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# Sealing The Breach: Contemporary Management Of Mid-Root Perforation In A Maxillary Central Incisor Using Mineral Trioxide Aggregate – A Case Report

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***Abstract:***
*Iatrogenic root perforations in anterior teeth pose significant clinical challenges due to esthetic demands and concerns regarding long-term prognosis, particularly in young patients. This case report describes the management of a mid-root mesial perforation in a 16-year-old female with a fractured maxillary central incisor (21). The defect was sealed with mineral trioxide aggregate (MTA) under rubber dam isolation, followed by root canal obturation and esthetic rehabilitation with a zirconia crown. At 6-month follow-up, the tooth was asymptomatic with radiographic evidence of successful repair. This case highlights the predictable sealing ability of MTA and underscores the importance of conservative preservation of anterior teeth in adolescents, while documenting the rare and unusual occurrence of a mid-root perforation, which adds valuable clinical insight.*

***Keywords –*** *Iatrogenic perforation, mid root perforations, mineral trioxide aggregate, bioceramic materials.*

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## I. Introduction

Iatrogenic perforations during endodontic procedures represent a significant clinical challenge and can jeopardize the prognosis of affected teeth if not promptly and effectively managed. Root perforations in anterior teeth demand particular attention due to the dual need to preserve function and maintain esthetics in the smile zone.[1,2]

Advancements in bioactive materials, particularly MTA, have transformed perforation repair by providing superior sealing ability, biocompatibility, and the potential to stimulate periradicular tissue regeneration.[3,4] Numerous reports have confirmed the successful use of MTA in repairing perforations in maxillary incisors, with favorable long-term outcomes.[4-6] The availability of magnification and bioceramic materials has further enhanced nonsurgical treatment options, enabling conservative approaches while preserving tooth structure.[3,7]

Nevertheless, treatment planning for anterior tooth perforations must be individualized, considering the location, size, timing of repair, and esthetic requirements. Case reports by Jain et al. and Pribadi and Kristanti have documented successful outcomes of strip perforation repair in maxillary incisors using MTA and fiber post reinforcement. [1,2] Similarly, long-term evaluations confirm the predictable results of MTA in both surgical and nonsurgical treatments.[5,6]

This case report describes the management of a mid-root perforation in a maxillary central incisor and emphasizes the role of MTA as a reliable material for anterior perforation repair.

## II. Case Report

A 16-year-old female patient presented to the department of conservative dentistry and endodontics with pain and swelling of the upper lip. She reported undergoing root canal treatment, two days earlier, on the left maxillary central incisor (21) at a private clinic.

Clinical examination revealed an Ellis Class III fracture of tooth 21(figure 1a and b). A periapical radiograph showed a mid-root perforation on the mesial aspect (figure 1c). Informed consent was obtained prior to the treatment.

Under rubber dam isolation, the perforation site was irrigated with normal saline. Bleeding was controlled with a hemostatic agent, and the site was dried with sterile paper points (figure 2a). The perforation was repaired with MTA - tricalcium silicate-based cement (figure 2b). A temporary restoration was placed with Cavit W. The postoperative radiograph confirmed complete sealing of the defect.

Following successful repair, root canal obturation was completed using the single-cone technique under rubber dam isolation. A subsequent radiograph verified adequate obturation (figure 2c and 2d).

Tooth 21 was prepared for an all-ceramic crown. A dual-viscosity impression was made with light- and heavy-body polyvinyl siloxane. A provisional crown was placed with Cool Temp, and the definitive zirconia crown was fabricated and cemented with a self-adhesive dual-cure resin cement.

At the 6-month follow-up, tooth 21 remained asymptomatic and functional, with radiographic evidence of repair and no pathological changes (figure 3a and b).

