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CASE REPORT

# Socket Preservation at Molar Site using Platelet Rich Fibrin and Bioceramics for Implant Site Development

**Himani Swatantrakumar Gupta, Kamedh Yashwant Chowdhary, Tushar Sakal Pathak, Vineet Vaman Kini Richard Pereira, Abhishek Mistry**

## ABSTRACT

**Background:** The extraction socket preservation technique conserves the alveolar architecture and prevents hard and soft tissue collapse that minimizes the necessity for future augmentation procedures. Also, considerable interest has recently emerged over the potential benefits of using platelet rich fibrin (PRF), a highly concentrated form of platelets power packed with growth factors encased in a leukocyte rich matrix that enhances osteogenic differentiation and bone repair. This article describes the currently improved technique utilizing alloplasts with autologous PRF to be implemented for preserving a future implant site.

**Materials and methods:** Following the atraumatic extraction of the periodontally compromised tooth, the socket bony walls were debrided and decorticated to facilitate regional acceleratory phenomenon. Venous blood was drawn from the antecubital fossa of the patient and was centrifuged according to Choukroun's method to yield autologous PRF that was minced into uniformly sized bits. Except for 2 to 3 mm of the coronal aspect of the socket, the rest was filled with particles of a slowly resorbing bone substitute material mixed homogeneously with minced PRF. A collagen membrane was used to seal the coronal end of the socket and was stabilized using 3-0 black braided silk sutures.

**Results:** Clinically and radiographically satisfactory and successful regeneration of the deficient ridge's hard and soft tissues was demonstrated after 6 months post therapy.

**Conclusion:** Socket preservation surgery utilizing bioceramics and PRF is an effective procedure for posterior socket preservation coupled with rapid healing and aids in providing sound bone quality for successful implant placement.

**Keywords:** Bone, Case report, Preservation, Socket, Platelets.

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## INTRODUCTION

The healthy natural tooth stimulates the alveolar bone, thus maintaining its volume and density. The removal of a tooth begins a cascade of events within the socket that completely heal with bone formation within 4 to 6 months. However, the final contour of the bone is reduced in width by 25%, increasing to about 40% loss in 3 years.[1] In addition, as the epithelium migrates over the socket, the intraseptal bone is lost and the bone slopes from the higher lingual aspect to the more apical facial cortical plate, which reduces the crestal height of bone. It is speculated that this is due in part to the constriction of the blood clot within the alveolus and the thin labial cortical plates remodeling in response to inadequate blood supply after the extraction. In addition, pre-existing periodontal or endodontic disease or trauma from the extraction often destroy the labial bony plate and causes the immediate loss of width and height of bone, which may exceed 50% of the optimum volume.[2]

The elaboration of the therapeutic spectrum in periodontics is in vogue and currently encompasses a narrow therapeutic window offered by novel techniques to reconstruct ridge defects using soft tissue grafts. These technically exacting procedures frequently involve complex flap manipulation that may account for some unwarranted side effects, such as gingival marginal recession, loss of keratinized gingival tissue, reduced interdental papillary height and scarring of the soft tissues.[3] Hence, the vehemence in determining the characteristics of those procedures leans more toward the quality of the regenerated bone as a prerequisite for establishing an adequate implant site and less toward the preservation of the topography and the esthetic contours of the soft tissues of the ridge. Socket seal surgery, a simplified, minimally invasive regenerative approach, was introduced more than a decade ago as a tool for optimizing the preservation of the hard and soft tissue components of the alveolar ridge immediately following tooth extraction.[4] There are a varied number of techniques that collectively fall in the category of socket seal procedures. These are:

1. Connective tissue grafts—Langer and Calanga (1980).
2. Socket seal or free gingival graft—Landsberg and Bichacho (1994).
3. Biocol or resorbable hemostatic plug technique—Sklar (1999).
4. Guided bone regeneration using resorbable/nonresorbable membranes.
5. Alloderm or acellular dermal graft—Misch (1998).
6. Prosthetic pontic socket plug.
   - Removable—Misch (1998), Kois And Kan (2001)
   - Fixed—Kois (1998), Spear (1999), Sklar (1999).
7. Combination epithelized subepithelial connective tissue graft—Stimmelmayr (2010).
8. Modified socket seal surgery with composite graft approach—Misch and Misch (1999).

