

THE MANAGEMENT OF PERIAPICAL MAXILLARY CYST BY USING THE A-PRF (PLATELET RICH ADVANCED FIBRIN): A CASE REPORT

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ABSTRACT

Periapical or radicular cysts are the most common inflammatory cysts of the jaw. The surgical intervention aims to remove periapical pathology to obtain bone regeneration and healing of periapical tissues. Improving the regeneration of the human body by using the patient's own blood is a unique concept in dentistry. The **purpose** of this case report is to illustrate the effectiveness of advanced platelet-rich fibrin (A-PRF) inserted into the bone defect resulting from a periapical cyst enucleation. The physiological time of healing of the cystic cavity is from 6 months to 1 year, but when the cystic cavity is filled with A-PRF, this phenomenon of physiological healing is accelerated, the healing period decreasing to three months. The **results** of this case report shows that APRF can be used successfully as monotherapy for obtaining periapical regeneration.

Keywords: periapical cyst, enucleation, A-PRF

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 (1). 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.

In the maxilla, the anterior region appears to be more prone to the development of the periapical cysts while in the mandible they occur more frequently in the premolar region (2). The radicular cyst pathogenesis comprises three distinct phases: the initiation phase, the phase of cyst formation and expansion phase (3). Initially, the patient may experience specific pain of pulpitis and apical periodontitis, followed by a period without symptoms corresponding to the moment of the cyst formation. Therefore, when radicular cysts are detected, they are usually painless, but can sometimes have mild pain or

sensibility on percussion of causal tooth. Periapical cysts become symptomatic when are infected or reach large dimensions and cause nerve compression.

Since it is an inflammatory cyst, its wall usually contains a dense mixed inflammatory infiltrate that is rich in plasma cells and lymphocytes. Cyst wall, in addition to its inflammatory component, is fibrous and often contain numerous capillaries, especially in the areas adjacent to the epithelial lining (4).

Several treatment options are available for a radicular cyst such as endodontic treatment, the extraction of causal tooth, marsupialization, complete enucleation (5). The surgical intervention aims to remove periapical pathology to obtain bone regeneration and healing of periapical tissues.

The treatment of periapical cysts by using the A-PRF

Hard and soft tissue healing is mediated by a variety of intra- and extracellular events that are regulated by signaling proteins. A number of studies from the literature have shown that the bone regeneration procedures may be improved by the addition of specific growth factors.

Improving the regeneration of the human body by using the the patient's own blood is a unique concept in dentistry. Platelet concentrates are used routinely for many years in various surgical and medical specialties. The platelets play a crucial role not only in hemostasis but also in wound healing (6).

Many techniques for obtaining autologous platelet concentrates were developed and applied in oral and maxillofacial surgery. The first generation includes platelet-rich plasma, the second generation involving platelet rich fibrin, while a third generation product is advanced platelet-rich fibrin.

Platelet-rich plasma was first introduced by Marx et al. in 1998 (7), which showed that

its use accelerates the rate and extent of new bone formation. Platelet-rich plasma (PRP) has been proposed as a method for introducing concentrate of growth factors PDGF, TGF- β , and IGF-1 at the surgical site, enriching the the natural blood clot, in order to accelerate the healing of wounds and to stimulate bone regeneration (8).

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 (9) 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 (10).

PRF is strictly autologous the fibrin matrix containing a large amount 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 (11).

Advanced platelet-rich fibrin (A-PRF) developed by dr. Choukroun in 2014 (12), is a third generation derived from a concentration of platelets and white blood cells (anti-infection). In order to create the A-PRF material, shall be taken a small amount of the patient's blood and centrifuged in the dental office. To produce A-PRF the protocol has been changed, the duration and spin speed have changed (revolutions per minute). By decreasing revolutions per minute and increasing the spin time for A-PRF, all monocytes are found equally distributed in

the fibrin clot, but equally was obtained a better distribution of platelets, which was initially focused equally on the inner end of the clot. It was necessary to prolong the coagulation time in the tube, which was obtained through the use of a special composite glass which allowed the slowing of clot formation.

