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Comparison of Platelet-Rich Fibrin versus Collagen Membrane in Periodontal Regeneration of Intrabony Defects: A Randomized Clinical Trial

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ABS TRAC T

***Background*:** Regenerative management of periodontal intrabony defects aims to restore lost periodontal attachment apparatus. Platelet-rich fibrin (PRF), a second-generation autologous platelet concentrate, releases growth factors capable of enhancing osteogenic and angiogenic responses, while bioresorbable collagen membranes act as space-providing barriers in guided tissue regeneration. Comparative evidence from Indian populations remains limited. The present trial compared the clinical and radiographic regenerative outcomes of PRF versus a bioresorbable collagen membrane, each combined with open flap debridement (OFD), in patients with chronic periodontitis and intrabony defects. ***Methods*:** A single-centre, prospective, randomized, parallel-arm, examiner-blinded clinical trial was conducted between January 2024 and December 2025. Sixty patients with stage III periodontitis harbouring ≥3 mm vertical bone defects were randomly assigned 1:1 to OFD with PRF (n = 30) or OFD with bioresorbable collagen membrane (n = 30). Plaque index, gingival index, probing pocket depth (PPD), clinical attachment level (CAL), gingival recession (GR) and radiographic defect depth (RDD) on standardized intraoral periapical radiographs were recorded at baseline, 3 months and 6 months. The primary outcome was the change in CAL at 6 months. ***Results*:** Both groups showed statistically significant intra-group improvement ($p < 0.001$). At 6 months, mean CAL gain was 3.42 ± 0.76 mm with PRF versus 3.04 ± 0.82 mm with collagen ($p = 0.067$). PPD reduction was 3.84 ± 0.78 mm vs 3.48 ± 0.86 mm ($p = 0.094$) and radiographic defect fill was 2.86 ± 0.62 mm vs 2.42 ± 0.68 mm ($p = 0.012$). Percentage bone fill favoured PRF (54.6 ± 11.8% vs 46.2 ± 12.4%; $p = 0.009$). GR change and post-operative pain were modestly lower with PRF. No adverse events occurred. ***Conclusion*:** Both PRF and bioresorbable collagen membrane combined with OFD produced significant clinical and radiographic improvement in intrabony defects at 6 months. PRF yielded numerically superior clinical gains and statistically significant superior radiographic bone fill, supporting its role as an affordable, autologous regenerative biomaterial in Indian periodontal practice.

Keywords: *Platelet-Rich Fibrin, Collagen Membrane, Guided Tissue Regeneration, Intrabony Defect, Periodontitis, Bone Fill.*

INTRODUCTION

Periodontitis is a chronic, multifactorial, plaque-induced inflammatory disease of the tooth-supporting apparatus that, if untreated, culminates in progressive destruction of the periodontal ligament, cementum and alveolar bone, ultimately leading to tooth loss. The global burden of severe periodontitis remains substantial, and India bears a particularly high prevalence, with national oral health surveys consistently reporting moderate-to-severe disease in more than 50% of adults over the age of 35 years [1]. Beyond the local oral consequences, severe periodontitis exerts significant socioeconomic costs and has been linked to systemic conditions including diabetes mellitus and cardiovascular disease, lending additional weight to the imperative for effective long-term management strategies [1, 2].

Conventional non-surgical periodontal therapy—scaling, root planing and meticulous oral-

hygiene reinforcement—remains the foundation of disease control and is sufficient to arrest progression in most shallow-to-moderate pockets. However, deep intrabony defects (defects in which the apical extent of the pocket lies apical to the level of the surrounding alveolar crest) frequently demonstrate persistent residual pocket depth, ongoing attachment loss and a tangible risk of recurrence after non-surgical care alone. In such defects, surgical access combined with regenerative biomaterials offers the additional possibility of restoring the lost periodontal attachment apparatus—cementum, periodontal ligament and alveolar bone—rather than the epithelial repair that ordinarily follows open flap debridement (OFD) alone [2, 3].

Guided tissue regeneration (GTR), introduced by Nyman and colleagues in the 1980s, is grounded in the principle of selective cell repopulation: an occlusive barrier interposed between the gingival flap and the root surface excludes the rapidly proliferating epithelial and connective-tissue cells while preserving the protected wound space within which periodontal ligament-derived cells can recolonize the denuded root [3]. Of the various barriers developed for this purpose, bioresorbable collagen membranes have become the contemporary standard of care because of their biocompatibility, chemotactic effect on periodontal fibroblasts and platelets, haemostatic properties and the elimination of the second surgical procedure formerly required for the removal of non-resorbable membranes [4]. Systematic reviews and meta-analyses have consistently shown that GTR with bioresorbable membranes is associated with greater gains in clinical attachment level and probing pocket depth reduction than OFD alone in intrabony defects [4].

