



CASE REPORT

Endodontic Management of Tooth with Open Apex using MTA as Apical Barrier and Platelet Rich Fibrin Membrane as Internal Matrix: A Case Report

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ABSTRACT: Endodontic therapy of tooth with necrotic pulp with wide open apex has always posed challenge to endodontists. Endodontic treatment for such teeth is conventional Apexification with or without apical barrier. Traditionally calcium hydroxide has been used for apexification but prolonged treatment time is one of its major disadvantages which was overcome by the use of MTA. However, one of the technical problems faced with this restorative material is to prevent over fill and under fill. Using of a matrix avoids the extrusion of material into the periapical tissues. This article demonstrates the concept of using platelet rich fibrin membrane as an apical matrix barrier for stabilization of MTA in root end Apexification procedure. Platelet Rich Fibrin is an autologous fibrin matrix containing a large quantity of platelet and leukocyte cytokines, which enhance healing by release of growth factor. This case report represents the successful management of case of immature maxillary anterior teeth with MTA plug and PRF as internal matrix.

Keywords: Apexification, mineral trioxide aggregate, platelet rich fibrin, autologous fibrin matrix

The teeth with immature root development, necrotic pulp and apical periodontitis present multiple challenges for successful treatment; firstly because the infected root canal cannot be cleaned and disinfected with standard root canal protocols using an aggressive procedure with endodontic files, secondly obturation poses next problem as there is no apical barrier for containing root filling without impinging on the periodontal tissues and finally the presence of thin roots which increases the

susceptibility to fracture.^{1,2}

In past treatment of open apex in non-vital teeth included use of custom fit cones and apical surgery. However, these procedures enjoyed limited success and led to the development of procedures wherein an artificial barrier was established and referred as “Apexification”. Apexification with

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calcium hydroxide is the most commonly advocated therapy for immature teeth with nonvital pulp and the healing rate is high.^{3,4} However Apexification with calcium hydroxide carried number of disadvantages with it such as the treatment requires compliance from the patient and many appointments over a period of time ranging from 3 to 24 months. During this period, the root canal is susceptible to reinfection around the provisional restoration, which may promote apical periodontitis and arrest of repair. In addition, *Andreasen et al.* (2002) reported that the fracture strength of immature teeth may be reduced by long-term calcium hydroxide treatment.^{5,6}

One alternative for calcium hydroxide apexification is a single-step technique using an artificial apical barrier. The one-visit apexification has been described as the nonsurgical compaction of a biocompatible material into the apical end of the root canal, thus, creating an apical stop and enabling immediate filling of the root canal.^{7,8}

Number of materials have been used for this purpose including tricalcium phosphate, calcium hydroxide, freeze dried bone, freeze dried dentin, collagen calcium phosphate, proplast (a polytetrafluor-ethylene and carbon felt like porous material).⁹⁻¹⁴

Over last decade, mineral trioxide aggregate (MTA) has been extensively researched and reported as possible alternative to calcium hydroxide apexification and has been recommended by numerous authors. These

applications are possible due to the favorable properties of MTA including biocompatibility, good canal sealing ability and the ability to promote dental pulp and periradicular tissue regeneration. *Felippe et al.* (2006) reported that MTA, when applied as an apical plug, favored apexification and periapical healing, regardless of the prior use of calcium hydroxide paste.^{15-17.}

One of the technical problems associated with the placement of the MTA when used as artificial barrier is to prevent an overfill and underfill. A recent case reports by *Nosrat et al* (2012) described the outcome of unintentional extrusion of MTA into periradicular tissue during apical barrier treatment in three cases and concluded that Extruded MTA may not harden and may be associated with ongoing periapical irritation.¹⁸ Therefore to confine MTA within root canal, using "internal Matrix concept" has been proposed. Platelet rich fibrin (PRF) was first described by Choukran et al in France. The PRF belongs to new generation of platelet concentrates, which has been shown to have several advantages like ease of preparation, lack of biochemical handling of blood which makes this preparation strictly analogues, promotion of wound healing, bone growth, bone maturation and hemostasis.¹⁹ This case reports presents the management of an immature tooth (open apex) with single step apical barrier placement using MTA and autologous PRF membrane as an internal matrix.

CASE REPORT:

A 15 year old female patient presented to the department of conservative dentistry and endodontics, with pain and broken upper front tooth region. Patient had experienced dull pain since 2 weeks. Past dental history revealed trauma to her upper front tooth. The medical history of the patient was non-contributory. Intraoral examination of her teeth revealed the presence of discoloured tooth i.r.t 22 along with Ellis class IV fracture(Fig 1). Tooth no. 22 was sensitive to percussion and did not respond to electric pulp test (EPT). Periodontal probing depth of the tooth # 22 was within normal limit. Intraoral periapical radiograph of the tooth no # 22 revealed an immature root and open apex associated with periapical radiolucency (Fig 2).

ii) Diagnosis:

The diagnosis made was open apex with pulpal necrosis and chronic apical periodontitis.

iii) Management:

The rubber dam was applied. Endodontic

access cavity preparation was done using a no.2 round bur and Endo Z bur (DENTSPLY) and the working length was determined. The canal was instrumented lightly with K files (Mani, Japan) and canal were thoroughly irrigated with sodium hypochlorite (1%) and saline (.9%) and then dried with absorber paper points(Dentsply) and calcium hydroxide was placed as an intracanalmedicament and access was temporized with cavit G (3M ESPE; Germany). The patient was recalled after 1 week.

