Dental Traumatology 2002; 18: 217–221
Printed in Denmark . All rights reserved

DENTAL TRAUMATOLOGY
ISSN 1600–4469

The use of MTA in teeth with necrotic pulps and open apices[1]

Giuliani V, Baccetti T, Pace R, Pagavino G. The use of MTA in teeth with necrotic pulps and open apices. Dent Traumatol 2002; 18: 217–221. © Blackwell Munksgaard, 2002.

Abstract – Three clinical cases have been treated with the use of an apical plug of MTA for apexification. All three cases were central incisors that had suffered premature interruption of root development as a consequence of trauma. According to the treatment protocol, the root canals were rinsed with 5% NaOCl; then, calcium hydroxide paste was placed in the canals for 1 week. Consequently, the apical portion of the canal (4 mm) was filled with MTA. The remaining portion of the root canals was then closed with thermoplastic gutta-percha. At 6-month and 1-year follow-up period the clinical and radiographic appearance of the teeth showed resolution of the periapical lesions. MTA appears to be a valid option for apexification with its main advantage being the speed at which the treatment can be completed.

Valentina Giuliani, Tiziano Baccetti, Riccardo Pace, Gabriella Pagavino

Department of Endodontics, The University of Florence, Italy

Key words: MTA; filling materials; apexification

Dr. Valentina Giuliani, Dipartimento di Odontostomatologia, The University of Florence, Via del Ponte di Mezzo, #46–48, 50127 Firenze, Italy
[1]The work has been not published before, is not being considered for publication elsewhere and has been read and approved by all authors (Dr. Valentina Giuliani, Dr. Tiziano Baccetti, Dr. Riccardo Pace and Dr. Gabriella Pagavino).
e-mail: r.pace@odonto.unifi.it

Accepted 26 February, 2001

A major problem in performing endodontics in immature teeth with necrotic pulp and wide open apices is obtaining an optimal seal of the root-canal system. In the past, the initial aim of the therapy was to induce a hard tissue barrier at the tooth apex. This process is known as apexification. The aim of the procedure is to limit bacterial infection and create an environment conducive to the production of mineralized tissue in the apical region. Calcium hydroxide is commonly used for this purpose (1). Recently, an experimental material, Mineral Trioxide Aggregate (MTA), has been proposed as a potential material to create an apical plug at the end of the root-canal system, thus preventing the extrusion of filling materials (2). MTA is a powder that consists of fine hydrophilic particles that set in the presence of moisture. The setting time of MTA in moisture is less than 4 h (3). The major compounds of MTA are tricalcium silicate, tricalcium aluminate, tricalcium oxide and silicate oxide.

In this paper, three clinical cases are presented. All cases were central incisors that had premature interruption of radicular development caused by a previous trauma. All immature central incisors had both clinical and radiographic signs of pulp necrosis and apical periodontitis.

Case 1

A 13-year-old boy suffered trauma to his upper left central incisor 5 years before the first visit. Clinical examination revealed a buccal sinus trait in proximity of the apex of the maxillary left central incisor with mild swelling on the corresponding palatal mucosa. The tooth exhibited an uncomplicated crown fracture and the mobility was within normal limits. The radiographic examination (Fig. 1A) revealed an immature tooth with a wide open apex and a radiolucent area in proximity of the apex of the tooth.

After the application of the rubber dam and access cavity preparation, the working length was obtained. The canal was then lightly mechanically cleaned by using intracanal instruments and NaOCl 5% (Niclor OGNA) irrigation. Then, the canal was dried with sterile paper point and calcium hydroxide (Ultracalxs, Ultradent) was placed in the root canal using an intracanal capillary point (C Tips, Ultradent). After 1 week, the calcium hydroxide was removed by repeated rinsing with NaOCl 5% followed by rinsing with sterile water. The canal was dried with capillary points (C Tips, Ultradent) connected to an aspirator device. The MTA mixture (Dental Tulsa Dentsply) was placed with a small amalgam carrier (Dovgan

