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A Case of Periradicular Surgery: Apicoectomy and Obturation of the Apex with Guided Bone Regeneration Using Platelet Rich Fibrin.

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Abstract

The main goal of apical surgery is to prevent bacterial leakage from the root-canal system into the Periradicular tissues ensured by sealing root apex following root-end resection. In the reported case, Apicoectomy was performed on the maxillary central incisor. A bony window at the surgical site was created using carbide bur. Thereafter; lesion enucleation, root-end resection, obturation and retrograde filling - were carried out through this window preparation. Platelet rich fibrin aggregate was used to promote guided bone regeneration. The chief objective of periapical surgery is to obtain tissue regeneration. This is accomplished by removal of periapical pathologic tissue and by exclusion of any irritants within the physical confines of the tooth. Patient was re-evaluated clinically and radiographically after a period of 3, 6 and 12 months.

Keywords: Apicoectomy, platelet rich fibrin, root canal treatment

Introduction

The success of root canal treatment is primarily determined by complete debridement and obturation of the root canal system [1, 2]. The principal treatment modalities frequently relied upon to manage endodontic treatment failures are orthograde retreatment and apical surgery. Apicoectomy involves the surgical management of a tooth with periapical lesion which cannot be otherwise treated by conventional endodontic treatment (root canal therapy or endodontic retreatment). Given the fact that the term Apicoectomy involves only one aspect (removal of root apex) of a complex series of surgical procedures, the terms "periapical surgery" or "Periradicular surgery" seem to be more justified. The key objective of periapical surgery is to promote tissue regeneration. This is primarily achieved by removal of periapical pathologic tissue and elimination of irritants within physical confimes of affected root.

Regenerative potential of platelet was introduced in the 70's [3], when it was observed that it contains growth factors responsible for increasing collagen production, cell mitosis, blood vessels growth, recruitment of other cells that migrate to the site of injury and promote healing and cell differentiation induction, amongst others [4]. The use of platelet concentrates are widely used in oral surgery for in vivo tissue engineering applications as platelet-rich plasma (prp) and platelet-rich fibrin (prf). Platelet concentrates are a concentrated suspension of growth factors found in platelets, which act as bioactive surgical additives that are applied locally to induce wound healing [4].

In the presented case platelet rich fibrin was used to promote wound healing.

Case 1

A 22 year old male patient with a history of dental trauma 4 years back, with no relevant medical history reported to the dental department at esic model hopspital , noida with the chief complaint of pain ,mobility and pus discharge in relation to maxillary right central incisor (11) since 6 months. He complained of pain on biting and palpation in the area. In his dental history, he reported that the tooth had been treated non-surgically 12 months earlier. Clinically tooth had ellis class 3 fracture associated with sinus and grade 1 tooth mobility (figure1). Tooth was tender on percussion. Periodontal probing was within normal limits when compared to contralateral and adjacent teeth. The radiographic examination revealed periapical radiolucency 4-5 mm in diameter along the root apex (figure 2). Considering the patient age and overall prognosis, periradicular surgery was planned for the patient. Written consent was obtained from the patient after explaning the treatment procedure and outcome along with risks and benefits involved.

After rinsing with 0.12% chlorhexidine solution for 60 seconds, the patient was administered local anaesthesia 1:100,000 adrenaline (biocaine adr). After ensuring profound anesthesia, a full thickness sulcular flap was elevated, with releasing incisions including interdental papilla on both sides of 11. The exposed site was considered a candidate for the bony window osteotomy as the cortical plate was found to be intact. The osteotomy was performed with a straight fissure carbide bur on the exposed cortical plate based on the measurement made on the digital radiograph and the topography of the exposed bone. Two vertical and two horizontal grooves were joined to create a bony window of approximately 5 mm by 6 mm. The granulation tissue at the surgically exposed site was excavated and removed by curettage with periodontal curettes until healthy bone margins were encountered and the root tip was clearly visible. At this stage;after obtaining dry and sterile field, obturation with gutta percha was done ensuring complete hermetic seal. Plasma rich fibrin aggregate was placed over surgical site for guided bone regeneration (figure 3). 3-0 silk sutures were used for suturing the soft tissue (figure 4). The patient was prescribed oral analgesics and antibiotics and instructed to rinse twice daily with a 0.2% chlorhexidine mouthwash for 1 week. The sutures were removed 7 days after surgery.

Preparation of prf

Whole venous blood (around 5 ml) was collected in two sterile vacutainer tubes (6 ml) without anticoagulant and the vacutainer tubes were then placed in a centrifugal machine at 3,000 revolutions per minute (rpm) for 10 min, after which blood settled into the following three layers: upper straw-colored acellular plasma, red-colored lower fraction containing red blood cells (rbcs), and the middle fraction containing the fibrin clot. The upper straw-colored layer was then removed and middle fraction was

collected, 2 mm below to the lower dividing line, thus obtaining prf (figure 5).

The follow-up examinations of this case were done after 2 weeks, 3 months, 6 months and 12 months. The examinations noted an absence of symptoms, such as pain, swelling, trismus and normal function of the tooth was restored. No sensory loss was reported by the patient. At 3 months intra oral periapical radiograph (iopa) showed reduction in pathology (figure 6). The patient presented for follow-up at 12 months with nearly healed periapical pathology and no clinical signs or symptoms (figure 7).

