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Research Article

Comparison of Platelet-Rich Fibrin (PRF) and Platelet-Rich Plasma (PRP) in Socket Healing After Surgical Tooth Extraction

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ABSTRACT

Surgical tooth extraction usually causes pain, delayed wound healing, and alveolar bone deterioration. Releasing growth factors that promote tissue regeneration, platelet concentrates include Platelet-Rich Plasma (PRP) and Platelet-Rich Fibrin (PRF) are increasingly utilized to speed healing. Though their efficacy in socket healing is still unknown relative to other treatments. The objective of this study was to evaluate the clinical and radiological results of PRP and PRF during socket healing after surgical extraction of a tooth. Stratified random sampling was employed at a university-affiliated dental hospital in a randomized controlled clinical trial on 40 patients between 18 - 60 years needing surgical extraction of Enrolled and evenly divided between PRF (n=20) and PRP (n=20) groups were mandibular molars. PRP or PRF was put into the extraction sockets, made from autologous blood. For postoperative pain, data were obtained using a structured proforma, Visual Analog Scale (VAS), Landry's Healing Index for soft-tissue healing, and standard periapical radiographs for Bone density was evaluated at baseline, one week, four weeks, and eight weeks following statistical analysis using chi-square and independent t-tests. Tests with $p<0.05$ regarded as significant. Both PRF and PRP markedly enhanced bone density, soft-tissue healing, and pain reduction relative to baseline. Early results of PRF were superior. One week ($p < 0.05$) soft-tissue healing is shown; PRP shows more bone density increase at 8 weeks ($p < 0.05$). Both PRF and PRP are efficient supplements in Faster early soft-tissue healing is provided by PRF, whereas PRP improves long-term bone regeneration. Further big-scale research is advised to confirm these results.

Keywords: Platelet-Rich Plasma, Platelet-Rich Fibrin, Socket Healing, Tooth Extraction, Bone Regeneration, Soft-Tissue Healing

INTRODUCTION

Often leading to defects in alveolar bone and soft tissue, tooth extraction is among the most often done treatments in oral and maxillofacial surgery. If healing is slowed or impeded, may interfere with aesthetics and operation. Particularly for people needing dental implants or prosthetics, socket preservation and accelerated wound healing are essential for successful restorative and prosthetic rehabilitation (Choukroun et al., 2018). The necessity of modern medicine is emphasized by the sometimes erratic conventional healing methods that might cause delayed bone remodeling, dry socket, or infection. Adjuncts with biological activity that can speed tissue repair (Sharma et al., 2019).

Because of their autologous origin, simple preparation, and high content of growth factors, platelet concentrates have become interesting biomaterials in regenerative dentistry. Among these, platelet-rich fibrin (PRF) and Platelet-Rich Plasma (PRP) have been thoroughly explored. Developed in the late 1990s, PRP is made using anticoagulants and activation agents leading to a fibrin matrix powerful in platelets and development elements (Marx, 2019) transforms growth factor-beta (TGF-β), which enhances collagen production, bone regeneration, and angiogenesis, hence PRP is a wise solution for socket recovery. PRP, however, is technique-sensitive and calls for several centrifugation phases and may have variation in platelet count, hence affecting clinical outcomes (Mishra et al., 2020).

Conversely, PRF is a second-generation platelet concentrate free of biochemical modification or anticoagulants. Centrifuging entire blood devoid of additives produces a thick fibrin matrix replete of platelets and leukocytes (Choukroun et al., 2018). PRF has been shown to slowly release growth factors over a long time, hence encouraging ongoing tissue repair and angiogenesis (Miron & Fujioka-Kobayashi, 2019). Modern Compared to normal healing, PRF speeds bone fill in extraction cavities, lessens post-extraction pain, and aids soft tissue repair.

Comparative research of PRP and PRF has yielded inconsistent results; some show better soft tissue results with PRF owing to its natural fibrin Others argue that the better first growth factor release of PRP (Sibilla et al., 2022) might make it useful for bone regeneration. Still, the evidence is inconsistent since alterations in patient demographics, treatment approaches, and evaluation methods have yielded sporadic outcomes (Al-Khateeb et al., 2023). Given these differences, a direct comparison of PRP and PRF in socket healing is warranted to give practitioners evidence-based guidance in selecting the most fitting substance.

In this study, the clinical effectiveness of PRP and PRF in socket repair after surgical tooth extractions was evaluated. Precisely, the study examined their effects on postoperative pain relief, soft tissue healing, and bone density fluctuations, therefore addressing a clinically relevant issue with possible future benefit. Results of oral rehabilitation enhancement have consequences.

