PRF –AN ASSET TO PERIODONTAL REGENERATION

Dr. Amit Mani*, Dr. RajuAnarthe**, Dr. Amola Patil***, Dr. Asawari Lawande***

Abstract :

Platelets can play a vital role in periodontal regeneration as they are reservoirs of growth factors and cytokines which are the key factors for regeneration of the bone and maturation

of the soft tissue. Platelet-rich plasma (PRP) and platelet-rich fibrin (PRF) are autologous plateletconcentrates prepared from patient's own blood. Recent researches are being focused on the development of therapeutic alternatives which are easy to prepare, non-toxic or biocompatible to living tissues and economically cheap that might result in the local release of growth factors accelerating hard and soft tissue healing. PRF is a natural fibrin-based biomaterial prepared from an anticoagulant-free blood harvest without any artificial biochemical modification that allows obtaining fibrin membranes enriched with platelets and growth factors. Evidence from the literature suggests the potential role of PRF in periodontal regeneration and tissue engineering. The slow polymerization during centrifugation and fibrin-based structure makes PRF a better healing biomaterial than PRP and other fibrin adhesives. The main aim of this article is to briefly describe the novel platelet concentrate PRF and its potential role in periodontal regeneration.

Keywords: *Periodontal Regeneration, Platelet rich fibrin(PRF), platelet concentrate*

Introduction :

Periodontal disease is defined as a complex, multifactorial disease characterized by the loss of connective tissue attachment with destruction of periodontal tissues. The aim of periodontal therapy is to eliminate inflammatory process, prevent the progression of periodontal disease and also to regenerate the lost periodontal tissues. Periodontal regeneration is a complex multifactorial process involving biologic events like cell adhesion,migration, proliferation, and differentiation in an orchestrated sequence[1]. Periodontal regenerative procedures include soft tissue grafts, bone grafts, root biomodifications, guidedtissue regeneration, and combinations of these procedures[20]. The current perspective is that regenerative periodontal therapiesto date can only restore a fraction of the original tissuevolume and have limited potential in attaining complete periodontal restoration[3]. Platelets also secrete fibrin, fibronectin, and vitronectin, which act as a matrix for the connective tissue and as adhesion molecules for more efficient cell migration[4]. This leads to the idea of usingplatelets as therapeutic tools to improve tissue repair particularly in periodontal wound healing. PRF is superiorto other platelet concentrates like PRP due to its ease andinexpensive method of preparation and also it does not needany addition of exogenous compounds like bovine thrombinand calcium chloride. It is more advantageous than autogenousgraft because an autograft requires a second surgical site andprocedure. Thus PRF has emerged as one of the

* Professor, ** Reader, *** 1st year PG student,

Address for correspondence:
Dr. Amola Patil,
Department of Periodontology, Rural Dental College, PIMS-DU,
Loni Bk., Tal.Rahata Dist. Ahmednagar 413736
Email : patilamola@hotmail.com

promisingregenerative materials in the field of periodontics. With this view this review article prominently explains the novel platelet concentrate PRF, its preparation,clinical applications and benefits and drawbacks overother biomaterials.

Platelet Rich Fibrin:

PRF is second-generation platelet derivative and is considered as an autologous healing biomaterial, incorporating in a matrix of autologous fibrin most leukocytes, platelets and growth fact harvested from simple blood sample[5].Unlike other platelet concentrates like PRP, this technique does not require anticoagulants nor bovine thrombin or any other gelifying agent. PRF represents novel measure in the therapeutic concept with elementary processing and absence of artificial biochemical modification like the use of bovine thrombin[6]. The crux of PRF synthesis lies in the attempt to accumulate platelets and release cytokines in a fibrin clot.

The PRF clot is yielded by a natural polymerization process during centrifugation, and its natural fibrin architecture seems responsible for a slow release of growth factors an matrix glycoproteins during e"7 days[7]. PRF exudate consists of growth factors such as PDGF-AB (platelet derived growth factor A B), TGF-Beta1 (transforming growth factor beta-1), VEGF (vascular endothelial growth factors) fibroblast growth factor, insulin like growth factor, epidermal growth factor, connective tissue growth factor etc[8,9]. Growth factors are mitogenic (proliferative), chemotactic (stimulate directed migration of cells) and angiogenic (stimulate new blood vessel formation). Therefore, they appear to be critical to the wound-healing process.

Role of PRF in Wound Healing:

- Prolonged release of growth factors at the wound site
- Proliferation of fibroblasts and osteoblasts
- Promotes angiogenesis
- Induces collagen synthesis
- Guides in wound coverage
- Mechanical adhesion by fibrin
- Trapping of circulating stem cells
- Regulation of immunity.

Classification:

PRFis classified into four categories, depending on their leukocyte and fibrin content[10]:

- Pure platelet rich plasma (P PRP), such as cell separator PRP
- Vivostat PRF or Anitua's PRGF
- Leukocyte and platelet rich plasma (L PRP); such as Curasan,Regen, Plateltex, SmartPReP, PCCS, Magellan, or GPS PRP
- Pure platelet rich fibrin (P PRF), such as Fibrinet; and
- L PRF, such as Choukroun's PRF.