The protective membrane and plugs that are produced release the key proteins that stimulate growth of bones and soft tissue, promote healing of soft tissue and bone. A-PRF membranes and plugs are made from own cells, and are not made from animal products. A-PRF has a higher concentration and a more homogeneous distribution of monocytes, which are believed to play an essential role in bone formation (12).

Advanced-PRF initiates the sustained release of multiple growth factors, including platelet-derived growth factor (PDGF), a protein that plays an important role in the replication of stem cells and osteoblasts which are organized to create a new bone. Studies conducted in The Clarion laboratory Research Group, Pennsylvania University (USA) and Repair-Lab, Institute of Pathology, Johannes Gutenberg University of Mainz (Germany) demonstrated that are released bone morphogenetic protein-2 BMP (Bone Morphogenetic Protein) and BMP-7. It also are launched the VEGF by monocytes that stimulate the formation of new blood vessels, increasing the blood flow to the surgical site.

Transforming growth factor (TGF-B), another protein, stimulates the growth of tissue by recruiting stem cells at the surgical site and stimulates them to reproduce and create the basis for new bone tissue. Also, the thrombospondin 1, an adhesive glycoprotein helps cell interactions (12). The first scientific and clinical results showed that vascularization is greater and early soft tissue growth is faster, more cytokines are released,

BMP VEGF, PDGF, TGF beta and thrombospondin than the classic PRF.

A-PRF membranes and plugs have numerous applications in dentistry: the protection and stabilization of bone augmentation material in sinus elevation, lateral ridge augmentation procedures, socket preservation after dental extraction or avulsion, treatment of furcation defects (13), for root coverage in the case of gingival recession, filling of cystic cavities etc.

The **purpose** of this case report is to illustrate the effectiveness of advanced platelet-rich fibrin (A-PRF) inserted into the bone defect resulting from a periapical cyst enucleation. After the complete enucleation of a cyst, the cavity usually is filled quickly with blood. This clot is the physiological version of A-PRF. The physiological time of healing of the cystic cavity is from 6 months to 1 year, but when the cystic cavity is filled with A-PRF, this phenomenon of physiological healing is accelerated, the healing period decreasing to three months.

CASE REPORT

The GB female patient, in the age of 50, came to the Private Dental Office "Dr. Anca Rusu", Bucharest accusing pain, swelling in the anterior maxilla.

The patient reported that the pain started about 3 years ago, at the level of anterior maxilla. Disease progression was slow, in bursts, with numerous acute exacerbations accompanied by pain of increased intensity at the level remaining teeth and a painful vestibular swelling associated with general malaise.

Following extra and intraoral clinical examination, neuromuscular, aesthetic, masticatory, phonation disorders were detected, changing in the position of the mandible, the vertical dimension and profile as a result of front and lateral, mandibular and maxillary edentations. Following a

radiological examination, was found a large unilocular periapical radiolucency in relation to left maxillary lateral incisor.

The osteolysis was well circumscribed around the apex of the tooth and have a radiopaque contour. The periodontal ligament space and lamina dura were destroyed in the region where the lesion was attached to the root of lateral incisor (fig.1).

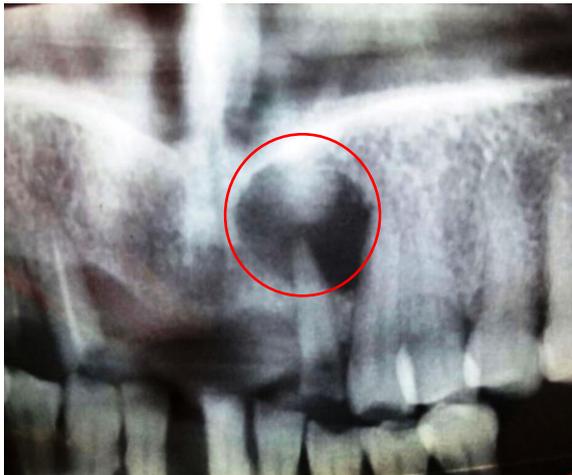


Figure 1. Radiologic appearance of periapical cyst

The affected tooth was sensitive to percussion and presented a mobility of 1st degree. Following the history, clinical examination and radiological the provisional diagnosis was periapical cyst.

