

A Insight on PRF - Unleash the Unknown

Nukalamarri Om Brahma Prasad Chary MDS¹, ²Kaki Roja Reddy MDS²

¹Maxillofacial Prosthodontics and Implantology

²Oral Medicine and Radiology

Abstract: *One of the revolution and greatest challenge in the field of surgical dentistry and clinical research is introduction of PRF. It accelerates the healing mechanism and reduce the inflammation. In this sense, platelet rich fibrin (PRF) appears as a natural and satisfactory alternative with favorable results and low risks. PRF alone or in combination with other biomaterials seems to have several advantages and indications both for medicine and dentistry. The following article summarized the role of PRF in the process of healing, its preparation, advantages, disadvantages, and clinical implications including advanced surgical dentistry.*

Keywords: Platelet rich fibrin, centrifugation, platelet rich plasm

1. Introduction

One of the modern attainments in dental Implantology is the use of platelet concentrates for regeneration of the hard and soft tissues ⁽¹⁾. Since 1990, scientific studies has identified number of components in blood, The main component of normal blood clot is RBC , approximately 5% platelets and less than 1% white WBC, as a part of the natural healing process, when used along with platelet concentrates it enhances the wound healing mechanisms ⁽²⁾. One of the advancements in the field of science is bioactive material to accelerate the wound healing process ⁽⁴⁾. Now it's well known that platelets have various functions beyond that of simple homeostasis as it contains various essential growth factors like Platelet Derived Growth factor (PDGF) , Transforming Growth factor- β (TGF- β), Fibroblastic Growth Factor (FGF), Vascular Endothelial growth Factor (VEGF) Epithelial Growth Factor (EGF) ,Insulin like Growth Factor (IGF) , that enhance and support wound healing ⁽³⁾ . In these scenario, growth factors secreted, are responsible for increasing cell mitosis, collagen production, binding other cells to the site of injury, enhancing vascular growth, inducing cell differentiation ,even though it's a complex process , thus platelets play an important role in both homeostasis and wound healing processes ⁽³⁾ .

Platelet Rich Plasma

Platelet rich plasma (PRP) contains a various concentrated growth factors like platelet-derived growth factor (PDGF), transforming growth factor-beta (TGF-), and insulin-like growth factor 1 (IGF-1) to the wound site which help in enhance the tissue healing , thus natural blood clot in helps in accelerate wound healing and improve the quality of bone regeneration ⁽⁴⁾. Natural blood clot involves 95% red blood cells (RBCs), 5% platelets, less than 1% white blood cells (WBCs), PRP has been used in different grafting procedures in bone augmentation ⁽³⁾. And fibrin strands. PRP blood clot, contains 4% RBCs, 95% platelets, and 1% WBCs. The PRP preparation protocol includes use of anticoagulant in autologous blood. Centrifugation will be done in two steps, and polymerization of the platelet concentrate was induced with calcium chloride and bovine thrombin.

Platelet Rich Fibrin

PRF is a new innovative phase in platelet gel therapeutic concept. Unlike PRP, this technique does not need any anticoagulant agent, and one step centrifugation is enough ⁽³⁾. A PRF blood clot, contains 3% RBCs, 97% platelets, and less than 1% WBCs. Platelets, leukocyte and cytokines play a significant role in these biomaterial, but the fibrin matrix supportive for PRF. Cytokines are immediately used and destroyed in a healing wound. Harmony among cytokines and their supportive fibrin matrix is distinctive other than any constant ⁽⁴⁾

Preparation of PRF

10 ml of patient blood has be taken in each tube. Before procedure clean the venipuncture site using 70% Isopropyl Alcohol or suitable cleanser in a centrifugal direction. Wait for a minute to dry the area by itself. Avoid direct or indirect contact at the point of entry after that area has been cleansed. Advise the patient to clench their fist, this makes the veins become more noticeable for easy entry (Figure 1). If the median cubital vein does not allow us to permit the withdrawal of the blood we can collect blood from the back of the hand veins, With the bevel up, puncture the vein using the needle between 15 to 30 degree, The blood should be collected quickly in less than 25 seconds per tube and should be centrifuged immediately (before 1 minute). The collected blood should be subjected to centrifuge at 1400rpm for 14 min and after that PRF is obtained ⁽²⁾ (Figure 3). The resultant product after centrifugation process consists of three layers: (figure 4) the uppermost layer of a cellular platelet-poor plasma, middle layer of PRF clot, and red blood cells (RBCs) at the bottom of the test tube. The fibrin clot that is formed is collected from the test tube and any remaining RBCs that are attached to it are discarded. Squeezing of the fluid out from the fibrin clot gives a PRF membrane ⁽⁶⁾