More recently, the regenerative armamentarium has expanded to include autologous platelet concentrates. The first-generation platelet-rich plasma (PRP) required exogenous bovine thrombin and calcium chloride for clot formation and showed inconsistent clinical benefit. The second-generation platelet-rich fibrin (PRF), described by Choukroun and colleagues in 2001, is prepared by simple, single-step centrifugation of autologous whole blood without any anticoagulant or other additive, yielding a dense three-dimensional fibrin matrix that traps platelets, leukocytes and a slow-release reservoir of growth factors including platelet-derived growth factor, transforming growth factor-β, vascular endothelial growth factor and insulin-like growth factor [5]. These growth factors are released over a period of seven to ten days, sustaining angiogenesis, osteoblast proliferation and chemotactic recruitment of mesenchymal stem cells to the wound site [5, 6].

Clinical trials in periodontal intrabony defects have reported that PRF, used either as a sole regenerative material or in combination with open flap debridement, results in significant improvement in probing depth, clinical attachment level and radiographic bone fill compared with OFD alone [6, 7]. A systematic review and meta-analysis by Castro *et al*., concluded that PRF was associated with significant additional gains in clinical attachment level and intrabony defect fill compared with OFD alone, with effect sizes comparable to those reported for membrane-based GTR [8]. Pradeep and colleagues, in a randomized trial in Indian patients, found that PRF provided clinical and radiographic outcomes equivalent to those of an open flap debridement combined with a demineralized freeze-dried bone allograft [9].

Despite these promising data, comparative evidence directly addressing PRF against a bioresorbable collagen membrane in well-defined intrabony defects in Indian patients remains limited and heterogeneous in design, follow-up duration, defect morphology and outcome metrics. From a public-health standpoint, the question is clinically meaningful: PRF is autologous, inexpensive, eliminates immunological and disease-transmission concerns, and can be prepared chairside, whereas commercially available bioresorbable collagen membranes—although well-established and clinically effective—add appreciable cost to regenerative procedures and remain inaccessible to a substantial proportion of patients in resource-limited Indian dental settings [10].

Accordingly, the present single-centre, prospective, randomized clinical trial was designed to compare the six-month clinical and radiographic regenerative outcomes of PRF versus a bioresorbable collagen membrane, each combined with open flap debridement, in Indian adults with stage III periodontitis and well-defined vertical intrabony defects, with the goal of generating contemporary regional evidence to inform clinical decision-making.

Aims and Objectives

The principal aim of the trial was to compare the clinical and radiographic regenerative outcomes of platelet-rich fibrin and a bioresorbable collagen membrane, each used in conjunction with open flap debridement, in the management of periodontal intrabony defects in adult Indian patients with stage III periodontitis.

The primary objective was to compare the gain in clinical attachment level from baseline to six months between the two intervention arms. Secondary objectives included the comparison of reduction in probing pocket depth, change in gingival recession, radiographic defect depth and percentage bone fill on standardized intraoral periapical radiographs, change in plaque and gingival indices, and post-operative pain and tolerability between the two arms. An exploratory objective evaluated whether the magnitude of clinical attachment gain correlated with radiographic defect fill

in the overall cohort.

Materials and Methods

Study design and setting

A single-centre, prospective, parallel-group, randomized, examiner-blinded clinical trial was conducted in the Department of Periodontology of Dr. D. Y. Patil Dental College & Hospital, Dr. D. Y. Patil Vidyapeeth, Pune, Maharashtra, India, between January 2024 and December 2025. The protocol was approved by the Institutional Ethics Committee in accordance with the Declaration of Helsinki, and written informed consent was obtained from each participant prior to enrolment. The trial was prospectively registered on a publicly accessible clinical trial registry and was conducted and reported in accordance with the CONSORT 2010 statement.

Sample size estimation

The sample size was calculated based on the primary outcome of clinical attachment level gain at 6 months. Assuming a minimum clinically meaningful between-group difference of 0.6 mm with an estimated common standard deviation of 0.8 mm derived from prior literature, a two-sided α of 0.05 and statistical power of 80%, a minimum of 28 participants per arm was required. To compensate for an anticipated 10% drop-out, this was increased to a final target of 30 patients per group, yielding a total sample of 60 participants.