For a more accurate diagnosis a biopsy was performed under local anesthesia using a 18-gauge fine needle and was aspirated some semi-viscous yellow liquid from lesion, which suggested that the lesion is cystic.

It was decided entirely enucleation of the cyst with intraoral approach and the use of A-PRF plugs for inducing tissue healing and bone remodelling.

The patient received detailed explanations of surgical procedures that will be performed, possible complications and informed consent was obtained from her. The surgical protocol included assessment of the patient's medical history and blood analyses. The systemic

antibiotic prophylaxis was performed before treatment. The surgical intervention began and was done under local anaesthesia.

The horizontal incision was then made at the cervical line of teeth (fig. 2) the mucoperiosteal flap in trapeze was detached to create access to the lesion (fig.3).



Figure 2. The horizontal incision at the cervical line of teeth



Figure 3. The detachment of the mucoperiosteal flap in trapeze

The left upper lateral incisor with crown massive destruction and unrecoverable was extracted (fig.4). Vestibular thinned cortex in the front of cyst was removed slowly, using surgical burs under copious irrigation with saline solutions to create the access to the lesion.

The cyst was identified and was then performed the slow separation of its mucosa from adjacent bone. The bone cavity was irrigated with sterile saline solution and dried easily. Careful clinical examination of the

area was made to verify that the cyst was totally removed without residual tissue remains.

The cyst was placed in 10% formalin neutral solution and sent for histopathological examination to confirm the definitive diagnosis of periapical cyst.

The remaining bony walls were very thin and the bone defect was deep and extended, thus presenting a significant risk of incomplete healing bone and fibrous invagination. APRF was prepared according to the protocol developed by Choukroun et al. There were collected 8 ml of venous blood from antecubital vein of the patient.



Figure 4. The extraction of remaining left lateral incisor root



Figure 5. The cyst was enucleated totally



Figure 6. The appearance and size of the cyst

The patient's whole blood was introduced into the tubes made of a special composite based on glass, without anticoagulant and has been centrifuged by means of a A-PRF machine for 14 minutes at 1500 revolutions per minute (fig.7). Within few minutes, the absence of anticoagulant allowed the activation of most platelets contained in the sample and was initiated the coagulation. The fibrinogen at first has been concentrated in the upper part of the tube, until the effect of the circulating thrombin transformed it into a fibrin network. The result was a fibrin clot containing the platelets located in the middle part of the tube, between the red blood cell layer located at the bottom and at the top the acellular plasma. One centrifugation resulted in the formation of three layers: the top layer is platelet poor plasma, the intermediate layer is A-PRF and the deep layer, contain red blood cells. The clot was removed from the tube and attached red blood cells were scraped and removed (fig.8).



Figure 7. Specific A-PRF centrifuge

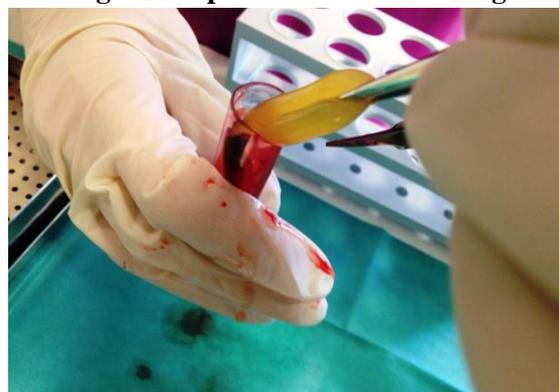


Figure 8. The fibrin clot containing platelets

In order to obtain plugs, the clot has been introduced into the special cylinders of A-PRF Box and slowly compressed with the help of the piston (fig.10). The clot was then cut to the appropriate size (fig.11) and inserted into the bone defect resulting from the enucleation of the cyst with the purpose of filling it (fig.12).

