# Direct pulp capping with mineral trioxide aggregate in a primary molar: a case report

## O. BODEM, S. BLUMENSHINE, D. ZEH & M. J. KOCH

Department of Conservative Dentistry, Dental School, University of Heidelberg, Heidelberg, Germany

**Summary.** A case is presented in which pulp capping was performed on a right first mandibular primary molar in a 7-year-old male patient. An alkaline cement powder based on mineral trioxide aggregate (MTA) was used for pulp capping. There were no pathological findings either on a radiograph taken after one year or on clinical examination after 18 months, and the right first mandibular primary molar remained vital after capping with MTA. Further clinical investigation of MTA for direct pulp capping of primary teeth should be performed.

## Introduction

The aim of pulp treatment is to preserve as much pulp vitality as possible. Direct pulp capping is less invasive than pulpotomy or pulpectomy. In primary teeth, however, the use of direct pulp capping is more limited than in permanent teeth. Pulp infection occurs earlier in primary teeth as a result of a faster progression of caries and thinner hard tissues [1]. Direct pulp capping in primary teeth has been shown to be significantly less successful than pulpotomy, despite the ability of vital primary pulp tissue to heal without radical pulp therapy [1]. The high failure rate of direct pulp capping in primary teeth has been explained by undifferentiated mesenchymal cells in the primary pulp which may become odontoclasts, leading to internal resorption [2]. It has been concluded, however, that direct pulp capping of primary teeth should not simply be rejected as a therapy option, but should be investigated further, since it is a potentially practical treatment [1].

A variety of materials may be used to cap the pulp including calcium hydroxide, zinc oxide–eugenol cement, corticosteroids and antibiotics, formocresol, polycarboxylate cements, inert materials, collagen fibres, and eventually, cytokines [1,3]. Out of these materials, calcium hydroxide has shown the best overall success, resulting in the formation of a reparative dentin bridge and having antibacterial qualities, and therefore, it is used most often [1]. However, the clinical success rate of calcium hydroxide is lower in primary teeth than in permanent teeth, possibly because of micro-leakage as well as induction of internal resorption [1,3,4]. Mineral trioxide aggregate (MTA) has been introduced as a superior material for pulpal therapy [4] and has been widely studied in the treatment of permanent teeth [5,6]. It has also been suggested as a suitable material for use in the pulpotomy of primary molars [7]. However, studies of the use of MTA in direct pulp capping of primary molars are lacking. In this paper, we report its use in direct pulp capping of the case of a primary molar.

#### **Case report**

The patient was a 7-year-old boy. His medical history revealed that he had undergone successful surgery at 3 years of age to place a shunt for the treatment of congenital hydrocephalus. The patient was referred by his general dentist to the Department of Paediatric Dentistry (a subdivision of the Department of Restorative Dentistry) at the University of Heidelberg, Heidelberg, Germany, because of behaviour management problems. Following clinical and radiographic

Correspondence: Oliver Bodem, Universität Heidelberg, Poliklinik für Zahnerhaltungskunde, Im Neuenheimer Feld 400, 69120 Heidelberg, Germany. E-mail: oliver\_bodem@med.uni-heidelberg.de



Fig. 1. Diagnostic radiograph.



Fig. 3. Exposed pulp on the primary molar is indicated by an arrow. A T-band was placed at the first molar.



Fig. 2. Intra-oral picture taken before restorations (under rubber dam isolation).

diagnostic examination (Fig. 1), it was decided to restore the carious right first mandibular primary molar. Rubber dam isolation was used (Fig. 2). Under local anaesthesia, peripheral caries were excavated using a handpiece with a bud bur, after which deeper layers of carious tissue were removed manually with an excavator. During this procedure, the pulp was minimally exposed (Fig. 3). In response to the exposure, the pulp was capped using MTA (pro Root, Dentsply, Konstanz, Germany) and the cap was covered with light-curing glass ionomer cement (Figs 4 & 5). The restoration was then completed with composite filling material (Fig. 6). Follow-ups at 6 months and one year revealed no clinical or radiographic pathological findings on the first mandibular primary molar (Figs 7 & 8). The patient was again examined clinically at one year and 6 months, and as before, no pathological changes were visible. The positive results for



Fig. 4. Appearance following application of mineral trioxide aggregate.



Fig. 5. Sub-base from glass ionomer cement on the first molar.



**Fig. 6.** Radiograph taken immediately following restoration: direct capping and restoration of the first molar.



Fig. 8. Clinical situation one year after treatment. NB: Those clinical photographs which were taken using a mirror were electronically corrected to resemble the clinical viewpoint.



Fig. 7. Radiograph taken 7 months after restoration. No pathological findings.

vitality testing of the first primary molar on each occasion coincides with reports from current literature on MTA as a successful agent in conservative pulp management [6,8].

