Case Report

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EXTRACTION AND IMMEDIATE IMPLANT PLACEMENT USING A COMBINED PRF, AND PROVISIONALIZATION TECHNIQUE

Abu-Hussein Muhamad[1],Abdulgani Azzaldeen[2]

1.University of Naples Federic II, Naples, Italy, Department of Pediatric Dentistry, University of Athens, Athens, Greece.

2.Department of Conservative Dentistry, Al-Quds University, Jerusalem, Palestine.

ABSTRACT:

The placement of dental implant into fresh extraction sockets was introduced in 1970 and is a well established treatment option for replacing missing teeth, allowing the restoration of masticatory function, speech and esthetics. Immediate post extraction implant placement is a well accepted protocol because of shorter total treatment time, maintenance of socket wall, reduced operative time and better actual implant placemen[1]. In immediate implant placement there is gap present between implant surface and socket wall and there are various materials used to fill this gap for better osseointegration but these materials are either expensive or not so effective. Platelet- rich fibrin (PRF) is simple, natural and inexpensive. Platelet-rich fibrin(PRF) concentrate helps in healing process, osteoblastic activity, angiogenesis, release growth factors and able to stimulate defense mechanism. PRF has been used as graft material in sinus lift procedure with simultaneous implant with success. This article describes a case in which the fenestration defect around an implant was treated by the application of platelet rich fibrin, a second generation platelet concentrate along with bone graft, and guided tissue regeneration membrane.

Key words: Guided bone regeneration, growth factors, platelet rich fibrin

INTRODUCTION:

Teeth replacement using dental implants has proven to be a successful and predictable treatment procedure; different placement and loading protocols have evolved from the first protocols in order to achieve quicker and easier surgical treatment times [1]. In situations where a tooth requires extraction and replacement, original protocol (gold standard) suggested a 6-12 month waiting period before implant placement [2]. The original protocol has been challenged within the last decade and new protocols have been developed in which implants are placed at the time of extraction of the tooth. This protocol where implants have been placed at the time of tooth extraction is known as immediate implants [3].

When an implant is placed in a fresh or recent extraction alveolus a gap between the implant surface and the bone walls of the socket may occur. The presence or size of the gap is both influenced by the configuration of the alveolus and by the

*Corresponding Author Address: Abdulgani Azzaldeen,Department of Conservative Dentistry, Al-Quds University, Jerusalem, Palestine. Email: abdulganiazzaldeen@gmail.com

design and width of the implant [4]. Wilson et al.[8] and Paolantonio et al.[9] demonstrated that for implants with a horizontal defect of 2 mm or less, spontaneous bone healing and osseointegration take place if the implant has a rough surface [5,6]. Horizontal defects in excess of 2 mm have been shown to not heal predictably with bone[5]. So To compensate for these problems, guided bone regeneration (GBR) using autografts, allografts, or alloplasts; barrier membranes; or combination therapy has been accomplished with what appear to be successful clinical results [3,7].

Implant therapy based on the principle of osseointegration has seen a remarkable expansion of its application in dentistry, in recent years. In the last decade, dental implants have become a reliable procedure for the treatment of partially or completely edentulous jaws. The lack of bone adjacent to an implant can be considered a true "bony defect" and several techniques have been proposed to promote defect fill with newly formed bone. One of the most popular procedures is guided bone regeneration (GBR), which involves placing a membrane over the defect to create a secluded space into which osteogenic cells can migrate and remain undisturbed over the exposed part of the implant[7,8]. Short-term animal and human studies have shown these immediate implants to be comparable to implants placed into healed bone. The advantage of the procedure include fewer surgical sessions, elimination of the waiting period for socket healing, shortened edentulous time period, reduced overall cost, as well as preservation of bone height and width [2,9]. Although immediate implantation is more demanding both surgically and prosthetically compared to the conventional placement technique, the advantages make it very appealing to patients who are in need of both extractions and implant therapy.[1,3,7,10]

Platelet-rich plasma (PRP) is an autologous product that concentrates a large number of platelets in a small volume of plasma. PRP functions as a fibrin tissue adhesive with hemostatic and tissue sealing properties, but it differs from fibrin glue and other platelet-poor tissue adhesives because its platelets provide a unique ability to promote wound healing and enhance osteogenesis[1,2].

