Medical and Research Publications
International Open Access

Review Article **Journal of MAR Dental Sciences (Volume 5 Issue 4)**

Platelet Rich Fibrin in Dentistry: A Review of Literature

Madhur Dutt*, Benny Budhwar[1]

1. MDS, Department of Orthodontics, Genesis Institute of Dental Sciences and Research, Ferozepur, Punjab , India.

Corresponding Author: Madhur Dutt, BDS, Sardar Patel Dental College, Lucknow, UP, India.

Received Date: April 11, 2022

Published Date: May 01, 2022

Abstract:

Platelet-rich fibrin is a second-generation platelet concentrate and is defined as an autologous leucocyte and platelet-rich fibrin biomaterial. Platelet-rich fibrin (PRF) is a natural fibrin matrix which contains platelet cytokines, growth factors, and stem cells that serves as a resorbable membrane which promotes wound healing and regeneration of periodontal tissues. Hence the aim of present review of literature is to provide details of PRF preparation and its application in dentistry.

Keywords*: PRF, Platelet Rich Fibrin, Dentistry*

Introduction

Platelet rich fibrin (PRF) is an autologous platelet concentrate with intimate assembly of cytokines, glycan chains, and structural glycoproteins, increased concentration of growth factors enmeshed within a slowly polymerized fibrin network, has the capability to accelerate soft tissue as well as hard tissue healing. Platelets play a crucial role in the field of dentistry.[1]

It was first described by Dr. Joseph Choukroun in France to promote wound healing in implants. Currently, the studies have been focussed on the use of an autogenous material called Platelet Rich Fibrin that provides an osteoconductive scaffold along with growth factors to stimulate patient's own cells towards a regenerative response.[2]

It can be obtained from blood with the help of a simple process. PRF is basically a concentrate of growth factors that promote wound healing and regeneration which is used in various disciplines of dentistry to repair various lesions and regenerate dental and oral tissues.[3,4] Hence the aim of present review of literature is to provide details of PRF preparation and its application in dentistry.

Classification of Platelet Rich Fibrin Products[4]

Dohan Ehrenfest et al. classified PRF into two types according to the leukocyte content:

1. Pure PRF or leukocyte Poor PRF

2. Leukocyte Rich PRF (also called advanced PRF or Choukroun's PRF).

Method of Preparation of PRF

PRF is an immune and platelet concentrate collecting on a single fibrin membrane, containing all the constituents of a blood sample which are favourable to healing and immunity.[5]

Though the classical method for preparation of PRF was given by Dr. Choukroun, the present technique for PRF preparation is legitimized by the French Health Ministry. Currently, PRF is prepared without any use of anticoagulant or bovine thrombin. A PRF with standard quality and quantity of the fibrin matrix, leukocytes, platelets, and growth factors demands a standard protocol for preparation.[6]

The PRF preparation protocol is very simple and armamentarium required is same as that of PRP. Around 5 ml of whole venous blood is collected in the sterile vacutainer tubes of 10 ml capacity without anticoagulant. The vacutainer tubes are then placed in a centrifugal machine at 3000 revolutions per minute (rpm) for 10 minutes, after which it settles into the following layers: red lower fraction containing red blood cells, upper straw-coloured cellular plasma and the middle fraction containing the fibrin clot.

The upper straw-coloured layer is then removed and middle fraction is collected, 2 mm below lower dividing line, which is the PRF. The mechanism which is followed here is that, fibrinogen which is initially concentrated in the high part of the tube, combines with the circulating thrombin due to centrifugation, to form fibrin. A fibrin clot is then obtained in the middle of the tube, just between the red corpuscles at the bottom and acellular plasma at top. Platelets are trapped massively in the fibrin meshes.[7]

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 a resorbable membrane. 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. 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.[8,9]

Current application 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.

Application in Periodontology

The use of PRF along with autogenous bone graft at implant dehiscence site has shown improvement in healing response which has resulted in rapid, clinically relevant bone closure at dental implant dehiscence defect.

