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THE ROLE OF GROWTH FACTORS IN AUTOLOGOUS PLATELET CONCENTERATE FOR TREATMENT OF PERIODONTAL BONE DEFECT WITH PLATELET RICH FIBRIN: A CASE REPORT

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ABSTRACT

The ultimate goal of periodontal therapy is regeneration of tissues which are destroyed as a result of periodontal disease. Periodontal regeneration is regarded as a difficult and challenging concept as it requires a complex process of coordination of various cellular activities. Dental surgeons are constantly looking for an edge that jump starts the healing process to maximize predictability as well as volume of regenerated bone.PRF is a new step in the platelet gel therapeutic concept with simplified processing minus artificial biochemical modification which accelerates healing at surgical sites, serving as a beneficial ingredient for regeneration.

INTRODUCTION

Regeneration is the natural renewal of a structure by growth and differentiation of new cells and intercellular substances to form new tissues or parts.[1]Periodontal regeneration is healing after periodontal surgery that results in the formation of new attachment apparatus, consisting of cementum, periodontal ligament and alveolar bone.[2] Advancements in periodontal regenerative techniques and materials have encouraged clinicians to achieve this therapeutic goal. A number of innovative treatment modalities using various bone grafts ,Guided Tissue Regeneration, biological mediators and growth factors have been used to promote periodontal regeneration.[3]Substantial variations in clinical predictability , degree of efficacy of this reaction have been reported which are the type of morphologic defect surgical precision and patient's post operative maintenance.[4,5]

A number of experimental studies have evaluated the role of matrix with growth and differentiation factors to stimulate wound healing and tissue remodelling. Growth factors represent an area of interest for surgeons attempting to modify and enhance the wound healing process. Autologous growth factors derived from platelets are the primary agents of action in Platelet Rich Fibrin. Choukroun Platelet Rich Fibrin, a second generation platelet concentrate is an autologous leukocyte, cellular and fibrin matrix. It consists of an assembly of cytokines, glycanic chains and structural glycoprotein's enmeshed between a slowly polymerized fibrin network.[6] Three proinflammatory cytokines(IL-1β,IL-6E,TNF-α)and anti-inflammatory cytokine(IL-4) plus VGEF (angiogenesis promoter)[7] are also incorporated. Furthermore main angiogenesis soluble factors such as FGF (Fibroblast Growth Factor), Angiopoietin, PDGF (Platelet Derived Growth Factor) are included in the fibrin gel.[8]It helps to localize the growth factors essentially increasing the local concentration at the desired location to guide tissue regeneration. Beneficial effects of PRF have been studied in various procedures such a facial plastic surgery, sinus lift procedure, as sole osteoconductive filling material and for treatment of multiple gingival recession cases. [9]

Bone regeneration is dependent upon wound closure, blood supply, space maintenance and wound stability. Bone grafting is most successful when it occurs in a contained well vascularised environment stressing the importance of primary closure and the promotion of angiogenesis. Injury to blood vessels during oral surgical procedures causes blood extravasation, subsequent platelet aggregation and fibrin clot formation. PRF is like a fibrin network and leads to more efficient cell migration and proliferation. This unique structure may act as a vehicle for carrying cells that are essential for tissue regeneration. Recent study has demonstrated that the PRF has a significant sustained release of key growth factors for a period of at least one week and up to 28 days in contrast to Platelet Rich Plasma (PRP). This suggest that the membrane stabilizes the environment for a significant time for wound healing to be conducted.[10]

According to Simon Pieri et al. the use of PRF and bone grafts offers the following four advantages: first, the PRF membrane maintains and protects the grafted biomaterials

by stabilizing the fibrin clot and PRF fragments serve as biological connectors between osteoblasts. Second, the integration of this fibrin network into the regenerative site facilitates cellular migration, particularly for endothelial cells necessary for the neo-angiogenesis, revascularisation and survival of the graft. Third, the platelet cytokines (PDGF, TGF- β, IGF-1) are gradually released as the fibrin matrix is resorbed, thus supplying a continuous source of growth factors for wound healing to occur. Lastly, the presence of leukocytes and cytokines in the fibrin network can play a significant role in the self-regulation of inflammation within the grafted material.[11]

CASE DESCRIPTION

A 32 year old male patient complaining of food lodgement and pain in the lower right mandibular premolar region reported to the Department of Periodontics and Implantology.Patient did not give any relevant medical history and there was no systemic condition that could interfere with physiologic wound healing.On intraoral examination there was generalized bleeding on probing present and suppuration was not observed. The probing pocket depth on distobuccal aspect of the tooth was 9 mm from cementoenamel junction(reference point), periodontal attachment level was 8mm whereas no mobility was detected Bleeding on probing subsided after Phase I therapy and after inflammation subsided surgery was performed.(Figure 1).A perapical radiograph was taken which revealed the presence of interproximal intrabony defect in tooth and the defect size was noted to be 4 mm when seen radiographically using a grid.(Figure 2).

