

Repair of Primary Molar Root Perforation with MTA: A Case Report

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Abstract

Introduction: Root perforation is an endodontic procedural error. Treatment of perforation depends on the location and size of perforation, duration of exposure to the oral cavity, patient's cooperation and degree of tissue inflammation. Several materials have been introduced to seal off the perforation. MTA is one of the best materials for this purpose.

Case Report: We report the repair of distal root perforation in a primary mandibular second molar of a 9 year-old boy who had congenital absence of the second premolar tooth at the same quadrant. The perforation site was sealed with MTA and the three root canals were filled with gutta percha. Follow up visits at 1, 3, 6, 12, 21 and 24 months showed clinical and radiographic success of treatment.

Key Words: MTA, Root canal filling materials, Root perforation, Primary molars

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Introduction

Root perforation may occur as the result of resorption, caries, endodontic procedural errors or post space preparation. The prognosis of root perforation depends on the size and location of perforation, duration of exposure to oral cavity and level of inflammation in the periodontium. The shorter the time interval between the perforation and repair, the smaller the size of perforation and the more apical its location, the greater the odds of treatment success. Aside from the recommended treatments for repair of root perforations, properties of the applied material are important as well. An ideal material for this purpose should be able to seal the perforation site and have optimal biocompatibility. Induction of osteogenesis and cement genesis, easy application, radiopacity, having bactericidal or bacteriostatic properties and low cost are among other important factors [1, 2].

Mineral Trioxide Aggregate (MTA) was introduced to the dental market in 1998 and has numer-

ous applications for repair of root perforations, direct pulp capping and apexification. MTA prevents microleakage, is biocompatible and induces the regeneration of periodontal tissue. MTA is a mineral powder comprising of hydrophilic particles [2]. It contains 50-75% calcium oxide and 12-25% silicon dioxide. These two materials comprise 70-95% of the cement. These two raw materials react and form tricalcium silicate, dicalcium silicate, tricalcium aluminate and tetracalcium aluminoferrite. By adding water, the cement is hydrated and forms silicate hydrate gel. A radiopaque material (bismuth oxide) is also added [3]. Iron is added to white MTA in order to obtain gray MTA [4]. It has a pH of 12.5 and polymerizes in presence of humidity during 4 hours. Several studies have confirmed the biocompatibility and sealability of MTA [2]. MTA is not susceptible to contamination with tissue fluids or blood; it has low cytotoxicity and possesses antibacterial activity. It is also capable of inducing cementogenesis when

used as root end filler. Several experimental studies have shown that MTA has a sealing potential superior to that of amalgam, ZOE and light-cure glass ionomers [2]. Moreover, its level of toxicity is lower than that of IRM or Super EBA [3].

Histological studies on periodontal tissue after furcal perforation have indicated healing of the periodontium and new cementum formation over the material [4]. Tissue repair as the result of the application of MTA is explained by the release of calcium ions. MTA releases calcium ions for several days after its setting. These ions spread throughout the dentinal defects [5]. Recently, biologic properties of MTA have been attributed to the production of hydroxyapatite as the result of contact of calcium ions with tissue fluids [5].

Several case reports describing repair of furcal perforation with MTA are available [1, 2, 3, 6] but no study was found on the repair of a lateral root perforation in a primary tooth. This case report describes a successful case of repair of a lateral root perforation in a primary tooth with MTA and its 24-month follow up.

Case Report

Our patient was a healthy 9 year-old boy with no history of systemic disease presenting to the Department of Pediatric Dentistry at Azad University Dental School in January 2010 complaining of tooth caries.

Extraoral examination was unremarkable. Intraoral examination revealed moderate oral hygiene and a severely decayed primary mandibular left second molar. PA radiography revealed congenital missing of the second premolar tooth bud at the same quadrant. Orthodontic consultation obviated the need for orthodontic treatment and thus, a consensus was reached to save the tooth. The treatment plan included debridement, irrigation of canals, obturation with gutta percha and placement of a stainless steel crown. Inferior alveolar nerve block was performed using 2% lidocaine plus 1/100,000 epinephrine. Rubber dam was placed and access cavity was prepared. Initial files (#15 K file for the mesial and #20 K file for the distal canals) were introduced into the canals for working length determination. Accurate working length was ensured radiographically. Canal preparation was performed by filing and irrigation with saline solution. Distal canal had continuous bleeding. PA radiography

showed a perforation in the middle one-third to apical one-third of the distal root (Figure 1).