PRP provides an immediate surgical hemostatic agent that is biocompatible, safe, and effective. PRP accelerates endothelial, epithelial, and epidermal regeneration, stimulates angiogenesis, enhances collagen synthesis, promotes soft tissue healing, decreases dermal scarring, enhances the hemostatic response to injury, and reverses the inhibition of wound healing caused by glucocorticoids. The high leukocyte concentration of PRP has an added antimicrobial effect. Since PRP is an autologous blood product, it carries no risk of transmitting infectious disease.[4,5,6]

PRP has an extremely broad range of clinical healing applications in head and neck surgery, otolaryngology, cardiovascular surgery, burns and wound

healing, oral and maxillofacial surgery, cosmetic surgery, and periodontics In addition to its effectiveness for patients with chronic non-healing wounds, it has also been used as an antiangiogenic agent and as a carrier for growth factors.[1,3,4]

In surgical settings, PRP decreases the frequency of intraoperative and postoperative bleeding at donor and recipient sites, accelerates soft-tissue healing, supports the initial stability of grafted tissue at recipient sites as a result of its cohesive and adhesive nature, promotes rapid vascularization of healing tissue by delivering growth factors and, when used in combination with bone replacement materials, induces regeneration.[3]

The term tissue engineering was originally coined to denote the construction in the laboratory of a device containing viable cells and biologic mediators (e.g., growth factors and adhesins) in a synthetic or biologic matrix, which could be implanted in patients to facilitate regeneration of particular tissues. The role of tissue oxygenation in wound healing became the focal point in the 1980s. Tissue oxygenation enhances phagocytic and bactericidal ability of host immune cells and supports collagen as well as other protein synthetic events. The importance of growth factors in enhancing wound healing has become the focus of research in the present day. In addition, a link has been established between tissue oxygenation and growth factors. Macrophage stimulation causes the release of angiogenic and other growth factors that support wound healing and resist infection. In general, tissue engineering combines three key elements, namely scaffolds (collagen, bone mineral), signaling molecules (growth factors), and cells (osteoblasts, fibroblasts). Tissue engineering has been redefined presently as the relatively new, highly promising field of reconstructive biology, which draws on the recent advances in medicine and surgery, molecular and cellular biology, polymer chemistry, and physiology.[4,5,6]

Platelets isolated from peripheral blood are an autologous source of growth factors. When platelets in a concentrated form are added to graft materials, a more predictable outcome is derived. Platelet-rich plasma (PRP) is an easily accessible source of growth factors to support bone- and soft-tissue healing. It is derived by methods that concentrate autologous platelets and is added to surgical wounds or grafts and to other injuries in need of supported or accelerated healing. A blood clot is the center focus of initiating any soft-tissue healing and bone regeneration. In all natural wounds, a blood clot forms and starts the healing process. PRP is a simple strategy to concentrate platelets or enrich natural blood clot, which forms in normal surgical wounds, to initiate a more rapid and complete healing process. A natural blood clot contains 95% red blood cells, 5% platelets, less than 1% white blood cells, and numerous amounts of fibrin strands. A PRP blood clot contains 4% red blood cells, 95% platelets, and 1% white blood cells[2,7,9].

The use of PRP in place of recombinant growth factors has several advantages, in

that growth factors obtained from platelets not only have their own specific action on tissues but also interact with other growth factors, resulting in the activation of gene expression and protein production. Therefore, the properties of PRP are based on the production and release of multiple growth and differentiation factors upon platelet activation. These factors are critical in the regulation and stimulation of the wound healing process, and they play an important role in regulating cellular processes such as mitogenesis, chemotaxis, differentiation, and metabolism.

