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Review Article

Platelet Rich Fibrin in Dentistry – A Review Article

Dr. MeenuBhola[1], Dr. Sumeet Palta[2], Dr. Geetika Jindal[3]

[1]Professor and head, Department of Pediatric & Preventive dentistry, Dasmesh Institute of Research and Dental Sciences,Faridkot, Punjab, India;
[2]Consultant Pediatric Dentist, Zirakpur, Mohali, Punjab, India
[3]Reader, Department of Pediatric & Preventive dentistry, Rayat Bahra Dental College, Mohali, Punjab, India

***ABSTRACT*:**
The ultimate aim of any procedure is complete eradication of infection followed by repair and regeneration of affected tissue to its natural undamaged state.In order to achieve this goal, Platelet rich fibrin emerges as a satisfactory alternative with promising results and low risks. Platelet rich fibrin is a fibrin matrix, 3-dimensional, biomaterial in which cytokines and growth factors are trapped and released after certain time that can be used as a resorbable membrane. Platelet rich fibrin alone or in combination of other biomaterials has immense uses in dentistry like treating endodontic and periodontic lesions, regeneration of pulp–dentine complex, implantology, sinus lift procedures.We will further discuss about implications of this material in this review.
Keywords: Platelet Rich Fibrin (PRF), BloodPlatelet, Growth factors, regeneration.

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Corresponding author: Dr. Sumeet Palta, Consultant Pediatric Dentist, Zirakpur, Mohali, Punjab, India

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INTRODUCTION

The ‘American Association of Endodontists’ defines regenerative endodontics as “biologically-based procedures designed to physiologically replace damaged tooth structures, including dentin and root structures, as well as cells of the pulp-dentin complex”[1]. The mechanics behind the revitalization endodontic procedure is that, despite the tooth being necrotic, some pulp tissue can survive apically which under favorable conditions proliferate to help in the process of regeneration[2]. Endodontic management is a challenge for pediatric dentists in necrotic immature permanent teeth with open apices because of its thin dentinal walls and lack of apical constriction.Conventional apexification procedures using calcium hydroxide has many disadvantages like its long-term application produces weaker dentinal walls and leaves the dentin more prone to fractures.Materials such as MTA are also associated with disadvantages, such as thin dentinal walls and a failure to induce further root development.Thus, there was a paradigm shift in the treatment protocol to Regeneration, a biological procedure that offers a huge potential for hard tissue formation in such teeth[3].

Maturogenesis or revascularization or regenerative endodontic therapy (RET) is believed to be the ideal treatment modality for managing the non-vital immature permanent teeth. A novel concept of revascularization of immature necrotic teeth was introduced by Nygaard Ostby in the 1960s, only to be reinforced further by the studies of Rule and Winter, who documented root development and apical barrier formation even in non-vital teeth in children[4]. The oldest method of achieving revascularization is by inducing bleeding into the pulp canal space by mechanically irritating the periapical tissues.The

limitation of using blood clot as scaffold is that erythrocytes in blood clot undergo degradation, adversely affect its properties and will cause discomfort to the patient during the process of mechanical irritation of periapical tissues.

Choukroun's platelet-rich fibrin (PRF), second-generation platelet concentrate, was described in France by Joseph Choukroun in 2001 which is totally autologous and contains platelets, growth factors, and cytokines which increase the healing potential of both soft and hard tissues, enhance tissue repair and regeneration with absolutely no discomfort or irritation. PRF is considered to be a replacement for the Platelet-Rich Plasma (PRP), also known as the first-generation platelet derivatives, as it is simple and safe compared to PRP.PRF is a 3-dimensional, easily handled, biomaterial, which does not dissolve, but is destroyed by remodeling over time, similar to a natural blood clot. The properties of PRF are based on the production and release of multiple growth and differentiation factors upon platelet activation. These factors are critical in the regulation and stimulation of the wound healing process, and they play an important role in regulating cellular processes such as mitogenesis, chemotaxis, differentiation, and metabolism[5].

Preparation of PRF

The patients' blood sample is taken without anticoagulant in 10-mL tubes in a glass or glass-coated plastic tubes, followed by immediate centrifugation processesat 3,000 rpm for 10 minutes. If not immediately centrifuged, polymerization of fibrin occurs, resulting in reduced quantity and quality of clot. After centrifugation three layers are obtained.

Topmost layer Acellular PPP (Platelet Poor Plasma)

PRF clot in the middle.

Red corpuscle base at the bottom.

The middle layer is removed from underlying RBC and transferred on sterile dish. PRF is rich in growth factors and should be preserved. PRF membrane can be obtained by squeezing it between gauze layers resulting in solid, gel like material.PRF membrane can also be prepared by compressing PRF clot in special tools like "PRF Box" resulting in standardized membranes of constant thickness and size along with PRF exudate.

