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Clinical Evaluation of Advanced Platelet-Rich Fibrin as an Adjunct to Scaling and Root Planning: A Split-Mouth Study

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Abstract: Advanced Platelet-Rich Fibrin (A-PRF) is a next-generation platelet concentrate prepared without biochemical manipulation and enriched with platelets, leukocytes, and growth factors to enhance periodontal healing and regeneration. This split-mouth randomized clinical trial evaluated the adjunctive efficacy of subgingival A-PRF combined with scaling and root planing (SRP) versus SRP alone in patients with chronic periodontitis. 15 systemically healthy subjects with contralateral quadrants exhibiting deep periodontal pockets were enrolled. Each subject served as their own control: Group 1 received conventional SRP (control), while Group 2 received SRP plus subgingival A-PRF application (test). Plaque Index (PI), Probing Pocket Depth (PPD), and Clinical Attachment Level (CAL) were measured at baseline and at three months. Baseline mean PPD and CAL values were comparable between the test (4.36 mm) and control (4.30 mm) groups. At three months, significant improvement occurred in both. The test group achieved a mean PPD and CAL of 2.27 mm (mean reduction = 2.09 mm), while the control improved to 3.93 mm (mean reduction = 0.36 mm). Subgingival application of A-PRF as an adjunct to SRP significantly enhances periodontal pocket reduction and clinical attachment gain compared to SRP alone. These findings indicate that A-PRF is an effective adjunctive therapy in managing chronic periodontitis.

Keywords: chronic periodontitis; advanced platelet rich fibrin; scaling and root planning; probing pocket depth; clinical attachment level.

1. Introduction

Biofilm and the host's immunoinflammatory response interact to cause periodontitis, an inflammatory disease that alters bone and connective tissue homeostasis. The destruction of the periodontal ligament, attachment loss, pocket formation, and bone loss mark it. Scaling and root planing (SRP), a standard non-surgical periodontal intervention, aims to halt disease progression by eliminating soft and hard deposits from root surfaces. Clinical studies have demonstrated that SRP significantly reduces probing depths and enhances clinical attachment levels, thereby improving periodontal health outcomes. Besides scaling and root planning, other non-surgical adjunctive therapies, such as laser therapy, platelet concentrates, herbal compositions, and antimicrobial agents, can enhance the therapeutic results of periodontal treatment [1-5].

Platelet-rich fibrin (PRF) is a second-generation autologous platelet concentrate derived from patient's own blood without chemical additives or anticoagulants. It gradually releases an array of cytokines, growth factors, and cells over time. The growth factors involved facilitate wound healing and tissue regeneration [6,7].

In 2014, Advanced platelet-rich fibrin (A-PRF) was the result of Choukroun *et al*. [8] modification. An increased tensile blood clot enriched with growth factors, as well as a scaffold of fibrin matrix, platelets, leukocytes, and stem cells that interact synergistically, is produced by reduced centrifuge speed and extended centrifugation duration. A-PRF obtained using the experimental low-force modified technique serves as an optimal source of leukocytes that directly stimulate the release of chemokines and growth factors, thereby promoting periodontal regeneration by enhancing bone height, reducing attachment loss, and decreasing probing depth [8-12]. Therefore, the aim of the present study was to clinically assess outcomes at 3 months following subgingival application of advanced platelet-rich fibrin as an adjuvant to conventional scaling and root planing.

2. Materials and Methods

The study employed a randomized controlled split-mouth clinical trial design with a three-month follow-up. Fifteen systemically healthy patients diagnosed with mild to moderate periodontitis were recruited from the Department of Periodontology at Rajarajeswari Dental College and Hospital in Bangalore during the period September 2023 to June 2024. Baseline periodontal examination confirmed the diagnosis, and those fulfilling the inclusion criteria, each presenting with two contralateral pockets of 4 to 6 mm depth, were enrolled after providing written informed consent. The study protocol (RRDCH/IEC/2023/79) was approved by the Institutional Ethics Committee on 17 August 2023, and the trial was conducted in accordance with the Declaration of Helsinki (1975, revised 2013).

