groups before and after treatment was evaluated with paired-sample t test for continuous variables or wilcoxon signed rank test for discrete variables. The level of agreement between examiners is determined using intra-class correlation co-efficient (ICC) values and its confidence intervals. ICC value is 1 for full agreement and 0 for no agreement. Inter-group variations of esthetic outcome were analyzed using Wilcoxon Signed rank test.

## 3. Results

Out of 30 patients treated 17 were males. The mean age of the patients was 26.4. All patients completed the study. Sloughing of a graft, without infection, occurred in control side of two patients, resulting in a recession defect. As the level of agreement between examiners were good (**Table 1**), the values measured by one of the examiners were taken for further analysis. There was no statistically significant difference in PD, CAL, KTW, GTH and VRD between test and control sides at baseline (**Table 2**). The OHI-S and GI scores showed a significant increase between baseline and 9 months. A statistically significant improvement in CAL, GTH and VRD was noted on both sides after 9 months (**Table 2**). Improvement in KTW after 9 months was statistically significant for control side but not for test side.


**Figure 1: a:** Preoperative view of control side**; b:** Connective tissue graft harvested and placed on recipient site**; c:** Flap coronally advanced and sutured**; d:** After 2 weeks; **e:** After 1 month; **f:** After 9 months

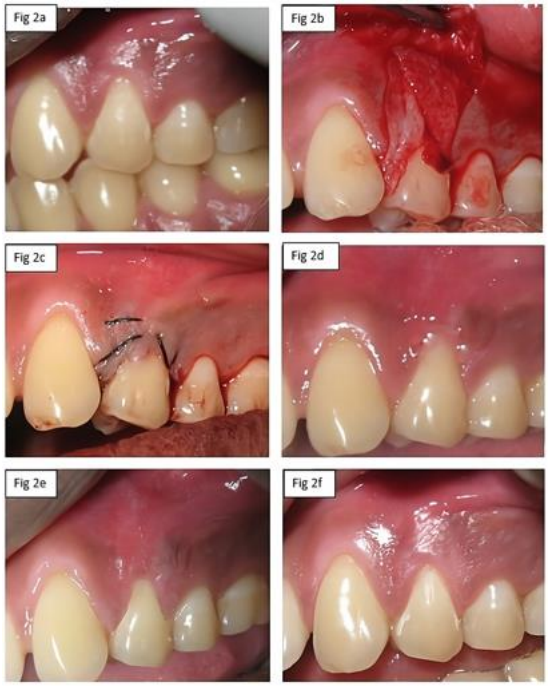


**Figure 2: a:** Preoperative view of test side; **b:** PRF prepared and placed; **c:** Flap coronally advanced and sutured; **d:** After 2 weeks; **e:** after 1 month; **f:** after 9 months

**Table 1:** Level of agreement between examiners was analyzed using intra class correlation co-efficient (ICC) values and its confidence intervals.

| Clinical variables | Intra class correlation co-efficient | 95% Confidence interval |
|---|---|---|
| **OHI-S** | 0.989 | 0.973 - 0.996 |
| **GI** | 0.944 | 0.865 – 0.978 |
| **PD** | 0.867 | 0.694 – 0.945 |
| **CAL** | 0.944 | 0.865 – 0.978 |
| **KTW** | 0.9195 | 0.8085 – 0.9674 |
| **GTH** | 0.944 | 0.865 – 0.978 |
| **VRD** | 0.965 | 0.914 – 0.986 |
| **HI** | 1.000 | 1.000 – 1.000 |
| **Esthetic outcome** | 0.847 | 0.653- 0.936 |

**OHI-S** (Simplified Oral Hygiene Index), **GI** (Gingival Index), **PD** (Clinical probing depth), **CAL** (Clinical Attachment Level), **KTW** (Width of keratinized tissue), **GTH** (Gingival/mucosal thickness), **VRD** (Vertical Recession Depth), **HI** (Healing Index)