Figure 1

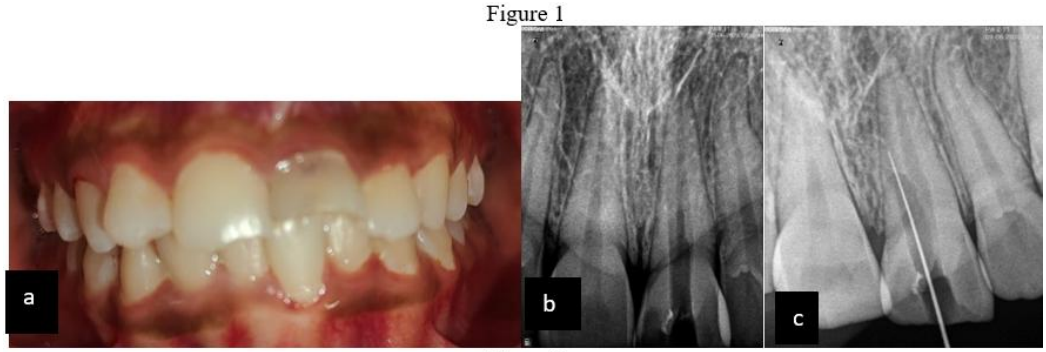


Figure 2

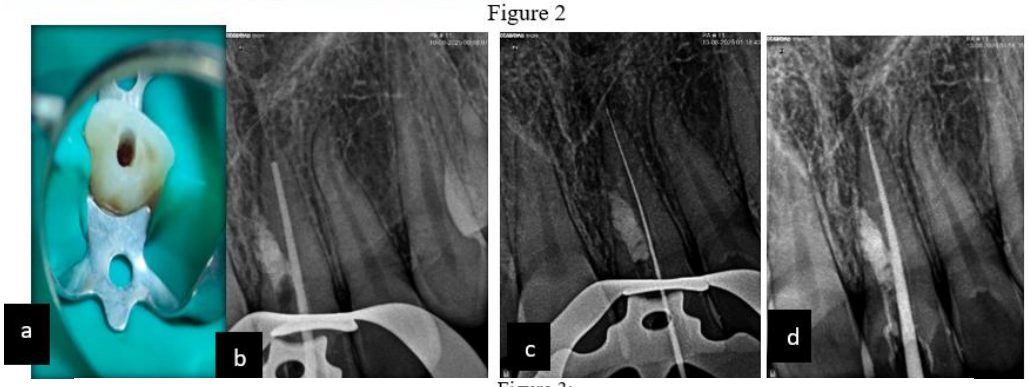


Figure 3:


**Figure Plan (Panels)**

Figure 1. (a) Ellis Class III fracture in maxillary left central incisor (21); (b) Preoperative periapical radiograph showing mid-root defect; (c) Radiographic evidence of mid-root perforation.

Figure 2. (a) Rubber dam isolation; (b) Perforation repair with mineral trioxide aggregate (MTA); (c) Working length determination; (d) Post obturation radiograph confirming hermetic seal of the root canal system.

Figure 3. (a) 6-month follow-up radiograph showing healing and no pathological changes; (b) Clinical view after esthetic rehabilitation with a zirconia crown.

## III. Discussion

Root perforations present a complex clinical challenge, particularly in anterior teeth where esthetic concerns are paramount. The etiology may be iatrogenic—commonly occurring during access cavity preparation, post-space creation, or over-instrumentation—or pathologic, due to caries, trauma, or resorptive processes.

The prognosis depends mainly on three factors: location, size, and timing of repair. Coronal and cervical perforations, especially on the facial surface of maxillary incisors, are highly susceptible to bacterial contamination and periodontal breakdown, whereas apical perforations generally have a more favorable prognosis.[1,2] Immediate sealing of the defect is critical, as delays increase the risk of inflammation, granulation tissue formation, and compromised healing.[3,4]

MTA has emerged as the material of choice for perforation repair due to its excellent sealing ability, biocompatibility, and capacity to promote cementogenesis and osteogenesis.[5] A systematic review confirms its superior sealing ability and biologic compatibility in perforation repair, while noting practical limitations such as prolonged setting time, handling difficulties, esthetic concerns, and cost.[8] Successful outcomes have been reported in both surgical and nonsurgical repair of anterior perforations, including those caused by resorption or lateral defects.[3,6,7] Adiga et al. reported favorable nonsurgical outcomes in a maxillary incisor perforation managed with MTA under magnification, highlighting the role of enhanced visualization in improving accuracy and prognosis.[3]

Unlike cervical or apical perforations, which are more commonly reported in the literature, mid-root perforations in anterior teeth are uncommon and present a distinctive clinical challenge.[1,2] Their concealed location complicates diagnosis, limits direct visualization, and makes precise sealing technically demanding. In the esthetic zone, the consequences of extraction or treatment failure are particularly severe in young patients, emphasizing the importance of conservative management.[3]

In the present case, MTA was selected because of its well-documented sealing ability, biocompatibility, and bioactive potential to promote cementogenesis and osteogenesis.[5,8] These properties are critical in mid-root repairs, where periradicular healing and long-term stability must be ensured. Although MTA has been extensively reported in the literature, its successful use in repairing a mid-root perforation of a maxillary central incisor in an adolescent patient adds a rare and clinically relevant perspective.[4,6]

This case demonstrates that, when coupled with magnification, proper isolation, and careful handling, MTA remains a reliable biomaterial for perforation repair.[3] While alternative materials such as Biodentine or newer calcium silicate cements have been advocated, the predictable outcome observed here reinforces MTA's continued role as the material of choice for anterior perforation management.[10] Longer follow-up, however, is essential to confirm the stability of the repair and the preservation of tooth function in growing patients.[7]

In some cases, reinforcement with fiber posts following MTA repair provides additional structural support and esthetic rehabilitation, as shown by Jain et al. and Pribadi & Kristanti.[1,2] Despite its advantages, MTA may cause discoloration in anterior teeth, which has led to the exploration of alternatives such as Biodentine and other newer bioceramic materials.

Surgical approaches remain a valid option when nonsurgical management is not feasible, particularly for lateral perforations with limited coronal access. Tay et al. demonstrated successful surgical management of a maxillary central incisor perforation using MTA.[7]

This case reaffirms the importance of early diagnosis, appropriate material selection, and conservative restorative planning in the management of anterior perforations. The successful nonsurgical repair in an adolescent patient highlights the potential for long-term tooth preservation and esthetic rehabilitation in cases that might otherwise be considered compromised.

## IV. Conclusions

Mid-root perforations in anterior teeth are rare and pose significant diagnostic and therapeutic challenges. This case highlights the importance of early recognition, conservative repair, and the use of bioactive materials such as MTA for achieving favorable outcomes. Successful management in an adolescent patient underscores the potential for tooth preservation and esthetic rehabilitation in cases that might otherwise be considered compromised.

Declaration Of Patient Consent:

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal.

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