Platelet rich fibrin, which is a second generation platelet concentrate, offers the surgeon an access to growth factors with a simple and available technology. These growth factors which are autologous, nontoxic and non immunogenic, enhance and accelerate the normal bone regeneration pathways. [10,11,12]

This article presents a case report in which a fenestration defect around an implant was treated by GBR with platelet rich fibrin (PRF)-enhanced bone graft and the PRF smeared barrier membrane for guided bone regeneration.

CASE DETAIL:

A healthy 27-year-old male oral surgery resident was referred to the author's private office for a apical lesions in the maxillary anterior teeth need to be removed and implant restoration . He gave the history of trauma four months back and simultaneous avulsion of the left central incisor tooth. On clinical examination , height of the alveolar ridge was adequate but the width of the ridge was inadequate for an implant placement. The ridge was found to be a class I defect according to Siebert's classification. Intraoral radiographs also revealed a deficient ridge. Ridge augmentation using bone graft with platelet rich fibrin (PRF) was planned. The patient was clinically healthy with no history of systemic diseases. Informed consent was taken from the patient.Fig.1-2

PREPARATION OF PRF:

PRF belongs to a new generation of platelet concentrate but with a simplified processing as compared to platelet rich plasma (PRP). Blood was drawn into 10ml test tubes without an anticoagulant and centrifuged immediately for 12 minutes at 2,700 rpm .

Indication for using PRF

I. BONE REGENERATION :

1. Sinus lift grafting

2. Ridge augmentation

3. Repair of bone defects created by removal of teeth or small cyst

4. Ridge preservation techniques

5. Periodontal defects

6. Closure of cleft lip and palate defects

7. Repair of oro-antral fistulas

8. Craniofacial reconstruction

II. SOFT TISSUE REGENERATION

1. Periosteal and connective tissue flaps

2. Free connective tissue and gingival grafts

3. Root coverage procedures

4. Controlling soft tissue healing and tissue maturity

CONTRAINDICATIONS

1. Unexplained anaemia where Hg is <12.5 g%

2. Thrombocytopenia < 100,000 / cu. mm

3. Diagnosed and treated anaemia Hg < 10.0 g%

4. Patients who have metastatic disease

5. Presence of tumour in the wound bed

6. History of platelet dysfunction

7. Active wound infection and sepsis requiring systemic antibiotics

8. Patients with poor prognosis associated with other disease process

9. Patient with bovine sensitivity

10. Patients with religious beliefs that prevent the use of blood.

The resultant product consists of the following three layers.

1. Topmost layer consists of acellular platelet poor plasma (PPP).

2. PRF clot in the middle.

3. RBCs at the bottom.

Successful preparation of PRF requires speedy blood collection and immediate centrifugation, before the clotting cascade is initiated. PRF can be obtained in the form of a membrane by squeezing out the fluids in the fibrin clot.

SURGICAL TECHNIQUE

The fractured root was carefully removed and a thorough curettage of the remaining alveolus was performed to eliminate any residual infective tissue in the avulsion socket that could compromise the osseointegration of an immediately placed implant. After completely remove infected lesions found that the buccal bone defect. A two - piece implant (zimmer) of diameter 4.25 mm and length 13 mm was placed in the region, 21 , reaching 35 Ncm primary stability. Then use the A-PRF to filling the bone defect area(fig 5),and ues the APRF membrane to cover the bone graft and area(fig6);then suture.Fig.3-10

POST-OPERATIVE CARE

Patient was recalled after two weeks and sutures were removed. Healing wassatisfactory. Patient was reviewed every two months and oral hygiene was reinforced. Six month following the surgery, the patient was again reviewed, clinically the width of the ridge showed an increase. Radiographs showed an adequate defect fill.

