One Step Apexification with Two Bioactive Materials – A CBCT Evaluation

Jerin Jose[1], Shoba K[2], Faizal C. P[3], Nithya Tomy[4], Shibu Aman[5]

1- 3rd year MDS, Department of Conservative Dentistry and Endodontics, Government Dental College, Kottayam. 2- Professor and Head of the Department, Department of Conservative Dentistry and Endodontics, Government Dental College, Kottayam. 3- Professor and Head of the Department, Department of Pedodontics and Preventive Dentistry, Kannur Dental College, Kannur. 4- 2nd year MDS, Department of Pedodontics and Preventive Dentistry, Kannur Dental College, Kannur. 5- Assistant Professor , Department of Conservative Dentistry and Endodontics Government Dental College, Kottayam.

Correspondence to:
Dr. Jerin Jose, 3rd year MDS, Department of Conservative Dentistry and Endodontics, Government Dental College, Kottayam, Kerala State, India, 686008
Contact Us: www.ijohmr.com

ABSTRACT

Traumatic dental injuries are common among children which may result in endodontic complications. The purpose of this case report is to compare Biodentine and MTA apexification in non – vital central and lateral incisors with open apices in a single patient. The case report details the successful treatment of a 12- year- old female with maxillary central incisors and lateral incisor that had open apices and periapical lesions. MTA apical plugs were used in central incisor and Biodentine in lateral incisor. A 12-month follow up with Cone beam- CT (CBCT) exhibited progressive involution of periapical radiolucency with the good healing of the periapical tissues for Biodentine when comparing to MTA.

KEYWORDS: Biodentine, CBCT, MTA, One step apexification, apical closure

INTRODUCTION

Root development completion and root apex closure may occur up to 3 years following the eruption of the tooth. In young permanent anterior teeth, occurrence of traumatic injuries are more common and may lead to pulp necrosis.[1] If pulp necrosis occurs before root completion, the dentin formation gets interrupted, and root development stops. This may result in the formation of a root with open apex and a wide canal which may lead to impaired cleaning and shaping and prevent achievement of an adequate apical stop.

Apexification is a method of inducing a calcified barrier in a root with an open apex. Numerous biomaterials were used to obtain the artificial apical closure. Among them, MTA is a biomaterial with good biocompatibility and adequate sealing property. But Biodentine is superior in its handling properties, fast setting time and push out bond strength.[2-3] This case report compares the healing efficacy of apexification by MTA and a new calcium silicate-based bioactive restorative cement Biodentine using Cone beam-CT (CBCT)

CASE REPORT

A 12- year- old female patient reported to the department of Conservative Dentistry and Endodontics with pain and swelling in relation to maxillary right central and lateral incisor. She had incurred a trauma at the age of 8 years. On clinical examination, a sinus tract was located in the mucobuccal fold of maxillary right lateral incisor. Palpation and percussion tests were showed positive response. Periodontal pathology was ruled out as there wasn't any alteration in probing depth and no associated mobility. Pulp vitality tests, including the cold test and an electric pulp testing, elicited a negative response. Radiographic examination revealed wide open canals with marked periapical radiolucency in relation to both maxillary right central and lateral incisor (Fig 1).

Fig 1- Pre-operative

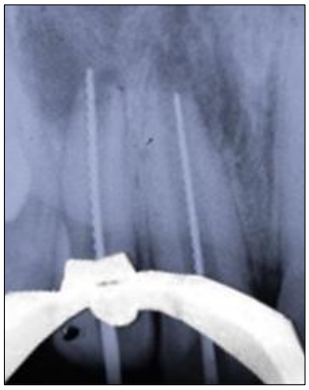

Fig 2- Working length

History, radiographic and clinical findings were suggestive of pulp necrosis and chronic apical periodontitis in relation to maxillary right central and lateral incisor. Taking into consideration the current guidelines, a nonsurgical endodontic retreatment with apexification was chosen as the line of treatment.

The teeth were anesthetized, followed by isolation with a rubber dam. Both maxillary right central and lateral incisor endodontically accessed with Endo Access Bur. The canals were then located and working lengths established radiographically 1 mm short of the radiographic apices (Fig. 2). Cleaning and shaping

How to cite this article:
Jose J, Shoba K, Faizal CP, Tomy N, Aman S. One Step Apexification with Two Bioactive Materials – A CBCT Evaluation. Int J Oral Health Med Res 2015;2(3):46-49.

performed up to ISO K file size 80 (Dentsply, Maillefer, Ballaigues, Switzerland) in a circumferential manner. Irrigant of choice was 2.5% NaOCl (Novo Dental Product, Pvt. Ltd., Mumbai, India) and sterile paper points were used for drying the canal. An inter appointment Ca $(OH)_2$ dressing was given as an intra-canal medicament.

