

Case Report

ALVEOLAR RIDGE AUGMENTATION UTILIZING PLATELET RICH FIBRIN IN COMBINATION WITH DEMINERALIZED FREEZE-DRIED BONE ALLOGRAFT – A CASE REPORT

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ABSTRACT

Platelet-rich fibrin, developed in France by Choukroun *et al.*, is a second generation platelet concentrate widely used to accelerate soft and hard tissue healing. It is a strictly autologous fibrin matrix containing a large quantity of platelet and leukocyte cytokines. It has also been shown to stimulate the growth of osteoblasts and periodontal ligament cells, both of which are significant for the regeneration of periodontal defects. Its advantages over the better known platelet-rich plasma include ease of preparation/application, minimal expense, and lack of biochemical modification (no bovine thrombin or anticoagulant is required). This article serves as use of platelet-rich fibrin in combination with demineralized freeze-dried bone allograft for alveolar ridge augmentation.

Key Words: *Growth Factor, Platelet Rich Fibrin, Platelet Rich Plasma*

INTRODUCTION

In order for a dental implant to be restored optimally, it must be placed in an ideal anatomic position. However, this is not always possible, since physiological wound healing following tooth extraction, trauma or pathology, often results in a deficiency of both hard and soft tissue. Unless augmentation procedures are carried out, placing an implant in these tissue-deficient sites would ultimately compromise the functional and aesthetic results (Chiapasco *et al.*, 2009). Although several different augmentation procedures have been developed, many of them are associated with a number of disadvantages such as increased overall cost, the requirement for a second surgical site, and the use of foreign graft materials (Darby *et al.*, 2009). Because these are relatively new procedure, very few studies regarding the techniques have been published; there is no evidence to support the superiority of one technique over the other.

Recently, Choukroun *et al.* introduced platelet rich fibrin (PRF), a second-generation platelet concentrate that improves healing of the both hard and soft tissues (Choukroun *et al.*, 2006). It consists of high concentrations of the collected platelets, which allow slow release of growth factors (GFs) (Kang *et al.*, 2011). These GFs include vascular endothelium growth factor (VEGF), platelet-derived growth factor (PDGF), fibroblast growth factor (FGF), epidermal growth factor (EGF), hepatocyte growth factor (HGF), insulin-like growth factor (IGF), and transforming growth factor- β (TGF- β). All of these play a role in replacing lost tissue, resurfacing of the wound, and restoring vascular integrity. Compared to other platelet concentrates, PRF releases these factors at a sustained rate over a longer period, thereby optimising wound healing (Blair and Flaumenhaft, 2009). Recently, PRF has also been shown to stimulate the growth of osteoblasts and periodontal ligament cells, both of which are significant for the regeneration of periodontal defects (Blair and Flaumenhaft, 2009; Ehrenfest *et al.*, 2010; Sharma and Pradeep, 2011; Mazor *et al.*, 2009; Simonpieri *et al.*, 2011). Here, we present a case where PRF was used in combination with demineralized freeze-dried bone allograft (DFDBA) for ridge augmentation procedure.

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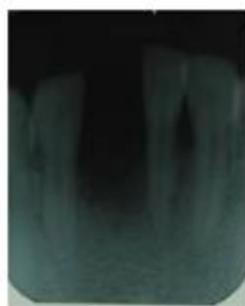
CASES

A 27-year-old male presented for the restoration of his dentition in the lower right jaw. Upon clinical examination, it was noted that #41 was missing (Figure 1). It was extracted before seven months due to caries. There was inadequate width for implant placement (Figure 1). The radiographic examination revealed the presence of inadequate vertical bone support for implant placement (Figure 2). In order to maximize the amount of available bone for implant placement, ridge augmentation procedure was implemented. There was no relevant medical history. The patient was a non-smoker.



Figure 1: Pre operative view of #41 showing inadequate width for implant placement

The patient was subjected to complete scaling and thorough root planning. The patient was given oral hygiene instructions. The patient was reviewed after one week. The procedure was explained to the patient and the consent was obtained for the same. Routine blood investigations were done.



Pre OP IOPAR

Figure 2: Pre operative IOPAR of #41 showing inadequate vertical bone support for implant placement

After assuring surgical asepsis, a pre-procedural rinse with 0.2% chlorhexidine gluconate was accomplished. After administration of local anesthetic (2% lignocaine with 1:80000 adrenalin), the conventional flap (crestal incision with two releasing incision) was adopted. A full-thickness

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flap was reflected. The defect area was curetted and all granulation tissue was removed. The exposed root surfaces were thoroughly scaled and root planed (Figure 3).



Figure 3: Conventional flap procedure

The PRF was prepared following the protocol developed by Choukroun *et al.* briefly, the procedure of PRF preparation: 10 ml intravenous blood was collected by venepuncture at the antecubital fossa. This was transferred into 10 ml sterile tube without anticoagulant and immediately centrifuged at 3000 rpm for 10 minutes. Fibrin clot formed in between the acellular plasma on top and the red blood cells at the bottom was separated using sterile tweezers and scissors (Figure 4).



Figure 4: PRF obtained

The PRF was mixed with DFDBA and placed in the defect with #41 (Figure 5). Suturing was done using 5-0 polyglactin 910 Vicryl. Then periodontal dressing was given.

The patient received postoperative instructions and was prescribed post operative antibiotic – amoxicillin 500 mg thrice for seven days and analgesic – aceclofenac 100 mg twice for three days.

