Repair of Perforating Inflammatory Root Resorption in a Previously Traumatized Incisor: 36-month Follow-up

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ABSTRACT

Inflammatory root resorption is a serious complication of dental trauma, which leads to progressive loss of the root structure. The purpose of this report was to present a case of perforating inflammatory root resorption in a previously traumatized young incisor tooth with incomplete root development. A 12-year-old girl, who had suffered a traumatic dental injury 4 years earlier, was referred with symptoms of pain and swelling in a permanent maxillary central incisor. The tooth had been root-filled and had thin dentinal walls and a wide open apex. During retreatment, a perforating resorption site was observed on the root's distal aspect. Because the entire root canal filling could not be removed, the resorption site was repaired with white mineral trioxide aggregate in the presence of the remaining gutta-percha. Clinical and radiographic follow-up was conducted for 36 months, demonstrating arrest of the resorptive process, regeneration of the periradicular tissues, and re-establishment of the periodontal space.

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Traumatic dental injuries may result in pulpal inflammation or necrosis.[1] In young permanent teeth, occurrence of such pulpal complications may lead to cessation of root development and compromised apical closure.[2,3] Further, endodontic treatment of immature teeth may substantially reduce the chances of long-term survival, owing to increased susceptibility to fracture.[3]

Inflammatory root resorption (**IRR**) is a pathologic condition that may be caused by dental trauma.[4-7] Following traumatic injury to precementum or predentin, bacteria and their by-products in the root canal and dentinal tubules may stimulate the inflammatory process with osteoclastic activity in the periradicular or pulpal tissues and initiate internal or external root resorption or both.[5,8] The long-lasting inflammatory response is the key factor that determines the progressive nature of IRR,[5,9] which can extend to significant dimensions before being recognized.[5,8,10] In advanced cases, endodontic intervention may even require prior repair of advanced resorption defects (eg, perforation) with a suitable biomaterial.[11]

Originally developed as a surgical root-end filling material, mineral trioxide aggregate (**MTA**) has many favorable properties as an endodontic repair material, including: superior sealing ability and marginal adaptation[12]; bio-compatibility[13-15]; antimicrobial activity[16]; and promotion of periradicular healing.[15,17] In addition to its ability to set in the presence of moisture and blood,[18] MTA can promote deposition of new cementum over its surface and, thus, create an environment conducive to periodontal healing.[14] Collectively, these properties render MTA as a material suitable for the treatment of root perforations.[14,19-21]

The purpose of this report was to describe the treatment and 36-month follow-up of a perforating inflammatory root resorption in a previously traumatized young permanent maxillary incisor. White mineral trioxide aggregate was used to seal the perforation site in the presence of partially removed root canal filling.

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CASE DESCRIPTION

A healthy, 12-year-old girl was referred to the clinic with a chief complaint of pain and mobility on the permanent maxillary right central incisor. Reportedly, the tooth had experienced luxation trauma in a fall accident 4 years earlier. At that time, upon prompt admittance to a local dental clinic, the tooth was splinted and the patient was prescribed antibiotics and analgesics. The splints were removed after 3 weeks, and the patient was scheduled for control visits. Two months later, the patient returned with pain and swelling on the same tooth, and the dentist initiated root canal therapy. According to the parents, the tooth received a definitive root filling after attending a number of visits, during which the dentist placed an interim medicament into the root canal. Since the complaint of the patient subsided after endodontic treatment, the patient did not attend control visits until recent symptoms of pain and mobility occurred.

On intraoral examination, the permanent maxillary central incisor presented with minimal swelling on the labial aspect. The tooth exhibited grade II mobility and tenderness to percussion. A periapical radiograph showed that the root was immature and had a wide apex (Figure 1A). The root canal had been inadequately filled and displayed an amorphous apical obturation. There was a periradicular radiolucency involving thin root walls of the mesial aspect of the root apex (Figure 1A). Based on clinical and radiographic findings, the father was informed that endodontic retreatment of the incisor would be necessary to extend the life of the immature root. Upon approval of the parent and the patient, the treatment was initiated at the same appointment.

After the tooth was isolated under rubber dam and the existing endodontic access restoration was removed, the gutta-percha was gently debrided with no. 80 Hedströem files in conjunction with copious 1.25% sodium hypochlorite (**NaOCl**) irrigation. A slight drainage of pus and bleeding was noticed during removal of gutta-percha, and a periapical radiograph confirmed a communication with the external root surface through a resorption defect (Figure 1B). Although the radiograph showed that the defect was located on the root's distal aspect, the exact dimensions of the resorption site and the possibility of other resorptive lesions could not be determined, since conebeam computed tomography was not available at the dental school. Anesthesia was administered, and copious irrigation was made with sterile saline. A mixture of calcium hydroxide and sterile saline was applied as an interim dressing, and sterile cotton pellets were condensed into the coronal access before sealing with temporary filling material (Cavit, 3M/ESPE, Seefeld, Germany).