Figure 1. Perforation detected on the PA radiograph

Considering the congenital missing of the permanent second premolar and patient's good cooperation, we decided to repair the perforation with MTA. Distal canal was dried with paper points as much as possible and a cotton pellet soaked with 5.25% sodium hypochlorite was placed in the access cavity (for relative disinfection of the perforation site). ProRoot® MTA was mixed according to the manufacturer's instructions and delivered to the perforation site in the distal canal by an endodontic plugger. Cleaning and shaping of the mesial canals were performed and canals were filled with gutta percha and AH26 sealer. Numerous studies can be found in the literature reporting successful outcome of MTA application and immediate filling of root canals in a single visit [7-11]. Thus, root canals were filled in the same session. In order to ensure coronal seal, the tooth preparation for SS crown was completed and #3 3M® stainless steel crown was placed. A radiograph was obtained to ensure its accurate adaptation and marginal fit and the crown was cemented using zinc polycarboxylate cement.

The patient presented one month later for follow up and the respective tooth was clinically and radiographically examined.

Repair of the perforation caused no lesion in the tooth supporting structures (PDL and alveolar bone). Follow ups were continued at 3, 6, 12, 21 and 24 months. Radiographs obtained at follow up sessions all confirmed successful repair of the perforation site.

Discussion

Successful application of MTA for sealing furcal perforations in primary and permanent teeth has been frequently reported in the literature [1, 2, 4, 6,

12, 13]. However, no study was found on repair of lateral root perforation in a primary tooth. Several materials have been studied in terms of biocompatibility and effectiveness for repair of root perforations in permanent teeth. Holland et al, in their study on periodontium of dogs reported various pulpal reactions that occurred during 30 days after the exposure of periodontium to MTA. However, no sign of inflammation was seen in the periodontium after 180 days [14]. Noetzel, et al. stated that due to high biocompatibility, MTA can create a perfect seal in root perforations [1].

Prognosis of the perforation depends on the location, size and duration of contamination (exposure to the oral cavity). Our patient had a lateral root perforation that has a more favorable prognosis than furcal perforations; because the risk of bacterial contamination of the area via the gingival sulcus and the PDL is small. In a case report, Oliveira et al. demonstrated that furcal radiolucency disappeared 20 months after repair with MTA indicating new bone formation and healing of the periodontal tissue. Thus, they recommended MTA as the material of choice for repair of furcal perforations in primary teeth and increasing the survival rate of these teeth [12].

In our case, due to the lack of access or direct vision of the perforation site, it was impossible to determine the exact size of the perforation. But, using radiography, we estimated the size of perforation to be approximately equal to the diameter of a #35 endodontic file tip. No sign of bone loss or inflammation were observed around the MTA on the follow up radiographs (Figure 2).

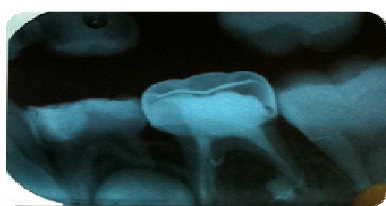


Figure 2. One month follow up

In this process, extrusion of the MTA into the periodontium is inevitable and a matrix is required to be placed beneath the sealing material to prevent its extrusion into the periodontium. This is a complex procedure and some of the matrixes introduced for this purpose decrease the sealability of

the material while some others are not biocompatible [15].

Some researchers have used calcium hydroxide prior to the application of MTA; whereas, some others recommend using a resorbable collagen matrix to prevent MTA extrusion [16]. Al-Dafaas and Al-Nazhan used calcium hydroxide to prevent the extrusion of MTA and observed mild to moderate chronic inflammation along with stratified squamous epithelial tissue around the perforation site [15]. We did not use a matrix in our patient and consequently, some material extruded from the distal wall which was inevitable. Radiographic follow-ups confirmed that this extrusion caused no problem and no sign of periodontal lesion or bone loss was observed (Figures 3-6).

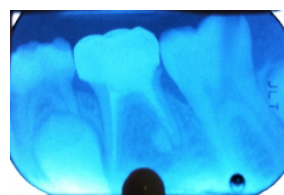


Figure 3. Six months follow up

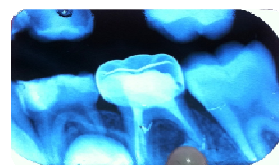


Figure 4. Twelve months follow up



Figure 5. Eighteen months follow up



Figure 6. Twenty-four months follow up

Immediate seal of the perforation site enhances the process of repair because it decreases the risk of bacterial contamination. Holland et al. showed that lateral root perforations that had been sealed with MTA after bacterial contamination had a worse outcome compared to the immediately sealed perforations [14]. In our patient, immediately after definite diagnosis of perforation, the site was repaired with MTA decreasing the risk of contamination.

