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Case Report

Platelet rich fibrin integration in impacted third molar extraction sockets for bony regeneration: A case report

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A B S T R A C T

Impacted third molars often lead to complications necessitating extraction. Platelet rich fibrin (PRF), a matrix rich in platelet cytokines and growth factors, shows promise in expediting bone healing post-extraction. This article investigates PRF's efficacy in a 23-year-old female patient with pericoronitis, exploring its role in bone regeneration. The patient underwent a meticulous extraction procedure, incorporating PRF into the socket. Radiographic evaluation at three and six months exhibited progressive bony healing, endorsing PRF's efficacy in fostering bone regeneration post-extraction. PRF preparation, blood withdrawal, centrifugation, and PRF placement in the extraction socket were carefully executed. Postoperative care and monitoring were conducted, revealing substantial bone healing at follow-up visits serves as a promising adjunct in impacted molar extractions, stimulating osseous regeneration and expediting bone healing. The case study and literature review underscore PRF's potential in dental surgeries for improved patient outcomes and accelerated healing. Further long-term trials are imperative for comprehensive understanding. The last erupted tooth (3^{rd} molar) is considered 33–58.7% being impacted. Partially or completely impacted third molar are often associated with various complications such as pericoronitis, regional pain, trismus, odontogenic abscess, distal caries, cysts, tumors etc. This report describes incorporation of platelet rich fibrin (PRF) into the impacted mandibular third molar extraction socket to evaluate bony regeneration. It is reported that PRF improves and fastens bone healing in the extracted socket within 6 months after surgery.

1. Introduction

Partially or completely impacted third molars are often associated with various complications such as pericoronitis, regional pain, trismus, odontogenic abscess, distal caries, cysts, tumors etc., to avoid such complications impacted third molars are often extracted.[1] The central question revolves around improving patient comfort after surgery. Addressing this lies in the utilization of PRF and growth factors. Currently, extensive research underscores the pivotal role of growth factors in enhancing wound healing. Three key components—scaffolds encompassing collagen and bone minerals, signaling molecules like growth factors, and cells such as osteoblasts and fibroblasts—work synergistically to foster tissue regeneration. This synergy is particularly evident in procedures targeting the re-ossification of bony defects and cavities, highlighting the intricate healing process.[2] The concept of platelet rich fibrin (PRF) originated from the work of Choukron et al. This innovative matrix constitutes a fibrin structure

