



# Management Of Open Apex Through Apexification Using Mta And Prf Apical Plug : A Case Report

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## ABSTRACT

The completion of root development and closure of the apex occurs up to 3 years after the eruption of the tooth and any kind of pulpal injury during this period provides a significant challenge for the clinician. Open apices commonly arise secondary to pulpal necrosis as a result of caries or trauma in an immature tooth with incomplete root formation. Apexification is a technique for inducing closure of the non-vital permanent teeth at the apex. A nonvital tooth with open apex is a challenging clinical condition for the dentist as it requires a systematic diagnosis of the problem and a customized treatment plan. The conventional method of apexification with calcium hydroxide has certain disadvantages such as a very long period of treatment, chances of tooth fracture and an incomplete calcification of the bridge. MTA has gained importance as an alternative treatment for management of open apices as it overcomes these disadvantages. Also MTA also has low cytotoxicity and superior biocompatibility as compared to calcium hydroxide used before. The current case report illustrates a case where MTA were used successfully for one step apexification in teeth with open apex.

Key words: Apexification, apical barrier, platelet rich fibrin (PRF), mineral trioxide (MTA)

## INTRODUCTION

Dental trauma to the anterior dentition is common in the young adolescent patient. Prevalence estimates suggest that up to one-half of children, between the ages of 5-18, will incur some type of dental injury during their school years. Also majority of dental trauma occurred before the age of 12 (86%)[1]. Trauma leading to complicated crown fractures and/or pulp necrosis can be a significant problem in these patients due to incomplete root development commonly found in these teeth. An incompletely formed tooth is left with thin dentin wall. Is highly susceptible to fracture. These thin-walled tooth also have a higher incidence of cervical root fracture which reduces the long-term restorative and overall prognosis of the tooth [1,2] The apical anatomy of these teeth is characterised by greater width at the apical portion compared to the cervical portion and the absence of apical constriction, which makes determining and staying within the working length difficult for the clinician.(3,4). In such cases, mineralized tissue must be used to close the

apical foramen or an artificial apical barrier must be created to allow condensation of the root filling material and promote an apical seal [3]. Apexification is a technique for creating a calcified barrier in an open apex root or continuing the apical development of an incompletely formed root in teeth with necrotic pulp[4]. Calcium hydroxide has been the first choice of material for apexification. The tooth required repeated intracanal dressings over the course of 5-20 months to induce the formation of calcific barrier. The efficiency of Calcium hydroxide has been demonstrated by many authors even in the presence of an apical lesion.[5]. However the unpredictability and often the lengthy course of this treatment modality presents challenges, like vulnerability of the temporary coronal restoration to re-infection and also variability of treatment time (average 12.9 months)[6,7], difficulty of the patients recall management, delay in the treatment and increase in the risk of tooth fracture after dressing with calcium hydroxide for extended periods. For these reasons, single visit apexification has been suggested.[7] Mineral trioxide aggregate (MTA) has been proposed as a material suitable for one visit apexification because of its biocompatibility, bacteriostatic activity, favourable sealing ability and as root end filling material.[8] MTA offers the barrier at the end of the root canal in teeth with necrotic pulps and open apices that permits vertical condensation of warm gutta-percha in the remainder of the canal.[8,9,10,11]. Concept of apical matrix has also been suggested in conjunction with apical plug; various materials have been used as material of choice to create the apical matrix such as collagen(12), hydroxyapatite(13), demineralised freeze dried bone graft(14) Platelet rich plasma or combination of platelet rich plasma and hydroxyapatite. The case report demonstrates use of MTA for apexification in open apex case to develop an apical stop and platelet rich plasma as apical plug to facilitate obturation.

## CASE REPORT

A 27-year-old male patient reported to the Department of Conservative Dentistry and Endodontics, with a chief complaint of fractured and discolored teeth in the upper front region of the mouth with a history of trauma 11 years ago. Clinical examination revealed discoloration and Ellis class 4 fracture with 11. Tooth responded normally to percussion, palpation and had normal periodontal probing. Radiographic examination demonstrated the presence of open apex and periapical radiolucency with 11.(Fig 1). Endodontic access opening was done under local anesthesia, and a periapical radiograph was taken to determine the working length. The root canal was irrigated with a hand file with 1.3% NaOCl. The root canal was then dried with sterile paper points. Calcium hydroxide was placed in the root canal, and the patient was recalled after one week. One week later, the tooth was again isolated under rubber dam, the calcium hydroxide dressing was removed by hand instrumentation, and irrigation was done with 1.3% NaOCl and 17% liquid EDTA Smear Clear (SybronEndo, CA, USA). The root canal was then dried with sterile paper points. PRF membrane was used for the formation of the apical plug. Patient's whole blood was drawn into 10 ml glass coated plastic tubes using PRF collection kit without anticoagulant and immediately centrifuged in Process® centrifuge (PC-02, Process Ltd., Nice, France) (Fig. 2) at 3000rpm for 10 minutes. Three layers got formed in the tube (Fig. 2): a base of RBCs, at the bottom, acellular plasma on the surface, and PRF clot in the middle. This membrane was pushed beyond the apex to form a matrix for the placement of MTA (Fig. 2). A thick mixture of White Proroot MTA (Dentsply, Switzerland) was then prepared and applied to the apical portion of the canal using a small plugger and the butt end of sterile paper points (Fig. 1) and excess material was cleared from the walls. Moistened gauze was placed in the remainder of the canal and the access cavity sealed using glass ionomer cement (Fuji, GC Corporation, Tokyo, Japan). Gutta percha backfill was performed using Obtura (Obtura/Spartan, Fenton, MO, USA), and the access cavity was sealed using composite resin (Fig. 1) A radiograph confirmed the completion of the endodontic therapy. A 6month follow-up revealed complete periapical healing and bone formation (Fig. 1). The clinical follow-up showed the patient functioning well with no reportable clinical symptoms and an absence of any sinus tract formation..