## Discussion

Improved and more conservative pulp management has the potential to reduce the need for more invasive endodontic treatment. However, if this is to be achieved in primary teeth, there is a need for better materials for endodontic procedures, especially pulp capping. Calcium hydroxide has been traditionally used for pulp capping with only limited success in primary teeth, but an alternative new material to cover pulp lesions is MTA. According to histological evidence from animal experiments, MTA both maintains vitality and also induces a tubular hardtissue bridge [9], and therefore, may be an ideal material for some endodontic procedures. However, more studies are required to establish the effectiveness of restorations placed over the MTA. Possible uses of MTA currently discussed in the literature include apexifications, repair of resorptive defects and lateral perforations [4,5,10,11]. To date, publications regarding uses of MTA for primary dentition have been limited to pulpotomies [7]. To our knowledge, this case is the first report on the use of MTA for pulp capping in the primary dentition. During the follow-up period of one year and 6 months, the tooth remained vital, suggesting reasonable success in this case. Further investigation is needed of the potential of MTA in pulp capping of primary dentition.

**Résumé.** Dans le cas présenté ici, un coiffage pulpaire a été réalisé sur une première molaire temporaire mandibulaire droite chez un garçon de sept ans. Une poudre de ciment alcalin à base d'agrégat trioxyde minéral (MTA) a été utilisé pour réaliser ce coiffage pulpaire. Aucune pathologie n'a été détectée après un an à la radiographie ou après 18 mois à l'examen clinique, la dent demeurant vitale. Une investigation plus poussée sur l'utilisation de MTA dans le coiffage pulpaire des dents temporaires est nécessaire.

**Zusammenfassung.** Ein Fall von einer direkten Überkappung bei einem Milchmolaren bei einem Siebenjährigen wird vorgestellt. Dazu wurde alkalisches Zementpulver auf Mineral Trioxid Aggregat-Basis (MTA). Röntgenologisch und klinisch zeigten sich nach 18 Monaten keine pathologischen Veränderungen, der Zahn war vital. MTA sollte für die direkte Überkappung am Milchzahn weiter untersucht werden.

**Resumen.** Se presenta un caso en que se realizó una protección pulpar en un primer molar temporal inferior derecho de un paciente varón de siete años. Para proteger la pulpa se usó un polvo de cemento alcalino basado en agregado de trióxido mineral (MTA). No hubo hallazgos patológicos ni en la radiografía tomada después de un año, ni en el examen clínico después de 18 meses; el primer molar temporal inferior derecho permaneció vital después de la protección con MTA. Se debería realizar más investigación clínica sobre la protección pulpar directa de los dientes temporales con MTA.

#### References

- 1 Kopel HM. Considerations for the direct pulp capping in primary teeth: a review of the literature. ASDC Journal of Dentistry for Children 1992; **59** (2): 141–149.
- 2 Fuks AB. Pulp therapy for the primary and young permanent dentitions. *Dental Clinics of North America* 2000; **44** (3): 571–596.

- 3 Kopel HM. The pulp capping procedure in primary teeth 'revisited'. ASDC Journal of Dentistry for Children 1997; 65 (2): 84-85.
- 4 Schmitt D, Lee J, Bogen G. Multifaceted use of ProRoot MTA root canal repair material. *Pediatric Dentistry* 2001; 23 (4): 326–330.
- 5 Schwartz RS, Mauger M, Clement DJ, Walker WA, 3rd. Mineral trioxide aggregate: a new material for endodontics. *The Journal of the American Dental Association* 1999; **130** (7): 967–975.
- 6 Tziafas D, Pantelidou O, Alvanou A, Belibasakis G, Papadimitriou S. The dentinogenic effect of mineral trioxide aggregate (MTA) in short-term capping experiments. *International Endodontic Journal* 2002; **35** (3): 245–254.
- 7 Eidelman E, Holan G, Fuks AB. Mineral trioxide aggregate vs. formocresol in pulpotomized primary molars: a preliminary report. *Pediatric Dentistry* 2001; **23** (1): 15–18.
- 8 Faraco IM Jr, Holland R. Response of the pulp of dogs to capping with mineral trioxide aggregate or a calcium hydroxide cement. *Dental Traumatology: Official Publication of the International Association for Dental Traumatology* 2001; 17 (4): 163–166.
- 9 Holland R, de Souza V, Murata SS, Nery MJ, Bernabe PF, Otoboni Filho JA, Dezan Junior E. Healing process of dog dental pulp after pulpotomy and pulp covering with mineral trioxide aggregate or portland cement. *Brazilian Dental Journal* 2001; **12**: 109–113.
- 10 Joffe E. Use of mineral trioxide aggregate (MTA) in root repairs. Clinical cases. *The New York State Dental Journal* 2002; 68 (6): 34–36.
- 11 Torabinejad M, Chivian N. Clinical applications of mineral trioxide aggregate. *Journal of Endodontics* 1999; **25** (3): 197–205.

Copyright of International Journal of Paediatric Dentistry is the property of Blackwell Publishing Limited and its content may not be copied or emailed to multiple sites or posted to a listserv without the copyright holder's express written permission. However, users may print, download, or email articles for individual use.