Management of internal resorption observed after a mineral trioxide aggregate pulpotomy in a primary molar tooth: A case report with a 36-month follow-up

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ABSTRACT

This report discusses the management of an internal resorption seen after a mineral trioxide aggregate (MTA) pulpotomy in a primary molar tooth and presents the histological evaluation. Internal resorption was detected in the distal root of the primary molar tooth at the coronal third, 3 months after an MTA pulpotomy. The resorption was not expanding and was repaired with apposition. At 36 months follow-up, the tooth was extracted, and histological evaluation showed that new mature bone tissue had formed in the resorption area. In addition, a hard tissue bridge was determined at the apical region of the resorption area and pulp vitality was also maintained. The evidence from this case study suggests that internal root resorption can be self-limiting, stable, and healable.

Key words: Internal Resorption, Mineral Trioxide Aggregate, Primary Molar, Pulpotomy, Sodium Hypochlorite

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INTRODUCTION

Internal resorption is an inflammatory condition that results in the progressive destruction of intraradicular dentin and dentinal tubules of the canal walls. There is also an accompanying metaplasia of normal connective tissue and macrophages to form giant multinuclear odontoclasts which are structurally and functionally similar to bone osteoclasts.[1] The resorptive spaces might be filled with granulation tissue only, or they may be found in combination with bone-like or cementum-like mineralized tissues.[2]

The possible etiological factors for the internal resorption after a pulpotomy treatment in primary teeth are mechanical or chemical injury to the protective tissues and stimulation by infection or pressure.[3]

Mineral trioxide aggregate (MTA) is a relatively new material but seems to be a suitable replacement material for pulp treatment. Studies confirm that limited or no radiographic failure occurs after MTA pulpotomies.[4,5]

This report discusses the management of internal resorption seen after an MTA pulpotomy in a secondary primary mandibular molar tooth in a 36-month follow-up, and presents the histological evaluation following the extraction of the tooth.

CASE REPORT

An 8-year-old girl was referred to the Pediatric Dentistry Department in March 2010 for a routine dental

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examination. Her medical history was noncontributory. A radiographic examination revealed deep dentin caries in the right mandibular second molar [Figure 1a]. Based on these findings, the treatment procedures, and possible discomforts were explained to the parents of the patient.

After administration of local anesthesia (Aventis, Istanbul, Turkey), the tooth was isolated with a rubber dam. After the cavity preparation, the pulp was exposed mechanically, and it was decided a pulpotomy treatment to the tooth would be the best course due to the perforation diameter and bleeding status. After hemostasis, a cotton pellet saturated with 5% sodium hypochlorite (NaOCl) was applied to disinfect the pulp chamber for 30 s. The pulp chamber was then covered with an MTA paste (white ProRoot MTA; Dentsply, Tulsa, OK, USA). A moistened cotton pellet was placed over the MTA paste, and the tooth was temporarily restored with reinforced zinc oxide eugenol (IRM; Dentsply, Milford, DE) to allow the MTA to set completely. The tooth was restored with a stainless steel crown after 24 h [Figure 1b]. In the first control appointment, internal resorption was detected in the coronal third of the distal root at 3 months [Figure 1c]. The resorption was followed, and it was determined that there was no extension or additional radiographic failure signs in resorption area at 9 months [Figure 1d]. Moreover, hard tissue trabeculation was determined in the resorption area at 12 months [Figure 1e]. At the end of 18, 24, and 32 months follow-up periods, the resorption area was not expanded and was repaired with apposition [Figure 1f-h]. Calcified radiopaque tissue surrounded the pulp tissue. The physiological eruption of the succedaneous permanent tooth was not affected in this process. After 36-month follow-up period, the tooth was extracted for histopathological evaluation when two-thirds of the succedaneous tooth roots had developed. Due to previously reported a high incidence of the internal resorption failures, a short follow-up interval was used to evaluate clinical and radiographic changes in tooth for first 12 months. After that, the clinical and radiographic changes were observed every 6 months in line with the guideline.[6] According to the same guideline, the clinician should monitor the internal resorption, removing the affected tooth if perforation causes loss of supportive bone and/or clinical signs of infection and inflammation to hold harmless of the succedaneous tooth. Following extraction, the teeth were immediately immersed in 10% buffered formalin, embedded in paraffin, and serially sectioned through the root canals in a mesiodistal direction using a microtome to obtain sections of 5 μm in thickness. Sections were stained using hematoxylin-eosin and examined under a light microscope. In histological evaluation, hard tissue was observed in the repaired resorption area, and this tissue was formed from new mature bone tissue with a lamellar structure. Osteoblasts were observed around the bone island, and edematous interstitial tissue was observed in the bone structure. The hard tissue bridge, which was composed of cementoid and dentine tissues, was determined at the apical area of the repaired resorption area. Healthy pulp structure characterized by fibrotic connective tissue was observed under the hard tissue bridge [Figure 2].

