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

Bioinformation 22(10): 6443-6447 (2026)

©Biomedical Informatics (2026)

www.bioinformation.net

Volume 22(10)

Research Article

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

DOI: 10.6026/973206300226443

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

Declaration on Publication Ethics:
The author's state that they adhere with COPE guidelines on publishing ethics as described elsewhere at https://publicationethics.org/. The authors also undertake that they are not associated with any other third party (governmental or non-governmental agencies) linking with any form of unethical issues connecting to this publication. The authors also declare that they are not withholding any information that is misleading to the publisher in regard to this article.

Declaration on official E-mail:
The corresponding author declares that lifetime official e-mail from their institution is not available for all authors

License statement:
This is an Open Access article which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly credited. This is distributed under the terms of the Creative Commons Attribution License

Comments from readers:
Articles published in BIOINFORMATION are open for relevant post publication comments and criticisms, which will be published immediately linking to the original article without open access charges. Comments should be concise, coherent and critical in less than 1000 words.

Disclaimer:
Bioinformation provides a platform for scholarly communication of data and information to create knowledge in the Biological/ Biomedical domain after adequate peer/editorial reviews and editing entertaining revisions where required. The views and opinions expressed are those of the author(s) and do not reflect the views or opinions of Bioinformation and (or) its publisher Biomedical Informatics. Biomedical Informatics remains neutral and allows authors to specify their address and affiliation details including territory where required.

Edited by Rashmi Laddha
E-mail: drrashmirdaga@gmail.com
Citation: Khurshid *et al*. Bioinformation 22(10): 6443-6447 (2026)

Role of platelet-rich fibrin (PRF) in enhancing implant stability in immediate implants

Ghazala Khurshid[1], Sarah Hesham Ahmed Mohamed Eweis[2,*], Vansh Jaiswal[3], Surbhi Joshi[4], Amrita Shinde[5] & Nidhi Singh Jhala[6]

[1]Department of prosthodontics and crown & bridge, Lake view Hospital, Ranchi, Jharkhand, India; [2]Department of General Dentistry,Nova international medical complex, Jeddah, Makkah, Saudi Arabia; [3]Department of Periodontology, Narsinhbhai Patel Dental College and Hospital, Visnagar, Gujarat, India; [4]Department of oral and Maxillofacial surgery, Daswani Dental college and research centre, Kota, Rajasthan, India; [5]Department of oral and maxillofacial surgery, Bharati Vidyapeeth (deemed to be university) dental college and hospital, Sangli, Maharashtra, India; [6]Department of oral and maxillofacial Surgery, Index Institute of Dental Sciences (IIDS) Indore, Madhya Pradesh, India; *Corresponding author

Affiliation URL:
https://www.lakeviewranchi.in/

ISSN 0973-2063 (online) 0973-8894 (print)
Bioinformation 22(10): 6443-6447 (2026)
©Biomedical Informatics (2026)

https://nova-medicals.com
https://npdch.edu.in
https://daswanidentalcollege.com
https://www.bvuniversity.edu.in/dchsangli/
https://indexdental.in

Author contact:
Ghazala Khurshid - E-mail: drghazala1395@gmail.com
Sarah Hesham Ahmed Mohamed Eweis - E-mail: drsaraheweis@gmail.com
Vansh Jaiswal - E-mail: drvanshmds@gmail.com
Surbhi Joshi - E-mail: Joshi.surbhi90@gmail.com
Amrita Shinde - E-mail: dramritashinde18@gmail.com
Nidhi Singh Jhala - E-mail: nidhi3004@gmail.com