Oral hygiene instructions and motivation of the patient was reinforced for performing effective oral hygiene maintainance.Phase I therapy including scaling and root planning using curettes and ultrasonic instruments was done. Patient was recalled after three weeks and re-evaluation of the patient following non-surgical periodontal therapy was done. Probing pocket depth (PPD) and Clinical Attachment Loss (CAL) were measured after the non-surgical periodontal therapy and they were found to be 8mm and 7 mm.Surgical periodontal therapy was performed after the routine blood investigations were done.

PRF PREPARATION

PRF was prepared using the technique by Choukroun et al i.e. intravenous blood was collected in a 10-ml sterile tube without anticoagulant and immediately centrifuged in centrifugation machine at 3,000 revolutions per minute for 10 minutes. Blood centrifugation leads to formation of structured fibrin clot in the middle of the tube, just between the red corpuscles at the bottom and a cellular plasma at the top(Figure 3).PRF was easily separated from red corpuscles base using a sterile tweezer and scissor just after removal of platelet poor plasma.(Figure 4)

SURGICAL PROCEDURE

Intra-oral antisepsis was performed with 0.2% chlorhexidine digluconate rinse and iodine solution was used to carry out extraoral antisepsis.Local anaesthesia was given and then crevicular incisions were made for the reflection of mucoperiosteal flaps.(Figure 5)Defect debridement and root planing were carried out using ultrasonic instruments and area specific curettes. A 4 mm of defect was appreciable on the distobuccal aspect of 34 which was similar to findings recorded on the pre-operative radiograph with grid.PRF was mixed with bone graft containing hydroxyapatite crystals and placed into the defect(Figure 6).It was condensed and later covered with PRF membrane (Figure 7).The mucoperiosteal flap was repositioned and secured in place using 3-0 non-absorbable black silk surgical suture (Figure 8).The surgical area was protected and covered with periodontal dressing.

POSTOPERATIVE CARE

Antibiotics and analgesics were prescribed (amoxicillin 500 mg three times per day for 5 days and ibuprofen 400 mg three times per day) along with chlorhexidine digluconate (0.2%) rinses twice daily for one week. Periodontal dressing and sutures were removed. Surgical wounds were gently cleansed with 0.2% of chlorhexidine digluconate and patient was instructed for gentle brushing with a soft toothbrush. Patient was reinforced and motivated for proper oral hygiene measures postoperatively and follow up was done weekly up to 1 month after surgery then at 3 months.

RESULTS

Re-examination at 3 months after the periodontal surgery revealed that PPD was reduced from 9 mm to 4 mm and improvement of CAL from 8 mm to 3 mm with no sign of bleeding on probing and significant radiographic bone formation in the periodontal intrabony defect (Figure 9).The defect size was reduced from 4mm to 3mm and alveolar crest resorption was 0.5mm.

The radiographic defect resolution was calculated as:

Defect resolution=Bone fill-Alveolar bone crest change.

Thus, the defect resolution was 2.5mm.

The defect resolution in percentage=Defect resolution/defect of intrabony defect x 100.

Bone fill was 75% in this case.

