Management of Peri Implant deficiency with PRP and bone grafts – A Case Report

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Abstract

The objective of this paper is to report a case that has been successfully managed by incorporating Platelet Rich Plasma (PRP) with a combination of autogenous bone graft and a commercial xenograft (BIO-OSS).

Platelet rich plasma seems to enhance early bone healing (3 months) when used along with Auto grafts and Xeno graft mixture. A Substantial increase in the area of bone was observed post operatively. In our case, Clinically, no major complications were noted after 3months when assessed using parameters like implant mobility, pain, infection, implant exposure. Therefore, the use of Platelet rich plasma along with auto graft and xeno graft mixture in peri implants deficient regions appears to be beneficial in clinical situations.

Keywords: Platelet Rich Plastms, Implants, Bone grafts

Introduction

"Platelet rich plasma"(PRP) is defined as the platelet containing supernatant of centrifuged anti coagulated blood. Platelet rich plasma is an otherwise normal autogenous blood clot that contains a highly concentrated number of platelets. It is a volume of autologous plasma that has a platelet concentration above base line which is non – toxic, non-immune substance that accelerates healing. [1]
Whitman et al first introduced Platelet rich plasma to the field of maxillo facial surgery in 1997 in an article titled " Platelet gel; An Autologous alternative to Fibrin glue with applications in Oral and Maxillofacial Surgery". The authors thought that through activation of the platelets within the gel and resultant release of growth factors, enhanced wound healing should be expected.[2]

Platelet rich plasma enjoyed a great popularity after the publishing of an article by Marx et al in 1998 titled " Platelet rich plasma; Growth factor enhancement for bone grafts". It documented that PRP is a concentration of platelets 4 to 7 times above baseline peripheral blood platelet levels. The study demonstrated that bone graft cells do indeed possess membrane receptors for nearly all of the growth factors contained with in platelets. [3]

Platelet rich plasma is a rich source of growth factors, which initiates the proliferation, and morpho differentiation of mesenchymal progenitor cells. Within Platelet rich plasma, the increased number of platelets delivers an increased number of growth factors to the surgical area. Growth factors are not mutagenic; they are natural proteins acting through normal gene regulation and normal wound healing feed back control mechanisms.

Effect of PRP on bone regeneration using bone substitutes

Recent studies of PRP have shown enhancement of nearly all bone substitute materials along with Autogenous bone. The reason is that autogenous cells are responsible for new bone formation even when a bone substitute is used. A bone substitute like Xenograft forms new bone via Osteoconduction from adjacent osteo progenitor cells, while the autogenous graft forms new bone via transplantation of osteoprogenitor cells from a distant site.

Since fewer osteo progenitor cells are contained in such Xeno grafts as compared to autogenous grafts, and since a significant migration is required to fill the volume, up regulation of these osteo progenitor cells and matrix formation for osteo conduction via PRP is more valuable.

The steps leading to bone formation include growth factor recruitment and stimulation of cells, their migration and differentiation before bone is actually formed. PRP has the ability to stimulate more bone formation in a shorter time when used in conjunction with a bone substitute graft like Xenograft.

Thus Platelet rich plasma was claimed to be beneficial as it

- " Jump starts" the cascade of osteogenesis in a bone graft
- Promotes early consolidation of the graft.
- Speeds up mineralization of the graft.
- Improves trabecular bone density.
- Allows placement of implants into the grafts at an earlier time
- Enhances osteo conduction.[4]
- May promote rapid vascularisation of the healing tissue by delivering growth factors.
- Aids in initial stability of grafted tissue at the recepient site
- In combination with bone replacement materials, induces regeneration[5].

Case Report

A 28 year old Male Patient wanted to get his missing tooth in the lower front jaw region replaced. Patient gave a history of undergoing cyst enucleation in the anterior mandible one year back and Iliac crest grafting in the same region 6months ago with a Non significant medical history. On examination, Extra Oral – everted lower lip, depressed mento labial sulcus were observed. Intra Oral findings were as follows:

- Missing 36, 35,34,33,32,31,41,42,43,44,45, 46,
- Mucosa over the ridge firm and resilient
- Inter arch distance –1 5 mm

A working diagnosis of Partially edentulous region present in relation to 36, 35,34,33,32,31,41,42,43,44,45, 46 with a deficient implant site was made. (fig 1)

Treatment Plan-

- Placement of four Bio horizon implants(Two 15 mm X 4 mm and Two 12 mm X 3.5 mm) in the edentulous regions extending from 36 to 46
- Peri implant deficient regions identified and grafted with platelet rich plasma enriched auto graft and xeno graft mixture.

