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A SIMPLIFIED APPROACH FOR MANAGING SEVERE HORIZONTAL RIDGE ATROPHY USING STICKY BONE ENRICHED WITH AUTOLOGOUS INJECTABLE PRF : A CASE REPORT

Dental Science

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ABSTRACT

Deficient alveolar bone height and width presents as a major challenge in placing dental implants for successful rehabilitation of edentulous areas. To overcome this, Guided Bone Regeneration (GBR) using bone graft and barrier membrane is used as a well-established technique for augmentation of atrophic alveolar ridges. For successful GBR, stability of bone graft, space maintenance, angiogenesis and tension free primary sutures are essential. A new concept of biologically activated bone graft matrix (also known as "Sticky bone") using autologous Injectable Platelet Rich fibrin (I-PRF) has been utilized in order to enhance bone regeneration in a predictable and simple manner. Sticky bone provides stabilization of bone graft and, therefore, accelerates tissue healing and minimizes bone loss during healing period. This case report presents the management of severe alveolar horizontal bone deficiency using Sticky Bone for successful implant treatment .

KEYWORDS

Injectable PRF, Sticky Bone, GBR

INTRODUCTION

Implant supported dental restorations have become a major option in the treatment of edentulous alveolar ridge for the past several decades. Extensive loss of alveolar bone presents a complex challenge for reconstruction. Numerous augmentation techniques are currently in use to create sufficient bone volume for reliable placement of endosseous implants in severely resorbed edentulous alveolar ridges.[1] In order to accelerate healing of bone graft over the bony defect, numerous techniques utilizing platelet and fibrinogen concentrations have been introduced in the literature. Platelet is known to contain high quantities of growth factors, such as transforming growth factors s-1 (TGFs-1), platelet-derived growth factor (PDGF), epithelial growth factor (EGF), insulin growth factor-I (IFG-I) and vascular endothelial growth factors (VEGF), which stimulates cell proliferation and up regulates angiogenesis.[2]

PRF was first developed in France by Choukroun et al. for specific use in oral and maxillofacial surgery. This technique requires neither anticoagulant nor bovine thrombin (nor any other gelling agent). It is nothing more than centrifuged blood without any addition, which makes it possible to avoid all the restrictions of the French law related to blood-derived product re-implantation.[3,4] The conventional protocol includes centrifuging freshly collected blood without any anticoagulant in glass-coated test tubes at 2700 rpm for 12 minutes. This treatment results in the formation of 3 distinct layers, the bottom layer contains red blood cells; the middle layer consists of a platelet-rich fibrin clot containing polymerized fibrin, platelets, white blood cells, and glycosaminoglycans (heparin, hyaluronic acid); and the top layer contains platelet-poor plasma. The middle layer can then be retrieved and used in its clot form or compressed to form a membrane.[5] The advantages of using PRF are that it is completely autologous, easy to prepare, inexpensive, and that it provides sustained release of growth factors over time.[6] So, PRF is gaining acceptance as a bioactive surgical additive in regenerative dentistry. However, PRF has only been available in gel or membrane form and is not suitable for injection. Recently, however, a liquid, injectable PRF has been introduced which can be mixed with particulate bone grafts cohesively to form " sticky bone" which can be easily used for bone regeneration.[5] The protocol for making I-PRF is different than that for obtaining membrane form of PRF in terms of centrifugal speed, time and type of test tubes used. This case report highlights the management of atrophic implant site and bone deficiency with "sticky bone" as a simple and smart alternative to conventional bone regeneration methods.

Case Report

A 26 year old male patient undergoing orthodontic treatment was referred to the Department of Prosthodontics (Subharti Dental College, Meerut) for the rehabilitation of missing maxillary right central incisor. Clinical and radiographic (CBCT) examination revealed severe horizontal ridge deficiency on the right maxillary central incisor (11 region) (figure 1) . The ridge width in 11 region was only 3mm (figure 2). It was planned with the consent of patient to go for surgical placement of implant in the edentulous site with horizontal bone augmentation with sticky bone.

Figure 1 : Pre-Operative view

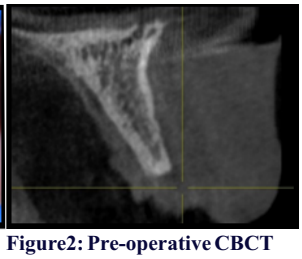

Figure2: Pre-operative CBCT showing ridge atrophy

The sticky bone (figure 3) was prepared just before the surgery using the following protocol:

1. 20 ml of patient's venous blood was drawn in a syringe which was poured equally in four non-coated plastic test tubes without any anticoagulant.
2. All the test tubes were centrifuged at 700 rpm for 3 minutes.
3. The tubes were retrieved from the centrifuge and it was ensured that the blood had separated into two fractions. The bottom layer fraction consisted of red blood cells, and the top layer consisted of plasma, platelets, and coagulation factors still in un-coagulated form. The separated plasma and platelets form a light-yellow colored layer in liquid form.
4. The top layer was aspirated using a syringe. The tip of the syringe was placed just above the junction of the 2 layers and the top layer was carefully aspirated. The aspirate was a partially active injectable form of PRF.

After the injectable PRF was obtained, it was mixed with particulate bone graft (1:1 allograft with xenograft). The particulate size of bone graft was 0.5-1 mm. After, approximately one to three minutes, the aspirate became a cohesive mass with a putty like consistency.

