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Research Article

Retrospective Clinical Evaluation of Platelet-Rich Plasma Application in Oral Surgery in Adults: A Comparative Study with a Control Group

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ABSTRACT

Platelet-rich plasma (PRP), an autologous blood concentrate rich in platelets and growth factors, has gained popularity in oral surgery due to its potential to enhance healing and reduce post-operative complications. However, its efficacy remains debated due to variations in preparation and application protocols. This retrospective comparative clinical study aimed to evaluate the healing enhancement and safety of PRP in various oral surgical procedures, such as tooth extractions, sinus lifts, periapical surgeries, and cyst enucleations, compared to a control group treated without PRP. A total of 84 adult patients (mean age 42.9 years) were included: 42 received PRP (study group) and 42 underwent standard surgery without PRP (control group). Healing was evaluated clinically and radiographically based on soft tissue closure, post-operative pain (Visual Analog Scale), infection, and bone regeneration. By day 30, complete soft tissue healing was achieved in 94.1% of PRP-treated cases versus 76.4% in controls ($P < 0.05$). Mean pain score on day 10 was 2.1 in PRP versus 3.8 in control ($P < 0.01$). Radiographic bone density increased in 6 months by 28.5% in PRP-treated sites and 14.2% in controls ($P < 0.01$). Patient satisfaction was higher in the PRP group (8.4 vs. 7.1). PRP appears to significantly improve both soft tissue and bone healing in oral surgical procedures compared with standard care, with high patient satisfaction and a favorable safety profile. Further prospective controlled trials are recommended for standardized protocol validation.

Keywords: Platelet-rich plasma, oral surgery procedures, tooth extraction, surgery procedures, tissue healing

INTRODCUTION

Platelet-rich plasma (PRP) has gained significant interest in oral surgery in recent years as a biological adjunct to oral surgery because of the rising trend and potential to enhance tissue healing. PRP is an autologous blood product with a higher platelet and growth factor concentration compared to untreated plasma. Its isolation is performed by a basic centrifugation process leaving specific blood components in a density to be sifted. The potential of PRP as a therapeutic agent is due to the growth factors that are released from it, such as platelet-derived growth factor, transforming growth factor-beta, and vascular endothelial growth factor, which are essential for tissue regeneration, angiogenesis and regulation of inflammation in the oral cavity.[1] Regarding oral surgery, PRP has been implicated on dental implants, periodontal disease resolution, and multiple forms of bone grafting. It is theorized to facilitate wound healing, reduce post-operative complications, and enhance the ingrowth of graft materials to the host tissue. Results studies show superior outcome results compared to wound healing rates, pain, and infections with the addition of PRP.[2-4] However, the benefits of PRP are still a matter of controversy, since preparation and application methods were not standardized; moreover the results may be influenced by different characteristics of the patient population included in different studies. Moreover, although several studies demonstrated significant favorable outcomes, the findings in which there was no difference in time to heal and complication rates when compared to the control group indicated that PRP does not affect beneficially all surgeries.[1,5]

This is a retrospective study of oral surgery procedures aimed to review cases involving PRP for determining whether it actually works in improving healing response and decreasing inflammatory sequelae in a variety of surgical indications and also to compare its outcomes with a matched control group

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receiving conventional management, to better understand its true clinical advantage in oral surgery.

MATERIAL AND METHODS

Study Design

This is a retrospective clinical trial being conducted to evaluate the healing enhancement ability of PRP in various oral surgical operations (conducted by the same surgeon in a private clinic during a 31-month period from June 01, 2014, to January 01, 2016). It comprises tooth extraction, lifting of maxillary sinuses for dental implant, periapical surgery, and enucleation of cysts. A standard PRP preparation protocol was used and follow-up has been done periodically for post-operative healing assessment. Patients were divided into two groups:

- PRP Group (n = 42): Received standardized PRP preparation and application
- Control Group (n = 42): Underwent the same surgical procedures without PRP use; standard care (suturing, saline irrigation, and antibiotic regimen) was applied.

