Journal of Oral Biology and Craniofacial Research 2011 December
Volume 1, Number 1; pp. 41–43

Case Report

Periodontal regeneration in deep intrabony periodontal defect using hydroxyapatite particles with platelet rich fibrin membrane—a case report

Pavitra Rastogi[1], Himani Saini[2], Rameshwari Singhal[3], Jaya Dixit[4]

[1]Assistant Professor, [2]Postgraduate Student, [3]Lecturer, [4]Professor and Head, Department of Periodontics, Faculty of Dental Sciences, Chhatrapati Shahuji Maharaj Medical University (Erstwhile King George Medical College), Lucknow, India.

ABSTRACT

Background: Growth factors such as platelet-derived growth factors exert potent effect on wound healing including the regeneration of periodontium. Platelet-rich fibrin (PRF) membrane provides a concentrate of such growth factors, accelerating the wound healing process.

Materials and Methods: In this case report, regeneration of the deep periodontal intrabony defect was attempted using hydroxyapatite particles mixed in the PRF membrane to assess if regeneration of new bone is possible.

Results and Conclusion: This resulted in a rapid and complete healing with the decrease in the pocket depth and a gain in the clinical attachment level. Rapid regeneration of the periodontium can be achieved with bone substitutes by incorporating the various growth factors from autogenous blood.

Keywords: *Bone substitutes, growth factors, hydroxyapatite, periodontal regeneration, platelet-rich fibrin membrane.*

INTRODUCTION

The major goal of the periodontal therapy continues to be the regeneration of the attachment structure of the teeth, including new bone, periodontal ligament and cementum, destroyed by the periodontal disease or trauma. Periodontal regeneration can be achieved by a variety of surgical procedures including bone grafts,[1] bone substitutes,[2] guided tissue regeneration (GTR)[3] or a combination of bone grafts or bone substitutes and GTR.[4]

Autogenous bone grafts with their osteogenic, osteoinductive and osteoconductive properties have long been considered as an ideal graft material in bone reconstructive surgeries. However, drawbacks with autogenous bone grafts include morbidity, availability and unpredictable graft resorption. Similarly, although allografts and xenogfts do not require additional surgical site but have the potential to provoke an immune response. Taking this into consideration, bone substitutes like hydroxyapatite (HA) have been used in treating bone defects associated with periodontal disease. The main shortcoming of bone substitutes is the lack of osteoinductive and osteogenic property. This can be overcome by adding growth factors, which act as mitogenic and chemotactic agents, thus bringing rapid regeneration.

Growth factors can be applied in the form of either platelet-rich plasma (PRP) or platelet-rich fibrin (PRF). The PRF provides a concentrated suspension of growth factors found in the platelet. These growth factors have been shown to play an important role in growth and differentiation of the cells involved in the periodontal wound healing.[5,6] In the case described here, the PRF membrane combined with the HA particles was used for the intrabony defect to assess if the regeneration of a new bone was possible.

CLINICAL PRESENTATION

A 25-year-old male was referred to the outpatient Department of Periodontics at our center for receding upper anterior interdental papilla and extrusion of an upper anterior tooth. On clinical examination, clinical attachment loss of 10 mm was observed on the mesial, 9 mm on the buccal and 5 mm on the distal surface of the maxillary left central incisor (Figure 1).

Correspondence: *Dr. Pavitra Rastogi, E-mail: drpavitrarastogi@rediffmail.com*

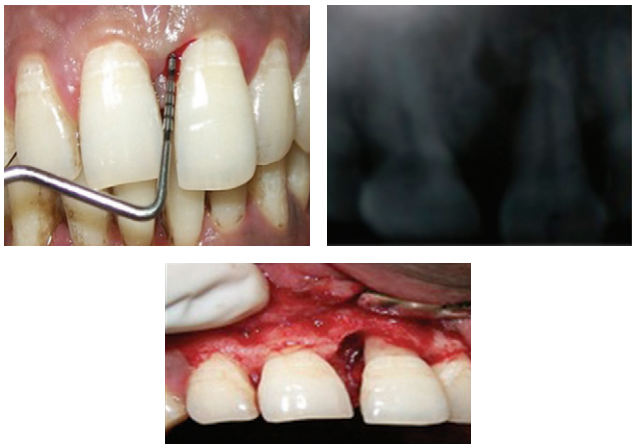

Figure 1 Intra-oral photograph showing pathologically migrated upper left central incisor with receding inter-dental papilla. Note the periodontal probe indicating a periodontal pocket of 9 mm on the mesial and 5 mm on the distal of this tooth, radiograph showing the intrabony defect on the mesial of the same tooth, intrabony defect.

The radiographical examination revealed an intrabony defect on the mesial surface (Figure 1). A diagnosis of the generalized chronic periodontitis was made with the generalized plaque and calculus deposition. The upper left central incisor had pathologically migrated due to the loss of periodontal support.

PRESURGICAL THERAPY

The patient was systemically healthy and there was no contradiction to the periodontal therapy. Initial periodontal therapy consisted of full mouth scaling and root planning. Oral hygiene instructions were given and reinforced throughout the treatment. Occlusal adjustment was performed by selective grinding. Following the completion of the initial therapy, a baseline examination was performed. Probing depths, clinical attachment level (CAL) measurements (Table 1), plaque and calculus score and gingival indices were recorded.

PLATELET-RICH FIBRIN PREPARATION[7]

The advantages of PRF over PRP are its simplified preparation and the lack of biochemical handling of the blood. The required quantity of blood was drawn in a 10 mL test tube without an anticoagulant and centrifuged immediately at 2700 rpm for 12 min. The resultant product consisted of the following three layers: topmost layer consisting of acellular platelet-poor plasma (PPP), PRF clot in the center, and red blood cells (RBCs) at the bottom. The PRF clot was then squeezed in the form of a membrane.