PROCEDURE

Platelet rich plasma preparation (fig 2)

Routine hematological investigations and informed consent were taken before with drawal of blood for Platelet rich plasma preparation.Cephalic Vein in the ante cubital fossa was used for blood with drawal. An 18-gauge needle used for drawing blood. 10 ml of blood drawn from the patient and placed in 2 test tubes as 5 ml each.Anti coagulant (Citrate Phosphate dextrose 1.5 ml) placed in test tubes and the withdrawn blood added to it. Each test tube contained 6.5 ml (blood with anti coagulant). The collected blood was centrifuged at 1300 rpm for 10 min, and blood separated into a red inferior phase (first centrifugation platelet rich plasma) and superior plasma supernatant phase (PPP). From the first centrifugation, platelet rich plasma was aspirated into a test tube. The test tube containing platelet rich plasma was centri fuged again Centrifugation was done using a 2000 rpm for 10 min which separates plasma into superior PPP and inferior Platelet rich plasma layer which was collected separately. The total volume of collected Platelet rich plasma was 4 to 5 ml.The PRP was stored in a sterile test tube till it was mixed with the bone grafts.

PREPARATION OF GRAFTS

Auto grafts were harvested from Intra oral implant Osteotomy sites using FRIOS bone collector, which is a special bone collector that is attached to the regular suction apparatus through an autoclavable titanium unit. This titanium bone collecting unit houses a titanium filter, which traps bone particles sucked along with irrigation solution during bone drilling. At the end of implant osteotomy, the bone-collecting unit is dismantled and the trapped bone particles are collected in a sterile stainless steel bowl. The bone, which gets entrapped in the grooves of the drill bits during osteotomy, is also collected in the sterile stainless steel bowl. Xeno graft material used was Bio – Oss (Anorganic bovine bone).The granules with the size of 0.25 mm- 1 mm were used. Auto grafts and Xeno grafts were mixed in a ratio of 1: 3 and enriched with Platelet rich plasma in a sterile stainless steel bowl to get a coherent mass.

SURGICAL PROCEDURE OF IMPLANT PLACEMENT

Implants were placed under local anaesthesia (2 % Lignocaine hydrochloride with 1:2,00,000 adrenaline). Before the placement of implants intra orally all patients were advised to rinse with chlor hexidine mouthwash, thus disinfecting the mucous membrane. Skin preparation and isolation of surgical field with barrier draping was accomplished.Surgical template was used to identify the implant placement site by marking

