Surgical Management of Peri-apical Lesion Using Platelet-rich-fibrin

Dr. Debojyoti Mazumder¹, Dr. Debolina Chowdhury² & Dr. Dibyendu Mazumder³

¹,²Post-graduate student, Department of Conservative Dentistry & Endodontics ³B.D.S, M.D.S (B.H.U)

Abstract: Complete periapical repair is utmost necessary for the success of endodontic therapy. When conventional endodontic therapy fails to resolve inflammatory periapical lesions, surgical intervention may be necessary to achieve the success. In the last few decades a variety of biomaterials have been introduced in dentistry that can fill in osseous defects after debridement of the periapical lesions and for acceleration of wound healing. Excogitation in the concept of tissue engineering has brought about a drastic improvement in the healing response of tissues. Wound healing is a staged process which involves the activity of leukocytes and platelets. The growth factors present in platelets are important to guide the regenerating cells to the area of healing. Platelet-rich fibrin is one such material that holds these growth factors enmeshed in the fibrin network resulting in their sustained release over a period of time that can accelerate the wound healing process. Now-a-days platelet-rich fibrin is used in various treatment procedures in endodontics. This case report illustrates the use of platelet-rich fibrin in bone regeneration after periapical surgery.

Keywords - PRF (platelet rich fibrin), cyst, growth factors, wound healing.

1. Introduction

Radicular or periapical cysts are the most common inflammatory cysts of maxilla and develop from the epithelial remnants of Malassez of the periodontal ligament that are remnants of Hertwig's epithelial sheath, which are stimulated to proliferate by an inflammatory process that originates from an infection or pulp necrosis of a non-vital tooth with the development of a periapical granuloma. By the liquefaction of the apical granuloma the radicular cyst appears. Over the years, the cyst may regress, should remain stationary or should increase in size.

Successful treatment for periapical lesion depends on removal of diseased soft tissue and sometimes application of different graft material to enhance new bone formation at the defective site.

In the last few decades a variety of biomaterials have been introduced in dentistry that can fill in osseous defects and accelerate wound healing. Materials like hydroxyapatite, freeze dried bone graft, tricalcium phosphate, bio-active glass etc. have been widely used and tested for their contribution in healing and regeneration of soft and hard tissues. Currently, the studies have been focused on the use of this autogenous material that provides an osteoconductive scaffold along with growth factors to stimulate patient’s own cells towards a regenerative response. The aim of this paper is to present three cases of endodontic surgery in which PRF was used to fill the osseous defects and with satisfactory results at six months’ follow-up.

Platelet-rich fibrin (PRF) is a tissue engineering product that has gained a lot of popularity due to its promising results in the induction of bone healing. It was developed in France by Dr.Choukroun et al in 2001 and is a second-generation of platelet concentrate widely used to accelerate soft and hard tissue healing. Its advantages compared to the platelet-rich plasma (PRP) include: ease of preparation / application, minimum cost as well as lack of biochemical changes (bovine thrombin, gelling agent or anticoagulant are not required), favorable healing due to slow polymerization, promotes hemostasis, has a favorable effect on the immune system. PRF is strictly autologous the fibrin matrix containing a large number of platelets and leukocyte cytokines. Although platelets and leukocyte cytokines play an important role in the biology of the biomaterial, the fibrin matrix which supports them certainly constitutes the decisive factor responsible for real therapeutic potential of PRF.

2. Case Report

A 28-year-old Indian female complaining of occasional pain in the upper right anterior region reported to the Department of Conservative Dentistry
and Endodontics. On intraoral examination, central incisor was slight discolored but there was no mobility, no swelling and no pus exudation was noticed. There was history of dental trauma which occurred in her childhood but no orthodontic treatment, and no injurious habit was reported by the patient. A periapical radiograph was taken using the standardized techniques, which revealed presence of interproximal intrabony defects with tooth 21 and 22 (Fig. 1 & 2). The patient was healthy and no other medical complication was there. So, it was decided to do root canal treatment in 21 &22 and remove the lesion surgically. Before planning for the surgical procedure, patient’s platelet count (3.5 lac/mm3), Hemoglobin (11.5 gm/dl), Bleeding time (2.5 min) and Clotting time (4.5 min) were assessed and found to be within normal limits. Root canal therapy of 21 & 22 done in conventional way using k files and obturated with gutta-percha and AH Plus sealer (Fig.3). Access cavity was filled up by glass ionomer cement.