Preparation of PRF:

Preparation of PRF follows the protocol developed by Choukroun et al. in Nice, France [11]. The protocol for PRF preparation is very simple; however it has to be manufactured just prior to its application.

Requirements:

i) blood collection armamentarium(fig. 1)

ii) 10-mL dry glass test tube (without anticoagulant),

Fig .1 : Blood collection armantarium

Fig.2 : Table Centrifuge

iii) table centrifuge,(fig. 2)

The blood obtained from the subject is placed into the test tube and centrifuged immediately for 10 minutes at 3000 rpm[9]. Others have used 2700 rpm for 12 minutes with similar findings[12].

The steps involved in PRF preparation are as follows:

1) blood specimen is collected or drawn from the patient,
2) the blood specimen is placed in the centrifuge and is allowed to spin immediately for the stipulated time,
3) following this the blood sample settles into various layers.

The absence of any anticoagulant grants the activation of platelets to set off a coagulation cascade. Due to the absence of the anticoagulant, the blood coagulates immediately upon contact with the glass tube. Initially, fibrinogen occupies the upper part of the tube, only till the circulating thrombin transforms it into a fibrin network[5].

The layers that are formed are as follows:

a) the lower fraction containing the RBCs,
b) the middle fraction containing the fibrin clot,
c) the upper fraction containing the straw-coloredacellular plasma.(Fig.3)

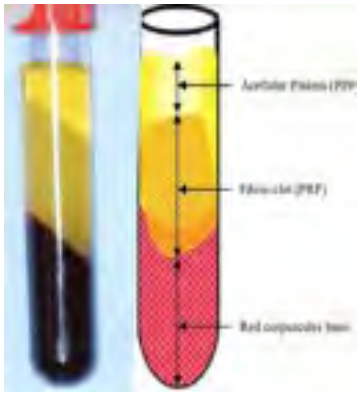

Fig.3 : the upper fraction containing the straw coloredacellular plasma

The upper portion of the test tube containing the acellularplasma is removed. The middle portion containing the fibrin clot is then removed and is scrapped off from the lower part containing the red blood cells. The natural and progressive polymerization results in a fibrin clot formation with substantial embedding of platelets and leukocyte growth factors into the fibrinmatrix[13].

PRF Membrane

The clot can be squeezed between two gauge pieces to obtain an inexpensive autologous fibrin membrane[5]. The serum exudate expressed from the clot is rich in proteins such asvitronectin and fibronectin[8]. This exudate may be used to hydrate graft materials, rinse the surgical site, and store autologous graft [5] (fig.4). The PRF Box (Process Ltd., Nice, France) is commercially available to prepare the PRF membrane. The PRF clot isplaced on the grid in the PRF box and covered with compressor lid which squeezes out the fluid from the clot. The membranes formed using this method had constant thickness which remain hydrated for several hours and have recovered the serum exudate expressed from the fibrin clots.(Fig.5)

Fig. 4 : PRF exudate combined with graft material

Fig. 5 : PRF membrane

Clinical Implications of PRF

Oral Applications

1) PRF and PRF membrane have been used in combination with bone grafts to hasten the healing in lateral sinus floor elevation procedures [14]
2) Protection and stabilization of graft materials during ridge augmentation procedures[15]
3) Socket preservation after tooth extraction or avulsion [16]
4) PRF membrane has been used for root coverage with single and multiple teeth recession[17]
5) Regenerative procedures in treatment of 3-walled osseous defect.
6) In the treatment of combined periodontic endodontic lesion.
7) Treatment of furcation defect [18]
8) PRF enhances palatal wound healing after free gingival graft [19]
9) Filling of cystic cavity.

Advantages of using PRF

Advantagesreported in the literaturerelated to the use of PRF :

9) Filling of cystic cavity.

- Its preparation is a simplified and efficienttechnique, with centrifugation in a single step,free and openly accessible for all clinicians [20]
- It is obtained by autologous blood sample
- Minimized blood manipulation
- It does not require the addition of externalthrombin because polymerization is a completelynatural process, without any risk of sufferingfrom an immunological reaction
- It has a natural fibrin framework with growthfactors within that may keep their activity for arelatively longer period and stimulate tissue regeneration effectively.
- It can be used solely or in combination withbone grafts, depending on the purpose [20]
- Increases the healing rate of the grafted bone.
- It is an economical and quick option comparedwith recombinant growth factors whenused in conjunction with bone grafts.
- Used as a membrane, it avoids a donor sitesurgical procedure and results in a reduction inpatient discomfort during the early wound-healing period.
- The studies of PRF present it to be more efficientand with less controversies on its finalclinical results when compared to PRP[20]

Disadvantages of using PRF

PRF may present some disadvantages as follows:

- The final amount available is low because it is autologous blood.
- The success of the PRF protocol depends directly on the handling, mainly, related to blood collection time and its transference for the centrifuge.
- Need of using a glass-coated tube to achieve clot polymerization.
- Possible refusal of treatment by the puncture required for blood collection (Wani 2014).
- Requires minimal experience of clinician for PRF manipulation [20]

Conclusion

The application of autologous platelet-rich fibrin could present new possibilities for enhanced healing and functional recovery. However, the effectiveness of PRF in regenerative procedures should be evaluated in studies that involve a large number of subjects.Moreover, the use of PRF in randomizedcontrol trials has to be encouraged.

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