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ORIGINAL ARTICLE

COMPARISON OF PRF AND I-PRF IN WOUND HEALING FOLLOWING SURGICAL EXTRACTIONS OF MANDIBULAR THIRD MOLARS

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Abstract

Background: Surgical extraction of impacted mandibular third molars is frequently associated with postoperative complications, including pain, delayed soft-tissue healing, periodontal pocket formation, and swelling. Autologous platelet concentrates, particularly platelet-rich fibrin (PRF) and injectable platelet-rich fibrin (I-PRF), have gained increasing attention due to their potential regenerative properties and ability to enhance tissue repair and postoperative healing.

Aim: To compare the effectiveness of PRF and I-PRF in enhancing wound healing following surgical extraction of impacted mandibular third molars.

Materials & Methods: A randomized, double-blind, split-mouth clinical study was conducted among 21 patients requiring bilateral surgical extraction of impacted mandibular third molars, resulting in a total of 42 extraction sockets. Each patient received both interventions: one extraction site was treated with PRF, while the contralateral site was treated with I-PRF according to a computer-generated randomization sequence. Postoperative pain, soft-tissue healing, swelling, periodontal pocket formation, and maximum interincisal mouth opening were assessed at predetermined follow-up intervals. Statistical analysis was performed using SPSS version 26. Intergroup comparisons were performed using the paired t-test and Wilcoxon Signed-Rank test, according to the distribution of the data.

Results: The I-PRF-treated sites demonstrated significantly improved early postoperative healing outcomes compared with PRF-treated sites. Postoperative pain scores were significantly lower in the I-PRF group on postoperative day 1 ($p = 0.001$) and day 3 ($p = 0.002$), whereas no significant difference was observed on day 7 ($p = 0.72$). Soft-tissue healing scores were significantly higher in the I-PRF group on day 3 ($p = 0.003$) and day 7 ($p = 0.001$). Postoperative swelling was significantly reduced in the I-PRF group compared with PRF-treated sites on days 3, 7, and 14 ($p < 0.05$). Periodontal pocket depth was significantly lower in the I-PRF group on day 7 ($p = 0.001$) and day 14 ($p = 0.002$). No significant differences were observed between groups regarding maximum interincisal mouth opening during the follow-up period.

Conclusion: Within the limitations of this study, both PRF and I-PRF demonstrated beneficial effects on postoperative healing following surgical extraction of impacted mandibular third molars. However, I-PRF provided superior early soft-tissue healing, reduced postoperative pain and swelling, and decreased periodontal pocket formation compared with conventional PRF. The findings suggest that I-PRF may represent a valuable adjunctive regenerative approach for improving early postoperative outcomes after third molar surgery.

Keywords: Platelet-rich fibrin; Injectable platelet-rich fibrin; Impacted mandibular third molar; Wound healing; Surgical extraction; Regenerative dentistry.

INTRODUCTION

Lower third molar extraction, also known as wisdom tooth extraction, is a routine minor surgical procedure performed in oral and maxillofacial surgery. Although it is generally considered a safe procedure, several postoperative complications may occur, including periodontal pocket formation, delayed wound healing, postoperative pain, swelling, and alveolar osteitis (AO). These complications may negatively affect the patient's postoperative experience by causing discomfort, prolonging recovery time, and, in some cases, increasing the risk of secondary infections. To overcome these limitations and enhance tissue regeneration, regenerative medicine has focused on platelet-rich fibrin (PRF) and its injectable form, injectable platelet-rich fibrin (I-PRF).

PRF is an autologous platelet concentrate prepared from the patient's own blood. Unlike earlier platelet concentrate techniques, PRF is produced without the use of anticoagulants, allowing the formation of a natural fibrin matrix. This fibrin matrix acts as a biological scaffold enriched with platelets, leukocytes, and various growth factors. When placed into the extraction socket, PRF promotes angiogenesis, enhances new blood vessel formation, reduces inflammation, and supports the healing process of soft tissue and bone.

