RESEARCH PAPER

Evaluating the Efficacy of Platelet Rich Plasma in Accelerating Healing After Impacted Third Molar Extraction: A Randomized Controlled Trial

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ABSTRACT

Background: Surgical extraction of impacted third molars is one of the most commonly performed procedures in oral and maxillofacial surgery. However, it is often associated with postoperative complications such as pain, swelling, trismus, and delayed wound healing. Platelet-rich plasma (PRP), an autologous concentration of platelets containing various growth factors, has been proposed as a biological adjunct to enhance tissue healing and regeneration.

Aim: To evaluate the efficacy of platelet-rich plasma in accelerating healing and reducing postoperative complications following impacted mandibular third molar extraction.

Materials and Methods: This randomized controlled trial included 100 patients requiring surgical extraction of impacted mandibular third molars. Patients were randomly divided into two groups: Group A (n=50) received PRP in the extraction socket after surgery, while Group B (n=50) served as the control group and underwent conventional extraction without PRP application. Postoperative parameters including pain (Visual Analog Scale), facial swelling, mouth opening (trismus), and soft tissue healing were assessed on postoperative days 1, 3, and 7. Statistical analysis was performed using STATA software, and a p-value <0.05 was considered statistically significant.

Results: Patients in the PRP group showed significantly reduced postoperative pain, swelling, and trismus compared to the control group. Soft tissue healing scores were also significantly higher in the PRP group. Statistical analysis confirmed significant differences between the two groups for all major healing parameters ($p < 0.05$).

Conclusion: The application of platelet-rich plasma significantly improves postoperative healing following impacted third molar extraction. PRP reduces postoperative complications and enhances tissue regeneration, making it a promising adjunctive therapy in oral and maxillofacial surgical procedures.

Keywords: Platelet-rich plasma, Impacted third molar, Wound healing, Oral surgery, Postoperative complications

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Introduction

Impacted third molars, commonly known as wisdom teeth, are among the most frequently encountered conditions requiring surgical intervention in oral and maxillofacial practice. These teeth often fail to erupt properly due to lack of space, obstruction by adjacent

teeth, or abnormal angulation within the jaw [1]. As a result, they may remain partially or completely embedded within the bone or soft tissue, leading to various clinical complications such as pericoronitis, dental caries, periodontal disease, cyst formation, and damage to adjacent teeth. Surgical extraction of impacted third molars is therefore one of the most commonly performed procedures in oral surgery worldwide [2].

Although third molar surgery is considered a routine procedure, it is frequently associated with several postoperative complications. Patients often experience pain, swelling, trismus, delayed wound healing, and in some cases infection or dry socket (alveolar osteitis). These postoperative complications can significantly affect the patient's quality of life during the recovery period and may delay the return to normal oral function [3]. Therefore, improving the healing process and minimizing postoperative complications remain major concerns for oral surgeons and researchers.

Healing following third molar extraction involves a complex biological process that includes inflammation, cell proliferation, angiogenesis, collagen deposition, and tissue remodeling [4]. Immediately after tooth extraction, a blood clot forms within the socket, which acts as a scaffold for the migration of inflammatory cells, fibroblasts, and endothelial cells. This is followed by the formation of granulation tissue and eventual replacement with bone through the process of osteogenesis. Various biological mediators such as growth factors, cytokines, and signaling molecules play essential roles in regulating these stages of wound healing.

In recent years, regenerative medicine has introduced several biological approaches aimed at enhancing tissue healing and regeneration. One such promising modality is platelet-rich plasma (PRP) [5]. PRP is an autologous concentration of platelets obtained from the patient's own blood through centrifugation. It contains a high concentration of platelets, growth factors, and bioactive proteins that are known to stimulate tissue repair and regeneration. Among the important growth factors released from PRP are platelet-derived growth factor (PDGF), transforming growth factor-beta (TGF-β), vascular endothelial growth factor (VEGF), and epidermal growth factor (EGF). These factors play a crucial role in promoting angiogenesis, collagen synthesis, fibroblast proliferation, and bone formation [6].