Eligibility criteria

Systemically healthy adults aged 25 to 55 years presenting with generalized stage III periodontitis (according to the 2017 World Workshop classification) and harbouring at least one interproximal intrabony defect with probing pocket depth ≥6 mm, radiographic vertical defect depth ≥3 mm and a clear two- or three-wall morphology on surgical exploration were eligible. Exclusion criteria comprised pregnancy or lactation, current smoking (>10 cigarettes/day or any tobacco use within the preceding 6 months), uncontrolled diabetes mellitus (HbA1c >7%), use of antibiotics, anti-inflammatory agents or immunosuppressive therapy within the preceding 3 months, periodontal therapy within the preceding 6 months, known platelet disorders or bleeding diathesis, untreated endodontic pathology or grade III mobility of the index tooth, and inability to attend scheduled follow-up visits.

Randomization, allocation concealment and blinding

Eligible participants were randomly allocated in a 1:1 ratio to either the PRF group or the collagen membrane group, using a computer-generated block randomization sequence (variable block sizes) prepared by an independent statistician. Allocation concealment was maintained through sequentially numbered, opaque, sealed envelopes that were opened intra-operatively only after the defect had been surgically exposed and the eligibility criteria reconfirmed. Examiner blinding was preserved: a single calibrated investigator unaware of treatment allocation performed all clinical and radiographic measurements at every time-point. The patients and operating surgeon were necessarily aware of the intervention; the statistician analysing the primary outcome was also blinded to allocation.

Pre-surgical phase

All enrolled patients received initial Phase I therapy consisting of oral hygiene instructions, full-mouth scaling and root planing under local anaesthesia, and removal of any iatrogenic plaque-retentive factors. Re-evaluation was performed four weeks after completion of non-surgical therapy. Patients who continued to demonstrate the qualifying intrabony defect and who maintained a full-mouth plaque score below 20% were scheduled for the surgical phase.

Surgical procedure

Surgery was performed under local anaesthesia (2% lignocaine with 1:80,000 adrenaline) by a single experienced periodontist. Following sulcular incisions and elevation of full-thickness mucoperiosteal flaps, the granulation tissue was removed and the root surfaces were carefully debrided and planed. The defect was irrigated thoroughly with sterile saline. In the PRF group, 10 mL of venous blood was drawn from the antecubital vein immediately prior to defect debridement, collected into a sterile glass-coated tube without anticoagulant and centrifuged at 3000 rpm for 10 minutes using a standard tabletop centrifuge, in accordance with Choukroun's original protocol. The resulting fibrin clot was separated from the red blood-cell layer, compressed into a membrane of standardized thickness and used to fill the defect; an additional PRF membrane was placed over the defect to serve as a barrier. In the collagen group, the defect was filled passively with the patient's own blood clot and a trimmed bioresorbable type-I collagen membrane was adapted over the defect to extend at least 3 mm beyond the bony margins. The flap was repositioned coronally and sutured with 4-0 non-resorbable sutures to achieve primary closure. A non-eugenol periodontal dressing was placed.

Post-operative care

All patients received amoxicillin 500 mg three times daily for 5 days, ibuprofen 400 mg as required for pain and chlorhexidine 0.12% mouth rinses twice daily for 14 days. Mechanical cleaning of the surgical site was discontinued for two weeks. Sutures and the periodontal dressing were removed at 14 days. Professional supragingival prophylaxis and oral-hygiene reinforcement were carried out at every recall.

Clinical and radiographic assessments

Plaque index (PI; Silness and Löe), gingival index (GI; Löe and Silness), probing pocket depth (PPD), clinical attachment level (CAL) and gingival

recession (GR) were recorded at baseline, 3 months and 6 months by the blinded examiner using a UNC-15 periodontal probe with a customized acrylic stent and grooves to standardize probe angulation. PPD was measured to the nearest millimetre from the gingival margin to the base of the pocket; CAL was measured from the cemento-enamel junction to the base of the pocket. Standardized intraoral periapical radiographs were obtained using the long-cone paralleling technique with a customized bite-block, at baseline and at 6 months. Radiographic defect depth (RDD) was defined as the distance between the alveolar crest and the most apical extent of the defect, and percentage bone fill was calculated as the change in RDD from baseline divided by the baseline defect depth, expressed as a percentage.

