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RESEARCH ARTICLE

MANAGEMENT OF NON-VITAL IMMATURE PERMANENT TEETH –A CASE SERIES

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ABSTRACT

Endodontic treatment of non-vital immature permanent teeth are a challenge itself, because of the size of the canal, the thin and fragile dentine walls and large open apex. The challenge has been faced by different treatment options like apicoectomy, apexification, regenerative and revascularization endodontics. The aim of the present article is to report three clinical cases of management of non-vital immature permanent teeth by using different treatment protocols. Child Patient with an age range of 8-10 yrs reported with a common chief complaint of pain. The clinical and radiographic examination revealed carious teeth with open apex in respect to 46 (2 cases) & Ellis class III fracture with open apex in 21(1case). Three different treatment plans were deviced for them. First case done by apexification using $Ca(OH)_2$, Second case, done by MTA apexification & Third case, done by MTA apexification guided by PRF matrix. Apexification done by the discussed procedure have good success rate. The technique was selected depending upon the situation.

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INTRODUCTION

Young permanent tooth is one which has recently erupted into the oral cavity & it's root formation has not yet completed. If such tooth suffer pulp necrosis during the stage of root formation due to trauma or dental caries, it may become non-vital, then the root development ceases and apical closure cannot be achieved. Root canal treatment of non-vital young permanent tooth is a significant challenge, because of the size of the canal, the thin and fragile dentine walls, the open apex & inadequate crown root ratio.

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The challenge can be faced by different treatment options such as periapical surgery, short fill technique, retrograde filling, customized cone technique, apexification using calcium hydroxide or mineral trioxide aggregate (MTA) & recent advancement revascularization to induce the root closure. According to American Association of Endodontists, Apexification is defined as "a method to induce a calcified barrier in a root with an open apex or the continued apical development of an incomplete root in teeth with necrotic pulp" (Paulindraraj *et al*., 2015). Traditionally calcium hydroxide is documented as the ideal material for apexification procedure (Rule, 1966). Variety of materials have been suggested to obtain artificial apical barriers as an alternative to traditional $Ca(OH)_2$ apexification (Brandell *et al*., 1986; Schumacher *et al*., 1993).

The application of MTA as an artificial apical barrier has been documented by Torabinejad and Chivian in 1999. Now a days it has become the material of choice in artificial apical barrier procedures (Yassen, 2013). But in some cases with wide open apices, adequate condensation of MTA at the apex is difficult because there is a chance of extrusion of material beyond the apex. Therefore an apical matrix is needed for the controlled placement of MTA to a desired level. (Khetarpal *et al*., 2013) Platelet rich fibrin (PRF) is an immune platelet concentrate, which can be used as a matrix. It stimulates osteoblasts, gingival fibroblasts, and periodontal ligament cells proliferation as a mitogen (Dohan Ehrenfest *et al*., 2009). This article presents three clinical cases of management of non-vital immature permanent teeth by using different treatment protocols.

Case Report-1

An eight Year-old male patient reported with a chief complain of pain in lower right back teeth region. Based on the clinical and radiographic findings, the diagnosis was chronic Irreversible pulpitis with thin root dentinal wall & open apex in 46 due to caries (Figure 1). The tooth tested negative to both electric & heat tests. Medical history was non-contributory. Treatment Plan was $Ca(OH)_2$ apexification followed by RCT after closure of root apex in 46. In the First visit, access cavity was prepared in 46 after achieving local anesthesia & rubber dam isolation. Minimum debridement of the canal using K file at an working length of 2mm short of radiographic apex followed by copious irrigation with normal saline and 2.5% Sodium hypochlorite was performed (Figure 2). After drying the canal using paper points (Densply India), $Ca(OH)_2$ powder was mixed with distilled water & placed into the canal at apex using hand plugger (Figure 3). Access opening filled with CAVIT^{TM} temporary restoration (3M ESPE). $Ca(OH)_2$ dressing changed every 3 month. At the end of 6 month tooth was asymptomatic with radiographic & clinical evidence of apex closure.