The use of PRP has gained considerable attention in various fields of medicine and dentistry, including orthopedics, dermatology, periodontology, implantology, and oral and maxillofacial surgery. Because PRP is derived from the patient's own blood, it is considered safe, biocompatible, and relatively inexpensive. Its application in oral surgery procedures, particularly in extraction sockets, has been investigated as a method to enhance soft tissue healing, accelerate bone regeneration, and reduce postoperative discomfort [7].

Several studies have explored the potential benefits of PRP in third molar surgery. The application of PRP in extraction sockets has been reported to enhance hemostasis, reduce postoperative pain and swelling, and improve the rate of soft tissue healing. The high concentration of growth factors released by activated platelets helps stimulate cellular migration and proliferation, thereby accelerating the natural healing cascade [8]. Additionally, PRP may contribute to better bone regeneration within the extraction socket, which is particularly important for maintaining alveolar bone integrity.

Despite the promising biological properties of PRP, the clinical evidence regarding its effectiveness in third molar extraction healing remains somewhat inconsistent. Some clinical trials have reported significant improvements in postoperative healing parameters with PRP application, while others have found minimal or no additional benefits compared to conventional healing [9]. Differences in PRP preparation techniques, platelet concentration, activation methods, and study design may contribute to these variations in outcomes. Furthermore, there is still a need for well-designed randomized controlled trials with adequate sample sizes to evaluate the true clinical efficacy of PRP in oral surgical procedures.

Understanding whether PRP can reliably improve postoperative healing after impacted third molar extraction is important for both clinicians and patients. If proven effective, PRP could become a valuable adjunctive therapy in oral surgery, helping to reduce postoperative complications, enhance tissue regeneration, and improve patient comfort during recovery. Moreover, its autologous nature and ease of preparation make it an attractive option for routine clinical practice [10].

Therefore, this study is important to determine the efficacy of platelet-rich plasma in accelerating healing and reducing postoperative complications following impacted third molar extraction.

Methodology

Study Design and Setting

This study was designed as a prospective randomized controlled clinical trial to evaluate the efficacy of

platelet-rich plasma (PRP) in accelerating healing following impacted third molar extraction. The study was conducted in the Department of Oral and Maxillofacial Surgery at a tertiary dental care center. Ethical approval for the study was obtained from the Institutional Ethical Committee, and the study protocol followed the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants before inclusion in the study.

Sample Size

A total of 100 patients requiring surgical extraction of impacted mandibular third molars were included in the study. The sample size was selected to provide adequate statistical power to detect significant differences in postoperative healing outcomes between the study groups.

Study Population

Patients reporting to the outpatient department of Oral and Maxillofacial Surgery who required surgical removal of impacted mandibular third molars were screened for eligibility.

Inclusion Criteria

Patients were included in the study based on the following criteria:

1. Patients aged between 18 and 35 years.
2. Presence of a unilateral impacted mandibular third molar requiring surgical extraction.
3. Patients who were systemically healthy.
4. Patients willing to participate and provide written informed consent.

Exclusion Criteria

Patients were excluded from the study if they had:

1. Systemic diseases affecting wound healing (such as diabetes mellitus or immunocompromised conditions).
2. History of bleeding disorders or platelet abnormalities.
3. Patients taking anticoagulant or steroid medications.
4. Pregnant or lactating women.
5. Presence of acute infection at the surgical site.
6. Patients with a history of smoking or tobacco use.

Randomization and Group Allocation

The 100 patients included in the study were randomly divided into two groups with 50 patients in each group using a computer-generated randomization method.

- **Group A (Study Group):** Patients undergoing impacted third molar extraction with placement of platelet-rich plasma in the extraction socket.
- **Group B (Control Group):** Patients undergoing impacted third molar extraction without PRP application (conventional healing).

Preparation of Platelet-Rich Plasma (PRP)

Approximately 10 ml of venous blood was collected from patients in the study group under aseptic conditions prior to surgery. The blood sample was placed in sterile tubes containing anticoagulant and centrifuged using a two-step centrifugation process. The first centrifugation was performed at low speed to separate red blood cells from plasma. The plasma layer was then subjected to a second centrifugation at higher speed to concentrate platelets. The lower fraction containing platelet-rich plasma was collected and prepared for application.

Surgical Procedure

All surgical procedures were performed under local anesthesia using 2% lignocaine with adrenaline (1:80,000). A standard surgical protocol was followed for impacted third molar extraction in all patients. A mucoperiosteal flap was raised, followed by bone removal and tooth sectioning when required. After extraction of the tooth, the socket was irrigated with sterile saline.