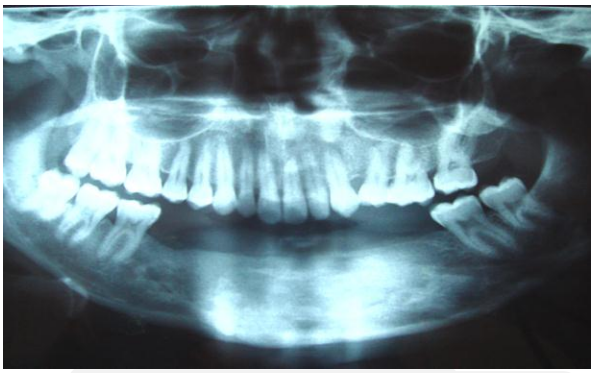


Fig.1 Preoperative radiograph

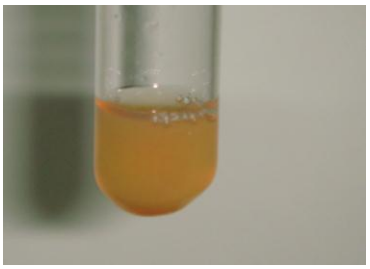


Fig.2 Platelet rich plasma pipetted out after double buffy layer between RBCs

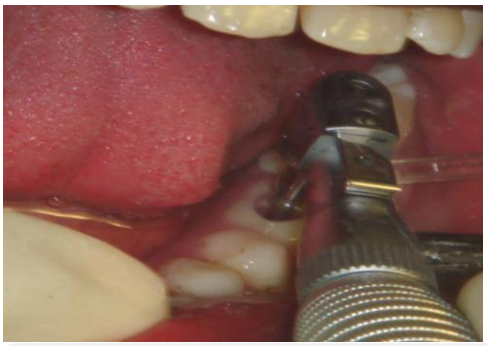


Fig.3 Initiating drill by placing the surgical template

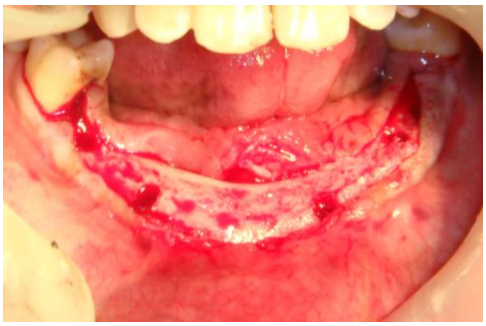


Fig.4 Drill sites identified and exposure of edentulous ridge for Implant placement

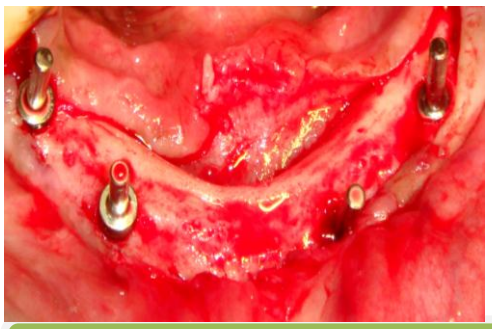


Fig.5 Implant sites checked for parallelism

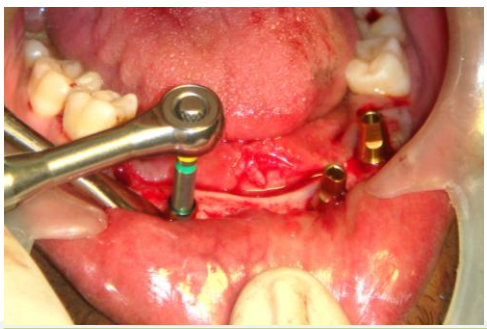


Fig.6 Implants checked for torque

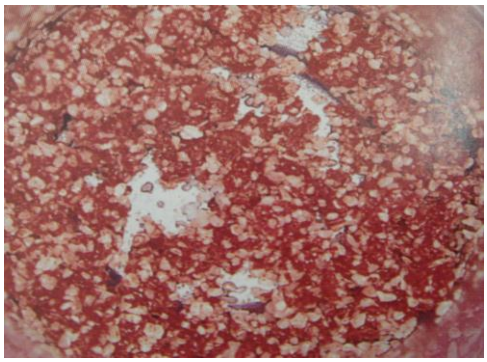


Fig.7 Auto graft and Xeno graft Mixture

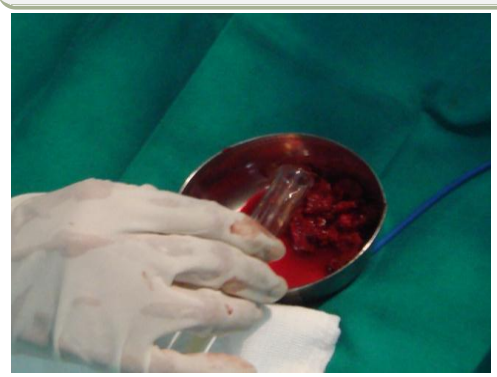
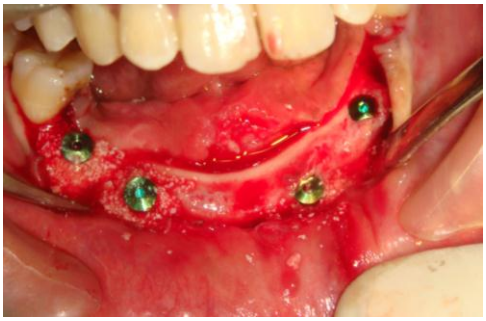


Fig.8 PRP mixed with the bone grafts



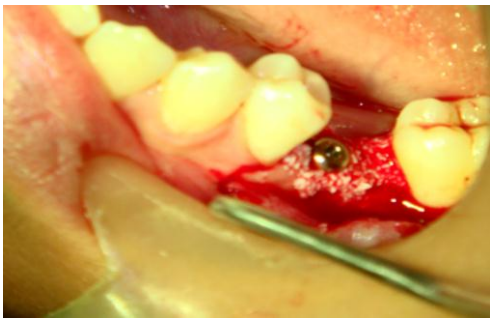


Fig 9. Implants with Cover screws placed along with Platelet rich plasma enriched with Autograft and Xeno graft (Bio- Oss) placement in peri implant deficient areas.