The patient returned 2 weeks later, and the calcium hydroxide was removed with sterile saline under anesthesia. Since there was no pus or bleeding, an attempt to remove the remaining gutta-percha was made as with

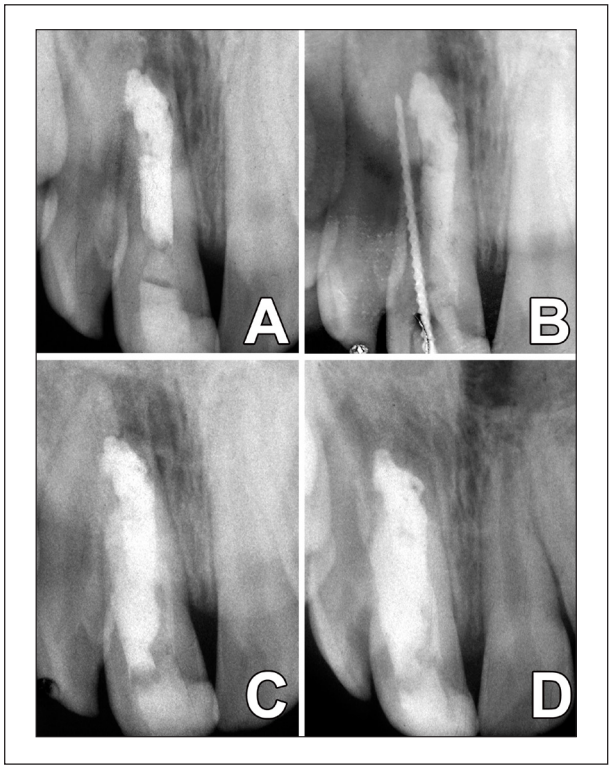

Figure 1. (A) Radiographic view of the central incisor at the initial visit. (B) Periapical radiograph demonstrating the extent of perforating inflammatory root resorption. (C–D) Mineral trioxide aggregate repair of the resorption site as viewed from 2 different angles. The remaining gutta-percha can be seen as a dense radiopaque mass.

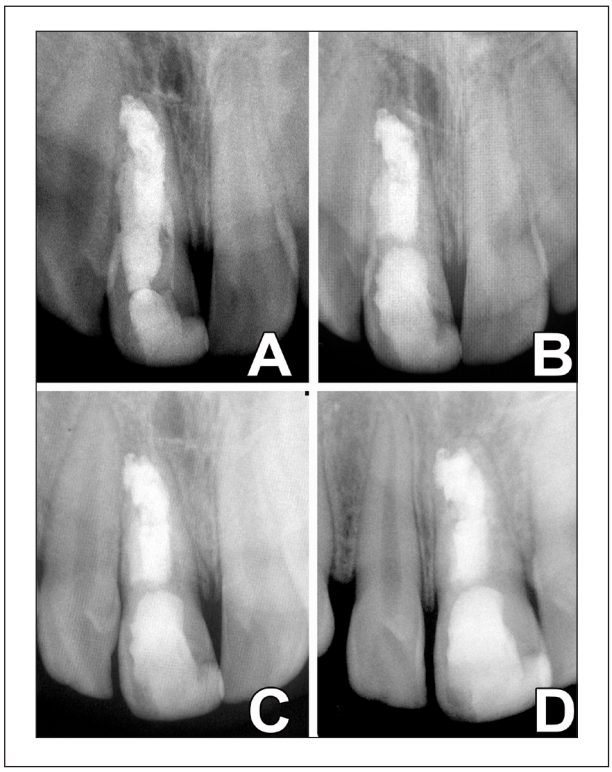

Figure 2. Radiographic view of the incisor at: (A) 6 months; (B) 1 year; (C) 2 years; and (D) 3 years.

Figure 3. Clinical view of the tooth at the 3-year recall visit.

the first appointment. Despite persistent efforts, however, the root filling could not be completely removed with hand files. In the presence of the existing and potential resorption sites, neither the use of a gutta-percha solvent nor a rotary removal instrument was considered safe. Furthermore, the extremely thin dentin walls of the apical region challenged removal of the root filling without damaging or reducing the root structure. Thus, it was decided to repair the resorption defect with MTA in the presence of remaining root filling and to follow the treatment outcome.

A final rinse was made with 1.25% NaOCl and sterile saline (10 ml each), after which the site was dried with sterile paper points. The internal portion of the resorption defect was filled with MTA (White Pro-Root MTA, Dentsply-Maillefer, Ballaigues, Switzerland) inserted in small portions by means of a Pro-Root MTA delivery gun (Dentsply-Meillefer) and gently condensed using an MTA plugger (Dentsply-Meillefer). Correct placement of the MTA was verified with periapical radiographs (Figures 1C-D). A moistened cotton pellet was placed in the pulp chamber, and the access cavity was sealed with glass ionomer cement. One week later, the temporary filling was removed and the setting of the MTA was confirmed with a hand plugger. The coronal restoration was made with hybrid resin composite (TPH Spectrum Dentsply/DeTrey Konstanz, Germany), bonded with an etch-and-rinse adhesive (Prime and Bond NT, Dentsply/DeTrey).

