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Optimizing Dental Extraction Outcomes With Second-Generation Fibrin-Rich Plasma (Prf A Comprehensive Case Study.

Ass.Dr.Sc Visar Disha[1]

***Corresponding author**
Dr. Visar Disha ,
Faculty of Medicine, University of Prishtina.
Email : dishavisar@gmail.com

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ABSTRACT

Tooth extraction is a routine dental procedure necessitated by various conditions, with subsequent alveolar ridge remodeling critical for optimal bone architecture preservation. This study evaluates the clinical application of Platelet-Rich Fibrin (PRF), particularly Advanced PRF (A-PRF), as an adjunct to bone grafting in alveolar ridge preservation. PRF, renowned for its regenerative potential, harnesses growth factors from platelets and leukocytes within a fibrin matrix to stimulate wound healing and tissue regeneration. The methodology involved a 42-year-old female patient requiring extraction of mandibular canine and premolar teeth due to recurrent infection and subsequent ridge preservation for future implants.

Pre-surgical procedures included antibiotic prophylaxis and PRF preparation through centrifugation. Surgical techniques incorporated minimally invasive extraction, followed by PRF membrane application over xenograft bone, promoting bone adhesion and minimizing postoperative complications. Clinical assessments revealed enhanced preservation of alveolar dimensions post-surgery, with decreased horizontal and vertical resorption compared to conventional methods.

Radiographic evaluations confirmed improved bone density and architecture at the extraction site, supporting PRF's efficacy in enhancing bone quality for subsequent implant placement. Minimal postoperative morbidity further validated PRF's safety profile and patient comfort. These findings underscore PRF's role as a cost-effective, autologous option in alveolar preservation, offering favorable clinical outcomes and patient satisfaction.

Keywords : Platelet-Rich Fibrin, PRF, alveolar ridge preservation, dental surgery, bone regeneration, clinical effectiveness.

INTRODUCTION

Tooth extraction is a common surgical procedure in dentistry indicated for various conditions such as extensive caries, trauma, inflammation, cysts, tumors, and for orthodontic and prosthetic reasons. The healing process post-extraction progresses through several phases, culminating in alveolar bone remodeling, characterized by significant osteoclastic and osteoblastic activity, particularly notable within the initial six months [1], [2].

Advancements in dental implantology and aesthetic dentistry emphasize the importance of preserving or reconstructing the biological foundation following tooth extraction. Alveolar ridge preservation represents a valuable strategy to maintain the original bone contour effectively, economically, and with simplicity [3]. A range of materials and techniques, including autografts, allografts, xenografts, and alloplastic materials, are utilized for their osteogenic, osteoinductive, and osteoconductive properties [4], with autografts considered the benchmark in these procedures [5].

Introduced by Dr. Choukroun in 2001, platelet-rich fibrin (PRF) represents a significant advancement in biological wound healing. This technique simplifies and enhances the effectiveness of platelet-rich fibrin preparations compared to earlier methods [6]. PRF and its advanced form, A-PRF, differ in their preparation protocols and composition, leveraging centrifugation to isolate platelet-enriched fibrin elements from blood. PRF's mechanism of action revolves around the controlled release of growth factors and cytokines embedded within the fibrin matrix, which play pivotal roles in wound healing and bone regeneration [7]. Its versatility extends across numerous oral and maxillofacial surgical procedures, including sinus elevation, alveolar preservation post-extraction, implantology, and cyst treatments [8].

This case study aims to evaluate the clinical effectiveness of PRF as an adjunct to bone grafting in alveolar ridge preservation.

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CASE DESCRIPTION

A 42-year-old female patient in good general health (ASA I) presented with recurrent episodes of pain, inflammation, and abscess in the mandibular region involving the canine and second premolar teeth. Clinical evaluation included a detailed history of symptoms and overall health assessment, focusing on any pre-existing medical conditions that could impact surgical suitability.

