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Review Article

Advancements and clinical applications of extended platelet-rich fibrin (E-PRF)

Ambujakshi Manjunatha Vinayaka[1]*, Soujanya Kohalli[1], Laxmi[2], R Sumukh Bharadwaj[3]

[1]*Dept. of Periodontology & Implantology, Dental College & Hospital, Yenapya University, Mangaluru, Karnataka, India*
[2]*Dept. of Periodontics, HKES Nijalingappa Institute of Dental Science and Research, Kalaburgi, Karnataka, India*
[3]*Dept. of Conservation Dentistry and Endodontics, JSS Dental College and Hospital, Mysuru, Karnataka, India*

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ABSTRACT

Extended platelet-rich fibrin (E-PRF) has emerged as a potent biological agent in regenerative medicine and dentistry. It leverages the natural healing capacities of growth factors and cytokines from platelets and leukocytes to promote tissue repair. This systematic review explores the role of E-PRF in various clinical applications, including wound healing, bone regeneration, and periodontal therapy. The findings indicate that E-PRF provides an enhanced bioactive matrix, supporting superior clinical outcomes compared to conventional treatments. Future studies should focus on optimizing E-PRF protocols and investigating its long-term effectiveness.

1. Introduction

The use of blood derivatives, such as platelet-rich plasma (PRP) and platelet-rich fibrin (PRF), has become a cornerstone in tissue regeneration due to their inherent growth factors and cytokines. Recently, an advanced version known as extended platelet-rich fibrin (E-PRF) has gained attention. E-PRF is an autologous preparation that enhances the regenerative potential of conventional PRF by prolonging the release of key bioactive molecules, thus extending its healing effects. This systematic review aims to consolidate current research on the clinical efficacy of E-PRF and its applications in regenerative therapies.[1–4]

2. Materials and Methods

The systematic review adhered to PRISMA guidelines for methodology. An electronic search was conducted across PubMed, Scopus, and Google Scholar databases using keywords such as “extended platelet-rich fibrin,” “E-PRF,” “regenerative medicine,” and “wound healing.” The search was restricted to studies published in English between 2010 and 2024. Clinical trials, cohort studies, case reports, and in vitro studies were included. Articles were excluded if they lacked control groups or provided insufficient data on the outcomes of E-PRF applications.

3. Results

3.1. Mechanism of action

E-PRF is developed through a centrifugation process, yielding a fibrin matrix rich in platelets and leukocytes. This matrix slowly releases growth factors, including platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF), and transforming growth factor-beta (TGF-β), over a prolonged period compared to traditional PRF. The sustained release is crucial in promoting angiogenesis, collagen synthesis, and tissue remodeling, which makes E-

* *Corresponding author*.
E-mail address: dravidavinu@gmai.com (A. M. Vinayaka).

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Table 1:

Key Concept	Description
Traditional PRF	Recognized for its regenerative potential, it has a short resorption period of 2–3 weeks, which limits its use in procedures requiring extended tissue support, like guided bone regeneration (GBR) and guided tissue regeneration (GTR).
Extended PRF (e-PRF) and Albumin-based PRF (Alb-PRF)[8]	Advances in PRF technology that extend resorption time to 4–6 months, achieved via a novel heating process that converts the liquid plasma albumin into a gel-like substance.
Preclinical Studies[8]	Demonstrated the transformation of the liquid plasma albumin into a gel extends PRF's structural integrity and degradation properties, lasting up to 4 months, per ISO standard 10 993 (subcutaneous animal model).
Clinical Implications[8]	e-PRF has been used successfully as a substitute for collagen membranes in procedures such as GTR/GBR, lateral sinus window closure, and extraction site management. It also shows promise in periodontal regeneration and soft tissue recession treatment.
Biological Properties[8]	e-PRF provides extended release of growth factors (PDGF, TGF-β, VEGF) and includes leukocytes, enhancing tissue healing, angiogenesis, collagen synthesis, and immune response, which reduces infection risk.
Applications in Facial Aesthetics and Orthopedics[1,8]	Alb-PRF can be used as an injectable regenerative filler with long-lasting effects in joints and soft tissues, offering benefits in treating osteoarthritis and facial rejuvenation.
Advantages Over Collagen Membranes[8]	e-PRF offers a more natural, biocompatible, and cost-effective alternative to collagen membranes, reducing risks of immune reactions or infections as it is derived from the patient's own blood.
Challenges	Preparation of e-PRF is technique-sensitive, requiring precision in centrifugation speeds and heating times. Patient factors such as platelet count and inflammatory status may affect e-PRF efficacy.

