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CASE REPORT
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Mineral trioxide aggregate in pulp chamber floor perforation with ten-year follow-up: case report

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ABSTRACT

Endodontic retreatment represents a clinical challenge that requires advanced techniques for filling removal and the repair of structural defects. This report describes the management of teeth 46 and 47, diagnosed as previously treated teeth with chronic apical abscess. The intervention consisted of the removal of cast posts and the treatment of perforations in the pulp chamber floor through the initial application of calcium hydroxide followed by temporary sealing. Endodontic re-treatment procedures were performed, and the perforations were sealed using mineral trioxide aggregate. The cores were rebuilt with reinforced composite resin and ceromer crowns were placed. Radiographic follow-up over a ten-year period revealed a progressive reduction in periapical and furcation osteolytic lesions. In conclusion, the use of mineral trioxide aggregate under a rigorous endodontic retreatment protocol provides therapeutic success, supported by clinical stability and long-term resolution of the pathology.

Keywords: root canal; furcation defects; endodontics; case report; re-treatment.

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INTRODUCTION

In contemporary dental practice, tooth preservation constitutes a priority that reinforces the role of endodontics as a discipline aimed at maintaining the integrity of the dental organ within the oral cavity (1,2). Root canal treatment, based on the cleaning, shaping, and disinfection of the root canal system, requires a comprehensive diagnostic assessment to ensure an appropriate therapeutic approach (2–5).

Among the complications associated with this procedure, root and pulp chamber floor perforations are particularly noteworthy, as they may arise during access cavity preparation, apical shaping, or the management of complex anatomical configurations (5–8). These complications may also result from underlying pathological processes, such as extensive caries or root resorption phenomena, which create communication between the root canals and periodontal tissues (9–11). Furthermore, iatrogenic factors—including errors in anatomical identification, instrumentation of teeth with pronounced curvatures, or limited access—contribute to their occurrence and increase the risk of compromising the prognosis of the affected tooth (12,13).

Timely diagnosis and treatment of these perforations are essential, since delayed management may trigger periodontal inflammation, alveolar bone loss, or therapeutic failure (14,15). In this context, transparent communication with the patient regarding clinical implications, restorative options, and realistic expectations is essential (14). This case report describes the clinical management of two pulp chamber floor perforations using mineral trioxide aggregate (MTA) in a patient who provided informed consent for this evaluation, analyzing its advantages, limitations, and relevance in therapeutic decision-making. This approach seeks to contribute clinically applicable evidence for similar scenarios, emphasizing the importance of biomaterial-based protocols and minimally invasive techniques.

CASE REPORT

A 22-year-old female patient (ASA I classification) presented for dental consultation due to the presence of sinus tracts in the vestibular mucosa at the level of teeth 46 and 47. During anamnesis, the patient reported the absence of symptoms and stated that she had undergone root canal treatment, reconstruction with metallic posts, and crown placement four years earlier.

The initial clinical evaluation revealed similar characteristics in both teeth, including the presence of cast posts with signs of corrosion and vestibular sinus tracts. Similarly, negative responses were recorded for sensitivity, palpation, and percussion tests (horizontal and vertical). Grade 1 mobility (Miller classification) was detected, along with furcation probing depths of 7 mm in tooth 46 and 6 mm in tooth 47.

The initial radiograph (Figure 1) revealed analogous findings in both teeth. Tooth 46 presented a double cast post with an approximately 3-mm furcation perforation of the pulp chamber floor. Both roots exhibited underfilled root canal treatments, with a mesial root apical radiolucency compatible with an osteolytic process, presumed fractured files at the middle third level, and canal deviation toward the mesial aspect. In addition, loss of the lamina dura in the distal root and a radiolucent image in the furcation area associated with the perforation were observed. It should be mentioned that cone-beam computed tomography (CBCT) was not performed due to the patient's financial limitations.

Tooth 47 presented a double cast post with a 4-mm perforation of the pulp chamber floor directed distally. Similar to the adjacent tooth, underfilled canals, a mesial root apical radiolucency, fractured file fragments in the middle third, and involvement of the distal lamina dura and furcation area were observed.