DISCUSSION

Pulpotomy failures in primary teeth can be attributed to undiagnosed inflammation in the residual pulp prior to treatment or pulp contamination due to a micro-leakage of restorative material.[7] In this case, the failure was

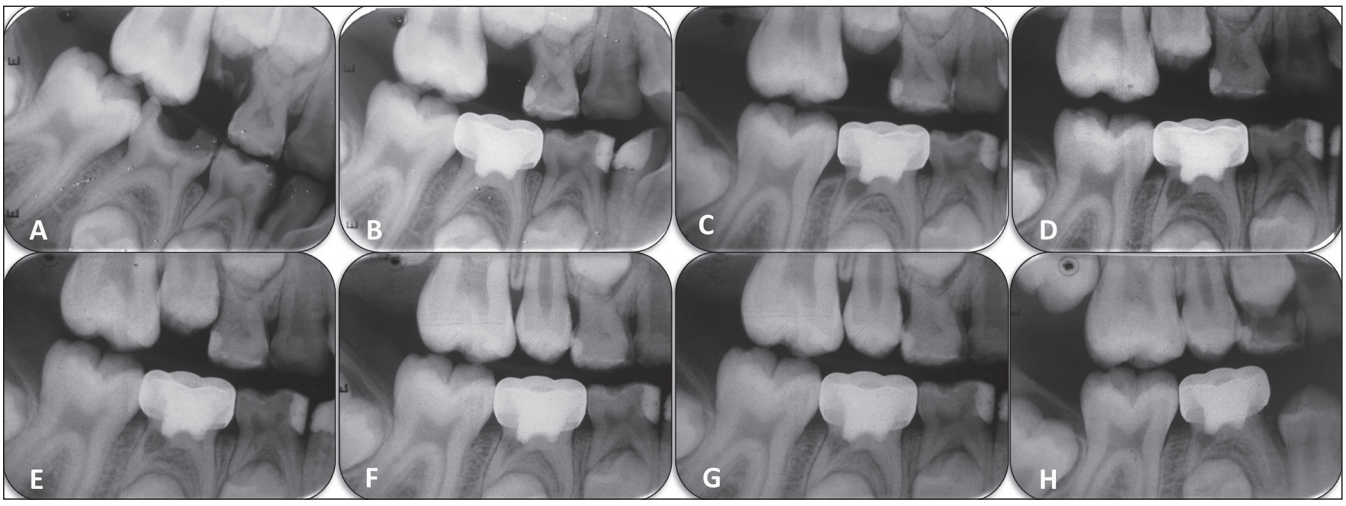

Figure 1: (a) A bitewing radiograph before the pulpotomy of a primary mandibular second molar. (b) After the performance of a mineral trioxide aggregate pulpotomy. (c) A 3-month follow-up radiograph of the tooth with internal resorption in the distal root. (d) A 9-month follow-up radiograph of the tooth. Notice there were no extensions or additional radiographic failure signs in the resorption area. (e) A 12-month follow-up radiograph of the tooth. Notice the hard tissue trabeculation in the resorption area. (f) An 18-month follow-up radiograph of the tooth. (g) A 24-month follow-up radiograph of the tooth. (h) A 32-month follow-up radiograph of the tooth

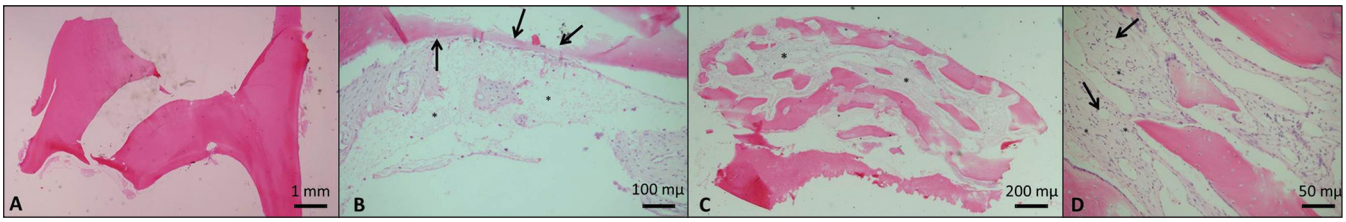

Figure 2: (a) General view of the histological section of the primary mandibular second molar (×20). (b) Magnification of a hard tissue bridge formation (arrows) composed of cementoid and dentine tissues under the repaired internal resorption area. Healthy pulp structure characterized by fibrotic connective tissue under the hard tissue bridge (asterisks) (×200). (c) Hard tissue formation in the repaired resorption area (asterisks) (×100). (d) Magnification of the hard tissue, which formed a lamellar structure with new mature bone tissue, in the repaired internal resorption area (arrows). Osteoblasts around the bone island and edematous interstitial tissue in the bone structure (asterisks) (×400)