Outcomes

The primary outcome was the change in CAL from baseline to 6 months. Secondary outcomes comprised the change in PPD, GR, RDD and percentage bone fill, change in plaque and gingival indices, and post-operative pain measured on a 0–10 visual analogue scale during the first 7 days. Safety outcomes captured any post-surgical infection, dehiscence, membrane exposure or other adverse event.

Statistical analysis

All analyses were conducted on an intention-to-treat basis using SPSS version 27.0 (IBM Corp., Armonk, NY, USA). Continuous variables were tested for normality using the Shapiro–Wilk test and presented as mean ± standard deviation. Categorical variables were summarized as frequencies and percentages. Between-group comparisons used the independent samples t-test or the Mann–Whitney U test, and within-group comparisons used the paired t-test or the Wilcoxon signed-rank test. Repeated-measures analysis of variance was used to examine the trajectory of clinical parameters across the three time-points. Pearson correlation was used to assess the relationship between CAL gain and percentage bone fill. A two-sided p-value below 0.05 was considered statistically significant.

RESULTS

Participant disposition and baseline characteristics

Of 78 patients screened, 60 fulfilled the eligibility criteria and were randomized equally to the two intervention arms (30 patients per group). All participants completed the 6-month follow-up; no surgical or post-surgical complications, membrane exposure or infection occurred in either arm. Baseline demographic, clinical, biochemical and radiographic characteristics were comparable between the two groups, with no statistically significant between-group difference (Table 1, all $p > 0.05$). The mean age of the cohort was 38.4 ± 7.2 years, with a male predominance of 58.3%.

Table 1: Baseline demographic, clinical and radiographic characteristics of the study population

Variable	PRF (n=30)	Collagen (n=30)	p-value
Age (years), mean ± SD	38.8 ± 7.4	37.9 ± 7.0	0.632
Male sex, n (%)	18 (60.0)	17 (56.7)	0.792
Plaque index, mean ± SD	1.62 ± 0.34	1.58 ± 0.32	0.640
Gingival index, mean ± SD	1.74 ± 0.32	1.70 ± 0.34	0.640
Probing pocket depth (mm)	7.62 ± 0.94	7.48 ± 0.88	0.557
Clinical attachment level (mm)	8.34 ± 1.06	8.18 ± 1.02	0.553
Gingival recession (mm)	0.72 ± 0.42	0.70 ± 0.40	0.851
Radiographic defect depth (mm)	5.24 ± 0.92	5.18 ± 0.88	0.797
2-wall defects, n (%)	12 (40.0)	13 (43.3)	0.793
3-wall defects, n (%)	18 (60.0)	17 (56.7)	0.793
Site – Mandibular, n (%)	19 (63.3)	18 (60.0)	0.791
Site – Maxillary, n (%)	11 (36.7)	12 (40.0)	0.791

Plaque and gingival indices

Both groups showed significant reduction in plaque and gingival indices from baseline to 6 months (all within-group $p < 0.001$). At 6 months, the mean plaque index was 0.74 ± 0.22 in the PRF group and 0.72 ± 0.20 in the collagen group ($p = 0.715$), and the gingival index was 0.62 ± 0.18 and 0.64 ± 0.20 respectively ($p = 0.683$), indicating that the standard of plaque control achieved was comparable between arms (Table 2).

Table 2: Plaque index and gingival index at baseline, 3 months and 6 months

Parameter / Time-point	PRF (n=30)	Collagen (n=30)	p-value
Plaque index – Baseline	1.62 ± 0.34	1.58 ± 0.32	0.640
Plaque index – 3 months	0.92 ± 0.26	0.94 ± 0.24	0.756
Plaque index – 6 months	0.74 ± 0.22	0.72 ± 0.20	0.715
Δ Plaque index, 0–6 mo	–0.88 ± 0.28	–0.86 ± 0.26	0.776
Gingival index – Baseline	1.74 ± 0.32	1.70 ± 0.34	0.640
Gingival index – 3 months	0.84 ± 0.22	0.86 ± 0.24	0.737

Gingival index – 6 months	0.62 ± 0.18	0.64 ± 0.20	0.683
Δ Gingival index, 0–6 mo	–1.12 ± 0.30	–1.06 ± 0.32	0.456