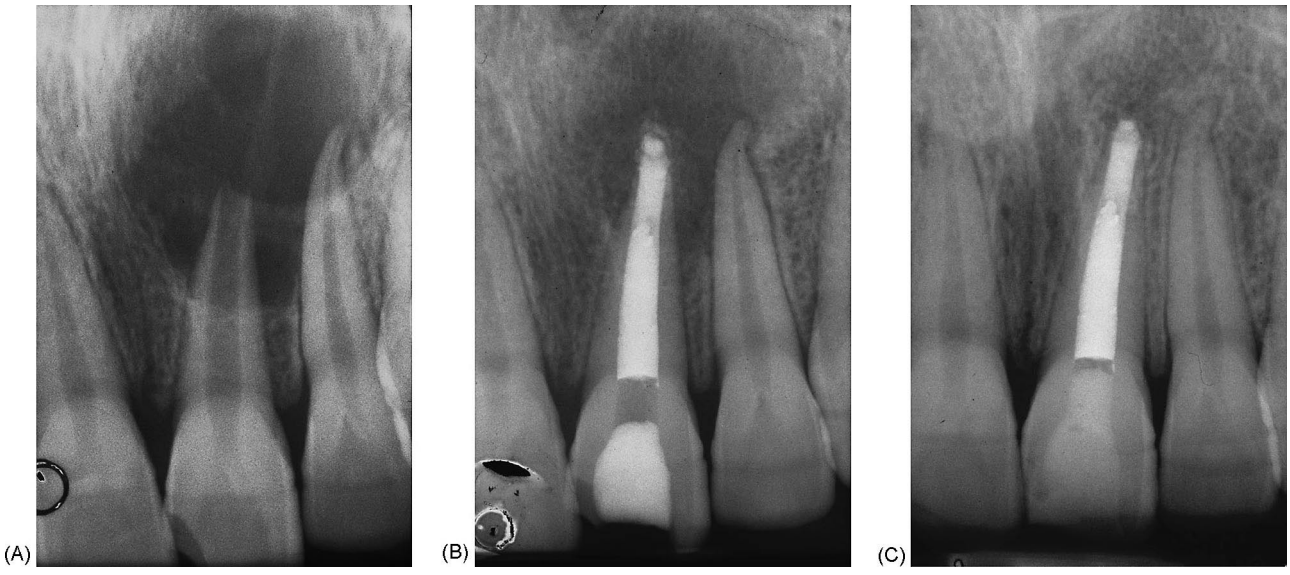

Fig. 1. (A) A preoperative radiograph of maxillary left central incisor with an open apex. (B) Follow-up after 6 months. (C) Follow-up after 1 year.

MTA Carrier 1.6 mm. Bendable), for apicectomies under the operative microscopy (Global Surgical Corp.) in the apical portion of the canal (4 mm) to create an apical plug. After the positioning of the MTA apical plug, the mixture was adapted to the canal walls using Schilder's posterior plugger with a size proportional to the apical gauge. To check the correct position of the MTA mixture, an X-ray control was done.

A wet cotton pellet with sterile water was then placed in the pulp chamber and the access cavity was closed with temporary filling material IRM (Caulk/Dentsply, Milford, DE, USA). After a week, the IRM and the cotton pellet were removed and the set of the MTA was gently tested. The rest of the canal was obturated with thermoplastic gutta-percha applied (Obtura II gun) in association with a canal sealer (Pulp Canal Sealer EWT Kerr). The tooth was later coronally sealed with composite resin.

The clinical follow-up at 6 months and 1 year revealed an adequate clinical function, an absence of clinical symptoms (voluntary and induced pain), the absence of the buccal sinus tract and the palatal swelling.

