Review Article

PLATELET RICH FIBRIN- A Natural Regenerative Biomaterial

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Abstract- PRF is a blood-derived autologous product, rich in platelets, leukocytes, growth factors, and fibrin matrix, obtained through a simplified centrifugation process. Its unique composition endows PRF with remarkable regenerative potential, making it a versatile tool in various medical fields. Clinical applications of PRF span across dentistry, orthopedics, dermatology, and beyond. In dentistry, it aids in bone grafting, tissue regeneration, and wound healing, enhancing postoperative outcomes. In orthopedics, PRF injections accelerate tissue repair and reduce pain in musculoskeletal disorders. Dermatologists employ PRF for facial rejuvenation, wound healing, and hair restoration, capitalizing on its natural growth factors. The future of PRF holds promising avenues in tissue engineering, chronic wound management, and sports medicine. Its safety and efficacy, coupled with minimal risk of adverse reactions, make it an attractive therapeutic option. PRF represents a breakthrough in regenerative medicine, offering personalized, minimally invasive solutions for a spectrum of clinical challenges. Ongoing research and innovation in PRF applications hold significant potential to transform patient care across diverse medical disciplines.

INTRODUCTION

Periodontitis is an inflammatory disease of the periodontal tissues, which is characterized by loss of support periodontal ligament fibers and the bone into which they are inserted.[1] Healing is a body response to injury to restore normal structure and function comprising of regeneration, and repair. When healing takes place by the proliferation of parenchymal cells and usually results in complete restoration of original tissues it is called regeneration and when healing takes place by the proliferation of connective tissue elements resulting in fibrosis and scarring it is known as repair.[2]

Platelets are essential for wound healing as they release growth factors such as platelet-derived growth factor, transforming growth factor-β, and insulin-like growth factor. These growth factors promote tissue repair and regeneration. Platelet-rich plasma (PRP) has been used for the past two decades to harness these growth factors and aid in wound healing. [1,3]

Over a while, platelet-rich fibrin got evolved and was classified as pure-PRF,
leukocyte-PRF, advanced-PRF, titanium-PRF, and injectable-PRF. The evolution of Platelet-rich fibrin started with the leukocyte-PRF which is based on high-speed protocol. Later on, advanced-PRF and injectible-PRF come into existence with lower g-forces and centrifugation times to increase the number of platelets and leucocyte.[4] Clinical application of platelet-rich fibrin in wound healing, regenerative procedures, bony defects, sinus lift surgeries, implants, plastic surgeries has made it popular in the last several years.[5] This review describes platelet-rich fibrin form its evolution to successful clinical implications.

HISTORY

In 1954, the term PRP was coined by Kingsley during experiments on blood coagulation, where he discovered that the plasma, he used to be rich in platelets, marking the beginning of platelet cell concentrate research. [5,6]

In 1986, Kingston and colleagues conducted the first clinical demonstration showing that platelet concentrates promote local healing, termed "Platelet derived wound healing factors" (PDWHF), using a two-step centrifugation process. In 1997, Whitman and others reported clinical results in oral and maxillofacial surgery using a platelet concentrate. [3]

In 1999 one of the popular methods advertised on large scale to prepare pure platelet rich plasma was commercialized as plasma rich in growth factors (PRGF) or also called as preparation rich in growth factors (Endoret, Victoria, Biotechnology Institute BTI, Spain). However, because of lack of specific pipetting steps and also lack of ergonomics, there were significant issues with this technique. Another widely promoted technique for P-PRP was commercialized by the name Vivostat PRF (Alleroed, Denmark). However, as the name implies it is not a PRF but produces a PRP product. [6]

In 2000 Choukroun et al. developed another form of PC in France which was labeled as PRF, based on the strong fibrin gel polymerization found in this preparation. It was stamped as a “second-generation” platelet concentrate because it was obviously different from other PRPs. This proved an important milestone in the evolution of terminology.[6]

CLASSIFICATION

This classification defined four main families [7]:

1. Leucocyte poor or pure platelet rich plasma.
2. Leucocyte and platelet rich plasma.
3. Leucocyte- poor or pure platelet rich fibrin.
4. Leucocyte and platelet rich fibrin.

PREPARATION

Preparation Of L- PRF:

The protocol followed is that of “Choukroun et al”: the blood samples are collected in 9 ml tubes, without anticoagulant and immediately centrifuged according to the following program: 30 s acceleration, 2 min at 2,700 rpm, 4 min at 2,400 rpm, 3 min at 3,000 rpm, and 36 deceleration and stopping.
After centrifugation, three parts are localized in the tube:

- The red blood cells at the bottom.
- A fibrin clot that represents the PRF in the middle.
- The acellular plasma at the top.

We can obtain the PRF extracting the matrix from the tube with forceps and removing the red clot. The success of this technique depends entirely on the blood collection and the transfer speed in the centrifuge.[8,9]

**Preparation Of i-PRF:**

Injectable platelet rich fibrin was prepared according to the protocol by Choukroun. Venous blood was drawn into i-PRF™ 10ml tube and placed for centrifugation at 700 rpm for 3 minutes. The spin has separated the RBCs and the i-PRF was visible at the top part of the tube. Upon termination of this process, it was possible to observe an orange color area in the upper part of the tube and the remaining blood. Then, the tube was opened carefully, to avoid homogenization of the material. About 3 ml of i-PRF from the tubes using a 5 ml syringe. The liquid (i-PRF) was drawn into the syringe by careful suction. [8,9]

**PREPARATION OF t-PRF:**

In order to obtain t-PRF, 20 ml of venous blood was drawn by syringe from the antecubital vein of each participant, and immediately transferred to the two sterile titanium tubes (10 ml for each tube) and centrifuged at 2800 rpm for 12 minutes according to the protocol developed by Tunali et al. After centrifugation, the t-PRF clots were removed from the tubes using sterile tweezers, separated from the red corpuscles base using scissors, and placed in a PRF box. Two stable t-PRF membranes were obtained. [8,9]

**SURGICAL APPROACHES USING PRF IN COMBINATION WITH GBR:**

There are two methods to combine PRF with GBR procedures. The first acts as a barrier membrane and second aims to supply bone-grafting particles with PRF by cutting PRF membranes into small “fragments” and thereafter mixing them with bone-grafting materials as “Sticky Bone”. Liao et al. (2011) examined PRF combined with MSCs and a GBR membrane to verify the osteogenic potential of bone substitutes. It was found that PRF + MSCs have good potential for bone regeneration, although no valuable controls were investigated supporting the use of PRF [10]. Ozdemir et al. (2013) investigated in 24 adult male New Zealand rabbit’s calvarium 1) empty, 2) PRF, 3) an organic bovine bone (ABB, BioOss), and 4) biphasic calcium phosphate (BCP) at 1 and 3 months of healing. It was found that significantly more new bone area was noted in the PRF alone group than in the control group. [11].

**CONCLUSION**

PRF is a blood-derived autologous product, rich in platelets, leukocytes, growth factors, and fibrin matrix, obtained through a simplified centrifugation process. They release growth factors such as platelet-derived growth factor, transforming growth factor-β, and insulin-like growth factor. These growth factors promote tissue repair and regeneration. The regenerative potential of these growth factors can be combined with the various procedures to get the better outcome.

**REFERENCES**