The sutures were removed 10 days after the procedure. The surgical site was examined for uneventful healing. There was no post - operative complications and

healing was satisfactory. The patient did not have any post-operative morbidity. Six months after the GBR treatment, intra-oral examination with the bone meter revealed adequate buccolingual width of the ridge of 7 mm. In order not to disturb the minimal amount of bone that would have formed over the fenestration defect, reentry was not performed. The implant was uncovered and a healing abutment was connected to allow emergence of the implant through the soft tissues, thus facilitating access to the implant from the oral cavity and final restoration was placed.Fig.11-17

DISCUSSION:

GBR is based on the principle of guided tissue regeneration, and was first performed in an experimental dog study. This technique was clinically tested in the treatment of ridge deformities. Improvements in this technique have led to its wide-scale clinical applications to augment deficient alveolar ridges, treat implant fenestration or dehiscence, and permit immediate implant placement in large alveolar sockets.[11,12,13]

One of the most recent developments is the use of the autologous Platelet Rich Fibrin [PRF] for the enhancement of the soft and hard tissue. It was first developed in France by Choukroun et al. It eliminates the risk associated with the use of bovine thrombin. PRF is an immune and platelet concentrate which is obtained on a single fibrin membrane, containing all the constituents of a blood sample which are favourable for healing and immunity.PRF releases a number of growth factors namely, transforming growth factor (TGF-beta- 1), vascular endothelial growth factor (VEGF),platelet-derived growth factor (PDGF-AB) and thrombospondin-1 (TSP-1) during 7 days. It also secretes fibroblast growth factor (FGF), epidermal growth factor (EGF) and proinflammatory cytokines like IL-1 , IL-6, and TNF- . Due to its mechanical function and a rapid angiogenesis promoting ability,PRF membranes are viable material for all types of superficial cutaneous and mucosal healing.[3,4,7,14]

PRF in the form of a membrane can be used in conjunction with bone grafts, which has several advantages, such as promoting wound healing, bone growth, maturation and density, wound sealing and haemostasis, and imparting better handling properties to graft material. PRF as an adjunct to bone graft makes it possible to enhance the graft volume without injuring the maturation quality in new bone.[5,15,16]

In this case-report, there was class I fenestration defect around the implant and to group II of the classification given by Daniel Buser, 1994, in which the prosthetically guided placement of an implant results in exposure of the buccal implant surface.[4,5,17,18]

At present, it can be stated that biodegradable membranes have the potential to support bone formation if they are supported by bone graft material to resist collapse and if they are long-lasting enough to maintain their barrier function for extended periods in small to

moderate bone defects. The degradation and resorption kinetics of a membrane for use in GBR should be set such that it remains intact for at least 6-9 months in large volume defects and then should be completely metabolized after 12-15months.[19,20] In a recent systematic review, a reasonable comparison between bioresorbable and non-resorbable membranes could not be drawn due to lack of well designed studies. In this case report, we used GTR membrane (Healiguide), which is made of collagen and PRF to treat the defect. This is a significant benefit to the patient and represents an important step in the development of GBR procedures. For successful outcomes with GBR, the factors as outlined by Mellonig *et al*. were followed.

Recent clinical and histologic findings suggest that the use of platelet concentrates have technical benefits and may enhance bone regeneration when used in conjunction with bone grafts. The amplification of platelet derived growth factor (PDGF) and transforming growth factor (TGF) beta is seen as an available and practical tool for enhancing the rate of bone formation and the final quality of bone formed.[9,11,18]

PRF has many advantages over platelet rich plasma (PRP). It eliminates the redundant process of adding anticoagulant as well as the need to neutralize it. It has been shown from the literature that it increases the rate of clinical graft consolidation, and PRF-enhanced grafts produce more mature and dense bone than do grafts without PRF. PRF is in the form of a platelet gel and can be used in conjunction with bone grafts, which offers several advantages including promoting wound healing, bone growth and maturation, graft stabilization, wound sealing and hemostasis and improving the handling properties of graft materials. In an experimental study which used osteoblast cell cultures to investigate the influence of PRP and PRF on proliferation and differentiation of osteoblasts, it was found that PRF had a superior influence over PRP. Also, bone augmentation grafts may act as space-maintaining devices to allow coronal migration of periodontal progenitor cells.[17,18,20]

