CASE REPORT

Mineral trioxide aggregate pulpotomy of a primary second molar in a patient with agenesis of the permanent successor

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Abstract


Aim To describe a pulpotomy with mineral trioxide aggregate in a primary second molar with no permanent successor.

Summary Coronal pulpotomy was performed on a carious primary molar with no permanent successor in a 7-year-old child. Follow-up examinations 24 months later revealed that the treatment was successful in preserving the tooth and the vitality of its pulp.

Key learning point Mineral trioxide aggregate might be considered as an alternative wound dressing for pulpotomy in primary molars, preserving pulp vitality and prolonging the useful life of the tooth.

Keywords: agenesis, hypodontia, mineral trioxide aggregate, primary teeth, pulpotomy.

Introduction

Hypodontia, which may be synonymous with partial anodontia, congenital absence, oligodontia or agenesia, occurs when one or more tooth buds fail to develop (Caldo-Teixeira & Puppin-Rontani 2003). Agenesis of permanent teeth has direct clinical implications, and the diagnosis of hypodontia must be made as early as possible, to allow careful planning of functional and aesthetic needs by a multidisciplinary team.
In some cases, the retention of primary molars is an acceptable semipermanent solution (Ith-Hansen & Kjaer 2000). A primary goal of all restorative treatment is to maintain pulp vitality whenever it is possible. If pulpal exposure occurs in a primary molar, a pulpotomy may be indicated for tooth preservation. Medicaments applied to radicular pulp tissue after pulpotomy have included formocresol (Fuks 2002), ferric sulphate (Fuks 2002) and calcium hydroxide (Witherspoon et al. 2006). Recently, mineral trioxide aggregate (MTA) has demonstrated the ability to induce hard tissue formation in pulpal tissue (Torabinejad et al. 1993, Torabinejad & Chivian 1999, Camilleri & Pitt Ford 2006). MTA is a mineral powder that consists of hydrophilic particles, whose principal components are tricalcium silicate, tricalcium aluminate, tricalcium oxide and other mineral oxides (Torabinejad & Chivian 1999). It has a pH of 12.5, and sets in the presence of moisture in approximately 4 h (Torabinejad et al. 1993, Torabinejad & Pitt Ford 1996, Schwartz et al. 1999, Torabinejad & Chivian 1999). Studies have shown that MTA is apparently equal or superior to other materials with respect to dye and bacterial leakage (Torabinejad et al. 1995, Schwartz et al. 1999, Torabinejad & Chivian 1999, McCabe 2003). It presents acceptable sealing ability (Torabinejad & Pitt Ford 1996, Torabinejad & Chivian 1999, Keiser et al. 2000, McCabe 2003), biocompatibility (Torabinejad & Pitt Ford 1996, Schwartz et al. 1999, Torabinejad & Chivian 1999, Witherspoon et al. 2006), low cytotoxicity (Torabinejad & Pitt Ford 1996, Torabinejad & Chivian 1999, Keiser et al. 2000) and induces odontoblasts to form hard tissue barriers (Torabinejad & Pitt Ford 1996, Shabahang et al. 1999, Torabinejad & Chivian 1999, Witherspoon et al. 2006).


Case report

A 7-year-old boy attended the Paediatric Dentistry Clinic of Bauru School of Dentistry with a request for dental care because of the presence of carious lesions. The medical and dental history were reviewed before commencing treatment. The mother reported that he had experienced pain in the decayed tooth when eating. Extra-oral examination revealed nothing of note.

The clinical and radiographic examinations revealed an extensive secondary carious lesion in the mandibular left second primary molar with no evidence of ankylosis or infra-occlusion, and absence of the successional premolar (Figs 1 and 2). According to the mother, there were no other known cases of tooth agenesis in the family.

After thorough examination, the initial treatment plan included the maintenance of the decayed tooth until it exfoliated normally in an attempt to avoid the establishment of a malocclusion in the future. It was therefore decided to attempt restoration of the carious molar. Initially, the patient received a regional anaesthetic block of the buccal, lingual and inferior alveolar nerves, and rubber dam isolation was achieved. Access to the carious
lesion and the removal of restorative material were completed using a diamond spherical bur in a high-speed handpiece with water spray. Dentinal caries removal was accomplished manually with an excavator. During this procedure, the pulp was exposed and a pulpotomy was indicated. The pulp chamber was opened with a carbide spherical bur, followed by irrigation with saline solution. After removal of the entire coronal pulp with hand instruments, haemostasis was achieved by irrigating copiously with saline solution and drying the pulp chamber with a sterilized cotton pellet. White MTA (NAngelus®, Londrina, Brazil) was then mixed with sterile water to a paste consistency, and an approximately 2-mm-thick layer of this material was applied into the pulp chamber with an amalgam carrier. The tooth was then restored with glass ionomer cement (Figs 3–5).

Follow-up examinations were carried out 12 and 24 months after treatment (Figs 6–8). Each checkup involved clinical and radiographic examinations of the tooth and periradicular area. All follow-up examinations, including pulp sensitivity tests, revealed that the treatment was successful in preserving pulpal vitality of the primary tooth. The patient will be monitored quarterly in order to follow the eruption of all permanent teeth.
Figure 3 Opening of the pulp chamber and control of bleeding of the remaining pulp tissue.

