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Second Generation Platelet Concentrate "Platelet Rich Fibrin" In Periodontal Surgery

KEYWORDS: Platelets, Growth factors, Platelet-rich fibrin

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ABSTRACT *The aim after periodontal regenerative surgery is to achieve complete wound healing and regeneration of the periodontal unit. Autologous platelet concentrate preparations are rich source of platelet-derived growth factor (PDGF) and transforming growth factor beta (TGF-β), both important in accelerating hard and soft tissue maturation and regeneration.*

The topical use of platelet concentrates is recent, and its efficacy remains controversial, and discovering which one of the platelet concentrates will help, is a clinician's dilemma. Here, we present a case reports of chronic periodontitis with bilateral intrabony defects (IBD), treated by means of autologous PRF. The clinical and radiological picture before intervention and following wound healing was assessed after six months post-op. There was a gain in the clinical attachment level and a decrease in probing depths. Radiographic evidences also showed that there was adequate bony fill.

This case showed that the PRF preparations can be a excellent alternative with a few added advantages such as ease of preparation/ application, minimal expense, sustained slow release of growth factors over a week, and lack of biochemical modifications (no bovine thrombin or anticoagulant is required).

INTRODUCTION

Researchers have long used biologically active molecules to achieve periodontal regeneration. One of them is platelets, which contains important growth factors like platelet derived growth factor (PDGF), transforming growth factors beta 1 and beta 2 (TGF-β 1 & 2), vascular endothelial growth factor (VEGF), interleukin-1 (IL-1), fibroblast growth factor (FGF), bone morphogenetic proteins (BMP) and platelet activating factor-4 (PAF-4) [1,2].

The use of PRP (Platelet Rich Plasma), also known as the "First generation platelet concentrates" and now PRF (platelet Rich Fibrin), also known as the "Second generation platelet concentrates" are hot topics for implant surgeons and periodontists alike. Discovering which one of these biological modalities will help us in enhancing our bone and soft-tissue procedures within the body, will help in resolving the clinician's dilemma [3].

Here, we present a case of chronic periodontitis, with bilateral intrabony defects (IBD), treated by means of autologous PRF, to investigate the healing properties as well as to evaluate the effectiveness of PRF as an effective interpositional biomaterial.

CASE HISTORY

A 30 year old female patient reported to the division of peridontology in the department of dental surgery of this institute, with chief complaint of pain in lower gums on both sides, for the past six months. On clinical examination, generalized probing (GP) was found to be more than 5 mm (GP is the distance from the margin of the coronal surface of gingiva to the base of the sulcus and GP >5mm corresponds to severe degree of clinical attachment loss). There was bleeding on probing (BOP), which correlated with severe bone loss at the base of tooth (due to the presence of infections). This was also correlated radiographically by an orthopantomogram (OPG), which revealed vertical bone loss with respect to 3 6 (left mandibular, 1st molar) and 4 6 (right mandibular, 1st molar) regions. She was diagnosed as a case of generalized aggressive periodontitis.

She had previously undergone a root canal treatment (RCT) in a private centre, 2 years ago at 4 6 region and thereafter underwent RCT at 3 6 location at our institute. The patient was taken up for dental surgery after 3 months. A full mouth open flap debridement was planned with the management of infrabony defect using 'regenerative therapy'.

Surgical Procedures:

Intraoral antisepsis was performed with 0.12% chlorhexidine rinse. After thorough debridement (under local anaesthesia cover) around 4 6 locus, the intra-osseous defect was filled with a combination of PRF mixed with bone substitute like beta tri-calcium phosphate and hydroxyapatite (BTCP+ HA). A second PRF was used as a membrane (obtained from the second blood sample) over the graft, which also acted like a barrier for guided tissue regeneration (GTR). The intra-osseous defect with respect to 3 6 locus was treated in a similar manner, where the bone substitute (BTCP+HA) was mixed with PRP and the defect was filled. This acted as a control, to compare the effects of PRF with an already existent method. The surgical area was protected and covered with periodontal dressing.

Post-operative care:

The patient was given suitable antibiotics and analgesics for five days. Periodontal dressing and sutures were removed two weeks post-op, proper oral hygiene was ensured and patient was kept under regular follow up. Six months post-op, there was an improvement in all the clinical parameters of both the sites, including probing depth

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(PD) and clinical attachment levels (CAL). There was resolution of inflammatory signs with appearance of healthy, firm and resilient tissues. There was no bleeding on probing (BOP). Radiographically, OPG revealed a bone-fill of both the vertical defects, indicating that healing was adequate with possible regeneration on both the sites (Figure 1 & 2).