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that encapsulates platelet cytokines, growth factors, and cells, steadily releasing them over an extended duration. Functioning as a resorbable membrane, PRF notably amplifies the process of bone healing. Its composition involves a fibrin matrix polymerized in a tetra-molecular structure, incorporating platelets, leukocytes, cytokines, and circulating stem cells. The autologous nature of PRF positions it as a healing biomaterial that expedites the body's natural wound healing mechanisms and significantly encourages the formation of new bone tissue.[3] What distinguishes PRF is its capacity for platelet activation and fibrin polymerization without the need for additional anticoagulants. Widely recognized for its efficacy, PRF has garnered significant usage in cardiac and vascular surgeries, particularly in the effective sealing of diffuse microvascular bleeding. In the realm of oral and maxillofacial surgery, PRF showcases its versatility. It finds application in a spectrum of procedures, including sinus lift operations, facilitating implant placements, managing conditions like alveolar osteitis, addressing issues related to extracted sockets, aiding in cyst nucleation procedures, and contributing to the closure of cleft lip and palate defects. Its multifaceted utility underscores PRF's substantial potential across various surgical domains.[4] PRF, as a second-generation platelet concentrate following PRP, offers distinct advantages. Its production technique, unlike PRP, is straightforward, cost-effective, and doesn't require biochemical modifications in the blood such as the addition of anticoagulants like bovine thrombin or calcium chloride. However, handling PRF requires meticulousness due to the blood's rapid clotting post-collection, necessitating immediate centrifugation. During this centrifugal process, platelets interact with the tube wall, releasing their granules. This interaction triggers the gradual polymerization of fibrin, contributing to the distinct matrix structure characteristic of PRF. The outcome is a resilient, adaptable PRF membrane enriched with leukocytes and cytokines, offering unique therapeutic potential.[5] Within PRF, platelet concentrates contain notable quantities of growth factors, such as platelet-derived growth factors, vascular endothelial growth factor b1, and b2. These growth factors play a pivotal role by actively stimulating cell proliferation and fostering angiogenesis—the formation of new blood vessels. This process creates an environment conducive to tissue repair and regeneration, ultimately contributing to enhanced healing outcomes in various surgical and medical contexts. The multifaceted potential of PRF, underscored by its rich concentration of growth factors, continues to fuel its exploration and utilization across diverse fields of medicine and surgery.[6,7] Different types of PRF are categorized by their centrifugation speed: Advanced (A-PRF), Pure (P-PRF), Leukocyte and Platelet Rich (L-PRF), Injectable (I-PRF), and Liquid (L-PRF). PRF, in dental surgery, serves multiple purposes across various procedures. It is instrumental in bone grafting for dental implants, facilitating the integration and stability of the implants within the jaw. Onlay and inlay grafts benefit from PRF due to its ability to enhance tissue healing and regeneration, aiding in restoring damaged areas. Guided bone and tissue regeneration techniques leverage PRF's properties to promote the growth of specific tissues and encourage optimal healing after surgical interventions.[8,9] Additionally, PRF plays a crucial role in sinus lift procedures by supporting bone regeneration in the maxillary sinus area, while also aiding in ridge augmentation procedures for improving bone structure.[10] Moreover, it assists in addressing bone defects resulting from the removal of impacted canines and in repairing fistulas that occur between the sinus cavity and the oral cavity, fostering efficient and effective healing processes.[11]

2. Case Presentation

The oral and maxillofacial surgery department received a referral for a 23-year-old female patient. She presented with symptoms related to a partially erupted right wisdom tooth (Figure 1). Over three weeks, she experienced discomfort, with a recent week marked by restricted jaw movement (trismus). Upon examination, tenderness was noted around tooth 48. The patient underwent an OrthoPantogram (OPG) (Figure 2), routine blood investigations, including viral markers (HIV, HCV, HbsAg, RBS). The diagnosis indicated pericoronitis, an inflammation affecting the gingival tissue surrounding the coronal portion of tooth 48. Given this condition, the recommended course of action was the extraction of tooth 48.

Figure 1: Preoperative image of impacted mandibular third molar 48

2.1. Treatment

The agreed treatment was the surgical removal of tooth 48 under local anesthesia. (Figure 3)

Figure 2: Preoperative image of impacted mandibular third molar 48

Figure 3: Preoperative facial profile of patient

2.2. Method of PRF Preparation

The process involved withdrawing 10 ml of intravenous blood from the antecubital region using a 10 ml syringe. This blood was collected into a test tube without any anticoagulant and immediately subjected to centrifugation. The blood underwent centrifugation in a tabletop centrifuge for 12 minutes at a speed of 3000 rpm.

The resulting product displayed three distinct biological phases:

1. The bottom layer contained a coagulated mass of red blood corpuscles settled at the base of the centrifuge tube.

2. In the middle or intermediate layer, there existed an elastic clot or gel, specifically platelet-rich fibrin (PRF) forming a distinct layer. (Figure 4)

3. At the topmost layer rested the supernatant serum, which consisted of cellular platelet-poor plasma.

This separation of the blood components into distinct layers—red blood corpuscles at the bottom, PRF in the middle (Figure 5), and platelet-poor plasma at the