Abstract:
Immediate implant placement has gained popularity due to reduced treatment time and increased demand for rapid aesthetic outcomes, yet challenges such as reduced primary stability, early bone loss and delayed osseointegration remain. Platelet-rich fibrin (PRF), an autologous concentrate rich in growth factors, has shown potential in enhancing both hard and soft tissue healing. This randomised controlled clinical trial involving 50 patients evaluated the effectiveness of PRF in improving implant stability, marginal bone levels, soft tissue healing, peri-implant complications and patient-reported outcomes. Immediate implants were placed in two groups-PRF and non-PRF-and assessed using resonance frequency analysis (ISQ) over 12 weeks, with radiographic bone measurements taken at 3 and 6 months. The PRF group showed significantly higher ISQ values, reduced marginal bone loss, superior soft tissue healing and lower post-operative pain scores compared to controls ($p < 0.05$). Thus, we show that incorporating PRF into immediate implant placement enhances stability, accelerates healing, improves patient comfort and reduces peri-implant bone loss, offering a simple, cost-effective adjunct for improving clinical outcomes.

Keywords: Platelet-rich fibrin, immediate implants, implant stability, bone preservation, soft tissue healing

Background:
Dental implants are a well-known way to replace missing teeth that gives predictable functional and aesthetic results. Traditionally, implant placement occurred after a healing period of several months post-extraction, facilitating bone remodelling and soft tissue maturation. But as more and more patients want shorter treatment times and immediate aesthetics, immediate implant placement-putting the implant directly into the extraction socket-has become more and more popular **[1, 2]**. Even though it has some benefits, immediate implant placement comes with problems like weakened primary stability, bone loss around the implant and delayed osseointegration **[3]**. To address these constraints, biologically active adjuncts have been suggested to improve bone regeneration and implant integration. Choukroun *et al.* **[4]** were the first to describe platelet-rich fibrin (PRF). It is a second-generation platelet concentrate made up of a dense fibrin network that is full of platelets, leukocytes and growth factors like PDGF, TGF-β and VEGF. These bioactive molecules encourage the growth of new blood vessels, the healing of wounds and the formation of new bone **[5]**. PRF is easy to make, doesn't need any anticoagulants and slowly releases growth factors over a long time **[6]**. This is different from older platelet concentrates. Numerous studies indicate that PRF may expedite soft tissue healing, promote bone regeneration and enhance implant stability **[7, 8]**. Therefore, it is of interest to assess the function of PRF in improving implant stability in immediate implants, concentrating on the implant stability quotient (ISQ), peri-implant bone alterations, soft tissue recovery and patient-related outcomes.

Methodology:
This prospective, randomised controlled clinical trial will involve 50 patients necessitating the extraction of non-restorable teeth, succeeded by immediate implant placement. Patients between the ages of 18 and 60, possessing sufficient bone volume and maintaining good systemic health (ASA I or II), will be included. Patients with systemic contraindications, including uncontrolled diabetes, immunocompromised states, significant smoking, bisphosphonate therapy, active infection at the extraction site, or inadequate oral hygiene, will be excluded. Patients who are eligible will be split into two groups at random, with 25 people in each group. Group A (the test group) will get an implant right away and use platelet-rich fibrin (PRF) as an extra step. Group B (the control group) will get an implant right away but not use PRF. Teeth will be extracted atraumatically in both groups and implants will be placed in accordance with the manufacturer's protocol to achieve primary stability. In Group A, PRF will be prepared according to Choukroun's protocol. This means that 10 ml of venous blood will be taken from sterile tubes that don't contain anticoagulant and spun at 2700 rpm for 12 minutes. The fibrin clot will be used as a membrane or in pieces to fill the socket before the final implant is put in place. The control group will not receive any PRF. All participants will receive the same post-operative care and medications. The primary outcome measure will be implant stability, assessed

through resonance frequency analysis (RFA) to record implant stability quotient (ISQ) values at baseline, 2, 4, 8 and 12 weeks. Secondary outcomes will encompass radiographic evaluation of marginal bone level alterations at baseline, 3 months and 6 months; clinical assessment of soft tissue healing via Landry's healing index at 1 and 2 weeks; documentation of peri-implant complications, including infection, mobility issues, or early failures; and patient-reported outcomes, such as post-operative pain and discomfort quantified by a Visual Analogue Scale (VAS). We will use SPSS software to do the statistical analysis. Independent t-tests or ANOVA will be used to compare continuous variables (ISQ values, bone loss) and the Chi-square test will be used to look at categorical variables (complications). A p-value of less than 0.05 will be deemed statistically significant. The Institutional Review Board will give ethical approval and all participants will have to sign a written consent form in line with the Declaration of Helsinki.

