Platelet Concentrates in Dentistry: Biological and Clinical Insights — A Narrative Review

Abstract

Background: Platelet concentrates, including platelet-rich plasma (PRP), platelet-rich fibrin (PRF), and leukocyte- and platelet-rich fibrin (L-PRF), are autologous biomaterials used to enhance tissue regeneration in dentistry. Objective: To review the biological mechanisms, technical protocols, and clinical applications of platelet concentrates, with emphasis on PRF and its advanced formulations. Methods: This narrative review synthesizes current literature on PRP, PRF, A-PRF, i-PRF, and C-PRF, with focus on centrifugation parameters, tube materials, and clinical outcomes in oral surgery, implantology, periodontology, and endodontics. Results: Evidence indicates that PRF accelerates wound healing, promotes angiogenesis, and enhances bone regeneration; innovations such as A-PRF+ and i-PRF suggest improved growth factor release and wider clinical versatility. Conclusions: PRF and its derivatives are cost-effective, autologous biomaterials with broad applications in dentistry; future research should prioritize protocol standardization and integration with regenerative technologies.

Keywords (MeSH):

Platelet-Rich Fibrin; Platelet-Rich Plasma; Regenerative Dentistry; Oral Surgical Procedures; Dental Implants; Periodontics; Endodontics.

Introduction

The use of platelet concentrates in medicine and dentistry has evolved significantly over the past three decades. Initially, platelet-rich plasma (PRP) was introduced as an autologous source of growth factors, but reliance on anticoagulants and exogenous activators limited clinical practicality. Platelet-rich fibrin (PRF) emerged as a second-generation concentrate, eliminating anticoagulants and providing a physiologically relevant fibrin matrix capable of sustained release of bioactive molecules. Advanced formulations (A-PRF, A-PRF+, i-PRF, and C-PRF) aim to optimize platelet and leukocyte retention, improve angiogenesis, and broaden clinical applications across implantology, periodontology, oral surgery, and endodontics.

Materials and Methods

This is a narrative review based on searches of peer-reviewed literature focusing on biological mechanisms, preparation protocols, and clinical outcomes of platelet concentrates. Key topics included centrifugation parameters (reported as relative centrifugal force, RCF), tube materials, handling and compression, growth factor release, and clinical applications in oral surgery, implantology, periodontology, and endodontics. As a narrative review, formal systematic registration (e.g., PROSPERO) and risk-of-bias scoring

were not undertaken. Where applicable, reporting follows general recommendations from the EQUATOR Network for narrative reviews.

Results

Technical parameters influence PRF bioactivity. Low-speed centrifugation protocols (A-PRF/A-PRF+) preserve more leukocytes and platelets, supporting enhanced growth factor release and angiogenesis. Glass tubes are preferred; silica-coated tubes may shed microparticles with potential cytotoxicity. Standardized compression (approximately 3–5 minutes) supports reproducible membrane thickness. Biologically, PRF acts as a reservoir for PDGF, TGF-β, VEGF, and IGF, enabling sustained release over 7–14 days. Clinically, PRF has been associated with reduced post-operative pain and alveolar osteitis, faster soft-tissue closure, improved implant stability, enhanced outcomes in periodontal defects and mucogingival surgery, and promise as a scaffold in regenerative endodontics. Emerging formulations (i-PRF, C-PRF) expand indications and handling options.

Discussion

Compared with PRP, PRF offers simplified preparation, absence of anticoagulants, and more sustained growth-factor delivery. Heterogeneity in preparation protocols, incomplete reporting of RCF and tube composition, and limited long-term data hinder reproducibility and meta-analytic synthesis. Priorities include protocol standardization, transparent reporting (RCF, rotor radius, tube material, timing to spin), and integration of PRF with biomaterials, stem cells, and digital/bioprinting workflows. Personalized approaches considering patient-related factors (e.g., hematologic parameters, medications) may further optimize outcomes.

Clinical Recommendations

1. Report centrifugation as RCF (g) and rotor radius; avoid RPM alone.
2. Prefer glass collection tubes; avoid silica-coated tubes where possible.
3. Standardize clot handling and compression (≈3–5 minutes) for consistent membranes.
4. Consider patient factors that influence PRF quality (hydration, medications).
5. Use PRF as an adjunct with grafts, membranes, and soft-tissue procedures when biologically indicated.

Limitations

Narrative design without formal registration; variability in protocols across studies; frequent lack of long-term outcomes; and inconsistent reporting of technical variables.

Conclusions

PRF and its derivatives represent versatile, safe, and cost-effective autologous biomaterials with benefits across oral surgery, implantology, periodontology, and endodontics. Standardized protocols and high-quality clinical trials are needed to confirm long-term outcomes and refine indications.

Conflict of Interest

The authors declare no conflicts of interest related to this work.

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Ethics Approval and Patient Consent

Not applicable. This article is a narrative review and does not include new studies with human participants or animals conducted by the authors.

Data Availability

No new data were created or analyzed in this study. Data sharing is not applicable.

Use of Artificial Intelligence

The authors did not use generative artificial intelligence tools for writing, editing, data analysis, or figure generation in the preparation of this manuscript. All content was created and verified by the authors.

Tables

Figure Legends

Figure 1. Schematic of PRF preparation workflow and key variables affecting clot biology.

Figure 2. Representative clinical applications of PRF in oral rehabilitation (illustrative).

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Table 1. Summary of PRF formulations, centrifugation parameters (RCF), and handling features.

Formulation	Centrifugation Parameters (RCF, time)	Biological Features	Handling Characteristics

PRP	Variable; requires anticoagulant	High platelet concentration; burst release of growth factors	Liquid; requires activation
PRF	≈400 g, 10–12 min	Fibrin matrix; sustained release of growth factors; leukocyte inclusion	Solid clot; can be compressed into membrane
A-PRF / A-PRF+	≈200 g, 14 min (low speed)	More leukocytes & platelets retained; enhanced angiogenesis	Flexible membrane; slower polymerization
i-PRF	≈60 g, 3–5 min	Injectable form; high growth factor release	Liquid injectable; used with grafts/scaffolds
C-PRF	Higher g-force; short spin	Concentrated platelet fraction; high GF release	Small volume; often injected or mixed with biomaterials

Table 2. Representative clinical indications for PRF in oral surgery, implantology, periodontology, and endodontics.

Field	Clinical Applications	Reported Benefits
Oral Surgery	Extraction sockets; alveolar ridge preservation; sinus lift adjunct	Reduced pain, faster epithelial closure, less alveolar osteitis
Implantology	Sinus augmentation; peri-implant defects; immediate implant placement	Enhanced osseointegration; graft stabilization; improved implant stability
Periodontology	Intrabony defects; furcation involvement; gingival recession coverage	Improved probing depth reduction; CAL gain; better root coverage
Endodontics	Regenerative endodontics; pulp revascularization	Provides scaffold for stem cells; promotes regeneration; higher revascularization success