The pulpal diagnosis for both teeth was previously treated tooth, and the periapical diagnosis was chronic apical abscess. The treatment plan consisted of cast post removal, sealing of the pulp chamber floor perforation, root canal retreatment, core reconstruction, and subsequent crown placement. Treatment was completed over four sessions.

During the first appointment on August 15, 2005, regional block anesthesia (2% lidocaine) and rubber dam isolation were performed. For removal of the cast posts in both teeth, the post cores were sectioned using a transmetal bur in a buccolingual direction, dividing them into mesial and distal fragments. Mesial fragments were removed using G1 and G2 ultrasonic inserts (Woodpecker®) with ultrasonic activation (Minipiezon®, EMS) at maximum power, whereas distal fragments were removed with extreme caution due to their proximity to the furcation area.

Following inspection of the pulp chamber floor (Figure 1), gutta-percha was observed at the entrances of the mesiobuccal (MB), mesiolingual (ML), and distal (D) canals. The perforations were confirmed: a 3-mm furcation-level perforation in tooth 46 and a 4-mm perforation directed distally in tooth 47. Granulation tissue was removed, irrigation with sodium chloride solution was performed, and disinfection was completed using 5.25% sodium hypochlorite. Subsequently, a calcium hydroxide paste mixed with propylene glycol was applied, followed by self-curing calcium hydroxide (Dycal®, Dentsply Sirona), and the pulp chamber was sealed with a temporary material.