Injectable Platelet-Rich Fibrin (I-PRF): Biological Properties and Clinical Applications

While conventional PRF is obtained as a solid fibrin membrane, injectable platelet-rich fibrin (I-PRF) represents a liquid formulation that provides greater flexibility in clinical applications. Due to its liquid state, I-PRF remains injectable for a short period before polymerization and clot formation, allowing clinicians to:

1. Inject it directly into the surgical site.
2. Combine it with bone graft materials to create a biologically active regenerative mixture.
3. Deliver a concentrated amount of cytokines and growth factors directly to the wound area.

I-PRF may enhance clot stabilization and improve the distribution of regenerative components within the extraction socket. For patients, this may result in reduced postoperative pain, decreased swelling, improved wound healing, and a lower risk of complications such as dry socket.

Aim

The present study was designed to compare the effectiveness of injectable platelet-rich fibrin (I-PRF) and conventional platelet-rich fibrin (PRF) in improving postoperative outcomes following surgical extraction of impacted mandibular third molars, including pain, swelling, soft-tissue healing, and periodontal pocket formation.

Objectives

1. To assess postoperative pain in the PRF and I-PRF groups.
2. To evaluate soft-tissue healing in the PRF and I-PRF groups.
3. To assess postoperative swelling in the PRF and I-PRF groups.
4. To evaluate periodontal pocket formation in the PRF and I-PRF groups.
5. To compare postoperative pain, soft-tissue healing, swelling, and mouth opening between the PRF and I-PRF groups.

MATERIALS AND METHODS

Study Design

A randomized, double-blind, split-mouth clinical study was conducted in the Department of Oral and Maxillofacial Surgery, SIBAR Institute of Dental Sciences, between June 2025 and August 2025. A total of 21 patients aged 18–45 years requiring bilateral surgical extraction of impacted mandibular third molars (Pell and Gregory Class I, Position A) were enrolled in the study.

As each patient contributed two extraction sockets, a total of 42 extraction sites were included. In the split-mouth study design, one extraction socket received platelet-rich fibrin (PRF), while the contralateral extraction socket received injectable platelet-rich fibrin (I-PRF). Both mandibular third molars were surgically removed during the same appointment, allowing each patient to serve as their own control and minimizing inter-individual variability.

All participants were informed about the nature, objectives, and procedures of the study, and written informed consent was obtained before enrolment. Ethical approval was obtained from the Institutional Ethics Committee (Reference No. 04/IEC-SIBAR/CIR/25).

Randomization and Blinding

A computer-generated randomization sequence was used to allocate PRF and I-PRF treatments to the extraction sites. One side was randomly assigned to receive PRF, while the contralateral side received I-PRF. Allocation concealment was maintained using sequentially numbered, opaque, sealed envelopes, which were opened immediately before placement of the platelet concentrate. The study followed a double-blind design. Patients were unaware of the treatment allocated to each extraction site, and the investigator responsible for postoperative assessment was blinded to the intervention. The surgeon performing the procedure was aware of the material being placed due to differences in preparation and handling techniques; however, the surgeon was not involved in postoperative outcome assessment.

Follow-up

Patients were evaluated postoperatively on days 1, 3, 7, and 14. Clinical parameters, including postoperative pain, soft-tissue healing, swelling, and periodontal pocket formation, were assessed during the follow-up period. All enrolled patients completed the scheduled follow-up visits.

Eligibility Criteria

Inclusion Criteria

• Individuals aged 18–45 years.
• Patients categorized as ASA Physical Status I or II.
• Presence of bilateral impacted mandibular third molars requiring surgical extraction (Pell and Gregory Class I, Position A).
• Patients willing to participate and comply with the follow-up evaluation schedule.

Exclusion Criteria

• Systemic diseases or medical conditions known to impair healing or contraindicate oral surgical procedures, including uncontrolled diabetes mellitus and bleeding disorders.
• Pregnant or breastfeeding women.
• Patients receiving medications that could influence coagulation or tissue repair.
• Presence of acute infection at the intended surgical site.

