CASE REPORT

Ridge Augmentation using Bone Graft and Platelet Rich Fibrin

Kriti Agarwal[1], Gupta KK[2], Kanika Agarwal[3], Nishant Kumar[4]

Quick Response Code

doi: 10.5866/2013.511155

[1]Senior Lecturer
Department of Periodontology, DJ Dental College, Modinagar.
[2]Professor
[3]PG Student
Department of Periodontology, Sardar Patel Institute of Dental and Medical Sciences, Lucknow.
[4]Senior Lecturer
Department of Oral and Maxillofacial Surgery, ITS Dental College, Greater Noida.

Received: October 13, 2012;
Review Completed: November 12, 2012;
Accepted: December 13, 2012
Available Online: March, 2013 (www.nacd.in)

Email for correspondence:
drkritimds@gmail.com

ABSTRACT:

Ridge augmentation procedures require bone regeneration outside the existing bony walls or housing and are therefore often considered to be the most challenging surgical procedures in implant dentistry. One of the most innovative developments in dentistry is the use of the autologous Platelet Rich Fibrin (PRF) for the soft and hard tissue regeneration. PRF is a source of growth factors that may contribute to an accelerated tissue regeneration process.

This article presents a case report of a 22 year old male patient who had an inadequate width of alveolar ridge for an implant placement in 11 region. Therefore, to increase the width of the alveolar ridge, bone grafting was done where PRF was used with bone graft which proved to be a beneficial entity.

Key words: Ridge augmentation, Platelet Rich Fibrin (PRF), Growth factors, Alloplasts.

INTRODUCTION

Healing and soft tissue maturation requires three main factors namely, angiogenesis by proper scaffolds, growth factors and mesenchymal stem cell activity.[1] Disruption of the vasculature leads to fibrin formation, platelet aggregation and simultaneous release of growth factors into the tissues from platelets. The process of angiogenesis requires an extracellular matrix which allows migration and division of endothelial cells. The specific dense structure of fibrin rich gel in PRF promotes neoangiogenesis. This paper reports a case where PRF was used with bone graft for horizontal ridge augmentation.

CASE REPORT

A male patient aged 22 years reported to the Department of Periodontics, Meenakshi Ammal Dental College, Chennai with the chief complaint of missing tooth in 11 region. He gave the history of trauma four

months back and simultaneous avulsion of the right central incisor tooth. On clinical examination (Fig.1), height of the alveolar ridge was adequate but the width of the ridge was inadequate for an implant placement. The ridge was found to be a class I defect according to Siebert's classification.[2] Intraoral radiographs also revealed a deficient ridge. Ridge augmentation using bone graft with platelet rich fibrin (PRF) was planned. The patient was clinically healthy with no history of systemic diseases. Informed consent was taken from the patient.

PREPARATION OF PRF

PRF belongs to a new generation of platelet concentrate but with a simplified processing as compared to platelet rich plasma (PRP). Blood was drawn into 10ml test tubes without an anticoagulant and centrifuged immediately for 12 minutes at 2,700 rpm (Fig. 2).

The resultant product consists of the following three layers.

1. Topmost layer consists of acellular platelet poor plasma (PPP).
2. PRF clot in the middle.
3. RBCs at the bottom.

Successful preparation of PRF requires speedy blood collection and immediate centrifugation, before the clotting cascade is initiated. PRF can be obtained in the form of a membrane by squeezing out the fluids in the fibrin clot.[3]

SURGICAL TECHNIQUE

Under local anesthesia, mucoperiosteal flap was elevated which revealed a concave defect in the labial wall of the ridge (Fig. 3). After decortication, an alloplastic material (Perioglas®) was mixed with blood and placed in the defect and sealed with the PRF membrane (Fig. 4), (Fig. 5). Mucoperiosteal flap was closed using 4-0 black silk sutures (Fig. 6). Antibiotics and analgesics were prescribed for the patient.

POST-OPERATIVE CARE

Patient was recalled after two weeks and sutures were removed. (Fig.7) Healing was satisfactory. Patient was reviewed every two months (Fig. 8) and oral hygiene was reinforced. Six months following the surgery, the patient was again reviewed, clinically the width of the ridge showed an increase (Fig. 9). Radiographs showed an adequate defect fill.

DISCUSSION

Ridge augmentation aims to re-establish adequate amount of bone volume for implant placement and to fulfil the biomechanical requirements of the prosthesis.