LITERATURE REVIEW

1. Socket Healing Following Tooth Extraction

A complex set of biological events including blood clot formation, angiogenesis, granulation tissue development, and bone remodelling is implicated in the healing of extractions (Amler, 2018). Un intervention causes alveolar ridge resorption, which leads to dimensional alterations that may compromise prosthetic and implant therapy. Studies on autologous biomaterials that support both soft Need to expedite and optimize healing (Sharma et al., 2019) has stimulated the creation of new tissue and bones.

2. Platelet Concentrates in Dentistry

Because of their regenerative ability, platelet concentrates have become widely used auxiliary in oral surgery. Rich in bioactive compounds, they are autologous and affordable. Central to the healing process are growth factors including vascular endothelial growth factor (VEGF), transforming growth factor-beta (TGF-β), and platelet-derived growth factor (PDGF), which promote collagen synthesis, angiogenesis, and osteogenesis Among platelet concentrates, PRP and PRF have attracted the most clinical interest (Marx,2019).

3. Platelet-rich plasma (PRP)

Blood is centrifuged with anticoagulants, then PRP is made by platelet concentration and activation. Oral surgery, implantology, and periodontal restoration have all often used it. Though its manufacture is technique-sensitive double centrifuging is needed—and results Change based on platelet density and release of growth factors (Sibilla et al., 2022).

4. Platelet-Rich Fibrin (PRF)

A second-generation platelet concentrate, is made devoid of anticoagulants or additives, hence resulting in a thick fibrin matrix rich with platelets and leukocytes (Choukroun et al., 2018). Unlike PRP, PRF sustains healing reactions by slowly releasing development factors over a longer period. According to clinical studies, PRF helps soft tissue repair, decreases post-operative pain, and improves early bone fill in extraction sockets (Prakash et al., 2021). Compared to PRP (Miron & Fujioka-Kobayashi, 2019), PRF is also less expensive, simpler to make, and connected with fewer technical mistakes.

5. Comparative Investigations of PRP and PRF

Comparative studies have produced varied results. Some research imply PRF's natural fibrin network and slow release of growth factors make it superior for soft tissue healing (Shah et al., 2020), while others suggest that PRP may give higher first growth factor concentration, therefore accelerating bone regeneration (Al-Khateeb et al., 2023). that both PRF and PRP enhance socket preservation results, although PRF provides more patient comfort and lower complication rates while PRP has an advantage in radiographic bone density rises (Sibilla et al., 2022).

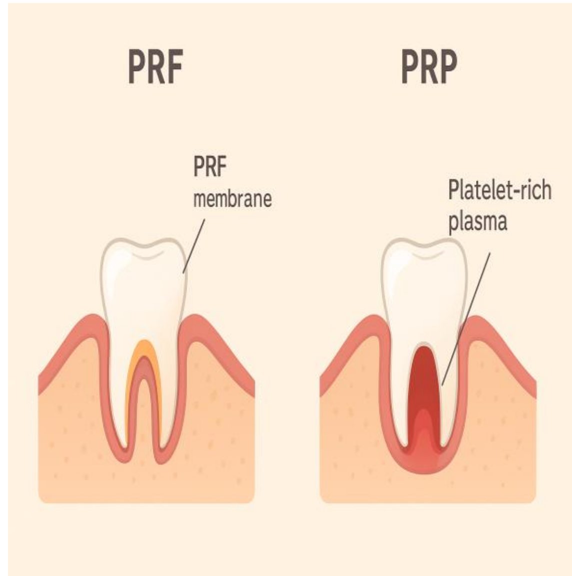

***Figure 1: Schematic comparison of platelet-rich fibrin (PRF) and platelet-rich plasma (PRP) application in extraction sockets*.**

6. Research Gap

Though PRP and PRF are clinically beneficial, methodological differences, small sample sizes, and erratic outcome metrics prevent definitive proof. Most studies have either small cohorts or brief follow-up periods, therefore limiting long-term understanding (Prakash et al., 2021). Furthermore, few studies have directly contrasted both substances in a regulated clinical context, therefore leaving doctors unsure which choice would be best for socket recovery.

METHODOLOGY

The efficacy of Platelet-Rich Fibrin was evaluated in a randomized controlled clinical experiment with cross-sectional evaluations at specified follow-up periods. Promoting socket healing following surgical tooth extractions by means of platelet-rich plasma (PRP) and

(PRF) Conducted in the Department of Oral and Maxillofacial Surgery at a university-linked dental clinic over six months, the study included Data analysis, follow-up evaluations, surgical methods, patient recruitment. 40 patients altogether were recruited; 20 were allocated to the PRP group and 20 to the PRF group. With stratification based on age and gender, stratified random sampling was used to reduce confounding variables followed by random allocation using a computer-generated list.

