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CASE REPORT

A Combination Of Platelet Rich Plasma And Hydroxyapatite (Osteogen) Bone Graft In The Treatment Of Intrabony Defects – A Case Report

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ABSTRACT:

A major goal of periodontal therapy is the regeneration of the attachment structures such as alveolar bone, periodontal ligament and the cementum. Open flap debridement results in the formation of long junctional epithelium, which is more susceptible to microbial invasion and is thought to be a less stable attachment. Regeneration is thought to partially mimic developmental mechanisms, which require a coordinated orchestration of cellular events such as proliferation, migration and differentiation. Polypeptide growth factors are naturally occurring biological modifiers that have the potential to alter the host tissue to stimulate or regulate the wound healing process. They can regulate key cellular events in tissue regeneration, including cell proliferation, chemotaxis, differentiation, and matrix synthesis via binding to specific cell surface receptors. Growth factors (GF), either singly or in combination, have been used and experimental evidence for bone regeneration has been documented in both animal and human trials. Platelets are a rich source of naturally occurring growth factors, which can play an important role in the regeneration of periodontal tissues.

Key words: Platelat rich plasma; bone graft; periodontal regeneration; growth factors

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Introduction:

The treatment of periodontal disease has several major therapeutic goals. As stated in the 1989 proceedings of The World Workshop in Clinical Periodontics. "The immediate goal is to prevent, arrest and control or eliminate periodontal disease. However, the ultimate goal of periodontal therapy is to restore the structures, integrity, and the

function of the tissues that have been lost as a result of inflammatory periodontal disease.[1] Traditional periodontal therapy such as scaling, root planing and gingival curettage are highly effective in reducing the likelihood of the progress of periodontal disease, but has an extremely limited capacity to stimulate regeneration. Though the reconstruction of the periodontium which has been destroyed by periodontitis is considered to be a major challenge in periodontal therapy, recently, a large number of clinical and animal studies have shown a greater promise to restore the lost alveolar bone through the use of bone grafts.[1]

In the late 1970's, the importance of growth factors within the wound healing cascade were identified. Studies, however, have shown that a single growth factor applied into a wound is not as effective as multiple growth factors. This is not surprising, as the wound healing cascade requires multiple growth factors for different stimulatory and inhibitory functions at different phases over long periods of time within the different stages of the wound healing cascade. Over the past few years, different emerging technologies have been developed, leading to the current use of **Platelet Rich Plasma** (PRP). PRP is obtained from autologous blood by sequestering and concentrating platelets by gradient density centrifugation.[1,2,3] Several authors have shown superior bone regeneration in human intrabony defects when PRP was combined with several graft materials as compared to the use of the same graft materials without PRP. Addition of PRP to synthetic porous hydroxylapatite (HA) can assist in jump-starting the cascade of events that might lead to the formation of new bone, by the delivery of growth factors to the healing site. These growth factors can begin and maintain the differentiation and proliferation of osteoblastic/progenitor cells into the space occupied by the osteoconductive HA.[4]

Case presentation:

A 28 years old female patient presented with localized periodontitis in relation to 34, 35 and 36, with no recession. The probing pocket depth was 8mm and radiographically vertical bone loss was observed (Fig 1).

Pre-surgical therapy

Preoperative haematological assessment included a complete blood count. Initial therapy consisted of oral hygiene instructions and scaling and root planing of the quadrant involving the teeth to be treated was performed. Symptoms of trauma of occlusion, if detected were corrected. Three weeks following the Phase-1 therapy, periodontal re-evaluation was performed, based on the plaque scores and on the presence or absence of the signs of gingival inflammation. Chlorhexidine gluconate 0.2% (b.i.d), as mouth wash, was advised two weeks prior to the surgical procedure. Platelet-rich plasma was extracted 30 minutes prior to the surgery by using venipuncture.