One of the most recent developments is the use of the autologous Platelet Rich Fibrin [PRF] for the enhancement of the soft and hard tissue. It was first developed in France by Choukroun et al.[3] It eliminates the risk associated with the use of bovine thrombin. PRF is an immune and platelet concentrate which is obtained on a single fibrin membrane, containing all the constituents of a blood sample which are favourable for healing and immunity.

PRF releases a number of growth factors namely, transforming growth factor β-1 (TGF-beta-1), vascular endothelial growth factor (VEGF), platelet-derived growth factor αβ (PDGF-AB) and thrombospondin-1 (TSP-1) during 7 days. It also secretes fibroblast growth factor (FGF), epidermal growth factor (EGF) and proinflammatory cytokines like IL-1β, IL-6, and TNF-α. Due to its mechanical function and a rapid angiogenesis promoting ability, PRF membranes are viable material for all types of superficial cutaneous and mucosal healing.[4] PRF in the form of a membrane can be used in conjunction with bone grafts, which has several advantages, such as promoting wound healing, bone growth, maturation and density, wound sealing and haemostasis, and imparting better handling properties to graft material.[5] PRF as an adjunct to bone graft makes it possible to enhance the graft volume without injuring the maturation quality in new bone.[6]

PRF offers a number of advantages over PRP. It is a simplified and cost effective process over PRP.[7] PRF eliminates redundant process of adding bovine thrombin to promote conversion of fibrinogen to fibrin which is necessary in PRP.[8] Bovine thrombin may have toxic effects on cells.

The conversion of fibrinogen to fibrin takes place slowly through the small amount of thrombin present in the blood sample itself. Thus due to slow polymerization, a physiologic architecture, which is beneficial for the healing process, is obtained.[9] Slow polymerisation during PRF processing leads to the intrinsic incorporation of platelet cytokines and organic chains in the fibrin meshes. Thus PRF, unlike the other platelet concentrates releases cytokines during the fibrin matrix remodelling. This explains the clinically observed healing properties of PRF.[10] Studies showed PRP has limited potential to stimulate bone regeneration as it releases growth factors quickly, just before the cell outgrowth from the surrounding tissue.

In the present case, the patient showed adequate bone fill within 6 months using bone graft and PRF. The use of PRF as an adjunct to bone graft proved to be highly beneficial in a deficient alveolar ridge. Implant has been planned for the augmented site.

CONCLUSION

Growth factors play a pivotal role in bone grafting procedures.PRF can be considered a healing biomaterial as it permits wound healing optimally. Thus further longitudinal studies are needed to determine and establish the role of PRF in addition to bone substitutes for sufficient augmentation of deficient alveolar ridges.

REFERENCES

1. Jankovic S, Aleksic Z, Klokkevold P, Lekovic V, Dimitrijevic B, Kenney EB, Camargo P. Use of platelet-rich fibrin membrane following treatment of gingival recession: a randomized clinical trial. Int J Periodontics Restorative Dent 2012 Apr; **32**(2):e41-50.
2. Seibert J.S. Reconstruction of deformed, partially edentulous ridges using full thickness onlay grafts. I. Technique and wound healing. Compendium of Continuing Education in General Dentistry; **12**:437-453.
3. Choukroun. J, Diss. A, Simonpieri A, Girard Mo, Schoeffler C, Dohan Sl et al. Platelet Rich Fibrin (PRF), A second generation platelet concentrate Part I: Technological concepts and evolution. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006; **101**:37-44.
4. Del Corso M, Toffler M, Ehrenfest DM, et al. Use of an Autologous Leukocyte and Platelet-Rich Fibrin (L-PRF) Membrane in Post-Avulsion Sites: An Overview of Choukroun's PRF. J Implant Adv Clin Dent 2010;**1**: 27-35.
5. Sunitha R, Munirathnam N. Platelet-rich fibrin: Evolution of a second-generation platelet concentrate. Indian J Dent Res 2008; **19**:42-46.
6. Marx RE. Platelet concentrate: A strategy for accelerating and improving bone regeneration. Bone Engineering Toronto: Em Squared 2000; 447-453.
7. He L, Lin Y, Hu X, Zhang Y, Wu H. 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 Surg Oral Med Oral Pathol Oral Radiol Endod 2009; **108**:707-713.
8. Dohan DM, Choukroun J, Diss A, Dohan SL, Dohan AJ, Mouhyi J, et al. Platelet-rich fibrin (PRF): A second-generation platelet concentrate, Part I: Technological concepts and evolution. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006; **101**:E37-44.
9. Vinazzer H. Fibrin sealing: Physiologic and biochemical background. Fac Plast Surg 1985;**2**:291-295
10. Dohan DM, Choukroun J, Diss A, Dohan SL, Dohan AJ, Mouhyi J, 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**:E45-50.