The radiographic follow-up at 6 months (Fig. 1B) revealed a decrease of the periapical rarefaction and

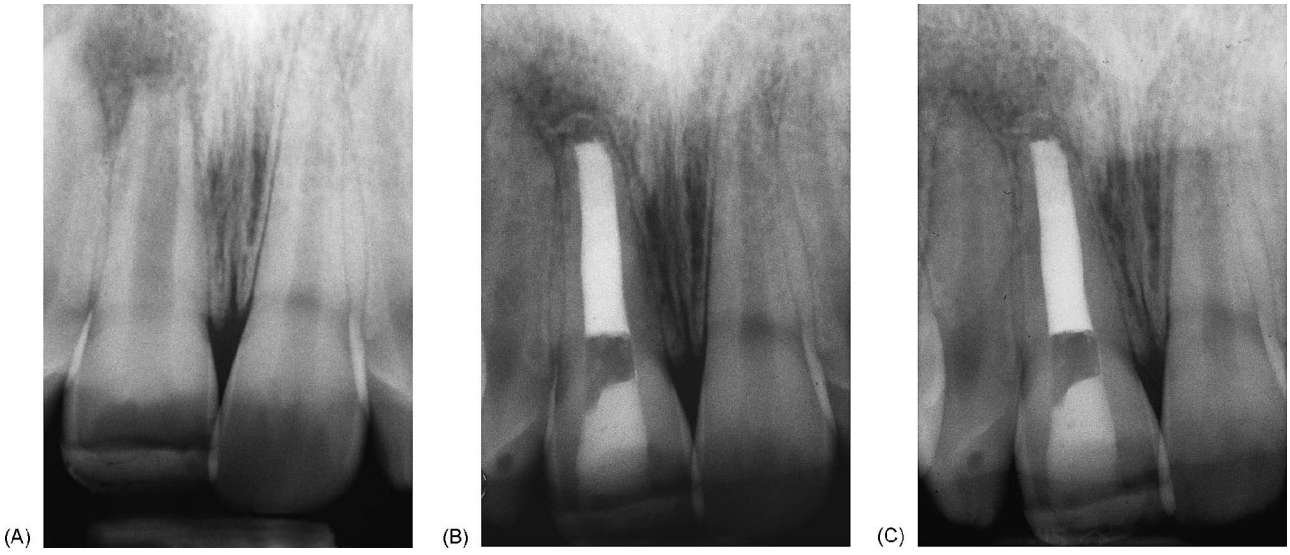

Fig. 2. (A) A preoperative radiograph of maxillary right central incisor with an open apex. (B) Follow-up after 6 months. (C) Follow-up after 1 year.

