



Case Report

Successful management of a rare two-rooted traumatic maxillary central incisor with severe external root resorption: A case report

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Abstract

Background: Severe external root resorption, especially in teeth with unusual root anatomy, poses a diagnostic and treatment challenge. CBCT, calcium hydroxide, and MTA are effective in addressing these cases.

Case Presentation: A 10-year-old boy presented with a two-rooted maxillary central incisor and severe root resorption following trauma. Cone-beam computed tomography (CBCT) confirmed necrotic pulp and severe external root resorption in both maxillary central incisors. The right central incisor exhibited chronic apical periodontitis, while the left had a chronic apical abscess. Treatment involved long-term calcium hydroxide therapy and placement of mineral trioxide aggregate (MTA) apical plugs.

Results: At the six-month follow-up, the patient's teeth were clinically and radiographically stable, with no signs of pain, inflammation, or ongoing resorption. The left central incisor demonstrated successful healing, while partial healing was observed in the right maxillary central incisor.

Conclusion: This case illustrates the value of CBCT for diagnosis and the success of calcium hydroxide and MTA in treating severe root resorption.

Keywords: Anatomic variation, External root resorption, Maxillary incisor, Trauma

Received: 04-12-2024; **Accepted:** 10-02-2025; **Available Online:** 27-03-2025

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1. Introduction

External root resorption is a destructive loss of tooth structure, beginning at a mineralized or exposed area on the root surface. Trauma is a potential predisposing factor for external root resorption and can play an important role.¹ There are several types of external root resorption, with external inflammatory root resorption being the most common.² The treatment goal in external apical root resorption is to remove or destroy bacteria to allow healing to take place in the periradicular space.³ And for this reason, Nonsurgical pulp therapy combined with a calcium hydroxide dressing, as recommended by Andreasen, has been used successfully in some studies.⁴⁻⁵ When initiating treatment, it is crucial to consider that variations in the internal morphology of root canals may influence the success of endodontic therapy.⁶

Regarding this fact, It is commonly believed that maxillary central incisors have a 100% prevalence of single

root and canal.⁷⁻⁹ However, according to a review article by Namaei Ghasemi et al., as of February 2023, 41 cases of such teeth having extra roots or canals have been reported.¹⁰ While various factors such as ethnicity, gender, age, diseases, and developmental anomalies like fusion and gemination have been proposed for multiple roots/canals in anterior teeth,¹¹⁻¹² dental trauma, particularly intrusive luxation to deciduous teeth, can lead to cervical loop division and formation of two roots in the successor tooth.¹³ In such cases, CBCT imaging helps in identifying variations in root morphology and detecting the exact location of extra roots.¹⁴

This report aims to provide data on the endodontic treatment of a rare case of a two-rooted maxillary central incisor with a history of previous trauma and inflammatory external root resorption.

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2. Case Report

A 10-year-old boy with a history of previous trauma presented to the Department of Endodontics at the School of Dentistry, (the name of the place is removed for blind review). Intraoral examination revealed a sinus tract in the vestibule above the maxillary left incisor, a composite build-up on the same tooth, and a complicated crown fracture of the adjacent central incisor (**Figure 1 a**). According to the parents, six months prior, a car accident had caused both front teeth to fracture and extrude from their sockets. The boy was taken to a local hospital where dental surgeons stabilized the teeth with metal wires. Subsequently, a dentist restored one tooth with composite and recommended root canal treatment (RCT) for the other. However, the pain eventually subsided, the treatment was neglected and after six months, they sought further treatment for both teeth.

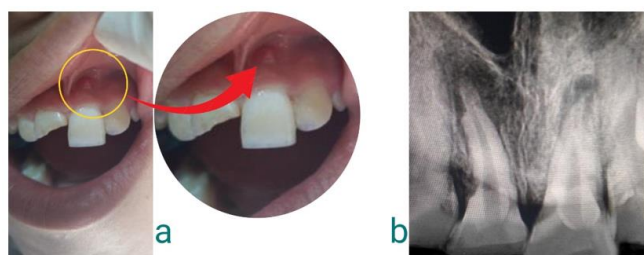


Figure 1: a: Clinical photograph showing the sinus tract in the vestibule above the maxillary left incisor and composite build-up on the same tooth. **b:** Periapical radiograph displaying bifurcated roots in the mesiodistal direction with noticeable apical radiolucency in both maxillary central incisors.

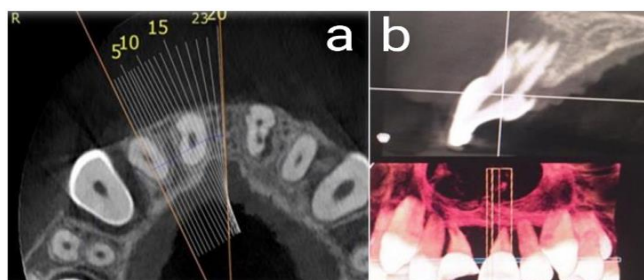


Figure 2: a: Axial view of CBCT scan showing the two-rooted maxillary left central incisor with thinning of the dentinal walls due to external root resorption. **b:** CBCT sagittal view of tooth #21 showing two distinct roots, with an apical third lesion and resorption localized in the coronal third of the tooth.