When incorporated as part of the site preparation for an implant restoration, placing a graft into an extraction socket

provides a scaffold for the in-growth of cellular and vascular components to form new bone of acceptable quality and quantity. Bioceramics are a group of alloplasts that comprise mainly of biphasic β-tricalcium phosphate and hydroxy-apatite that are primarily osteoconductive in nature, mirroring the chemical composition and structure of human bone and is well tolerated by the body. When it is placed in a bone defect, it only occupies 10% of the defect space leaving 90% of the space for regeneration of new bone.[5] Autologous blood concentrates constitute a safe and convenient approach to deliver high concentrations of polypeptide growth factors to periodontal surgical wounds. Among platelet concentrates, platelet-rich fibrin (PRF) belongs to a group of second-generation blood autologous preparations that was originally described by Choukroun et al. PRF is obtained by gentle centrifugation of peripheral blood and is characterized as being leukocyte and platelet rich and fibrin dense, besides not requiring the addition of any anticlotting agent. PRF can be used directly as a filler agent or compressed into a membrane. PRF is believed to release polypeptide growth factors, such as transforming growth factor-β1, platelet-derived growth factor, vascular endothelial growth factor and matrix glycoproteins (such as thrombospondin-1), into the surgical wound in a sustained fashion for at least 7 days.[6]

The combination of bioceramics and PRF present a preserved crystalline structure well integrated within an organic matrix. This combination may prove effective in regenerating deficient bone volumes. This paper presents a case report of socket seal procedure carried out to preserve and augment the bone at the mandibular first molar site, for future implant placement, utilizing bioceramics and PRF.

## CLINICAL PRESENTATION AND CASE MANAGEMENT

The patient, aged 35 years, presented to the Department of Periodontics in November 2012 with the chief complaint of pain and mobility associated with 36. The patient was a nonsmoker and had good general health. Clinical examination revealed that the tooth was periodontally compromised with a pocket depth of 10 mm mid midbuccally and grade II mobility (Fig. 1). Tooth was sensitive upon vertical percussion or vestibular palpation. The tooth was found to give no response when electric pulp vitality test was conducted. Radiographic examination revealed bone present only on the mesial root and there was radiolucency in the inter-radicular area accompanied with pathologic migration along with root resorption of the distal root (Fig. 2). The patient voiced his opinion regarding no additional intervention to save the tooth. Consequently, two main options were discussed: replacing the tooth with an implant and replacing the tooth with a fixed prosthesis such as a bridge. The patient opted for an implant.

## CLINICAL PROCEDURE

### Initial Therapy

Initial therapy consisted of detailed oral hygiene instructions. Full mouth scaling and root planing was performed using hand curettes and an ultrasonic device under local anesthesia. Trauma from occlusion was evaluated by examining the obvious presence of fremitus in centric occlusion or in working or balancing excursions. Six to eight weeks following phase I therapy, a periodontal re-evaluation was performed to confirm the suitability of the site for this periodontal socket seal surgery.

### Preoperative Protocol

Following thorough cleansing of the teeth, the patient was instructed to use 0.2% chlorhexidine as a mouthrinse. Patients' vital signs were determined and assessed before commencing surgical treatment. To minimize vaso-constriction, a local anesthetic (lidocaine 2%), with minimal epinephrine concentration, i.e. a maximum of 1:100,000, was administered in the extraction site.