Then, one week postoperatively, the dressing was removed and saline irrigation was done. The patient was monitored at regular intervals and was under maintenance therapy. At the end of 6 months, clinical examination and intraoral periapical radiograph of the treated area was taken. The clinical measurements were repeated and compared to the baseline values.

On examination during subsequent follow-up visits, treated area showed satisfactory healing without any post-operative complications. There was increase in width and height of the alveolar ridge at six months (Figure 6). Bone regeneration was noticed in radiograph (Figure 7).

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Figure 5: PRF mixed with DFDBA and placed in the defect with #41



Figure 6: Post operative width of the alveolar ridge at six months



Post OP IOPAR

Figure 7: Post operative IOPAR showing bone regeneration at six months

DISCUSSION

The healing of an extraction socket is characterised by both internal and external changes that ultimately affect the shape of the alveolar ridge (Darby *et al.*, 2009). Studies indicate that during healing, bone does

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not regenerate to the level of bone crest or to the level of the neighboring teeth, and therefore 100% socket fill does not occur. Using an animal model, Araujo and Lindhe showed that in the first 8 weeks following extraction, there is marked osteoclastic activity, resulting in the resorption of the facial and lingual bone walls, especially in the crestal region (Araujo and Lindhe, 2009). They also noted that bone resorption was greater on the facial wall and that any loss of ridge height was accompanied by a horizontal loss on both facial and lingual walls of the extraction site.

During the last decade several different ridge augmentation techniques have been developed, most of which include the use of a graft material (Darby *et al.*, 2009). This increases the treatment cost as well as increases the risk of disease transmission. Studies also indicate that in many cases, the graft material is not totally incorporated into the newly formed bone and when compared to sites without graft material, they show less vital bone formation. In some cases it requires the use of collagen membranes. In these cases a 25% membrane exposure rate has been reported, and this directly affects the amount of bone fill that takes place within the socket (Darby *et al.*, 2009).

PRF was first described by Choukroun *et al.*, 2006. It is considered a second-generation platelet concentrate and has been used in various surgical procedures in an attempt to enhance wound healing. It is prepared from the patient's own blood thereby eliminating the possibility of disease transmission or foreign body reactions. The preparation technique of PRF is simple and requires no special equipment. Blood is drawn into standard glass/silica coated blood collection tubes and centrifuged at a predetermined speed to ensure cell separation. No anticoagulants are used during the procedure and natural coagulation can therefore take place. This unique preparation technique allows PRF to trap at least 95% of the platelets of the collected blood into a fibrin mesh (Ehrenfest *et al.*, 2010). The fibrin mesh can then be easily manipulated into a membrane that allows it to be transferred to any surgical site. Here, high concentrations of the collected platelets allow for the slow release of growth factors (GFs) from the platelet granules (Kang *et al.*, 2011). These GFs include vascular endothelium growth factor (VEGF), platelet-derived growth factor (PDGF), fibroblast growth factor (FGF), epidermal growth factor (EGF), hepatocyte growth factor (HGF), insulin-like growth factor (IGF), and transforming growth factor- β (TGF- β). All of these play a role in replacing lost tissue, resurfacing of the wound, and restoring vascular integrity. Compared to other platelet concentrates, PRF releases these factors at a sustained rate over a longer period, thereby optimising wound healing (Blair and Flaumenhaft, 2009). Recently, PRF has also been shown to stimulate the growth of osteoblasts and periodontal ligament cells, both of which are significant for the regeneration of periodontal defects (Blair and Flaumenhaft, 2009; Ehrenfest *et al.*, 2010; Sharma and Pradeep, 2011; Mazor *et al.*, 2009; Simonpieri *et al.*, 2011).

Currently, PRF has been successfully tested in a number of procedures including maxillofacial surgery, periodontal surgery, and implantology (Sharma and Pradeep, 2011). Mazor *et al.* successfully used PRF as the only grafting material in a series of sinus augmentation procedures (Mazor *et al.*, 2009). With this technique Mazor *et al.* were able to demonstrate that PRF could stimulate new bone formation in areas that were previously deficient of the amount of bone required for implant placement (Mazor *et al.*, 2009). In a similar 6-year follow-up study, Simonpieri *et al.* were able to demonstrate that using PRF as a sole grafting agent was a viable long-term option in sinus augmentation procedures (Simonpieri *et al.*, 2011).

PRF has also been used successfully to treat periodontal defects. In a series of clinical trials conducted by Pradeep and Sharma it was shown that PRF could be used as a guided tissue regeneration (GTR) membrane to affect periodontal regeneration in three wall bony defects and degree II furcation lesions (Ehrenfest *et al.*, 2010; Sharma and Pradeep, 2011). Del Corso *et al.* published several case reports showing the successful use of PRF membranes in the management of both single and multiple gingival recession defects (Corso *et al.*, 2009). The clinical results were maintained successfully for at least one year. Ramakrishnan *et al.* and Shah confirmed this observation and showed that PRF could be used for root coverage procedures (Ramakrishnan *et al.*, 2009; Shah *et al.*, 2012).

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Conclusion

In the above case report, we demonstrated the successful use of PRF in an ridge augmentation procedure. The biomaterial acts by releasing high-concentration growth factors to the wound site, thereby stimulating healing and new bone formation (Kang *et al.*, 2011). Unlike other procedures, the use of PRF is a simple method that requires minimal cost and reduces the need for specialised grafting material. Because it is a completely autologous product, the risk of disease transmission and graft rejection is negated.

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