PRF and Bonegraft-Magical tools in Periodontics- A case report

Renjith KP[1,*], Harish Kumar VV[2], Santhosh VC[3], Sreekanth Puthalath[4], Shabeer Mohamed[5]

[1]PG Student, [2]Professor & HOD, [3]Professor, [4]Reader, [5]Senior Lecture, Dept. of Periodontology & Oral Implantology, KMCT Dental College, Calicut, Kerala

***Corresponding Author:**
Email: renjithkp3956@gmail.com

Abstract

Periodontal regeneration can be defined as the reconstitution of a lost or injured part to restore the function of the periodontium. Regeneration of lost periodontal tissues are the ultimate goal of any periodontal therapy. Platelet-rich fibrin (PRF) was developed in France by Choukroun et al in 2001. It belongs to a second generation platelet concentrate with autologus fibrin matrix containing cytokines and platelets. In periodontal wound healing it helps and motivates tissue repair. This case report investigate the effectiveness of autologous PRF along with the use of DFDBA (Demineralised freeze dried bone graft) in the management of intrabony defects.

Keywords: DFDBA, Chronic periodontitis, Intrabony defects, Platelet rich fibrin.

Introduction

Periodontal disease can be defined as a complex, multifactorial disease characterized by the loss of connective tissue attachment with destruction of periodontal tissues.(1) The elimination of inflammatory process, the prevention of progression of periodontal disease and the regeneration of the lost periodontal tissues are the ultimate goal of periodontal therapy.(1) Root biomodifications, bone grafts, soft tissue grafts, guided tissue regeneraton and combinations of above procedures include various periodontal regenerative procedures.(2)

A sequence of coordinated interactions between gingival fibroblasts, epithelial cells, periodontal ligament cells and osteoblasts leads to periodontal wound healing. The rupture of vasculature during wound healing leads to fibrin formation, platelet aggregation and release of several growth factors into the tissues from platelets through molecular signals.(3)

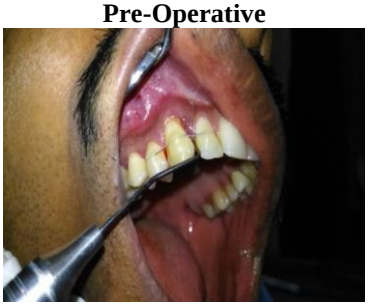
As platelets are the hub of growth factors and cytokines they play an important role in periodontal regeneration. Growth factors and cytokines in platelets play unique roles in inflammation and wound healing.(4) Platelets secrete fibronectin, vitronectin and fibrin which acts as a matrix for connective tissue and as adhesion molecules for cell migration.(5)

This has led to the idea of using platelets as therapeutic tools to improve tissue repair particularly in periodontal wound healing. The clinical application of different bioactive surgical additives that manipulate surgical wound environment is the important step in developing new therapeutic approaches in order to enhance the wound healing.(5)

Case Report

A 35 yr old male patient came to the Department of Periodontology KMCT Dental College with slight mobility of upper right canine(13) and also bleeding from the gums. On intraoral examination it was found that there was a grade I mobility of 13. An IOPA radiograph was taken and it was found that there was a vertical bone loss in the distal aspect of 13. Endodontic treatment of 13 was performed. Splinting was done on the buccal aspect connecting 12, 13, and 14. After 2 weeks periodontal flap surgery was planned. Lignocaine hydrochloride injection 1.8 ml was injected in the buccal vestibule. Crevicular incisions are placed using a no 11 bard-parker blade from 12 to 14. Flaps are elevated using molt no.15 periosteal elevator. The exposed root surface was thoroughly debrided and root planed. DFDBA (Osseograft) was emptied into a dappen dish and were incrementally added to the defect. Autologus PRF was prepared and mixed with Osseograft and was condensed in the defect. The flap was closed with 3'0' black braded silk. A tension free primary closure was obtained. Periodontal pack was placed. Antibiotics and analgesics were prescribed. 500 mg of amoxycilin 3 times a day for 5 days and a combination of mefenamic acid with paracetamol for 5 days were prescribed. Post-operative instructions were given. Patients were adviced to avoid chewing in the area for 2 weeks and not to brush for 10 days. Suture removal was done after 10 days. Recall appointments were scheduled at 3 and 6 months after the surgery for soft tissue evaluation and recording clinical variables.