Figure 4 Mineral trioxide aggregate applied into the pulp chamber.

Figure 5 Tooth restored with glass ionomer cement.
Discussion

Tooth agenesis is an anomaly that may result in dental malpositioning, periodontal damage, lack of development of maxillary and mandibular alveolar bone height and may have significant psychological, aesthetic and functional consequences. Knowledge of the condition may contribute to the development of more effective therapies (Silva Meza 2003, Kirzioglu et al. 2005).

Figure 6  Immediate postoperative radiograph of the tooth treated with mineral trioxide aggregate.

Figure 7  Twelve-month follow-up periapical radiograph.

Figure 8  Twenty-four-month follow-up radiograph showing the success of treatment.
Management of hypodontia can pose a significant clinical challenge (Cuoghi et al. 1998, Rao & Sarkar 1999). Primary teeth that have no permanent successors may be ankylosed or infra-occluded. Besides, root resorption of these teeth may be less pronounced than those with permanent successors (Haselden et al. 2001). Before embarking on treatment, the practitioner must decide whether to extract the retained primary teeth and maintain the space until prosthetic rehabilitation, or maintain those teeth until their root resorption becomes more severe. In cases with crowding, the missing premolar may be used as an extraction space. The mandibular second primary molar can be extracted, and the space used to relieve crowding, retract anterior teeth or both. On the other hand, when the early removal of the second primary molar occurs, a series of changes in the dental arches can be observed, such as reduction in arch length, inclination of adjacent teeth, alveolar bone resorption and extrusion of the antagonist tooth. In such cases, if the decision is to keep the primary molar, a malocclusion may be avoided in the future (Bjerklin & Bennett 2000, Ith-Hansen & Kjaer 2000).

In young children, pulp exposures due to extensive carious lesions may be treated by pulpotomy, and several materials have been used as wound dressings (Fuks 2002). Formocresol has been the most popular pulp dressing material for pulpotomized primary molars for many years, but due to potentially hazardous effects, its use has decreased considerably worldwide (Eidelman et al. 2001, Holan et al. 2005). Ferric sulphate has been proposed as a substitute to formocresol (Fuks 2002). For other authors (Witherspoon et al. 2006) the material of choice is calcium hydroxide. MTA is now available as an alternative for use in pulpotomy (Torabinejad et al. 1997, Torabinejad 2004, Witherspoon et al. 2006). It is a biocompatible material with numerous clinical applications in endodontic procedures. Several laboratory and in vivo studies have shown that it prevents microleakage and promotes regeneration of the original tissues when it is placed in contact with the dental pulp or periradicular tissues (Torabinejad et al. 1997, Torabinejad 2004, Witherspoon et al. 2006). According to histological evidence from animal experiments, MTA both maintains pulp vitality and induces a tubular hard tissue bridge (Bernabe et al. 2005), and therefore, may be ideal for several endodontic procedures (Schwartz et al. 1999, Torabinejad 2004).

On the basis of recent studies, MTA may prevent microleakage and promote regeneration of the original tissues when it is placed in contact with the dental pulp or periradicular tissues (Shabahang et al. 1999, Torabinejad & Chivian 1999, Holland et al. 2001, Main et al. 2004, Yildirim et al. 2005, Camilleri & Pitt Ford 2006, De-Deus et al. 2006). There are reports of complete dentine bridge formation when MTA was used as a pulp capping agent (Schwartz et al. 1999, Queiroz et al. 2005). It showed a higher long-term clinical and radiographic success than formocresol in primary teeth (Eidelman et al. 2001, Agamy et al. 2004, Holan et al. 2005). MTA can be recommended because its replacement, unlike formocresol, does not induce undesirable responses (Eidelman et al. 2001, Holan et al. 2005). Despite its high cost, MTA may be considered as an alternative option for pulpotomy in primary teeth in an attempt to prolong their longevity.

The treatment of agenesis often involves a combined orthodontic-surgical-restorative approach. The orthodontic treatment may contribute to the overall management of hypodontia by closing or redistributing spaces (Zarrinnia & Bassiouney 2003, Fekonja 2005). Prosthetic methods for replacing congenitally missing teeth include traditional fixed prostheses, resin-bonded fixed partial dentures, removable partial dentures or osseointegrated implants to support an independent anatomically contoured crown (Zhu et al. 1996). In the present case, an implant may be indicated in future. It is worth mentioning that the osseointegration technique is not recommended for young children because osseointegrated implants are not displaced during growth like normal teeth (Zuccati 1993).
Coronal leakage and tooth fracture are real issues for the longevity of endodontically treated primary molars. In this case, a simple glass ionomer cement restoration was rapidly placed, rather than a stainless steel crown. This material has good sealing properties and is easy to handle. It is, however, accepted that this approach may represent a compromise, and the use for a stainless steel crown cannot be ruled out in future.

Conclusion

This case revealed that MTA was an effective alternative for primary molar pulpotomy, at least in the short term. Full-scale clinical trials to evaluate the effectiveness of MTA are warranted.

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References