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I-PRF: The Miracle Mender

Yashashree Chande[1*], Aashi Jain[2], Rishita Suri[2] and Bhavya Shah[2]
[1]Lecturer, Department of Periodontics and oral Implantology
[2]Intern, DY Patil University School of Dentistry, Mumbai

[*]**Corresponding author:** Chande Y, Lecturer, Department of Periodontics and oral Implantology

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Abstract

I PRF, an abbreviation for Injectable platelet-rich fibrin is an autologous biomaterial as it is derived from the patient's own blood. It is a complex fibrin meshwork clinically appearing as a fluid in consistency as that of the platelet rich plasma (PRP); structurally appearing like a platelet rich fibrin (PRF) clot. Along with presence of blood platelets and rich in growth factors, it predominantly consists of type-1 collagen and blood lymphocytes. It is a cost-effective product, since the preparation procedure is simple requiring minimal instrumentation and other materials. It has been widely used in various fields like dermatology, ophthalmology, plastic & cosmetic medicine and a regenerative therapy biomaterial, showing many desirable outcomes.

Keywords

Injectable PRF; Platelet concentrate; Regenerative therapy; Wound healing; Periodontal surgeries

Introduction

Injectable Platelet Rich Fibrin (I PRF) is an advanced therapeutic approach that employs the body's own healing factors & mechanisms to promote new cellular & tissue regeneration and repair. This innovative

treatment involves the extraction of a concentration of platelets and growth factors from the patient's blood, which is then processed to create a fibrin matrix rich in these healing components. Unlike traditional platelet-rich plasma (PRP), I PRF is prepared without the use of anticoagulants, resulting in a more natural and biocompatible product. The application of I PRF has gained significant attention in various medical fields, including dentistry, orthopedics, and dermatology, due to its potential to enhance wound healing, accelerate recovery, and improve overall clinical outcomes. By harnessing the power of growth factors, I PRF aims to facilitate the body's innate healing processes, making it a promising option for patients seeking effective regenerative therapies [1-3].

Platelet-rich fibrin (PRF) as a second generation of platelet concentrate is rich in various growth factors and releases them slowly, aids in appropriate growth factor delivery. PRF is derived independent of anticoagulants and coagulation factors and, due to reduced centrifugation G-force, leukocyte numbers and growth factor concentrations are stimulated. PRF products lead to quicker wound healing since they induce rapid angiogenesis of tissues and are completely compatible with the immune system of the individual. Blood Platelets are a rich source for healing growth factors which are essential for tissue regeneration and maintenance, such as vascular endothelial growth factor (VEGF), platelet-derived growth factors (PDGFs), and insulin-like growth factor (IGF) and transforming growth factor-beta (TGF-β), they can be released only after platelet aggregation. The leukocytes in PRF-based biomaterial aid in regeneration, fight infection, biological behavior of these products are improved and assist in the cross-talk between local cells [4-6].

Preparation of I-Prf

In 2014, by altering the centrifugation protocol and lowering the centrifugation speed to 700 rotations per minute (RPM) and adding 40 grams of force, I PRF was developed as an advanced product of PRF. Hence, it resulted in segregation of the blood into 2 layers: the topmost layer was the liquid platelet rich fibrin (Liquid PRF) and the bottom layer was the red blood cells. Aspiration of the topmost layer (liquid PRF) can be made in a syringe and for an average of 5-10 minutes it should stay in the injectable form. Liquid fibrinogen slowly polymerises into a fibrin matrix after which it becomes a fibrin clot. Therefore, I PRF in its injectable form has various clinical applications like soft and hard tissue management in periodontal and oral surgical procedures. The fibrin meshwork gradually degrades resulting in the release of various cytokines including growth factors into the surgical wound area promote regeneration and healing. I PRF preparation method differ depending on various factors such as the time duration of centrifugation, centrifugal speed, and centrifuge device. An optimum centrifugation speed of 700 rotations per minute (rpm) is utilized to obtain I-PRF, the number of platelets, inflammatory factors, and cytokines significantly increases with a decrease in relative centrifugal force (RCF).

Take a test tube with 9 to 10 ml of blood without adding any preservatives, and centrifugal time span of 2-3 minutes with an application of centrifugal speed of 3300 rpm produces an orange-colored fluid that is thought to contain injectable platelet-rich fibrin, according to Mourao et al. Then, in 2009, AL-Malawi declared that, with a low-speed configuration approach, blood must first be collected in a test tube and immediately kept in a centrifuge at 600 rpm, 44g, for eight minutes. Following this procedure, a yellow i-PRF was created at an upper level, and other components were created or were already existent at a

lower level [7-9].