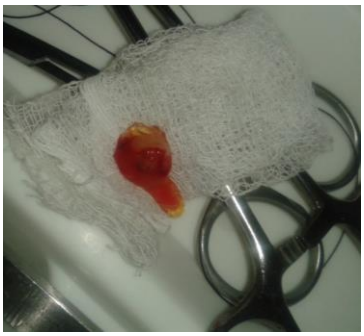
Pre-Operative



PRF and Bonegraft

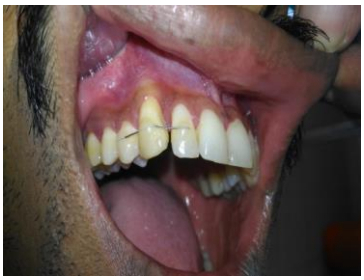
Osseograft

PRF

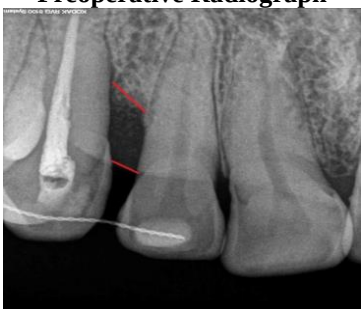


Post-Operative 10 Days

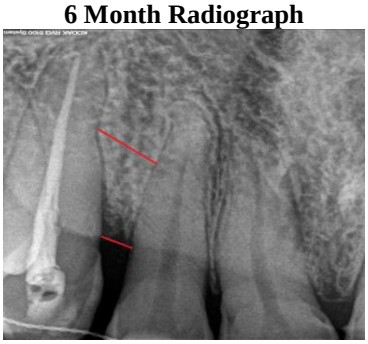
6 Months



Preoperative Radiograph



6 Month Radiograph



Discussion

Platelet rich fibrin (PRF) has been introduced by Choukron et al in 2001 belongs to a second generation platelet concentrate. It is a biomaterial which is fibrin –based and is prepared from anticoagulant –free blood harvest without any biochemical additions.[6] The PRF concentrates almost all the growth factors and platelets of the blood harvest.[7,8] PRF preparation can be done with a REMI centrifuge and a blood collection kit consisting of 24 gauge needle and 9ml blood collection tubes. A sample of blood is taken from the patient and centrifuged at a rate of 3000 rpm for 10 min. The PRF clot will be seen as a middle layer. It can also be prepared in the form of a membrane by sequeezing out the fluids present in the fibrin clot. Since it is prepared without the addition of anticoagulants it is classified as a second generation plateletconcentrate.[9,10] PRF has a dense fibrin network comprising of glycoproteins, and various cytokines.[11] It contains transforming growth factor b1,vascular endothelial growth factor, and thrombospondin-1.[12] The PRF scaffold which contains leukocytes will result in growth factor release[12] regulation of immune reactions, anti-infectious activities[13] and matrix remodeling during wound healing. For favorable wound healing, the slow polymerization mode of PRF plays a crucial role.[14]

Studies show that by stimulation of alkaline phosphatase activity, the production of osteoprotegrin, differentiation of osteoblasts, and increasing the RUNX2 expression, PRF enhances the alveolar bone formation.[15,18] Li et al concluded that PRF promotes bone augmentation along with soft tissue healing on implant site.[17] PRF helps in the proliferation and

migration of periodontal progenitor cells and periodontal soft tissue regeneration through increased collagen synthesis in periodontal cells.[19]

In a study conducted by Choukron et al, found that the healing properties of bone was enhanced by PRF in implant surgery.[20] According to Chang et al PRF promotes the production of osteoprotegrin and stimulates the expression of phosphrylated extracellular signal-regulated protein kinase(p-ERK).[21]

Huang et al reported that by upregulation of osteoprotegrin and alkaline phosphatase expression, PRF activates the osteogenic differentiation of the human dental pulp cells.[22]

In a one year study on osteotome sinus floor elevation using PRF grafting material Diss et al proved that fibrin matrix of PRF promotes angiogenesis.[23]