Fig. 1. Preoperative radiograph

Fig. 2. Working length determination

Clinically, apical barrier formation was confirmed by using gutta-percha (GP) point to check for the presence of resistance "stop" & absence of hemorrhage or exudates (Figure 4). Then affected tooth was obturated with GP using lateral condensation technique & extra coronal restoration done with stainless steel crown (Figure 6).

Fig. 3. Intracanal Ca (OH)2 medicament Placed

Fig. 4. Apical barrier achieved after 6 months

Fig. 5. Trial fiitting of GP

Fig. 6. Post operative radiograph after obturation followed by SS crown

Case Report-2

An eight year old boy brought to the department with chief complaint of pain in lower right back tooth region. Medical

history of the patient was non-contributory. Clinical examination revealed grossly carious 46 with gingival swelling which was tender on percussion & gave delayed response to pulp vitality test. Radiographic examination revealed presence of peri-apical radiolucency with open apex in distal root (Figure 1).

Fig. 1. Preoperative radiograph

Treatment plan was decided, MTA Apexification in distal root followed by fiberpost & obturation in mesial roots with GP. After rubber dam isolation conventional access cavity was prepared & working length determined in 46 (Figure 2). Root canal debridement was done by using K file followed by copious irrigation with normal saline & 2.5% Sodium hypochlorite. Calcium hydroxide was placed into the canal for 1 week & access cavity temporarily restored with CAVIT^{TM}. Next appointment, Calcium hydroxide was removed with copious irrigation with 2.5 % Sodium hypochlorite alternatively with normal saline. Canals were dried with paper points. MTA (Angelus) was mixed in a sterile glass slab with spatula as recommended by the manufacturer. MTA was transferred into the root canal with amalgam carrier and the apical portion of the distal canal was filled with MTA by hand obturation technique to create an apical plug of 4 mm in thickness using MTA pluggers. Correct placement of MTA was confirmed by Radiovisiography (RVG). Then the mesial canals were obturated completely with GP by lateral condensation method (Figure 3).

Fig. 2. Working length determined

Fig. 3. MTA apical plug in distal canal

Fig.4. Fiber-post cemented in distal canal

Fig. 5. SS crown with immediate Post-operative Radiograph

Access cavity was sealed with CAVIT. After 24 hrs, the fiber optic post (Coltene) is inserted into the distal canal and cemented with resin cement (Ivoclair Vivadent) (Figure 4). The crown portion is restored with light cure composite (Ivoclair Vivadent) followed by stainless steel crown (Figure 5).

Case Report-3

A ten yrs old male patient reported with the chief complain of pain & discoloured tooth in upper front teeth region. Clinical examination revealed Ellis class III fracture in 21 with discharging sinus in relation to 21 (Figure 1). Dental history revealed that the patient had suffered trauma at the age of 7 yrs. Radiograph (RVG) showed thin radicular dentin wall with periapical radiolucency in proximity of the apex (which was open and immature) of 21(Figure 2). Treatment planning was MTA apexification in 21 guided by PRF matrix. Conventional access cavity was prepared on 21.Working length was determined using K file (Mani) (Figure 3). The canal was then gently cleaned with minimal instruments with K file followed by copious irrigation with normal saline and 2.5% NaOCl. Tri-antibiotic paste containing metronidazole, ciprofloxacin & amoxicillin was placed in the root canal and access cavity sealed with CAVIT^{TM}. After one week, access cavity was reopened and tri-antibiotic paste was removed by copious irrigation with 2.5 % Sodium hypochlorite & normal saline. The canal was dried with paper points (Densply India). Platelet rich fibrin membrane was prepared using the procedure described by Dohan *et al*. Blood (8.5 ml) was drawn by venipuncture of the anticubital vein. This blood was collected in a 10 ml sterile glass tube without anticoagulant. The tube was centrifuged immediately at 3000 revolutions/min (rpm) for 10 min. After the centrifugation the resultant in the glass tube consisted of the top most layer of acellular platelet poor

plasma, PRF clot in the middle and red blood cell's at the bottom (Kumar *et al*., 2014). PRF membrane was cut into pieces (Figure 4) & placed with hand plugger into the canal to form an apical barrier at the level of apex. MTA (angelus) was mixed according to the manufacturer's instructions and condensed in the apical portion of canal with hand pluggers against the PRF matrix till 4mm thickness achieved at the apex (Figure 5). A wet cotton pellet was placed into the canal. Access cavity was sealed with CAVIT^{TM}. After 24 hrs the patient, 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.