DISCUSSION

The present case report demonstrates the clinical efficacy of PRF in the treatment of intrabony defect and significant improvement radiographically. PRF acts as a healing and interposition biomaterial. The fibrin matrix itself shows mechanical adhesive properties and act as fibrin glue to maintain the flap in a stable position enhancing neoangiogenesis, reducing necrosis and shrinkage of the flap.This environment guarantees maximal periodontal regeneration by remodelling and stabilization of the surgical site for wound.[10]

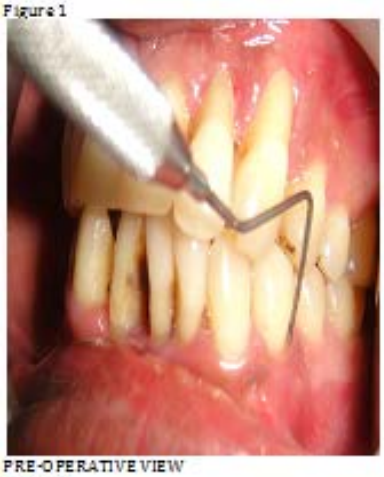
Polypeptide growth factors are biological mediators that have the ability to regulate cell proliferation, chemotaxis and differentiation. Platelet derived growth factor amongst all growth factors have favourable effect on periodontal regeneration. Platelet rich fibrin is a new step in the platelet gel therapeutic concept with simplified processing minus artificial biochemical modification. This technique requires neither anticoagulant nor bovine thrombin. Its advantages over platelet rich plasma include ease of preparation, minimal expense and lack of biochemical modification.

Platelet rich fibrin is a matrix of autologous fibrin where a large quantity of platelets and leukocyte cytokines are embedded during centrifugation. The intrinsic incorporation of cytokines within the fibrin mesh allows for their progressive release over time (7-11 days).The easily applied PRF membrane acts much like a fibrin

bandage, serving as a matrix to accelerate the healing of wound edges. It also provides a significant postoperative protection to surgical site. The platelets and leukocyte cytokines play an important role in biology of biomaterial.

PRF is a biomimetic material.It helps in better healing procedures, easy, fast and cost effective preparation without use of any anti-coagulant, along with functional intact platelets in fibrin matrix and substantial growth factors. PRF is considered the leader in fibrin techonology.PRF along with bone grafts have shown to be an effective regenerative modality for the treatment of osseous defects in periodontal diseases.

Figure 1



PRE-OPERATIVE VIEW

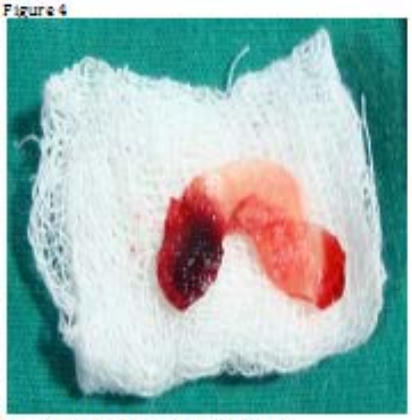
Figure 2

PRE-OPERATIVE RADIOGRAPH SHOWING INTRABONY DEFECT

Figure 3

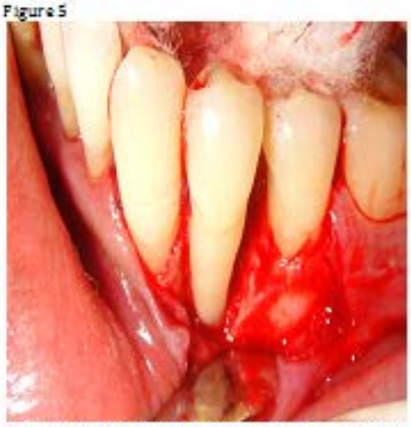
PREPARATION OF PLATELET RICH FIBRIN

Figure 4



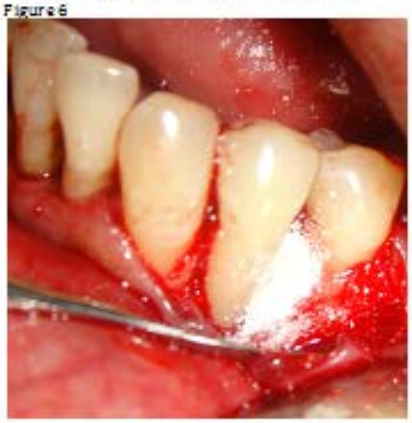
PLATELET RICH FIBRIN MEMBRANE

Figure 5



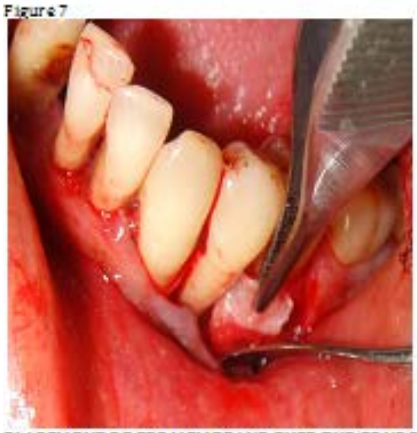
INTRABONY DEFECT AFTER REFLECTION OF FLAP