PRF, shows compelling data in various in vitro and clinical studies. It can be utilized in various procedures such as management of intrabony defects, gingival recession, furcation defects, extraction socket preservation, and accelerated healing of wound.[10]

Application in Oral Surgery

Third molar removal is one of the most common procedures performed in the field of oral and maxillofacial surgery. Surgical removal of mandibular third molars is usually accompanied by pain, swelling, trismus and delayed healing of the sockets which may affect the patients quality of life. Meticulous surgical technique and scrupulous pre-operative care can reduce the risk of complications

and limit their severity. Various medical and\or surgical modifications have been used to improve patients quality of life. Platelet Rich Fibrin (PRF) is an autologous soluble biologic material devoid of foreign material which is best suited for the surgical site. PRF which comprises of platelet, cytokines, leucocytes and circulating stem cells that are entangled by a complex fibrin matrix. These unique components in PRF makes it a good healing biomaterial that permits optimal healing. The slow release of cytokines –transforming growth factor from alpha granules, vascular endothelial growth factor, epidermal growth factor and platelet derived growth factor are the key factors which play an important role in neoangiogenesis, tissue healing makes this particular material very unique L-PRF is used postoperatively in these cases in order to reduce pain, facial swelling and soft tissue healing.[11]

Application in Endodontics

Regenerative endodontic procedures require the use of appropriate scaffolds to provide a spatially correct position of cell location, regulate differentiation, proliferation, or metabolism of the stem cells. Platelet-rich fibrin is one such scaffold which is currently gaining popularity in the field of regenerative endodontics. Studies have shown that PRF can be used as a scaffolding material in an infected necrotic immature tooth for pulpal regeneration and tooth revitalization. Use of PRF in regenerative pulpotomy procedures have also been documented where coronal pulp is removed and the pulp wound is covered by PRF followed by sealing it with MTA and GIC. PRF has also been used to fill in the bony defects after periapical surgeries like root end resection etc.[12]

Application in Pediatric Dentistry

The advantage with PRF is stimulation and healing of the tissues, this could help in PRF finding a major place in various treatment modalities done in pediatric dentistry.[13] Platelet Rich Plasma could be an effective material used for direct pulp capping due to its excellent wound healing, tissue regeneration and osteogenic properties. Cytotoxicity and mutagenic effects have always been major disadvantages discovered with the use of formocresol, as a pulpotomy agent. Platelet Rich Plasma with its low toxic effects and increased tissue regeneration showed excellent clinical results. A study conducted by Damle et al. (2004)[14] compared PRP and Calcium Hydroxide and found 100% success rate with Platelet Rich Plasma. Another study with Nagasaki et al. (2007)[15] compared PRP vs Hydroxiapetite crystals, and found PRP to be much superior.

Application in Cleft Management

Cleft lip and palate are congenital defects in maxillary and nasal processes that result in cleft lip and/or palate. Surgical closure is the treatment of choice. PRP enhances soft tissue closure of cleft palate. It

also reduce the incidence of oronasal fistula. Mixing PRF with bone grafts resulted in complete closure of 90.9% cases. Alveolar clefts are congenital alveolar bone defects that affect more than three fourth of the cleft lip and palate patients. The combination of iliac graft and PRP reduce bone resorption compared to iliac graft alone in patients.[18]

Application in Tissue Engineering

The use of PRF as a tissue engineering scaffold was investigated by many researchers for the past few years. PRF appears to be superior to collagen as a scaffold for human periosteal cell proliferation and PRF membranes can be used for in vitro cultivation of periosteal cells for bone tissue engineering. Thus PRF is a potential tool in tissue engineering but clinical aspects of PRF in this field requires further investigation.[3,19]

Advantage of PRF[16,17]

- Simple, Cost effective
- PRF helps in hemostasis.
- PRF has supportive effect on immune system.
- It can be used solely or in combination with bone grafts, depending on the purpose.
- Accelerates the healing rate of the grafted bone
- There is no risk of suffering from an immunological reaction as polymerization is a natural process and there is no need for addition of any external thrombin.
- Used as a membrane, it avoids a donor site surgical procedure and results in a reduction in patient discomfort during the early wound-heal¬ing period.
- The studies of PRF present it to be more effi¬cient and with less controversies on its final clinical results when compared to PRP.

Disadvantage of PRF[16,17]

- Need of using a glass-coated tube to achieve clot polymerization.
- Possible refusal of treatment by the puncture required for blood collection.
- Its storage for longer duration is also not possible because of the shrinkage and altering the structural integrity of PRF.
- Quick handling is required immediately after collection. The technique entirely depends on the speed of blood collection and transfer to the centrifuge.
- Only limited volume of PRF can be used as it is obtained from autologous blood sample, the quantity of PRF produced is low and this limits its use for general surgery.

