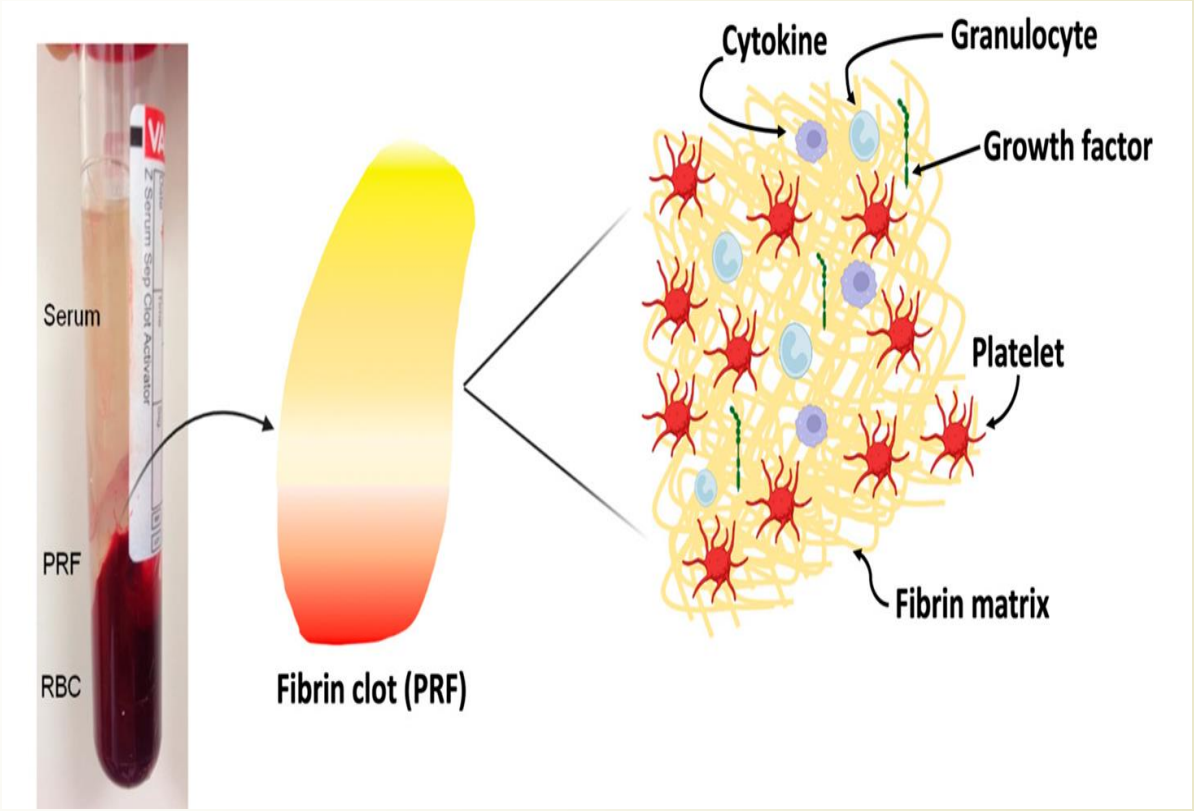
Platelet-Rich Fibrin and Healing of Oral Mucosa