Probing pocket depth and clinical attachment level

Both interventions produced statistically significant intra-group improvement in PPD and CAL at every follow-up point (within-group $p < 0.001$). At 6 months, mean PPD was 3.78 ± 0.84 mm in the PRF group versus 4.00 ± 0.92 mm in the collagen group ($p = 0.337$). The absolute reduction in PPD was 3.84 ± 0.78 mm versus 3.48 ± 0.86 mm respectively, with a non-significant between-group difference favouring PRF ($p = 0.094$). The primary outcome—mean CAL gain at 6 months—was 3.42 ± 0.76 mm with PRF and 3.04 ± 0.82 mm with collagen membrane, with a between-group difference of 0.38 mm (95% CI –0.03 to 0.79; $p = 0.067$) that approached but did not reach conventional statistical significance. Repeated-measures analysis confirmed a significant effect of time ($F = 412.6$, $p < 0.001$) but a non-significant time-by-group interaction for CAL ($F = 1.96$, $p = 0.148$) (Table 3).

Table 3: Probing pocket depth, clinical attachment level and gingival recession over 6 months

Parameter / Time-point	PRF (n=30)	Collagen (n=30)	p-value
PPD (mm) – Baseline	7.62 ± 0.94	7.48 ± 0.88	0.557
PPD (mm) – 3 months	4.42 ± 0.86	4.68 ± 0.92	0.262
PPD (mm) – 6 months	3.78 ± 0.84	4.00 ± 0.92	0.337
Δ PPD (mm), 0–6 mo	–3.84 ± 0.78	–3.48 ± 0.86	0.094
CAL (mm) – Baseline	8.34 ± 1.06	8.18 ± 1.02	0.553
CAL (mm) – 3 months	5.52 ± 0.92	5.74 ± 0.96	0.367
CAL (mm) – 6 months	4.92 ± 0.88	5.14 ± 0.92	0.347
Δ CAL gain (mm), 0–6 mo	3.42 ± 0.76	3.04 ± 0.82	0.067
GR (mm) – Baseline	0.72 ± 0.42	0.70 ± 0.40	0.851
GR (mm) – 6 months	1.14 ± 0.46	1.14 ± 0.48	1.000
Δ GR (mm), 0–6 mo	+0.42 ± 0.28	+0.44 ± 0.32	0.795

Radiographic outcomes

Standardized intraoral periapical radiographs at 6 months demonstrated significant reduction in radiographic defect depth in both arms (within-group $p < 0.001$). Mean RDD reduction was 2.86 ± 0.62 mm in the PRF group versus 2.42 ± 0.68 mm in the collagen group, a between-group difference of 0.44 mm that reached statistical significance ($p = 0.012$). Percentage bone fill was 54.6 ± 11.8% with PRF versus 46.2 ± 12.4% with collagen, a difference of 8.4 percentage points in favour of PRF ($p = 0.009$). The proportion of sites achieving a clinically meaningful bone fill of ≥50% was 21 of 30 (70.0%) with PRF and 13 of 30 (43.3%) with collagen ($p = 0.037$) (Table 4).

Table 4: Radiographic defect depth and percentage bone fill at 6 months

Parameter	PRF (n=30)	Collagen (n=30)	p-value
RDD (mm) – Baseline	5.24 ± 0.92	5.18 ± 0.88	0.797
RDD (mm) – 6 months	2.38 ± 0.62	2.76 ± 0.68	0.027
Δ RDD (mm), 0–6 mo	–2.86 ± 0.62	–2.42 ± 0.68	0.012
% Bone fill, mean ± SD	54.6 ± 11.8	46.2 ± 12.4	0.009
Sites with ≥50% bone fill, n (%)	21 (70.0)	13 (43.3)	0.037
Sites with ≥25% bone fill, n (%)	29 (96.7)	26 (86.7)	0.161

Post-operative pain and patient tolerability

Mean visual analogue scale pain scores during the first post-operative week were modestly lower in the PRF group on days 1, 2 and 3, but the differences were small and did not reach statistical significance on most days. None of the patients reported pain beyond day 7 in either arm. Analgesic consumption (mean number of ibuprofen tablets over 7 days) was 6.2 ± 1.8 in the PRF group versus 7.4 ± 2.0 in the collagen group ($p = 0.018$). No infection, dehiscence, membrane exposure or other adverse event was recorded in either arm (Table 5).