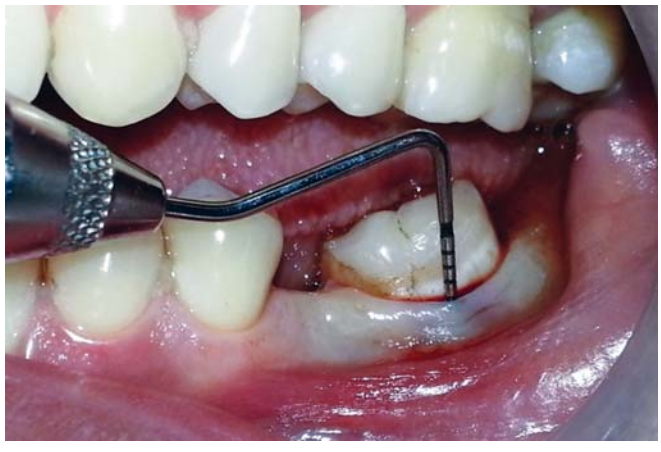

**Fig. 1:** Deep periodontal pocket with 36

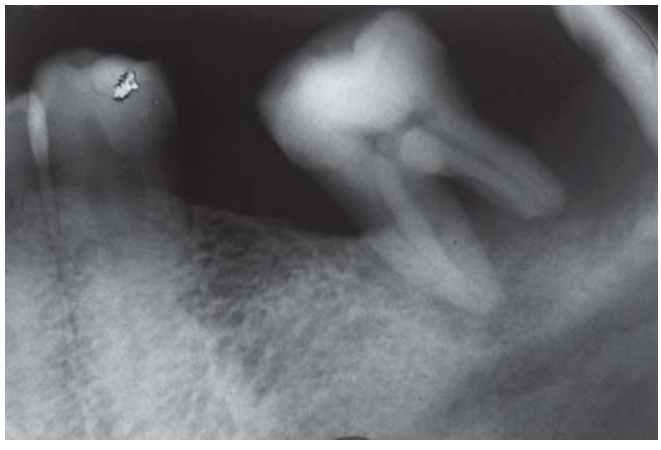

**Fig. 2:** IOPA preoperative

## Tooth Removal

A sharp #15 surgical blade was used to sever the dento-gingival and dentoalveolar connective tissue fibers around 36. To achieve a forceless extraction, a slow, gentle rotational-pulling force was preferred until the periodontal ligament fibers were torn completely and to minimize the amount of mechanical pressure applied to the buccal bone. Thumb support against the labial aspect of the alveolus and a check on the state of the soft tissue walls of the fresh extraction socket to ensure intactness was done (Figs 3 and 4).

## Socket Preparation

The fresh socket was debrided thoroughly of granulation tissue and residual periodontal ligament fibers followed by a thorough evaluation of the remaining bony housing. The socket bony walls were decorticated with a half round bur further in their apical part (except for the labial wall) to increase the participation of endosteal bone-forming cells in the wound (Fig. 5). The epithelialize dinner layer of the gingival walls at the socket orifice is removed gently by a sterile water-cooled high-speed coarse diamond bur to expose the vascularized lamina propria.

## Preparation of PRF

Immediately before the surgical procedure, 10 ml of blood was drawn from the subject's antecubital vein. The blood sample was collected in glass-coated plastic tubes not containing any anticlotting agent. The blood-containing tubes were immediately centrifuged at 1,000 gm for 10 minutes. The centrifuged blood mass presented with a structured fibrin clot in the middle of the tube, between the red corpuscle layer on the bottom and the acellular plasma on top (Fig. 6). The fibrin clot could easily be removed from the tube and shaped freely, and was used immediately after its collection.[6] PRF was compressed between two tongue blades in order to take the form of a consistent membrane, which was minced and incorporated with the bone graft (Fig. 7).[7]

## Bone Grafting

An osteoconductive material composed of β-tricalcium phosphate and hydroxyapatite (Ossifi Equinox, Mumbai), in the ratio of 30:70, was selected for socket seal. Minced PRF was mixed with the bone graft and placed in the socket (Figs 8 and 9). Condensation of the bone graft was not done because this action could block or inhibit vascularization and mesenchymal cell participation inside the healing socket. Except for the most coronal 2 mm, the bone material with PRF was used to fill the socket. This allowed appropriate space for the collagen sponge to be placed atop the bone graft.

