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CASE REPORT

Hong Kong Dent J 2011;8:51-5

Mineral trioxide aggregate repair of lateral root perforation using intentional replantation and bone grafting

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ABSTRACT

Root perforation is a significant complication during root canal treatment. Root perforation can result in loss of integrity of the root structure and severe periodontal and bone defect. Repair of lateral root perforation presents a clinical challenge to the operator. This report is of root perforation during post space preparation in a right maxillary central incisor that has caused an extensive periodontal lesion. Since the bone lesion was large and unreachable from either a coronal access cavity or buccal surgical flap, a combination of mineral trioxide aggregate sealing, bone grafting, and intentional replantation was used as the method of treatment. The patient's symptoms ceased and the existing lesions resolved during the 5-year follow-up.

Key words: Root canal therapy; Treatment outcome

Introduction

Root perforation may occur during root canal therapy, post space preparation, or as a result of caries or internal resorption¹. Such perforations result in loss of integrity of the root and the destruction of adjacent periodontal tissues. When the tooth has a strategic value, repair of the perforation is indicated. This can be carried out through the coronal access cavity (intra canal repair) or by surgical intervention². Many materials have been used to repair perforations, including amalgam, Cavit (3M ESPE AG, Seefeld, Germany), super ethoxybenzoic acid (super EBA), glass ionomer cement, and mineral trioxide aggregate (MTA). The success of these materials has been variable, but MTA shows a marked improvement in the prognosis³.

This report describes the treatment of a lateral-palatal perforation in a maxillary central incisor using a combination of MTA sealing, bone grafting, and intentional replantation.

Case report

In 2003, a 23-year-old Chinese woman presented to the Endodontic Section of Peking University School of Stomatology, Beijing, China, with pain, buccal swelling, and tooth mobility in the right maxillary central incisor region. There was a history of root canal treatment on a tooth with a vital pulp and post-crown restoration of the right maxillary

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central incisor 3 years previously. The medical history of the patient was non-contributory. On examination, the maxillary central incisor exhibited grade III mobility with a swelling and sinus tract on the labial side of the alveolus. A periapical radiograph revealed a post in the root canal, which deviated to the mesial root surface with a lateral root perforation. A large apical and lateral radiolucency presented adjacent to the perforation (Figure 1). Owing to the technical difficulties for intracoronary retreatment, a combination of intentional replantation with perforation repair, curettage of inflamed tissue, and bone graft was planned. The guarded nature of the prognosis was explained to the patient and consent obtained.

A full-thickness mucoperiosteal flap was elevated under local anesthesia (Xylestesin-A; 3M ESPE AG, Seefeld, Germany) extending from distal to the right maxillary lateral incisor to distal to the left maxillary central incisor. A large bony defect of 10 x 8 mm in size, with complete

loss of the labial cortical plate, was observed mesial to the right maxillary incisor. The tooth was extracted with minimal trauma and placed in a sterile saline solution. The perforation area was prepared by ultrasonic retro-tip (P5 Ultrasonic Retrotips; Satelec, Mèrignac, France) as for a retrograde root canal procedure in apical surgery and repaired by MTA (ProRoot MTA; Dentsply Tulsa Dental Specialties, Tulsa [OK], USA) [Figure 2]. Debridement of the tissue at the defect site was followed by irrigation with sterile saline solution. During the preparation, the metal post was dislodged and the post space was filled with glass ionomer cement. The tooth was replanted into the alveolus without a splint within 10 minutes after extraction. Graft material (BIO-Oss; Geistlich Pharma AG, Wolhusen, Switzerland) was mixed with a little of the patient's blood and packed into the defect. The flap was sutured with Vicryl sutures (Ethicon Inc., Somerville [NJ], USA). Ibuprofen 400 mg 3 times a day orally for 2 days, as well as amoxicillin 500 mg 3 times a day orally for 5 days were given. Also, 0.2% chlorhexidine gluconate mouth rinse was prescribed for 7 days.