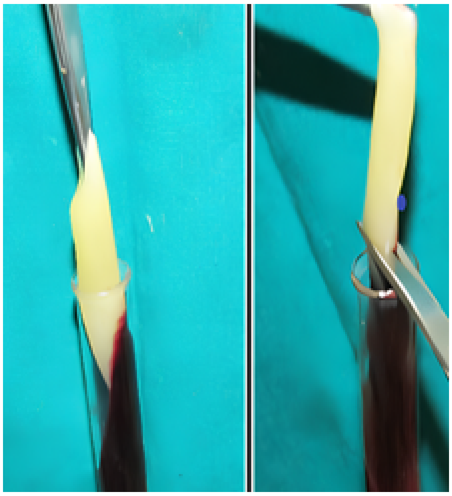

Figure 4: PRF taken using hemostatand cutting it with Scissors

top—illustrates the centrifugation's efficacy in isolating these biological elements based on their densities.

Figure 5: Platelet rich fibrin

2.3. Intraoperative Procedure

The patient's preparation involved gargling with a chlorhexidine gluconate mouthwash 10 minutes before the procedure. Following draping, the surgical site was sanitized using a povidone-iodine solution. An anesthetic solution of 2% lignocaine hydrochloride with adrenaline at a concentration of 1:80,000 was administered. Using a No. 15 BP blade, a standard ward incision was made to raise a mucoperiosteal flap. Subsequently, bone removal was performed using a straight fissure bur (No. 702 carbide).

After the tooth extraction, meticulous steps followed: smoothing the bone margins and thoroughly irrigating the socket with normal saline. Platelet-rich fibrin (PRF), handled with tweezers, was carefully placed into the socket before suturing the area with 3-0 silk sutures (Figures 6 and 7). Post-extraction care instructions were provided, and the patient was scheduled for follow-up visits on the 7^{th} day, 3^{rd} month, and 6^{th} month for monitoring and evaluation.

Figure 6: PRF in extraction socket

Figure 7: Immediate post-operative image after closure

The patient was prescribed analgesic and antibiotic as under:

1. Tab Amoxicillin and Clavulanic Acid 625 mg – 1 tab 8 hrly for 5 days
2. Tab Metronidazole 400 mg — 1 tab 8 hrly for 5 days
3. Tab Aceclofenac, Paracetamol and Serrato peptidases – 1 tab 12 hrly for 5 days
4. Tab Pantoparazole 40 mg — 1 tab daily before breakfast for 5 days
5. Chlorhexidine — Twice daily for 2 weeks.

Bone healing (trabecular pattern score) was assessed by using intraoral periapical radiograph (IOPAR) at third and sixth months follow up as described by Kelly et al.Figure 8

1. Trabecular pattern score at 3^{rd} month — 2
2. Trabecular pattern score at 6^{th} month — 3

Granular, nearly homogenous patterns; individual trabeculae essentially absent, delicate, finely meshed trabeculae

Mostly coarse, some fine trabeculae and all trabeculae are substantially coarse.

Figure 8: RVG taken at 6^{th} month postoperatively

3. Discussion

PRF is a fibrin network that gradually releases platelet cytokines, growth factors, and cells over time. This biomaterial acts as a resorbable membrane, enhancing bone healing by incorporating platelets, white blood cells, cytokines, and circulating stem cells into its tetramolecular structure. Autologous PRF is viewed as a healing agent that speeds up natural wound healing processes and the development of new bone tissue.

Several studies have investigated the therapeutic potential and efficacy of platelet-rich fibrin (PRF) in various dental applications. Choukron et al. (2006) emphasize that the deliberate slow fibrin polymerization process during PRF formation results in the integration of platelet-derived cytokines and glycanic chains within the fibrin meshes. This gradual incorporation is believed to contribute significantly to the unique properties of PRF, promoting tissue healing and regeneration. In a randomized, controlled, multicenter clinical trial following tooth extraction, Scheyer et al. (2016) reported a significant increase in horizontal measures of the extraction socket at the primary 6-month endpoint, highlighting the positive impact of PRF in post-extraction healing. Dutta et al. (2016) compared PRP, PRF, and hyaluronic acid (HA) as graft materials, revealing that PRF and PRP outperformed HA in terms of pain management, swelling reduction, dry socket prevention, and improvement in soft tissue healing. Jeyaraj and Chakranarayan (2018) observed substantial clinical and radiographic improvements in hard and soft tissue recovery, healing, and regeneration when autologous PRF was included during impacted third molar extraction. Girish Kumar et al. (2018) reported that clinical application of PRF contributed to improve postoperative healing in various dental procedures. Revathy et al. (2018) found that PRF enhances and accelerates bone healing in the extracted socket of impacted mandibular third molars within a six-month period post-surgery. Overall, these studies collectively suggest the promising therapeutic benefits of PRF in promoting effective dental and maxillofacial tissue healing and regeneration. (Table 1)