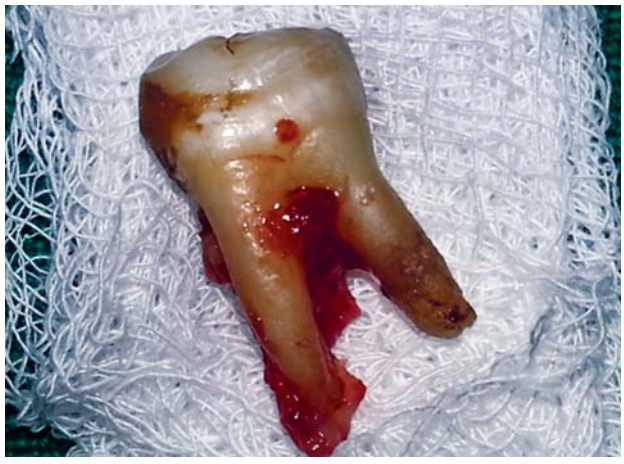

**Fig. 3:** Atraumatically extracted tooth

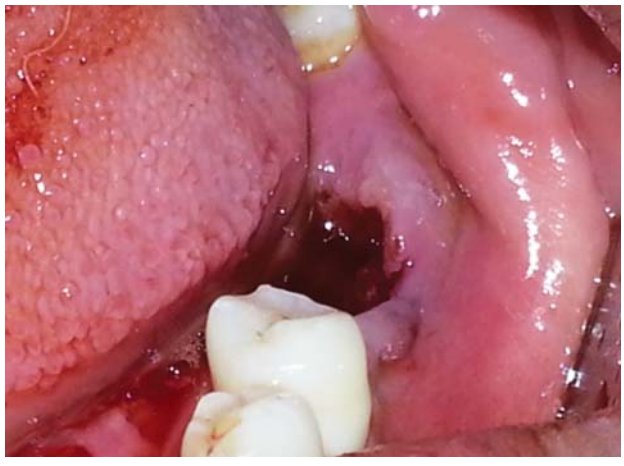

**Fig. 4:** Extraction socket after removal of 36

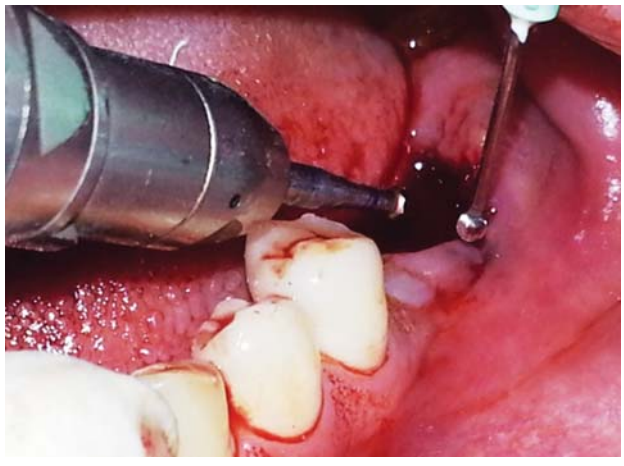

**Fig. 5:** Decortication of socket walls

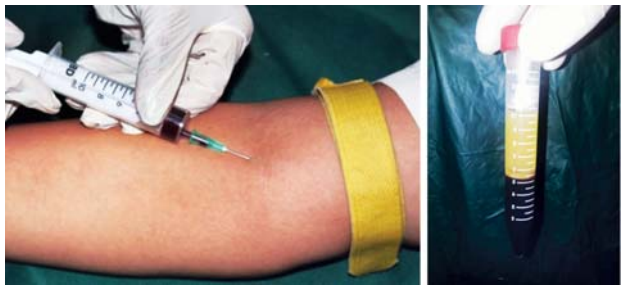

**Fig. 6:** Venous blood drawn and centrifuged

### Socket Sealing and Suturing

The extraction socket graft was covered with resorbable collagen sponge to protect the bone graft from the intrusion of undesired tissue growth and oral debris. Resorbable collagen sponge (Surgispon, Aegis Lifesciences, Gujarat) was inserted just below the free gingival margins without pouch or flap elevation (Fig. 10). The membrane was intentionally exposed and secured using cross-mattress black braided silk sutures (Fig. 11).