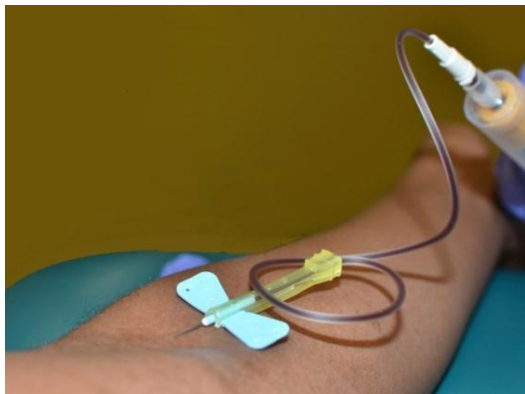


Figure 1: Collection of blood from median cubital vein



Figure 3: Centrifuge machine

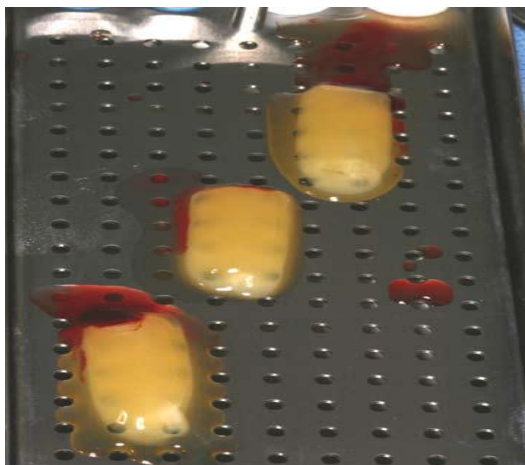


Figure 4: Layers of centrifuged blood



Figure 2: Armamentarium required for PRF preparation



Figure 5: PRF plug



Figure 6: PRF Membrane

Table 1: Different types of PRF and there centrifugation timings

PRF type	Centrifugation	Time	Tubes
P-PRF	3000 RPM	15 mints	Silica coated
L-PRF/S-PRF	2700 RPM	12 mints	Silica coated
A-PRF	1500 RPM	14 mints	Silica coated
I-PRF	1200 RPM	3 mints	Plain tube
T-PRF	3500 RPM	15 mints	Titanium coated

Why PRF over PRP

The making of PRF is a very simplistic and effective procedure compared to PRP. It excludes addition of thrombin to helps in changing fibrinogen into fibrin which is requires in PRP. Conversion of fibrinogen to fibrin proceeds slowly with slight quantities of physiologically existing thrombin present in the blood. Hence a physiologic architecture that is favorable to the healing process is attained due to slow polymerization. Fibrin network produced is like a natural one, and leads to a more effective cell migration and proliferation, and thus cicatrisation. Slow polymerization through PRF processing leads to the intrinsic integration of platelet cytokines and organic chains in the fibrin meshes. This result could indicate that PRF unlike the other platelet concentrates could able to release cytokines in the fibrin matrix remodeling. Studies showed PRP has inadequate potential to stimulate bone regeneration compared to PRF. It's also demonstrated that bovine thrombin used for PRP preparation may have toxic effects on the body cells.

Clinical applications of PRF

Platelet-rich fibrin (PRF) has been known to have several qualities that help in healing and regeneration. PRF aids in the treatment of various oral diseases one among them is periodontal infrabony defects. It protects open wounds from the oral environment where in a situation suture cannot inculcate with mucosal margins. PRF, in association with freeze-dried bone allograft (FDBA), there is a markable decrease in bone healing for implant placement. PRF may act as a biologic cement to hold the particles together, which

aid the manipulation of the bone grafts. PRF considerably enhances the new bone formation. PRF membrane can also use as regenerative material for maxillary sinus floor augmentation. It helps in wound curing, protecting the surgical procedures aiding soft tissue repair, and when mixed with bone graft, it may act as a "biological connector."

- Some other potential uses of PRF such as ⁽⁷⁾
- To improve the healing of the donor site post harvesting of free gingival graft.
- For pulp revascularization and dentinogenesis of a necrotic tooth.
- To preserve height of the alveolar ridge after extraction of multiple teeth.
- As an adjuvant for healing in transalveolar extraction procedure.
- For peri-implant bone regeneration
- Reconstructive material for surgical defects after oral cancer therapy.
- For the removal of cystic pathologies and to fill the defects.
- As an adjuvant to enhance healing after ablative surgical treatment of oral mucosal Lesions.
- To increase the tissue volume.
- Autologous fat transfer procedúres.
- For the treatment of articular cartilaginous defects of temporomandibular joint.
- Mineralized PRF can be used for therapeutics purpose like bone replacement procedúres.
- In localized inflammation of bone.

