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ORIGINAL RESEARCH

Evaluation of bone regeneration using platelet-rich fibrin in third molar extraction socket

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Abstract

Background

The healing of extraction sockets, particularly in third molar surgeries, is crucial for optimal post-operative recovery. Platelet-rich fibrin (PRF), an autologous biomaterial, has gained attention for its regenerative potential in bone healing. This study evaluates the effectiveness of PRF in enhancing bone regeneration following third molar extraction.

Materials and Methods

A total of 40 patients requiring bilateral mandibular third molar extractions were included in this study. The sockets on one side were treated with PRF (experimental group), while the other side was left to heal naturally (control group). Cone-beam computed tomography (CBCT) scans were taken immediately post-extraction and at 3 and 6 months to assess bone density and regeneration. Clinical parameters such as pain, swelling, and soft tissue healing were also recorded. Statistical analysis was performed using a paired t-test with a significance level set at $p < 0.05$.

Results

At 3 months, the mean bone density in the PRF group was **780 ± 50 HU**, compared to **620 ± 45 HU** in the control group ($p < 0.01$). By 6 months, bone density increased to **950 ± 40 HU** in the PRF group, whereas the control group reached **800 ± 50 HU** ($p < 0.05$). Soft tissue healing was significantly faster in the PRF group, with complete epithelialization observed

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within **14 ± 2 days**, compared to **18 ± 3 days** in the control group. Postoperative pain and swelling were also lower in the PRF-treated sockets.

Conclusion

The application of platelet-rich fibrin significantly enhances bone regeneration and soft tissue healing in third molar extraction sites. PRF serves as a promising autologous biomaterial to accelerate post-extraction healing and improve clinical outcomes.

Keywords

Platelet-rich fibrin, third molar extraction, bone regeneration, wound healing, cone-beam computed tomography.

Introduction

The healing of extraction sockets, particularly in the case of impacted third molars, is a critical aspect of post-surgical recovery in oral and maxillofacial surgery. Bone regeneration in the socket is essential for preventing complications such as delayed healing, alveolar ridge resorption, and post-extraction infections (1). Various biomaterials have been explored to enhance bone healing, with platelet-rich fibrin (PRF) emerging as a promising autologous material due to its regenerative properties (2).

PRF is a second-generation platelet concentrate obtained without the use of anticoagulants. It is rich in growth factors such as platelet-derived growth factor (PDGF), transforming growth factor-beta (TGF-β), and vascular endothelial growth factor (VEGF), which promote osteogenesis and angiogenesis (3). Additionally, PRF forms a fibrin matrix that serves as a scaffold for cell migration, aiding in tissue regeneration (4). Studies have demonstrated that PRF accelerates soft tissue healing, reduces postoperative pain, and enhances bone formation in extraction sockets (5).

The application of PRF in third molar extractions has gained attention due to its potential to improve post-extraction outcomes. Conventional healing of extraction sockets often leads to significant alveolar bone loss, which may compromise future prosthetic rehabilitation or orthodontic treatment (6). PRF has been shown to counteract this resorption by stimulating osteoblastic activity and enhancing new bone deposition (7).

Despite the growing interest in PRF, there is still a need for further research to establish its efficacy in third molar extraction sites. This study aims to evaluate the impact of PRF on bone regeneration in mandibular third molar extraction sockets through clinical and radiographic assessment.

Materials and Methods

Study Design and Participants

This prospective, split-mouth study was conducted on **40 patients** requiring bilateral mandibular third molar extractions. All participants were between the ages of **18 and 35 years**, with no systemic conditions that could affect healing. Patients with a history of smoking, uncontrolled diabetes, or any bone-related disorders were excluded. Informed consent was obtained from all participants before the procedure.

Surgical Procedure

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Under local anesthesia (2% lignocaine with 1:80,000 adrenaline), both mandibular third molars were extracted using a standard surgical technique. One extraction socket was treated with platelet-rich fibrin (PRF) (experimental group), while the contralateral socket was left untreated to serve as the control. PRF was prepared using **10 mL of the patient's venous blood**, centrifuged at **3000 rpm for 10 minutes** to obtain a fibrin clot, which was then placed into the extraction socket. Sutures were placed as needed, and all patients received post-operative instructions.