The development of biomaterials, ideally coupled with the incorporation of bone growth factors and bioactive peptides, represents an important line of research in this direction. Recent systematic reviews regarding the survival rate of implants into sites with regenerated/augmented bone using barrier membranes varied between 79% and 100% with the majority of studies indicating more than 90% after at least one year of function.[4,7,8,11] Immediate implants in the maxillary esthetic area are currently used frequently and are subtle, exacting treatments. However immediate implant placement and bone grafts are always sensitive to the gingival quality, as the gingival tissue has to cover and protect the site. If the gingival tissue is weak or damaged, dehiscence can appear in the covering tissue leading to the

contamination of the grafted site. For this reason, some authors recommend the use of connective tissue grafts to reinforce the peri-implant tissues. The L-PRF is therefore especially indicated in this application. The fibrin membrane of L-PRF acts as a bio-barrier, protecting the implant and the graft from the oral environment. Moreover, by providing growth factors, leukocytes, and a permeable fibrin matrix for the growth of endothelial and epithelial cells, this healing material stimulates neoangiogenesis and accelerates gingival healing and maturation. The use of healing materials such as L-PRF are well suited to these applications because this material has a robust stimulating effect on the healing of soft and osseous tissues.[13,17,19,20]

Thus, in this case report, a fenestration defect was effectively treated by the application of growth factors both to the bone graft and GTR membrane.

CONCLUSION:

Platelet-rich fibrin (PRF) in patients with chronic apical lesions after tooth extraction performed immediately implantation show high success rate of bone graft, anti-infective ability. This technique offers advantages for patient comfort and the healing process. It also facilitates a natural healing and maturation of the periimplant bone and soft tissues around the implant.

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FIGURES:

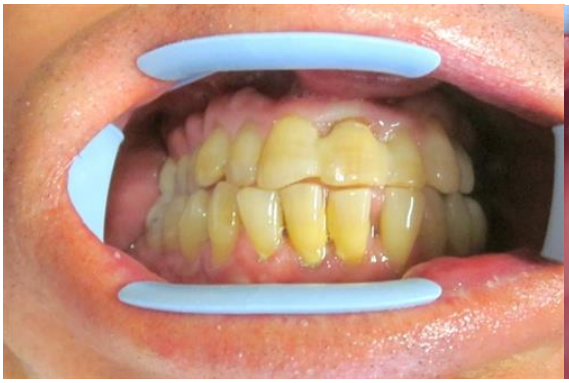

Figure 1: Pre op photo

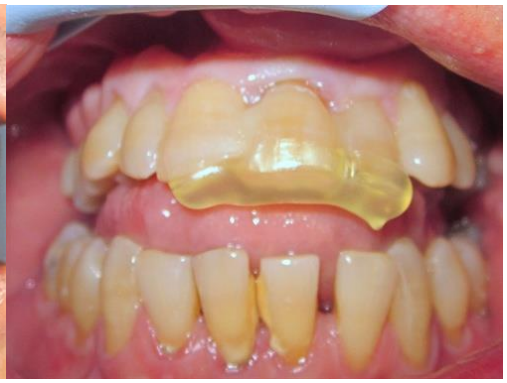

Figure 2: Incisal matrix made with Triad Gel to help realign the patient's natural tooth

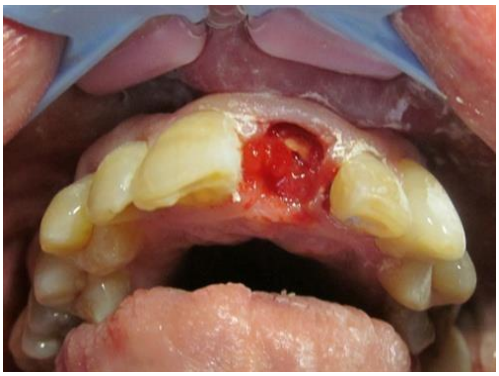

Figure 3. After removal of the tooth (coronal portion)