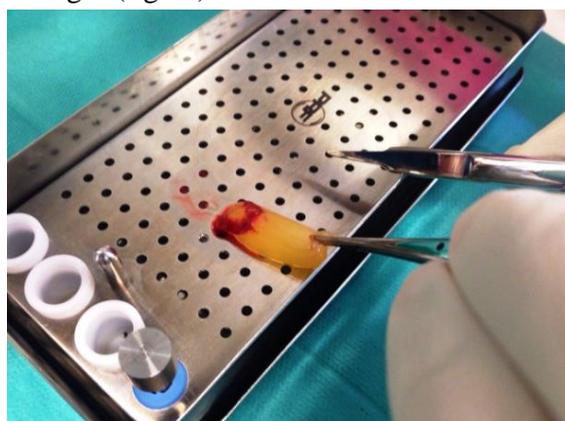


Figure 9. Realisation of A-PRF plugs

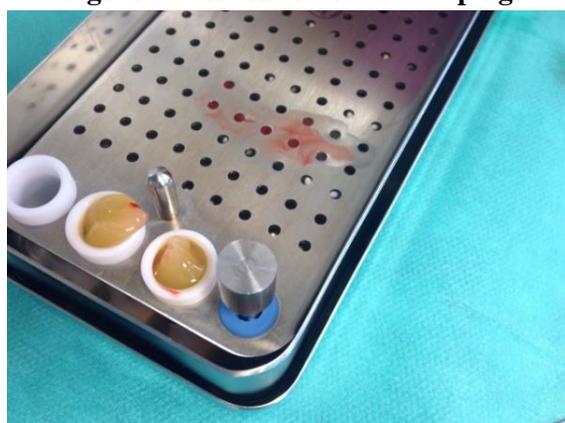


Figure 10. The clot introduced in special cylinders of A-PRF Box



Figure 11. Appearance of A-PRF plugs



Figure 12. A-PRF application into the bone defect after the cyst enucleation

Then it was reapplied and repositioned on the bone bed mucoperiosteal flap in trapeze and the suture was performed with resorbable threads (fig.13).



Figure 13. The suture

The growth factors of A-PRF plugs are gradually released for 7 days and their action leads to rapid healing from the first days after surgery. By stimulating the angiogenesis and thus the intake of nutritional factors and healing in the grafted area, A-PRF contribute decisively also in the consolidation phase of the initial results.

The patient has received post-operative instructions. Antibiotics, analgesics, oral rinse with mouthwash has been prescribed for 5 days after surgery.

At 24 hours after surgery was noted a moderate edema of area concerned, which gradually decreased during the first 7 days. No signs of infection were noted. The patient

was recalled every 1,3,6 months for routine intraoral examination. Radiographic examination revealed bone regeneration with bone trabeculae appearance.

DISCUSSIONS

Periapical cyst is most frequently found and was classified as inflammatory. Pulp necrosis leading to periapical inflammation appears to be the most common etiology of periapical cyst (14). However, it usually goes unnoticed and rarely exceeds the palpable size, being found after an radiological examination.

In the specialized literature, most cases of periapical cysts have been described in the anterior area of the upper jaw (15,16). Some of the possible reasons for such cysts develop in maxilla and are reported in the literature could be: the spongy structure of maxillary bone and the reluctance to extract the anterior teeth which present periapical processes and their prolonged maintenance in the arch leads to the formation of cysts.

Periapical surgery includes removal of damaged tissue and sometimes the application of different grafting materials to enhance new bone formation at the remained defect site. The surgical approach of maxillary periapical cystic lesion is marsupialization or total enucleation through intraoral approach (17). The treatment is dependent on the size and location of the lesion, the bone integrity of the cyst walls and its proximity to vital structures.

Post-surgically, the formation of blood clots initiates the healing and regeneration of hard and soft tissues. Wound healing is an organized process involving leukocyte and platelet activity. For this process to work effectively, the platelets play a vital role.

Growth factors present in blood platelets are important to guide the regenerative cells to the healing area.

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. (18) demonstrated that monocytes are the first to send positive signals to stimulate bone progenetic cells. This effect is crucial because it will immediately triggers a cascade of reactions that will lead to osteogenesis.

The use of platelet-rich fibrin, or A-PRF that is a healing autologous material is a way to accelerate and enhance the natural wound healing mechanisms of the body.

CONCLUSIONS

A-PRF speeds up the healing process, as shown in our case report in which A-PRF is effective in the healing of the bone defect resulting from cyst enucleation in a faster rate, both clinically and radiologically, so the healing time of cystic cavity was reduced to 3 months instead of 6 to 12 months.

Accelerating the healing process 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 shows that APRF 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.

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