Case Report

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A NOVEL APPROACH OF APEXIFICATION OF IMMATURE PERMANENT TOOTH USING AUTOGENOUS APICAL MATRIX AND A MTA BARRIER: A CASE REPORT

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ABSTRACT:

The absence of a natural apical constriction in a nonvital immature permanent tooth makes endodontic treatment a challenge. There is a need to induce or create an apical barrier against, which the obturating material can be condensed. Traditionally, calcium hydroxide is the material of choice to induce apexification. Due to certain drawbacks such as prolonged treatment durationand unpredictable apical barrier formation, it is being replaced by materials, which have a more predictable outcome like mineral trioxide aggregate (MTA). One step apexification with MTA reduces the treatment time when compared with traditional calcium hydroxide apexification, which requires an average time of 12–19 months. In one step apexification using MTA, the technical problem encountered is controlling the overfilling or underfilling of MTA. The use of a matrix material helps to overcome this shortcoming. Platelet rich fibrin (PRF) is an immune platelet concentrate, which can be used as a matrix because it also promotes wound healing and repair. A case report of one step apexification using MTA as an apical barrier and autologous PRF as an internal matrix has been discussed.

Key words: Internal matrix, mineral trioxide aggregate, one step apexification, open apex, platelet rich fibrin.

INTRODUCTION:

Traumatic injuries to young immature permanent teeth often result in necrosis of the pulp, which eventually causes arrested root formation. These teeth have thin and fragile root walls with large open apex. Endodontic treatment of these teeth with open apices is difficult due to inability to complete debride, disinfect and seal the root canal system. Immature teeth with apical periodontitis may be treated by using different procedures (1).

A wide array of materials have been used for apexification including calcium hydroxide, magnesium oxide, barium hydroxide, zinc-oxide, calcium oxide, calcium phosphate collagen gel, tricalcium phosphate and etc (2). Calcium hydroxide is the most commonly used material for apexification, with long history of clinical success (3). However, it

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was found that long term application of calcium hydroxide produces weaker dentinal walls and make the dentin more vulnerable to fractures [4].

An alternative to calcium hydroxide apexification is one step apexification technique using mineral trioxide aggregate (MTA) as an artificial barrier. Various studies using MTA for apexification have shown promising results. The advantages of MTA apexification are reduction of treatment time, does not changes mechanical properties of dentine, excellent biocompatibility and stimulation of repair [5]. Common technical difficulties associated with the placement of MTA as an apical barrier is formation of overfill or underfill. Lemon first advocated the use of an internal matrix when the apical diameter is >1mm to avoid extrusion of sealing material. The use of a matrix is advisable since provides a base on which the sealing material like MTA, can be placed and packed [6]. Several materials have been recommended to create an internal matrix, including calcium hydroxide, hydroxyapatite, resorbable collagen, calcium sulfate and decalcified freeze dried bone allograft (DFDBA), Platlate rich plasma or PRF.

This article presents a novel case report about the use of platelet rich fibrin (PRF) as an autogenous, cost effective and resorbable internal matrix prior to placement of MTA as an apical barrier in a fractured, nonvital immature permanent tooth with chronic periapical abcess and wide open apex.

CASE DETAILS:

A ten year old male patient reported to the outpatient department of Pedodontics and Preventive dentistry with the chief complain of pain in upper front teeth region. Clinical examination revealed Ellies class III fracture in 21 with labial discharging sinus in relation to 21 and Ellies class II fracture in relation to 11 & 22 (Figure 1). 21 was tender on vertical percussion. Past dental history revealed that the patient had suffered trauma in upper front teeth region at the age of 8 years. Intraoral peri-apical radiograph of 11 and 21 region revealed thin radicular dentin wall with periapical radiolucency in proximity of the apex (which was open and immature) of 21 (Figure 2). Based on the clinical and radiographic findings, provisional diagnosis of chronic periapical abscess in relation to 21 was made.