**Table 2:** Intra-group analysis of clinical variables between baseline and follow ups for test and control side using paired t test.

| Clinical variable | Comparison | Mean | SD | Paired t test | P-value |
|---|---|---|---|---|---|
| **Test side** | | | | | |
| **OHI-S** | Baseline and 9 months | 0.6150 | 0.4441 | 4.380 | **0.002*** |
| **GI** | Baseline and 9 months | 0.1670 | 0.1580 | 3.343 | **0.009*** |
| **PD** | Baseline and 4 months | 0.00 | 0.47 | 0.000 | 1.000 |
| | Baseline and 9 months | 0.00 | 0.47 | 0.000 | 1.000 |
| **CAL** | Baseline and 4 months | 1.00 | 0.94 | 3.354 | **0.008*** |
| | Baseline and 9 months | 0.90 | 0.88 | 3.250 | **0.010*** |
| **KTW** | Baseline and 4 months | 0.00 | 0.67 | 0.000 | 1.000 |
| | Baseline and 9 months | 0.00 | 0.67 | 0.000 | 1.000 |
| **GTH** | Baseline and 4 months | 0.200 | 0.258 | 2.449 | **0.037*** |
| | Baseline and 9 months | 0.250 | 0.354 | 2.236 | **0.042*** |
| **VRD** | Baseline and 1 week | 1.70 | 0.67 | 7.965 | **0.000*** |
| | Baseline and 2 week | 1.50 | 0.53 | 9.000 | **0.000*** |
| | Baseline and 1 month | 1.20 | 0.63 | 6.000 | **0.000*** |

| | | | | | |
|---|---|---|---|---|---|
| | Baseline and 4 months | 1.30 | 0.67 | 6.091 | **0.000*** |
| | Baseline and 9 months | 0.90 | 0.57 | 5.014 | **0.001*** |
| **Control side** | | | | | |
| **Clinical variable** | **Comparison** | **Mean** | **SD** | **Paired t test** | **P value** |
| **OHI-S** | Baseline and 9 months | 0.6150 | 0.4441 | 4.380 | **0.002*** |
| **GI** | Baseline and 9 months | 0.1670 | 0.1580 | 3.343 | **0.009*** |
| **PD** | Baseline and 4 months | 0.20 | 0.42 | 1.500 | 0.168 |
| | Baseline and 9 months | 0.20 | 0.42 | 1.500 | 0.168 |
| **CAL** | Baseline and 4 months | 2.20 | 1.23 | 5.659 | **0.00*** |
| | Baseline and 9 months | 2.20 | 1.23 | 5.659 | **0.00*** |
| **KTW** | Baseline and 4 months | 1.00 | 0.67 | 4.743 | **0.001*** |
| | Baseline and 9 months | 0.80 | 0.42 | 6.000 | **0.000*** |
| **GTH** | Baseline and 4 months | 0.300 | 0.258 | 3.674 | **0.005*** |
| | Baseline and 9 months | 0.300 | 0.258 | 3.674 | **0.005*** |
| **VRD** | Baseline and 1 week | 2.40 | 1.43 | 5.308 | **0.000*** |
| | Baseline and 2 weeks | 2.40 | 1.43 | 5.308 | **0.000*** |
| | Baseline and 1 month | 2.40 | 1.43 | 5.308 | **0.000*** |
| | Baseline and 4 months | 2.20 | 1.03 | 6.736 | **0.000*** |
| | Baseline and 9 months | 2.00 | 1.15 | 5.477 | **0.000*** |

**OHI-S** (Simplified Oral Hygiene Index), **GI** (Gingival Index), **PD** (Clinical probing depth), **CAL** (Clinical Attachment Level), **KTW** (Width of keratinized tissue), **GTH** (Gingival/mucosal thickness), **VRD** (Vertical Recession Depth)

