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Clinical, radio graphical evaluation of efficacy of revascularization by using mineral trioxide aggregate and Biodentine with triple antibiotic paste in immature permanent incisor teeth: An *In vivo* study

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Abstract

Pulp necrosis of an immature tooth as a consequence to caries or trauma can arrest the closure of the root apices and leave the tooth with thin root canal walls that are susceptible to fracture. The absence of an apical constriction makes routine root canal treatment impossible; this is because sealing open apices with conventional obturation method is challenging.

Materials Used: Triple antibiotic paste (TAP), Mineral Trioxide Aggregate (MTA) Biodentine

Follow-up: follow-up is performed at 1, 3 and 6 months after treatment the tooth was asymptomatic, and the color of the crown did not change.

Conclusion: Comparative studies between MTA and Biodentine revealed that both materials offer excellent sealing performance after direct pulp capping prevents the risk of subsequent microbial contamination. Biodentine has great potential to revolutionise the management of affected tooth in the operative dentistry and endodontics.

Keywords: Triple antibiotic paste (TAP), mineral trioxide aggregate (MTA) Biodentine, revascularization

Introduction

Pulp necrosis of an immature tooth as a consequence to caries or trauma can arrest the closure of the root apices and leave the tooth with thin root canal walls that are susceptible to fracture. The absence of an apical constriction makes routine root canal treatment impossible; this is because sealing open apices with conventional obturation method is challenging. In earlier times, Apexification was done by using calcium hydroxide introduced to Endodontics by Hermann in 1920 used commonly as intracanal medicament mainly due to its high alkaline pH and antibacterial action. In these particular cases, successful management comprises of revascularization inducing apexification & encourage an apical barrier with materials such as Mineral trioxide aggregate (MTA), Biodentine, Bioceramic, bio aggregate materials Revascularization procedure consists of three important stages: STAGE 1: Elimination of bacteria from the root canal system, STAGE 2: Creation of a scaffold for the ingrowth of new tissue, STAGE 3: Prevention of reinfection by creating a bacteria-tight seal.

The purpose of this report was to describe regenerative endodontic therapy cases using Biodentine as a new endodontic biomaterial and MTA in permanent incisor teeth with immature apices.

Treatment Procedures: Three patients (age ranged between 10 and 20 years) were referred to the department of conservative dentistry and endodontics for endodontic management of of immature, anterior incisor teeth presenting with or without signs and/or symptoms of periapical pathology. Inclusion Criteria were immature apices, either blunderbuss canals or wide canals with parallel walls and a slight flaring in the apical end, and in a few cases, moderately developed root but with open apex. During clinical examination, the teeth were not sensitive to percussion or palpation and did not respond to cold or electric pulp tests. For each tooth, a common diagnosis of pulp necrosis was made on the basis of clinical findings. Radiographic examination showed healthy periapical tissues.

Taking into consideration the incomplete root development with wide open apices. The endodontic access cavity was prepared using a diamond-coated fissure bur (Diatech, Heerbrugg, Switzerland) and a high-speed handpiece with copious water spray. On entering the pulp chamber, necrotic tissue in the mesial and distal canals was observed. The working lengths were determined by an apex locator (Propex Pixi; Dentsply Maillefer, Ballaigues, Switzerland) and confirmed by placing size 20 K-files in the canals and taking a periapical radiograph. None of the canals were instrumented; they were irrigated with 2.5% sodium hypochlorite (NaOCl) (20 mL), sterile saline (10 mL), and 17% EDTA (10 mL) and then gently dried with sterile paper points. After irrigation and drying, the apical tissue was irritated using a #20 K-file. However, in all cases, inadequate bleeding was observed in the root canal. Triple antibiotic paste consisting of equal amounts of metronidazole, ciprofloxacin and minocycline was mixed with propylene glycol on a glass slab. the access cavity was temporarily sealed with temporary restoration [2] After 2 weeks; the patient is recalled for review next visit, the canal is re-entered and irrigated with NaOCl and chlorhexidine followed by saline and dried. Then bleeding is induced inside the canal by over instrumentation. After blood clot is formed, MTA/Biodentine is placed at the level of Cementoenamel junction.