PRF a more potent option in regenerative treatments.[4–8]

4. Applications in Regenerative Medicine

4.1. Wound healing

Several studies suggest that E-PRF significantly accelerates wound healing by promoting re-epithelialization and reducing inflammation. In a randomized clinical trial by Miron et al. (2020 & 2024),[1,8] E-PRF demonstrated faster wound closure and improved histological outcomes in comparison to PRF in patients undergoing oral surgical procedures.

4.2. Bone regeneration

Bone regeneration is a critical aspect of oral and maxillofacial surgery. A study by Castro et al. (2022)[2] showed that E-PRF, when used in conjunction with bone grafts, significantly enhanced bone mineral density and volume in patients requiring alveolar ridge augmentation . This synergistic effect is attributed to the prolonged release of growth factors, which facilitates the recruitment of osteoblasts and other progenitor cells involved in bone formation.

4.3. Periodontal therapy

Periodontal regeneration has shown promising results with the use of E-PRF. A comparative study between E-PRF and conventional scaling and root planing (SRP) revealed that E-PRF not only improved pocket depth reduction but also enhanced clinical attachment gain in patients with chronic periodontitis . The matrix provides a conducive environment for soft tissue regeneration and maintains growth factor release for several days post-application.[7,8]

5. Advantages Over Traditional PRF

E-PRF has a more dense and resilient fibrin network, allowing it to maintain its structural integrity for longer durations. The extended release of growth factors is a distinguishing feature that enhances its regenerative potential compared to PRF. Additionally, the inclusion of leukocytes in E-PRF supports a more balanced immune response, reducing the risk of infections during the healing process.

6. Limitations

Although E-PRF presents numerous benefits, there are challenges to its widespread use. The preparation process is more technique-sensitive than PRF, requiring precise control of centrifugation speeds and times. Additionally, the long-term outcomes of E-PRF in large-scale studies are yet to be fully established. Variability in individual patient factors, such as platelet count and inflammatory status, can also influence the efficacy of E-PRF.

7. Discussion

The reviewed literature consistently supports the enhanced efficacy of E-PRF in regenerative treatments, particularly in soft and hard tissue healing. Its advantages over conventional PRF, including prolonged growth factor release and enhanced structural integrity, make it a promising addition to regenerative protocols. However, standardization in preparation and application techniques is crucial to ensuring consistent outcomes. [1–8]

8. Future Directions

Future research should focus on refining E-PRF preparation techniques and exploring its potential in other fields of medicine, such as dermatology and plastic surgery. Furthermore, large-scale clinical trials are needed to evaluate the long-term effects of E-PRF in various patient populations.

9. Conclusion

Extended platelet-rich fibrin (E-PRF) is a promising biomaterial in regenerative medicine, offering superior outcomes in wound healing, bone regeneration, and periodontal therapy. Its extended release of growth factors and robust fibrin matrix make it more effective than traditional PRF. However, further research is required to standardize its preparation and assess its long-term efficacy.

10. Source of Funding

None.

11. Conflict of Interest

None.

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Author's biography

Ambujakshi Manjunatha Vinayaka, PhD Scholar https://orcid.org/0000-0002-1255-7944

Soujanya Kohalli, Consultant Orthodontist

Laxmi, Assistant Professor

R Sumukh Bharadwaj, Postgraduate Student

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