2. Discussion

PRF was introduced by Choukroun et al. in France and it is a new generation of platelet concentrate. PRF is a platelet gel form, it can also be used to prepare sticky bone along with graft particles. Platelet concentrates provides numerous advantages like stimulating wound healing, bone growth and maturation, hemostasis, graft stabilization and thereby improving the properties of graft materials ⁽²⁾. The PRF had a simplified processing technique which doesn't requires any biochemical material, thus makes it superior to PRP. Dohan et al, demonstrated a slower release of growth factors from PRF than PRP and noticed better healing efficacy with PRF ⁽³⁾⁽⁵⁾. The literature shows that the cells are able to migrate from fibrin scaffold and demonstrated the PRF as a supportive matrix for bone morphogenetic protein as well. PRF can be used as a membrane ⁽⁸⁾. The number of clinical trials anticipate that the combination of both bone grafts and growth factors inculcated in PRP and PRF may be satisfactory to improve bone density. In an experimental study, the growth factor content in PRF and PRP was measured using Elisa kits ⁽⁴⁾. Results has showed that the growth factor contain (PDGF and TGF- β) was similar in both. Release of growth factors from PRF through in vitro studies lead to improve the clinical application of PRF⁽⁹⁾. In a research by Bensaid et al. it was perceived that the cells are able to migrate from fibrin scaffold; while Kawamura and Urist showed that PRF may act as a supportive matrix for bone morphogenetic protein.

3. Conclusion

PRF has given efficient results and fewer complications when compared to any other biomaterials which have been tried in the recent past. PRF will definitely revolutionize and accelerate the healing process and efficacious in healing bony defects. PRF can also use for varieties of superficial dermal and in mucous healing, it can be used in different intraoral and extraoral applications. More clinical, histomorphometric and statistical trails are now essential to appreciate the efficiency of this new platelet concentrate. However, it cannot be overcome, since it is attained from an autologous blood, the quantity of PRF obtained is low and only a limited quantity can be used. This fact confines the systematic application of PRF

References

- [1] Eduardo Borie^{1,2}, Daniel García Olivá³, Iara Augusta Orsi², Katia Garlet⁴, Benjamín Weber⁵, Víctor Beltrán¹, Ramón Fuentes¹. Platelet-rich fibrin application in dentistry: a literature review. *Int J Clin Exp Med* 2015;8(5):7922-7929
- [2] Dr. Kiran N K 1, Dr. Mukunda K S 2, Dr. Tilak Raj T N 3 Platelet Concentrates: A Promising Innovation In Dentistry. *Journal of Dental Sciences & Research* 2:1:50-61
- [3] Balaram Naik, P Karunakar¹, M Jayadev¹, V Rahul Marshal² Role of Platelet rich fibrin in wound healing: A critical review. *Journal of Conservative Dentistry | Jul-Aug 2013 | Vol 16 | Issue 4*
- [4] Seyed Ahmad Raeissadat¹, Marzieh Babae et al . An overview of platelet products (PRP, PRGF, PRF, etc.) in the Iranian studies. *Future Sci. OA* (2017) 3(4), FSO231.
- [5] Dohan DM, Choukroun J, Diss A, Dohan SL, Dohan AJ, Mouhyi J, *et al.* Platelet-rich fibrin (PRF): A second-generation platelet concentrate. Part III: Leucocyte activation: A new feature for platelet concentrates? *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2006;101:e51-5.
- [6] Dohan Ehrenfest DM, Rasmusson L, Albrektsson T. Classification of platelet concentrates: From pure platelet-rich plasma (P-PRP) to leucocyte- and platelet-rich fibrin (L-PRF). *Trends Biotechnol* 2009;27:158-67.
- [7] Maniyar N, Sarode GS, Sarode SC, Shah J. Platelet-Rich fibrin: A “wonder material” in advanced surgical dentistry. *Med J DY Patil Vidyapeeth* 2018;11:287-90.
- [8] Choukroun J, Diss A, Simonpieri A, Girard MO, Schoeffler C, Dohan SL, *et al.* Platelet rich fibrin (PRF): a second-generation platelet concentrate. PartV histologic evaluation of PRF effect on bone allograft maturation in sinus lift. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2006;101(3):299-303.
- [9] Antoniades HN, Williams LT. Human platelet-derived growth factor: Structure and functions. *Fed Proc.* 1983;42:2630-4