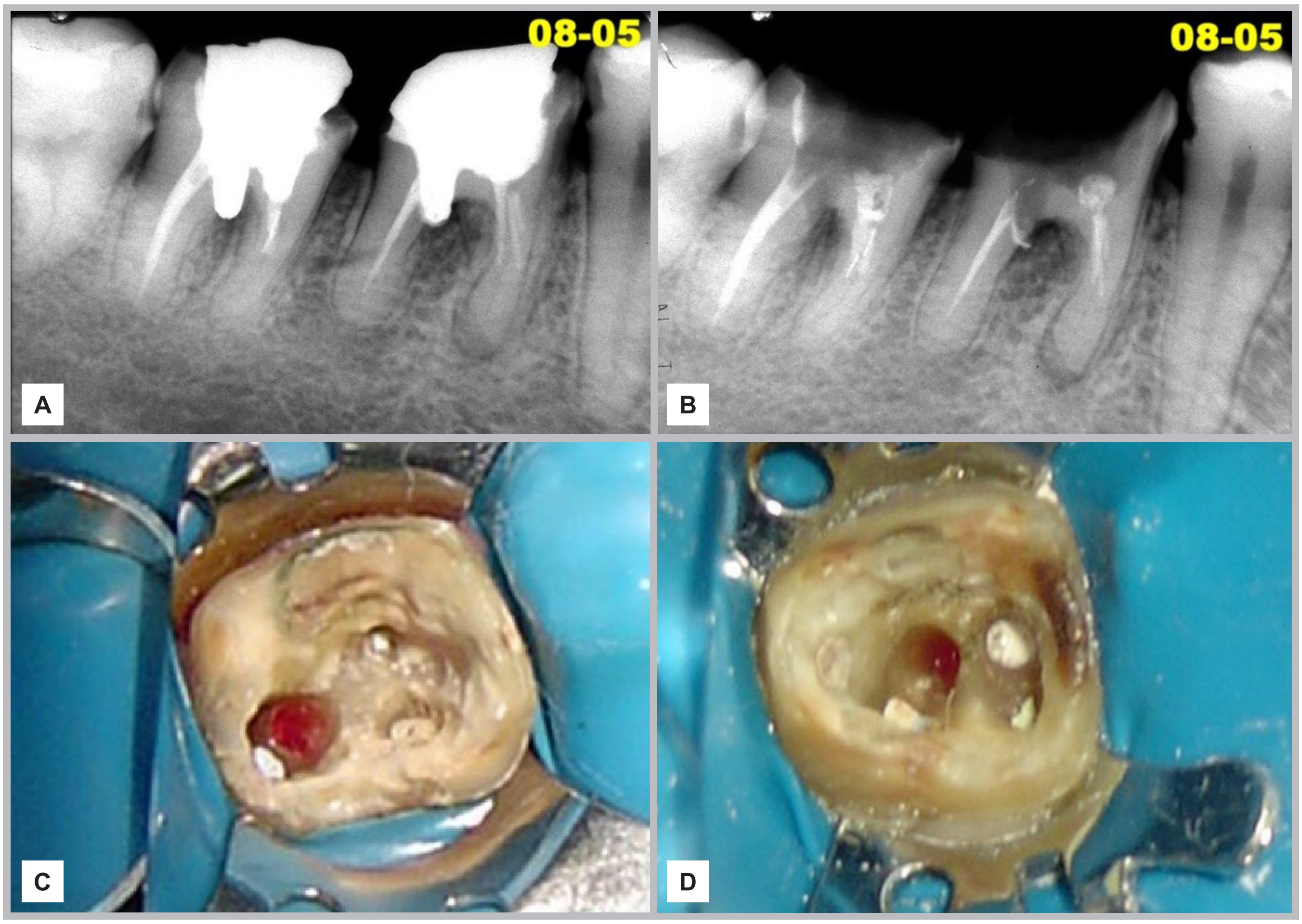

Figure 1. A) Teeth 46 and 47: diagnostic radiographic image. B) Teeth 46 & 47: removal of metallic posts. C) Tooth 47: photograph showing a 4-mm pulp chamber floor perforation. D) Tooth 46: photograph showing a 3-mm pulp chamber floor perforation.

At the second appointment on August 17, 2005, the canals in tooth 46 were cleared using Hedström files (Maillefer®), with the files being removed separately from the MB and ML canals. Patency and foraminal localization were achieved in the ML and D canals; however, a ledge was encountered in the MB canal. Working lengths were as follows: 11 mm (MB), 14.5 mm (ML), and 10 mm (D) (Figure 2). Biomechanical preparation was completed using the Protaper Universal system up to file F3, whereas the D canal was instrumented manually up to file 70.

In tooth 47, fractured files were removed from the mesial canals, achieving patency and foraminal localization only in the distal canal. Recorded working lengths were 10 mm (MB), 13.5 mm (ML), and 12 mm (D) (Figure 1). Biomechanical preparation was analogous to that of the previous tooth. The area was then irrigated with 5.25% sodium hypochlorite, and a cotton pellet impregnated with paramonochlorophenol was placed before temporary sealing.

Five days later, during the third appointment, the temporary material was removed from both teeth, and final biomechanical preparation was completed, accompanied by irrigation with 5.25% sodium hypochlorite. Cone fit verification for tooth 46 was performed using gutta-percha cones size 45 in the MB canal, size 35 in the ML canal, and size 70 in the D canal. For tooth 47, cone size 40 was used in the MB and ML canals and size 70 in the D canal.

The final irrigation protocol included sodium hypochlorite, 17% ethylenediaminetetraacetic acid, and a final rinse with sodium hypochlorite. After drying with paper points, canals were obturated using the modified Tagger technique with gutta-percha and Endofill sealer. Subsequently, perforations were sealed using MTA Angelus®. Postoperative radiographic assessment revealed overextension of the sealing material measuring 3 mm in tooth 46 and 5 mm in tooth 47 (Figure 2).

During the final session on August 25, 2005, cores were reconstructed with ParaCore (Coltene®), and ceromer crowns were cemented using RelyXTM U200 resin cement. Follow-up radiographs demonstrated adequate adaptation and sealing.