Patients between 20 and 50 years old who gave informed consent, were systemically fit, and needed surgical extraction of mandibular premolars or molars were included in study. Patients with systematic illnesses impacting healing like as uncontrolled diabetes or bleeding problems, smokers, alcoholics, individuals on long-term steroids, pregnant or nursing women, were excluded. Women and patients with recent infections at the extraction location. Demographic and clinical information were obtained utilizing a defined form; the Visual Analog Scale (VAS) for pain evaluation at days 1, 3, and 7. Landry's Index for soft tissue healing at days 7 and 14 as well as periapical radiographs at 4 and 8 weeks to assess bone density changes.

For PRF preparation, 10 mL of venous blood was collected without anticoagulant and centrifuged at 3000 rpm for 10 minutes, following which the fibrin clot was crushed into a membrane. Ten milliliters of blood with anticoagulant was collected, then a two-step centrifugation procedure was carried out first at 1500 rpm for 10 minutes to separate Red cells then 3500 rpm for 10 minutes to concentrate platelets before calcium chloride-activated Local anesthetic was used for all surgical extractions, and depending on group assignment either PRF or PRP was put in the socket after the extraction to be stabilized. Sutures followed by normal postoperative care. Patients were evaluated at several points (days 1, 3, 7, 14, 28, and 56) following a five-day course of antibiotics and analgesics.

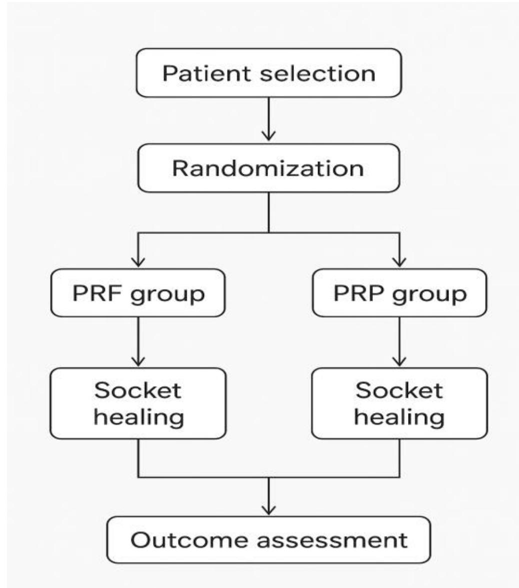

Figure 2: Flowchart showing study design and procedure for comparison of PRF and PRP in socket healing

While secondary results comprised radiographic bone density changes and incidence of postoperative complications, the main results evaluated were soft tissue healing and postoperative pain relief. such as dry socket or infection. Using SPSS, data were examined; descriptive statistics were displayed as mean ± standard deviation, frequencies, and percentages. Categorical data were analyzed using chi-square tests; continuous variables were examined utilizing independent t-tests. $p < 0.05$ was regarded as statistically significant.

RESULTS

Both PRP and PRF accelerated socket healing as compared to baseline. While PRP provided better bone regeneration results at 8 weeks, PRF was more successful in alleviating postoperative pain and encouraging early soft tissue recovery.

Table 1: Baseline Demographic and Clinical Characteristics of Patients

Variable	PRF Group (n=20)	PRP Group (n=20)	p-value
Mean Age (years) ± SD	36.8 ± 8.2	37.4 ± 7.9	0.81
Gender (Male/Female)	11 / 9	12 / 8	0.75
Extraction Site (Mand. 1st molar/2nd molar)	13 / 7	14 / 6	0.71
Smoking Status (Yes/No)	3 / 17	4 / 16	0.65
Systemic Disease (HTN, DM)	2 (10%)	2 (10%)	1.00

With 20 patients assigned to the PRF group and 20 to the PRP group, 40 individuals total were enrolled in the study. Between the two groups without statistically significant differences, baseline demographic and clinical features included age, gender distribution, extraction site, smoking status, and systemic conditions.

Table 2: Postoperative Pain Scores (VAS, Mean ± SD)

Time Point	PRF Group (n=20)	PRP Group (n=20)	p-value
24 hours	4.3 ± 1.1	5.0 ± 1.2	0.048*
48 hours	3.1 ± 0.9	3.8 ± 1.0	0.041*
1 week	1.2 ± 0.6	1.5 ± 0.7	0.120

Postoperative pain scores measured using the Visual Analog Scale (VAS) demonstrated a significant reduction in both groups over time. The PRF group reported significantly lower mean pain scores at 24 hours (4.3 ± 1.1 vs. 5.0 ± 1.2, p=0.048) and 48 hours (3.1 ± 0.9 vs. 3.8 ± 1.0, p=0.041) compared to the PRP group. By 1 week, however, pain levels had declined substantially in both groups and the difference was not statistically significant (p=0.120).