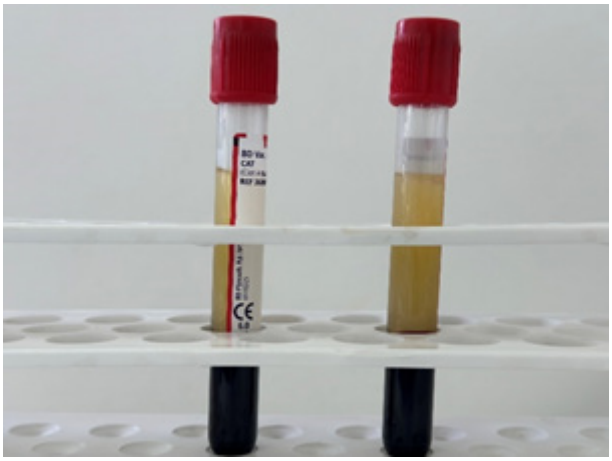
Physical examination revealed discrete swelling in the right mandibular region and mobility of a prosthetic bridge involving teeth 43, 44, and 45, likely due to inadequate oral hygiene. These findings, depicted in **Figure 1**, indicated the need for multiple extractions of the lower second canine and premolar with alveolar ridge preservation using "sticky bone," in preparation for future dental implants. The patient provided informed consent for the planned procedure.

Prior to surgery, the patient received antibiotic prophylaxis (2g amoxicillin plus clavulanic acid) and rinsed with cetylpyridinium chloride 0.05% for oral disinfection. Venous blood was collected for preparation of advanced platelet-rich fibrin (A-PRF) using specialized tubes and centrifugation at 1200 rpm for 8 minutes (**Figure 2**).

The surgical procedure began with minimally invasive extraction of the affected teeth, preserving surrounding soft tissues. Surgical debridement and wound cleansing followed, using antiseptic solutions. PRF membranes were prepared in a dedicated PRF box (**Figures 3, 4**) and utilized to promote bone adhesion. Xenograft bone impregnated with PRF was then applied and shaped using a cancellous bone toolbox to fit the extraction sockets (**Figure 5**). A second PRF membrane covered the graft site, and sutures were placed for wound closure (**Figures 6, 7**).

Figure 1: Initial clinical presentation showing an old ceramic bridge with indicated abutments for extraction.

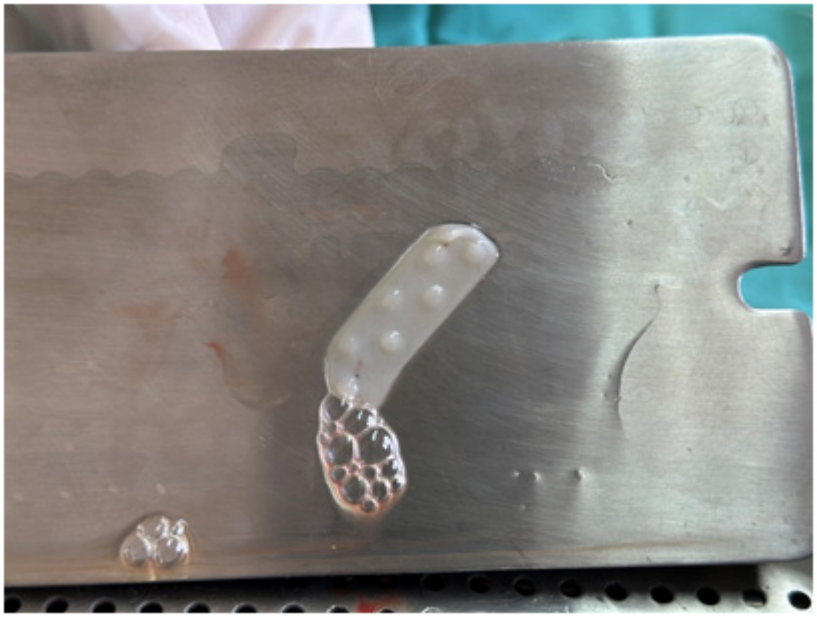
Figure 2: A-PRF tubes used for blood collection and centrifugation.