**PREOPERATIVE LABIAL PHOTOGRAPH**



**PREOPERATIVE PALATAL VIEW**



**PREOPERATIVE IOPA X-RAY**



**WORKING LENGTH IOPA X-RAY**



**FORMATION OF PRF AFTER CENTRIFUGATION**



**PRF**



**IOPA X-RAY AFTER PLACEMENT OF  
CA(OH)<sub>2</sub> DRESSING**



**IOPA X-RAY AFTER PLACEMENT OF PRF  
PLUG AND MTA**



**IOPA X-RAY AFTER COMPLETION OF  
OBTURATION**



**SIX MONTHS FOLLOW UP X-RAY**



## DISCUSSION

The major problem in cases of a wide open apex is the need to limit the material, thus avoiding the extrusion of material into the periapical tissue. Using a matrix avoids the extrusion of the material into the periapical tissues, reduces leakage of the sealing material and also allows favorable response of the periapical tissues. The apical barrier technique utilizing calcium sulfate or a combination of calcium sulfate and collagen in a powdered form has been performed in the past. Various materials have been used for formation of apical barrier during apexification. This case report has introduced 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 (12). The intrinsic incorporation of cytokines within the fibrin mesh allows for the progressive release of cytokines over time (7-11 days), as the network of fibrin disintegrates.(15) The easily applied PRF membrane acts much like a fibrin bandage which serves as a matrix to accelerate the healing of wound edges (16)

According to Simon pieri et al (2009) (17), the use of this platelet and immune concentrate offers the following 4 advantages: Firstly, the fibrin clot plays an important mechanical role, as the PRF membrane maintains and protect the grafted biomaterials and PRF fragments serve 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 (14), vascularization and survival of the graft. Thirdly, the platelet cytokines (PDGF, TGF-®, IGF-1) are gradually released as the fibrin matrix is resorbed, thus creating a perpetual process of healing8 (15). Lastly, the presence of leukocytes and cytokines in the fibrin network also play a significant role in the self-regulation of inflammatory and infectious phenomena within the grafted material

MTA is a powder consisting of fine hydrophilic particles of tricalcium silicate, tricalcium oxide and silicate oxide. It has low solubility and its radiopacity is slightly greater than that of dentin. This material has also demonstrated good sealability and biocompatibility. MTA has a pH of 12.5 which after setting is similar to the pH of calcium hydroxide and it has been suggested that this property of mta may impart some antimicrobial properties to it. [18] Because of MTA's excellent biological properties and ability to create a good seal, it has been recommended for creating an artificial barrier in the apical area of teeth with open apices, thus reducing the treatment time to 1 or 2 visits. The cell's response to MTA and the mechanism of deposition in barrier formation are unknown and require further investigation.[19] Mineral trioxide aggregate as an apexification material represents a primary monoblock. Apatite-like interfacial deposits form during the maturation of MTA which result in filling the gap induced during material shrinkage phase and improve the frictional resistance of MTA to root canal walls. The formation of nonbonding and gap filling apatite crystals also accounts for the superior seal of MTA. MTA has superior biocompatibility and it is less cytotoxic due to its alkaline pH and presence of calcium and phosphate ions in its formulation result in its capacity to attract blastic cells which in turn promote favorable environment for cementum deposition. [20] In the present case, MTA was placed for around 6 mm in the apical region.[21]. MTA has demonstrated the ability to stimulate cells to differentiate into hard tissue – forming cells and to produce a hard tissue matrix. A number of animal studies have demonstrated a more predictable healing outcome when MTA is used when compared with teeth treated with calcium hydroxide(4). In a prospective human outcome study, 57 teeth with open apices were obturated with MTA in one appointment. Forty – three of these cases were available for recall at 12 months, of which 81% of cases were classified as healed . A recent case series done by Sharma et al. concluded that combination of PRF as a matrix and MTA as an apical barrier is a good option for creating artificial root-end barrier. However, this study further also recommended that controlled clinical trials are necessary to investigate the predictability of the outcome of this technique (22)

## CONCLUSION

Single visit apexification with a novel biocompatible material like MTA has proved to be an boon in effective management of teeth with open apex .This innovative procedure is predictable and is less time .. Mineral trioxide aggregate showed clinical and radio-graphic success as a material used to induce root-end closure in necrotic immature permanent teeth. MTA is a suitable replacement for calcium hydroxide for the apexification procedure

Although the clinical performance and patient compliance of MTA are found to be much better than that of calcium hydroxide, the material of choice to be MTA or calcium hydroxide depends on cost and number of appointments the patient can afford. Commercial products made out of MTA are still expensive, thus making use of MTA unaffordable for a number of patients, especially in developing countries.(23)

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