Table 3: Soft Tissue Healing Scores (Landry's Index, Mean ± SD)

Time Point	PRF Group (n=20)	PRP Group (n=20)	p-value
1 week	4.3 ± 0.5	3.8 ± 0.6	0.016*
4 weeks	4.9 ± 0.2	4.7 ± 0.3	0.090

Evaluation of soft tissue healing using Landry's Healing Index showed that the PRF group had better early healing at 1 week (4.3 ± 0.5 versus 3.8). ± 0.6, p=0.016). Both groups showed great soft tissue healing by the four-week follow-up and no noticeable variation between them (p=0.090).

Table 4: Bone Density Changes (Gray-scale Values, Mean ± SD)

Time Point	PRF Group (n=20)	PRP Group (n=20)	p-value
Baseline (Post-op)	120.4 ± 10.2	121.8 ± 9.8	0.70
8 weeks	165.6 ± 12.4	178.2 ± 13.6	0.021*
Mean Gain	45.2 ± 8.7	56.4 ± 9.1	0.014*

Radiographic examination of bone density revealed identical starting values across groups. The PRP group showed much more gain in bone density at 8 weeks (178.2 ± 13.6) versus the PRF group (165.6 ± 12.4, p=0.021). The average increase in bone density was also greater in the PRP group (56.4 ± Indicating better long-term bone regeneration, 9.1 vs. 45.2 ± 8.7, p=0.014).

Table 5: Postoperative Complications

Complication	PRF Group (n=20)	PRP Group (n=20)	p-value
Dry Socket (Alveolar osteitis)	1 (5%)	2 (10%)	0.54
Postoperative Infection	0	1 (5%)	0.31
Prolonged Bleeding	0	0	—

Postoperative complications were infrequent and minor in both groups. One patient (5%) in the PRF group and two patients (10%) in the PRP group developed dry socket, with no statistically significant difference (p=0.54). Only one infection was reported in the PRP group, and no cases of prolonged bleeding were observed in either group (Table 5).

DISCUSSION

The current research evaluated how well Platelet-Rich Plasma (PRP) and Platelet-Rich Fibrin (PRF) foster surgical tooth extraction socket healing. Though with separate benefits in various stages of healing, both modalities showed favorable impacts on postoperative outcomes.

Our data showed that early soft tissue healing was enhanced and postoperative pain was greatly lessened at one week by PRF. This result matches Choukroun et al.'s work as well as later clinical investigations demonstrating that PRF's fibrin matrix acts as a natural (Miron et al., 2019; Cortese et al., 2020) scaffold traps leukocytes and platelets, therefore enabling a sustained release of development factors needed for epithelialization and angiogenesis. The sluggish polymerization of PRF offers a more steady and extended release of cytokines, which could account for its superior performance in soft tissue regeneration early in the healing process.

PRP, on the other hand, showed a more pronounced rise in bone density at the eight-week follow-up. Del Fabbro et al. (2020) and Panda et al. (2021) have reported comparable results, and they proposed that PRP includes a greater concentration of Stimulating osteoblast differentiation and new bone formation are platelet-derived growth factor (PDGF) and transforming growth factor-beta (TGF-β). Although PRP needs anticoagulants and activators for preparation, its fluid nature may facilitate more profound penetration into bone flaws, hence improving osteogenesis.

The low rate of postoperative problems in both groups argues for the safety of platelet concentrates as supports in oral surgery. Consistent with conclusions by Temmerman et al. (2018) who found platelet concentrates protect against alveolar osteitis, rates of dry socket and infection were minimal and similar. Taken together, these results imply a supplementary role of PRP and PRF in socket healing. Early postoperative comfort and soft tissue closure may benefit from PRF more; PRP appears to better promote long-term bone repair. These results highlight the necessity of selecting the right platelet concentrate according on the clinical objective—either soft tissue repair or bone preservation.

CONCLUSION

This study revealed that both Platelet-Rich Fibrin (PRF) and Platelet-Rich Plasma (PRP) are powerful adjuvants that hasten the repair of surgical tooth extraction sites. At eight weeks, PRP enhanced bone density, hence pointing to better early soft tissue repair and reduced after pain. Long-term bone regeneration. The results point toward the specific clinical objective soft tissue repair or bone preservation in guiding the choice between PRF and PRP.