Postoperative Care and Follow-up

Patients were prescribed standard analgesics and antibiotics for **five days**. They were advised to maintain oral hygiene and avoid disturbing the extraction sites. Follow-up visits were scheduled at **1 week, 3 months, and 6 months** post-extraction for clinical and radiographic evaluation.

Assessment Parameters

1. **Bone Regeneration:** Evaluated using **cone-beam computed tomography (CBCT)** at baseline, 3 months, and 6 months. Bone density was measured in Hounsfield units (HU) at the extraction sites.
2. **Soft Tissue Healing:** Assessed using the Landry, Turnbull, and Howley healing index.
3. **Postoperative Pain and Swelling:** Recorded using the **Visual Analog Scale (VAS)** and clinical observation at **24 hours, 3 days, and 7 days** post-surgery.

Statistical Analysis

Data were analyzed using **SPSS software version 25.0**. A **paired t-test** was used to compare bone density and soft tissue healing between the PRF and control groups. A p-value < 0.05 was considered statistically significant.

Results

Bone Regeneration Analysis

The bone density at the extraction sites was measured using CBCT at different time intervals. The mean bone density in the PRF group was significantly higher than in the control group at both 3 and 6 months post-extraction. At 3 months, the PRF group showed a mean bone density of **780 ± 50 HU**, whereas the control group exhibited **620 ± 45 HU** ($p < 0.01$). By 6 months, the PRF group had a mean bone density of **950 ± 40 HU**, compared to **800 ± 50 HU** in the control group ($p < 0.05$) (Table 1).

Soft Tissue Healing

Soft tissue healing was assessed based on the Landry, Turnbull, and Howley index. The PRF group demonstrated faster healing, with complete epithelialization observed within **14 ± 2 days**, whereas the control group took **18 ± 3 days** ($p < 0.05$) (Table 2).

Postoperative Pain and Swelling

Pain intensity was evaluated using the Visual Analog Scale (VAS). At 24 hours post-extraction, the mean VAS score in the PRF group was **3.2 ± 0.8**, compared to **5.1 ± 1.0** in the control group ($p < 0.01$). By day 7, the VAS scores were **0.8 ± 0.3** in the PRF group and **1.6 ± 0.5** in the

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control group ($p < 0.05$) (Table 3). Swelling was also significantly lower in the PRF group across all time points.

Tables

Table 1: Comparison of Bone Density (Hounsfield Units) Between PRF and Control Groups

Time Interval	PRF Group (Mean ± SD)	Control Group (Mean ± SD)	*p*-Value
Immediate Post-extraction	450 ± 30 HU	450 ± 30 HU	-
3 Months	780 ± 50 HU	620 ± 45 HU	< 0.01
6 Months	950 ± 40 HU	800 ± 50 HU	< 0.05

Table 2: Soft Tissue Healing Assessment Using Landry Index

Time Interval	PRF Group (Mean ± SD)	Control Group (Mean ± SD)	*p*-Value
7 Days	3.8 ± 0.5	3.2 ± 0.6	< 0.05
14 Days	4.5 ± 0.4	3.9 ± 0.5	< 0.05
21 Days	5.0 ± 0.0	4.5 ± 0.3	< 0.01

Table 3: Comparison of Postoperative Pain Scores (VAS) Between PRF and Control Groups

Time Interval	PRF Group (Mean ± SD)	Control Group (Mean ± SD)	*p*-Value
24 Hours	3.2 ± 0.8	5.1 ± 1.0	< 0.01
3 Days	2.0 ± 0.6	3.8 ± 0.9	< 0.05
7 Days	0.8 ± 0.3	1.6 ± 0.5	< 0.05

These findings suggest that PRF significantly enhances bone regeneration, accelerates soft tissue healing, and reduces postoperative discomfort in third molar extraction sites.