**Table 3:** Inter-group analysis of clinical variables at baseline and each of the follow ups using paired t-test

| Variable | Follow up | Mean | SD | t-test | P-value |
|---|---|---|---|---|---|
| **PD** | Baseline | 1.00 | 0.74 | 0.429 | 0.678 |
| | 4 months | 0.10 | 0.57 | 0.557 | 0.591 |
| | 9 months | 0.10 | 0.57 | 0.557 | 0.591 |
| **CAL** | Baseline | 0.80 | 1.81 | 1.395 | 0.196 |
| | 4 months | 0.40 | 0.84 | 1.500 | 0.168 |
| | 9 months | 0.50 | 0.97 | 1.627 | 0.138 |
| **KTW** | Baseline | 0.10 | 1.60 | 0.198 | 0.847 |
| | 4 months | 0.90 | 1.45 | 1.964 | 0.081 |
| | 9 months | 0.70 | 1.64 | 1.353 | 0.209 |
| **GTH** | Baseline | 0.50 | 0.643 | 0.246 | 0.811 |
| | 4 months | 0.50 | 0.550 | 0.287 | 0.780 |
| | 9 months | 0.00 | 0.408 | 0.000 | 1.000 |
| **VRD** | Baseline | 0.70 | 1.89 | 1.172 | 0.271 |
| | 1 week | 0.20 | 0.42 | 1.500 | 0.168 |
| | 2 week | 0.20 | 0.42 | 1.500 | 0.168 |
| | 1 month | 0.50 | 0.53 | 3.000 | **0.015*** |
| | 4 months | 0.30 | 0.58 | 1.964 | 0.081 |
| | 9 months | 0.40 | 0.70 | 1.809 | 0.104 |

**PD** (Clinical probing depth), **CAL** (Clinical Attachment Level), **KTW** (Width of keratinized tissue), **GTH** (Gingival/mucosal thickness), **VRD** (Vertical Recession Depth)

**Table 4:** Inter-group analysis of HI, VAS and AP using wilcoxon signed rank test

| Clinical variable | Follow up | Z score | p value |
|---|---|---|---|
| **HI** | 1 week | 0.000 | 1.000 |
| | 2 weeks | 3.162 | **0.002*** |
| **VAS** | 1 week | 2.202 | **0.028*** |
| | 2 weeks | 1.414 | **0.025*** |
| | 1 month | 0.000 | 1.000 |
| **AP** | 1 week | 2.530 | **0.011*** |
| | 2 weeks | 0.000 | 1.000 |
| **Esthetic outcome** | 9 months | 1.17 | 0.242 |

**HI** (Healing Index), **VAS** (Visual Analogue Scale), **AP** (Analgesic Pills)

## 4. Discussion

Among root coverage surgical methods, the coronally advanced flap technique remains predominant in clinical application.[3] On the contrary sub-epithelial connective tissue graft (SCTG) introduced by Langer and Langer in 1985 has been proposed as "Gold standard". Because of its predictable esthetic results. But it has a greater disadvantage of a second donor surgical site and increased patient discomfort. Platelet rich membranes with CAF were used for the treatment of gingival recession in many studies.[3,6,7] Platelets harbor multiple growth factors and cytokines crucial for modulating inflammatory responses and facilitating tissue repair processes. Autologous PRF is free of any hypersensitive reaction as well as economic when treatment cost is concerned.

In view of the above facts present study evaluated the 9-month outcomes of the CAF+PRF and SCTG techniques. The results demonstrate that both CAF+PRF and SCTG techniques are effective treatment methods for gingival recession. A mean root coverage of 86% was obtained at control side after 9 months and is found to be well within the limits of the studies done by Eren and Atilla[7] and Jepsen et al.8 who obtained root coverage of 94.2% and 72% respectively. On the other hand, the test side showed mean root coverage of 56.67% after 9 months compared to 80.7% on the study by Aroca et al.[3] 76.63% by Tunali et al.[9] and 77.12% by Oncu.[10] Discrepancies in baseline recession depths compared to prior research may account for these outcomes. A potential factor in the test group's reduced root coverage could involve PRF's interference with collateral circulation, critical for revascularizing delicate flaps during healing.[11]

Consistent with existing literature, both test and control groups exhibited gingival thickening.[7] This enhancement likely stems from PRF-derived growth factors stimulating fibroblast proliferation or the membrane's physical spacer effect.