Conclusion

Platelet concentrates has been used in various application of dentistry since many years. Technological advancement in this field shows promising result in use of platelet rich fibrin in dentistry. The PRF has wide applicability, from Dentistry to Medicine, with excellent results in the short term; all In-vivo and In- Vitro studies have shown the safety in its use for dental application. Several studies have demonstrated safe and promising results, without contradic¬tory findings, related to the use of PRF alone or in combination with other biomaterials. However, more long term studies are required to evaluate deeper knowledge about the efficacy of this biomaterial and to optimize its use in routine clinical dentistry.

References

1. Mani A, Anarthe R, Sachdeva S, Kale A. Platelet-rich fibrin in dentistry. J Datta Meghe Inst Med Sci Univ 2021;16:587-9.

2. Kanakamedala A, Ari G, Sudhakar U, RajaramVijayalakshmi, Ramakrishnan T, Emmad P. Treatment of a furcation defect with a combination of platelet-rich fibrin (PRF) and bone graft – a case report. ENDO 2009; 3(2):127–135.

3. Agrawal M, Agrawal V. Platelet Rich Fibrin and its Applications in Dentistry- A Review Article. Natl J Med Dent Res 2014; 2(3): 51-58.

4. Dohan Ehrenfest DM, Rasmusson L, Albrektsson T. Classification of platelet concentrates: From pure platelet rich plasma (P PRP) to leucocyte and platelet rich fibrin (L PRF). Trends Biotechnol 2009;27:158 67.

5. Mosesson MW, Siebenlist KR, Meh DA. The structure and biological features of fibrinogen and fibrin. Ann N Y Acad Sci. 2001;936:11–30.

6. Dohan DM, Choukroun J, Diss A, Dohan SL, Dohan AJ, Mouhyi J, et al. Platelet rich fibrin (PRF): A second generation platelet concentrate. Part III: Leucocyte activation: A new feature for platelet concentrates? Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006;101:e51 5

7. Saluja, H., Dehane, V., & Mahindra, U. (2011). Platelet-Rich fibrin: A second generation platelet concentrate and a new friend of oral and maxillofacial surgeons. Annals of maxillofacial surgery, 1(1), 53–57.

8. Archana MS, SujanaV, NageshB , Babu PJ. Revascularization- An overview. J Int Dent Med Res2012;5:56-9

9. Kumar VR, Gangadharan G . Platelet rich fibrin in dentistry: A review of literature International Journal of Medicine 2015; 3(2);72-76

10. Sachdeva S, Phadnaik MB, Saluja H. Platelet-rich fibrin, a physiological concentrate in management of buccal dehiscence of implant-A case report, J Pierre Fauchard Acad (India sec) 2015;29:103-6.

11. Uyanık LO, Bilginaylar K, Etikan İ.Effects of platelet-rich fibrin and piezosurgery on impacted mandibular third molar surgery outcomes. Head Face Med. 2015 Jul 26;11:25. doi: 10.1186/s13005-015-0081.

12. I.B. Geeta, Galagali G, Kulkarni S, Suran P, Noushin F. A Natuaral Meliorate: Revolutionary Tissue Engineering in Endodontics. J ClinDiagn Res. 2013; 7(11):2644-2646

13. Nakashima M, Akamine A. The application of tissue engineering to regeneration of pulp and dentin in endodontics. J Endod. 2005; 31:711–718.

14. Kalaskar RR, Damle SG. Comparative evaluation of lyophilized freeze dried platelet derived preparation with calcium hydroxide as pulpotomy agents in primary molars. J Indian Soc Pedod Prev Dent 2004;22:24-9.

15. Ide Y, Nagasaki N, Tomioka R, Suito M, Kamiya T, Maeshima M. Molecular properties of a novel, hydrophilic cation-binding protein associated with the plasma membrane. J Exp Bot. 2007;58:1173-83.

16. Bansal S, Garg A, Khurana R, Chhabra P. Platelet-rich fibrin or platelet-rich plasma – Which one is better? An opinion. Indian J Dent Sci 2017;9:S49-52.

17. Raaj V, Gautam A, Abhishek, Kumari P. Platelet-Rich Fibrin (PRF): A New Generation Paltelet Concentrate. Int J Dent Med Res 2015;1(6):164-167.

18. Merigo E, Oppici A, Parlatore A, Cella L, Clini F, Fontana M, Fornaini C. Platelet-rich plasma (PRP) rinses for the treatment of non-responding oral lichen planus: a case report. Biomedicines. 2018;6:15.

19. Sunitha Raja V, Munirathram Naidu E. Platelet rich I fibrin: Evolution of second generation platelet concentrate. Indian J Dent Res. 2008;19:42-46.