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Conservative Management of Root Perforation Using Mineral Trioxide Aggregate and Guided Tissue Regeneration Membrane under Dental Operating Microscope: A Case Report

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Case Report

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Abstract: The current study presents a case of iatrogenic mid-root perforation with a maxillary central incisor in a 59 -year-old female patient, with a history of trauma in that region. Perforations that occur in the mid-root region pose a challenge to the dentist due to inadequate access to the perforation site. Perforations also increase the chance of inflammatory reaction in the periodontal ligament. A concept for the repair of root perforations is presented using a resorbable collagen matrix which reconstructs the outer shape of the root and facilitates the adaptation of MTA. The current clinical case shows successful root perforation repair with follow up using aforementioned technique.

Keywords: GTR membrane, Mineral Trioxide Aggregate, perforation repair.

INTRODUCTION

Cleaning and shaping play an important role in endodontic treatment. Procedural errors which occur during the process of biomechanical preparation are ledges, zipping, apical transportation and perforation [1]. Perforation is defined as a communication between the root canal system and the periodontal attachment apparatus through the root canal walls [2]. Perforations bridge the continuity of the root structure and the destruction of surrounding periodontal tissue. Causes of root perforation include caries, root resorption and iatrogenic cause like misalignment of bur while access cavity preparation. Iatrogenic root perforations occur in approximately 2-12% of teeth [3]. Factors which determine the prognosis in management include time at which perforation is diagnosed, location of perforation, selection of material used and host response [4, 5].

Materials used to repair perforation include amalgam, Cavit, Super EBA, Glass Ionomer cement, MTA. Literature review on treatment modalities using different materials shows that MTA is an excellent material for the repair of root perforation at different levels [6, 7].

The present case report describes the conservative nonsurgical management of root perforation using MTA and resorbable collagen membrane (CollaGuide, Bioland, Cheongwon, Korea) under dental operating microscope.

CASE HISTORY

A 59-year-old female patient reported to the Department of Conservative Dentistry and Endodontics with a chief complaint of pain in the upper right front region of jaw. The patient gave a history of trauma 3 months back. On clinical examination the right central incisor did not reveal any signs of fracture and the crown of the tooth appeared to be intact. However, the tooth did not give any response to pulp vitality testing which was indicative of pulp necrosis.

The tooth was opted for root canal treatment. During access cavity preparation an iatrogenic error of perforation occurred. Following this the patient was transferred to the postgraduate department for repair of the perforation.

In order to locate the exact site of the perforation a 10k file was inserted into the defect and radiographic examination revealed a mid-root perforation which had occurred below the alveolar crest (Fig-2A). The patient was informed about the procedural error that had taken place.

Both surgical and nonsurgical options were given to the patient and it was decided to carry out the repair of the perforation non-surgically. Informed consent was taken for the same and the procedure was carried out under a dental operating microscope.

The tooth was isolated under rubber dam. The earlier prepared access cavity was modified and the glide path was established using a #20 file (Fig-2B). The biomechanical preparation was performed using step back technique where the canal was enlarged in the apical third to a #55 instrument. The next step in the preparation was achieved by increasing the size of the file and decreasing the length, to produce a coronal taper. During instrumentation copious irrigation was carried out using 2.5% Sodium Hypochlorite to prevent blockage of the canal with pulpal or dentinal debris.

Following the biomechanical preparation, the walls of the perforation was cleaned using a piezoelectric unit (EMS, Switzerland) and an ultrasonic tip (#30 Integrated Endodontics). The remaining canal apical to the perforation was isolated using paper points to prevent MTA from entering into the canal (Fig-1). An absorbable collagen membrane (CollaGuide, Bioland, Cheongwon, Korea) was placed at the perforation site in increments with the help of a plugger to achieve haemostasis and to act as a physical barrier (Fig-2C). The MTA was placed over the GTR membrane using a MTA carrier followed by placement of a moist cotton pellet for 24 hours and the cavity was sealed with temporary ZOE cement. The set of MTA was confirmed after 24 hours. The obturation of the canal was carried out using cold lateral compaction technique. A #55 master cone (*Dentsply* Sirona, USA) was inserted to fit snugly at the working length. After verifying with a radiograph the canal was coated with calcium hydroxide sealer (Sealapex, Kerr USA) using the master cone. A finger spreader was inserted alongside the master cone to a level 1mm short of the working length and subsequent accessory cones were placed by lateral compaction until complete obturation of the radicular space was achieved (Fig-2D). Access cavity was sealed with a temporary restoration (Cavit 3M ESPE Minnesota, US).