Table 1 Pre-operative and postoperative clinical assessment

In relation to the left maxillary central incisor	*Baseline*	*After 5 months*
Pocket depth (mm)		
Mesial	9	3
Distal	5	2
Facial	9	4
Clinical attachment level (mm)		
Mesial	10	4
Distal	5	2
Facial	9	4

SURGICAL PROCEDURE

The surgical procedure was performed under local anesthesia. Following intracrevicular incision, the muco-periosteal flap was raised taking care to preserve the marginal and interdental tissues at the maximum possible level. Vertical releasing incisions extending into the alveolar mucosa were performed for proper access to the defect. The inner surface of the flap was carefully curetted to remove granulation tissue. Complete defect debridement as well as scaling and root planning was done. The surgical area was then rinsed with copious amount of sterile saline and the defect at this point was classified as a two-wall intrabony defect with distal and palatal walls being present (Figure 1). The depth of the defect was 5 mm from the alveolar crest; 5 mL of the patient's blood was drawn in a test tube and centrifuged immediately to obtain PRF, which was then squeezed to form the PRF membrane (Figure 2). This membrane was then mixed with the HA particles and tightly packed into the defect to the level of the surrounding bony walls (Figure 2). After placement of the biomaterial, the flap was sutured using single interrupted sutures and the patient was instructed to rinse the mouth with 0.2% of chlorhexidine gluconate, twice a day and antibiotics and nonsteroidal anti-inflammatory drugs were prescribed for the next 5 days. Periodontal dressing was placed and the sutures were removed after 3 weeks. Mechanical oral hygiene was initiated at the end of 4th postoperative week.

Figure 2 Postoperative photographs showing healing with reduced pocket depths after a period of 5 months, platelet-rich fibrin membrane after squeezing platelet-rich fibrin clot, intrabony defect filled with hydroxyapatite particles in platelet-rich fibrin membrane.

RESULTS

A significant difference was noted in the pocket depth and attachment level values at baseline and 5 months after treatment as shown in Figure 2 and Table 1.

DISCUSSION

Regeneration in the deep intrabony defects remains a delicate procedure, due to slow and difficult integration of the grafted material into the physiological architecture. The recent use of the platelet concentrates aims to improve the process of integration by accelerating the bone and mucosal healing. Choukroun's PRF is a healing biomaterial that concentrates in a single autologous fibrin membrane, and consists of most platelets, leucocytes and growth factors from a 10 mL blood harvest, without biochemical modification (no anticoagulant, no bovine thrombin).

The PRF has been proposed to improve the handling of particulate grafts, facilitate graft placement and stability, improve the rate and quality of the vascular ingrowths, increase bone regeneration, enhance soft tissue healing and exert mitogen effects on critical cells.

The main growth factor in PRF which is most thoroughly studied and developed clinically is the platelet-derived growth factor (PDGF). This protein is present in the bone matrix and is secreted by the platelets during the early fracture repair. It is both chemotactic and mitogenic for osteoblasts and stimulates osteoblast type I collagen synthesis, which is the primary extracellular component of the bone.[8] Growth factors act by binding to the transmembrane receptor molecules on the mammalian cells and induce cytoplasmic cascade reaction, which give rise to the transcription of mRNA and intracellular and extracellular protein release.[9]

Thus, within the limits, this case report has shown that the use of PRF membrane resulted in a significant pocket depth reduction and clinical attachment level gain in much lesser time. Although the growth factors and the mechanisms involved are still poorly understood, the ease of applying PRF and its beneficial outcomes, including rapid healing and periodontal regeneration, holds promise for future. Well-designed and properly controlled studies are needed to provide solid evidence of the PRF's capacity and impact on wound healing and periodontal regeneration.

REFERENCES

1. Hiatt WH, Shallhorn RG. Intraoral transplants of cancellous bone and marrow in periodontal lesions. *J Periodontol* 1973; 44:194–208.
2. Kenney EB, Lekovic V, Sa Ferreira JC, Han T, Dimitrijevic B, Carranza FA Jr. Bone formation within porous hydroxyapatite implants in human periodontal defects. *J Periodontol* 1986; 57:76–83.
3. Becker W, Becker B, Prichard J, Caffesse R, Rosenberg E, Gian-Grasso J. Root isolation for new attachment procedure. A surgical and suturing method: three case reports. *J Periodontol* 1987;58:819–26.
4. Guillemin MR, Mellonig JT, Brunswold MA. Healing in periodontal defects treated by decalcified freeze-dried bone allografts in combination with e-PTFE membranes. Clinical and scanning electron microscope analysis. *J Clin Periodontol* 1993;20:528–36.
5. Lynch SE, Williams RC, Polson AM. A combination of platelet-derived and insulin-like growth factors enhances periodontal regeneration. *J Clin Periodontol* 1989;16:545–8.
6. Wang HL, Pappert TD, Castelli WA, Chiego DJ Jr, Shyr Y, Smith BA. The effect of platelet-derived growth factor on the cellular response of the periodontium. An autoradiographic study on dogs. *J Periodontol* 1994;71:752–9.
7. Sunitha RV, Munirathnam NE. Platelet-rich fibrin: evolution of a second generation platelet concentrate. *Ind J Dent Res* 2008;19:42–6.
8. Bolander ME. Regulation of fracture repair by growth factors. *Proc Soc Exp Biol Med* 1992;200:165–75.
9. Trippel SB. Growth factors as therapeutic agents. *Instr Course Lect* 1997;46:473–6.