Figure 6



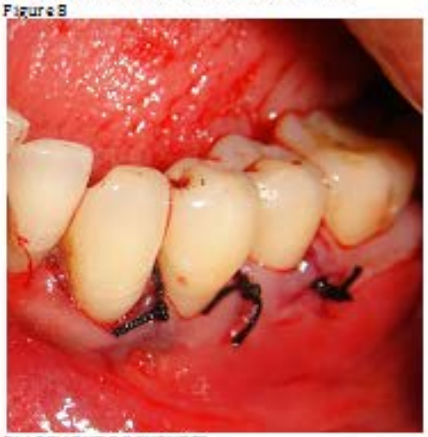
PLACEMENT OF BONE GRAFT IN THE DEFECT

Figure 7



PLACEMENT OF PRF MEMBRANE OVER THE BONE GRAFT

Figure 8



PLACEMENT OF SUTURES

Figure 9

POST-OPERATIVE RADIOGRAPH

CONCLUSION

The present case report demonstrated the clinical efficacy of PRF in the treatment of intrabony defect and showed significant improvement in clinical as well as radiographic parameters with 90% bone fill.

CLINICAL SIGNIFICANCE

Importance of autologous material prepared at very low cost chairside for periodontal regeneration

REFERENCES

1. Newman et al (2006): Carranza's Clinical Periodontology, 10th edition
2. Lekovic V ,Camargo PM , Weinlaender M, Vasilic N, Aleksic Z, Kenney B : Effectiveness of a combination of platelet rich plasma,bovine porous bone mineral and guided tissue regeneration in the treatment of mandibular grade II molar furcations in humans. J Clin Periodontol 2003:30(8):746-751.
3. Nevins M, Nevins ML, Karimbux N, Kim SW, Schupbach P, Kim DM: The combination of purified recombinant human platelet derived growth factor-BB and Equine particulate bone graft for periodontal regeneration. J Periodontol 2012 May;83(5):565-73.

4. Rosen PS, Reynolds MA, Bowers GM.: The treatment of intrabony defects with bone grafts. Periodontol 2000. Feb; 22:88-103.
5. Sclafani AP.: Safety, Efficacy and utility of Platelet Rich Fibrin: Matrix in facial plastic surgery. Arch Facial Plast Surg. 2011 Jul- Aug ; 13(4):247-51.
6. Inchingolo F,Tatullo M, Marrelli M, Inchingolo AM et al: Trial with Platelet Rich Fibrin and Bio-Oss used as grafting materials in the treatment of the severe maxillar bone atrophy: clinical and radiological evaluations: Eur Rev Med Pharmacol Sci. 2010 Dec;14(12):1075-84.
7. Choukroun J, Diss A, Simonpieri A, Girard MO et al: Platelet rich fibrin: A Second Generation, Platelet conceration:clinical effects of tissue healing: Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006 Mar;101(3):e56-60.
8. Nakatsu M, Sainson Richard, Aoto J, Taylor K et al: Angiogenic sprouting and capillary lumen formation modeled by human umbilical vein endothelial cells (HUVEC) in fibrin gels:the role of fibroblasts and Angiopoietin-1. I Microvascular Research 66 (2003):102–112.
9. Chen M, Zhang J, Zhang M, An Y, Chen F, Wu, Z. A review on endogenous regeneration techonology in periodontal regeneration medicine. Biomaterials 2010 Nov ; 31 (31). 7892-7927.
10. Toffler M, Toscano N, Holtzcal D, Corso M et al:Introducing Choukroun's Platelet rich Fibrin(PRF) to the reconstructive Surgery Mileu: J of Implant and Advanced Clin Dent 2009 Sept; 1(6).21-32.
11. Aroca S, Keglevich T, Barbieri B, Gera I, Etienne D: Clinical evaluation of a modified coronally advanced flap alone or in combination with a platelet rich fibrin membrane for the treatment of adjacent flap alone or in combination with platelet rich fibrin membrane for the treatment of adjacent multiple gingival recessions:A 6 month study. J Periodontol. 2009 Feb; 80(2):244-52.