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A Case Report and Review of Literature on the usage of Platelet Rich Fibrin with Hydroxyapatite in an Infrabony Periodontal Defect

Abstract:
A 37-year-old male patient reported to the Department of Periodontics, with the chief complaint of pain and sensitivity on the upper right posterior tooth region for the last six months. On clinical examination, a 6 mm probing pocket was found on the distal aspect of upper first premolar. The patient was then advised regenerative periodontal therapy with appropriate debridement, biomechanical preparation and filling of the defect with autogenous platelet rich fibrin (PRF) mixed with hydroxyapatite bone graft (HA). GTR membrane was placed and sutured with vicryl. Hence, it can be suggested that treatment of intrabony defects with PRF produces substantial enhancements of clinical parameters. HA thus when added to PRF augments the regenerative properties of PRF when used for the treatment of intrabony defects in periodontal diseases.

Key-words: Hydroxyapatite; Intrabony defect; Periodontal disease; Platelet rich fibrin; Regeneration

Introduction:

Periodontal reconstructive therapy basically entails the primary motive of regeneration and rehabilitation of the diseased tissue. The process of regeneration entails therapeutic cure of all periodontal tissues in a well-coordinated and integrated manner pertaining to the corresponding biologic events.[1] Periodontal surgery facilitates to gain access to diseased areas for suitable cleaning/debridement in order to attain pocket reductionor abolition and reinstate periodontal tissues that has been lost. There are several surgical procedures that have been adopted for the diseased condition, for instance, open flap debridement; open flap debridement with bonegrafts/bone substitutes and guided tissue regeneration (GTR). In an attempt to fill the periodontal intrabony defects, porous hydroxyapatite (HA) bone grafting material has proven to be efficacious.[2] These porous HA bone grafts have brilliant bone conductive properties that allow outgrowth of osteogenic cells from existing bone surfaces into the neighbouring bone material. Platelet-rich fibrin (PRF) is the most favored among platelet concentrates in fibrin technology. It is a fibrin matrix consisting of platelet cytokines, growth factors and cells that facilitate in the promotion of osteoblast proliferation and suppresses the growth of oral epithelial cells. PRF is autologous and does not encourage any inflammatory reaction near the graft.[3] Hence, we report a case here of a young male patient who was treated with platelet rich fibrin (PRF) with hydroxyapatite (HA) in an infrabony periodontal defect.

Case report:

A 37-year-old male patient reported to the OPD with the chief complaint of pain and sensitivity on the upper right posterior tooth regionfor the last 6 months. On clinical examination, a 6 mm probing pocket was found on the distal aspect of the tooth #14. The tooth was sensitive to both cold and hot substances. Intra-oral periapical (IOPA) radiograph showed an angular

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bone defect on the distal aspect of #14. The tooth was tender on percussion. The patient had undergone root canal treatment earlier (Fig. 1a) and was re-evaluated after 8 weeks that showed minimum amount of probing pocket depth (PPD) reduction. The patient was then advised and subjected to regenerative periodontal therapy.

After adequate local anesthesia, a crevicular incision was given and a full thickness mucoperiosteal flap was elevated. Following proper debridement, biomechanical preparation was done with citric acid and the defect was filled with autogenous platelet rich fibrin (PRF)(Fig. 1b) mixed with hydroxyapatite bone graft (HA) (Fig. 1c). GTR membrane was placed and sutured with vicryl. Mucoperiosteal flap was then closed with silk suture. Postoperative maintenance was done 1week, 2week, 1month, 3months and 6months after surgery. At each visit, patient was instructed to maintain oral hygiene and the surgical site was irrigated with normal saline. At the end of 3 months and 6 months, the patient was evaluated throughout the study period by clinically and radiologically (Fig. 1d). There was a marked reduction of probing pocket depth after three months (PPD$\leq$ 3mm) and was maintained up to 6months. The tooth was asymptomatic on percussion at the time of evaluation. IOPA x-ray showed adequate bone fill on the defect site.

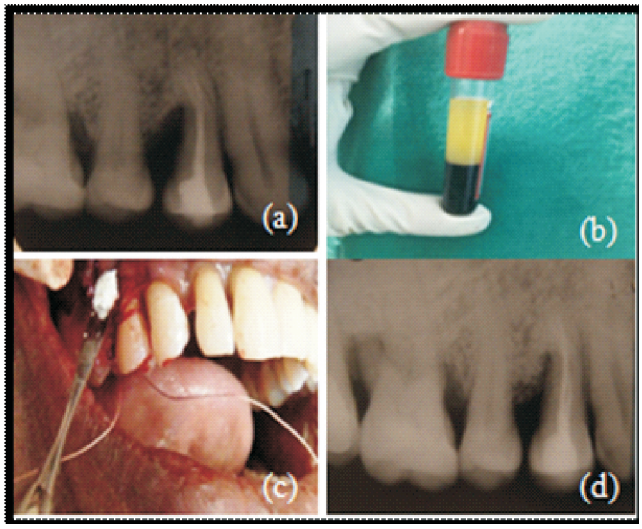

Fig. 1- (a) Pre-operative view, (b,c) Placement of PRF and HA, (d) Post-operative view

Discussion:

Prichard in 1957 had first focused on the morphology and treatment of the infrabony pocket and thus periodontal therapy has progressed significantly since then. However, periodontal regeneration remains an indefinable goal.