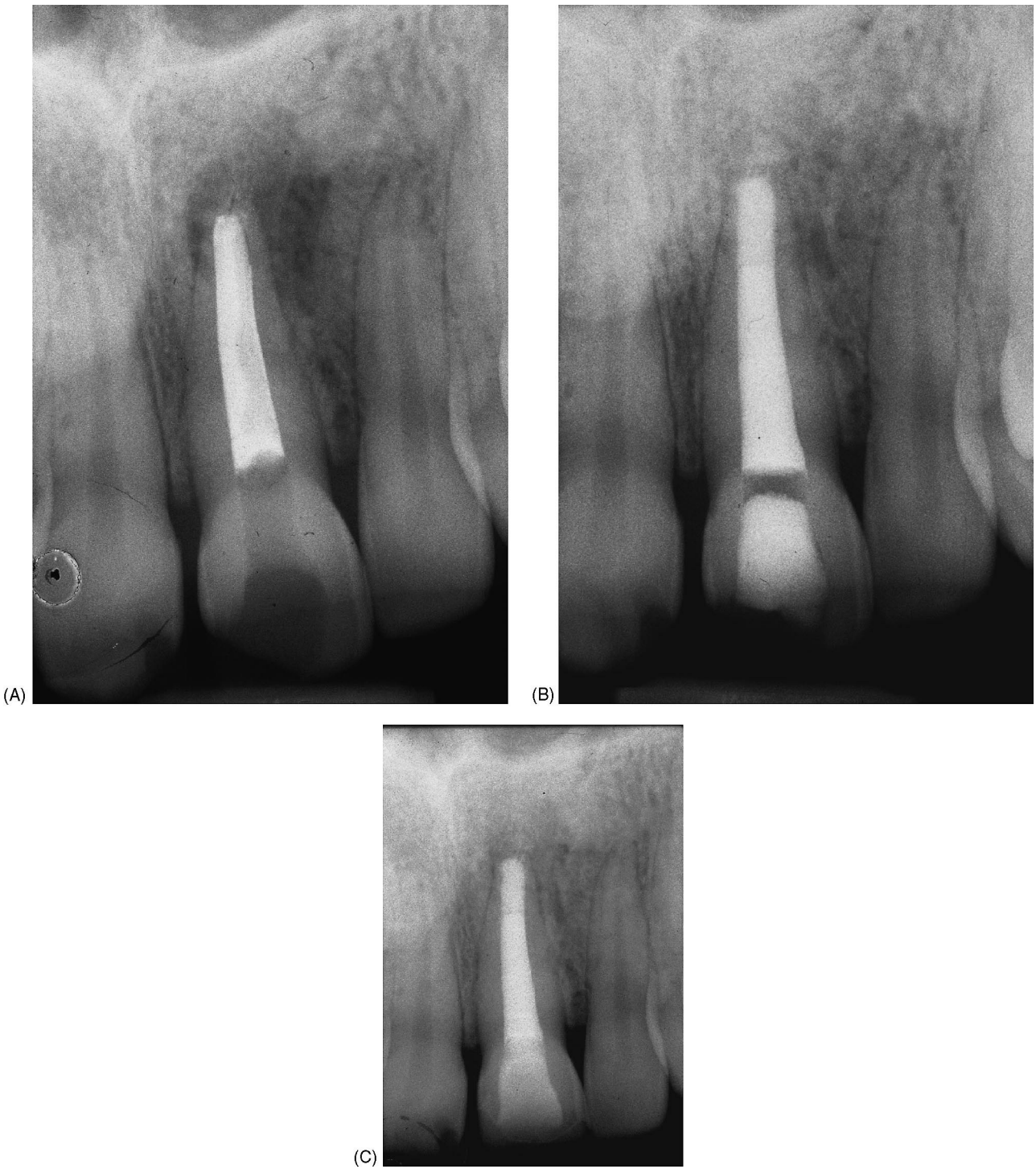

Fig. 3. (A) A preoperative radiograph of right central incisor with endodontic therapy. (B) Follow-up after 6 months. (C) Follow-up after 1 year.

at 1 year (Fig. 1C) the periapical radiolucenty had disappeared.

Case 2

A 15-year-old boy presented a buccal sinus tract in the area of the upper right central incisor. At 9 years of age, he suffered trauma to this area. The tooth was asymptomatic; the clinical examination revealed physiological mobility and slight discolouration. Radiographic examination (Fig. 2A) of the tooth revealed a wide open apex and a radiolucent area at the end of the root-canal system. The protocol for the creation of an apical plug with MTA mixture was implemented

as in Case 1. The clinical examination after 6 months and 1 year revealed the absence of mobility, pain and any signs of buccal sinus tract; the X-ray at 6 months (Fig. 2B) revealed the reduction of the radiolucent area periapically and after 1 year (Fig. 2C), a further reduction of the radiolucency could be observed.

Case 3

A 27-year-old woman presented a sinus tract in the proximity of the apex of the upper right central incisor that had a composite filling in the crown.

The radiographic examination (Fig. 3A) showed a previous endodontic therapy and a radiolucent lesion periapically. The apex was open. An unsuccessful attempt for apexification of the tooth had been performed 10 years earlier.

After removal of gutta-percha from the root canal, a second intervention was carried out by using the protocol with MTA explained in the first case.

At both 6 months (Fig. 3B) and 1 year (Fig. 3C) follow-ups, the sinus tract had disappeared and an absence of clinical symptoms (voluntary and induced pain) and mobility was registered.