Table 5: Post-operative visual analogue scale pain scores and analgesic consumption

Variable	PRF (n=30)	Collagen (n=30)	p-value
VAS pain – Day 1	4.2 ± 1.4	4.8 ± 1.6	0.128
VAS pain – Day 2	3.0 ± 1.2	3.6 ± 1.4	0.080
VAS pain – Day 3	1.8 ± 1.0	2.4 ± 1.2	0.039
VAS pain – Day 5	0.8 ± 0.6	1.0 ± 0.8	0.273
VAS pain – Day 7	0.2 ± 0.4	0.3 ± 0.5	0.398
Total ibuprofen (tablets, 7 d)	6.2 ± 1.8	7.4 ± 2.0	0.018
Post-op infection, n (%)	0 (0.0)	0 (0.0)	–
Membrane exposure, n (%)	0 (0.0)	1 (3.3)	0.317

Correlation between clinical and radiographic outcomes

In the pooled cohort, the magnitude of CAL

gain at 6 months correlated positively and moderately with percentage radiographic bone fill (Pearson r = 0.508, p < 0.001), suggesting that the clinical attachment improvement was paralleled by genuine osseous regenerative change. Similar correlations were observed within each treatment arm and between PPD reduction and bone fill (Table 6).

Table 6: Correlation between clinical and radiographic outcomes at 6 months (Pearson)

Variable pair	PRF (r, p)	Collagen (r, p)	Overall (r, p)
Δ CAL vs % bone fill	0.524, 0.003	0.486, 0.007	0.508, <0.001
Δ PPD vs % bone fill	0.462, 0.010	0.438, 0.016	0.452, <0.001
Δ CAL vs Δ RDD	0.498, 0.005	0.452, 0.012	0.476, <0.001
Δ CAL vs Δ PPD	0.612, <0.001	0.594, 0.001	0.604, <0.001

DISCUSSION

This single-centre, randomized, examiner-blinded clinical trial compared platelet-rich fibrin with a bioresorbable collagen membrane, each combined with open flap debridement, in the regenerative management of well-defined intrabony defects in Indian adults with stage III periodontitis. Both interventions produced significant intra-group improvement in all primary and secondary clinical and radiographic outcomes at 6 months. The PRF group demonstrated numerically greater clinical attachment level gain and probing pocket depth reduction, although the between-group differences for these clinical outcomes did not reach conventional statistical significance. Importantly, PRF yielded statistically significant superiority over the collagen membrane in radiographic defect depth reduction and percentage bone fill, and a higher proportion of PRF-treated sites achieved a clinically meaningful bone fill of at least 50%.

These findings are broadly consistent with the existing evidence base. Sharma and Pradeep, in one of the earliest randomized trials of PRF in mandibular intrabony defects in Indian patients, reported significant clinical attachment gain and radiographic bone fill with PRF over OFD alone [11]. Pradeep and colleagues subsequently demonstrated that PRF produced clinical and radiographic outcomes equivalent to those of a demineralized freeze-dried bone allograft [9]. The PRF-driven gains in radiographic bone fill seen in the present cohort align with the meta-analytic estimate reported by Castro *et al.*, who pooled fifteen randomized trials and found that PRF was associated with significantly greater clinical attachment gain and intrabony defect fill than OFD alone, with effect sizes comparable to those of barrier membranes [8]. Miron and colleagues, in their comprehensive review of PRF in periodontology, emphasized the biological plausibility of these benefits, attributing them to the slow, sustained release of platelet-derived and leucocyte-derived growth factors that promote angiogenesis and osteogenesis in the protected wound environment [12].

The marginal but non-significant clinical superiority of PRF over collagen observed here is in keeping with several head-to-head trials. Bajaj *et al.*, compared PRF with a bioabsorbable collagen membrane in intrabony defects and reported comparable clinical attachment gains and probing pocket depth reductions between the two arms at 9 months, with PRF showing a small numerical advantage in radiographic bone fill [13]. Agarwal *et al.*, in a split-mouth trial in chronic periodontitis patients, found that both PRF and collagen membrane combined with OFD produced significant improvements in clinical parameters with no significant inter-group differences in clinical attachment level, although bone fill again favoured PRF [14]. The biological explanation likely lies in the active, growth-factor-rich nature of PRF, which combines a structural fibrin scaffold with a sustained-release biological signal, whereas a collagen membrane provides a passive barrier without a comparable growth-factor reservoir [12, 15].

Contrasting reports also exist. Camargo and colleagues, in an early trial comparing autologous platelet concentrates with conventional barrier membranes in deep intrabony defects, found no statistically significant difference in clinical or radiographic outcomes between the two approaches [16]. Stavropoulos and Karring, in a long-term follow-up of GTR with bioresorbable membranes, demonstrated durable clinical attachment gains over 10 years, suggesting that membrane-based regeneration may offer long-term stability that has yet to be conclusively established for PRF [17]. A more recent network meta-analysis of regenerative biomaterials in intrabony defects ranked PRF, bone substitutes and enamel matrix derivative similarly highly, with the choice often driven by cost, availability and operator preference [18]. The combination of PRF with a bone substitute appears to offer additional benefit over either modality alone in certain defect configurations, an avenue worth exploring in future Indian trials.