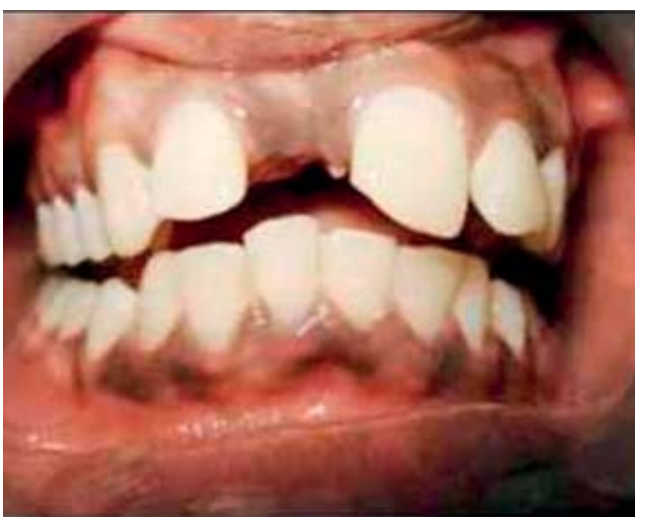

Figure 1: Pre-operative view

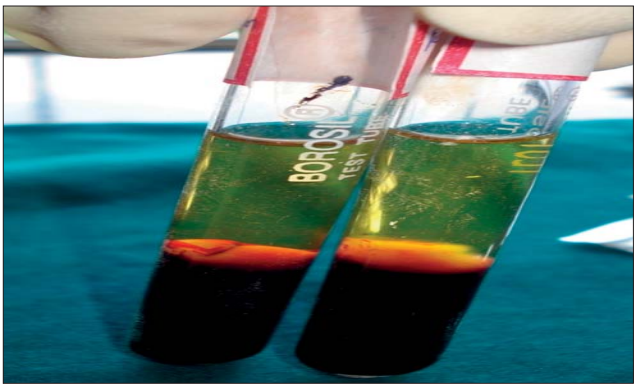

Figure 2: Preparation of PRF

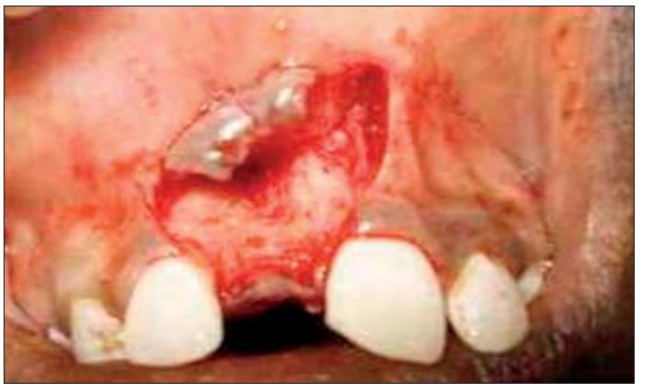

Figure 3: Elevation of flap

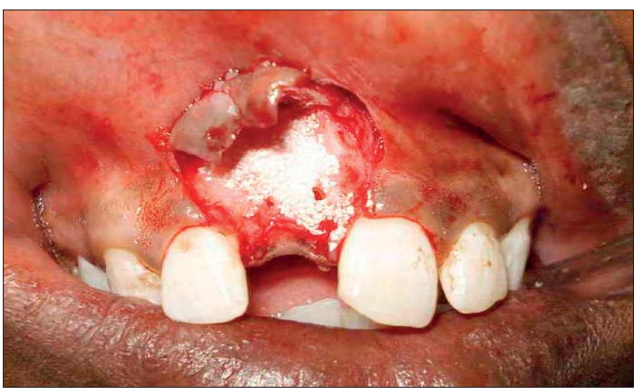

Figure 4: Decortication of bone and placement of bone graft

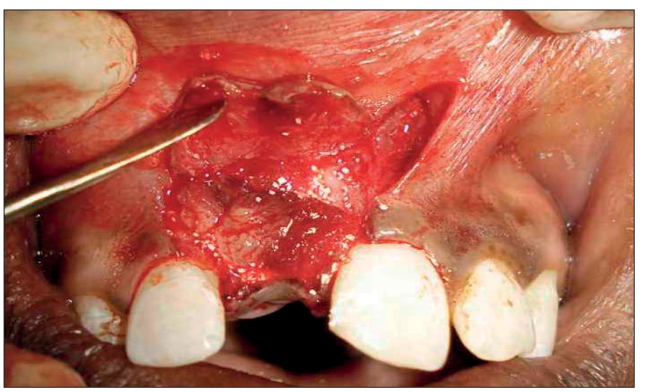