At the 3-month recall examination, the sinus tract was healed and the patient was asymptomatic. At the 6-month recall, a new post and crown were placed. The radiolucency was absent at the 6-month, 1-year, and 5-year follow-up visits (Figure 3). However, at the 6-year recall examination the sinus tract was again noted and a radiolucent lesion was present at the repair site (Figures 4 and 5). The patient had remained asymptomatic. The patient was referred to the



Figure 1 Periapical radiograph showing a post in the root canal with a perforation at the site of the post end. A large apical-lateral radiolucency was also observed



Figure 2 Extracted tooth after the mineral trioxide aggregate repair



Figure 3 (a) The tooth replanted; (b) the tooth after 6 months with a new post-crown restoration; and (c) apical radiolucency was absent at 5-year recall



Figure 4 Radiolucent lesion at repair site at 6-year recall



Figure 5 Sinus at the apical region at 6-year recall

Division of Implantology for consideration of the extraction of the tooth and replacement with an implant.

Discussion

The foremost factors that determine the success of root perforation repair are its size and location, the time elapsed since the perforation occurred, the presence or absence of infection, and the sealing ability and biocompatibility of the repair material ^{1,3}. The main goal of management of a perforation is to arrest the inflammatory process and to preserve the healthy tissues at the site of the perforation. If a lesion already exists, as in this patient, it is important to restore the tissue attachment and regenerate the lost bone ⁴.

Many materials have been used to repair perforations including amalgam, Cavit, super EBA, glass ionomer cement, and MTA. In addition to providing a good seal, the materials for repair of root perforations must be biocompatible, nontoxic, insoluble in the presence of tissue fluids, and capable of promoting regeneration of the periradicular tissues. Based on the outcome of some studies, MTA is an excellent material for the repair of perforations at various levels of the root ^{5,6}.

The successful treatment of a periapical inflammatory lesion depends on reduction and elimination of the offending organisms. Root canal therapy, periapical surgery, or extraction of the tooth might be the treatment alternatives. Periapical surgery includes the curettage of all periapical soft tissues, and sometimes application of different biomaterials to enhance new bone formation at the defect site. Bone grafts and barrier membranes can be used to achieve optimal healing and regeneration of the periapical defect area after degranulation of the lesion ⁷⁻⁹. Several recent studies ^{10,11} have shown that treatment of perio-endo lesions using biodegradable collagen membranes, alone or in combination with an organic bovine bone matrix,

results in increased amount of bone, periodontal ligament, and cementum formation when compared with open flap debridement in a canine model.

The indications of apical surgery include the inability to negotiate the canal due to canal blockages or nonsurgical revision resulting in significant destruction of dentin and compromising the tooth structure ¹². The patient in this report had a metal post, perforation, and a large apical-lateral lesion. Apical surgery with bone graft was the standard method of treatment indicated. However, for root perforation management, the lateral-palatal site was unreachable from the surgical opening, and therefore intentional replantation was necessary for complete sealing of the perforation by MTA.

The main cause of failure in intentionally replanted teeth is external root resorption and ankylosis caused by damage to the periodontal ligament ^{13,14}. The ideal treatment for the avulsed tooth is to replace it into the socket as soon as possible. Regardless of the extraoral period, the age of the patient, or whether the tooth is intentionally extracted and replanted within the socket, the prognosis is guarded because the likelihood of replacement resorption is high ¹². Regarding our patient, the presence of periodontal inflammation and bone resorption were poor prognostic indicators for intentional replantation. However, root resorption and sinus tract formation was observed only 6 years after the operation.

Traditionally, a tooth with a large apical lesion and lateral perforation is an indication for extraction if it cannot be treated surgically. Based on our patient, a combination of intentional replantation, bone graft, and MTA repair might be a possible choice of treatment for a patient who is reluctant to have the tooth removed. However, due to the poor long-term prognosis, the ideal mode of treatment would be extraction of the tooth and immediate replacement with an implant or a bridge.

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