Platelet-rich plasma preparation

First, 20 ml of blood was drawn from each patient by venipuncture of the antecubital vein in the forearm, into a 20ml syringe. 10ml of blood was collected into two glass tubes containing 10% trisodium citrate solution as an anticoagulant. The glass tubes containing blood were centrifuged at 1200 rpm for 20 minutes, which resulted

in the separation of the two fractions; plasma at the top and red blood cells at the bottom (Fig 2). The plasma, along with the top 2ml of red blood cells, was aspirated with the help of "Eppendorff pipettes". This fraction was again centrifuged at 2000 rpm for 15 minutes to get three basic fractions; platelet-poor plasma (PPP) at the top of the preparation (supernatant), PRP in the middle and the red blood cell fraction at the bottom (Fig 3). The top 80% fraction corresponding to PPP was aspirated with a pipette, leaving the residual (0.5 -2 ml) platelet concentrate.[3]

Surgical procedure

Surgical sites were disinfected with chlorhexidine mouthwash prior to the administration of local anaesthesia. The surgical procedure was performed by local infiltration of 2% lidocaine containing adrenaline at a concentration of 1:100,000. Buccal and lingual sulcular incisions were used and a mucoperiosteal flap was elevated. Complete debridement of the defects, as well as scaling and root planing were achieved with the use of an ultrasonic device and hand curettes. The root biomodification was done with a tetracycline solution (125mg tetracycline/ml of saline). The area was then rinsed with saline. At the time of the application of the bone graft, the synthetic, osteoconductive, non-ceramic form of hydroxylapatite (Osteogen) was mixed with the PRP preparation in a proportion of 1:1. The coagulation of the PRP/synthetic HA mixture was achieved by its combination with 5 µml of 10% calcium chloride. Within a few seconds, it assumed a sticky gel consistency (Fig 4). The synthetic HA/coagulated PRP mixture was then tightly packed into the bony defects by using a plastic condenser to the level of the bony crest (Fig 5). Flaps were sutured at the original level with black braided silk (4-0) by using interrupted sutures. Antibiotics (Amoxicillin 250 mg every 6 hours for 5 days) and 0.12% chlorhexidine gluconate rinse (every 12 hours for two weeks) were prescribed. Oral analgesic (Ibuprofen 400 mg every 8 hours as necessary) was also prescribed.

Post-operative care

The periodontal dressing and sutures were removed two weeks postoperatively. Surgical wounds were gently cleansed with 0.2% chlorhexidine gluconate on a cotton swab. The patients were instructed to rinse during the second postoperative week. Mechanical oral hygiene, consisting of brushing, was initiated by the patient at the end of the second post operative week. The patients were examined weekly, up to one month after surgery and then at three and nine months. The postoperative care included the reinforcement of oral hygiene and mechanical plaque removal, wherever necessary. The post operative probing depth after 9 months showed 3mm. Standardized radiographs were taken at 9 months post-operatively, which showed the bone fill in the defect (Fig 6).

Discussion:

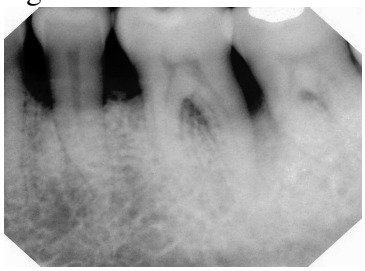
The rationalization of the use of PRP as a bone regenerative stimulating agent lies in the possibility of concentrating the growth factors contained in the platelets and carrying them into the regenerating site with an ideal carrier, like the patient's platelets. The ability of PRP to enhance the consolidation of bone graft has been well established

since 1998 by the pioneering works of Robert E Marx et al.[4] Several studies have exemplified the role of platelet formulations in the regeneration of soft/hard tissues, including the formation of new bone. In many studies, different types of bone replacement materials such as demineralized bone powder, Bio-bone/Bio-Oss, hydroxylapatite and other forms of allografts have been used in combination with the PRP gel. Siebrecht et al (2002) demonstrated increased bone ingrowths into porous hydroxylapatite in a bone chamber rat model when used in combination with a platelet concentrate.[3,4]