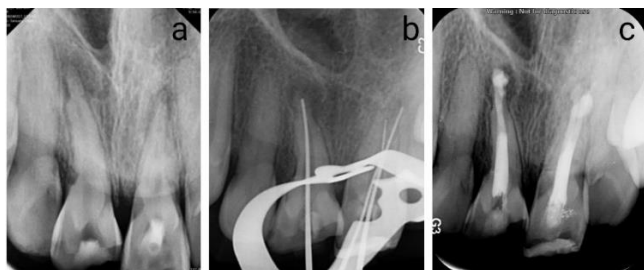


Figure 3: a: Radiograph taken two months after the second recall, showing significant healing in tooth 21 and cessation of the resorption process in tooth #11. **b:** Radiograph confirming the working. **c:** Radiograph displaying the final obturation in teeth #11 and #21 after MTA application and warm vertical technique with gutta-percha.



Figure 4: Clinical and radiographic follow-up at six months showing successful healing with no signs of resorption or inflammation.

3. Clinical and Radiographic Findings

Both maxillary incisors showed no response to electrical (Coxo, medical INS Co, China) and thermal (Cold spray, Diamant, Iran) pulp tests, while adjacent teeth responded within normal ranges. The patient reported moderate pain on palpation and percussion (indicated by tightly closing his eyes). Periodontal examination showed a maximum probing depth of 3 mm in the proximal areas of tooth #21. The mobility of both central incisors did not exceed grade 1.

A mesiodistally angled periapical radiograph displayed bifurcated roots in the mesiodistal direction with noticeable apical radiolucency in both maxillary central incisors, periodontal ligament (PDL) widening, and multiple root resorptions (**Figure 1b**). Cone-beam computed tomography (CBCT) using Carestream dental num 9600 CS was performed for improved assessment, revealing a two-rooted left central incisor with one orifice and two foramina. Dentinal wall thinning, without perforation, resulting from external root resorption was observed in the coronal third of the roots in both maxillary central incisors. Due to resorption in the apical third of both teeth, the canals appeared to be perforated to the lateral wall at the root tips (**Figure 2 a & b**).

With a diagnosis of necrotic pulp and chronic apical periodontitis for tooth #11 and chronic apical abscess for tooth #21, long-term calcium hydroxide treatment was planned for both teeth. The patient was then referred to the dental restorative department for crown restoration consultation.

3.1. First appointment

After administering a local infiltration of 2% lidocaine with 1:100000 epinephrine (Darupakhsh, Tehran, Iran), the tooth was isolated using a rubber dam and disinfected. The access cavity was prepared with a high-speed No. 801/021 round bur

(Teeskavan, Iran) under continuous water spray. The canals of both teeth were located using a #15 K-file (Mani Inc., Utsunomiya, Japan), and the working lengths were determined with K-files #20 and #30, measuring 20.5 mm for the buccal canal and 17 mm for the lingual canal in tooth 21, and 21 mm with an H-file #25 for tooth 11 from the fractured cusp. These measurements were verified using an electronic apex locator (Morita Root ZX mini, Japan) and radiographs.

Chemo-mechanical cleaning and shaping were performed for both teeth using hand instrumentation up to size 45 and the crown-down technique with rotary files (Denco, blue super files III, China), up to size F3 for all three canals. Irrigation was performed with alternating 5.25% sodium hypochlorite (Morvabon, Iran) and normal saline. The canals were then dried with paper points (META, Chugbuk, South Korea). A dense, thick mixture of saline calcium hydroxide (Morvabon, Iran) was placed into the canals 1 mm short of the working length and compacted with hand pluggers (Denco, China). Excess calcium hydroxide above the CEJ was removed, and the teeth were restored using glass ionomer restorative material (GC Fuji II LC, Japan).

4. Second Appointment

The first recall took place 28 days later. An intraoral examination was performed, and the fistula above the left maxillary incisor had resolved. A periapical (PA) radiograph was taken to check if the calcium hydroxide had been washed out, though no signs of radiographic healing were observed. The temporary filling was removed, and both teeth were isolated using a rubber dam. Continuous irrigation with 5.25% NaOCl and saline, along with gentle mechanical instrumentation, was used to remove the previous calcium hydroxide. The canals were dried with paper points and a thick, sandy mixture of calcium hydroxide /few drops of saline was placed into the canals of teeth 11 and 21. The teeth were then restored with temporary glass ionomer fillings.

5. Third Appointment

The second recall occurred two months after the previous visit. Radiographically and clinically, significant healing was observed in tooth 21, and the resorption process in tooth 11 had ceased (**Figure 3 a**). The teeth were then prepared for the application of an MTA plug.