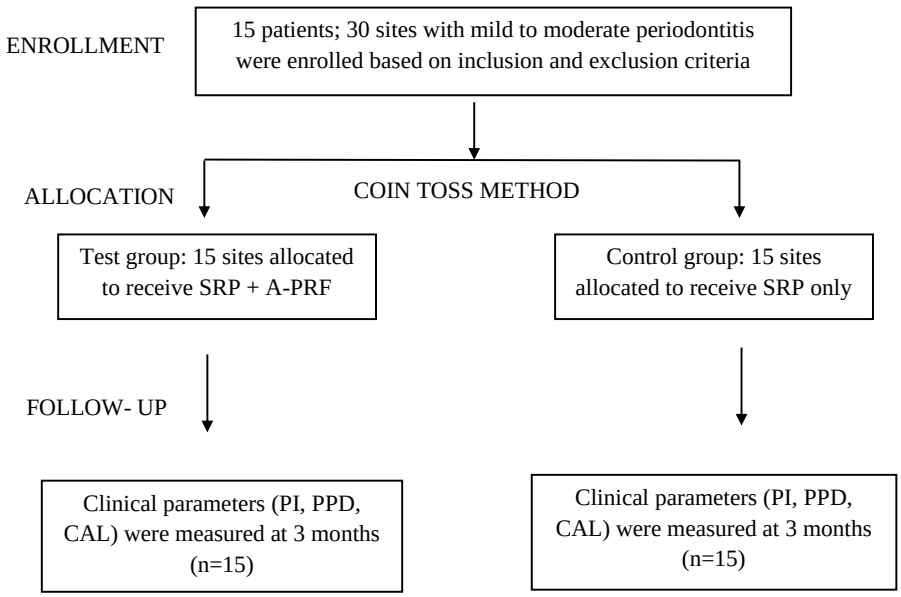

Figure 1. The number of participants, the defect sites, and the treatment protocol.

Treatment allocation between the two contralateral sites was achieved by simple randomization using a coin toss, with heads or tails assigning the test intervention to the right or left pocket with equal probability. This method aimed to ensure unbiased assignment of treatment at the site level. Only the study participants were blinded to the allocation,

constituting a single blind design; the examiner assessing clinical outcomes, Plaque Index, Probing Pocket Depth, and Clinical Attachment Level, was aware of which site received which intervention. Exclusion criteria included receipt of periodontal therapy within the previous three months, pregnancy or lactation, current smoking, and use of dental prosthesis. A CONSORT flow diagram illustrating participant recruitment, site-level allocation, follow-up, and the treatment protocol is presented in Figure 1.

2.1. Clinical intervention.

Two quadrants exhibiting contralateral deep periodontal pockets in each subject were selected and divided into a control group and a test group. The control sites received scaling and root planing only, while the test sites underwent SRP in conjunction with subgingival application of A-PRF (Figure 2). SRP was performed to eliminate supragingival and subgingival plaque and calculus using an ultrasonic scaler and curettes. Following SRP, the pockets were irrigated with a saline solution.

Advanced Platelet-Rich Fibrin membranes were prepared using a protocol of 1500 RPM for 14 minutes (RCF-max = 208 g). A-PRF membranes were produced using 10-mL glass tubes in a Duo Quattro centrifugation device with a 40° rotor angulation and a radius of 88 mm at the clot and 110 mm at the maximum. A fibrin clot formed in the center of the tube between the red blood cells (RBCs) at the base and the plasma at the top. The fibrin clot was then separated from the red blood cells using tweezers and surgical scissors and promptly placed in a sterile PRF box. The PRF was gently compressed for 10 minutes to reduce its thickness to 1 mm. The prepared PRF membranes were inserted into the base of the periodontal pocket, extending to the marginal gingiva to fill the defect (Figure 3).

.In order to prevent mechanical trauma and potential disturbance of the A-PRF from the periodontal pocket, participants were advised to refrain from toothbrushing on the first post-operative day. Tooth brushing was resumed the following day. Oral hygiene instructions were reinforced at each follow-up visit, tailored to each patient's needs. Periodontal clinical parameters were reevaluated after a period of three months (Figure 4).

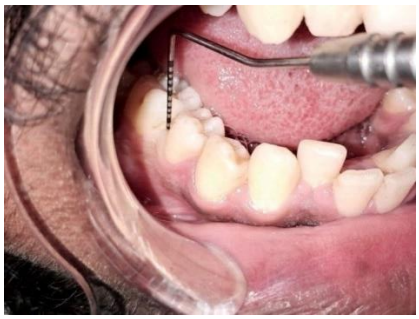

Figure 2. Pre-operative image showing a 4 mm probing pocket depth on the treatment site.

Figure 3. Subgingival application of Advanced platelet fibrin on the test site.

Figure 4. Post-operative image at 3 months follow-up period showing 3mm of probing pocket depth.

3. Results and Discussion

Statistical analyses were conducted using IBM SPSS Statistics for Windows (version 25.0; IBM Corp., Armonk, NY). Continuous variables are presented as mean ± standard deviation (SD). For comparisons between groups, the Wilcoxon signed-rank test was applied. Similarly, pre- and postoperative values within each group were compared using the Wilcoxon signed-rank test. A two-tailed p-value of less than 0.05 was considered statistically significant.