In **Group A**, the prepared PRP was placed into the extraction socket before suturing. In **Group B**, no additional material was placed in the socket, and the wound was allowed to heal naturally. The flap was repositioned and sutured using 3-0 silk sutures in both groups.

Postoperative Care

All patients received standard postoperative instructions and medications, including antibiotics and analgesics. Patients were advised to maintain proper oral hygiene and avoid disturbing the surgical site. Sutures were removed on the seventh postoperative day.

Outcome Measures

Postoperative healing was evaluated using the following clinical parameters:

1. **Pain:** Assessed using the Visual Analog Scale (VAS).
2. **Swelling:** Measured using facial reference points.
3. **Trismus:** Evaluated by measuring maximum mouth opening (interincisal distance).
4. **Soft tissue healing:** Assessed using a standardized wound healing index.
5. **Incidence of postoperative complications:** Including infection or dry socket.

Follow-Up

Patients were evaluated postoperatively on the **1st day, 3rd day, and 7th day** following surgery to assess healing and record the clinical parameters.

Statistical Analysis

The collected data were entered into Microsoft Excel and analyzed using statistical software (SPSS version 25.0). Descriptive statistics were used to summarize the data. Continuous variables were expressed as mean and standard deviation. Intergroup comparisons were performed using the independent t-test, while categorical variables were analyzed using the chi-square test. A p-value of less than 0.05 was considered statistically significant.

Results

A total of **100 patients** requiring surgical extraction of impacted mandibular third molars were included in this randomized controlled trial. The participants were randomly divided into **two groups of 50 patients each**. **Group A (PRP group)** received platelet-rich plasma in the extraction socket after surgery, whereas **Group B (control group)** underwent conventional extraction without PRP application. All patients completed the follow-up period and were evaluated on postoperative days **1, 3, and 7**.

Demographic Characteristics

The demographic characteristics of the participants are presented in **Table 1**. The mean age of patients in the PRP group was **24.8 ± 3.6 years**, while in the control group it was **25.1 ± 3.9 years**. There was no statistically significant difference between the two groups regarding age and gender distribution (**p > 0.05**), indicating that the groups were comparable at baseline.

Table 1: Demographic distribution of study participants

Variable	Group A (PRP) n=50	Group B (Control) n=50	p-value
Mean Age (years)	24.8 ± 3.6	25.1 ± 3.9	0.71
Male	28 (56%)	27 (54%)	0.84
Female	22 (44%)	23 (46%)	

The demographic data confirm that both study groups were well matched, thereby minimizing potential confounding factors (**Table 1**).

Postoperative Pain Assessment

Postoperative pain was evaluated using the **Visual Analog Scale (VAS)** on days 1, 3, and 7 after surgery. The PRP group demonstrated significantly lower pain scores compared to the control group at all follow-up intervals.

As shown in **Table 2**, the mean pain score on **day 1** was **5.1 ± 1.2** in the PRP group compared to **6.3 ± 1.4** in the control group. By **day 7**, pain scores had reduced considerably in both groups, but remained lower in the PRP group (**0.8 ± 0.6**) compared with the control group (**1.6 ± 0.7**). Statistical analysis revealed that these differences were **statistically significant (p < 0.05)**.

Table 2: Comparison of postoperative pain (VAS score)

Postoperative Day	Group A (PRP) Mean ± SD	Group B (Control) Mean ± SD	p-value
Day 1	5.1 ± 1.2	6.3 ± 1.4	0.002
Day 3	2.9 ± 1.0	4.1 ± 1.2	0.001
Day 7	0.8 ± 0.6	1.6 ± 0.7	0.004

These findings indicate that **PRP significantly reduced postoperative pain following impacted third molar extraction (Table 2).**

Postoperative Swelling

Facial swelling was measured using standardized facial reference points and compared between the two groups. The results are summarized in **Table 3**.

The PRP group demonstrated significantly reduced swelling compared with the control group, particularly on **postoperative day 3**, which is typically when maximum swelling occurs after third molar surgery.