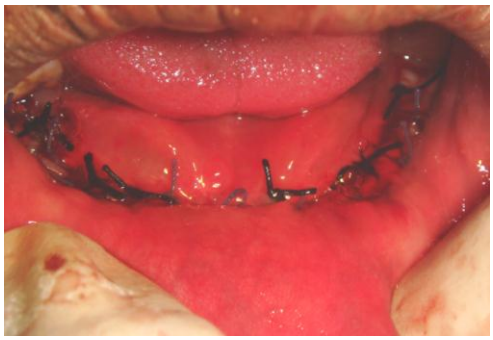


Fig 10. Closure of the Implant site

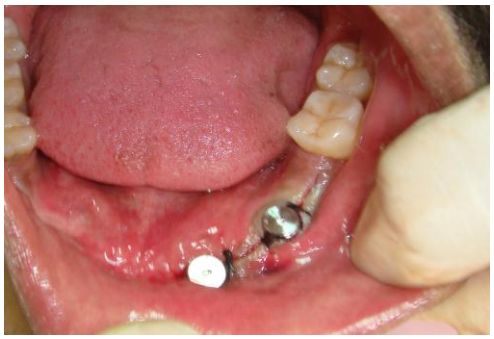


Fig.11 Healing abutment placement After three months.

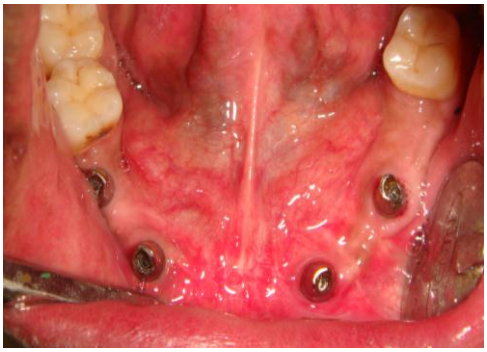


Fig 12. Prosthetic abutments

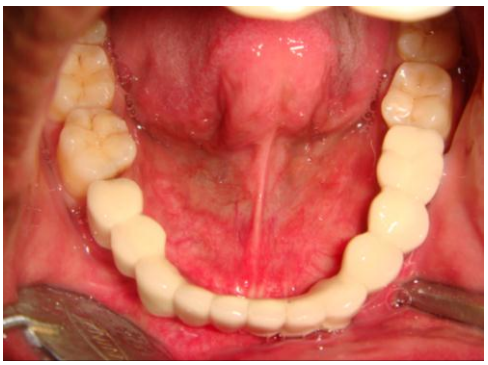


Fig 13. Final prosthesis

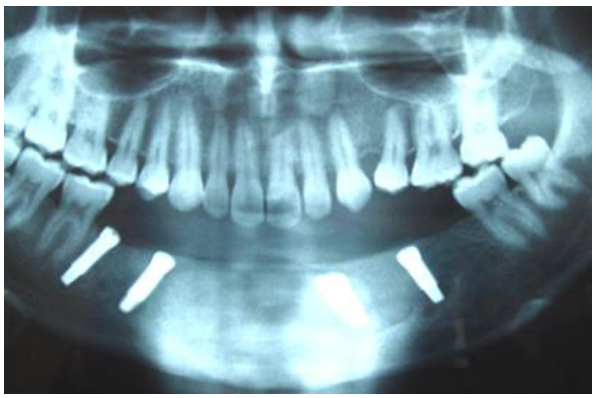


Fig 14. Post operative radiograph

with the round drill bit. A Crestal incision given with No.15 blade, Muco periosteal flap reflected and alveolar bone exposed. Implant site preparation was done with Reduction gear hand piece (1:16) with external irrigation attached The bone obtained from the osteotomy sites while drilling from the burs were collected using filters. Implant osteotomy was performed using standard drill bits in sequence using the bony walls as guide. The osteotomy was proceded till the desired depth reference line was achieved. Pre tapping of the bone was performed when pre tapped implant system was used and done at maximum of 40 RPM. The Orientation of Osteotomy was checked using paralleling pins if two or more implants are being placed. A low speed drilling was set for implantation and placement is completed using the surgical manual torque wrench till its final depth.All Implants placed were of tapered design endosseous implants with length ranging from 10 to 15 mm and diameters from 3-5 mm. After placement of cover screws, the peri implant area were assessed and deficient areas were grafted with PRP mixed with Auto graft and Xeno graft mixture. After implant placement, the incision closure done with 3-0 vicryl sutures. (Fig 3-14)