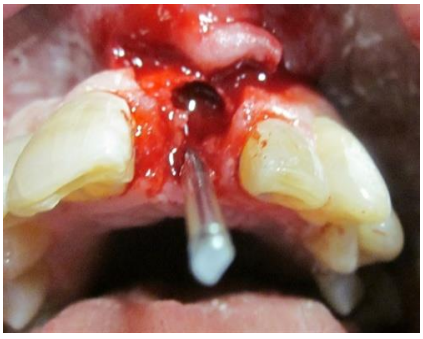

Figure 4. Pilot drill in place engaging palatal bone

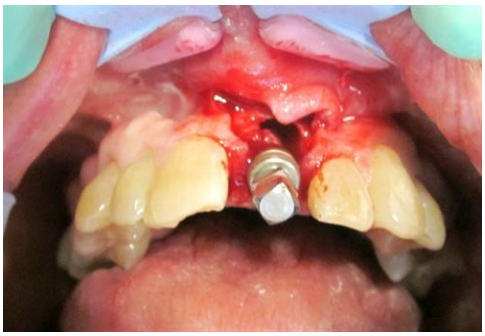

Figure 5: Blue Sky Bio Bond spreader in place

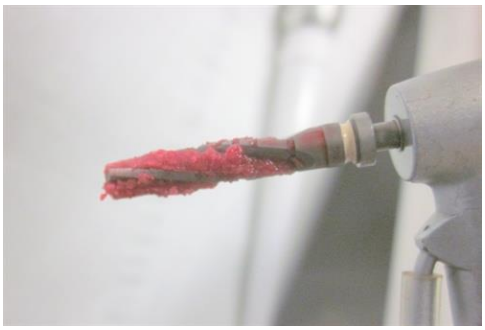

Figure 6: 3.8mm drill at 75 r.p.m.'s to harvest some autogenous bone to fill in on the bucca

Figure 7: autogenous bone to fill in on the buccal

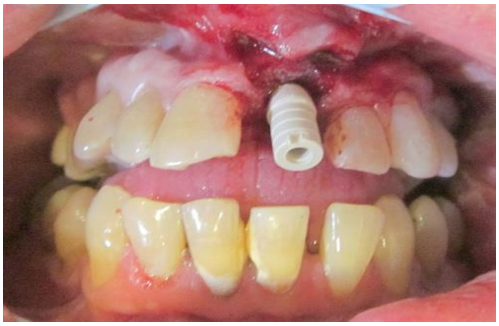

Figure 8: Zimmer Peek Provisional abutment before preparation

Figure 9: Platelet Rich Fibrin (centrifuged whole blood for 12 min.)

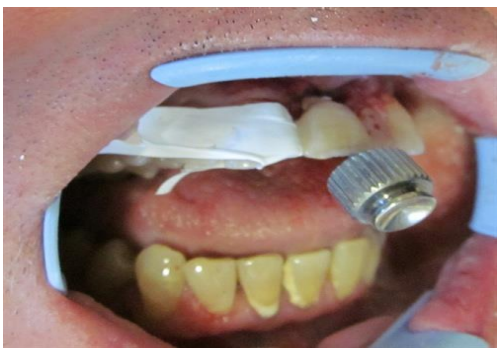

Figure 10: Patient's existing tooth (after removal of the lingual portion) secured to the Peek Provisional abutment in the mouth with flowable resin

