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Repair of Iatrogenic Perforation with Mineral Trioxide Aggregate: A Case Report

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***Abstract**: Iatrogenic Perforations through the floor of the pulp chamber are undesirable complications and unfortunate incidents that occur most commonly during endodontic procedures. Materials used for perforation repair before had many limitations due to bacterial leakage and lack of biocompatibility to the underlying tissues. Studies have shown that the material used recently have been showing the promising results to correct these iatrogenic mishaps. In the recent literatures MTA has been regarded as an ideal material for perforation repairs and a barrier for these kind of communications. This article describes a case report where an iatrogenic perforation was repaired successfully with Mineral Trioxide Aggregate.*
***Keywords:** Iatrogenic perforation, MTA, perforation repair.*

I. Introduction

During day to day endodontic practice there are several difficulties faced by a clinician out of which perforations are unfortunate complications that occur in the course of endodontic treatment even for the most skilled clinicians. They are defined as pathologic or iatrogenic communications between the root canal system and the attachment apparatus. **[1]** Often, the cause is iatrogenic as a result of misaligned use of rotary burs during endodontic access preparation or during search for root canal orifices.**[2]** Iatrogenic perforations can occur at different levels (coronal, middle and apical) and at different sites (buccal, lingual, mesial or distal). The result is a chronic inflammatory reaction of the periodontium (characterized by the formation of granulation tissue) that can lead to irreversible loss of attachment apparatus or even loss of the tooth. **[3]** Repair of iatrogenic perforation during endodontic treatment is very challenging to a clinician. Factors that affect the prognosis of perforation repair include: the location of the perforation, size and shape of the perforation, time delay prior to perforation repair, proper isolation techniques, previous contamination by microorganisms and the biological and physical characteristics of the restorative materials.**[4]** Such perforations are managed surgically or non surgically, depending on the particular characteristics of the case.**[3]**

A variety of materials have been suggested for the nonsurgical repair of perforation between roor canal system and attachment apparatus including: amalgam,IRM, gutta-percha, dentine chips, calcium hydroxide, Cavit, tricalcium phosphate, hydroxyapatite, glass–ionomer cement, Super EBA and, more recently, Mineral Trioxide Aggregate.**[5]** The ideal material for treating radicular perforations should be nontoxic, nonabsorbable, radiopaque, and bacteriostatic or bactericidal. It should also provide adequate seal against microleakage from the perforation. Mineral Trioxide Aggregate (MTA) is found to be having all of these characteristics and has been applied with good outcomes in root-end surgery, direct pulpal coverage, apexification, radicular resorption, and repair of lateral radicular and furcal perforation.**[6]]** Microscopic examinations conducted by several clinicians of periodontal tissues after perforation repair with MTA in the furcal area demonstrated favourable healing of the periodontium and new cementum formation over the material.**[7]** The present case report presents a case of iatrogenic perforation repair in 46 with Mineral trioxide aggregate (MTA) with favourable healing response.

II. Case Report

A ten year old girl patient reported to the Out Patient Department of Pedodontics and Preventive Dentistry of Guru Nanak Institute of Dental Science and Research, Kolkata with the chief complaint of pain in lower right back tooth region from last six days. Patient gave history of dental treatment on the offending tooth one week back by a general dental practitioner after which the pain started. Intra oral examination revealed large carious cavity on 46 restored with temporary restoration. The tooth was tender on both percussion and palpation. Temporary restoration was removed and coronal access opening was modified. Distal, mesiobuccal and mesiolingual canal orifices were found and negotiated with no 15 K file (Mani). Thorough examination of the

access cavity revealed bleeding point adjacent to mesial wall of the access cavity. A 10 K file (Mani) was inserted into the bleeding point and an Intra oral peri apical radiograph of 46 was obtained. The intra oral peri apical radiograph (Figure 1) revealed perforation at mesio-lingual line angle through the pulp chamber floor. Periapical radiolucency was noted with respect to the distal root of 46 and also in periradicular region between mesial and distal roots.

Considering the age of the patient, time passed since iatrogenic perforation, size and position of the defect a clinical decision of repairing the defect with Mineral Trioxide Aggregate (MTA) along with endodontic treatment of 46 was taken. The patient's parents were informed about the condition and possible consequences were explained. Informed consent was obtained from the parents.

The tooth was isolated with rubber dam. Working length measurement was done with Ingle method for distal, mesiobuccal and mesiolingual root canals (Figure 2). The root canals were irrigated with 5.2% sodium hypochlorite and normal saline and enlarged up to 25K file at the measured working lengths. The canals were blocked with no 25 K files before perforation repair so that MTA cannot flow to the canal orifice.

Bleeding from the perforation site was controlled with firm pressure by moistened cotton pellet. White MTA (Proroot MTA, Densply) powder was dispensed on to a mixing pad. An Ampule containing distilled water was opened and the contents were squeezed out on to the mixing pad next to MTA powder. After gradually incorporating the liquid into the powder, they were mixed for about 1 min to ensure all powder particles are hydrated to gain a creamy consistency. Once the material acquired this consistency, it was applied with the help of a MTA carrier and gently packed into the perforation site with condenser and pressed with moistened cotton pellet. Proper placement of MTA was checked with intra oral peri apical radiograph (Figure 3). The files were removed from the root canals. The access cavity was sealed with cotton pellet followed by a layer of Zinc oxide eugenol cement (Cavit). Systemic antibiotics and analgesics were prescribed for 5 days.