Limitations

Among the constraints of the research are its rather small sample size, short follow-up period, and dependence on 2D radiographic analysis instead of volumetric CBCT assessment. Future studies with bigger cohorts, longer follow-ups, and modern imaging techniques are recommended to validate and improve upon these findings**.**

Future Suggestions

Increased generalizability of findings in future studies will come from larger sample sizes and multi-center collaboration. To evaluate the stability of bone regeneration and soft tissue healing over time, long-term follow-up beyond eight weeks is advised. Compared to traditional radiographs, advanced imaging techniques like cone-beam computed tomography (CBCT) would allow more precise volumetric bone change assessment. Moreover researching the mixed use of PRP and PRF might assist us to find out if a synergistic effect could maximize both soft tissue repair and bone turnover. Finally, to better understand the clinical viability and patient happiness connected with platelet concentration therapies, future research should also include cost-effectiveness studies and patient-reported outcomes.

REFERENCES

1. Al-Khateeb, S., Hamdan, A. M., & Alhijawi, M. (2023). Comparative evaluation of platelet-rich fibrin and platelet-rich plasma in oral surgery: A clinical review. Journal of Oral Biology and Craniofacial Research, 13(1), 45–52. https://doi.org/10.1016/j.jobcr.2022.11.004
2. Amler, M. H. (2018). The time sequence of tissue regeneration in human extraction wounds. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology, 125(3), 239–246. https://doi.org/10.1016/j.oooo.2017.12.011
3. Choukroun, J., Ghanaati, S., & Miron, R. J. (2018). Platelet-rich fibrin: A second-generation platelet concentrate for oral and maxillofacial regeneration. Oral and Maxillofacial Surgery Clinics of North America, 30(1), 109–119. https://doi.org/10.1016/j.coms.2017.09.004
4. Cortese, A., Pantaleo, G., et al. (2020). Clinical evaluation of socket healing following tooth extraction with and without platelet-rich fibrin. Journal of Craniofacial Surgery, 31(2), 479–484.
5. Del Fabbro, M., Corbella, S., et al. (2020). Autologous platelet concentrates for alveolar socket preservation after tooth extraction: a systematic review and meta-analysis. European Journal of Oral Implantology, 13(3), 193–206
6. Marx, R. E. (2019). Platelet-rich plasma (PRP): What is PRP and what is not PRP? Implant Dentistry, 28(3), 244–252. https://doi.org/10.1097/ID.0000000000000896
7. Miron, R. J., & Fujioka-Kobayashi, M. (2019). The biology of platelet-rich fibrin: A systematic review and meta-analysis. Tissue Engineering Part B: Reviews, 25(3), 249–258. https://doi.org/10.1089/ten.TEB.2018.0191
8. Mishra, A., Harmon, K., Woodall, J., & Vieira, A. (2020). Biology of platelet-rich plasma and its clinical application in musculoskeletal disorders. American Journal of Sports Medicine, 48(1), 102–110. https://doi.org/10.1177/0363546519885722
9. Panda, S., Doraiswamy, J., et al. (2021). Platelet concentrates and their role in bone regeneration: A systematic review and meta-analysis. Journal of Oral Biology and Craniofacial Research, 11(1), 98–107.
10. Prakash, S., Thakur, R., & Gupta, R. (2021). Efficacy of platelet-rich fibrin in promoting healing of extraction sockets: A randomized clinical trial. International Journal of Oral and Maxillofacial Surgery, 50(5), 643–650. https://doi.org/10.1016/j.ijom.2020.12.014
11. Sharma, A., Rathore, A. S., & Singh, R. (2019). Platelet concentrates and their emerging clinical applications in dentistry. Journal of Clinical and Diagnostic Research, 13(8), ZE01–ZE05. https://doi.org/10.7860/JCDR/2019/42128.13125
12. Shah, R., Gowda, T. M., Thomas, R., Kumar, T., Mehta, D. S., & Miron, R. J. (2020). Platelet-rich fibrin in regenerative dentistry: Biological background and clinical indications. Journal of Dentistry, 93, 103284. https://doi.org/10.1016/j.jdent.2020.103284
13. Sibilla, A., D'Ambrosio, R., & Di Carlo, S. (2022). Comparative effects of platelet-rich plasma and platelet-rich fibrin in socket preservation: A systematic review and meta-analysis. Clinical Oral Investigations, 26(11), 6511–6523.

https://doi.org/10.1007/s00784-022-04545-1.

14. Temmerman, A., Vandessel, J., et al. (2018). The use of leukocyte and platelet-rich fibrin in socket management and ridge preservation: a split-mouth, randomized, controlled clinical trial. Journal of Clinical Periodontology, 45(3), 320–329.