The blood, when collected and placed in the test tube, undergoes the process of intrinsic coagulation on coming into contact with the glass, thereby separating the blood into the clot and the plasma. Hence, speedy blood collection and immediate centrifugation is advised for successful preparation of PRF [6]. The slow handling of blood to centrifugation process will result in diffuse polymerization of fibrin leading to the formation of a small blood clot with irregular consistency[7].

PROCESS OF PREPARING PRF CLOT AND MEMBRANE

Fig 1 (a) - Venipuncture and blood collectionFig1 (b) - Centrifugation of collected Blood

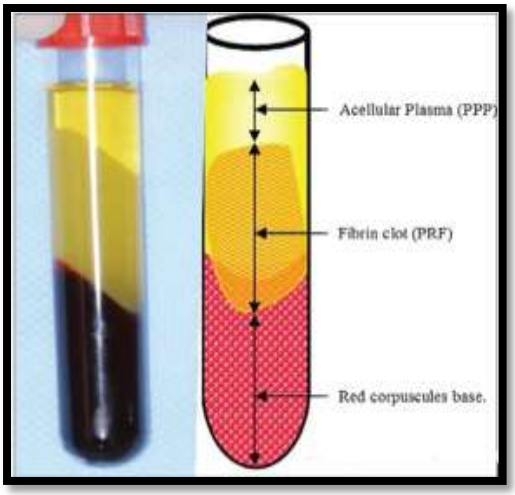

Fig 1 (c) - PRF clot in the middleafter centrifugation

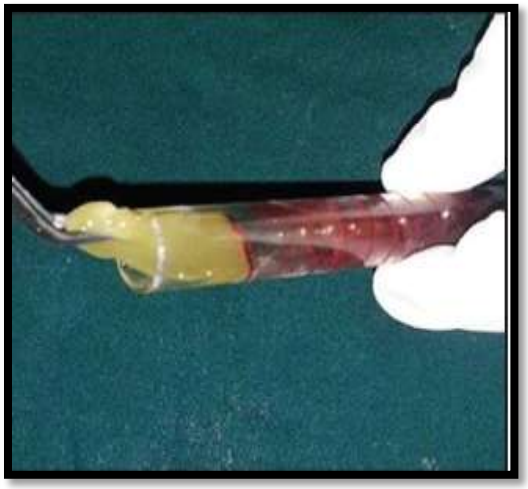

Fig 1 (d) - Removal of clot from tube

Fig 1 (e) - PRF clot before compression

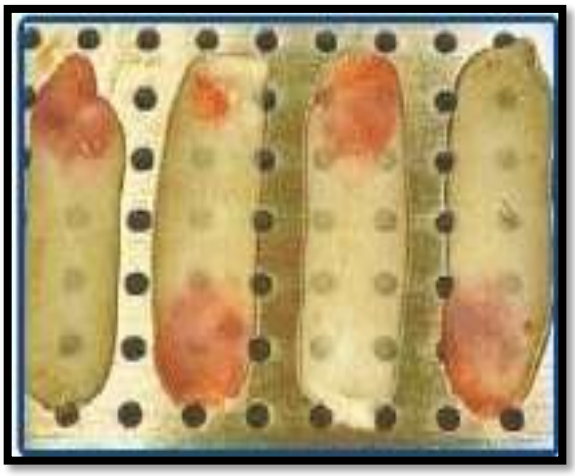

Fig 1 (f) - PRF membrane after compression

CLASSIFICATION OF PRF:

As per the current classification 2009, platelet concentrates are generally divided into four groups based on the presence of a cell content (mostly leukocytes) and the fibrinarchitecture(Fig.2)

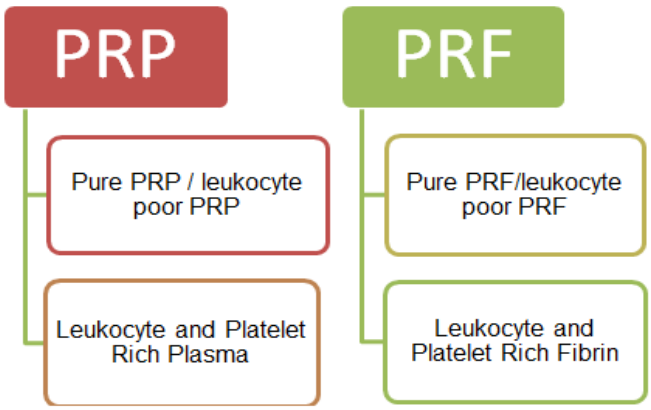

Fig.2 Classification of Platelet concentrates

COMPOSITION OF PRF:

Platelet rich fibrin is a fibrin matrix in which platelet cytokines, growth factors and cells are trapped,released after a certain time that can serve as aresorbable membrane [4].Recently, studies have demonstrated that the PRF has a very significant slow sustained release of many key growth factors like PDGF and TGF for at least 1 week and up to 28 days which means that PRF could release growth factors with its own biological scaffold for wound healing process [Table 1].The remarkable feature of PRF is its ability to accumulate platelets and the slow release of cytokines in the fibrin clot. The natural polymerization which resulted in three-dimensional fibrin architecture was found to be responsible for the slow release of cytokines over seven days [6].

