ISSN 0973-2063 (online) 0973-8894 (print)

Bioinformation 22(8): 5401-5405 (2026)

BIOINFORMATION
Discovery at the interface of physical and biological sciences

BIOMEDICAL INFORMATICS

www.bioinformation.net

Volume 22(8)

Research Article

Received August 1, 2026; Revised August 31, 2026; Accepted August 31, 2026, Published August 31, 2026

DOI: 10.6026/973206300225401

SJIF 2026 (Scientific Journal Impact Factor for 2026) = 8.478
2022 Impact Factor (2023 Clarivate Inc. release) is 1.9

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Citation: Pandey *et al.* Bioinformation 22(8): 5401-5405 (2026)

Comparative evaluation of autologous sticky bone and leukocyte platelet-rich fibrin block in intrabony defects

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ISSN 0973-2063 (online) 0973-8894 (print)
Bioinformation 22(8): 5401-5405 (2026)

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Abstract:
Periodontal intrabony defects require regenerative approaches and platelet-rich fibrin formulations can deliver growth factors while stabilizing particulate graft material. Therefore, it is of interest to compare the autologous sticky bone with a leukocyte platelet-rich fibrin (L-PRF) block in 30 intrabony defect sites randomized equally between the two treatments and assessed clinically and by CBCT. Probing pocket depth and clinical attachment level were recorded at baseline, 3 months and 6 months, while crestal level and bone fill were evaluated at baseline and 6 months. Both groups showed significant improvements in gingival index, probing depth and attachment level over time, with comparable intrabony defect reduction, bone fill and crestal-level changes and no significant intergroup differences. Sticky bone and L-PRF block therefore produced similar six-month clinical and radiographic improvements in the treatment of intrabony periodontal defects.

Keywords: Intrabony defects; sticky bone; leukocyte-platelet rich fibrin block; xenograft; periodontal regeneration; bone fill; crestal level

Background:
Periodontitis is a progressive disease causing irreversible loss of connective tissue and alveolar bone, often resulting in tooth loss **[1]**. Scaling and root planing (SRP) improves clinical outcomes, but deep pockets and aggressive pathogens can limit its effectiveness and allow recurrence **[1]**. Due to these limitations, surgical intervention is often required in advanced periodontitis, aiming to halt disease progression and regenerate the tooth-supporting periodontal tissues **[2]**. Periodontal regeneration involves restoring a functional periodontium, including new alveolar bone, oriented periodontal ligament fibres and cementum **[2]**. Approaches include open flap debridement (OFD) alone or combined with bone grafts, biologic agents, guided tissue regeneration (GTR), or tissue engineering techniques **[3, 4]**. Among the available regenerative strategies, bone replacement grafts are the most frequently utilized for managing periodontal osseous defects **[5]**. Xenograft, derived from other species (commonly bovine or porcine), are osteoconductivity, biocompatible and structurally analogous to human bone **[5]**. They act as scaffolds or calcified matrices that facilitate the migration and proliferation of osteogenic cells, while also maintaining space and stabilizing the blood clot during healing **[5]**. Platelet concentrates, from PRP to PRF, have advanced regenerative strategies in periodontology by enhancing healing, stimulating regeneration and promoting cell proliferation. Variations in centrifugation have led to PRF variants such as L-PRF and i-PRF. i-PRF formation relies on the principle of low-speed centrifugation concept while L-PRF preparation involves centrifugation of blood at 2700 rpm for 12 minutes **[6, 7]**. Combining i-PRF with bone graft granules has led to the formation of sticky bone **[8]**. Yang *et al.* first introduced autologous sticky bone in 2015 **[8]**. Similarly, liquid fibrinogen mixed with L-PRF membrane and particulate biomaterial is being used as L-PRF block for horizontal augmentation of deficient alveolar ridge **[9]**. Existing literature provides limited evidence detailing the effectiveness of sticky bone and L-PRF in the treatment of intrabony defects **[9]**. Hence, the current study has been planned to evaluate and compare the efficacy of L-PRF block and Autologous Sticky bone in the treatment of intrabony defects using clinical and cone beam computed tomography (CBCT) parameters **[9]**. Therefore, it is of interest to compare the clinical and CBCT outcomes of autologous sticky bone and L-PRF block in the treatment of periodontal intrabony defects.