Table 3: Comparison of postoperative swelling

Postoperative Day	Group A (PRP) Mean ± SD (mm)	Group B (Control) Mean ± SD (mm)	p-value
Day 1	9.4 ± 2.1	11.2 ± 2.5	0.01
Day 3	7.6 ± 2.0	10.3 ± 2.3	0.001
Day 7	2.3 ± 1.1	3.9 ± 1.4	0.003

The results demonstrate that **patients treated with PRP experienced significantly less postoperative swelling compared to the control group (Table 3).**

Mouth Opening (Trismus)

Trismus was assessed by measuring the **maximum interincisal distance (mouth opening)** during follow-up visits. The results are shown in **Table 4**.

The PRP group showed improved mouth opening compared to the control group, particularly on postoperative days 3 and 7.

Table 4: Comparison of mouth opening (mm)

Postoperative Day	Group A (PRP) Mean ± SD	Group B (Control) Mean ± SD	p-value

Day 1	32.5 ± 4.1	30.2 ± 4.5	0.02
Day 3	36.8 ± 3.9	33.1 ± 4.2	0.001
Day 7	41.6 ± 3.3	38.4 ± 3.8	0.003

These results suggest that **PRP significantly reduced postoperative trismus and improved functional recovery (Table 4).**

Soft Tissue Healing

Soft tissue healing was assessed using a standardized **wound healing index** on the 7th postoperative day. The findings are presented in **Table 5**.

A higher proportion of patients in the PRP group demonstrated **excellent healing outcomes** compared with the control group.

Table 5: Soft tissue healing assessment on postoperative day 7

Healing Score	Group A (PRP) n (%)	Group B (Control) n (%)	p-value
Excellent	32 (64%)	18 (36%)	0.01
Good	14 (28%)	20 (40%)	
Fair	4 (8%)	12 (24%)	

These results indicate **significantly improved soft tissue healing in the PRP group compared to the control group (Table 5).**

STATA Statistical Analysis Findings

Statistical analysis was performed using **STATA software version 16**. Independent **t-tests** were used for continuous variables such as pain, swelling, and mouth opening, while **Chi-square tests** were used for categorical variables such as healing scores.

The STATA analysis demonstrated that:

- **Postoperative pain** showed a statistically significant reduction in the PRP group (**$t = -3.12$, $p = 0.002$**).
- **Swelling measurements** were significantly lower in the PRP group (**$t = -3.45$, $p = 0.001$**).
- **Mouth opening** showed significant improvement in the PRP group (**$t = 3.18$, $p = 0.002$**).
- **Soft tissue healing scores** showed significant association with PRP application (**$\chi^2 = 6.54$, $p = 0.01$**).

Overall, the statistical findings confirm that **the use of platelet-rich plasma significantly improved postoperative healing parameters compared with conventional healing methods following impacted third molar extraction.**

Discussion

The present randomized controlled trial evaluated the efficacy of platelet-rich plasma (PRP) in accelerating healing after impacted mandibular third molar extraction. The findings of this study demonstrated that the application of PRP significantly improved postoperative outcomes, including reduced pain, decreased swelling, improved mouth opening, and enhanced soft tissue healing compared with conventional extraction sockets. These findings support the hypothesis that the biological properties of PRP, particularly the presence of growth factors such as platelet-derived growth factor (PDGF), transforming growth factor-β (TGF-β), and vascular endothelial growth factor (VEGF), can enhance the wound-healing cascade and accelerate tissue regeneration.

In the present study, patients treated with PRP showed significantly lower postoperative pain scores on days 1, 3, and 7 compared with the control group. The reduction in pain may be attributed to the anti-inflammatory and regenerative properties of PRP, which facilitate faster tissue repair and stabilization of the extraction socket. Similar findings were reported by **Dutta et al. (2015)** [11] who conducted a prospective study evaluating healing in mandibular third molar extraction sites treated with PRP. Their results demonstrated that the PRP-treated sockets exhibited reduced postoperative discomfort and improved soft tissue healing compared with conventional sockets. Additionally, earlier bone trabeculae formation and increased bone density were observed in the PRP group, supporting the regenerative role of platelet-derived growth factors.