6. Apical Plug Application

In teeth 11 and 21, working length confirmation was obtained through radiography (**Figure 3b**), and the canals were then dried using paper points. Mineral trioxide aggregate (MTA) (Angelus Dental, Londrina, Brazil) was applied to the apex of tooth 11 using pluggers until reaching the predetermined apical stop. Due to slight overextension, a small amount of MTA was inadvertently pushed beyond the apical length. As the patient's left central incisor had two canals, the MTA was

placed separately in each. A #35 K-file was left in the lingual canal while MTA was placed in the buccal canal, and this placement was verified with a subsequent (PA) radiograph. After several minutes, the file in palatal canal was removed, and the remaining apical 5mm of the root canal was filled with MTA.

After allowing 15 minutes for the MTA to set, the remaining parts of the canals in teeth 11 and 21 were obturated using the warm vertical technique. The obturation was performed with FastFill (Fast Fill Obturation System; Eighteenth, ChangZhou, China) using gutta-percha and AH-26 sealer (Dentsply, Ballaigues, Switzerland) (**Figure 3 c**). After the procedure, the quality of the filling was evaluated on a periapical radiograph. The access cavity was then filled with type II Glass Ionomer Cement (GIC), and the patient was referred to the department of restorative dentistry for permanent restoration. At the 6-month follow-up, both teeth were clinically and radiographically asymptomatic, and the patient reported no pain on percussion (**Figure 4**).

7. Discussion

Injuries to the periodontal ligament (PDL) can initiate resorption cavities on the tooth's surface. When combined with exposed dentinal tubules, necrotic pulp, local toxins, and contamination, this process intensifies inflammatory resorption on the tooth surface. If left untreated, it can progress into the root canal. However, appropriate endodontic treatment can redirect the condition from inflammatory resorption to replacement resorption, preventing further damage.¹⁵⁻¹⁶ Alongside the fast timing for initiating the RCT ones knowledge of root morphology plays a significant role in RCT success.⁶

The presence of two roots in a maxillary central incisor is a rare occurrence.¹⁰ This anatomical variation can significantly impact endodontic treatment, potentially leading to missed canals and subsequent treatment failure if not properly diagnosed and addressed.

The case presented here is unique due to the combination of two rare conditions: a two-rooted maxillary central incisor and severe external root resorption following trauma. This complexity necessitated a careful approach to treatment planning and execution.

In this case, the use of CBCT imaging was crucial in identifying the unusual root morphology and precisely locating the extra canal. The three-dimensional information provided by CBCT allowed for a more predictable and thorough treatment approach, especially given the complexity introduced by the external root resorption.

The management of external inflammatory root resorption in this case followed the principles outlined by Andreasen, utilizing a combination of nonsurgical pulp space therapy and calcium hydroxide dressing.⁴⁻⁵ This approach aims to eliminate bacteria and create an environment

conducive to healing in the periradicular space.³ The long-term calcium hydroxide treatment proved effective in halting the resorptive process and promoting healing, as evidenced by the radiographic improvements observed during follow-up appointments.

The decision to use MTA for the apical plug in both teeth was based on its higher success rate that can be up to 100%¹⁷ and sealing ability and biocompatibility.¹⁸ MTA has been shown to be particularly effective in cases of open apices or resorption-induced apical widening, as it can provide a reliable barrier against bacterial ingress while promoting healing of periapical tissues.¹⁸

While another approach for obturating the rest of the canal was to fill the whole canal with MTA¹⁹ the warm vertical obturation technique with gutta percha used in this case allowed for a three-dimensional fill of the complex canal system, and for other restorative options in future regarding the retention by use of post and cores if needed. Another reason that allowed us to use warm gutta percha was that by CBCT evaluation there seemed to be no perforation in coronal one third of the root despite the extensive external root resorption.

Although the six-month outcome is promising, long-term success in cases involving severe external root resorption remains uncertain. The affected roots may be more susceptible to fractures due to structural weakening.²⁰⁻²² Furthermore, residual resorption or recurrence of infection could present challenges over time. The complex root anatomy could further complicate long-term monitoring and treatment. Continued follow-up is crucial to ensure stability and identify any emerging complications promptly.

As well as long term follow up is crucial for a favorable outcome in such challenging cases.

This case report was developed in accordance with the guidelines set forth by the Preferred Reporting Items for Case Reports in Endodontics (Price) 23 which has been sent as a separate document.

7.1 Patient consent statement

The authors confirm that informed consent was obtained from the patients' parents, allowing the use of their child's images and clinical data for publication. They understand that while personal details, such as names and initials, will remain confidential, complete anonymity cannot be guaranteed, though all efforts will be made to protect privacy.

8. Source of Funding

None.

9. Conflict of Interest

None.

Acknowledgment

The authors declare that there are no acknowledgments to report.

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Cite this article: Khoshbin E, Karkehabadi H, Mahavi A. Successful management of a rare two-rooted traumatic maxillary central incisor with severe external root resorption: A case report. *Int J Clin Biochem Res*. 2025;13(1):46-50.