Materials and Methods:
The present study was planned as a full-mouth, single-center, randomized controlled trial with 1:1 allocation, with patients being recruited from the outpatient Department of Periodontology, after obtaining informed consent. The study adhered to CONSORT guidelines and received Institutional Ethics Committee approval. Sample size calculation using Epi Info determined 30 sites, with 15 in each group. Subjects with at least two or more even sites with: probing pocket depth (PPD) ≥ 5mm, clinical loss of attachment (CAL) ≥ 3 mm, gingival Index (GI) ≥ 1 and sites exhibiting evidence of Intrabony defects of minimum 3 mm dimension as observed through Cone Beam Computed Tomography (CBCT) were included in the study. While subjects with recent periodontal therapy, medications affecting gingival healing, systemic diseases, pregnancy or lactation, smoking or tobacco use, or poor oral hygiene were excluded from the study. A comprehensive evaluation of the selected subjects was carried out through medical history, clinical examination, routine investigations, intraoral periapical radiographs and CBCT to verify the presence of appropriate bony defects. All participants received Phase I therapy, which included oral hygiene instructions, scaling and root planing and occlusal adjustments when necessary. After 3–4 weeks, a re-evaluation was performed and subjects meeting the inclusion criteria were scheduled for surgery under Phase II therapy, which comprised surgical intervention. Subjects presenting with

a minimum of two intrabony defect sites were included. Each site was then randomly assigned using the chit-picking method to one of two groups:

[1] Group A: Sites treated with autologous sticky bone.
[2] Group B: Sites treated with leukocyte platelet-rich fibrin (L-PRF) block.

Clinical parameters:
Clinical parameters—Gingival Index (GI), probing pocket depth (PPD) and clinical attachment level (CAL)—were recorded at baseline, 3 months and 6 months by a single trained examiner using a UNC-15 probe. A customized acrylic stent was used to ensure standardized probe positioning and angulation. CBCT was performed at baseline and 6 months to assess intrabony defect depth (IBD), bone fill and crestal level (CL). The radiographic parameters were measured as the distance from (a) from incisal/occlusal tip of tooth to the base of defect at the baseline and 6 months (IBD); (b) The difference of the two was considered bone fill and (c) CL was evaluated by calculating the difference in crestal level from occlusal/ incisal tip at baseline and 6 months.

Surgical procedure:
Under surgical phase, adequate anesthesia with 2% lignocaine HCL containing 1:80,000 adrenalines was obtained at the surgical site. A mucoperiosteal flap was designed according to the surgical site and a full thickness flap was reflected. Root planing and through debridement of the intrabony defects was done. Subsequent treatment steps were performed in an identical manner for both groups.

Preparation of autologous sticky bone:
For sticky bone preparation, 10 ml of intravenous blood from patient's antecubital vein, was collected in sterile tubes without anticoagulant and was immediately centrifuged in at 2400-2700 revolutions/minute for 2 minutes. Once the centrifugation was stopped, the tube showed 2 different layers. The Injectable platelet- rich fibrin (i-PRF) comprised the upper layer while the bottom layer of RBCs was discarded. i-PRF was collected with a syringe and mixed with particulate bone graft. The time taken for the polymerisation of i-PRF with bone graft (Sticky bone) took approximately 5-10 minutes. The sticky bone obtained was yellow coloured.

Preparation of leukocyte platelet rich fibrin block:
For L-PRF block preparation, 10 ml of intravenous blood was drawn into two 5 ml sterile tubes without anticoagulant and centrifuged at 2800 rpm for 10 minutes. After 3 minutes, one tube was removed to collect the yellow liquid (liquid fibrinogen) without aspirating red blood cells and centrifugation of the second tube continued for the remaining 7 minutes. The L-PRF clot from the fully centrifuged tube was retrieved, compressed into a membrane, chopped and mixed with bone graft. One milliliter of liquid fibrinogen was added and gently stirred for about 5 seconds, allowing it to clot and form the L-PRF block. Sticky bone was placed in the defects for Group A patients and for Group B, L-PRF block was placed, followed by suturing. Post-operatively, patients were instructed to avoid mechanical plaque control at the surgical site for one week and to maintain oral hygiene with 0.2% chlorhexidine mouthwash. Systemic antibiotics (amoxicillin–clavulanic acid 625 mg, three times daily for 5 days) and analgesics (paracetamol, as required) were prescribed. Standard post-operative instructions were provided and sutures were removed 10 days following surgery. Soft tissue assessments were conducted at the 15th day, 3 months and 6 months post-surgery, while hard tissue examinations were performed exclusively at the 6-month mark. A maintenance protocol with regular recall visits was followed. To ensure standardization and minimize variability, all clinical parameters were recorded by a single examiner and all surgeries were performed by the same operator. The collected data were subjected to statistical analysis. Statistical analysis was done by Statistical Package for the Social Sciences (SPSS) software package (SPSS 16 Inc., Chicago IL, USA). The normality of data was tested by Shapiro Wilk's test. The values obtained was statistically analyzed and to compare the parameters between groups by parametric test Independent t- test, for intra group Repeated measure of ANOVA followed by Bonferroni test was used among the study population. The level of significance and confidence interval was 5% and 95% respectively, *i.e.* $p < 0.05$.