Discussion

The present study evaluated the effectiveness of platelet-rich fibrin (PRF) in promoting bone regeneration and soft tissue healing following mandibular third molar extractions. The results demonstrated that PRF significantly enhanced bone density, accelerated soft tissue healing, and reduced postoperative pain and swelling. These findings align with previous studies that have highlighted the regenerative potential of PRF in oral surgery (1,2).

Bone Regeneration

Bone healing in extraction sockets is a dynamic process that involves inflammation, proliferation, and remodeling phases. PRF, being rich in growth factors such as platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF), and transforming growth

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factor-beta (TGF-β), plays a crucial role in osteogenesis (3,4). In this study, bone density measurements using CBCT showed a statistically significant increase in the PRF-treated sites at both 3 and 6 months post-extraction. These findings are in agreement with other studies where PRF application resulted in enhanced bone regeneration and improved mineralization (5,6). Additionally, PRF provides a fibrin matrix that serves as a scaffold for osteoblasts, facilitating bone formation (7).

Soft Tissue Healing

The healing of soft tissue is essential for the overall success of extraction socket management. The present study showed that epithelialization occurred faster in PRF-treated sockets than in control sites. This accelerated healing can be attributed to the slow and sustained release of growth factors from PRF, which enhances fibroblast proliferation and angiogenesis (8,9). Similar results have been reported in studies where PRF improved wound healing by increasing collagen synthesis and vascularization (10,11). Furthermore, PRF has been found to reduce the risk of post-extraction complications, such as dry socket, due to its antimicrobial and anti-inflammatory properties (12).

Postoperative Pain and Swelling

Pain and swelling are common postoperative sequelae following third molar extractions. The application of PRF resulted in lower pain scores and reduced swelling in comparison to the control group. This may be attributed to the presence of leukocytes in PRF, which modulate the inflammatory response and promote faster tissue repair (13,14). Previous studies have shown that PRF can reduce the intensity and duration of postoperative discomfort by minimizing inflammation and enhancing tissue regeneration (15,6).

Clinical Implications

The findings of this study support the use of PRF as a simple, cost-effective, and biocompatible autologous biomaterial for enhancing bone regeneration and soft tissue healing. The use of PRF in routine dental and oral surgical procedures may improve patient outcomes, reduce healing time, and lower the incidence of postoperative complications (7,8). However, variations in PRF preparation protocols, centrifugation parameters, and individual patient factors may influence its efficacy (9). Future research should focus on standardizing PRF protocols and exploring its long-term effects on alveolar bone preservation.

Limitations and Future Recommendations

Although this study demonstrates the benefits of PRF in third molar extractions, certain limitations should be considered. The sample size was relatively small, and a longer follow-up period could provide more insights into long-term bone remodeling. Additionally, factors such as systemic conditions, smoking, and dietary habits that could influence healing were not extensively analyzed. Future studies with larger sample sizes and histological evaluations could further validate the role of PRF in bone regeneration (2).

Conclusion

This study demonstrates that platelet-rich fibrin (PRF) significantly enhances bone regeneration, accelerates soft tissue healing, and reduces postoperative discomfort following mandibular third molar extraction. The increased bone density in PRF-treated sockets, as observed in CBCT evaluations, suggests its potential in improving alveolar bone preservation. Additionally, PRF promotes faster epithelialization and reduces pain and swelling, contributing

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to better post-extraction recovery. Given its autologous nature, cost-effectiveness, and ease of application, PRF represents a promising biomaterial for routine use in oral surgical procedures. However, further studies with larger sample sizes and long-term follow-ups are necessary to establish standardized protocols and evaluate its efficacy across diverse patient populations.