Follow-up

At follow-ups performed at 1, 3 and 6 months after treatment the tooth was asymptomatic, and the color of the crown did not change. The continuity in the periodontal ligament space with absence of periapical radiolucency was observed, a cone-beam computed tomography scan was done.

Materials Used

Triple antibiotic paste (TAP)

- A mixture of metronidazole, ciprofloxacin, and minocycline.
- It is the most widely used intracanal medicament in endodontic regeneration

Mineral Trioxide Aggregate (MTA)

- It is hydrophilic in nature which makes it compatible with moisture and also challenges to seal communication between the root canal system and oral cavity and between the root canal system and the periodontium.

Biodentine

- Composed of powder that consists of tricalcium silicate, dicalcium silicate, calcium carbonate, calcium oxide, zirconium oxide, and CH.
- These ideal properties for repair of perforations of the pulpal floor, apexifications, open immature tooth, retrograde filling, pulp therapy. The appreciable properties and ability to achieve biomimetic mineralization

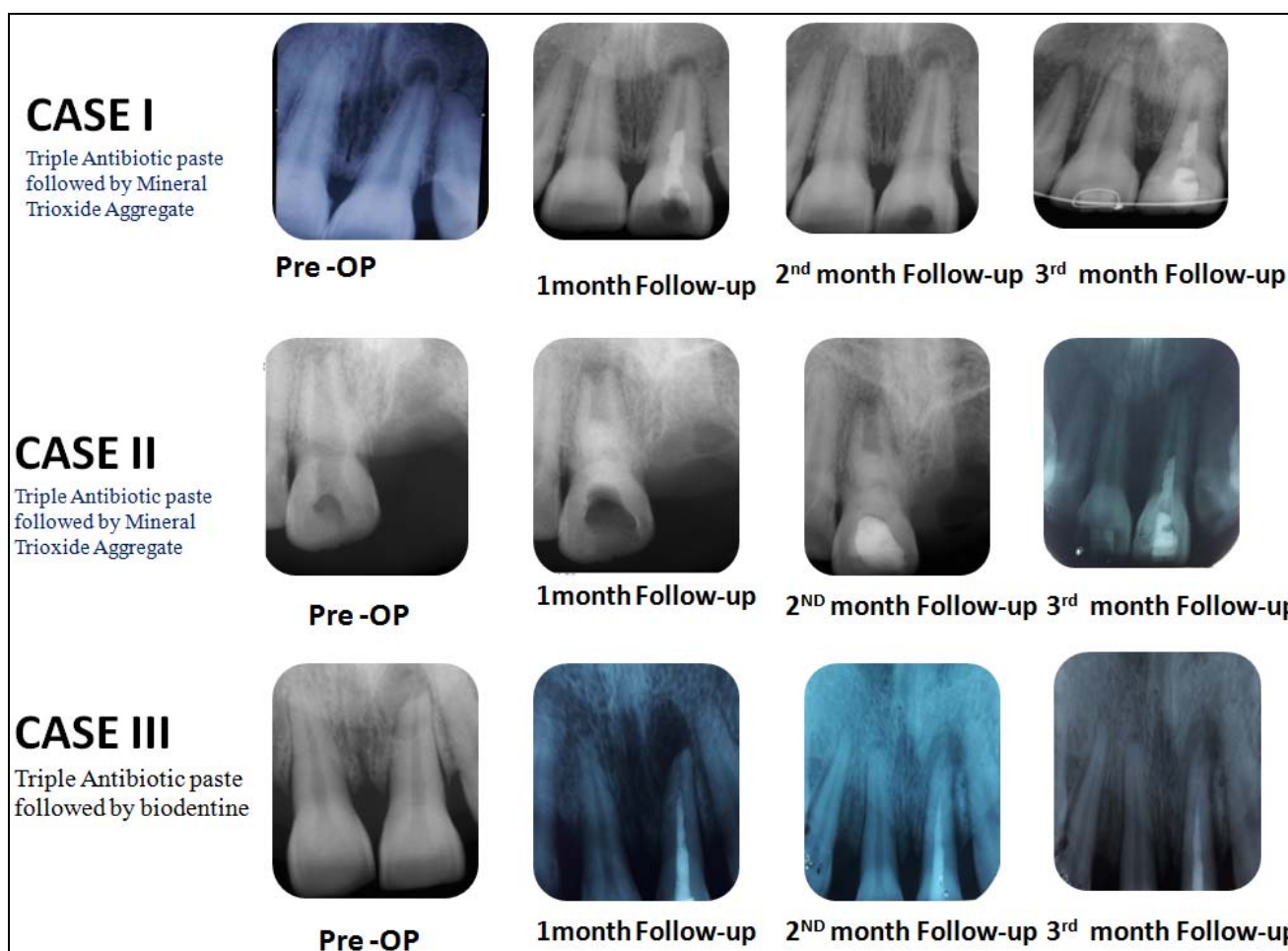


Fig 1: showing case 1, II, III with pre-op, 1st, 2nd & 3rd month follow up

Follow-up

At follow-ups performed at 1, 3 and 6 months after treatment the tooth was asymptomatic, and the color of the crown did not change. The continuity in the periodontal ligament space with

absence of periapical radiolucency was observed, a cone-beam computed tomography scan was done.

Discussion

Apexification is defined as a method of inducing a calcified apical barrier or continued apical development of an incompletely formed root in teeth with necrotic pulp (3). MTA is a bioactive cement with the capacity to induce the formation of new cementum and periodontal ligament, which makes this material biologically acceptable for closing a root canal with an open apex. The mechanism of action of MTA lies in releasing calcium ions that activate cell attachment and proliferation, and at the same time, the high pH creates an antibacterial environment. MTA produces apical hard tissue formation with significantly greater consistency than CH (6). Biodentine