Patient reviewed after 2 weeks, and the involved teeth found to be asymptomatic. Access cavity was reopened and Ca $(OH)_2$ removed mechanically up to working length. 2.5% NaOCl (Novo Dental Product, Pvt. Ltd., Mumbai, India) was used for root canal irrigation and dried with sterile paper points. The treatment protocol was MTA apexification for maxillary right central incisor and Biodentine apexification for maxillary right lateral incisor respectively.

MTA (MTA Angelus, Angelus, Londrina–PR, Brazil) was mixed according to manufacturer's guidelines to a thick creamy consistency. It was then deposited into maxillary right central incisor, 1-1.5 mm short of the working length with MTA carrier and compacted using Schilder's *plugger*. Thickness of apical plug (5-6 mm) was confirmed radiographically (Fig 3). Access cavity sealed with IRM after placing a cotton pellet inside the canal. After 1 week, the tooth was isolated and accessed as before. A hand plugger tapped against MTA plug to confirm hardened set. The remaining canal was obturated using injectable thermoplasticized *gutta percha* (Obtura II) and restored with GIC (Fig 4).

Fig 3- MTA and Biodentine plug

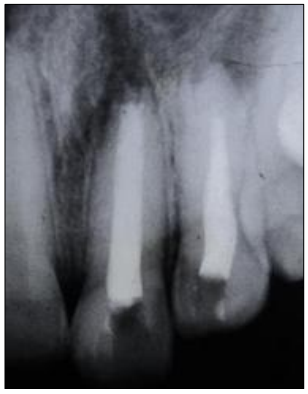

Fig 4- Immediate Post-operative

Biodentine™ (Septodont, St. Maur-des-Fossés, France) was manipulated according to manufacturer's instructions. The prepared mixture of Biodentine was carried into maxillary right lateral incisor with MTA carrier and condensed with root canal plugger. An apical barrier of 5 mm thickness was created by adding several increments (Fig 3). A sterile cotton pellet was placed in the canal for 15 minutes and the root canal was obturated by thermo plasticized Gutta percha technique (Obtura II) (Fig 4). GIC was used to seal access cavity.

Follow up clinical and radiographic examination after 1 month showed complete healing of the sinus tract and involution of periapical radiolucency respectively (Fig. 5). The patient was recalled after 1 year, and IOPAR (Fig. 6) and CBCT (Fig. 7, 8, 9) were a dvised. Both IOPAR and CBCT demonstrated a reduction in periapical radiolucency and a progressive healing with a calcific apical barrier for both central and lateral incisor. Hard tissue healing was superior in the case of lateral incisor (Fig. 8) in which biodentine apexification had done when compared to central incisor (Fig. 9) where MTA used to create the artificial apical plug.

Fig 5-1st month review

Fig 6-1st year review

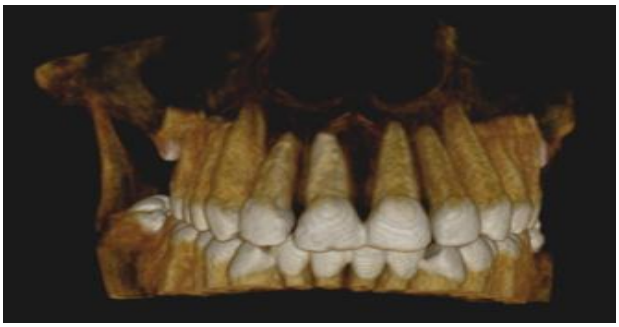

Fig 7- Cone Beam CT

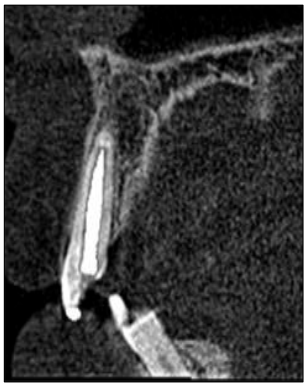

Fig 8- CBCT Sagital view lateral incisor

Fig 9- CBCT Sagital view central incisor

DISCUSSION

The presented case shows successful management of an immature permanent tooth with the periapical lesion. Revascularization was not attempted for this case because of the chronic nature of the lesion. Previously Calcium Hydroxide was the most commonly used material for inducing biological sealing in teeth with incompletely formed apices.[4] Though the material was efficient in creating an artificial barrier, the technique had some disadvantages such as the prolonged treatment time, risk

of recontamination of the root canal system and a chance of cervical tooth fracture during treatment.[2,5]

MTA is the preferred material for single visit apexification thanks to its bio-compatibility, less cyto-toxicity, osteo-conductive properties, bio-remineralisation abilities and hydrophilic nature. MTA offers faster treatment outcome in comparison with Ca $(OH)_2$, with high clinical success rates. But it has some drawbacks like long setting time, difficulty in handling, and low compressive and flexural strengths.[6]