Results:
Both Group A and Group B showed significant improvements in all clinical and radiographic parameters over the study period. Gingival Index (GI) decreased from baseline to 15 days, 3 months and 6 months ($p < 0.001$) with no intergroup differences. Probing Pocket Depth (PPD) and Clinical Attachment Level (CAL) improved at 3 and 6 months ($p < 0.001$), while intergroup comparisons were non-significant **(Table 1).** Radiographically, Intrabony Defect Depth (IBD) and Crestal Level (CL) improved significantly at 6 months (IBD: $p < 0.001$; CL: Group A $p = 0.001$, Group B $p = 0.012$), with no significant differences between groups **(Table 2).**

Table 1: Comparison of clinical parameters pre and postoperatively within Group A and Group B (intra-group comparison) as well as between Group A and Group B (inter-group comparison)

Parameters	Groups	Mean ± S.D.				p Value		
		Baseline	15 Days	3 Months	6 Months	Baseline vs 15 Days	Baseline vs 3 Months	Baseline vs 6 months
GI	A	1.60 ± 0.507	0.53 ± 0.516	0.53 ± 0.516	0.67 ± 0.489	<0.001**	<0.001**	<0.001**
	B	1.80 ± 0.414	0.20 ± 0.414	0.40 ± 0.507	0.60 ± 0.507	<0.001**	<0.001**	<0.001**
	p	0.332^{NS}	0.086 ^{NS}	0.495 ^{NS}	0.754 ^{NS}	–	–	–
PPD	A	7.00 ± 0.655	–	3.13 ± 0.640	3.07 ± 0.594	–	<0.001**	<0.001**
	B	7.07 ± 0.704	–	2.93 ± 0.704	3.00 ± 0.535	–	<0.001**	<0.001**
	p	0.781 ^{NS}	–	0.383 ^{NS}	0.742 ^{NS}	–	–	–
CAL	A	10.60 ± 1.502	–	7.20 ± 2.077	7.47 ± 2.295	–	<0.001**	<0.001**

	B	10.87 ± 1.060	–	7.07 ± 1.486	6.87 ± 1.302	–	<0.001**	<0.001**
	p	0.561 NS	–	0.844 NS	0.404 NS	–	–	–

**Significant p<0.05, **Highly Significant p<0.01, NSNot Significant p>0.05. SD=Standard deviation, GI=Gingival index, CAL=Clinical attachment loss, PPD=Probing pocket depth.*

Table 2: Comparison of radiographic parameters pre and postoperatively within Group A and Group B (intra-group comparison) as well as between Group A and Group B (inter-group comparison)

Parameter	Group	Baseline (Mean ± SD)	6 Months (Mean ± SD)	Intragroup p value (Baseline vs 6 months)
IBD	A	9.213 ± 1.401	8.587 ± 1.405	<0.001**
	B	9.547 ± 2.266	8.587 ± 1.997	<0.001**
	p	0.637 NS	1.000 NS	-
IBD Bonefill	A	-	0.627 ± 0.3035	-
	B	-	0.973 ± 0.8940	-
	p	-	0.166 NS	-
CL	A	8.087 ± 1.686	7.687 ± 1.596	0.001**
	B	7.600 ± 2.222	6.907 ± 1.499	0.012*
	p	0.431 NS	0.118 NS	-

**Significant p<0.05, **Highly Significant p<0.01, NS Not Significant p>0.05. SD=Standard deviation, CL=Crestal level, IBD=Infrabony defect.*

Discussion:

The primary goal of regenerative periodontal therapy is to restore lost connective tissue attachment and alveolar bone **[10]**. Recently, tissue engineering strategies have gained attention, with growth factors playing a key role in regulating progenitor cell migration, attachment, proliferation and differentiation. PRF acts as a "biological connector," supporting stem cell activity and blood vessel formation, ultimately enhancing bone regeneration. Among different platelet concentrates, i-PRF contains the highest leukocyte concentration when compared to PRP and peripheral blood. The fibrin matrix in i-PRF serves as a delivery system, gradually releasing growth factors throughout the healing process **[11]**. When mixed with bone graft materials, i-PRF promotes new bone formation and results in a cohesive material known as "Sticky Bone." **[6]**. Sticky bone offers significant advantages in periodontal regeneration due to its moldable consistency and dense, interlinked fibrin network, which allows it to adapt easily to various shapes of bone defects. The mineral scaffold provides essential bone-forming cells along with growth factors that stimulate cellular activity **[8, 12]**. PRF undergoes further refinement to give rise to Leukocyte- Platelet Rich Fibrin (L-PRF), which contains higher concentrations of platelets, leukocytes and growth factors. L-PRF has the potential to promote the formation of mature lamellar bone, making it a valuable grafting material **[13]**. Leukocyte and Platelet-Rich Fibrin Block (L-PRF block) combines L-PRF membranes known for their osteoinductive properties—with bone grafts that provide osteoconductive support. By acting as a biological connector between bone graft particles, the L-PRF block forms a moldable matrix rich in growth factors and bioactive molecules **[14]**. Xenograft have been effectively utilized in regenerative procedures to treat intrabony defects as they closely resemble human cancellous bone in terms of surface area, porosity, crystal size and the calcium-to-phosphorus ratio. They are osteoconductive and integrate well with native bone **[15]**. Sticky Bone and L-PRF Block both have shown promising results in periodontal therapy. However, there is a lack of studies directly evaluating and comparing the efficacy of Sticky Bone and Leukocyte Platelet-Rich Fibrin (L-PRF) block in the management of intrabony defects with CBCT assessment. This study was therefore conducted to address this gap. The use of both autologous sticky bone and L-PRF block has shown significant improvements in PPD reduction and CAL gain in both the groups. The results were better in Group B (L-PRF block) as compared to Group A (Sticky bone); however, the intergroup comparison of the results was not statistically significant. The beneficial effects observed may be attributed to the role of PRF, along with xenograft. These findings align with studies conducted by Panda *et al.* and Chaudhary *et al.*, which reported similar results by the use of PRF and xenograft combination **[16, 17]**. Improvement in gingival scores were seen in both the groups which can be attributed to the beneficial effects of open flap debridement which contributes in resolving the underlying infection and allows the body's natural healing and anti-inflammatory processes to begin **[18]**. Additionally, participants sustained healthy gingival conditions, likely due to regular oral hygiene practices, which were emphasized and reinforced during follow-up visits. Based on the results obtained from CBCT, the extent of post-operative bone fill was analyzed to determine the efficacy of sticky bone and L-PRF block in the management of intrabony defects. The bone fill was quantified by calculating the difference in intrabony defect measurements between baseline and six months. Upon intergroup comparison between Group A and Group B, the mean intrabony defect bone fill was determined to be 0.627±0.3035 and 0.973±0.8940, respectively. Although Group B showed slightly higher bone fill than Group A, statistical analysis revealed no significant between the two differences. This outcome could be attributed to the bioactive characteristics of the L-PRF membranes within the Leukocyte- Platelet-Rich Fibrin Block (L-PRF block), which promote osteoblast adhesion and proliferation, as well as the synthesis of collagen-related proteins—key factors in bone regeneration. The fibrin matrix acts as a biological bandage, facilitating wound healing and providing postoperative protection to the surgical site. Sticky bone, by combining bone graft particles with a fibrin matrix, creates a scaffold that holds the graft in place prevents micromovement and releases growth factors that stimulate regeneration. This helps to prevent soft tissue invasion into the graft site, leading to a more successful and predictable treatment outcome **[6]**. Castro *et al.*, Salama *et al.* and Cortellini *et al.* conducted studies that produced findings consistent with the current study, further validating the

observed results **[9, 14 and 19]**. According to Yang *et al.* (2025), Sticky Bone showed excellent volume stability and bone fill in extraction sockets **[8]**. Similarly, Castro *et al.* (2018) found that within 14 days, L-PRF Blocks released high levels of TGF β-1, VEGF, BMP-1 and PDGF-AB, with consistent and sustained secretion of these growth factors throughout the observation period **[14]**. These findings likely explain the positive outcomes observed in the current study, which included improvements in crestal bone levels, reductions in PPD, increase in CAL, better GI scores, decrease in the depth of intrabony defects and greater bone fill within those defects in both study groups. It is noteworthy that these improvements were more pronounced in Group B, where Leukocyte-Platelet Rich Fibrin (L-PRF) block was employed than in Group A where sticky bone was employed. This can be attributed to the fact that L-PRF block is essentially a denser, self-supporting and robust version of the sticky bone. In spite of these clearly discernible distinctions, both treatment groups—Sticky Bone and L-PRF Block—produced similarly favorable and comparable clinical and radiographic results, with no statistically significant difference between them. A recent randomized clinical trial protocol by Kotecha *et al.* **[20]** also evaluates autologous sticky bone and PRF-based grafting for periodontal infrabony defects using radiographic bone fill, PPD reduction and CAL gain as key outcomes, underscoring the continuing clinical interest in these autologous fibrin-graft combinations.

Conclusion:

Both sticky bone and L-PRF block produced significant clinical and radiographic improvement in periodontal intrabony defects. Intergroup differences at 6 months were not statistically significant, indicating comparable treatment performance. Both approaches may be useful regenerative adjuncts when appropriate case selection and periodontal maintenance are ensured.

Limitations:

[1] A large sample size could have been taken.
[2] Absence of histological analysis to assess true regeneration.
[3] Absence of long-term follow-ups.

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