Table 1: Growth Factors and Their Source Cells

GROWTH FACTORS	SOURCE CELLS
Platelet Derived Growth Factor (PDGF)	Platelets, Macrophages
Transforming Growth Factor(TGF-B)	Platelets, Lymphocytes
Insulin Like Growth Factor-1 (IGF-1)	Osteoblasts, Macrophages
Fibroblast Growth Factor (FGF)	
Vascular Endothelial Growth Factor (VEGF)	Endothelial Cells

CURRENT APPLICATIONS OF PRF IN DENTISTRY

PRF has immense use in the field of dentistry because of its improved healing capacity, better compatibility with patient's immune system and it is autologous in nature. Common uses of PRF in dentistry are:

- PRF promotes the soft tissue healing by modifying the progenitor proliferation and migration. It is used as a filling material in extraction sockets, will act as a stable blood clot for neovascularization and accelerated tissue regeneration. This can be used to improve wound healing in immunocompromised and diabetic patients.
- PRF stimulates coagulation (with thrombospondin) and wound closure, it can be used as an adjuvant in patients on anticoagulant therapy [8].
- PRF membrane can be used as a protective membrane in cases of wide sockets and lesions as it promotes re-epithelialization of the site and accelerates the merging of the wound margins.
- PRF membrane provides a solid, stable fibrin mesh which reduces the healing time of the donor site.
- PRF gel and PRF membrane has been used in combination with a bone graft for treating a tooth with a combined periodontic- endodontic lesion[2].
- PRF has been used to treat gingival recession, intra-bony defects and periapical lesions**.**
- Application of PRF with alloplastic graft material in treatment of periodontal intrabony defect is based on reduction in probing pocket depth.
- PRF is used as a potential scaffold in pulp revascularization procedures of necrotic immature permanent tooth as it is rich in growth factors, it seems to enhance cellular proliferation and differentiation, augmenting angiogenesis, acting as a matrix for tissue growth, and regulating the inflammatory reaction [9]
- Used in large periapical lesions to induce faster periapical healing .
- Used in regenerative pulpotomy procedures where coronal pulp is removed and pulp wound is covered by PRF followed by sealing it with MTA and GIC.
- PRF reduce the risk of flap necrosis by stimulating angiogenesis and promote impregnation of surgical site with blood proteins, followed by slow release of growth factors[6].
- Reduces post-surgical pain and edema .

CONCLUSION

Platelet concentrates as a whole have shown great scope in field of regenerative medicine and dentistry. In recent times, PRF has been used in wide range of treatment modalities. Choukroun's PRF has shown promising results as an adjunct in periodontal regeneration, wound healing, regeneration of pulp-dentin complex for endodontic procedures. Ability to accumulate platelets and the slow release of cytokines in the fibrin clot makes PRF as a outstanding biomaterial in a regenerative field.

REFERENCES

1. Bansal R, Jain A, Mittal S , Kumar T, Kaur D Regenerative Endodontics: A Road Less Travelled Journal of Clinical and Diagnostic Research. 2014;8(10).
2. Shivashankar VY, Johns DA , Vidyanath S , Ramesh Kumar M. Platelet Rich Fibrin in the revitalization of tooth with necrotic pulp and open apex. Journal of Conservative Dentistry. 2012 Vol 15 Issue 4
3. Nagaveni NB, Poornima P, Joshi JS, Pathak S, Nandini DB. Revascularization of Immature, Nonvital Permanent Tooth Using Platelet-rich Fibrin in Children. Pediatric dentistry .2015 V 37 / NO 1
4. Archana MS, SujanaV, NageshB , Babu PJ. Revascularization- An overview. J Int Dent Med Res2012;5:56-9
5. Sánchez, Andrés R.; Sheridan, Phillip J.; Kupp, Leo I.Is Platelet-rich Plasma the Perfect Enhancement Factor? A

Current Review. International Journal of Oral & Maxillofacial Implants 2003, Vol. 18 Issue 1, p93-103.
6. Kumar VR, Gangadharan G . Platelet rich fibrin in dentistry: A review of literature International Journal of Medicine 2015; 3(2);72-76
7. Gupta V, Bains VK, Singh GP, Mathur A, Bains R. Regenerative Potential of Platelet Rich Fibrin In Dentistry: Literature Review. Asian J Oral Health Allied Sci 2011; 1(1):22-28
8. Corso MD, Toffler M, David M, Ehrenfest D. Use of autologous leukocyte and platelet rich fibrin (L-PRF) membrane in post avulsion sites: an overview of Choukroun's PRF. The journal of implant and advanced clinical dentistry 2010; 1(9):27-35.
9. Keswani D and Pandey RK. Revascularization of an immature tooth with a necrotic pulp using platelet-rich fibrin: a case report. Int Endod J 2013; 46: 1096-1104.