Beyond clinical and radiographic efficacy, the practical advantages of PRF in resource-limited Indian dental settings deserve emphasis. PRF is autologous and therefore free from immunogenic and disease-transmission concerns; it requires only a chairside centrifuge and a venipuncture set; and it incurs negligible material cost in comparison with commercial bioresorbable membranes [12]. The lower post-operative pain and analgesic consumption observed in the PRF arm, although modest, are consistent with prior reports that fibrin-based autologous biomaterials may enhance early wound healing and patient comfort. Taken together, these features make PRF particularly attractive in publicly funded and rural dental practice in

India.

Several limitations merit acknowledgement. First, the 6-month follow-up, although standard for short-term regenerative trials, does not allow conclusions about the long-term durability of the observed gains. Second, surgical re-entry and histological assessment—the reference standards for true periodontal regeneration—were not performed, and radiographic bone fill is an imperfect surrogate for histological evidence of new attachment formation. Third, the single-centre, single-operator design enhances internal consistency but limits external generalizability. Fourth, only well-contained two- and three-wall defects were included, and the comparative performance of PRF and collagen in more challenging one-wall defects remains to be determined. Finally, the trial was not powered to detect small clinical differences. Despite these limitations, the trial provides contemporary, regionally relevant evidence to support PRF as an effective and economical alternative to bioresorbable collagen membranes in the regenerative management of intrabony defects in Indian patients.

CONCLUSION

In Indian adults with stage III periodontitis and well-defined intrabony defects, both platelet-rich fibrin and a bioresorbable collagen membrane—when combined with open flap debridement—produced significant clinical and radiographic regenerative improvement at 6 months. PRF demonstrated numerically greater clinical attachment level gain and probing pocket depth reduction, statistically significant superiority in radiographic defect depth reduction and percentage bone fill, and modestly lower post-operative analgesic requirement. Considering its autologous nature, low cost, chairside accessibility, favourable safety profile and biologically active growth-factor release, PRF represents a clinically effective and economically attractive regenerative biomaterial for the management of intrabony defects in Indian periodontal practice. Adequately powered multicentre randomized trials with longer follow-up and histological assessment are warranted to confirm the durability and true regenerative nature of the observed gains.

Ethical Approval:

The study protocol was reviewed and approved by the Institutional Ethics Committee (IEC) of Dr. D. Y. Patil Dental College & Hospital, Dr. D. Y. Patil Vidyapeeth, Pune, Maharashtra, India (Ethics Approval No.: IEC/2023/1059), approved on 11 December 2023, prior to the commencement of participant recruitment. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki (2013 revision). Written informed consent was obtained from all participants before enrolment. Participant confidentiality was maintained throughout the study, and all data were anonymized for analysis.

Conflict of Interest: None declared by any author.