Types of Prfs

(PRF - platelet-rich fibrin) In 2000, Choukroun introduced Leukocyte Platelet rich fibrin (L PRF) procuring it from autologous blood derived from the same individual by centrifuging it at 2700 RPM for 12 mins in a glass tube. Tunali et al, 2014 derived Titanium Platelet rich Fibrin (T PRF) by centrifuging blood at 2700 RPM for 12 mins in a titanium tube. In 2014, Choukroun et al centrifuged patients' blood at 1300 RPM for 14 minutes in a glass tube to procure Advanced PRF (A PRF). Recently, Fujioka et al 2020, Introduced Albumin Platelet rich Fibrin (ALB PRF) by centrifuging at 1300 RPM for 8 minutes in a glass tube. Mourao et al, 2015 introduced I PRF by centrifuging blood in a plastic test tube at 700 RPM for 3 minutes.

I-Prf V/S Other Types of Prf

Injectable platelet-rich fibrin (I-PRF) is one of the most recent and successful advancement in PRF. By omitting the formation of a PRF membrane and slowing down the liquid-based centrifugation approach, it was created. I-PRF is an advanced type of PRF since it is injected into mucous membrane, soft tissues, or skin and also aids in the regeneration of human tissues. Three layers created after centrifugation: the uppermost layer is made up of platelet-poor plasma, the middle layer is made up of fibrin clots with a high concentration of platelets, and the lower layer is made up of red blood cells. Titanium platelet-rich fibrin (T-PRF) has been created to prevent the potential contamination of silica particles from the glass tubes into the fibrin structure traveling to the patient. T-PRF has lengthy resorption time and abundance of growth factors; therefore it was helpful in the repair of soft tissues. A low centrifugal speed approach has shown a resultant significant increase in the concentration of inflammatory cells and growth-promoting substances, advanced platelet-rich fibrin (A-PRF) was created. In PRF centrifugation, when blood and silica in a glass tube come into contact, coagulation starts. Tighter fibrin network structure is seen with T-PRF as it contacts the titanium surface of the tube rather than silica when blood comes into touch with it. T-PRF's drawback was that it was available in solid form when compared to PRP; as a result I PRF was produced [10].

Application of I-Prf

I PRF in Bone Regeneration

A Study by Wang et al has shown that I PRF on clinical use has resulted in a 3 fold significant increase in migration as well as proliferation of human osteoblast cells which causes more alkaline phosphatase secretion post 14 days. Another study shows that there is formation of lumina along with microvessel like configuration in cell cultures with I PRF. I PRF when used with different bone grafts shows consistent results affecting osteoblast cell viability, proliferation, metabolic activities, mineralization and differentiation markers which is significantly more in all parameters as compared to bone grafts alone. Studies also show that I PRF when coated on titanium discs helps improve osteolast cell proliferation and migration and alkaline phosphatase secretion.

I PRF in Periodontal Pocket Therapy

Studies have shown that there is a significant reduction in the probing depth when I PRF is used in

periodontal pocket therapy. A study by Vucković et al shows better clinical results when I PRF is used in combination with scaling and root planning in comparison to scaling root planning alone.

Wound Healing and Anti-inflammatory Efficacy of I PRF

Dohle et al conducted an in-vitro Study which evaluated the effect of I PRF on its Anti-inflammatory action and wound healing and it was discovered that it showed a positive effect. The efficacy of wound healing was high because of evidence of increase in the secretion of cytokine and proangiogenic growth factors involved in wound healing mechanisms with the likes of vascular endothelial growth factor, platelet derived growth factor, alkaline phosphatase, bone morphogenetic protein, intercellular adhesion molecules, etc.

I PRF in Dental Pulp Revascularization/Regeneration

Role of I PRF on the dental pulp cells was evaluated which showed I PRF has an influence on the proliferation, migration, differentiation, mineralization potential, collagen production, etc of the dental pulp cells. These provide a proof that iPRF has a potential for forming reparative dentin and also odontoblastic differentiation in dental pulp cells.

I PRF in Orthodontic Tooth Movement

In one of the studies, the retraction time of the incisors was evaluated and it was found out that the I PRF infiltration group had a significantly faster retraction of teeth when compared to the control group. Another study showed the same results when the retraction of canine was evaluated. The I PRF group also showed enhanced bone remodeling markers. The markers evaluated were interleukin I beta, matrix metalloproteinase-8, receptor activator of nuclear factor kappa-B ligand and osteoprotegerin. In a study by Zeitounlouian et al on the efficacy of I PRF in preventing root resorption and preserving bone in orthodontic patients, it was observed that I PRF is not that effective in cases of preventing canine resorption during canine retraction.

Skin Rejuvenation

I PRF has shown positive effects on correction of the skin complexion, reduces hyperpigmentation and stimulates collagen production thus maintaining the skin integrity.

Hair loss

I PRF has proven quite effective in the reduction of hair loss and hair thinning in both men and women.

Joint and Soft tissue disorders

I PRF can help with joint and soft tissue disorders like tennis elbow and plantar fascitis.

Merits and Demerits of I-Pr

I-PRF is a promising regenerative adjunct to dental procedures. I-PRF seems to be a potential agent in enhancing wound healing, regeneration, bone augmentation, repair of endodontic lesions, periodontal regeneration, accelerating orthodontic tooth movements, antimicrobial effect, anti-inflammatory effect etc. further it has the advantage of being autologous and biomimetic in nature thus eliminating the

possibility of immune reaction.

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