Figure 5: Placement of Platelet-rich fibrin membrane

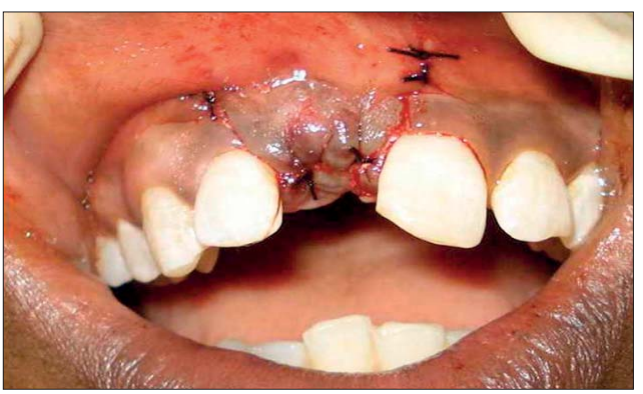

Figure 6: Suturing of flap

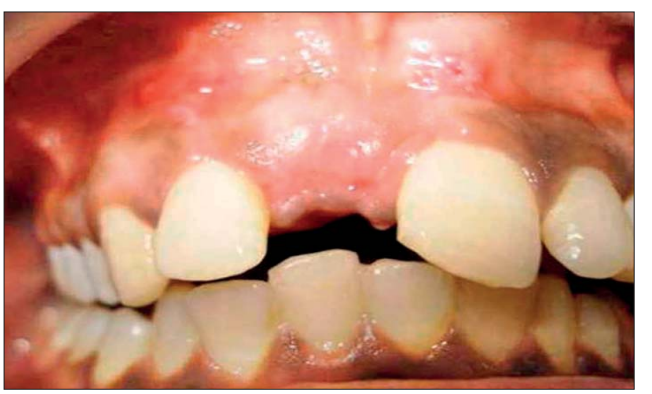

Figure 7: Post-operative view Two weeks

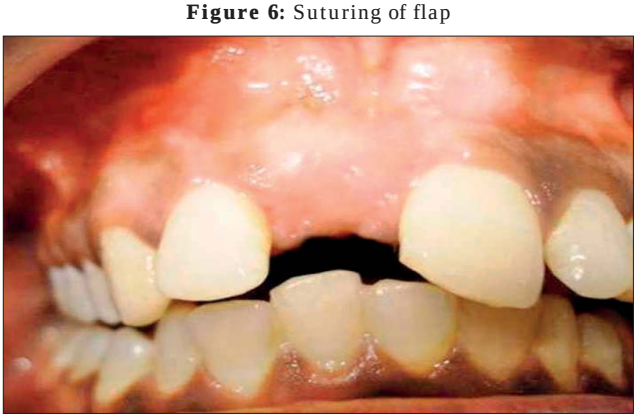

Figure 8: Post-operative view Two months

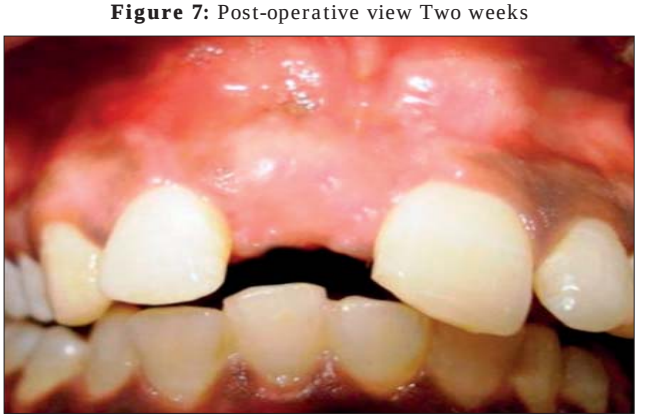

Figure 9: Post-operative view Six months