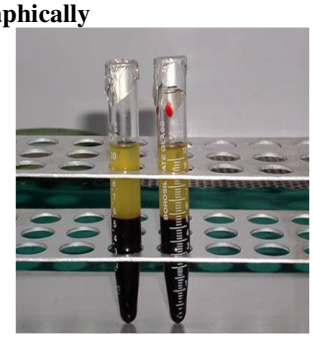
Platelets isolated from peripheral blood are an autologous source of growth factors. When platelets in a concentrated form are added to graft materials, a more predictable outcome is derived. PRP can be used as an easily accessible source of growth factors to support bone and soft tissue healing. A blood clot is a center focus of the initiation of any soft tissue healing and bone regeneration. PRP is a simple strategy to concentrate platelets or to enrich a 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. The use of PRP in place of recombinant growth factors has several advantages, in that 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 the stimulation of the wound healing process and they play an important role in regulating cellular processes such as mitogenesis, chemotaxis, differentiation and metabolism.[5,6,7] Hydroxylapatite resorbs acting as a mineral reservoir, inducing bone formation via the osteoconductive mechanism. Its reported advantage is its slow resorption rate which allows it to act as a mineral reservoir, at the same time acting as a scaffold for bone replacement. OsteoGen which was used here acts as a carrier for platelet rich plasma.

Conclusion:

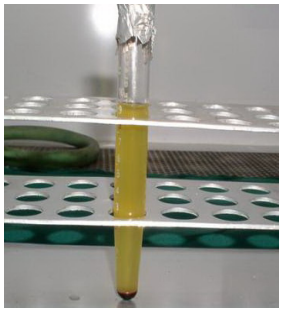
Although a number of treatment modalities are currently available, clinicians continue to seek more predictable regenerative therapies. Platelet rich plasma has an advantage over standard grafting techniques. It offers the clinical surgeon access to growth factors with a simple and available technology. These growth factors, which are autogenous, nontoxic, and nonimmunogenic and they enhance and accelerate normal bone regeneration pathways. Platelet rich plasma also has documented reproducible scientific proof of efficacy, as well as a clinical tract record. It has been shown to increase the rate of clinical graft consolidation and PRP-enhanced grafts produce a more mature and dense bone than do grafts without PRP.



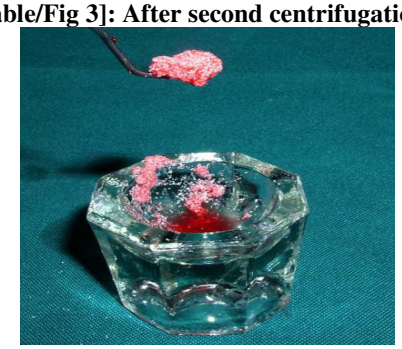
[Table/Fig 1]: Pre-operative view radiographically



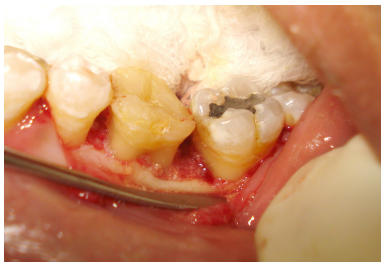
[Table/Fig 2]: After first Centrifugation



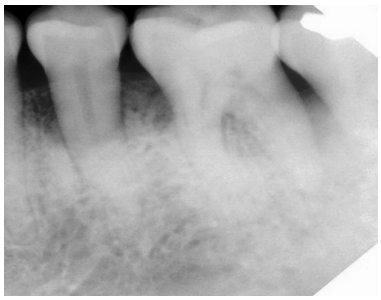
[Table/Fig 3]: After second centrifugation



[Table/Fig 4]: PRP and bone graft (Osteogen) combination



[Table/Fig 5]: Placement of PRP and bone graft intothedefect



[Table/Fig 5]: Radiograph showing 9 months post-operative view

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