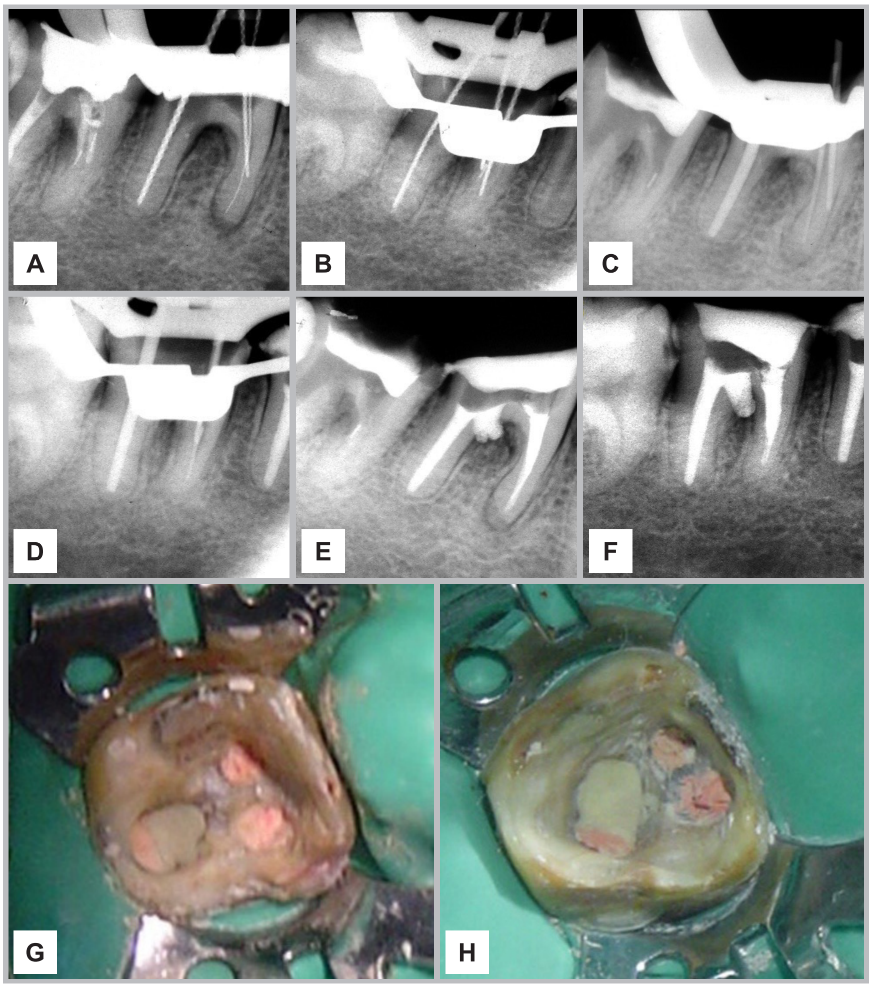

Figure 2. A) Tooth 46: file removal and working length determination. B) Tooth 47: file removal and working length determination. C) Tooth 46: cone fit verification. D) Tooth 47: cone fit verification. E) Tooth 46: post-obturation control radiograph and perforation sealing. F) Tooth 47: post-obturation control radiograph and perforation sealing. G) Tooth 47: photograph of the pulp chamber floor after perforation sealing and canal obturation. H) Tooth 46: photograph of the pulp chamber floor after perforation sealing and canal obturation.

The case was followed for approximately ten years through four scheduled evaluations (Figure 3). At the first follow-up, performed in July 2006, the patient presented without adverse signs or symptoms. Radiographic evaluation demonstrated intact MTA sealing, absence of resorption, and evidence of bone regeneration at the periapical and furcation regions of both teeth.

By June 2010, the patient remained asymptomatic. Radiographic evaluation showed a significant reduction of osteolytic lesions at both the periapical and furcation levels. Later, in December of the same year, the third follow-up confirmed complete healing of these lesions. At the final follow-up, 9 years and 3 months later, the patient remained free of adverse symptoms. Clinical examination revealed metal-ceramic crowns on both teeth and a 4-mm buccal probing depth in tooth 46. Radiographic assessment identified radiopaque images in the distal canals of both teeth compatible with metallic posts. A small osteolytic lesion in the furcation area and slight MTA resorption were observed in tooth 46, whereas tooth 47 showed no apparent adverse findings (Figure 3).