Biodentine is a recently introduced bioactive dentine substitute based on "Active Biosilicate Technology".[7] It has good biocompatibility, fast setting time, less micro leakage and better handling properties.[7,8] Biodentine has the ability to create a tag-like crystalline structure within the dentinal tubules which may contribute to the micromechanical bond between dentin and novel calcium silicate material. There might be a possibility of ion exchange between natural dentin and dentin substitute material as result of this micromechanical bond formation. [9] Comparatively reduced size of powder particles and presence of an accelerator in the liquid attributed to fast the setting time of Biodentine (9-12 minutes) .[7] Calcium silicate–based materials might produce tighter but less soluble seals at the interface. Mechanism behind this property may be their ability to produce surface apatite crystals by interacting with the phosphates present in oral tissue fluids. Root canal dentinal uptake of calcium and silicon from MTA and Biodentine found it to be higher for the latter.[9]

When comparing with other calcium silicate dental materials Biodentine has many advantages. The properties such as compressive strength, elasticity modulus and microhardness of Biodentine are more similar to that of natural dentine, hence an ideal material for apexification. Biodentine is stable, less soluble, non-resorbable and easy to prepare and place, needs less setting time, and produces a tighter seal.[10]

This novel bioactive material provides a good biological seal and excellent marginal adaptation, having better handling properties and with fast setting time comparing to MTA. Antibacterial and hard tissue healing properties of biodentine are closely associated with pH and calcium release. When used as root end filling material Biodentine and MTA show similar antibacterial action and hard tissue healing.[11]

Although it might be possible to assess the healing of periapical lesions, it is much more challenging to establish confidently the true extent of the involution of the lesion by using conventional radiographic techniques. A three-dimensional evaluation of the healing of periapical lesion can be possible with imaging modality like CBCT.[12] Hence, even though a conventional radiograph was showing satisfactory healing, CBCT was advised, as extremely minute bone changes like bone formation are more accurately evaluated by it during follow-up visits than the former.[13]

CONCLUSION

This case report presents favorable clinical outcomes for Biodentine and MTA used as an apexification material. But faster bone deposition was observed for the Biodentine. Taking into account the healing outcome and other clinical factors like setting time, handling properties and better marginal adaptation Biodentine has an edge over MTA. Hence, Biodentine can be a good alternative to MTA as an apexification material.

ACKNOWLEDGEMENT

Authors acknowledge Principal, Government dental college, Kottayam for providing the permission for accessing materials needed for this case study from the college itself.

REFERENCES

1. Navabazam A, Farahani SS. Prevalence of traumatic injuries to maxillary permanent teeth in 9 to 14 year old school children in Yazd, Iran. Dent Traumatol 2010;26:154-7.
2. Simon S, Rilliard F, Berdal A, Machtou P. The use of mineral trioxide aggregate in one-visit apexification treatment: a prospective study. Int Endod J. 2007;40(3):186-97
3. Bronnec F. Biodentine: a dentin substitute for the repair of root perforations, apexification and retrograde root filling. Endod 2010;36(3):400-413.
4. Morse DR, O'Larnic J, Yesilsoy C. Apexification: review of the literature. Quintessence Int. 1990;21(7):589-98.
5. Torabinejad M, Rastegar AF, Kettering JD, Pitt Ford TR. Bacterial leakage of mineral trioxide aggregate as a root-end filling material. J Endod. 1995;21(3):109-12.
6. Günes B, Aydinbelge HA. Mineral trioxide aggregate apical plug method for the treatment of nonvital immature permanent maxillary incisors: Three case reports. J Conserv Dent 2012;15:73-6.
7. Septodont Biodentine™ Active Biosilicate TechnologyTM scientific file; 2010. Available from: http//www.septodont.fr/fichiers_upload/ biodentinescientificfile.pdf
8. Kokate SR, Pawar AM. An in vitro comparative stereomicroscopic evaluation of marginal seal between MTA, Glass Inomer Cement &Biodentine™ as root end filling materials using 1% methylene blue as tracer. Endod 2012;2:36-42.
9. Han L, Okiji T. Uptake of calcium and silicon released from calcium silicate based endodontic materials into root canal dentine. Int Endod J 2011. 44:1081-7.
10. A.M. Ahmed, A. Fadhel, Nasr H. Al-Qudami Al-Kudami. Endodontic Repair Filling Materials: A Review Article. British Journal of Medicine & Medical Research 2014. 4(16): 3059-3079
11. Sulthan IR, Ramchandran A, Deepalakshmi A, Kumarapan SK. Evaluation of pH and calcium ion release of mineral trioxide aggregate and a new root-end filling material. e-J Dent 2012;2:166-9.
12. Khetarpal A, Chaudhary S, Sahai S, Talwar S, Verma M. Radiological assessment of periapical healing using the cone beam computed tomography periapical index: Case report. J Dent Med Sci 2013; 9:46-51.

13. Lofthag-Hansen S, Hummonen S, Grondahl K, Gröndahl HG. Limited cone beam CT and intraoral radiography for the diagnosis of periapical pathology. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2007; 103:114-9.

Source of Support: Nil
Conflict of Interest: Nil