

Single-visit apexification with MTA following ozone disinfection

A case report

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Fig. 1



Fig. 2

Fig. 1_ Pre-op photograph showing discoloured crown of tooth 21, with mild swelling of the periapical zone and a discharging sinus tract.

Fig. 2_ Pre-op digital radiograph showing under-formed apex and lesion of endodontic origin following pulp necrosis.

_Abstract

Introduction

Immature teeth with necrotic pulp and large periapical lesions are difficult to treat using conventional endodontic therapy. Materials such as mineral trioxide aggregate (MTA) are indispensable. However, disinfection is still problematic and alternatives such as ozone are under consideration. This case report demonstrates successful healing after single-visit apexification using MTA following ozone disinfection.

Methods

The case report presents a case of traumatised a maxillary anterior tooth. The radiographic evaluation revealed an open apex with a very wide canal. The canal was cleaned using intra-canal instrumentation and 0.5% NaOCl and final irrigation with 15% EDTA. In order to ensure sufficient canal disinfection, the canal was treated with ozone for 72 seconds. Subse-

quently, a 4 mm apical barrier (plug) was created with MTA and allowed to set. The root canal was then obturated with thermo-plasticised gutta-percha. The access cavity was sealed with a composite resin restoration.

Results

A one-year follow-up demonstrated a clinically asymptomatic and adequately functional tooth with radiological signs of healing. The positive clinical resolution of this case is encouraging for the use of ozone and white MTA as an apical plug in immature teeth with open apices.

Conclusion

The combination of ozone disinfection and MTA appears to be a valid option for single-visit apexification, with its main advantage being the speed at which the treatment can be completed. Apexification in one visit using ozone and an apical plug of MTA can be considered a predictable treatment and may be an alternative to long-term calcium hydroxide apexification.

_Case report

A 50-year-old female patient presented to the Faculty of Dental Medicine at the Medical University of Plovdiv with a discoloured maxillary left central incisor and sinus tract discharging pus (Fig. 1). The patient gave a history of trauma about 43 years ago. After the acute period, amputation paste was applied to the same tooth by a local dentist. There was no history of severe pain and swelling, or any other symptom, except occasional pus discharge from the sinus



Fig. 3



Fig. 4

Fig. 3 _Ozone was generated by Prozone and introduced into the canal via a plastic cannula for 72 seconds (corresponding to 0.672 mg of ozone).

Fig. 4 _MTA apical plug positioning using an endodontic plugger.

tract and moderate discomfort during mastication. Recently, the crown involved had become markedly discoloured, owing to which the patient's facial appearance had become highly unaesthetic. The radiographic examination of the tooth showed a wide canal with an open apex and periapical lesion (Fig. 2). Electric pulp testing was performed on teeth in the area of trauma, that is, from the maxillary left canine to the maxillary right canine. All the teeth gave a positive pulpal response, indicating their vitality, except the involved maxillary left central incisor.

Treatment protocol

Regarding the current clinical guidelines, it was decided to treat the case non-surgically by placing an MTA apical barrier.¹ Adequate isolation was achieved with the use of cofferdam. Once the working length had been determined, the canal was cleaned using a size 80 H-file and gentle but copious irrigation with 0.5% sodium hypochlorite and 15% EDTA as final irrigation. After final drying of the canal prior to obturation, ozone gas produced by the Prozone generator (W&H) was introduced directly into the root canal to within 3 mm of the apex using a slow in-and-out movement of the flexible cannula for 72 seconds, as recommended by the manufacturer (Fig. 3). We used ozone to eliminate any residual bacteria in inaccessible anatomical areas or within the dentinal tubules. White MTA (ProRoot MTA, DENTSPLY Tulsa Dental Specialties) was mixed to a paste consistency with sterile water and delivered to the canal using a Dovan carrier. An endodontic plugger of a suitable size was used to condense the MTA at the apex to about 4 mm in thickness (Fig. 4). A radiograph was taken to confirm its position (Fig. 5). A moist cotton pellet was sealed inside for setting of the MTA. The patient was recalled the next day and the hard set of the MTA was verified with an endodontic file. The remaining portion of the root canals was then closed with thermo-plastic gutta-percha and a radiograph was taken (Fig. 6). Intracoronary bleaching was also performed. The sinus tract disappeared two weeks after the treatment (Fig. 7). The 12-month follow-up found an asymptomatic and adequately functioning tooth with radiological signs of healing (Fig. 8).