3.1. Probing pocket depth.

The clinical parameter probing pocket depth demonstrated a statistically significant reduction in both the test and control groups at the 3-month follow-up ($p = 0.001$*). Baseline measurements revealed a mean PPD of 4.36 ± 0.15 mm in the advanced platelet-rich fibrin (A-PRF) group, compared to 4.30 ± 0.09 mm in the control cohort. At 3 months, PPD had decreased to 2.27 ± 0.16 mm in the A-PRF group versus 3.93 ± 0.11 mm in controls. Intragroup comparisons from baseline to 3 months indicated a substantial reduction in both groups (Table 1)

Table 1. Comparison of probing pocket depth between the two groups at baseline and at 3 months.

	Groups	**Pre-op** (Mean±SD)	**Post-op** (Mean±SD)	**P value**	**Difference (Pre-Post)**
Probing Pocket depth	Scaling and root planing (n=15)	4.30±0.09	3.93±0.11	0.001*	0.36±0.06
	Scaling and root planing + Advanced platelet-rich fibrin (n=15)	4.36±0.15	2.27±0.16	0.001*	2.09±0.27
P value		0.154	0.001*		0.001*

* p<0.05, statistically significant

3.2. Plaque index.

Mean plaque index in the control group significantly decreased from 1.47 ± 0.19 at baseline to 0.35 ± 0.09 at 3 months ($p = 0.001$), with the test group showing an identical reduction of 1.11 ± 0.18. Despite these significant within-group improvements, between-group comparisons at baseline, post-operative assessment, and in net change did not yield marked differences (Table 2).

Table 2. Comparison of plaque index between the two groups at baseline and at 3 months.

	Groups	**Pre-op** (Mean±SD)	**Post-op** (Mean±SD)	**P value**	**Difference (Pre-Post)**
Plaque Index	Scaling and root planing (n=15)	1.47±0.19	0.35±0.09	0.001*	1.11±0.18
	Scaling and root planing + Advanced platelet-rich fibrin (n=15)	1.47±0.19	0.35±0.09	0.001*	1.11±0.18
P value		0.99	0.99	-	0.99

* p<0.05, statistically significant

3.3. Clinical attachment level.

Clinical attachment level decreased significantly within both the control and advanced platelet-rich fibrin test groups from baseline to three months ($p < 0.05$). In the control group, mean CAL decreased from 4.30 ± 0.09 mm to 3.93 ± 0.11 mm, while in the test group it decreased from 4.36 ± 0.15 mm to 2.27 ± 0.16 mm. Between-group comparisons at both baseline and the 3-month follow-up revealed no marked differences ($p > 0.05$; Table 3).

Table 3. Comparison of Clinical Attachment Level between the two groups at baseline and at 3 months.

	Groups	**Pre-op** (Mean±SD)	**Post-op** (Mean±SD)	**P value**	**Difference (Pre-Post)**
Clinical Attachment Level	Scaling and root planing (n=15)	4.30±0.09	3.93±0.11	0.001*	0.36±0.06
	Scaling and root planing + Advanced platelet-rich fibrin (n=15)	4.36±0.15	2.27±0.16	0.001*	2.09±0.27
P value		0.154	0.001*		0.001*

* p<0.05, statistically significant

This study assessed the adjunctive effect of subgingival advanced platelet-rich fibrin combined with scaling and root planing on the management of chronic periodontitis. While both the test and control groups showed a significant reduction in plaque index following treatment ($P = 0.001$), no additional benefit was observed with the inclusion of A-PRF in plaque control ($P = 0.99$). However, the A-PRF group demonstrated significantly greater improvements in probing pocket depth and clinical attachment level compared to SRP alone ($P = 0.001$), with mean reductions of 2.09 ± 0.27 mm and 0.36 ± 0.06 mm, respectively. These findings indicate that A-PRF, when used as an adjunct to SRP, significantly enhances periodontal healing and results in superior clinical outcomes over a 3-month period, as observed in a small sample. The incorporation of A-PRF appears to be a promising non-surgical approach for improving soft tissue regeneration in patients with chronic periodontitis. Radiographs were not included due to the shallow 4-6 mm pockets and short-term follow-up.

Advanced Platelet-Rich Fibrin offers a significant advantage in non-surgical periodontal therapy due to its ability to enhance soft tissue healing without the need for invasive procedures. When used alongside scaling and root planing, A-PRF serves as a bioactive scaffold that promotes tissue regeneration and modulates the inflammatory response. This combined approach is particularly effective in managing moderate to severe periodontitis, where SRP alone may be insufficient to achieve optimal regenerative outcomes.