Figure 11: Closeup of the Peek abutment cured to the patient's existing tooth

Figure 12: Closeup of the Peek abutment cured to the patient's existing tooth

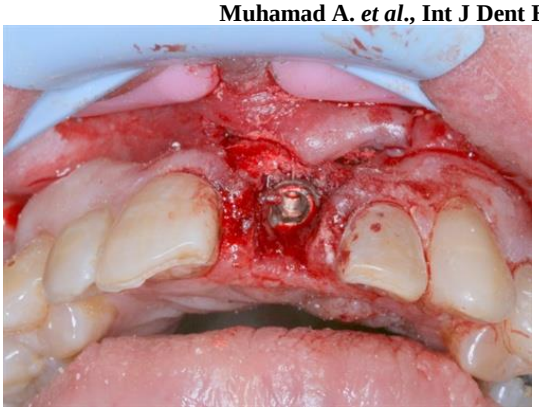

Figure 13: Bone fill on buccal with with autogenous bone

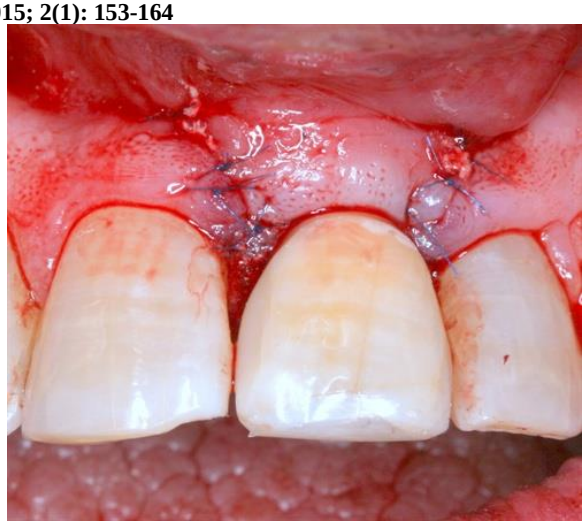

Figure 17: Closeup

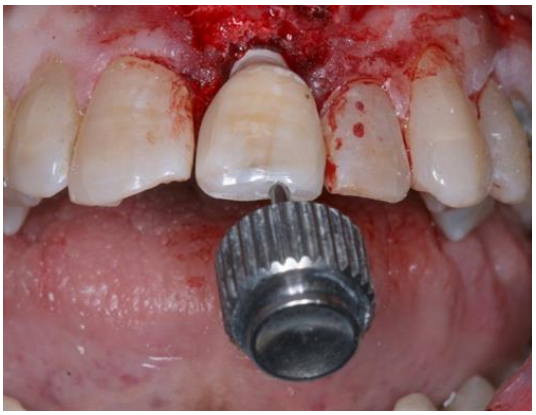

Figure 14: Peek abutment cured to the patient's existing tooth--screwed into place

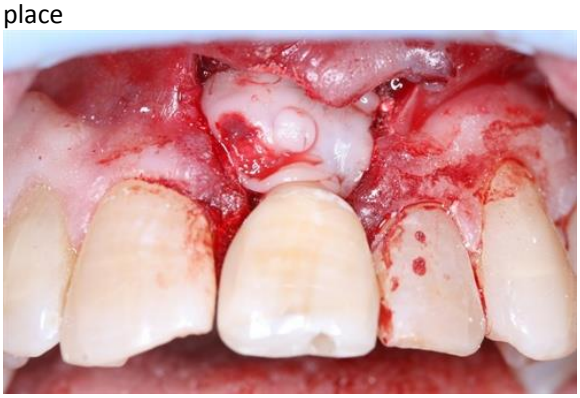

Figure 15: PRF membrane

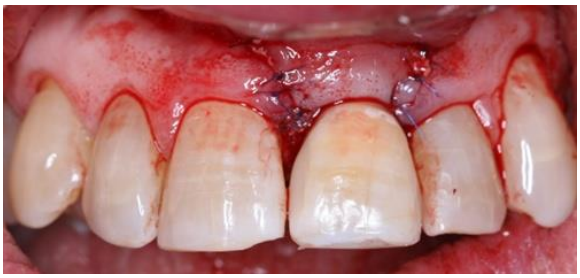

Figure 16: Suture with 7/0 Prolene sutures