Discussion

The most important problem in the classic apexification technique with calcium hydroxide is the duration of the therapy, which is from 3 to 21 months (4). The duration depends on factors such as size of the apical opening, the traumatic displacement of the tooth and the repositioning methods used. Calcium hydroxide creates an environment conducive to the formation of an apical barrier formed by osteo-cementum tissue at the end of the root canal in teeth with open apices (5, 6). During apexification procedure the root canal is susceptible to reinfection because it is covered by a temporary seal. In addition, the canal is susceptible to fracture during treatment. A permanent treatment is preferable to limit reinfection that could cause apical periodontitis and inhibit canal closure. The importance of the coronal seal was shown by Tronstad et al. (7), which found the highest success rate in teeth diagnosed with good endodontics and good coronal restorations. The rate dropped by 10% in teeth with good endodontics and poor restorations and in teeth with poor endodontics and good restorations, the success rate dropped even further.

With the MTA apical plug technique, a one-step obturation after short canal disinfection with calcium hydroxide could be performed. The MTA mixture created an artificial stop to the filling material. In agreement with other studies, MTA appeared to show good sealing ability (1), good marginal adaptation (9), a high degree of biocompatibility (8) and a reasonable setting time (about 4 h). From a practical point of view, MTA can be used in the presence of moisture in the root canal. This property is important in teeth with necrotic pulps and inflamed periapical lesions because one of the problems found in these cases is the presence of exudate at the apex of the root. However, the application of MTA mixture should be preceded by a temporary calcium hydroxide dressing in order to limit bacterial infection in the tooth.

In these cases, the MTA mixture is placed in the apical portion of the root under the operative microscopy. This technique allows an accurate placement of the mixture and a good adaptation of the material, which allows a tight seal of the root-canal system. The application of the MTA mixture must not be pushed at the end of the root canal, but only fitted with a Shilder's posterior plugger to the wall of the root-canal system to prevent the extrusion of the material. The operative microscopy allows one to see directly to the end of the root-canal system directly allowing for a good chance for accurate placement of the material.

The clinical cases reported here demonstrate that when MTA is used as an apical plug in necrotic teeth with immature apices, the canal can be effectively sealed.

Both clinical and radiography follow-ups in the reported three cases showed healing of the apical periodontitis and new hard tissue formation in the apical area of affected teeth. The results are similar to another clinical report (3), where MTA was used as an apical plug in central incisor with an open apex. In conclusion, MTA appeared to be a valid option for apexification with the added advantage of speed of completion of therapy. Long-term-outcome studies appear appropriate to test if this method is consistently successful over a large group of teeth.

References

1. Estrela C, Bammann LL, Pimenta FC, Pécora JD. Control of microorganisms in vitro by calcium hydroxide pastes. Intern Endod J 2001;34:341.
2. Torabinejad M, Watson TF, Pitt Ford TR. Sealing ability of a mineral trioxide aggregate when used as a root end filling material. J Endod 1993;19:591.
3. Torabinejad M, Chivian N. Clinical application of mineral trioxide aggregate; J Endod 1999;25:197–205.
4. Metzger Z, Solomonov M, Mass E. Calcium hydroxide retention in wide root canals with flaring apices. Dent Traumatol 2001;17:86.
5. Leonardo M, et al. Histological valuation of therapy using a calcium hydroxide dressing for teeth with incompletely formed apices and periapical lesion. J Endod 1993;19: 348–52.

6. Binniee WH, Rowe AHR. A histological study of periapical tissue of incompletely formed pulpless teeth filled with calcium hydroxide. J Dent Res 1973;52:1110.
7. Tronstad L, Asbjornsen K, Pedersen I, Eriksen HM. Influence of coronal restorations on the periapical health of endodontically treated teeth. Endod Dent Traumatol 2000;16: 218–21.
8. Koh ET, McDonald F, Pitt Ford TR, Torabinejad M. Cellular response to Mineral Trioxide aggregate. J Endod 1998;24:543–7.
9. Torabinejad M, Smith PW, Kattering JD, Pitt Ford TR. Comparative investigation of marginal adaptation of Mineral Trioxide Aggregate and other commonly used root-end filling materials. J Endod 1995;21:295–9.