The inclusion (healthy adults) and exclusion (adults with systemic diseases that affect healing process) criteria were identical for both groups. Matching was performed based on age, sex, type of surgery, and general health status to reduce selection bias.

PRP Preparation and Activation

1. Venipuncture: Blood was withdrawn from patients on a sterile 18-gauge needle into vacutainer tubes contain sodium citrate as an anticoagulant
2. Centrifugation: First Spin (Soft Spin): At 1,500 rpm (circa 200 g) for 12 min. This separates the blood into three layers: Red blood cells at the bottom, The Buffy coat (White Blood Cells and Platelets) in the middle, and Platelet-Poor Plasma (PPP) at the top. Second Spin (Hard Spin): 3,500 rpm (around 400–500 g) for 7 min. This is to pellet the platelets, and the top PPP layer is discarded
3. PRP Activation: Activated using a 10% calcium chloride ($CaCl_2$) solution. The PRP becomes gel-like in consistency within 10–15 min from activation
4. Application of PRP: Activated PRP gel was applied directly to the extraction sockets, sinus lift areas, and periapical bony lesions due to periapical surgery or cyst enucleation.

Study Procedures

1. Tooth Extraction Sockets (20 cases for each group): Direct application of PRP to sockets after tooth extractions using sterile gauze. Follow-up: Clinical evaluation (inspection) was performed on days 3, 10, 30, and 60 to evaluate pain intensity (Visual Analog Scale [VAS] 0–10), soft tissue healing, infection, and bone remodeling
2. Sinus Lifts (8 cases for each group): PRP was combined with alloplastic bone graft material and used to fill the maxillary sinus floor for bone development. Follow-up: Clinical and radiographic checks were done on days 10, 30, 90, and 180 to evaluate, pain intensity (VAS 0–10), integration of the bone graft, healing of the sinus, and occurrence of complications. Dental Implants: Dental implants were inserted in the sinus lift sites between days 90 and 100 after ascertaining good bone development and stability
3. Periapical Surgery and Cyst Enucleation (14 cases for each group): PRP was utilized to fill the bone defects following periapical surgery and cyst enucleation in an attempt to enhance bone regeneration and prevent cyst recurrence. Clinical and radiographic evaluations were performed on days 10, 30, 90, and 180 to check the pain intensity (VAS 0–10), tissues healing, infection signs, and other complications.

Follow-Up and Evaluation

Assessment of healing relied on both clinical evaluation and radiographic imaging. For soft tissue, clinicians monitored for infection, inflammation, and the process of epithelialization, basically, checking whether the tissue was closing up properly without weird swelling or redness. When it came to bone, radiographs were used to look for signs of new bone formation (radiographic bone density increase) and to confirm that the graft was integrating with the existing bone. Any troubling findings, such as bone loss or graft failure, were noted.

Generally, healing was considered “uncomplicated” if the patient didn’t experience major problems no infections, delayed healing, or rejection of the graft. In essence, if everything progressed smoothly and without serious complications, the outcome was classified as uneventful.

Data Collection and Analysis

- Clinical Records: The study utilized retrospective patient records to evaluate the effectiveness of PRP in the specified surgical procedures
- Data Analysis: Researchers compared clinical observations and radiographic findings to determine PRP’s impact on healing rates and treatment outcomes
- Patient progress was assessed at multiple follow-up intervals to monitor and analyze the trajectory of healing over time
- Comparative analysis between the PRP and control groups was conducted using:
  - Chi-square test for categorical data (healing, infection rates)
  - Independent t-test for continuous data (pain scores, bone density)
  - $P < 0.05$ considered statistically significant.

Outcome Measures

1. Primary Outcome: The main outcome of the study was to determine whether PRP worked as effectively in enhancing healing results (soft and hard tissue) for patients undergoing the chosen oral surgeries
2. Secondary Outcome: Secondary outcomes were the rate of complications (e.g., infection or delayed recovery) and requirement for further procedures (e.g., additional grafting, revision operations)
3. Success in healing: In this study, healing was assumed to be successful when clinical and radiographic examinations have ascertained normal tissue healing without any complications.

