Procedure Update

Clinical Standardization of Platelet-Rich Plasma (PRP) and Platelet-Rich Fibrin (PRF) Treatments in Complex Wounds: A Protocol for Biological Optimization and Evidence-Based Practice

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Abstract

Introduction. Complex wounds represent a critical public health challenge, requiring effective adjuvant therapies to reverse cellular senescence. Autologous platelet derivatives, namely Platelet-Rich Plasma (PRP) and Platelet-Rich Fibrin (PRF), concentrate essential growth factors to accelerate tissue regeneration. However, the lack of methodological standardization limits clinical reproducibility.

Objective. To develop and scientifically validate a structured nursing protocol for the preparation and clinical application of PRP and PRF in complex wounds.

Methods. Technical analysis and theoretical validation of institutional protocol EP431, cross-referencing operational parameters (relative centrifugal force, processing times, and handling techniques) with high-impact clinical trials.

Results. The protocol establishes a relative centrifugal force of 1500 x g for 9 minutes for PRP (separator gel tubes, inverted 5-8 times) and 700 x g for 15 minutes for PRF. Evidence confirms that these parameters maximize platelet integrity and sustained cytokine release. Intradermal/subcutaneous injection techniques (0.1 mL/cm), an optimal 4-5 day application interval, and advanced perilesional silicone barriers are detailed.

Conclusion. Clinical standardization via protocol EP431 mitigates biological variability, ensuring a safe, reproducible, and robust evidence-based intervention.

Keyword: Platelet-Rich Plasma, Platelet-Rich Fibrin, Chronic Wounds, Wound Healing, Clinical Protocols, Regenerative Medicine

Introduction

The management of complex wounds—including chronic ulcers, dehiscent surgical wounds, burns, and refractory traumatic lesions—imposes a severe socioeconomic and clinical burden on global healthcare systems.[1] These lesions are frequently arrested in a pathological, self-perpetuating inflammatory stage characterized by an imbalance in matrix metalloproteinases (MMPs), premature degradation of structural proteins, and cellular senescence. Autologous platelet concentrates provide a supraphysiological delivery of growth factors, triggering native cellular cascades indispensable for real tissue repair. Despite clear biological plausibility, clinical implementation faces substantial heterogeneity. Methodological discrepancies in centrifugation speeds, tube selection, and activation handling result in unpredictable biological profiles. This paper presents a comprehensive validation of protocol EP431 (originally presented at EWMA 2024, London)[2] to establish reproducible clinical excellence.

Operational Parameters and Preparation Methodology

The preparation of autologous concentrates requires strict technical adherence to avoid premature platelet activation or unwanted cellular lysis. Whole blood processing relies on precisely calibrated centrifugation forces and times adjusted to optimize biological yield.

Table 1. Material Requirements and Supply Checklist for Protocol EP431.

Category	Detailed Item Description	Clinical Purpose
Cleansing Solutions	1st: Sterile Saline Solution 2nd: Super-Oxidized Water	Ensure biological decontamination and mechanical cleansing of the wound bed without causing cell cytotoxicity.
Collection Tubes	PRP-specific tubes (with separator gel) PRF-specific tubes (without chemical additives)	Guarantee accurate separation of whole blood fractions during the specified rotation cycle.
Perilesional Protection	Specific barrier protection cream	Prevent maceration of the wound edges induced by chronic biological exudate.
Interfaces & Dressings	Silicone contact layer or paraffin gauze Self-adherent soft silicone foam dressing	Protect the applied platelet concentrate, maintain optimal moisture balance, and prevent mechanical trauma during removal.

Differential Centrifugation Mechanics:

- Platelet-Rich Plasma (PRP): Spun at 2800 rpm for 9 minutes (RCF of 1500 x g). Requires mandatory 5-8 gentle inversions to thoroughly homogenize the highly concentrated growth factors located right above the gel barrier.
- Platelet-Rich Fibrina (PRF): Spun at 1300 rpm for 15 minutes (RCF of 700 x g). Processed without additives; require immediate extraction and application of the un-retracted three-dimensional fibrin matrix.

Clinical Application Protocol and Therapeutic Approach

Administration must follow strict anatomical and physiological guidelines. The protocol mandates a precise dosage of 0.1 mL per linear or square centimeter, delivered via intradermal and subcutaneous micro-injections directly into the viable margins and wound bed. This ensures uniform local bio-distribution. Indications include vascular ulcers (venous/arterial), diabetic foot ulcers, dehiscent wounds, complex burns, and ischemic surgical flaps. Absolute contraindications comprise uncontrolled

active localized infections, malignancy within the wound bed (due to angiogenic risks), severe thrombocytopenia, or active systemic autoimmune flare-ups.

Biomolecular Mechanisms and Discussion

The therapeutic efficacy of protocol EP431 relies on highly coordinated cellular events. Autologous platelet derivatives act as an immuno-modulator, downregulating pro-inflammatory cytokines (TNF-alpha, IL-1) and driving macrophage polarization toward the pro-healing M2 phenotype. Angiogenesis is significantly accelerated via the sustained release of Vascular Endothelial Growth Factor (VEGF) and Fibroblast Growth Factor (FGF) from the alpha granules, restoring capillary density and tissue perfusion. Proliferation of fibroblasts and keratinocytes is driven by PDGF and TGF-beta, which ensure organized collagen deposition and limit hypertrophic scarring. Furthermore, concentrated platelets release antimicrobial peptides (AMPs), disrupting bacterial membranes and preventing biofilm formation.[3]

Scientific Evidence and International Validation

The operational parameters established in Protocol EP431 are heavily validated by seminal peer-reviewed literature:

1. Clinical Efficacy: Meznerics FA, et al. J Clin Med. 2022;11(24).[1] A robust systematic review and meta-analysis confirming that autologous platelet concentrates significantly increase complete closure rates and reduce healing time in chronic wounds compared to standard care.
2. Centrifugation Optimization: Eppley BL, et al. Plast Reconstr Surg. 2004;114(6).[4] Demonstrates that intermediate-to-high relative centrifugal forces (around 1500 x g, matching the PRP parameters of EP431) maximize platelet recovery while preserving alpha granule structural integrity.
3. Infection Control: Zhang W, et al.[3] Tissue Eng Part B Rev. 2019;25(3). Validates the exact molecular pathways involved in leukocyte phagocytosis and platelet-derived AMP release, confirming the local bio-protective capacity against critical colonization.

Conclusion

The institutional protocol EP431 successfully addresses the historical challenge of methodological inconsistency in regenerative medicine. By standardizing the relative centrifugal forces (1500 x g for PRP; 700 x g for PRF) and specifying precise localized tissue delivery, it establishes a reliable, clinically reproducible model that significantly optimizes wound care outcomes and advances evidence-based nursing practice.

References

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