is a new bioactive dentin substitute cement, which is composed of powder that consists of tricalcium silicate, dicalcium silicate, calcium carbonate, calcium oxide, zirconium oxide, and CH. The alkaline caustic effect of Calcium Hydroxide degrades the collagenous component of the interfacial dentin, leading to the formation of a porous structure that facilitates the permeation of high concentrations of Ca(2+), OH(-), and CO(3) (2) ions(8). Apexification procedure of a traumatically injured tooth with Biodentine revealed that this bioactive and biocompatible calcium-based cement can regenerate damaged dental tissues. The liquid for mixing with the cement powder consists of a water-soluble polymer and calcium chloride, which accelerates the setting reaction. Biodentine has a shorter setting time of 12 minutes, as compared with that of MTA, which is 2 hours 45 minutes. The powder is mixed with 5 drops of liquid and activated in the dental triturator for 30 seconds.

Zanini *et al* (06) suggest that Biodentine is bioactive because it induces differentiation of odontoblast-like cells and increases murine pulp cell proliferation and biomineralization (12). The response of dental pulp after direct capping with Biodentine revealed a complete dentinal bridge formation and a layer of odontoblast-like cells under the osteodentin. Biodentine has been shown to lack cytotoxicity, and it is able to stimulate collagen fiber and fibroblast formation.

Conclusion

Comparative studies between MTA and Biodentine revealed that both materials offer excellent sealing performance after direct pulp capping prevents the risk of subsequent microbial contamination. The marginal sealing properties of calcium silicate-based cements are due to its ability to produce Calcium Hydroxide during hydration, which in contact with the phosphates of tissue fluids form a calcium phosphate phase. Biodentine has great potential to revolutionise the management of affected tooth in the operative dentistry and endodontics. However further studies are required to extend the future scope of this material regarding the clinical applications.

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