Surgical Procedure

All procedures were performed under local anesthesia following a standardized surgical protocol. A mucoperiosteal flap was reflected to expose the impacted tooth, followed by bone removal and tooth sectioning whenever required. After extraction, the socket was thoroughly irrigated with sterile saline solution to remove debris and bone particles. For the PRF group, 10 mL of venous blood was collected without the use of an anticoagulant and centrifuged at 3000 rpm for 10 minutes (Figure 1).

Figure 1. Centrifuged blood samples in test tubes showing the separation of platelet-rich fibrin (PRF)

The resulting fibrin clot was separated and compressed to form a PRF membrane, which was subsequently placed into the extraction socket (Figure 2).

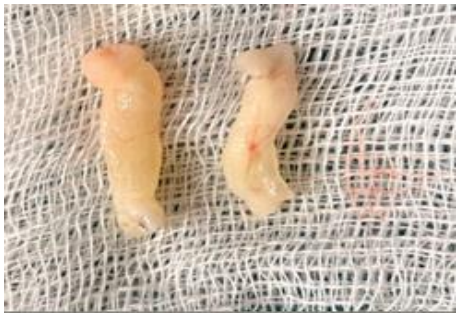

Figure 2. Extracted PRF matrix from the test tubes

In the PRF group, PRF matrix is placed in the socket of extracted tooth (Figure 3,4).

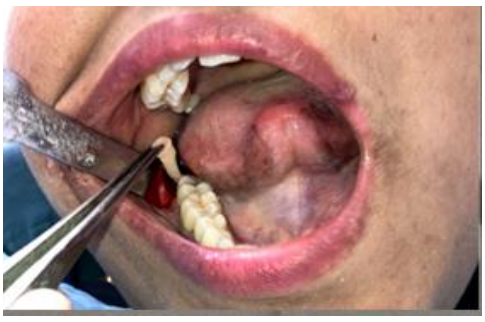

Figure 3. Placement of PRF in the extracted socket with the help of tissue holding forceps

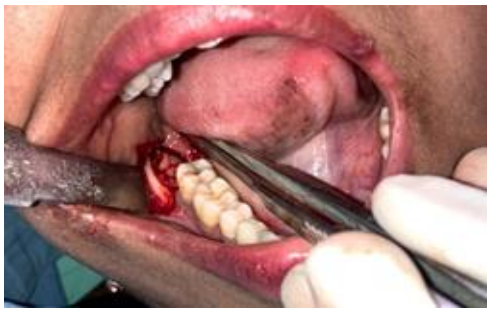

Figure 4. Placed PRF in the extracted socket

For the I-PRF group, 10 mL of venous blood was collected and centrifuged at 700 rpm for 3 minutes. The upper orange-coloured liquid layer was aspirated and used as injectable platelet-rich fibrin (I-PRF) (Figure 5,6).

Figure 5. Centrifuged blood samples in test tubes showing the separation of Injectable platelet-rich fibrin (I-PRF)

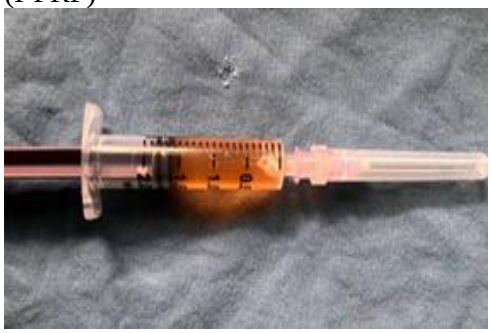

Figure 6. Extracted I-PRF in the syringe from the test tubes

The prepared I-PRF was immediately injected into the contralateral extraction socket following tooth removal and socket irrigation (Figure 7).

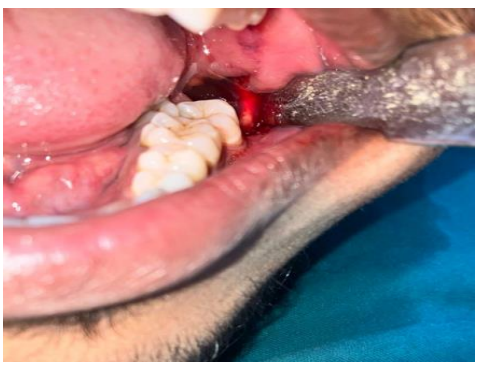

Figure 7. Placement of I-PRF in the extracted socket.