### Postoperative Treatment

Periodontal dressing was placed over the surgical area, and antibiotics (amoxicillin 500 mg every 8 hours for 7 days) and oral analgesics (ibuprofen 400 mg, every 4 hours as needed for pain) were prescribed. A 0.2% chlorhexidine mouthwash was prescribed every 12 hours for 2-week duration postsurgically. Patient was instructed not to use a toothbrush or mechanical cleansing at the surgical area. Only a soft diet is advised for the first 2 weeks of the healing process. Sutures were removed 7 to 14 days postsurgery and healing was found to be satisfactory, with no bone graft exposed to the oral cavity. The patient did not report any untoward consequences. The patient was assessed after 3 months (Figs 12 and 13) and 6 months (Figs 14 and 15).

## DISCUSSION

The use of bone replacement grafts have both been shown to enhance socket healing and to potentially modify the resorption process. Bone augmentation techniques using β-tricalcium phosphate and hydroxyapatite have demonstrated potential in surgical therapy.[8] It has been found to be biocompatible, biodegradable, osteoconductive, safe and nontoxic. The unique microscopic structure of this bioceramic demonstrates 90% interconnected porosity. When it is placed in bone defect, it occupies 10% of the defect space leaving 90% of the space for regeneration of bone.[9] The purity and synthetic nature of this material ensure safe grafting without the risk of transmitting viral infections. The pore size of this material is highly reproducible and constant. This reproducible interconnected porosity combined with a large granular inner surface area provides the highest degree of osteoconductivity through clot