After 1 week, the tooth was asymptomatic. At this appointment, decision was made to use PRF membrane as an internal Matrix against which MTA(ProRootMTA,Dentsply Tulsa Dental) was placed as an apical barrier. Informed consent of the patient was obtained in writing after thoroughly explaining the clinical procedure, risk involved.

All the procedure was performed under dental operating microscope (seiler, 12X magnification). The canal were irrigated with sodium hypochlorite and dried with absorbent



Fig- 1: Non vital tooth with Ellis class IV fracture



Fig- 2: Pre operative xray showing immature root with open apex

paper points (Dentsply, Tulsa dental).

Preparation of PRF membrane: the preparation was performed by using procedure described by Dohan DM et al.¹⁹ 30 minute before clinical procedure; 10 ml of whole blood was withdrawn by venipuncture of the antecubital vein. Blood was collected in 10ml sterile glass tube without anticoagulant and immediately centrifuged at 3000 revolutions per minute for 10 minute. The resulted product consisted of three layers: topmost layer consisted of acellular platelet poor plasma, PRF clot in the middle and red blood cells at the bottom. The PRF clot was retrieved and fluids were squeezed out to obtain a PRF membrane (Fig 3). PRF membrane was gently compacted using hand pluggers to produce a barrier at the level of the apex with the use of operating microscope. MTA(ProRootMTA, Dentsply Tulsa Dental), was introduced into the canals and compacted using pluggers against the PRF membrane. A radiograph was exposed to

confirm adequate placement of MTA to form an apical stop approximately 3-4mm thick (Fig 4). The blunt end of a large paper point was moistened with water and left in the canal to promote setting. Cotton pellet was place in the chamber and access cavity was sealed with temporary filling material intermediate restorative material (IRM). After 48 hours patient was recalled and the tooth was isolated. A hand plugger was lightly pressed against MTA plug to confirm a hardened set.

The root was reinforced with polyethylene fiber (2mm Ribbond, Inc, Seattle, wash) and Luxa core dual cure resin cement (DMG), was used for both cementation and core build up. The canals were etched with 35% phosphoric acid and coated with bonding agent. The polyethylene fiber tape was cut into twice the length of the post space and core height. The fiber tape was saturated with the resin was formed into "V" shape and introduced into the canal leaving excess "ear" out of the canal. It was further condensed using endodontic



Fig- 3: Platelet rich fibrin membrane



Fig- 4: Placement of mineral trioxide aggregate at apical third of root canal

plugger. Core was made of same dual cure resin cement over the post portion projecting out of canal.

The patient was recalled after 3 and 6 months postoperatively. The follow up radiograph showed reduction in size of radiolucency(Fig 5,6).

DISCUSSION:

Apexification with Calcium hydroxide has shown higher success rate but requires multiple visits over the course of 5-20 months to induce formation of a calcific barrier.²⁰ however problems such as failure to control infection, recurrence of infection and cervical root fracture may occur.² Above all the treatment requires high level of patient compliance. To overcome these disadvantages, one step Apexification with MTA was suggested. MTA was introduced by Torabinejad and colleagues at Loma Linda University and has demonstrated following advantages such as minimal leakage, biocompatible, less cytotoxicity than other material used in Apexification.²¹

The major problem encountered in cases of open apex is the need to limit the material to the apex, thus avoiding extrusion of material into apical region. A large volume of extruded material may set before it disintegrates and get resorbed and result in the persistence of inflammatory response, which might complicate and or even prevent repair of the tissues.¹⁸

Using of matrix avoids extrusion of material into periodontal tissue, reduces leakage and allows favorable healing of periodontal tissues. Calcium hydroxide, Hydroxyapatite, resorbable collagen and calcium sulfate has been used.

Platelet contains variety of growth factors including transforming growth factor B, Vascular endothelial growth factor and platelet derived growth factor. These growth factors are released from the platelets when they are activated, secreted or aggregated by collagen or epinephrine. PRF being an immune platelet concentrate, collected on a single fibrin membrane favors healing and



Fig- 5: Three months follow up radiograph



Fig- 6: Six month follow up radiograph

immunity. Its molecular structure with low thrombin concentration acts as an optimal matrix for migration of endothelial cells and fibroblast. It permits a rapid angiogenesis and easier remodeling of fibrin. Hence it has all the parameters essential for optimal healing.²²

When treating nonvital teeth, the main issue is elimination of bacterial from root canal system. As instruments cannot be used properly in the teeth with open apices, cleaning and disinfection of the root canal rely on the chemical action of NaOCl as an irrigants and calcium hydroxide as an intracanal dressing.²³

NaOCl is known to be toxic especially at high concentrations and in case of open apex chances of apical extrusion are high.

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Therefore in the present cases, copious irrigation was done using lower concentration of sodium hypochlorite (1%).²⁴

Calcium hydroxide pastes were used as intracanal medicamentfor its antimicrobial activity²⁵

In this case, the polyethylene fiber tape was used instead of prefabricated fiber post because of its advantage of adaptability to root canal space and improved impact strength, modulus elasticity and flexural strength of composite material.²⁶

CONCLUSION:

The combination of PRF as a matrix and MTA as an apical barrier provided a good option for creating artificial root end barrier.

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