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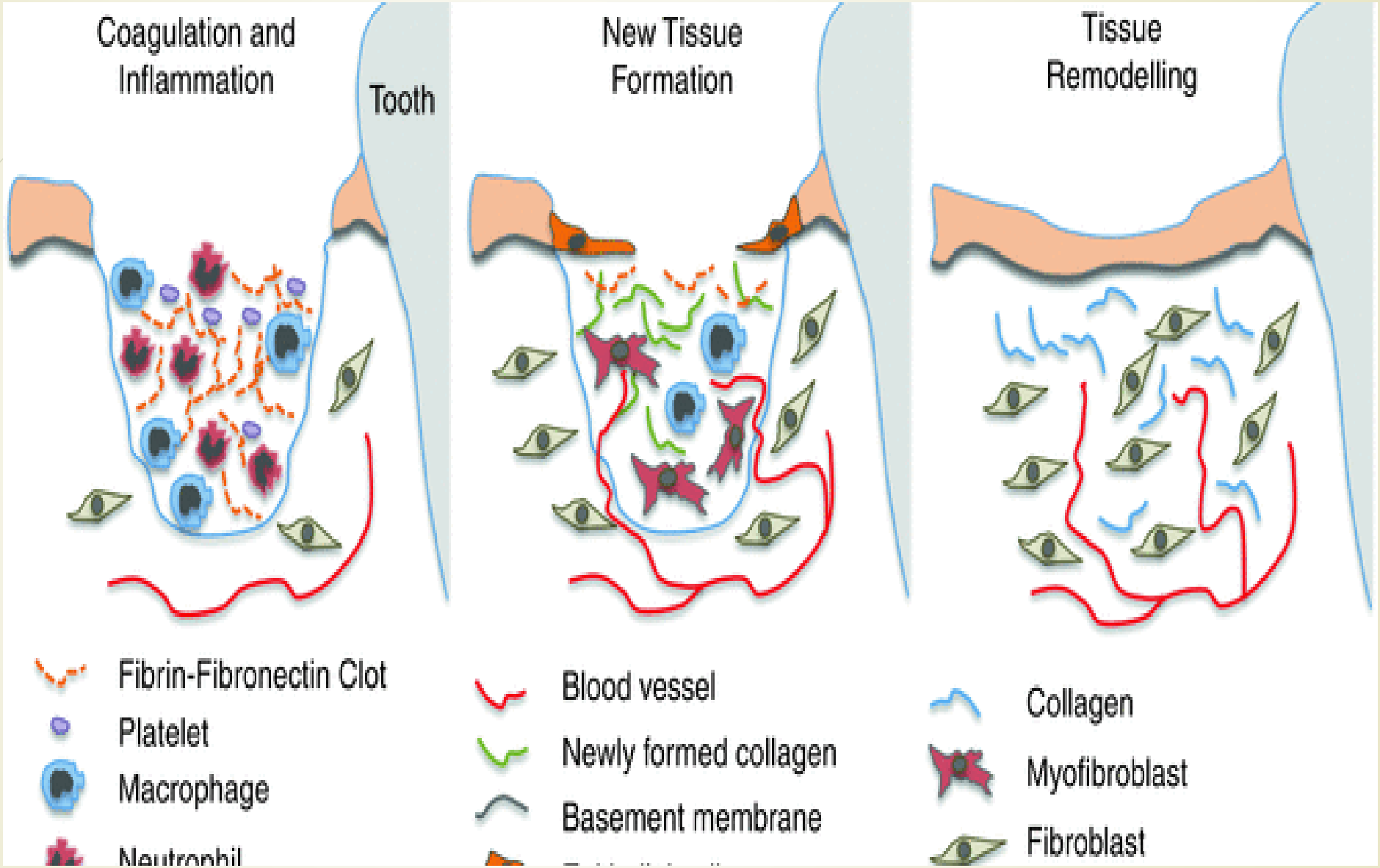
Introduction

- Oral mucosal tissues are constantly exposed to mechanical, chemical, and microbial challenges. Surgical procedures, trauma, ulcers, and inflammatory diseases may compromise their integrity and delay healing.
- According to the **World Health Organization**, oral health is an essential component of general health and quality of life. Therefore, improving wound healing in the oral cavity is a major clinical objective.
- In recent years, regenerative approaches have gained increasing attention. Among these, **Platelet-Rich Fibrin (PRF)** has emerged as a promising autologous biomaterial for enhancing soft tissue repair and regeneration.
- PRF belongs to the second generation of platelet concentrates and is widely used in oral surgery, periodontology, implantology, and management of mucosal lesions.


Coagulation and Inflammation
Tooth
New Tissue Formation
Tissue Remodelling
Fibrin-Fibronectin Clot
Platelet
Macrophage
Neutrophil
Blood vessel
Newly formed collagen
Basement membrane
Collagen
Myofibroblast
Fibroblast

Historical Background of Platelet Concentrates

1- First Generation: Platelet-Rich Plasma (PRP)

- Introduced in the 1990s.
- Requires anticoagulants and bovine thrombin.
- Preparation is complex.
- Risk of immunological reactions.