RESULTS

Patient Demographics and Study Design

Eighty-four patients (46 males, 38 females; mean age 42.9 ± 8.4 years) were included and evenly divided between the PRP and control groups. No significant demographic or procedural differences were found between groups ($P > 0.05$). The gender and age distribution are shown in Figure 1 and Table 1, respectively.

The most common indications for PRP use included:

- Dental extractions: 40 patients (47.6%)
- Bone grafting procedures: 44 patients (52.4%), further categorized as:
  - Periapical surgery defects: 16 cases (36.4%)
  - Cyst enucleation defects: 12 cases (27.2%)
  - Sinus lift for implant placement: 16 cases (36.4%)

The details of the surgical procedures are shown in Figures 2 and 3.

Each of the surgical categories included equal numbers of PRP and control cases. Healing was compared between the two groups based on: Soft tissue epithelialization (clinical inspection), Pain intensity (VAS 0–10), Infection incidence, and Radiographic bone density changes at 3 and 6 months

Soft Tissue Healing and Pain

Healing was evaluated based on soft tissue closure, pain intensity (using the VAS), and post-operative infection rates (as shown in Table 2).

1. Complete soft tissue healing was observed in 94.1% of cases by post-operative day 30, in the PRP group
2. The mean pain score (VAS) on post-operative day 10 was 2.1, indicating low levels of discomfort in the PRP group
3. No infections were recorded during the follow-up period in the PRP group.

The Comparison of soft tissue healing rates in the platelet-rich plasma and control group are shown in Figure 4.

Bone Regeneration

Radiographic assessments at 3 and 6 months showed a mean bone density increase of 28.5% in the PRP group compared to 14.2% in controls ($P < 0.01$) as shown in Figures 5. The radiographs confirmed earlier trabecular bone maturation in PRP-treated sites.

Patient Satisfaction and Clinical Outcomes

Mean satisfaction score: PRP group: 8.4 ± 0.7. Furthermore, control group: 7.1 ± 1.2 ($P < 0.05$). Patients consistently reported: Faster recovery, mild post-operative swelling, and improved comfort during the healing period.

Adverse Effects and Safety Profile

No serious adverse events were associated with PRP use. Minor complications (swelling, mild bleeding) occurred in 7.1% of PRP-treated patients versus 16.6% of controls. All cases were self-limiting, all of which resolved without further intervention.