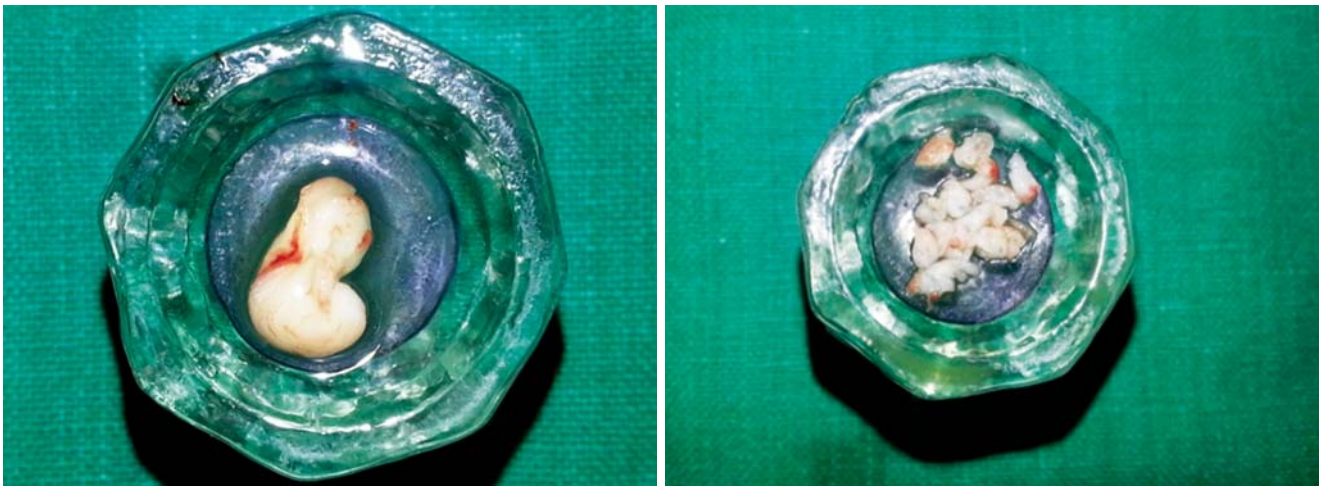

**Fig. 7:** Platelet rich fibrin whole and minced

**Fig. 8:** PRF mixed with bioceramic bone graft

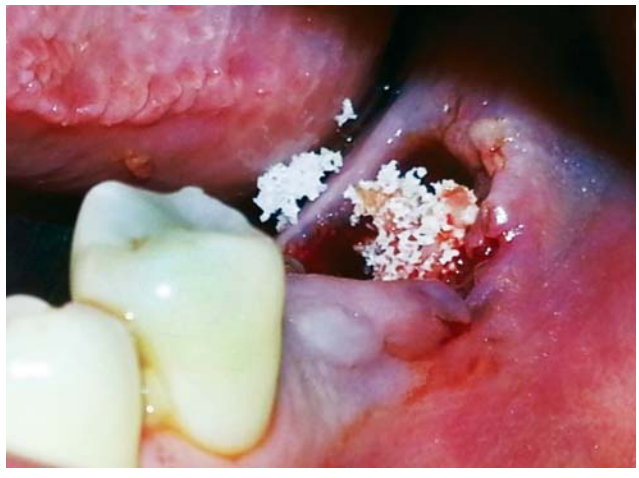

**Fig. 9:** PRF with bioceramics grafted in the extraction socket

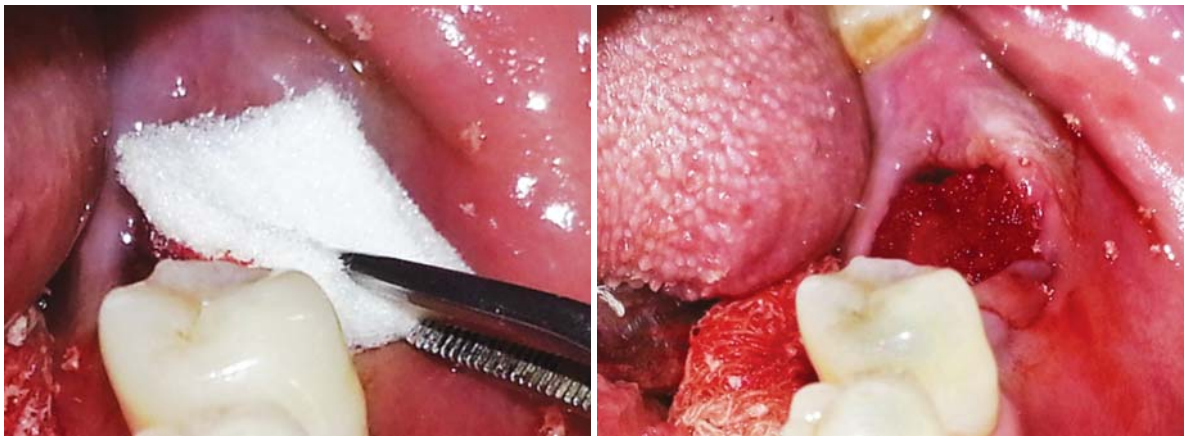

**Fig. 10:** Collagen sponge placed over the grafted socket

**Fig. 11:** Site closure with cross-mattress sutures

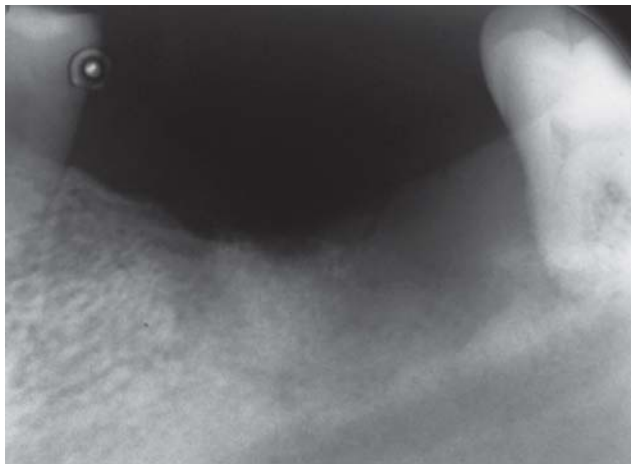

**Fig. 13:** Radiographic appearance of socket after 3 months

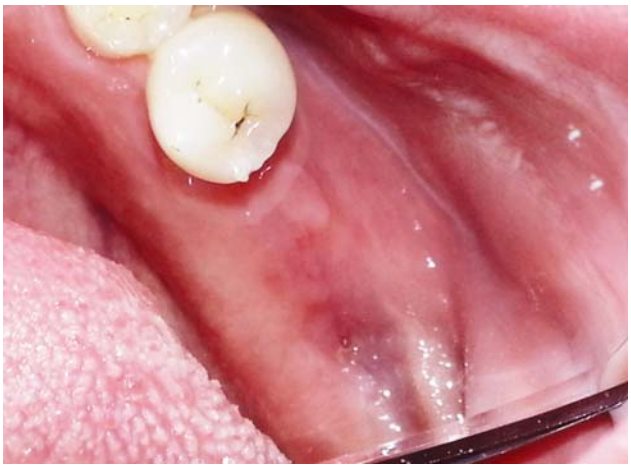

**Fig. 12:** Postoperative view after 3 months

stabilization, vascularization, cell adhesion and penetration of host bone repair into the inner part of the graft material. Biphasic calcium phosphate enhances the biological resorption of the granule and ensures optimum bone ingrowth and formation.[5]

As it undergoes degradation, it leaves behind a calcium phosphate trellis. Osteoblasts attach to it and start secreting the bone matrix.[9] Kim et al reported that on light microscopic level, new bone can be seen adhering to the bioceramic graft particles on re-entering the socket.[10]

Simonpiori et al summarized the advantages of PRF as it maintains and protects graft materials, serving as biologic connector between bone particles. It integrates fibrin network into regenerative site and facilitates cellular migration (neoangiogenesis). Also, platelet growth factors get released as fibrin network is resorbed over a period of time. Leukocytes in fibrin network play a role in self-regulation of inflammatory phenomenon of the graft material.[11]