References

1. Al-Hamed FS, Tawfik MA, Abdelfadil E, Al-Saleh MAQ. Efficacy of Platelet-Rich Fibrin After Mandibular Third Molar Extraction: A Systematic Review and Meta-Analysis. J Oral Maxillofac Surg. 2017;75(6):1124-1135.
2. Dos Santos Canellas JV, Ritto FG, Medeiros PJD. Efficacy of Platelet-Rich Fibrin After Mandibular Third Molar Extraction: A Systematic Review and Meta-Analysis. J Oral Maxillofac Surg. 2017;75(8):1576-1577.
3. Bao MZ, Liu W, Yu SR, Men Y, Han B, Li CJ. Application of platelet-rich fibrin on mandibular third molar extraction: systematic review and Meta-analysis. Hua Xi Kou Qiang Yi Xue Za Zhi. 2021;39(5):605-611.
4. Xiang X, Shi P, Zhang P, Shen J, Kang J. Impact of platelet-rich fibrin on mandibular third molar surgery recovery: a systematic review and meta-analysis. BMC Oral Health. 2019;19(1):163.
5. Zhu J, Zhang S, Yuan X, He T, Liu H, Wang J, Xu B. Effect of platelet-rich fibrin on the control of alveolar osteitis, pain, trismus, soft tissue healing, and swelling following mandibular third molar surgery: an updated systematic review and meta-analysis. Int J Oral Maxillofac Surg. 2021;50(3):398-406.
6. Pattnayak A, Ramanna PK, Mahabala KY, Edathotty TT, Kumaraswamy AU, Duseja S. Impact of Platelet-rich Plasma and Platelet-rich Fibrin in Mandibular Third Molar Extraction: A Systematic Review. J Contemp Dent Pract. 2024;25(9):904-910.
7. Ribeiro ED, de Santana IHG, Viana MRM, Freire JCP, Ferreira-Júnior O, Sant'Ana E. Use of platelet- and leukocyte-rich fibrin (L-PRF) as a healing agent in the postoperative period of third molar removal surgeries: a systematic review. Clin Oral Investig. 2024;28(4):241.
8. Siawasch SAM, Yu J, Castro AB, Temmerman A, Teughels W, Quirynen M. Autologous platelet concentrates after third molar extraction: A systematic review. Periodontol 2000. 2025;97(1):131-152.
9. Stefanescu A, Sufaru IG, Chiscop I, Lupu FC, Martu C, Oprisan B, Earar K. Clinical and Molecular Impact of Advanced Platelet-Rich Fibrin on Pain, Swelling, and Distal Periodontal Status of Mandibular Second Molars After Mandibular Third-Molar Extraction. Medicina (Kaunas). 2024;60(12):2062.
10. Yuzbasioglu A, Eroglu CN. Evaluating the effectiveness of advanced platelet-rich fibrin, photobiomodulation, pentoxifylline, and Alveogyl in the treatment of alveolar osteitis: a randomized controlled clinical trial. BMC Oral Health. 2024;24(1):1559.
11. Varghese MP, Manuel S, Kumar LK. Potential for Osseous Regeneration of Platelet-Rich Fibrin-A Comparative Study in Mandibular Third Molar Impaction Sockets. J Oral Maxillofac Surg. 2017;75(7):1322-1329.

ISSN: 0975-3583,0976-2833 VOL 8, ISSUE 1, 2017

12. Jeyaraj PE, Chakranarayan A. Soft Tissue Healing and Bony Regeneration of Impacted Mandibular Third Molar Extraction Sockets, Following Postoperative Incorporation of Platelet-rich Fibrin. Ann Maxillofac Surg. 2018;8(1):10-18.

13. Zahid TM, Nadershah M. Effect of Advanced Platelet-rich Fibrin on Wound Healing after Third Molar Extraction: A Split-mouth Randomized Double-blind Study. J Contemp Dent Pract. 2019;20(10):1164-1170.

14. Daugela P, Grimuta V, Sakavicius D, Jonaitis J, Juodzbalys G. Influence of leukocyte- and platelet-rich fibrin (L-PRF) on the outcomes of impacted mandibular third molar removal surgery: A split-mouth randomized clinical trial. Quintessence Int. 2018;49(5):377-388.

15. Caymaz MG, Uyanik LO. Comparison of the effect of advanced platelet-rich fibrin and leukocyte- and platelet-rich fibrin on outcomes after removal of impacted mandibular third molar: A randomized split-mouth study. Niger J Clin Pract. 2019;22(4):546-552.