**PRF Preparation:**
The PRF was prepared in accordance with the protocol developed by Choukroun et al. Just prior to surgery, 8 ml intravenous blood (by venipuncturing of the antecubital vein) was collected in a 10-ml sterile tube without anticoagulant and immediately centrifuged in centrifugation machine at 3,000 revolutions per minute for 10 minutes (Fig.4). Blood centrifugation immediately after collection allows the composition of a structured fibrin clot in the middle of the tube, just between the red corpuscles at the bottom and acellular plasma (Platelet-poor plasma) at the top. PRF results from a natural and progressive polymerization which occurs during centrifugation. PRF was easily separated from red corpuscles base [preserving a small red blood cell (RBC) layer] using a sterile tweezers and scissors just after removal from the tube and then transferred onto a sterile dappen dish and stored in refrigerator (Fig.5).

**Surgical Procedure:**
Iodine solution was used to carry out extraoral antisepsis. Following administration of local anaesthesia, buccal sulcular incisions were made and full thickness mucoperiosteal flaps were reflected. The loss of labial cortical plate was evident in relation to the left central and lateral incisor. The cystic lining was enucleated and sent for biopsy (Fig.6). The PRF prepared and stored prior to surgery was filled into the intrabony defect to cover the defect (Fig.7). The mucoperiosteal flaps were repositioned and secured in place using 3-0 non-absorbable black silk surgical suture. The simple interrupted sutures were placed.

![Fig.6- Cystic cavity after removal of lesion](image-url)
Post-operative Care:
The suitable antibiotics and analgesics for 5 days were prescribed, along with warm saline mouth bath three to four times daily for 2 weeks. Sutures were removed 1 week postoperatively. Patient was re-instructed for proper oral hygiene measures post-operatively and examined weekly up to 1 month after surgery and then 2 and 6 months.

3. Discussion

Most of the peri-radicular lesions heal uneventfully after conventional endodontic treatment. In this case, as the disease persisted after the proper endodontic treatment, we opted for surgical intervention to remove the pathological tissue and simultaneously eliminating the source of irritation that could not be removed by the orthograde root canal treatment. Bone regeneration after surgical intervention takes place in a very slow manner. Hence, to enhance the healing process PRF was used in these cases to achieve successful and complete healing of the bone faster. PRF consists of a fibrin matrix polymerized in a tetramolecular structure with the incorporation of platelets, leukocytes, cytokines, and circulating stem cells. This fibrin matrix is flexible, elastic, and very strong. Degranulation of platelets results in release of various growth factors which stimulate cell migration and proliferation and the fibrin matrix acts as a scaffold. Entrapment of growth factors and cytokines in the 3-dimentional architecture of fibrin matrix results in their sustained release for a prolonged period of time which play important role in various stages of wound healing promoting periapical tissue regeneration. Leukocytes and the cytokines (like IL-6, IL-4, and TNF-α) trapped in PRF give it the anti-infectious effect and let PRF act in an immune regulation mode.

Amongst the various growth factors that PRF contains, platelet derived growth factor (PDGF), Transforming growth factor b (TGF b-1 & b-2), and insulin like growth factor (IGF), epidermal growth factor, vascular endothelial factor, and fibroblast growth factors are believed to play a major role in bone metabolism and potential regulation of cell proliferation. PDGF is an activator of collagenase which promotes the strength of healed tissue. TGF-B activates fibroblasts to form procollagen which deposits collagen within the wound. PRF facilitates healing by controlling the local inflammatory response. According to Simonpieri et al, the use of this platelet and immune concentrate during bone grafting offers the following 4 advantages: First, the fibrin clot plays an important mechanical role, with the PRF membrane maintaining and protecting the grafted biomaterials and PRF fragments serving as biological connectors between bone particles. Second, the integration of this fibrin network into the regenerative site facilitates cellular migration, particularly for endothelial cells necessary for the neo-angiogenesis, vascularization and survival of the graft. Third, the platelet cytokines (PDGF, TGF-α, IGF-1) are gradually released as the fibrin matrix is resorbed, thus creating a perpetual process of healing. Lastly, the presence of leukocytes and cytokines in the fibrin network can play a significant role in the self-regulation of inflammatory and infectious phenomena within the grafted material.

The procedure of its preparation is simple and cost effective. Platelet concentrates are used routinely for many years in various surgical and medical specialties. The principle is to recover the cytokines or growth factors contained in platelets after centrifugation of the whole blood of the patient. Omar et al. demonstrated that monocytes are the first to send positive signals to stimulate bone progenitor cells. This effect is crucial because it will immediately trigger a cascade of reactions that will lead to osteogenesis. The use of platelet-rich fibrin, or PRF that is a healing autologous material is a way to accelerate and enhance the natural wound healing mechanisms of the body.
4. Conclusion

Accelerating the healing process by using PRF makes the treated area to be less sensitive to external factors (mechanical, bacterial and chemical), at the same time influencing the aesthetic result and post-operation patient comfort. The results of this case report show that PRF can be successfully used as monotherapy for obtaining periapical regeneration, not being an expensive procedure it can be used in patients who cannot afford expensive regenerative therapies.

5. References


