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Review Article

PRF: A Boon in Periodontal Therapy

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Abstract

Platelet concentrates, mostly platelet-rich fibrin, has gained path breaking significance in various medical and dental fields, because of their potential to stimulate and improve regeneration of hard and soft tissues. This platelet concentrate is prepared from the patient's blood and shows promising result in various surgical fields including oral and maxillofacial surgery. The effects of these biomaterials are described to be a result of the large concentration of platelets which contain a wide range of growth factors. The aim of this article is to introduce the principle and function of these platelet concentrates, to review their preparation, use in different fields.

Keywords: *Platelet-Rich Plasma; Platelet-Rich Fibrin; Platelets; PRP; PRF*

Introduction

The primary goal of periodontal treatment is achievement of periodontal apparatus on a previously denuded diseased root surface [1]. Now-a-days the primary focus of research in periodontal regeneration is hugely shifted towards application of platelet concentrates. There is enough evidence and available literature on use of platelet concentrates in clinical practices both in medical and dental field showing favorable results [2]. Platelet concentrates are classified into 4 categories according to their leucocyte and fibrin content by Dohan Ehrenfest., *et al*. [3] i.e. pure platelet rich plasma, leucocytes- and platelet rich plasma, pure platelet rich fibrin, leucocyte-and platelet rich fibrin (P-PRP, L-PRP, P-PRF, L-PRF). Initially platelet concentrates were used for the treatment and prevention of hemorrhage later was introduced for treatment of chronic non healing cutaneous ulcer. Recently there have been numerous uses of platelet concentrates like dental implant, bone grafting and periodontal surgeries to facilitate healing [4].

In 1954, platelet rich plasma (PRP) was 1st used and termed by Kingsley [5].

In 1970, Matras introduced fibrin glue by polymerizing fibrinogen and thrombin and calcium. In 1986, Knighton found that these platelet concentrates successfully promotes healing and they termed it as platelet derived wound healing factor (PDWHF) [6]. In 1997, Whiteman., *et al*. named it as platelet gel. In 1998, PRP was clinically approved and was used for reconstruction of maxillofacial bone and reconstructive procedure in orofacial region. In 2001, Choukroun., *et al*. developed another form of platelet concentrates without adding anticoagulant and named it as 2nd generation platelet concentrates or PRF [7]. In 2006, Bielecki., *et al*. was developed (PRG) Platelet rich gel [8]. In 2008, Everts., *et al*. developed 2 forms of product, one is activated gel called platelet leucocyte gel (PLG) and other is inactivated called platelet leucocyte rich plasma (P-LRP). In 2013, Tunali., *et al*. developed a new form PRF called titanium platelet rich fibrin (T-PRF) [9]. In 2014 Ghanati., *et al*. developed another new form of PRF called A-PRF or advanced-PRF [10]. Recently in 2017 an injectable form of platelet concentrate (i-PRF) was developed in liquefied injectable form [11].

PRF

Platelet rich fibrin is a 2nd generation platelet concentrate introduced by Choukroun., *et al*. in 2001 [7]. These PRF is prepared from patient's blood free of anticoagulants and any other biomechanical modifications, which contains platelets and growth factors in a form of natural fibrin matrix [12]. It is also called Chaukroun's PRF.

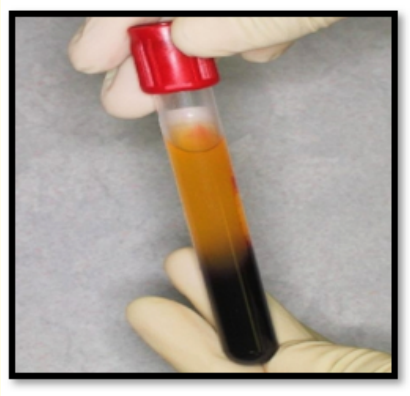

Figure 1

Components

PRF contains Leukocytes, platelets, TGF-1 beta, Vascular endothelial cells, cytokines, growth factors, IL -4, IL -6.

Use of PRF over PRP

The main advantage of PRF is that it does not contain any anticoagulant and it subsequently releases growth factors slowly in a constant manner up to 10 to 14 days but on the other hand PRP releases most of its growth factor on 1st days of healing cascade [12].

Method of preparation

PRF preparation is 100% autologous and popularized because of its simplicity of preparation and its implementation clinically. The time and cost of preparation is low because it does not need any direct activation with bovine thrombin or extrinsic anticoagulants [13]. PRF details a larger number of cytokines and growth factor in a fibrin matrix scaffold. At first patient's blood should be collected and then samples must be centrifuged immediately to avoid activation of coagulation cascade. After centrifugation, on the top of the collection tube fibrinogen is seen which will be seen until thrombin transforms into a fibrin network. Then there will be a formation of fibrin matrix which is rich in platelet and growth factor found between plasma layer and erythrocytes. The clot matrix may then should be removed immediately and condensed in a metal box to obtain a covering membrane. The resulting matrix then may be cut andused to hydrate graft materials to use in case of osteogenesis [14].

Figure 2

Use

It is used to promote wound healing, for regeneration of infrabony defects, for furcation defect regeneration, for root coverage in gingival recession [15] with GTR and for management of extraction socket and also in sinus elevation procedure as a sole osteoconductive filling material and in facial plastic surgery.