Journal of Dentistry and Oral Research (ISSN 2767-4037)

Figure 3: PRF box used for preparation of PRF membranes

Figure 4: PRF membrane prepared from the centrifuged blood.



Journal of Dentistry and Oral Research (ISSN 2767-4037)

Figure 5: Application of adhesive bone in the alveolus following tooth extraction.

Figure 6: Application of A-PRF membrane over the graft site.

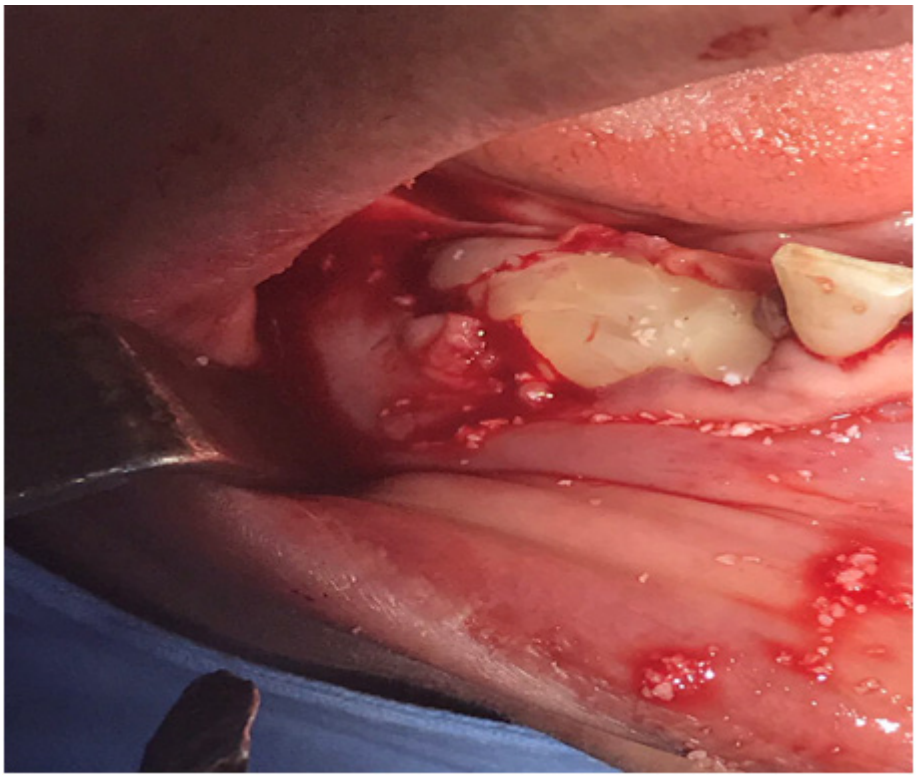


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Figure 7: Sutures placed for tension-free wound closure with excellent soft tissue condition.

Ethical Considerations

The patient provided written informed consent for the planned procedure after being thoroughly informed about the proposed therapeutic method. The study adhered to ethical principles outlined in the Declaration of Helsinki. All aspects of patient confidentiality were strictly maintained throughout the study. Institutional ethical approval for conducting the study was obtained from [UKIM].

Immediately after the intervention, the clinical width of the remaining alveolar ridge was evaluated. The measurement was performed with a bone measuring caliper in the vestibulo-oral direction. To assess the height of the residential alveolar ridge, a graduated periodontal probe was used to measure the distance from the cemento-enamel border of the adjacent tooth at two points: One on the buco-distal side and the other on the distal oral side. to the tip of the interdental septum. The average distance between these two points was calculated. Also, the height of the interdental papilla was measured and marked with a periodontal probe, from the cement-enamel border of the adjacent tooth to the highest point of the interdental papilla. The height of the residential alveolar ridge was estimated, with the help of a graduated periodontal probe, by measuring the distance from the cemento-enamel border of the adjacent tooth at two points, one on the bucco-distal side and the other on the oral side. distal side, at the tip of the interdental septum and taking the mean The same clinical parameters were measured 3 months after surgery (**Table 1**).