Clinical and radiographic follow-up was conducted for 36 months, demonstrating arrest of the resorptive process, regeneration of the periradicular tissues, and reestablishment of the periodontal space in the absence of clinical symptoms and mobility (Figures 2-3). At 12 months, intracoronal bleaching was performed with sodium perborate and distilled water due to discoloration at the crown's cervical region.

DISCUSSION

In addition to iatrogenic factors such as inadequate root canal obturation, failure of endodontic therapy can result from residual post-treatment root canal infection,[22] encountered after traumatic dental injuries.[23] In such cases, nonsurgical root canal retreatment may be required to reestablish healthy periradicular tissues.[24] The clinical success of endodontic retreatment depends strongly on effective elimination of necrotic tissue, bacteria and, undoubtedly, the infected obturation material such as gutta-percha and sealers from the root canal.[25,26] To complement favorable treatment outcome, the retreatment procedure also requires chemomechanical reinstrumentation of root canals before refilling.[24]

One of the main problems associated with endodontic retreatment is the difficulty in achieving complete removal of root filling materials.[27] Despite the low possibility of the latter,[28,29] gutta-percha might be substantially removed from the root canal by a variety of materials and techniques, including solvents, manual or rotary endodontic files, heated instruments, and ultrasonics.[29] In the present case, the entire root canal filling could not be removed with hand files. The adjunct use of gutta-percha solvents was not considered safe, owing to concerns of irritation in periradicular tissues neighboring the perforating resorption defect. Utilization of a heated instrument was also avoided for the same reason. Furthermore, the use of rotary retreatment files was not suitable due to the root canal's large diameter, while the possible use of Gates-Glidden drills jeopardized complete removal of the gutta-percha without damaging or reducing the weak root structure. Based on all those considerations, coupled with the need to repair the resorption site in a timely manner,[30] the remaining root canal filling was left intact.

In inflammatory root resorption, the treatment protocol should involve removal of the bacteria in the root canal system, which is responsible for the underlying inflammatory process and activity of resorbing cells.[31,32] Disinfection of the root canal system removes the stimulus to the periradicular inflammation, which will arrest the resorptive process and, ideally, allow for reestablishment of the periodontal space.[33] NaOCl is toxic at high concentrations, and rinsing root canals with perforation defects poses the risk of pushing the irrigant into the periradicular region. It is, therefore, advisable to use less concentrated NaOCl to decrease the risk of toxicity.[34] In the present case, the use of 1.25% NaOCl did not cause any adverse tissue reaction, although its contact with periradicular tissues through the perforation site was inevitable. Undoubtedly, irrigation should be done gently to decrease the risk of a sodium hypochlorite accident. The present disinfection plan also included short-term placement of calcium hydroxide for elimination of the bacteria in the root canal and the resorption site.[35] Complete elimination of

bacteria in this case, however, could not be possible by solely placing intracanal calcium hydroxide, owing to the bacteria and biofilm within the remaining gutta-percha. Presumably, the excellent sealing properties and antibacterial action of MTA contributed to the decrease in bacterial load in the resorption site.[16]

Despite the endodontic retreatment conditions being far from ideal, the repair of the perforating root resorption presented with optimal healing of the periradicular tissues. In the present case, MTA was used as a repair material because of its reported ability to provide a biologically suitable surface over which bone and cementum can regenerate.[9,14,36,37] It has also been shown that root perforations repaired with MTA present less leakage vs those repaired with amalgam, intermediate restorative material, or SuperEBA.[37-39] Jacobovitz and de Lima[40] showed that treatment of inflammatory internal root resorption with white MTA could result in considerable tooth discoloration, and the findings in this case were consistent with their findings. The authors explained this phenomenon as a possible result of the oxidation of tetracalcium aluminoferrite within the product formulation.[41]

In the present case, calcium hydroxide was applied as an interim dressing before the placement of MTA. Calcium hydroxide must be used for a short period of time, ideally for 2 weeks or less. If used for longer periods of time, calcium hydroxide denatures the dentin, making it weak and susceptible to fracture. As described by other authors,[3,42] calcium hydroxide can be placed in the perforation site in cases of excessive hemorrhaging or drainage, so that the repair using MTA could be performed under ideal conditions. Also, calcium hydroxide makes the surrounding tissue avascular. This is extremely important for the successful use of MTA, which must be placed in as dry a field as possible. MTA placed in the presence of bleeding washes out and will not set correctly. Following application of calcium hydroxide herein, the affected incisor was successfully treated by orthograde obturation of the entire resorption site and the remaining root canal by MTA. Recent reports on severely resorbed, traumatized incisors justify the obturation of root canals with MTA in complex and challenging endodontic conditions.[43,44]

The favorable 36-month clinical and radiographic outcome of this challenging case showed that, even in the presence of incomplete endodontic retreatment, a proper disinfection protocol followed by repair of perforating IRR with MTA can be a viable treatment option to maintain an immature permanent tooth with otherwise questionable prognosis. The goal of retreatment was also to allow for preservation and the continued growth of the alveolar bone to enable possible implant placement at a future date, when growth is complete.

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