During the second appointment (after 5 days) the tooth was found to be clinically asymptomatic. The access cavity was reopened and clinical and radiological examinations (Intra oral peri apical radiograph) of the repaired perforation site were performed. Successful repair of the perforation site was noted both clinically and radiologically. The root canals were thoroughly irrigated with 5.2% sodium hypochlorite and normal saline and mechanical preparation was done upto F3 file (Protaper Densply) in distal canal and F2 file (Protaper Densply) in mesial canals. The root canals were dried with sterile paper point and filled with water based Calcium hydroxide medicament (Ivoclair vivadent). The access cavity was again sealed with cotton pellet followed by a layer of Zinc oxide eugenol cement (Cavit).

On next appointment (after 1 month) Intra oral peri apical radiograph of 46 revealed decreased radiolucency and sign of healing in both periradicular and periapical regions. The root canals were then obturated with Gutta Percha cones (Densply India) with calcium hydroxide based sealer (Prime Dental). The access cavity was then sealed with packable light cure composite resin (Ivoclair Vivadent) (Figure 4).

The patient was recalled after 7 days and the tooth was clinically asymptomatic. Stainless steel crown (Kids Crown) cementation was done with Type 1 Glass Ionomer Cement (Fuji I) utilising Halls technique (Figure 5). The Patient was advised for regular recall visit in every 6 months.

III. Discussions

Iatrogenic perforation is an undesirable problem that may occur during root canal treatment or post preparation. The repair or management of such defect possesses a challenge to the clinician as there are several factors affecting the prognosis of the perforation repair.[1,4] The two most important factors affecting the prognosis are the time between perforation and treatment and the restorative material available for sealing such defect. It has been observed that immediate sealing of perforation enhances repair. Immediate perforation repair helps to prevent bacterial contamination and thus protects adjacent structures (ie, epithelial attachment, periodontal ligament, and bone). In the present case report immediate repair of perforation could not be achieved as the patient reported 7 days after iatrogenic perforation made by a previous dental practitioner.

Despite an accurate diagnosis and immediate treatment planning, suitable perforation repair material is a key element in successfully sealing the artificial channel or defect which has been created. Mineral trioxide aggregate (MTA) has been found be the ideal material for perforation repair. It is nontoxic, nonabsorbable, radiopaque, bacteriostatic or bactericidal and also provide a seal against microleakage from the perforation. Another key advantage of MTA over other available materials (amalgam, IRM, gutta-percha, dentine chips, calcium hydroxide, Cavit, tricalcium phosphate, hydroxyapatite, glass–ionomer cement, Super EBA) for perforation repair is that all other restorative materials require absolute dry fields for proper setting which is very difficult to achieve in such defects. Due to its inherent hydrophilic properties MTA achieves proper setting in wet fields also.[8, 9]

MTA was developed by Torabinejad and colleagues. MTA is a powder that consists of fine trioxides and other hydrophilic particles that set in the presence of moisture. Concerning biocompatibility, Koh, et al demonstrated that MTA was not cytotoxic for fibroblasts or osteoblasts, and promoted the formation of dentin

bridges when used in direct pulp capping.[10] Other studies demonstrated the formation of cementum, periodontal ligament, and bone adjacent to MTA when used to seal perforations and as a retrofilling material in surgical endodontic procedures.[11] Main et al [8] also concluded that MTA provides an effective seal of root perforations and can be considered a potential repair material enhancing the prognosis of perforated teeth.

Ideally perforation repair should be performed under operative microscope as it would give better visualisation of the defect. In this case proper visualisation was achieved with conventional techniques without use of any advanced devices.

Recently it has also been seen that Portland cement can act as a cheaper alternative to MTA in such treatment procedure. Wucherpfenning & Green (1999)[12] reported that MTA and Portland cement were almost identical macroscopically, microscopically and when evaluated by X-ray diffraction analysis. Saidon et al. (2003) [13] also reported that MTA and Portland cement had similar properties. De-Duas G et al (2006)[14] demonstrated that MTA and Protland cements are equally effective in perforation repair.

Another important criteria is the post endodontic coronal restoration, that should ensure complete sealing of the coronal access cavity. In this case report coronal restoration has been done with packable light cure composite resin followed by preformed Stainless Steel crown considering the patients chronological and dental age. Stainless steel crown will be replaced with permanent metal ceramic crown after complete eruption of permanent first and second molars.

IV. Conclusion

Treating a perforation between the root canal system and the attachment apparatus may often require a multidisciplinary approach in order to establish an appropriate treatment plan, and the clinicians must decide whether to extract the tooth or treat it with a nonsurgical and/or surgical approach. The prognosis of perforated teeth is better nowadays than it was in the past, and this is due to the improved vision provided by the operating microscope as well as the use of biocompatible materials such as MTA. With this approach, perforations can be more predictably repaired without surgery, thus reducing the need for invasive and more costly procedures.

Legends

Figure 1: IOPAR showing perforation
Figure 2: IOPAR showing working length measurment
Figure 3: IOPAR showing MTA placement
Figure 4: 1 month postoperative IOPAR showing decreased radiolucency
Figure 5: IOPAR showing obturation of root canals and stainless steel restoration

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Figures

Figure 1

Figure 2

Figure 3

Figure 4

Figure 5