_Discussion

Until a relatively short time ago, calcium hydroxide has been used to establish an apical hard-tissue barrier in immature open apices.² The time interval for calcium hydroxide apexification has been reported to vary from 12 to 24 months.² This presents possible problems regarding patient compliance and the risk of reinfection if the temporary restoration fails, and predisposes the tooth to fracture.² Moreover, calcium hydroxide is a strong alkali and could irritate periodontal tissue. The barrier produced by calcium hydroxide apexification has been reported to be more porous and weak, and can allow apical micro-leakage.²

MTA has been widely recommended for closure of open apices. It demonstrates good apical seal, biocompatibility, and pulpal and periodontal regeneration capabilities.^{1,3-6} White MTA was preferred over the grey MTA, as it has shown significantly less micro-leakage.⁷

When single-visit apexification with MTA is the preferred treatment protocol, the major problem is ensuring sufficient canal disinfection with respect to the exposed periapical tissue. A low-concentra-

Fig. 5 _Radiograph showing MTA apical barrier.

Fig. 6 _Radiograph showing final root-canal filling.



Fig. 5



Fig. 6

Fig. 7 _ The sinus tract disappeared two weeks after the treatment.

Fig. 8 _ The 12-month follow-up found an asymptomatic and adequately functioning tooth with radiological signs of healing.



Fig. 7



Fig. 8

tion sodium hypochlorite (0.5%) was selected in this case for irrigation owing to the open apex. Higher concentrations with more cytotoxicity that extrude even slightly beyond the apex can cause severe damage to the periapical tissue and irritation, with the resultant pain and swelling.^{8,9} Copious irrigation was used during instrumentation to compensate for the low concentration used.⁸ EDTA was used to remove the smear layer after instrumentation but its toxicity compared with NaOCl seems to be insignificant.¹⁰ Conventional irrigation has some limitations however. The high surface tension of the chemical solutions (even with ultrasonic activation) plays a role in the incomplete cleaning of dentinal tubules, whereas there is no such restriction when using a gas such as ozone, which will flow into any available spaces.^{8,11} Ozone is also responsible for immune modulation, anti-inflammatory effects, accelerating biosynthesis (activation of the metabolism) when is used in medicine. Other effects reported are bioenergetic, antihypoxic, analgesic and haemostatic.^{8,11-13} Ozone has great potential for use as an antimicrobial in endodontics. It is one of the most powerful antimicrobial agents with enormous capacity to reduce the number of micro-organisms (planktonic and organised in biofilm) in the root canal.¹² Ozone is effective when prescribed in sufficient concentration, used for an adequate time and delivered correctly into root canals after the customary cleaning, shaping and irrigation have been completed.^{8,11} Studies have proved the potential use of ozone gas and ozonated water (or irrigants) in endodontic therapy.^{8,11-13}

The rapid healing within 12 months reported in this case was attributed to the stimulation of the local immune response by the ozone, which releases free oxygen radicals, as well as the potent bactericidal and fungicidal action of the ozone.

_ Conclusion

Single-visit apexification with MTA was ideal for this case. It entails the non-surgical compaction of a biocompatible material into the apical end of the root canal, thus creating an apical plug and enabling immediate filling of the root canal. Disinfection with ozone was chosen to avoid using high concentrations of NaOCl. Intra-canal disinfection using ozone and the use of MTA as an apical plug achieved a positive initial clinical outcome for the immature tooth. The 12-month follow-up found clinical and radiological signs of healing.

The above-mentioned technique saves a great deal of time compared with calcium hydroxide apexification and achieves a predictable apical barrier in a single visit. Long-term follow-up is however necessary to ensure success.

Editorial note: A complete list of references is available from the publisher.

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