4. Conclusion

Autologous PRF can be used as an adjunct to promote wound healing in mandibular impacted third molar extraction sockets. In this case report, the decision to take autologous PRF was made as it stimulates osseous regeneration as well as improves and fastens bone healing. It showed excellent hard tissue healing and showed lesser postoperative complications.

The incorporation of PRF into impacted mandibular third molar extraction sockets stand as a promising technique for evaluating bony regeneration. Impacted third molars often lead to various complications, making their extraction a common practice. The utilization of PRF, a fibrin matrix rich in platelet cytokines, growth factors, and cells, has shown significant potential in expediting bone-healing processes post-extraction within a relatively short period. The case study presented a 23-year-old female patient with symptoms of pericoronitis related to a partially erupted wisdom tooth, necessitating extraction. The patient underwent a meticulous surgical procedure wherein PRF was incorporated into the extraction socket, followed by postoperative care and monitoring. Radiographic evaluation at the third and sixth months demonstrated progressive bony healing, indicating the efficacy of PRF in fostering bone regeneration. Previous research highlighted the benefits of PRF in promoting tissue healing, and the results of this case study further endorse its role in enhancing postoperative recovery and bone regeneration following impacted third molar extractions. The study echoes existing literature, emphasizing the promising outcomes and potential advantages of integrating PRF in dental surgical procedures for improved patient outcomes and accelerated healing.In the same vein, generating autologous PRF in a dental environment proves to be a swift and straightforward process, providing advantages for both patients and dental professionals. Its autologous nature significantly reduces the potential for immune reactions and disease transmission,

Table 1: Some of the studies on PRF from literature

Studies	Conclusion
Choukron J et al[2] (2006)	His conclusion highlights that the deliberate slow fibrin polymerization occurring during the PRF processing results in the inherent integration of platelet cytokines and glycanic chains within the fibrin meshes. This deliberate, gradual process ensures that the platelet-derived cytokines and complex glycanic structures become embedded within the fibrin matrix of PRF. Such incorporation is believed to contribute significantly to the unique properties and therapeutic potential of PRF in promoting tissue healing and regeneration.
Scheyer ET et al[4](2016)	Following tooth extraction, a randomized, controlled, multicenter clinical trial reported a significant increase in horizontal measures of the extraction socket at the primary 6-month endpoint.
Dutta SR et al[6](2016)	PRP and PRF were found to outperform HA (Hydroxy apatite) as graft materials, showing superior outcomes in terms of pain management, reduction of swelling, prevention of dry socket, and improvement in soft tissue healing.
Jeyraj PE et al[7] (2018)	The advantages of including autologous PRF during impacted third molar extraction were evident, showcasing noticeable clinical and radiographic improvements in both hard and soft tissue recovery, healing, and regeneration.
Girish Kumar N et al[8](2018)	Studies have reported that the clinical application of PRF contributes to improve postoperative healing.
Revathy NS et al[9] (2018)	Studies have indicated that PRF enhances and accelerates bone healing in the extracted socket of impacted mandibular third molars within a six-month period post-surgery

ensuring safety. However, conducting extensive, prolonged randomized controlled trials is essential to comprehensively understand its clinical and radiological effects on long-term bone regeneration outcomes.

5. Source of Funding

None

6. Conflict of Interest

None

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