Various types of bone grafting materials including autografts, xenografts, and alloplasts have been applied and evaluated so far. DFDBA has both osteoconductive and osteoinductive properties. By numerous animal experiments Urist et al have shown that DFDBA stimulate new bone formation by osteoinduction.[25]

Bonegrafting is a surgical procedure that replaces missing bone with material from patients own body, an artificial, synthetic, or natural substitute. Bone grafting is possible because bone tissue has the ability to regenerate completely if provided the space into which it has to grow. As natural bone grows, it generally replaces the graft material completely, resulting in a fully integrated region of new bone.[26]

Osseograft

Osseograft (Advanced biotech Products Ltd India) is a xenograft. It is a demineralised bone matrix composed of type I collagen derived from cortical bone sample with a particle size of 250 micrometers.[27]

The major difference between allografts and synthetic grafts is in the histologic results. Allografts heal by regeneration of periodontium whereas grafts of synthetic bone heal by encapsulation of the graft particle by connective tissue.[28]

Xenografts are grafts shared between different species. They are osteoconductive, readily available and risk free of disease transmission.[29]

When compared to DFDBA in the management of intrabony periodontal defect, a combination of PRF and DFDBA demonstrated better clinical results. PRF acts as biological connector between bone particles. In the self-regulation of inflammatory phenomenon with in the graft material the gradual release of cytokines plays an important role.

Conclusion

PRF and DFDBA shows better results compared to conventional procedure. Since it is patients own blood, PRF is having a less chance for allergic reactions, readly available and cost effective. Results of the present case shows that combined treatment approach with PRF is effective in treating combined endo perio lesions. Ideal ratios of components of PRF preparation are still being investigated and more clinical researches are required to assess the long term effectiveness of this combined therapy.

References

1. Giannobile WV. The potential role of growth and differentiation factors in periodontal regeneration. J Periodontol 1996;67:545e53.
2. Greenwell H. Committe on research, science and therapy, American Academy of Periodontology, Position paper: guidelines for periodontal therapy. J periodontal 2001;72:1624-8.
3. Deodhar AK, Rana RE Surgical physiology of wound healing: a review. J Postgrad Med 1997;43:526.
4. Giannobile WV. Periodontal tissue engineering by growth factors. Bone 1996;19(suppl.1):23S-37S.
5. Dohan DM, Choukroun J, Diss A, et al. Platelet rich fibrin(PRF): a second generation platelet concentrate ,Part I: techno-logical concept and evolution. Oral Surg Oral Med Oral Path Oral Radiol Endod 2006;101: E37-44.
6. Toffler M, Toscano N, Holtzcaw D, Corso MD, Ehrenfest DM,. Introducing Choukroun's PRF to the reconstructive surgery millieu. The Journal of Implant and Advanced Clinical Dentistry 2009;1:21-32.
7. Dohan DM, Choukron J, Diss A, et al. Platelet rich fibrin(PRF): a second generation platelet concentrate. Part II: platelet related biologic features. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006;101:E45e50.
8. Dohan DM, Choukroun J, Diss A, et al. platelet rich fibrin(PRF): a second- generation platelete concentrate. Part III; leucocyte activation: a new feature for platelet concentrates? Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006;101:E51e55.
9. Bowers GM, Chadrof B, Carevale R, Mellonig J, Corio R, Emerson J et al. Histologic evaluation of new attachment apparatus in humans. Part II. J Periodontol 1989;60;676-82.
10. Cortellini P, Bowers GM. Perioidontal regeneration of intrabony defects: an evidence based treatment approach. Int J Periodontics Restorative Dent 1995;15:128-45.
11. Dohan Ehrenfest DM, Diss A, Odin G, Doglioli P, Hippolyte MP, Charrier JB. In vitro effects of Choukrouns PRF on human gingival fibroblasts, dermal prekeratinocytes, preadipocytes and maxillofacial osteoblasts in primary cultures. Oral surg Oral Med Oral Pathol Oral Radiol Endod 2009;108:341-52.
12. Dohan Ehrenfest DM, de Peppo GM, Doglioli P, Sammartino G .Slow release of growth factors and thrombospondin-1 in Choukroun's platelet rich fibrin(PRF): a gold standard to achieve for all surgical platelet concentrates technologies. Growth factors 2009;27:63-9.
13. Moojen DJ, Everts PA, Schure RM, et al. Antimicrobial activity of platelet –leukocyte gel against Staphylococcus aureus. J Orthop Res 2008;26:404-10.
14. Anitua E, Andia I, Ardanza B, Nurden P, Nurden AT Autologus platelets as a source of proteins for healing and tissue regeneration. J Thromb haemostat 2004;91:4-15.
15. D.M.D Ehrenfest P, P. Doglioli, G. M. de Peppo, M. Del Corso, and J. B. Charrier, 'Choukroun's platelet- rich fibrin (PRF) stimulates in vitro proliferation and differentiation of human oral bone mesenchymal stem cell in a dose-dependent way", Archives of Oral Biology, vol.55 no. 3, pp. 185–194, 2010.