As open apex of 21 was wide open in nature, a clinical decision of apexification with apical barrier was made. Under local anesthesia (2% lignocaine with 1:80000 adrenaline) access opening was done on 21 . Working length was determined using no. 80 K file by radiovisiography (Figure 3). Thorough BMP was done by step back procedure to remove the entire canal debris and necrotic tissues. Canal was irrigated with 2.6% sodium hypochlorite followed by normal saline. The root canal was then dried with sterile paper points. Water base Calcium hydroxide (Apexcal, IvoclarVivadent) was placed in the root canal and canal coronal seal was done with Glass Ionomer Cement. Patient was recalled after 2 weeks. After two weeks access cavity was reopened and calcium hydroxide dressing was removed by hand instrument. The canal was debrided further with sodium hypochlorite and saline. The canal was dried with paper points (Densply India). Platelet rich fibrin (PRF) membrane was prepared using the procedure described by Dohan *et al* (9). The PRF membrane was cut into two halves to reduce the size of the membrane [Figure 4]. PRF membrane was introduced into the canal and was gently compacted using hand pluggers to form an apical barrier at the level of apex.

MTA (angelus) was mixed according to the manufacturer's instructions and was placed in the apical portion of canal against the PRF matrix, subsequent increments were condensed with hand pluggers till a thickness of 5 mm [Figure 5]. A wet cotton pellet was placed into the canal. Access cavity was sealed with temporary restoration.

After 1 week the patient was asymptomatic, the access cavity was reopened and cotton pellet was removed. A hand plugger was tapped against the MTA barrier to confirm the setting of MTA (Figure 7). The fiber optic post (Coltene) is inserted into the canal and cemented with resin cement. The crown portion is restored with light cure composite (IvoclairVivadent). 11 & 22 were also restored with light cure restoration (Figure 6). On recall visits at a interval of every 3 months 11 an 22 was found to be clinically an radiologically asymptomatic.

DISCUSSION:

Apexification procedure aims at formation of an apical barrier to prevent the passage of toxins and bacteria from the root canal into periapical tissues. Technically this barrier is necessary to allow compaction of root filling material and to confine the obturating material into the root canal preventing an overfill (7,8). The major problem in cases of a wide open apex is the need to limit the material, thus avoiding the extrusion of a large amount of material into the periodontal tissue. Using a matrix avoids the extrusion of the material into the periodontal tissues, reduces leakage in the sealing material and allows favourable response of the periodontal tissues. Various materials have been used for formation of apical barrier during apexification. This case report discusses about a new concept of using PRF as an apical matrix membrane. PRF is a matrix of autologous fibrin, in which are embedded a large quantity of platelet and leukocyte cytokines during centrifugation (9). The intrinsic incorporation of cytokines within the fibrin mesh allows for their progressive release over time (7-11 days), as the network of fibrin disintegrate (10). The easily applied PRF membrane acts much like a fibrin bandage serving as a matrix to accelerate the healing of wound edges (11).

According to Simonpieri *et al* (2009) (12), the use of this platelet and immune concentrate offers the following 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 [9], vascularization and survival of the graft. Third, the platelet cytokines (PDGF, TGF-?, IGF-1) are gradually released as the fibrin matrix is resorbed, thus creating a perpetual process of healing [13]. 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.

Platelet rich fibrin membrane has a soft consistency and it inherently contains some amount of moisture, still it serves as a good matrix material for placement of MTA, this is because MTA has a wet sand like consistency and can be placed without pressure application and therefore it does not require a pressure resistant matrix for application. Moreover, MTA sets in the presence of moisture and does not require a moisture free environment. Another advantage of using PRF as a matrix is that it promotes wound healing and repair [14]. The precise mechanism of action of PRF is yet to be proved. PRF is a second generation platelet concentrate which is still under study and many more advancements in its clinical applications are expected in near future

CONCLUSION:

The combination of PRF as a matrix and MTA as an apical barrier can be considered as a good option for one-step apexification procedure. However, controlled clinical trials need to be conducted to investigate the predictability of the outcome of the technique.

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FIGURES:

Figure 1: Preoperative clinical

Figure 2: Preoperative radiograph

Figure 3: Working length

Figure 4: PRF Preparation

Figure 5: MTA placement over PRF

Figure 6: Post-operative clinical

Figure 7: Post-operative Radiovisiograph