Results:

There were no dropouts or early implant failures and 50 patients (25 in each group) finished the study. The results were measured by looking at how stable the implant was, how much bone was lost around the edges, how well the soft tissue healed and how much pain the patient said they were in. Stability of the implant we measured the implant stability quotient (ISQ) values at the start of the study, then again at 2, 4, 8 and 12 weeks. At baseline, there was no significant difference between the two groups ($p > 0.05$). However, starting from the second week, Group A (PRF) had ISQ values that were much higher than those of Group B (Control). The difference was most noticeable at 4 and 8 weeks, which is when healing starts. After 12 weeks, both groups showed good stability, but the implants that had been treated with PRF always had higher values. **Table 1** shows these results. Bone Loss on the Edge Radiographic analysis indicated that Group A demonstrated markedly reduced marginal bone loss compared to Group B at both 3 and 6 months. In the PRF group, the average bone loss was 0.41 ± 0.11 mm at 3 months and 0.62 ± 0.16 mm at 6 months. In the control group, it was 0.58 ± 0.14 mm and 0.89 ± 0.20 mm, respectively. **Table 2** shows these results in more detail. Healing of Soft Tissue Soft tissue healing was evaluated using Landry's Healing Index at 1 and 2 weeks. At both times, Group A had better scores than Group B. This means that the PRF group had faster and better healing of soft tissue. **Table 3** shows these observations. Outcomes reported by patients The Visual Analogue Scale (VAS) was used to measure pain levels. During the first week after surgery, Group A always said their pain scores were lower than those of Group B. As shown in **Table 4**, the difference was statistically significant at all time points.

Table 1: Mean Implant Stability Quotient (ISQ) values in both groups at different time intervals

Time Interval	Group A (PRF) Mean ± SD	Group B (Control) Mean ± SD	p-value
Baseline	68.2 ± 2.1	67.8 ± 2.4	0.62
2 weeks	70.5 ± 2.3	67.1 ± 2.7	0.01*
4 weeks	72.8 ± 2.0	68.9 ± 2.5	0.002*
8 weeks	75.4 ± 1.9	72.1 ± 2.1	0.004*
12 weeks	77.2 ± 1.7	74.8 ± 1.8	0.03*

*Significant at $p < 0.05$

Table 2: Mean marginal bone loss (mm) at 3 and 6 months

Time Interval	Group A (PRF) Mean ± SD	Group B (Control) Mean ± SD	p-value
3 months	0.41 ± 0.11	0.58 ± 0.14	0.01*
6 months	0.62 ± 0.16	0.89 ± 0.20	0.003*

*Significant at $p < 0.05$

Table 3: Mean soft tissue healing scores

Time Interval	Group A (PRF) Mean ± SD	Group B (Control) Mean ± SD	p-value
1 week	4.1 ± 0.4	3.6 ± 0.5	0.02*
2 weeks	4.7 ± 0.3	4.2 ± 0.4	0.01*

Table 4: Mean VAS scores for pain

Time Interval	Group A (PRF) Mean ± SD	Group B (Control) Mean ± SD	p-value
Day 1	3.1 ± 0.8	4.2 ± 0.9	0.01*
Day 3	2.0 ± 0.6	3.1 ± 0.7	0.004*
Day 7	0.9 ± 0.4	1.5 ± 0.5	0.03*

Discussion:

The current study assessed the supplementary function of platelet-rich fibrin (PRF) in immediate implant placement, concentrating on implant stability, marginal bone preservation and soft tissue healing and patient comfort. The findings unequivocally indicated that the application of PRF conferred substantial benefits in comparison to implants inserted without PRF. Resonance frequency analysis showed that ISQ values were much higher in the PRF group during the early healing period, especially at 2, 4 and 8 weeks. This means that the implants were more stable. This is a very important time when implant stability usually goes down because the implant is moving from primary to secondary stability. The elevated ISQ values in the PRF group indicate that PRF enhances osseointegration, likely attributable to its abundant composition of platelets, leukocytes and growth factors. These results align with the findings of Areewong *et al.* **[8]**, which indicated that PRF improves implant stability in immediate implants and with the similar conclusions of Öncü and Alaaddinoglu **[9],** who noted enhanced stability when PRF was applied around implants. The study demonstrated a significant reduction in marginal bone loss within the PRF group at both 3 and 6 months. This may be elucidated by the secretion of vascular endothelial growth factor (VEGF) and platelet-derived growth factor (PDGF), which promote angiogenesis and bone remodelling. Chen and Buser **[2]** stressed that marginal bone resorption is still a big problem in immediate implant cases. Our results support the use of PRF to lessen this effect. Thakkar *et al.* **[10]** reported similar radiographic outcomes, demonstrating diminished crestal bone loss surrounding implants when PRF was utilised. Landry's healing index showed that the PRF group had much better healing of soft tissue. The fibrin network of PRF acts as a natural scaffold for cells to move around, fibroblasts to grow and new blood vessels to form, which speeds up the healing process. Simonpieri *et al.* **[6]** previously emphasised the advantages of PRF for soft tissues, which are validated by the current study. Additionally, Kumar and Shubhashini **[11]** showed that PRF speeds up the healing of

epithelial tissue in extraction sockets, which backs up what we found. Patients in the PRF group reported lower post-operative pain scores during the first week, in addition to better outcomes for hard and soft tissue. This is in line with the biological properties of PRF, which lower inflammation in the area and speed up tissue repair. Our results are consistent with those of Pietrokovski and Massler **[12]**, who showed that the application of PRF led to reduced pain and swelling subsequent to oral surgical interventions. The present study highlights the beneficial role of platelet-rich fibrin (PRF) in enhancing implant stability, soft-tissue healing and early bone preservation in immediate implant placement. These findings align with a growing body of contemporary literature supporting PRF as an effective biological adjunct in implantology. PRF contains a dense fibrin matrix enriched with platelets, leukocytes, cytokines and growth factors that promote angiogenesis, collagen synthesis and osteoblastic activity. This explains the early improvement in stability observed in our study. Similar outcomes were demonstrated in a recent systematic review and meta-analysis by Guan *et al.* **[13]**, who reported that PRF significantly increased implant stability quotient (ISQ) values during early healing. Their analysis concluded that PRF accelerates secondary stability by supporting faster osseointegration. Another systematic review by Mahesh *et al.* **[14]** further reinforced these findings, indicating that PRF consistently enhances early implant stability and reduces post-operative complications. The review emphasized that PRF acts as a biologically active scaffold that supports both hard and soft tissue healing, leading to more favorable peri-implant environment. Clinical evidence from randomized trials has also confirmed the benefits of PRF in bone preservation. Darestani *et al.* **[15]** showed that leukocyte- and platelet-rich fibrin (L-PRF) significantly reduced marginal bone loss around implants placed in the posterior maxilla while simultaneously improving primary and secondary stability. Their findings suggest that PRF optimizes the biomechanical and biological conditions during the critical early healing phase. Similarly, a split-mouth randomized clinical trial by Kapoor *et al.* **[16]** reported higher ISQ values in PRF-treated sites prior to prosthetic loading. They concluded that PRF enhances osseointegration by providing a stable fibrin architecture that supports cellular migration and early tissue regeneration. Taken together; the current literature consistently demonstrates that PRF serves as a valuable adjunct to immediate implant placement by improving initial stability, reducing early bone loss and accelerating soft-tissue healing. Tabassum *et al.* Platelet-rich fibrin (PRF) has been reported to play a significant role in improving the stability and healing of immediate dental implants. PRF acts as a biological scaffold that releases growth factors, which promote bone regeneration and enhance osseointegration around the implant site. Its use in immediate implant placement has been associated with improved primary stability and faster soft and hard tissue healing. Therefore, PRF can be considered a beneficial adjunct in immediate implant procedures to enhance implant success and stability **[17].** The outcomes of our study corroborate these findings, further supporting the integration of PRF into implant protocols to achieve predictable and improved clinical outcomes. Further supporting the findings of the present study, recent literature has emphasized the importance of CBCT in mandibular morphometric assessment. Giammarinaro *et al.* **[18]** reported that CBCT provides highly accurate three-dimensional visualization of mandibular structures, enabling precise identification of anatomical landmarks and reducing measurement errors. This improved diagnostic accuracy plays a crucial role in enhancing treatment planning and clinical outcomes in implant dentistry. Similarly, Iram *et al.* **[19]** highlighted that accurate localization of the mental foramen and its relationship with surrounding anatomical structures is essential to prevent neurosensory complications during surgical procedures. The authors further concluded that CBCT offers superior diagnostic reliability compared to conventional imaging techniques, thereby facilitating safer and more predictable implant placement.