Discussion

In case of failure of the conventional root canal treatment (rct), non-surgical retreatment is the preferred treatment of choice in most cases. However, factors such as a complex root canal system, previous procedural accidents, trauma, large periapical defects may impede the success of non-surgical retreatment. These cases warrant periradicular surgery and apicoectomy as a treatment of choice to preserve the tooth.

During endodontic surgery, enucleating granulation tissue in bony lesions makes reduction of cortical bone inevitable, especially in case of a large apical lesion. However, extensive intraoperative removal of the buccal bone plate may result in delayed healing and dehiscence of the resected roots [5]. In two recent studies, one on dogs and another on human subjects, cone-beam computed tomography (cbct) evaluation of healing at 6 months and one year, respectively, demonstrated that the slowest component to regenerate was the cortical plate. A greater bone regeneration score was evident at the resected root surface and the surrounding medullary bone, whereas, the cortical bone was not reestablished to its preoperative continuity and thickness [6,7]. Jansson et al. Reported questionable healing in teeth with larger defects as compared to small lesions that showed remarkable healing [8]. They measured an average defect diameter of 5.9 mm in successful cases and diameter of 7.5 mm in uncertain cases. When osteotomy sites were small (7.04 mm), complete healing was more frequently observed than in cases with larger osteotomy sites (> 8.60 mm) wherein healing was not that remarkable [5]. Hence, preserving a healthy buccal plate may enhance the prognosis.in the presented case bony window size was kept to the minimal by carefully assessing pre-operative radiograph and bony topography. Subsequent to root-end resection and preparation,root canal obturation was done in a way to close the path of communication between root canal system and surrounding periradicular tissues.

In the present case platelet rich plasma aggregate was used as autogenous membrane.prf comprises of an autologous leukocyte-platelet-rich fibrin matrix [9, 10], composed of a tetra molecular structure, with cytokines, platelets, cytokines, and stem cells within it [11, 12], which acts as a biodegradable scaffold [13] that favors neo microvascularization and guides epithelial cell migration to its surface [12, 14]. Also, prf may serve as a vehicle for carrying cells associated with tissue regeneration [15] and seems to have a sustained release of growth factors [16] in a period between 1 and 4 weeks, stimulating the environment for wound healing [17]. It has a complex architecture of strong fibrin matrix with favorable mechanical properties and is slowly remodeled as in case of blood clot [17]. Many studies [18-21] have demonstrated that prf is a healing biomaterial with a great potential for bone and soft tissue regeneration, without significant inflammatory reactions and may be used alone or in combination with bone grafts for promoting hemostasis, bone growth, and maturation. This autogenous matrix demonstrated in vitro studies a great potential to increase cell attachment [17] and signaling to differentiate and proliferate osteoblasts [22]. Dohan et al.

[14, 23] stated that prf has immunological and antibacterial properties which may lead to leukocyte degranulation and has cytokines that may induce angiogenesis and pro/anti-inflammatory reactions. The chief difference between natural blood clot and prf is that the latter is more homogeneous and stable and easy to handle [24]. During surgical procedures, prf could serve as a resorbable membrane for guided bone regeneration (gbr) [15], preventing the migration of epithelial cells into bone defect and providing a space that allows the immigration of osteogenic and angiogenic cells [25].the follow-up examinations showed absence of symptoms and normal function of the tooth was restored. No sensory loss was reported by the patient.

Conclusions

In the presented case apicoectomy resulted in long term favourable treatment outcome. In present case prf was used as graft material. Although prf belongs to a new generation of platelet concentrates, the biologic activity of fibrin molecule is itself good enough to account for significant cicatricial capacity of the prf. The slow polymerization mode confers to prf membrane as a reasonably favorable physiologic architecture to support the healing process. However, it is now necessary to look further into platelet and inflammatory features of prf. Only a perfect understanding of its components and their significance will enable us to comprehend the clinical results obtained and subsequently extend the therapeutic application of this biomaterial.

Conflict of interest: the authors declare not having any conflict of interest.

Figure legends

Figure 1: intraoral periapical radiograph of maxillary right central incisor showing incomplete rct with periapical radiolucency (11).

Figure 2: clinical picture of maxillary right central incisor showing fractured 11 along with sinus.

Figure 3: clinical picture showing raised flap with vertical realising incisions, prepared window, placed plasma rich fibrin aggregate.

Figure 4: site sutured with 3-0 silk sutures.

Figure 5: prepared plama rich fibrin aggregate.

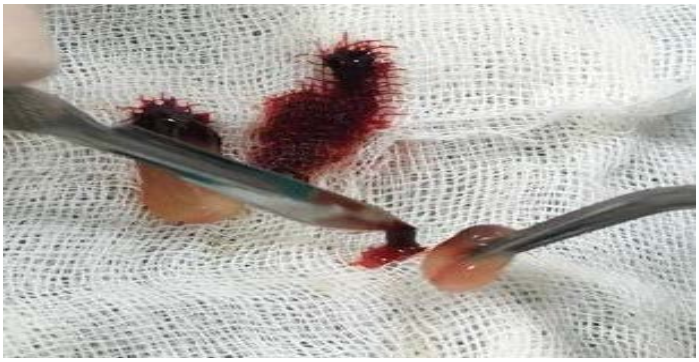

Figure 6: 3 month post-operative radiograph showing perfectly obturated canal with resolving periapical lesion.

Figure 7:12 month post-operative radiograph showing periapial healed site.

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