POST OPERATIVE PROCEDURE

Antibiotics (Cap.Augmentin 625 mg t.i.d for five days) and anti inflammatory drugs (Tab.Imol t.i.d for three days) were prescribed . Patient was checked for any pain/ swelling/ infection/ wound break down / soft tissue dehiscence in the implant region on third and seventh post operative days for suture removal. Post operative radiographic analysis were done after 3 months. Healing abutments were placed after 3 months. Subsequently, the healing abutments were removed and permanent abutments placed and prosthesis was given.

RADIOLOGICAL ASSESSMENT

Digital tomograms were done preoperatively to assess the bone height and for selection of appropriate implants. Digital tomograms were also done three month post operatively and assessed for implant healing and bone regeneration.

DISCUSSION

Platelet rich plasma has been recommended for use in increasing the rate, amount and quantity of the bone deposition and regeneration when augmenting edentulous sites for implant placement. As it is considered a bone graft enhancement material, it may be valuable for use in conjunction with bone auto grafts, allograft, xenografts, or alloplasts in sinus lift and in alveolar ridge augmentation procedures prior to or in conjunction with dental implant placement[6].

Fennis and co workers found evidence to support the positive effect of PRP added to an autogenous bone graft in their study performed on goats. [7,8.]

When Platelet rich plasma was used as an adjunct to Bio-Oss in repair of bone defects adjacent to titanium dental implants, addition of Platelet rich plasma may decrease peri implant bone healing according to a study conducted by Tae –Min You et al in dog tibia.[9]

Chawket Mannai studied the reconstruction of maxilla with simultaneous placement of ITI - implants with combined use of a small amount of intra oral autogenous bone providing the necessary viable stem cells, and a larger amount of xenogeneic bone used as a scaffold and a purely autologous platelet concentrate providing the growth factors for optimal bone formation. The use of autologous platelet concentrate combined with autogenous and xenogenous grafts allowed fast soft and hard tissue healing[10].

David Gerard et al had undertaken a Radiographic and Histomorphometric analysis on the effect of Platelet rich plasma on immediate autologous bone grafts in a dog model and concluded that Platelet rich plasma appeared to enhance early autologous graft healing. However, after 2 months this effect was no longer significant. The early enhanced healing occurred by increasing the amount of non – viable grafted bone that was removed and increasing the amount of new bone that was formed. PRP did not change the rate at which new bone was formed, and no increase in trabecular density was realized in these grafts. [11]

Recently, some invitro studies demonstrated that PRP could stimulate the mitogenic activity of osteoblasts or osteoblast- like cells thereby contributing to the mineralized tissue. Among the growth factors contained in PRP, PDGF TGF- beta and IGF are also believed to play a major role in bone metabolism and potential regulation of proliferation. According to Ogino et al, PRP stimulated the proliferation of osteoblast like cells in a dose dependent manner and PDGF and TGF-beta-1 not IGF contributed to the proliferation significantly.[12]

Thor et al in their histological study showed that significantly more new bone was formed at PRP- treated sites after 3 months of healing. After 6 months, this formation of new bone could no longer be observed. And concluded that PRP had a rather low regenerative capacity but may influence the early phase of bone healing.[13]

A study conducted by Slapnicka et al to evaluate the effect of progressively increasing concentrations of activated and non activated Platelet rich plasma on proliferation of human Osteoblasts in vitro failed to show significant increase in proliferation of human osteoblasts treated with activated or non activated PRP compared with controls in vitro.[14]

SUMMARY AND CONCLUSION

Platelet rich plasma seems to enhance early bone healing (3 months) when used along with Auto grafts and Xeno graft mixture. A Substantial increase in the area of bone was observed post operatively. In our case, Clinically, no major complications were noted after 3months when assessed using parameters like implant mobility, pain, infection, implant exposure. Therefore, the

use of Platelet rich plasma along with auto graft and xenograft mixture in peri implant deficient regions appears to be beneficial.

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