Table 1: Clinical parameters - Case 1 Horizontal diameter immediately after surgery (34mm) and 3 months after surgery (31mm). The vertical dimension after the operation: immediate 7mm and after 3 months 4mm. Postoperative morbidity was also assessed, reporting the degree of pain using the visual analog scale (VAS).), the presence/absence of postoperative edema, hematoma, infection, regional lymphadenitis, trismus, and the need for sedative administration.

Table No. 1	Immediate postoperative diameter in mm	Post operative diameter after 3 months in mm
Horizontal diameter	34	31
Vertical diameter	7	4

Interpretation

The immediate postoperative measurements indicated a horizontal diameter of 34 mm, which decreased to 31 mm after 3 months. Similarly, the vertical dimension decreased from 7 mm immediately post-surgery to 4 mm at the 3-month follow-up. These changes reflect typical post-extraction remodeling of the alveolar ridge.

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Postoperative Morbidity

Postoperative morbidity was assessed, including pain levels measured using the Visual Analog Scale (VAS), presence of edema, hematoma, infection, regional lymphadenitis, trismus, and need for sedative administration. Detailed descriptions and severity ratings were recorded to provide comprehensive insights into patient recovery and surgical outcomes.

DISCUSSION

Platelet-enriched fibrin (PRF) represents a pivotal advancement in oral surgery, leveraging its unique histomorphological composition to foster robust wound healing processes in both hard and soft tissues (9). The concentrated presence of platelets and leukocytes within PRF plays a crucial role in orchestrating neocollagenesis and neoosteogenesis through the release of growth factors from α-granules, influencing fibroblast and osteoblast activities (10). This biological mechanism underscores PRF's versatility in enhancing hemostasis, promoting angiogenesis, and facilitating epithelialization, pivotal for optimal post-extraction healing in oral and maxillofacial surgeries (11).

Studies, including that by Dohan et al., have underscored PRF's function akin to a biologically active scaffold, stimulating local defense mechanisms and modulating inflammation through controlled cytokine release during matrix remodeling (11). This regulatory role of cytokines like IL-1β, IL-6, and TNF-α not only supports tissue homeostasis but also enhances the overall healing environment (12).

Efforts to refine PRF protocols, as noted in recent modifications, aim to enhance its properties and extend growth factor release kinetics, thereby improving clinical outcomes and procedural efficiency (13). In our clinical case of alveolar preservation post-extraction, the adjunctive use of A-PRF demonstrated notable benefits. It facilitated easier application of graft material, minimizing material displacement and contamination risks. Clinically, this approach resulted in enhanced preservation of alveolar volume and mitigated horizontal and vertical bone resorption, corroborating findings from similar studies (14, 15, 16).

Radiographic assessments, including CBCT scans, revealed favorable outcomes with increased neoosteogenesis and improved bone architecture within the extraction site. These findings substantiate PRF's role in not only preserving but also enhancing bone quality, crucial for subsequent implant placement and long-term dental health (15).

Importantly, our study observed minimal postoperative morbidity and discomfort, consistent with broader literature highlighting PRF's favorable safety profile and patient outcomes (17, 18). However, future research should focus on longitudinal studies to ascertain the longevity of PRF-mediated benefits and compare its efficacy against conventional techniques.

CONCLUSION

A-PRF emerges as a cost-effective, autologous, and straightforward option for alveolar preservation following tooth extraction. This study confirms its efficacy in maintaining both bone volume and quality, highlighting its versatility as a therapeutic adjunct. The observed absence of significant postoperative discomfort further supports A-PRF as a safe and effective method for achieving favorable clinical outcomes. These findings underscore its potential utility in enhancing patient care and outcomes in dental practice.

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