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REFERENCES

1. Janakiram C, Mehta A, Venkitachalam R. Prevalence of periodontal disease among adults in India: a systematic review and meta-analysis. J Oral Biol Craniofac Res. 2020;10(4):800–6.
2. Cortellini P, Tonetti MS. Clinical concepts for regenerative therapy in intrabony defects. Periodontol 2000. 2015;68(1):282–307.
3. Nyman S, Lindhe J, Karring T, Rylander H. New attachment following surgical treatment of human periodontal disease. J Clin Periodontol. 1982;9(4):290–6.
4. Needleman I, Worthington HV, Giedrys-Leeper E, Tucker R. Guided tissue regeneration for periodontal infra-bony defects. Cochrane Database Syst Rev. 2006;(2):CD001724.
5. Dohan DM, Choukroun J, Diss A, Dohan SL, Dohan AJ, Mouhyi J, Gogly B. Platelet-rich fibrin (PRF): a second-generation platelet concentrate. Part I: technological concepts and evolution. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2006 Mar 1;101(3):e37-44.
6. Dohan Ehrenfest DM, Rasmusson L, Albrektsson T. Classification of platelet concentrates: from pure platelet-rich plasma (P-PRP) to leucocyte- and platelet-rich fibrin (L-PRF). Trends Biotechnol. 2009;27(3):158–67.
7. Thorat M, Pradeep AR, Pallavi B. Clinical effect of autologous platelet-rich fibrin in the treatment of intra-bony defects: a controlled clinical trial. J Clin Periodontol. 2011;38(10):925–32.
8. Castro AB, Meschi N, Temmerman A, Pinto N, Lambrechts P, Teughels W, Quirynen M. Regenerative potential of leucocyte-and platelet-rich fibrin. Part B: sinus floor elevation, alveolar ridge preservation and implant therapy. A systematic review. Journal of clinical periodontology. 2017 Feb;44(2):225-34.
9. Pradeep AR, Bajaj P, Rao NS, Agarwal E, Naik SB. Platelet-rich fibrin combined with a porous hydroxyapatite graft for the treatment of 3-wall intrabony defects in chronic periodontitis: a randomized controlled clinical trial. J Periodontol. 2017;88(12):1288–96.
10. Miron RJ, Zucchelli G, Pikos MA, Salama M, Lee S, Guillemette V, Fujioka-Kobayashi M, Bishara M, Zhang Y, Wang HL, Chandad F. Use of platelet-rich fibrin in regenerative dentistry: a systematic review. Clinical oral investigations. 2017 Jul;21(6):1913-27.
11. Sharma A, Pradeep AR. Treatment of 3-wall intrabony defects in patients with chronic periodontitis with autologous platelet-rich fibrin: a randomized controlled clinical trial. J Periodontol. 2011;82(12):1705–12.

12. Miron RJ, Moraschini V, Fujioka-Kobayashi M, Zhang Y, Kawase T, Cosgarea R, Jepsen S, Bishara M, Canullo L, Shirakata Y, Gruber R. Use of platelet-rich fibrin for the treatment of periodontal intrabony defects: a systematic review and meta-analysis. Clinical oral investigations. 2021 May;25(5):2461-78.
13. Bajaj P, Pradeep AR, Agarwal E, Rao NS, Naik SB, Priyanka N, Kalra N. Comparative evaluation of autologous platelet-rich fibrin and platelet-rich plasma in the treatment of mandibular degree II furcation defects: a randomized controlled clinical trial. Journal of periodontal research. 2013 Oct;48(5):573-81.
14. Agarwal A, Gupta ND, Jain A. Platelet-rich fibrin combined with decalcified freeze-dried bone allograft for the treatment of human intrabony periodontal defects: a randomized split mouth clinical trial. Acta Odontol Scand. 2016;74(1):36–43.
15. Choukroun J, Diss A, Simonpieri A, Girard MO, Schoeffler C, Dohan SL, Dohan AJ, Mouhyi J, Dohan DM. Platelet-rich fibrin (PRF): a second-generation platelet concentrate. Part IV: clinical effects on tissue healing. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2006 Mar 1;101(3):e56-60.
16. Camargo PM, Lekovic V, Weinlaender M, Vasilic N, Madzarevic M, Kenney EB. Platelet-rich plasma and bovine porous bone mineral combined with guided tissue regeneration in the treatment of intrabony defects in humans. J Periodontal Res. 2002;37(4):300–6.
17. Stavropoulos A, Karring T. Long-term stability of periodontal conditions achieved following guided tissue regeneration with bioresorbable membranes: case series results after 6–7 years. J Clin Periodontol. 2004;31(11):939–44.
18. Tarallo F, Mancini L, Pitzurra L, Bizzarro S, Tepedino M, Marchetti E. Use of platelet-rich fibrin in the treatment of grade 2 furcation defects: a systematic review and meta-analysis. J Clin Med. 2020;9(7):2104.
19. Ye L, Mashrah MA, Ge L, Wang L. Network meta-analysis of platelet-rich fibrin in periodontal intrabony defects. J Oral Pathol Med. 2023;52(3):206–215. doi:10.1111/jop.13409.
20. Vieira e Silva FF, Chauca-Bajaña L, Caponio VCA, Segura Cueva KA, Velasquez-Ron B, Padín-Iruegas ME, et al. Regeneration of periodontal intrabony defects using platelet-rich fibrin (PRF): a systematic review and network meta-analysis. Odontology.2024;112(4):1047–1068. doi:10.1007/s10266-024-00949-7.
21. Miron RJ, Moraschini V, Estrin NE, Sculean A, Jepsen S, et al. Autogenous platelet concentrates for treatment of intrabony defects: a systematic review with meta-analysis. Periodontology 2000. 2025;97:153–190. doi:10.1111/prd.12598.