DISCUSSION

The ideal goal for periodontal therapy is the reconstitution of bone and connective tissue attachment that has been destroyed by the disease process. At present, one of the most widely used periodontal regenerative modalities is bone graft therapy. Unfortunately, bone graft materials derived from the host or other living tissues may pose complications due to their inherent limitations [4].

PRF has been shown to stimulate mitogenic activity of human trabecular bone cell, thereby contributing to the regeneration of mineralized tissues. In our case also, there was radiological evidence of bone fill but the regenerative potential of PRF (or PRP) cannot be commented at this point (i.e. after 6 months post-op) as histological studies have not been carried out. However, studies using histomorphometric parameters have shown that PRP enhances regeneration of hard tissues [5].

PRF is referred to as a second generation platelet concentrate, first developed in France by Choukroun et al. It is considered to be a fibrin biomaterial, whose molecular structure has low concentration of thrombin, making it an optimal matrix for endothelial cells and fibroblasts migration. It permits rapid angiogenesis and forms a more resistant connective tissue. Therefore, these PRF membranes can be used for all types of superficial cutaneous and mucous healing. The PRF preparation process creates a gel like fibrin matrix that incorporates platelets, leukocyte, cytokines, and circulating stem cells [6].

At present, the PRF preparation protocol is a simple and inexpensive way to produce a platelet concentrate. In our case, just before the surgery, intravenous blood (by venipuncturing of the antecubital vein) was collected in two 10-mL sterile tubes without anticoagulant and immediately centrifuged in a centrifugation machine at 3,000 revolutions per minute (i.e around 80g) for 10 minutes. Centrifuging the blood immediately after collection allows the formation of a structured fibrin clot in the middle of the tube, just between the red corpuscles at the bottom and acellular plasma (platelet-poor plasma [PPP]) at the top (Figure 3). PRF was easily separated from red corpuscles base (preserving a small red blood cell [RBC] layer) using sterile forceps and scissor just after removal of PPP. A stable fibrin membrane was obtained by squeezing serum out of the PRF clot [7].

Method of preparation of PRF is a simple, fast, and cheap technique. The PRF obtained can be squeezed to form a membrane that can be used as fibrin bandage. It does not use bovine thrombin or other exogenous activators in the preparation process, which minimizes biochemical handling of blood and makes it strictly autologous. The membrane formed from PRF is elastic, amenable to suturing, and seems to be responsible for a slow yet sustained release of growth factors and matrix glycoproteins for almost a week [8]. The findings of Wiltfang et al from a series of clinical trials are encouraging, in which PRF has been considered as a better alternative to PRP [1,7].

Our case report demonstrates that, autologous PRF can be an effective alternative in the treatment of IBDs with uneventful healing of sites. The surgical dentistry in the near future will definitely revolutionize, with the use of PRF; however more histologic evaluations from other parts of the world are required to understand the true benefits of this second generation platelet concentrate [1].

Conflict of Interest: None of the authors declare any potential case of conflict of interest.

Ethical approval: All procedures performed in in the case report were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was obtained from the individual included in the case report.

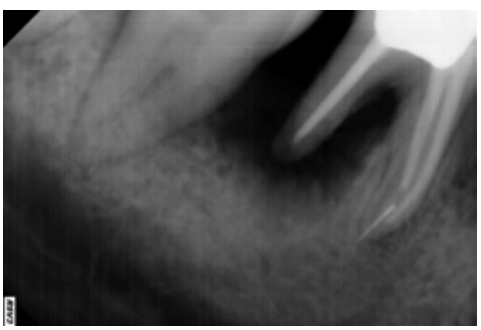

Figure 1: PRE-PROCEDURE- BONE LOSS AROUND 4 6 LOCATION

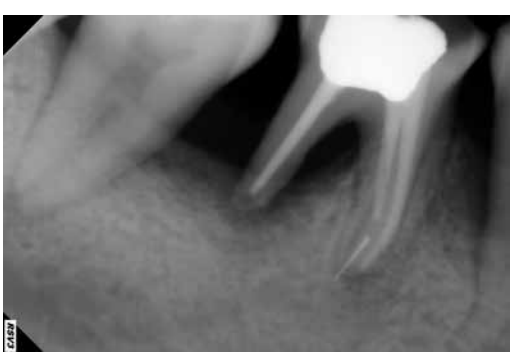

Figure 2: BONE FILL AFTER 6 MONTHS

Figure 3: PREPARATION OF PRF FROM WHOLE BLOOD AFTER CENTRIFUGATION

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