Table 1: Age distribution of patients

Age range (years)	Number of patients
20–30	12
31–40	20
41–50	32
51–60	20

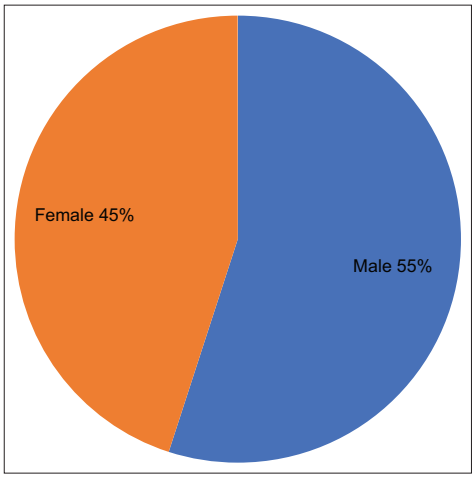

Figure 1: Gender percentages of patients

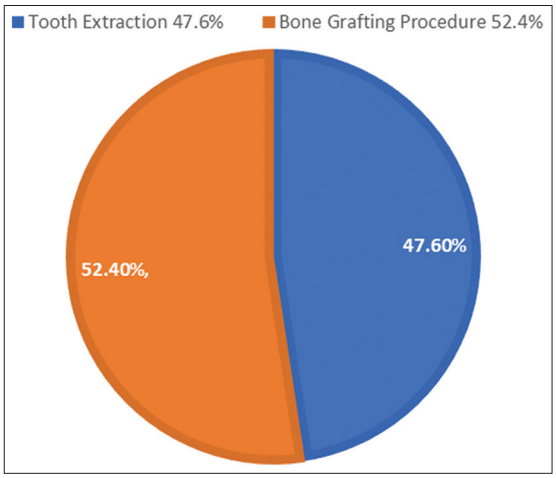

Figure 2: Percentage of main surgical procedures

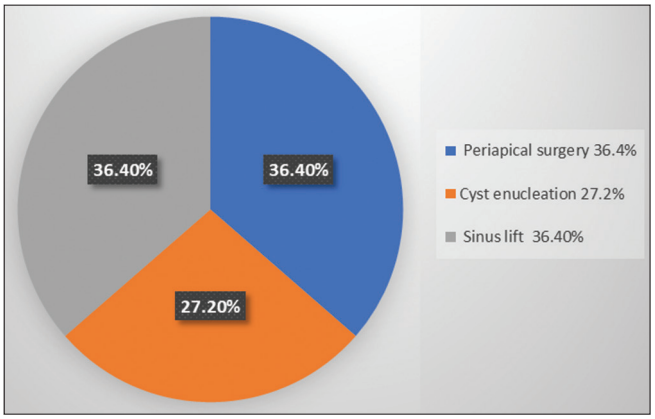

Figure 3: Details of bone grafting procedures

Table 2: Comparison of soft tissue healing, pain, and infection rate in PRP and control group

Parameter	PRP group (*n*=42)	Control group (*n*=42)	*P*-value
Complete healing by Day 30	94.1	76.4	0.03*
Mean VAS pain score (Day 10)	2.1±0.8	3.8±1.1	0.01*
Infection rate	0	9.5	0.04*

*Statistically significant, VAS: Visual Analog Scale

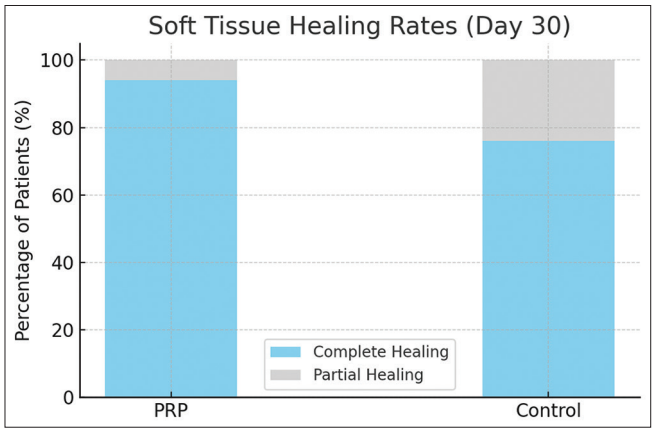

Figure 4: Comparison of soft tissue healing rates in the platelet-rich plasma and control group

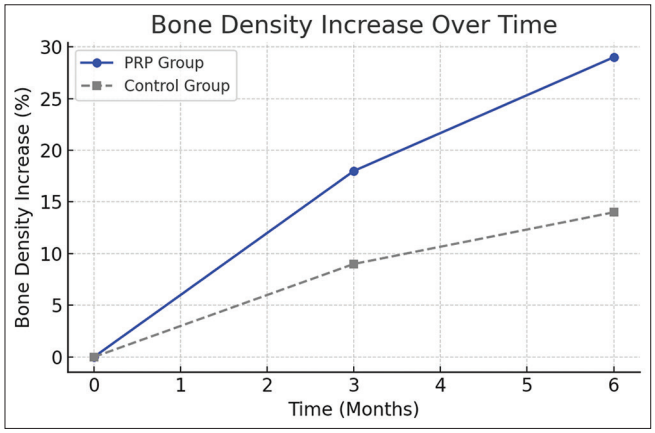

Figure 5: Comparison of bone density in platelet-rich plasma and control group

DISCUSSION

PRP and platelet-rich fibrin (PRF) are increasingly being incorporated into oral surgery, primarily to enhance healing and reduce post-operative complications. While PRF has been extensively studied in the context of third molar extractions,[6-8] this particular investigation focused on evaluating the clinical efficacy of PRP across a broader spectrum of oral surgical interventions, including dental extractions, bone grafting, and sinus lift procedures.