2- Second Generation: Platelet-Rich Fibrin (PRF)

- Developed to overcome PRP limitations.
- No anticoagulants or additives.
- Natural polymerization process.
- Simpler and safer protocol.

PRF represents a more physiological and biocompatible approach to tissue regeneration.

Definition of Platelet-Rich Fibrin

- Platelet-Rich Fibrin is an **autologous fibrin-based biomaterial** obtained from centrifuged whole blood without anticoagulants. It contains:
  - Platelets
  - Leukocytes
  - Cytokines
  - Growth factors
  - A dense fibrin matrix
- This biological scaffold supports cell migration, proliferation, and differentiation.

Biological Composition of PRF

- **1-Fibrin Matrix**
- Forms a three-dimensional network.
- Acts as a scaffold for cell attachment.
- Stabilizes wound margins.
- Supports angiogenesis.
- **2- Platelets**
- Platelets are rich in bioactive molecules, including:
- Platelet-Derived Growth Factor (PDGF)
- Transforming Growth Factor-β (TGF-β)
- Vascular Endothelial Growth Factor (VEGF)
- Epidermal Growth Factor (EGF)

- **3- Leukocytes**
- Leukocytes contribute to:
  - Immune defense
  - Infection control
  - Regulation of inflammation
  - Secretion of cytokines
- Their presence improves healing quality.

Mechanism of Action in Oral Mucosal Healing
PRF influences all major stages of wound healing:

1-Hemostasis Phase

- Fibrin matrix promotes clot formation.
- Provides mechanical stability.
- Reduces postoperative bleeding.

2- Inflammatory Phase

Leukocytes modulate inflammation.

Reduces excessive inflammatory response.

Prevents infection.

Promotes balanced immune activity.

- **3- Proliferation Phase**
- PRF stimulates:
  - Fibroblast proliferation
  - Keratinocyte migration
  - Endothelial cell growth
  - Collagen synthesis
- This results in faster epithelialization.
- **4- Remodeling Phase**
- Supports organized collagen deposition. Improves tensile strength. Enhances tissue maturation. Minimizes scar formation.

Preparation Protocol of PRF

Blood Collection

- Venous blood (5–10 ml per tube).
- Collected without anticoagulant.
- Must be centrifuged immediately.

Centrifugation

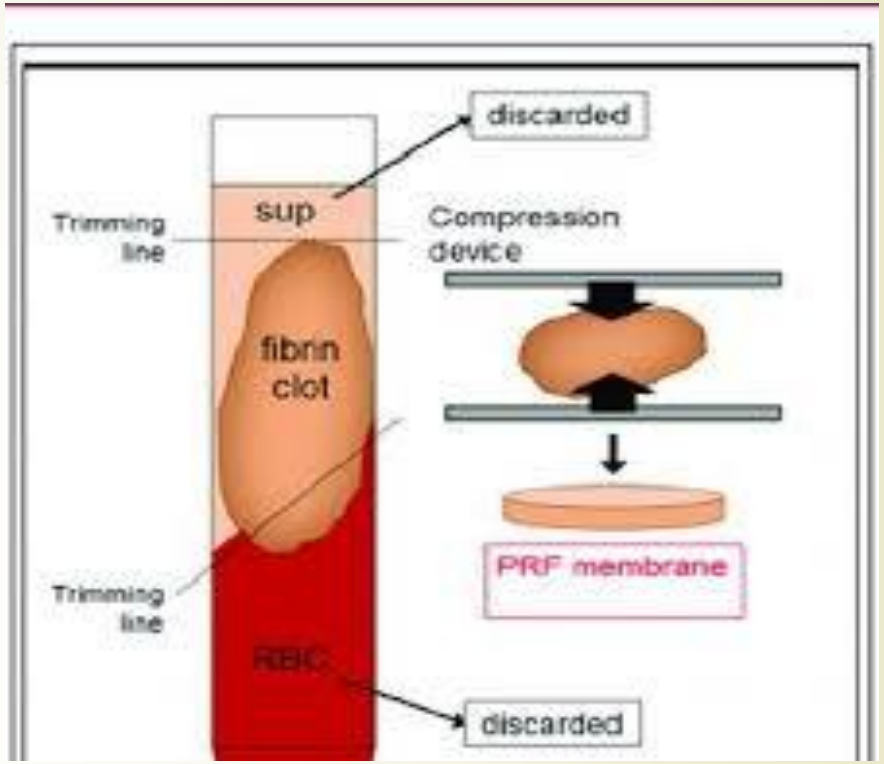
Typical protocol:

- Speed: 2700–3000 rpm
- Time: 10–12 minutes

This produces three layers:

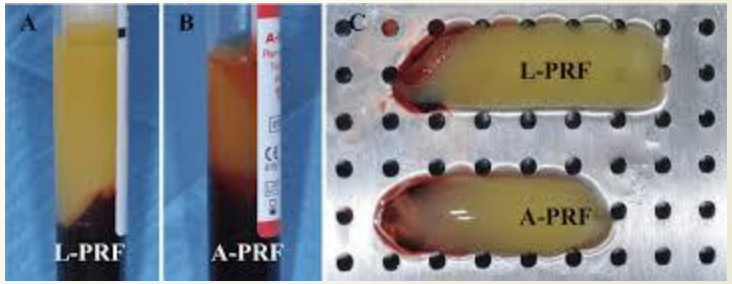
1. Red blood cells (bottom)
2. PRF clot (middle)
3. Platelet-poor plasma (top)

- **PRF Processing**
- The PRF clot can be:
- Compressed into membrane
- Used as plug
- Processed into injectable PRF (i-PRF)



Types of PRF

- 1- Standard PRF (L-PRF)Contains leukocytes. Used as membrane or clot.
- 2- Advanced PRF (A-PRF)Lower centrifugation speed. Higher growth factor content. Enhanced cellular release.
- 3- Injectable PRF (i-PRF)Liquid form. Used for injections. Suitable for soft tissue regeneration.



Clinical Applications in Oral Mucosal Healing

- **Post-Surgical Wound Healing**
- PRF is widely used after:
  - Biopsies
  - Excisional surgeries
  - Gingivectomy
  - Frenectomy
- Benefits:
  - Faster epithelialization
  - Reduced pain
  - Better wound closure
  - Decreased edema

8.2 Management of Oral Ulcers

PRF has shown efficacy in:

- Recurrent aphthous stomatitis
- Traumatic ulcers
- Chronic mucosal defects

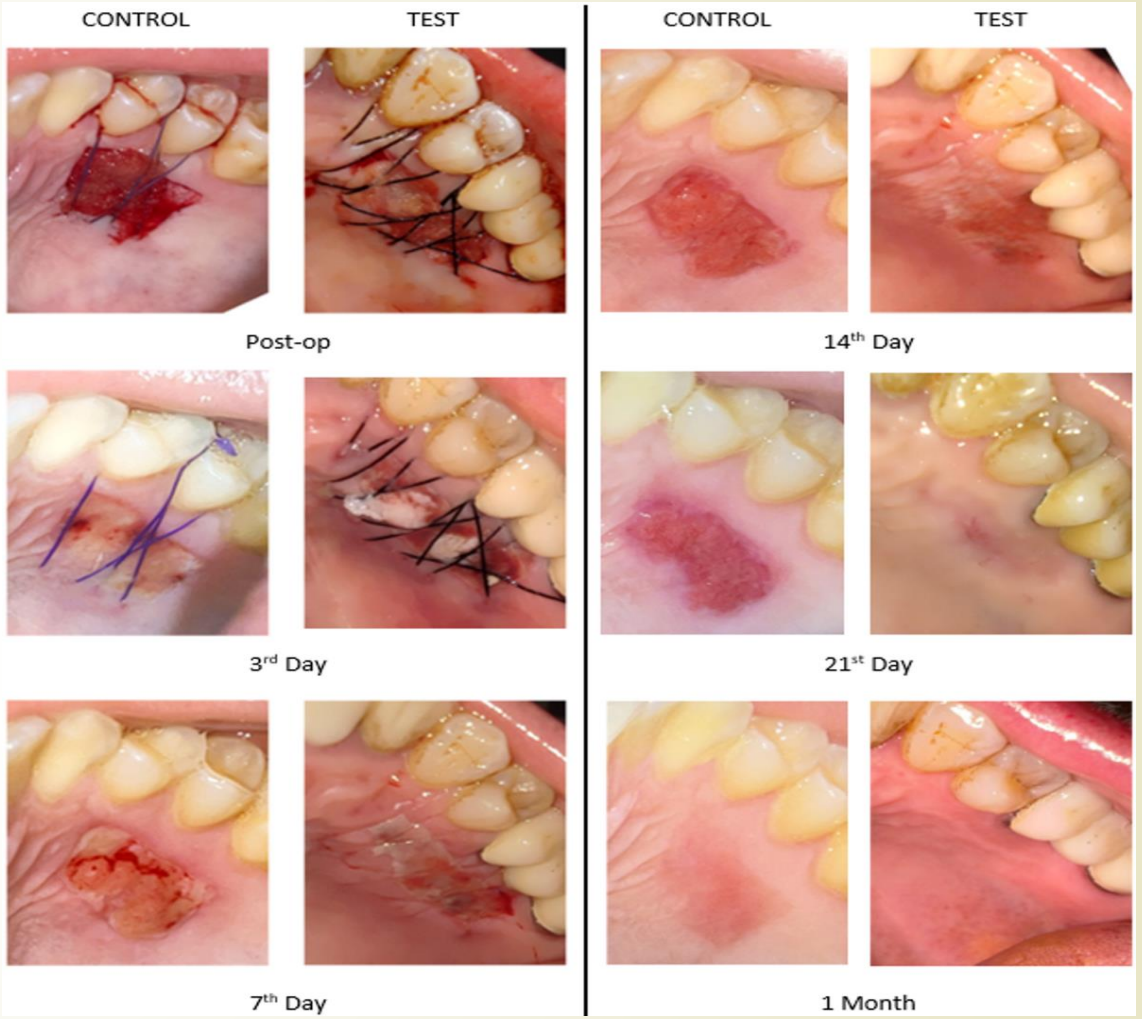
Effects:

- Pain reduction
- Accelerated healing
- Improved patient comfort

8.3 Palatal Donor Site Healing

After connective tissue graft harvesting:

- PRF reduces bleeding.
- Improves patient tolerance.
- Enhances tissue regeneration.
- Shortens recovery period.



- 8.4 Treatment of Inflammatory and Immune-Mediated LesionsPRF has been used as adjunct therapy in:Lichen planusPemphigus vulgarisMucocutaneous disordersIt promotes tissue repair and symptom control.
- 8.5 Peri-Implant Soft Tissue Management PRF improves:

Peri-implant mucosal thickness Soft tissue stability Esthetic outcomes Resistance to inflammation

9. Advantages of PRF in Oral Medicine

- ✓ Autologous and biocompatible
- ✓ No risk of disease transmission
- ✓ No chemical additives
- ✓ Easy preparation
- ✓ Low cost
- ✓ Sustained growth factor release
- ✓ Enhanced angiogenesis
- ✓ Improved patient satisfaction

10. Limitations and Challenges

- Despite its benefits, PRF has some limitations:
- ❌ Technique-sensitive preparation
  ❌ Short handling time
  ❌ Limited volume
  ❌ Variability between patients
  ❌ Lack of universal standardization

11-Comparison Between PRF and Other Materials

Feature	PRF	PRP	Collagen Membrane
Autologous	Yes	Yes	No
Additives	No	Yes	No
Cost	Low	Moderate	High
Growth Factors	High	High	None
Immunogenic Risk	Very Low	Low	Possible

- **12. Evidence from Scientific Studies**
- Systematic reviews and clinical trials have demonstrated that PRF:
  - Accelerates oral wound healing
  - Reduces postoperative pain
  - Improves epithelial regeneration
  - Enhances angiogenesis
  - Modulates inflammation
- Histological studies confirm improved collagen organization and vascular density.

Conclusion

- Platelet-Rich Fibrin is a biologically active, autologous biomaterial that significantly enhances oral mucosal healing.
- Through its fibrin scaffold, growth factor release, and immunomodulatory properties, PRF accelerates wound closure, reduces pain, and improves tissue quality.
- Its simplicity, safety, and effectiveness make PRF an essential tool in modern oral medicine and oral surgery.
- With continued research and standardized protocols, PRF will remain a cornerstone of regenerative dentistry.


Thank You