Conclusion

Repair of root perforation with MTA in our patient (primary mandibular second molar) was associated with successful clinical and radiographic outcome at 24 months follow up. Clinical trials with adequate sample size are required in this respect.

References

- 1- Noetzel J, Ozer K, Reissbaur B, Anil A, Rossler R, Neumann K, et al. Tissue responses to an experimental calcium phosphate cement and mineral trioxide aggregate as materials for furcation perforation repair: A histological study in dogs. *Clin Oral Invest*. 2006 Mar; 10(1):77-83.
- 2- Unal G, Maden M, Isidan T. Repair of furcal iatrogenic perforation with mineral trioxide aggregate: Two years follow-up of two cases. *Eur J Dent*. 2010 Oct; 4(4):475-81.
- 3- Pelliccioni G.A, Ciapetti G, Cenni E, Granchi D, Nanni A, Pagani S, et al. Evaluation of osteoblast-like cell response to Proroot® (Mineral Trioxide Aggregate) cement. *J Mater Sci*. 2004 Feb; 15(2):167-173.
- 4- Sherif B, Norhan A, El D, Dalia A. Sealing ability of MTA versus Portland cement in the repair of furcal perforation of primary molars: a dye extraction leakage model. *J Am Sci*. 2011 Jan; 7(2): 1037-42.
- 5- Camillar J. The chemical composition of mineral trioxide aggregate. *J Conserv Dent*. 2008 Oct-Dec; 11(4):141-43.
- 6- Samiee M, Eghbal MJ, Parirokh M, Mashhadi Abbas F, Asgari S. Repair of furcal perforation using a new endodontic cement. *Clin Oral Invest*. 2010 Dec; 14(6):653-58.
- 7- Rudagi KB, Rudagi BM. One-step apexification in immature tooth using grey mineral trioxide aggregate as an apical barrier and autologous platelet rich fibrin membrane as an internal matrix. *J Conserv Dent*. 2012 Apr-Jun; 15 (2):196-199.
- 8- Roberta A, Silveira FM, Cunha R.S. Single-session use of mineral trioxide aggregate as an apical barrier in a case of external root resorption. *J Oral Sci*. 2010 Jun; 52(2):325-328.
- 9- Steinig TH, Regan JD, Gutmann JL. The use and predictable placement of mineral trioxide aggregate in one-visit apexification cases. *Aust Endod J*. 2003 Apr; 29(1):34-42.
- 10- 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 Mar; 40(3):186-97.
- 11- Raut AW, Mantri VR, Palekar AU, Kamat S. Single-step apexification with mineral trioxide aggregate (MTA)-Case Reports. *NJDSR*. 2012 Jan; 1 (2):28-33.
- 12- Oliveira TM, Sakai VT, Silva TC, Santos CF, Machado MA, Abdo RC. Repair of furcal perforation treated with mineral trioxide aggregate in a primary molar tooth: 20-month follow-up. *J Dent Child*. 2008 May-Aug; 75(2):188-91.
- 13- Rodd HD, Waterhouse PJ, Fucks AB, Fayle SA, Moffat MA. UK national clinical guidelines in pediatric dentistry (Pulp therapy for primary molars). *Intern J Pediat Dent*. 2006 May; 16(1):15-23.
- 14- Holland R, Bisco Ferreira I, de Souza V, Otoboni Filho JA, Murata SS, Dezan E Jr. Reaction of the lateral periodontium of dogs' teeth to contaminated and noncontaminated perforations filled with mineral trioxide aggregate. *Endod*. 2007 Oct; 33(10):1192-7.
- 15- Al- Dafaas A, Al- Nazhan S. Healing evaluation of contaminated furcal perforation in dogs' teeth repaired by MTA with and without internal matrix. *Oral Surg Oral Med Oral Pathol Oral Endod*. 2007 Jan; 103(3):92-9.
- 16- Parirokh M, Torabinejad M. Mineral trioxide aggregate: A comprehensive literature review-Part III: Clin applications, drawbacks, and mechanism of action. *J Endod*. 2010 Mar; 36(3):400-413.