Resorbable barriers were used to cover the graft material. It is biocompatible, exhibits multidirectional strength and tear resistance, easy to use, and possesses adequate cell occlusiveness to promote osteoblasts proliferation while excluding gingival cell invasion. The use of an occlusive membrane eliminates the problem of particle migration while simultaneously preventing epithelial and soft tissue migration into the socket. It also prevents external ridge resorption in the early healing period.[12]

This technique offers the dual vantage of maintaining soft and hard tissue contours as well as augmenting bone with the help of autologous PRF and bone simulating bioceramics. However, histologic and radiographic analysis

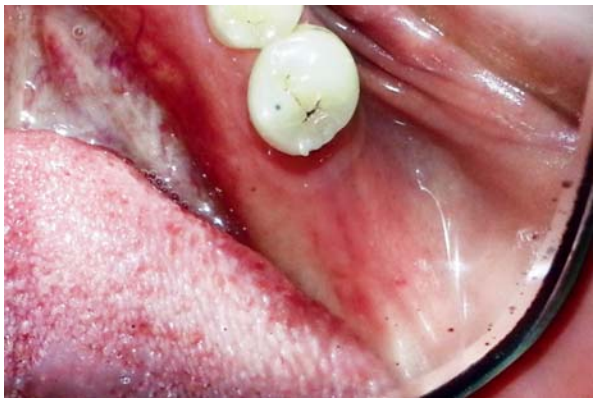

**Fig. 14:** Postoperative view after 6 months

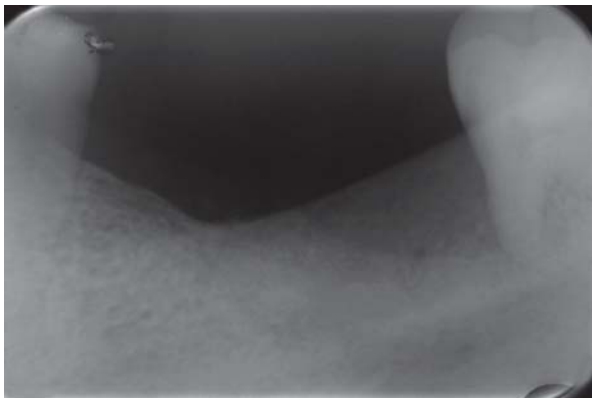

**Fig. 15:** Radiographic appearance of socket after 6 months

needs to be done to evaluate the effectiveness of this combination in the socket preservation procedure.

## CONCLUSION

Socket preservation procedures at the time of tooth extraction improve the prognosis related to maintenance of the width and height of the remaining bone. The combination of bioceramics and PRF proves to be beneficial in achieving successful socket preservation.

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