Subsequently, all surgical sites were closed using 3-0 silk sutures to facilitate wound stabilization and postoperative healing (Figure 8).

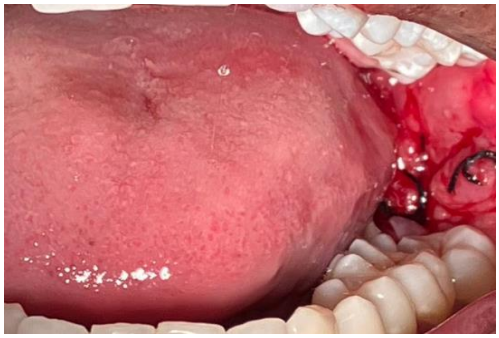

Figure 8. Closure of the extraction socket

Measurements were recorded to evaluate the degree of postoperative edema and to compare changes in swelling between the PRF-treated and I-PRF-treated extraction sites. Swelling assessment was performed during the early healing period, including postoperative days 3, 7, and 14.

Outcome Assessment

Pain Assessment

Postoperative pain intensity was recorded using a 10-point Visual Analogue Scale (VAS), where higher scores indicated greater pain severity. Assessments were performed on postoperative days 1, 3, and 7.

Swelling Assessment

Facial swelling was evaluated through clinical measurements obtained at baseline and during follow-up visits.

Soft-Tissue Healing Assessment

Healing of the surgical site was assessed using a standardised wound-healing index (Laundry) that considered tissue appearance, epithelialization, and overall wound closure. Evaluations were carried out on postoperative days 3 and 7.

Periodontal Pocket Depth Assessment

Periodontal pocket depth adjacent to the extraction site was measured in millimetres using a graduated periodontal probe. Measurements were recorded during follow-up to assess periodontal healing.

Statistical Analysis

Data were analysed using SPSS software version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were expressed as mean ± standard deviation (SD). The normality of continuous variables was assessed using the Shapiro–Wilk test. Variables demonstrating a normal distribution were analysed using the paired t-test, whereas variables not following a normal distribution were analyzed using the Wilcoxon Signed-Rank test. Pain scores, soft-tissue healing scores, and periodontal pocket depth measurements were compared between the PRF and I-PRF groups. A p-value of less than 0.05 was considered statistically significant

RESULTS

I-PRF significantly reduced pain compared to PRF ($p < 0.05$), showing improved early pain control. By day seven, there is no significant difference in the pain levels between the two groups.

Table 1. Postoperative Pain

Day	PRF	I-PRF	p-value
1	6.0 ± 1.2	4.0 ± 1.0	0.001*
3	4.0 ± 1.1	2.0 ± 0.9	0.002*
7	1.0 ± 0.5	1.0 ± 0.4	0.72

Table 2. Soft Tissue Healing

Day	PRF	I-PRF	p-value
3	2.0 ± 0.6	3.0 ± 0.7	0.003*
7	4.0 ± 0.5	5.0 ± 0.5	0.001*

At both Day 3 and Day 7, I-PRF showed significantly superior soft tissue healing scores compared to PRF ($p < 0.05$)

Table 3. Pocket Formation

Day	PRF (mm)	I- PRF (mm)	p-value
Day 7	2.2 ± 0.4	1.6 ± 0.3	0.001 *
Day 14	1.8 ± 0.3	1.2 ± 0.2	0.002 *

The I-PRF group had less pocket formation, with a statistically significant p-value > 0.05.

Table 4. Postoperative swelling

Day	PRF (mm)	I- PRF (mm)	p-value
Day 3	12.4 ± 2.1 mm	8.6 ± 1.9 mm	0.003*
Day 7	7.8 ± 1.8 mm	4.9 ± 1.5 mm	0.001*
Day 14	3.5 ± 1.1 mm	2.1 ± 0.9 mm	0.012*

Postoperative swelling gradually decreased in both groups during the healing period. However, the I-PRF group consistently demonstrated lower swelling measurements than the PRF group at all follow up visits.