Use of PRF in wound healing

In healing with PRF, leucocytes, platelets and cytokines plays a key role because fibrin matrix supports these elements for therapeutic potential. The tissue regeneration depends on their angiogenic potential, immune system control, potential to engage circulating stem cells and their potential to get undisturbed wound closure. The growth factors engaged in the fibrin matrix including PDGF, TGF-BETA1, IGF and VEGF have main role in angiogenic potential of PRF [13]. Now-a-days, PRF is more popular and mostly used platelet concentrate because of expression of integrin avb3 which allows cell to bind with fibrin, fibronectin, vitronectin thus promotes cell adhesion and spreading [16]. These events initiates the process of angiogenesis and tissue wound healing.

Use of PRF in GBR (Guided bone regeneration) and management of extraction socket

In recent years, study of changes in height and width of alveolar bone followed by extraction is an important topic of research. Suddenly after extraction because of decrease in blood supply and absence of PDL tremendous changes in alveolar bone occurs within 8 weeks after extraction.

A study conducted by Girish Rao., *et al*. suggested that filling of extraction socket with PRF reduces the dimensional change of alveolar bone [17]. Hoaglin., *et al*. found that PRF 10 times decreases the risk of osteomyelitis infection as compared to natural healing process in an extraction socket of 3rd molar [18]. In addition to decrease the dimensional changes, also promotes early healing because of leucocytes and cytokines and growth factors activity and also reduces the risk of infection that promotes regeneration because of its angiogenic property [13]. PRF also provides good soft tissue healing after implant placement, but as compared to use of collagen membrane alone, additional use of PRF with this gives immense result.

Use of PRF in furcation defects

According to a study by Sharma., *et al*. (2011) [19], Pradeep., *et al*. (2016), Bajaj., *et al*. (2013), there is a great importance of use of PRF in regaining of clinical attachment level as compared to OFD (open flap debridement) alone. But the result could be better with addition of other bioactive growth factors.

Infrabony defects regeneration with PRF

In recent times, PRF is mostly used for regeneration of infrabony defects. It was reported that addition of platelet concentrates along with OFD improves reduction in disease activity along with improvement in the clinical attachment level. According to a study by Pradeep., *et al*. (2012), PRF combined with porous hydroxy apatite graft act as a gold standard in the treatment of intrabony 3-walled defect [20].

Root coverage using PRF

The use of PRF for root coverage in gingival recession is still in doubt. Though it doesn't give any additional benefits, because of its regenerative property it can be used for root coverage. According to a study by Rajaram., *et al*. treatment of a gingival class II recession according to Miller's classification with PRF doesn't give satisfactory result as compared to displaced flap technique [21].

Use of PRF in sinus lifting

Newer research states the use of PRF as a graft material for sinus lifting which promotes bone healing. Some authors concluded that PRF helps in bone healing and increasing bulkiness of bone between sinus floor and alveolar ridge [22].

Recent advances in PRF

Though PRF has gained new heights in regenerative periodontal therapy in both medical and dental field, there are also technically advanced PRF like I-PRF, A-PRF, T-PRF developed in recent times that limit the drawbacks of PRF:

1. T-PRF: Tunali., *et al*. developed a new form of PRF by using titanium tube at the time of centrifugation. The silica particles present in glass tubes cause some health problems when infused into blood. To avoid this kind of problems, use a titanium tube for centrifugation was recommended. This new form of PRF is much thicker and tighter as compared to PRF [9].

2. A-PRF: In 2014, Ghanati., *et al*. reported another modified PRF version called the advanced-PRF or A-PRF [10]. A-PRF is most popular in recent years than I-PRF and T-PRF because of cost effectiveness. It also contains more no. of cytokines than PRF. Because of less centrifugation and prolonged time, more no of neutrophilic granulocytes are detained in the distal part of matrix.

3. I-PRF: In 2017 a liquid form of PRF is developed but the study is still on process [11]. It is 100% natural and autologous and it is prepared with soft spin centrifugation method. PRF avoids any reaction with materials, used in implants and with some specific graft materials. It is popular because of ease of infiltration, but it is still not used broadly because of high cost associated with it.

4. Sticky bone: In 2010 a new developed platelet concentrate was introduced by Sohn., *et al*. called "Sticky bone". It is formed by polymerization of mixture of autologous fibrin glue and bone graft for 5 - 10 mins. It is easy to mold and also retains leucocytes and platelets and also blocks the movement of bone grafts.

Studies

1. There was a study conducted by Thorat., *et al*. in 2011 on open flap debridement alone and open flap debridement with PRF. It was reported that open flap debridement (OFD)with PRF gives more effective result than OFD alone [23].

2. In 2019 another study was conducted on a modified platelet concentrate including i-PRF. He collected blood samples from patients to prepare i-PRF and peripheral blood as control group. It was found that there is high concentration of platelets and lymphocytes in i-PRF than in peripheral blood [24].

3. Another study was conducted evaluating the effect of T-PRF and connective tissue graft (CTG) for root coverage. There was no significant differences noted between the groups but after 1 year there was increased keratinized tissue width in T-PRF group than in CTG group [25].

4. Masuki., *et al*. (2016) concluded that PRF and CGF gives efficient periosteal cell proliferation than use of PRP and its derivatives because of greater number of growth factor and pro-inflammatory cytokine content [26].

Conclusion

PRF has a blooming action for rapid wound healing and to achieve enhanced soft tissue repair and hard tissue regeneration. Two FDA approved growth factors i.e. platelet-derived growth factor and bone morphogenic proteins in addition with PRF helps promote its activity. It shows as a promising agent for future prospective in relation to repair and regeneration. Application of the advanced modalities of platelet concentrates open windows for hardly achieved true periodontal regeneration.

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