16. L. He, Y. Lin, X. HU Y. Zhang, and H. Wu, "A comparative study of platelet-rich fibrin (PRF) and platelet-rich plasma (PRP) on the effect of proliferation and differentiation of rat osteoblasts in vitro", Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology and Endodontology, vol. 108, no. 5, pp. 707–713, 2009.
17. Li Q, Pan S, Dangaria SJ, Gopinathan G, Kolokythas A, Chu S, Geng Y, Zhou Y, Luan X. Platelet-rich fibrin promotes periodontal regeneration and enhances alveolar bone augmentation. Biomed Res Int. 2013;2013:638043.
18. I.C. Chang, C.H. Tsai, Y.C. Chang. "Platelet-rich fibrin modulates the expression of extracellular signal regulated protein kinase and osteoprotegerin in human osteoblasts. "J Biomed Mater Res A, 95 2010, pp. 327–33.
19. Kawase T, Okuda K, Wolff LF, Yoshie H. 'Platelet rich plasma-derived fibrin clot formation stimulates collagen synthesis in periodontal ligament and osteoblastic cells in vitro'. J Periodontol. 2003 Jun;74(6):858-64.
20. Choukroun J, Adda F, Schoeffer C, Vervelle A.PRF: an opportunity in perio-implantology. Implantodontie 2000;42:55–62 in French.
21. Chang IC, Tsai CH, Chang YC. Platelet-rich fibrin modulates the expression of extracellular signal-regulated protein kinase and osteoprotegerin in human osteoblasts. J Biomed Mater Res A 2010;95:327–32.
22. Huang FM, Yang SF, Zhao JH, Chang YC. "Platelet-rich fibrin increases proliferation and differentiation of human dental pulp cells. J Endo 2010;36:1628e32.
23. Diss A, Dohan DM, Mouhyi J, Mahler P. Osteotome sinus floor elevation using Choukroun's platelet-rich fibrin as grafting material: a 1-year prospective pilot study with micro threaded implants. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2008;105, 572e9.
24. Reynolds MA, Aichelmann-Reidy ME, Branch-Mays GL. Regeneration of periodontal tissue: Bone replacement grafts. Dent Clin North Am 2010;54:55-71.
25. Urist MR. Bone formation by auto induction. Science 1965;150:893.
26. Prasanna Kumar, Belliappa Vinitha, and Ghousia Fathima. Bone grafts in dentistry. J Pharm Bioallied Sci. 2013 Jun; 5(Suppl 1): S125–S127.doi: 10.4103/0975-7406.113312.
27. Rajan Gupta, Nymphea Pandit, Rajvir Malik, Shaveta Sood. Clinical and Radiological Evaluation of an Osseous Xenograft for the Treatment of Infrabony Defects. JCDA. July/August 2007, Vol. 73, No. 6. 513-513f.
28. James T. Mellonig, DDS, MS. Bone Allografts in Periodontal Therapy. Clin orthop relat Res.1996 Mar;(324):116-25.
29. A.L Dumitrescu, chemicals in surgical periodontal therapy. Springer –verlag berlin Heidelberg 2011. Bone Grafts and Bone Graft Substitutes in Periodontal Therapy 73-127.
30. Simonpieri A, Del Corso M, Sammartino G, Dohan Ehrenfest DM. The relevance of Choukroun's platelet rich fibrin and metronidazole during complex maxillary rehabilitations using bone allograft. Part I: A new grafting protocol. Implant Dent 2009;18:102.11.