The differences were statistically significant on Days 3, 7, and 14 ($p < 0.05$), indicating improved control of postoperative swelling with I-PRF.

Table 5. Comparison of Maximum Interincisal Mouth Opening Between Groups

Day	PRF (mm)	I- PRF (mm)	p-value
Day 3	29.4 ± 4.1	30.2 ± 3.8	0.487
Day 7	36.8 ± 3.5	37.5 ± 3.2	0.534
Day 14	43.6 ± 2.9	44.1 ± 2.7	0.648

Mouth opening improved progressively in both groups during the postoperative period. No significant differences in trismus were observed between the PRF and I-PRF groups at Days 3, 7, or 14 ($p > 0.05$).

DISCUSSION

Trismus, postoperative pain, oedema, and delayed soft-tissue healing are well-recognized sequelae following surgical extraction of impacted mandibular third molars. These complications arise from the inflammatory cascade triggered by periosteal elevation, bone removal, and socket trauma[1]. Autologous platelet concentrates have garnered increasing interest as adjuncts to socket management, as they deliver a supraphysiological concentration of growth factors — including platelet-derived growth factor (PDGF), transforming growth factor-β (TGF-β), vascular endothelial growth factor (VEGF), and insulin-like growth factor (IGF) — directly to the wound environment[2]. The present split-mouth randomised study was designed to critically compare injectable platelet-rich fibrin (I-PRF) with conventional platelet-rich fibrin (PRF) in terms of postoperative pain, soft-tissue healing, swelling, and pocket formation following mandibular third molar surgery.

Platelet-Rich Fibrin (PRF) was introduced by Choukroun J et al. (2001) as a second-generation platelet concentrate that forms a dense fibrin matrix capable of progressively releasing growth factors at the surgical site[3]. Additionally, cellular migration and tissue regeneration are supported by the fibrin scaffold. Dohan DM et al. (2006) elaborated on the biological characteristics and regenerative potential of PRF, highlighting its capacity to promote bone regeneration and soft-tissue healing [4].

Daugela P et al. (2018) observed that using PRF in extraction sockets reduced postoperative pain and swelling while increasing soft-tissue recovery following mandibular third molar surgery[5]. Similarly, Kumar N et al. (2015) found that patients treated with PRF after surgical extraction of impacted third molars had better postoperative recovery and faster healing [6]. The results of the current study are in accordance with the PRF group's satisfactory healing and reduced postoperative discomfort.

Emerging literature demonstrates that Injectable Platelet-Rich Fibrin (I-PRF) is generated by a low-speed centrifugation procedure. I-PRF was first proposed by Miron RJ et al. (2017). They reported that it has a greater concentration of leukocytes and platelets, which optimises its capacity for regeneration and induces angiogenesis and cellular migration[7]. I-PRF can be injected directly into tissues owing to its liquid state, which facilitates growth factor dispersion confined to the surgical site. The I-PRF group in the present study demonstrated significantly better early postoperative results, such as increased pain and swelling reduction and enhanced soft-tissue healing.

These findings are consistent with those of Tanya Nagrani et al. (2021), who investigated bone regeneration following tooth extraction and socket preservation and discovered that I-PRF enhanced bone healing and ridge preservation[8]. Similarly, PRF enhances bone and soft-tissue healing after mandibular third molar extraction, according to Manzoor Mohammad Dar et al. (2018)[9]. Additionally, Zwittnig B et al. (2024) reported that the use of PRF facilitated postoperative recovery and minimised complications after third molar surgery [10].