DISCUSSION

The present case report demonstrates clinical success in two endodontic retreatment procedures, in which precise diagnosis, rigorous clinical management, and assessment of the initial prognosis proved to be decisive. The incidence of root perforations, which have multifactorial etiologies, requires a detailed analysis of operative, anatomical, and systemic risks. The literature highlights that a comprehensive preoperative assessment—including clinical and radiographic analysis and, when feasible, cone-beam computed tomography (CBCT)—significantly contributes to reducing iatrogenic complications in retreatment procedures or cavity preparations (1–3).

Figure 3. A) Eleven-month follow-up: reduction of apical and furcation osteolytic lesions; favorable bone regeneration. B) Four-year and ten-month follow-up: healing of the apical lesion and further reduction of the furcation lesion; favorable bone regeneration. C) Five-year and four-month follow-up: well-adapted ceromer crown with adequate sealing and no MTA resorption. D) Nine-year and three-month follow-up: reconstruction with cast post and metal-ceramic crown observed.

Taha et al. (4) emphasize that the appropriate management of perforations is essential to prevent periradicular inflammation and bone loss. In this regard, MTA has been established as an effective biomaterial due to its bioactivity, osteoinductivity, and biocompatibility (4, 5), properties that promote mineralized tissue formation and periodontal ligament regeneration. Clinical success depends on critical technical parameters: i) strict hemostasis, ii) appropriate selection of the type of MTA, and iii) three-dimensional hermetic obturation following sealing. These factors minimize microleakage and optimize the integration of MTA with the surrounding tissues (6).

Nevertheless, orthograde retreatments present additional challenges, such as the removal of residual materials, disinfection of altered root canals, and effective coronal reconstruction. This complexity increases in cases involving calcifications or root curvatures, where access difficulties or instrumentation errors may aggravate preexisting structural defects (7). The prognosis of perforations depends on the elapsed time until repair, lesion diameter, anatomical location (coronal, middle, or apical), and antimicrobial control. These variables are associated with both iatrogenic causes—including surgical errors—and non-iatrogenic causes, notably resorption and advanced carious lesions (9).

In terms of restorative options, bioceramic biomaterials such as MTA and Biodentine® are considered therapeutic standards due to their hermetic sealing ability, bioactivity, and hard tissue induction potential. Biodentine® is additionally distinguished by its favorable clinical handling properties and accelerated setting time, advantages that enhance operative efficiency (10). Furthermore, the nonsurgical technique with an internal hemostatic matrix has emerged as the gold standard, as it ensures material containment and prevents extrusion into periradicular tissues (11).

Post-endodontic reconstruction encompasses the set of components and materials used to restore the treated tooth, factors that determine its longevity. Wang et al. (11) reported that fiber posts exhibit a survival rate exceeding 89% in the medium term in teeth with extensive coronal structure loss (≤2 remaining walls), owing to their elastic modulus and lower risk of root fracture. Meanwhile, Martins et al. (12) argue that both metallic and fiber posts constitute viable options, depending on the clinical requirements of each case.

Longitudinal studies underscore the relevance of clinical follow-up. Mente et al. (14) reported a 93% success rate for the use of MTA in perforations treated promptly (diameter <2 mm and repair within the first 72 hours). Conversely, lesions larger than 3 mm demonstrated a 62% recurrence risk after a 14-year period (13). Both anatomical and microbiological factors—particularly the presence of residual biofilm—are determinant for long-term treatment stability. A relevant limitation of this case report was the unavailability of CBCT imaging due to the patient's financial limitations.

CONCLUSIONS

This clinical case demonstrates that the use of MTA for sealing pulp chamber floor perforations can ensure long-term preservation of the tooth, even when the initial prognosis is unfavorable due to the various clinical complications observed in both teeth. Follow-up over more than ten years confirms the effectiveness of this biomaterial and supports its use as a viable alternative in similar clinical scenarios.

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