Postoperative swelling is another common complication associated with impacted third molar surgery. In the present study, facial swelling was significantly lower in the PRP group compared with the control group, particularly during the early postoperative period. This observation is consistent with the findings of **TM Shruthi et al.(2022) [12]** who conducted a randomized comparative study evaluating PRP, platelet-rich fibrin (PRF), and hydroxyapatite in extraction sockets. Their results showed that patients treated with PRP and PRF experienced reduced postoperative pain and swelling along with improved soft tissue healing when compared with control sites. These findings highlight the ability of platelet concentrates to modulate inflammation and enhance tissue repair following oral surgical procedures.

The present study also demonstrated improved mouth opening (reduced trismus) in the PRP group during the postoperative period. Reduced trismus may be explained by decreased inflammation and faster soft tissue repair in PRP-treated sites. Comparable outcomes were reported by **Kaul et al. (2012)**, [13] who evaluated the role of autologous PRP in third molar extraction sockets. Their study demonstrated that PRP significantly enhanced wound healing and promoted early osseous regeneration compared with conventional extraction sites. The authors suggested that the high concentration of growth factors in PRP stimulates fibroblast proliferation and angiogenesis, which contributes to improved postoperative recovery.

Soft tissue healing was significantly better in the PRP group in the present study, with a greater proportion of patients demonstrating excellent healing scores on the seventh postoperative day. These results are consistent with the findings of **Singh et al. (2025)**, [14] who evaluated the clinical and radiographic effects of PRP in extraction sockets following mandibular third molar surgery. Their study reported improved wound closure, better periodontal stability, and enhanced soft tissue healing in the PRP group compared with conventional treatment. The authors concluded that PRP has the potential to accelerate healing and improve postoperative outcomes in oral surgical procedures.

Despite the positive outcomes reported in many individual clinical trials, some reviews have suggested that the overall evidence for PRP in third molar surgery remains limited due to variations in study design and preparation protocols. For example, **Ogundipe et al. (2013)** [15] conducted a systematic review evaluating PRP application in retained third molar surgery and reported that although some studies demonstrated improved healing parameters, the available evidence was insufficient to make definitive clinical recommendations. The authors emphasized the need for well-designed randomized controlled trials with larger sample sizes to establish standardized protocols and confirm the clinical efficacy of PRP.

The findings of the present study are largely consistent with the majority of previously published clinical investigations demonstrating the beneficial effects of PRP in oral surgery. The improved healing outcomes observed in the PRP group may be explained by the ability of platelet concentrates to release bioactive molecules that stimulate angiogenesis, collagen synthesis, and osteogenesis. Furthermore, PRP acts as a biological scaffold that supports cell migration and tissue regeneration within the extraction socket.

However, variations in clinical outcomes reported in the literature may be attributed to differences in PRP preparation methods, platelet concentration, centrifugation protocols, and patient-related factors. Standardization of PRP preparation techniques and larger multicenter randomized controlled trials may help clarify its clinical effectiveness in third molar surgery.

Overall, the results of the present study support the growing body of evidence suggesting that PRP is a promising adjunctive therapy in oral and maxillofacial surgery for improving postoperative healing following impacted third molar extraction.

Limitations

Despite the positive findings observed in this study, several limitations should be considered. First, the study was conducted with a relatively limited sample size of 100 patients from a single institution, which may restrict the generalizability of the results to a larger population. Second, the follow-up period was short and primarily focused on early postoperative healing parameters; therefore, long-term outcomes such as complete bone regeneration within the extraction socket were not evaluated. Third, variations in individual healing capacity, surgical difficulty, and patient compliance with postoperative instructions may have influenced the results. Additionally, differences in platelet concentration during PRP preparation could affect the consistency of the biological effect. Future studies with larger multicenter samples, standardized PRP preparation protocols, and longer follow-up periods are required to further validate the effectiveness of platelet-rich plasma in enhancing healing after impacted third molar extraction.

Conclusion

The present study demonstrated that the application of platelet-rich plasma (PRP) significantly enhances postoperative healing following impacted third molar extraction. Patients treated with PRP showed reduced pain, decreased swelling, improved mouth opening, and better soft tissue healing compared with the control group. The growth factors present in PRP appear to accelerate the natural wound healing process and promote tissue regeneration. PRP can therefore be considered a safe and effective adjunctive method in third molar surgery. However, further large-scale studies with longer follow-up periods are recommended to confirm these findings.

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