The superior performance of I-PRF observed in the present study can be attributed to several biological advantages over conventional PRF. The low-speed centrifugation protocol (700 rpm for 3 minutes) employed for I-PRF preparation yields a liquid concentrate that retains a significantly higher proportion of viable platelets, leukocytes, and mesenchymal stem cells compared to the high-speed protocol used for PRF. This is consistent with Miron RJ et al. (2017), who demonstrated that the reduced centrifugal force preserves platelet morphology and prevents premature degranulation, thereby maintaining the full growth factor payload for release at the wound site[7]. Furthermore, the liquid consistency of I-PRF allows it to permeate the three-dimensional architecture of the cancellous bone within the extraction socket, ensuring uniform growth factor distribution, an advantage that the solid PRF membrane, which acts primarily as a surface scaffold, cannot replicate. The resultant paracrine signaling by PDGF and TGF-β is likely responsible for the accelerated fibroblast proliferation, angiogenesis, and collagen synthesis observed in the I-PRF group, particularly on days 3 and 7 postoperatively.

While the statistical differences between I-PRF and PRF across pain ($p = 0.001–0.002$), soft-tissue healing ($p = 0.001–0.003$), and pocket formation ($p = 0.001–0.002$) were highly significant, it is important to critically appraise the clinical magnitude of these differences. The mean VAS pain score on day 1 was 6.0 ± 1.2 in the PRF group and 4.0 ± 1.0 in the I-PRF group a difference of 2 points. Although statistically significant, the minimal clinically important difference (MCID) for VAS pain is generally accepted to be 1.5–2.0 points; therefore, the observed difference falls at the lower boundary of clinical relevance. Similarly, by day 7, pain scores converged (1.0 vs 1.0, $p = 0.72$), indicating that the primary advantage of I-PRF is in early postoperative pain control rather than long-term pain reduction. Clinicians should, therefore, interpret I-PRF's superiority as an early-phase benefit with limited long-term differentiation from conventional PRF. The reduced pocket formation in the I-PRF group (1.6 mm vs 2.2 mm at day 7) carries clearer clinical relevance, as reduced probing depths at the distal aspect of the second molar have implications for long-term periodontal health of the adjacent tooth.

The present study has certain limitations. The relatively small sample size ($n = 42$) and short follow-up of 14 days limit the generalizability of findings and preclude assessment of long-term bone regeneration and periodontal outcomes. Swelling was quantified by facial measurements rather than volumetric analysis, and pain was assessed using the subjective VAS scale, both of which may introduce measurement variability. Additionally, growth factor concentrations (PDGF, TGF-β, VEGF) were not assayed, limiting mechanistic interpretation of the observed clinical differences.

A limitation of this split-mouth study is the inability to blind the operator during socket treatment, which may have introduced procedural bias. Additionally, variations in the timing of I-PRF application before polymerisation could have affected treatment consistency.

In summary, the findings of the present study suggest that I-PRF confers a clinically and statistically meaningful advantage over conventional PRF in early postoperative wound healing following mandibular third molar surgery. The biological basis for this advantage lies in its superior cellular viability, uniform intrasocket diffusion, and sustained growth factor bioavailability. However, the convergence of outcomes by day 7 for pain and the modest absolute difference in healing scores underscore that both materials achieve satisfactory clinical outcomes and that I-PRF's principal benefit is in accelerating the early inflammatory-to-proliferative transition. Future randomised controlled trials with larger sample sizes, longer follow-up, quantitative growth factor assays, and blinded outcome assessment are warranted to consolidate these findings.

Limitations:

The limitations of this study include a small sample size, a short follow-up duration, and its conduct at a single centre. In addition, healing was evaluated only through clinical assessment, without radiographic or histological analysis. The possibility of observer bias cannot be completely excluded.

CONCLUSION

I-PRF demonstrated favourable postoperative healing in contrast to PRF in this study. Increased penetration into the extraction socket, enriched concentration of growth factors, and regenerative cell constituents. In contrast to a solid PRF membrane, the slow development of a natural fibrin scaffold further stimulates early tissue regeneration, angiogenesis, and collagen formation, facilitating enhanced and effective healing.

DECLARATION

Conflict of Interest

The author declares no conflict of interest.

Funding

No external funding was received for this study.

Ethical approval

The study was reviewed by the College Ethical Committee.

Consent for publication

Patients were informed verbally and in writing about the study and gave written informed consent.

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