Conventionally, PRF is assessed for its influence on post-operative pain, swelling, and trismus. In contrast, we have demonstrated that the overall soft tissue healing rate (94.1%) of the PRP has been very much higher at 30 days (low pain [VAS: 2.1] and low level of complications). These findings reinforce previous literature, which highlights the generation ability of growth factors induced by PRP.[1]

The inclusion of a matched control group strengthens the present findings, demonstrating that PRP significantly accelerates soft tissue closure and reduces pain and infection rates compared with standard care.

The superior results in the PRP group are attributed to the high concentration of autologous growth factors that stimulate fibroblast proliferation, angiogenesis, and osteoblast differentiation. Radiographically, bone density gains in PRP-treated areas were nearly double those in controls at 6 months, aligning with previously reported data.[1,2]

In contrast, the control group healing followed the normal physiologic pattern without biologic enhancement, leading to slower epithelialization and greater post-operative discomfort. These comparative outcomes reinforce PRP's value as a regenerative adjunct in oral surgical wound management.

The efficacy of PRF in minimizing the occurrence of trismus and enhancing healing of the extraction socket has shown contrary results on a series of previous investigations,[9,10] with some reporting the absence of detectable differences between comparison stations.[11] In contrast to these findings, we and other authors using PRP in oral surgery have shown more consistent elevation of clinical results indices, as 8.4 for patient satisfaction levels, and suggest a potential value contribution over defined kinds of oral surgical intervention.

PRP's bone-healing abilities were radiographically measured with an increased radio-opacity of the bone after 3 and 6 months, proving PRP's part in stimulating osteogenesis during graft surgery. Based on radiographic assessments, the study's bone regeneration results in this study demonstrated improved bone density at three and six months, confirming PRP's ability to promote osteogenesis during grafting procedures. In contrast, PRF's effect on osteoblastic activity and alveolar ridge preservation remains questionable, as previously noted in the literature.[12] In addition, while PRF has shown potential in sinus membrane repair and as a solitary filler material during sinus floor elevation,[13] our retrospective evaluation of PRP application in sinus lift procedures demonstrated favorable healing and integration, warranting further controlled trials to compare efficacy.

In the field of implantology, PRP may similarly enhance early osseointegration**,** much like PRF, through its growth factor-rich composition that promotes angiogenesis and cellular proliferation.[14] While previous research has shown PRF improving implant stability,[15,16] the findings of this study suggest that PRP may yield comparable benefits, especially when integrated into a standardized surgical protocol.

Finally, no significant adverse effects were observed in this study, and the minor complications reported (7.1%) were self-limiting, confirming the favorable safety profile of PRP in clinical practice**.**

Limitations

The study uses data of patients already collected, which impairs control over the collection process and makes it more

difficult to determine cause and effect (PRP = healing). The combination of different operative methods (e.g., extractions, sinus lifting, cyst enucleation) leads to diversity and makes cases hard to be compared with one another. In addition, follow-up patterns can be variable among individuals, allowing for possible heterogeneity in healing adjudication. Furthermore, clinical evaluation of healing is subjective, and it may lead to variability in the assessment of soft tissue healing and infection. The limitations of Radiographs. Radiographic images do not always provide the entire scope for bone and soft tissue healing; therefore, their interpretation may be incomplete. Finally, Patient-Related factors: Health-related factors, such as the age, disease status, and smoking habits of the patient might affect the healing outcomes and bias the observations.

CONCLUSION

When compared with a control group treated without PRP, patients receiving PRP exhibited faster soft tissue healing, lower post-operative pain, enhanced bone regeneration, and higher satisfaction rates. These results confirm PRP's role as an effective, safe, and biocompatible regenerative adjunct in oral surgery. However, prospective randomized trials are essential to establish standardized preparation and application guidelines.

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