In the present study no significant improvement in KTW was noted in the test side after 9 months which is in agreement with the study by Aroca et al.[3] This is in contrary to studies with CAF alone[12] or CAF-PRP combination.[7] But the control side showed a significant improvement in KTW (2.80 ±1.55 at baseline to 3.60±1.71 after 9 months). Keratinized tissue width expansion on control sides potentially reflects palatal graft's capacity to promote epithelial keratinization.

In the case of PD and CAL, there was no significant difference between the two sides at 9 months. But Aroca et al[3] and Eren and Atilla[7] showed no significant difference between the two groups at 6 months for PD, but a significant CAL gain in favour of the control group was observed at that time.

In the present study there was an enhanced wound healing associated with PRF group which is in agreement with a 6 month randomised contolled trial done by Jankovic et al.[13] HI improvements in PRF-treated areas correlate with bioactive components, particularly platelet derived growth factors, vascular endothelial growth factors and transforming growth factors enhancing tissue regeneration.[14] The effect on HI achieved in the test side is directly correlated with decreased patient discomfort. VAS score also shows significant difference in 1 and 2 weeks follow up in favour of test side.

Esthetic outcome measurement of both sides showed improved esthetics with mean RES of 8.20 ±1.75 for control side and 7.6 ±1.26 for test side. Inter-group analysis showed no statistical difference between two sides. Subject level analysis showed that control side of 8 patients and test side of 5 patients showed the highest RES (10 points), demonstrating a perfect reconstruction of the treated area. Cairo et al evaluated RES system by examining 31 recession defects treated by various surgical procedures with mean RES 7.8.[5]

In a recent systematic review a statistically significant difference between the SCTG and PRF groups was found only in the case of keratinized mucosa. However, gingival recession, clinical attachment level, and probing depth parameters in the PRF group were found to be statistically equal to those of the SCTG group (the gold standard) ($p \geq 0.05$) which is in agreement with the present study.[15]

Strength of this study includes 1) it is a split mouth study with control and test sites are on the same patient, 2) test side is compared to a gold standard as control 3) only bilateral localized class I and II recession defects are used for this study and 4) each clinical variable was measured by two examiners reducing individual variations. Limitations of the study is that 1) it is a non-randomized controlled trial with small sample size, 2) examiners are not masked about the procedure except for those examining esthetic outcome; increasing the risk for bias, 3) used conventional armamentarium rather than a microsurgical unit for the surgical procedure and 4) Notably, histological examination was not conducted in this study to assess the regenerative potential of PRF on denuded root surfaces. The aforementioned limitations are critical to a comprehensive understanding of the test material PRF, underscoring the need for further research to address these knowledge gaps.

Within the limitations of this study coronally advanced flap with PRF can be considered as an alternative to sub-epithelial connective tissue graft for the treatment of gingival recession with the additional advantages of no second donor surgical site, minimal post-operative discomfort, rapid healing and comparable esthetics to the gold standard.

## 5. Conclusion

From the present study it is clear that both CAF+PRF and SCTG techniques are effective procedures in the treatment of localized gingival recessions. PRF mimics SCTG functionality, serving as a bioactive scaffold that enables gingival recession treatment while eliminating donor site morbidity. While certain aspects of the histologic and long-term clinical performance of PRF remain unclear, its less invasive nature makes it a promising area for further investigation through additional clinical case-control studies.

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## 7. Conflict of Interest

The authors declared that there is no conflict of interest.

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