detected in a tooth restored with stainless steel crowns, thus, eliminating the possibility of contamination due to a poor restoration seal. Due to osteoclastic activity that occurs only in the presence of inflammation and not in healthy pulp,[8] the internal resorption observed during the first evaluation probably occurred as a result of an undiagnosed inflammation of the residual pulp in this case.

According to the traditional radiographic criteria, internal resorption has been categorized as a radiographic failure in the literature. However, some authors do not regard internal resorption as a sign of failure. Smith *et al.*[9] claimed that defining osseous changes versus dental changes should be regarded when evaluating the success of a pulpotomy. They did not consider some traditional radiographic failure criteria, as long as the permanent tooth was not affected. Although this approach was not completely accepted by several authors, and they did not include internal resorption in the definition of successful treatment, they proposed that the process did not require intervention and could be left for follow-up observations. During this time, they expected the arrest of the process and the development of calcific metamorphosis, as long as it was not associated with external inflammatory root resorption.[10] For this reason, the internal resorption was not treated in this case because the tooth was asymptomatic and did not show any signs of clinical failure. However, internal resorption could continually progress, involve osseous changes, and clinical signs and symptoms could be detected in future follow-up appointments.[4] Therefore, a periodical clinical and radiographic evaluation of the internal resorption was performed to make timely interventions and prevent the permanent successor. During the follow-up period, the resorption area was not expanded but was repaired with calcified radiopaque tissue, and the succedaneous permanent tooth erupted into its proper location without an enamel defect. The arrest of the progression of the internal resorption process by a replacement with calcified material was reported earlier by Smith *et al.*[9] in primary molars pulpotomized with ferric sulfate.

Pulpotomy treatment is based on the assumption that the inflammation is limited to the coronal pulp. The clinical definition of the histological status of the residual pulp is quite difficult.[10,11] After the accurate determination of the radicular pulp status, another important factor is the material selection. NaOCl is a powerful antibacterial agent and has been employed in several studies following the mechanical exposure of pulp. Previous studies have demonstrated that the use of NaOCl is nontoxic to pulpal cells and does not inhibit pulpal healing, odontoblastoid cell formation, or dentinal bridge formation. The use of NaOCl was recommended as routine treatment for pulpal tissues following mechanical exposure. Hafez *et al.*[12] support the use of NaOCl for the disinfection and chemical amputation of operative debris, clot, and coagulum debris, and for the establishment of a dentin-pulp interface free of organic biofilm before the placement of medicament. Therefore, the antibacterial activity, as well as the fibrin clot and dentin chip removal potency, of NaOCl from the subjacent pulpal tissues may have promoted the healing of the internal resorption in this case.

Studies have shown that MTA is biocompatible and promotes the regeneration of the original tissues when placed in contact with pulp tissue. MTA can set in the presence of moisture and is not affected the presence of blood or exudate, which may have provoked better-sealing properties.[13,14] Therefore, MTA can be used in areas where it is nearly impossible to obtain a totally dry environment such as in pulp chambers. In addition, the success of the material has been associated with suppressing the risk of subsequent inflammation when the appropriate contact is provided with the pulp tissue.[4] Due to these excellent physiochemical features of MTA, the healing process may have occurred following the use of this material as a pulpotomy agent. In this case report, the possible contribution of NaOCl application as a pulp chamber antibacterial agent is not clear. Therefore, after disinfection and chemical amputation of the pulp chamber with NaOCl, MTA seems to be the most appropriate material for use as a pulpotomy material because of its better physical and chemical properties, as compared with other pulpotomy materials.

CONCLUSION

Internal root resorption can be self-limiting, stable, and healable. Pediatric dentists should monitor the internal resorption and follow the clinical and radiographic signs. MTA seems like ideal pulpotomy material and should thus be preferred, especially for long-term pulpotomy in primary teeth.

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Conflicts of interest
There are no conflicts of interest.

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