The results of this study were compared with those of studies employing PRF through both non-surgical and surgical methods, revealing significant similarities in findings. Özcan *et al.*[4] determined that the combination of scaling and root planing with platelet-rich fibrin therapy yielded an average probing pocket depth of 2.57 ± 0.75 mm after three months. Additional research by Al-Rihaymee S *et al.*[7], Parwani *et al.*[19], Niemczyk W *et al.*[20], Narendran N *et al.*[21], and Albonni H *et al.* [22], revealed markedly improved clinical outcomes, encompassing accelerated healing, diminished probing pocket depths, reduced clinical attachment loss, and limited gingival recession [9,19-22]. In contrast, Bajaj *et al.*[23], Tadepalli A *et al.*[24], Csifó-Nagy BK *et al.*[25], Salama M H *et al.*[26], Goswami A *et al.*[27], Dhopte A *et al.*[28], and Mlachkova A *et al.*[29] emphasize the exceptional and distinctive efficacy of A-PRF, PRF, and i-PRF in improving outcomes for both surgical and non-surgical interventions [23-29].

Numerous studies comparing PRF preparation using different tube types show that additive-free plain glass tubes yield larger, cleaner clots and avoid introducing external

contaminants, while silica-coated plastic tubes release significant amounts of silica microparticles into the PRF matrix, which readily adsorb onto cell membranes, generate reactive oxygen species, induce apoptosis, reduce cell proliferation and viability, and may provoke inflammatory reactions thereby impairing regenerative outcomes, claims that glass-coated plastic tubes are safe lack convincing evidence, as cytotoxicity from detachable silica microparticles remains a serious concern [30,31]. As a result, additive-free glass test tubes were used in this study for the preparation of A-PRF.

Although -PRF protocols have been foundational for over a decade, horizontal (swing-out) centrifugation now offers a superior method, achieving approximately 3–4-fold increase in platelet and leukocyte concentrations, more uniform cell separation, enhanced growth factor release, and significantly better antibacterial activity compared to fixed-angle systems. This makes it the preferred technique for producing both solid PRF and concentrated PRF (C-PRF). C-PRF, harvested from buffy coat–rich layers under optimized relative centrifugal force (RCF), delivers higher levels of key growth factors such as TGF-β, PDGF, and VEGF, thereby supporting improved cell migration, proliferation, and soft tissue augmentation. Meanwhile, injectable PRF (i-PRF), prepared using low-speed, short-duration centrifugation, remains in liquid form for approximately 10–15 minutes and allows for direct subgingival injection into periodontal pockets. A randomized clinical trial conducted by Çağıran Gürbüz T [34] reported significant reductions in probing depth and gains in clinical attachment, particularly in smokers, when used in combination with scaling and root planing, along with favorable changes in inflammatory markers and growth factor profiles in gingival crevicular fluid. Injection of i-PRF into periodontal pockets offers a minimally invasive, site-specific delivery approach with the potential for multiple applications, while membrane or clot forms of PRF provide scaffold support in surgical contexts [32-34].

This study had several limitations that should be considered when interpreting the results. Firstly, the sample size was relatively small, with only fifteen patients enrolled, which may limit the generalizability of the findings to a broader population. Secondly, the follow-up period was restricted to three months, making it difficult to assess the long-term stability and sustainability of the observed clinical improvements. Additionally, the study did not include any radiographic evaluation, thereby limiting the ability to detect changes in alveolar bone levels or other subclinical periodontal alterations. Another limitation was the single-anonymized design, in which only the participants were blinded to treatment allocation, while the examiner was aware of the interventions. This could introduce observer bias in the measurement of clinical parameters. Future studies with larger sample sizes, longer follow-up durations, standardized radiographic assessments, and double-anonymized designs are recommended to validate and extend these findings.

4. Conclusions

The adjunctive use of A-PRF with scaling and root planing has proven to be an effective non-surgical treatment for mild to moderate periodontitis, with both treatment arms showing significant improvements in key clinical parameters such as probing pocket depth and clinical attachment level. However, validation through larger-scale longitudinal trials, including standardized radiographic assessments, is needed to confirm the durability and broader applicability of these outcomes.

Author Contributions

Conceptualization – R.K., A.P.J., N.J.; Methodology – R.K., A.P.J.; Software – A.P.J., N.J.; Validation – R.K., A.P.J., N.J.; Formal analysis – R.K., A.P.J.; Investigation – A.P.J., N.J.; Resources – R.K., A.P.J., N.J.; Data curation – R.K., N.J.; Writing – original draft – R.K., A.P.J., N.J.; Writing – review & editing – R.K., A.P.J., N.J.; Visualization – R.K., A.P.J., N.J.; Supervision – R.K., N.J.; Project administration – R.K., A.P.J., N.J. All authors must confirm their agreement with the contribution statement before submission.

Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki and approved by the Institutional Ethics Committee of RAJARAJESWARI DENTAL COLLEGE AND HOSPITAL (Approval No. RRDCH/IEC/2023/79 and approved on 17/08/2023).

Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

Data supporting the findings of this study are available upon reasonable request from the corresponding author.

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Conflicts of Interest

The authors declare no conflict of interest.

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