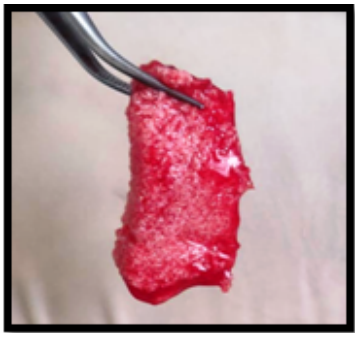

Figure 3 : Prepared Sticky Bone

The implant surgery was performed under local anesthesia by using 2% lidocaine with 1:1,00,000 epinephrine. Full thickness mucoperiosteal flap was elevated to expose the implant site. The edentulous site showed severe narrow alveolar ridge (3 mm wide). Osteotomy was performed at the edentulous site with surgical drills rotating at 1000 rpm under copious saline irrigation after ensuring its correct direction (figure 4). An implant (alpha-biocare dfi) of size 3.75 mm x 13 mm was placed in 11 region. Prepared sticky bone using bovine bone (geistlich bio-oss) and mineral allograft (puros, zimmer dental) was grafted over the exposed implant surface and bony defect labially (figure 5). A resorbable collagen membrane (periocol- eucare pharmaceuticals pvt. Ltd.) Was covered over the bone graft. Finally, primary closure was done using resorbable vicryl sutures followed by post- operative opg (figure 6). After six months, another cbct evaluation of 11 region was done and it revealed favorable horizontal ridge augmentation around the dental implant. A horizontal bone gain of 5-6 mm was achieved (figure 7). Stage ii surgery was performed during which resonance frequency analysis (rfa) using ostell (u.s.a.) Device demonstrated an implant stability quotient (isq) value of 80. Following this, gingival former was placed on the implant and after two weeks, the impression was made and finally implant was restored with metal ceramic crown (figure 8, 9). The patient was satisfied with the final result.

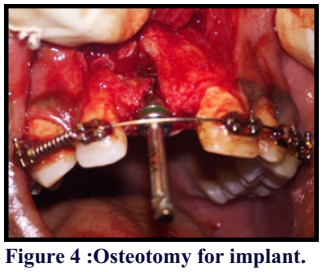

Figure 4 :Osteotomy for implant.

Figure 5 : Sticky Bone graft placed veneered over exposed implant surface.

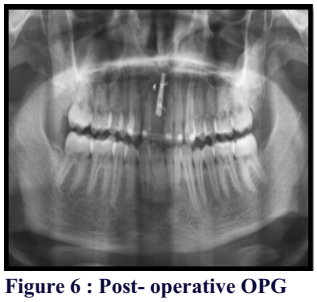

Figure 6 : Post- operative OPG

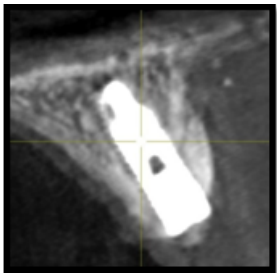

Figure 7 : 6 months Post-operative CBCT

Figure 9 : Frontal view after Crown placement

Figure 10 : Post-operative smile

DISCUSSION

Atrophic alveolar ridge is a challenging site to place implant. GBR using bone graft and barrier membrane is a well-established technique for augmentation of atrophic alveolar ridges. For successful GBR, stability of bone graft, space maintenance, angiogenesis, and tension free primary suture are essential.[7] Space maintenance with particulate bone graft should be provided during healing period. However particulate bone graft is easily migrated when grafted on the large horizontal/vertical bone defect. To reconstruct large one or two wall bony defect or for the 3-dimensional ridge augmentation, bone tack on the collagen membrane or titanium mesh is required to contain particulate bone graft during healing but these procedures are surgically time consuming and technique sensitive. In addition, the early exposure of titanium mesh causes bone loss and infection which causes failure of bone augmentation. For solid space maintenance in the severely atrophic alveolar ridge, block bone graft procedure is widely accepted but this technique has several disadvantages such as early exposure of bone graft, neurosensory disturbance, increased patient's postoperative discomfort and surgical cost, delayed surgical time and additional surgery from donor site.[8,9]

Sticky bone has numerous advantages: 1) it is moldable, so well adapted over various shape of bony defect; 2) Micro and macro movement of grafted bone is prevented. So the volume of augmentation is maintained during healing period, therefore the need of block bone and titanium mesh is minimized; 3) Fibrin network entraps platelets and leukocytes to release growth factors, so bone regeneration and soft tissue is accelerated; 4) No biochemical additives are needed to make sticky bone unlike PRP or PRGF; 5) Fibrin interconnection minimizes soft tissue in growth into the sticky bone graft.[2]

In this case report, the rationale behind using autologous I-PRF was that injectable PRF technically contains all components of PRF, including the platelets, white blood cells, and all the clotting factors comprising fibrinogen, in an uncoagulated form.[5]

CONCLUSION

Sticky bone is a simple and effective method for reconstruction of atrophic edentulous ridges making it a minimally invasive ridge augmentation procedure. Since, there is little literature available on I-PRF, so, more clinical trials are required to establish evidence for long term predictability and success of sticky bone in the management of atrophic ridges for implant treatment.

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