Fig. 1. Preoperative clinical

Fig. 2. Preoperative radiograph

Fig. 3. Working length determined

Fig. 4. PRF Preparation

The fiber optic post (Coltene) was inserted into the canal and cemented with resin cement (Ivoclair Vivadent). The crown portion was restored with light cure composite (Ivoclair Vivadent) (Figure 6&7).

Fig. 5. MTA placement over PRF

Fig. 6. Post operative RVG after fiberpost cementation

Fig. 7. Post operative clinical

All cases six months follow up were showed successful outcome both clinically and radiographically and patients were instructed for further follow up every 6 months interval.

DISCUSSION

Traditionally, treatment for infected immature teeth involves creating a calcified barrier to promote formation of a hard apical barrier at the open apex through the process of apexification. Several procedures by utilizing different materials have been tried to induce root-end barrier formation. Kaiser in 1964 introduced the use of calcium hydroxide in apexification (Paulindraraj *et al*., 2015). Calcium hydroxide apexification is the most commonly advocated therapy for non-vital immature teeth and reported high success rate (Morse *et al*., 1990; Leonardo, 1993). Advantage of $Ca(OH)_2$

apexification is- promotes healing & repair ,inexpensive & easy to use. The first case was done by $Ca(OH)_2$ apexification technique because patient counld't afford expensive treatment procedure. But the disadvantage of $Ca(OH)_2$ apexification procedure is longer treatment time, require multiple visits, making patient compliance a problem and increased chances of re-infection due to microleakage from failed temporary restoration (Tronstad *et al*., 2000). It may also further weaken the teeth and there is increased risk of tooth fracture after prolonged use of calcium hydroxide (Andreasen *et al*., 2002).

In recent times, single visit MTA apexification has gained widespread popularity than calcium hydroxide apexification. It promotes apical hard tissue formation with greater consistency than calcium hydroxide apexification. MTA is a biocompatible & bacteriostatic material, it has good sealing ability & also helps in the formation of bone & periodontium around its interface, can be used to create a physical barrier. But the disadvantages of MTA as obturating material is -difficulty in placement of the material in curved canals and elective removal after placement, slow setting time and high cost (Boutsioukis *et al*., 2008; Torabinejad *et al*., 1995). Another the technical problem encountered is controlling the overfill or underfill of MTA. To overcome such problem Lemon in 1992 introduced the 'internal matrix concept' (Kumar *et al*., 2014).Lemon advocated the use of a matrix when the perforation diameter is larger than 1mm to avoid extrusion of the sealing material. The use of a matrix material helps to overcome this shortcoming. Various biocompatible materials used as apical matrix. These are tricalcium phosphate, collagen calcium-phosphate, osteogenic protein-1, bone growth factor and oxidized cellulose, proplast, barium hydroxide, true bovine bone ceramics, and dentin chips. PRF developed in France by Choukroun and Dohan represents a new step in the platelet gel therapeutic concept (Khetarpal *et al*., 2013). PRF contains platelet derived growth factors, vascular endothelial growth factor. It can be used as a matrix, it stimulates osteoblasts, gingival fibroblasts & also promotes wound healing and repair. In the third case opening of root apex was greater than 1mm. Therefore, placement of PRF as an apical barrier was planned. Another advantage of using PRF as a MTA sets in the presence of moisture.

Conclusion

$Ca(OH)_2$ apexification though cheap requires multiple visit & longer duration of treatment than MTA apexification. The technical problem encountered in MTA apexification is in controlling the overfilling and underfilling of MTA. This shortcoming can be overcome by using MTA apexification guided by PRF matrix. Apexification done by the discussed procedure have good success rate. The technique is selected depending upon the situation.

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