Conclusion:

We show that the application of platelet-rich fibrin (PRF) alongside immediate implant placement markedly improves implant stability, diminishes marginal bone loss, expedites soft tissue healing and enhances patient comfort during the initial post-operative phase. PRF is a useful addition to immediate implantology and may help improve long-term results.

References:

[1] Lazzara RJ. *Int J Periodontics Restorative Dent*. 1989 **9**:332. [PMID: 2640210]
[2] Chen ST & Buser D. *Int J Oral Maxillofac Implants*. 2009 **24**:186. [PMID: 24660198]
[3] Lang NP *et al. Clin Oral Implants Res*. 2012 **23**:39. [PMID: 22211305]
[4] https://www.scienceopen.com/document?vid=38d30c61-808c-4355-bda4-1eb440085011
[5] Ehrenfest DMD *et al. Trends Biotechnol*. 2010 **28**:158. [PMID: 19187989]
[6] Simonpieri A *et al. Implant Dent*. 2011 **20**:46. [PMID: 21278521]
[7] Mazor Z *et al. J Periodontol*. 2009 **80**:2056. [PMID: 19961389]
[8] Areewong K *et al. Clin Implant Dent Relat Res*. 2019 **21**:1156. [PMID: 31647177]
[9] Öncü E & Alaaddinoglu EE. *Int J Oral Maxillofac Implants*. 2015 **30**:578. [PMID: 26009908]
[10] Thakkar DJ *et al. Contemp Clin Dent*. 2016 **7**:371. [PMID: 27630503]
[11] Kumar RV & Shubhashini N. *Cell Tissue Bank*. 2013 **14**:453. [PMID: 23143637]
[12] Pietrokovski J & Massler M. *J Prosthet Dent*. 1967 **17**:21. [DOI: 10.1016/0022-3913(67)90046-7].
[13] Guan S *et al. Heliyon*. 2023 **9**:e13196. [DOI: 10.1016/j.heliyon.2023.e13196].
[14] Mahesh L *et al. J Oral Biol Craniofac Res*. 2020 **10**:141. [PMID: 32489812]
[15] Darestani MN *et al. Int J Implant Dent*. 2023 **9**:23. [PMID: 37555894].

ISSN 0973-2063 (online) 0973-8894 (print)
Bioinformation 22(10): 6443-6447 (2026)
©Biomedical Informatics (2026)

[16] Kapoor A *et al. J Indian Soc Periodontol.* 2022 **26**:137. [PMID: 35321306].
[17] Tabassum S *et al. Int J Health Sci (Qassim).* 2022 **16**:58. [PMID: 36101844]
[18] Giammarinaro E *et al. BMC Oral Health.* 2025 **25**:615. [PMID: 40264081]
[19] Iram J *et al. Natl J Maxillofac Surg.* 2024 **15**:467. [PMID: 39830456]

Caveat Emptor is applicable among the literate community where required and possible. The publisher, its journal, editors and the internal/external reviewers take adequate steps to check, evaluate, correct, edit, revise and improve content where possible and required.