Finally, the coronal chamber was restored with composite resin (Ivoclar Vivadent US). Regular follow up showed the tooth was free of symptoms and radiographic evidence of healing was visible.

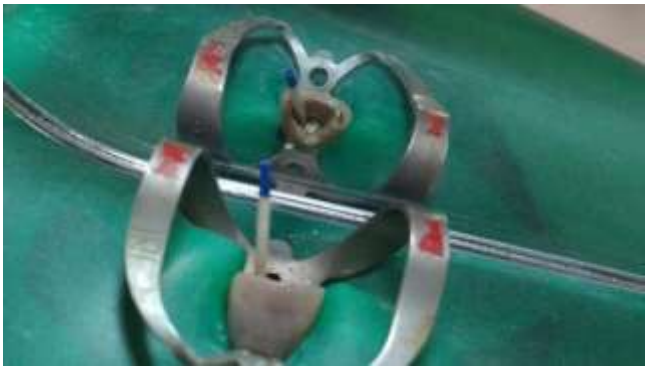

Fig-1: Canal isoloated using paper points to prevent MTA from entering into the canal

Fig-2: (A) Perforation defect, (B) Glide path established, (C) Placement of CollaGuide, (D) Obturation completed

DISCUSSION

Root canal perforations are one of the inadvertent errors that take place during routine endodontic therapy. If left untreated, it may cause damage to the periodontium and eventually lead to loss of the tooth. The perforations which occur close to the alveolar bone crest create a periodontal defect and have poor prognosis [8, 9]. Proclined anterior teeth are especially likely to suffer perforation on the labial aspect due to deficiency in access extension. Perforations that occur in the mid-root region pose a challenge in the diagnosis and management due to inadequate access to the perforation site, difficulty in

placement of the repair material and improper isolation leading to aesthetic impairment [10].

Direct observation and visualization of the perforation site always determines the success of the non-surgical treatment. The increased magnification of an operating microscope allows us to access small, narrow canal openings without excessive removal of tooth structure.

Guided tissue regeneration is based on the concept of selective growth of cells derived from periodontal ligament which prevents the apical migration of epithelium and gingival connective tissue cells along the root surface. It also provides protection to the blood clot during early stages of wound healing and ensures space maintenance for ingrowth of newly formed tissue.

Several types of non-resorbable and bioresorbable barrier membranes have been developed, some of which include polytetrafuoroethylene, titanium reinforced ePTFE, collagen or chitosan and primarily poly (L-lactide) (PLLA). One of the limitations of non-resorbable membrane is that a second surgical procedure is required for their removal which may increase the chances of secondary infection.

CollaGuide (Bioland, Cheongwon, Korea) is a resorbable, non-friable, GTR barrier membrane derived from bovine source and obtained from highly purified Type- l to avoid any antigenicity. It can be used in periodontology for guided tissue regeneration procedure for infrabony defects, oral implantology for guided bone regeneration procedures for sinus graft procedures, ridge augmentation and peri implant defects.

MTA is the most widely used material for managing root perforations. The predominant presence of calcium oxide in its formula, make it useful for tissue healing promoting hard tissue formation [11]. MTA is indicated for repair of root perforations during root canal therapy, root-end fillings, repair of root resorptions, pulp capping and pulpotomies in teeth with immature apices, and providing for an apical plug during apexification procedures. White MTA was introduced as a low-iron, non-staining formula to minimize the disadvantage of discoloration [11]. A study of 16 cases using MTA for repair of root perforations demonstrated normal tissue architecture adjacent to the repair site up to one year following the procedure which showed that MTA provides an effective seal for root perforations and shows promise in improving the prognosis of perforated teeth that would otherwise be compromised [12]. MTA has also shown to have significantly less leakage than IRM or amalgam [13].

CONCLUSION

In the present case a mid-root level perforation was managed using MTA as a perforation seal material and GTR membrane. The properties of MTA make it a suitable material for closing the communication between the root wall and the underlying periodontal tissues. The dental operating microscope provides better magnification thus enabling the operator to best visualise the operative site. If the perforation is sealed adequately, the prognosis of the tooth can be enhanced.

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