The use of PRF and the respective procedure was first described by Dohan et al. that was applied to maxillary sinus augmentation in 2006.[4] There have been several researches that have focused on the multiple benefits of PRF including the capability to slowly release autologous growth factors, presentation of a stronger and more long-lasting effect on the differentiation and proliferation of osteoblasts.[5] PRF can be effortlessly reformed to form a membrane that acts as a matrix for wound healing acceleration and also helps to improve new bone formation and diminish the curing period of graftmaterials. Another advantage of the PRF is its easy preparation, manipulation, and low-cost product.[6] In a study done by Anitua E et al. (2009), it was demonstrated that patients receiving dental implants after sinus floor augmentation surgery with PRF exhibited a 100% survival rate with a mean follow-up of 33 months.[7] Dohan DM et al. (2006) showed that PRF plays an imperative role in overpowering inflammatory reactions and hence proved to be a node of immune regulation.These effects were accredited to the production of anti-inflammatory cytokines.[5] In a study by Trisi P et al. (2006)the use of platelet-rich fibrin glue along with autogenous bone and Biogran improved new bone formation and formed a greater amount of bone only five to six months.[8] In a meta-analytical study done by Liu R et al. (2019), the authors had concluded that PRF acts as an efficacious substitute to other regenerative procedures in order to treat periodontal bony defects. The absence of variation in the survival rate, formation of new bone, junction between newly formed bone and its substitute, percentage of residual bone graft and soft-tissue area between non-PRF and PRF groups were indicated in this meta-analysis.[9] Thus, in the present case report PRF was judiciously used as graft particles in combination with bone substitute materials, owing to the above-mentioned advantages.

The periodontal intrabony defects are presently being managed with numeroustechniques such as the open-flap debridement (OFD), guided tissue regeneration (GTR), combination of advanced surgical techniques with platelet-derived growth factors (like PRF). The benefits of using these methods have provided evidence for bone augmentation and periodontal tissue healing in intrabony defects.[10] However, limited number of studies and minimalistic information is obtainable for comparing periodontal regeneration using surgical approaches, inclusive of PRF+OFD, GTR, and OFD alone, for intrabony defects depending on the clinical, radiographic and wound healing parameters.[2]

Platelets consist of PDGF-AB (platelet derived growth factor AB), TGFß-1 (transforming growth factor ß-1) and VEGF

(vascular endothelial growth factor) that stimulate cell proliferation, matrix remodeling and angiogenesis. The use of PRF in the maxillary intrabony defect in the present case report had shown faster healing. Previous cases have shown that gingival recession treated with PRF membrane generated greater gingival thickness and complete root coverage. PRF is considered to be used efficaciously in sinus lift procedures, cystic cavity and socket augmentation procedures. They can also be adjunctively used in surgical periodontal therapy and could possibly enhance soft tissue and hard tissue healing.[3]

PRF has a fibrin matrix polymerized in a tetra molecular structure along with the combination of platelets, leukocyte, cytokines, and circulating stem cells. These enables to gradually release cytokines during fibrin matrix remodeling that is an essential property of the PRF.PRF forms a dense fibrin scaffold consisting ofhuge of leukocytes and particular slow release of growth factors like TGF-β, PDGF-AB, vascular endothelial growth factor (VEGF) and glycoproteins (such as thrombospondin-1) for a period of 7 days.Thus, leukocytes have a strong influence on growth factor release,immune regulation, anti-infectious activities,and matrix remodeling during healing.It has also been evidenced that PRF has physical and biochemical properties that facilitates in periodontal wound healing, thus acting as a potential regenerative agent for intrabony periodontal defects.[1]

Previous studies have reported that the amalgamation of a mineralized, rigid graft material, with a semi-fluid, non-rigid agent, for example enamel matrix proteins, suggestively improved the clinical consequence of intrabony defects preserved without the addition of rigid graft material. Therefore, HA was used for the present case here keeping in mind the objective that it could improve the PRF properties by preserving the adequate space for tissue regeneration to ensue, and also exert an osteoconductive effect in the intrabony defect area. Hence, it was evident from the present case follow-up period that the combination of HA and PRF produced greater reduction in pocket depth, facilitated clinical attachment gain and helped to fill the defect. PRF membrane was used to cover the defects after they were filled that helped to contain the HA and PRF in the intrabony defect during the initial phase of healing.

Conclusion:

The present case report proves that PRF (in the form of a membrane or a gel in conjunction with alloplastic materials), is a useful substitute to PRPin the treatment of bone defects owing to periodontitis.The use of PRF for the management of intrabony defects may lead to enhanced wound healing and noteworthy decrease in intrabony defect depth in generalized aggressive periodontitis cases as compared to other procedures.PRFis easy to prepare and handle and can be moulded to form a membrane thus, making it an efficient substitute to PRP, especially in a private clinic.

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