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Bio-obturation Repair of Extensive External Root Resorption in Neglected Avulsed Teeth: A Case Report

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Abstract

Tooth avulsion represents a severe dental injury, and prognosis depends on extra-oral time and storage. Its major complications include ankylosis and external inflammatory root resorption. We report a 14-year-old female who presented with pain in her upper incisors one year after avulsion of teeth 11 and 21, replanted after 60 minutes in dry cloth and splinted for four months without follow-up. Clinical and radiographic examinations were consistent with severe external inflammatory root resorption in the teeth #11, 12, 21, and 22. Given her age and unsuitability for implants, staged endodontic therapy was performed over four months. Canals were prepared under rubber dam isolation, irrigated with 17% EDTA and 5.25% sodium hypochlorite with ultrasonic activation, and dressed with non-setting calcium hydroxide. Dressing was refreshed at sequential visits until resorption stabilized. Final obturation used calcium-enriched mixture (CEM) cement at perforations and gutta-percha in remaining canal spaces, and AH-26 sealer was used as sealant. Our treatment arrested resorption and preserved function, though the long-term risk of ankylosis remains high. This case report underscores the need for immediate replantation, physiologic storage media, and timely endodontic intervention to mitigate complications. Close monitoring remains vital for maintaining aesthetics and function in growing patients.

Keywords: Calcium Hydroxide; CEM Cement; Root Resorption; Tooth Evulsion

Introduction

Tooth avulsion is among the more gruesome injuries in dentistry and predominantly happens in young males, with a 2:1 male-to-female ratio. A significant amount of force is usually required to displace a tooth. Such forces are usually enough to cause injury to the surrounding tissue, so alveolar fractures must be suspected [1].

Treatment consists of immediate replantation and aims to preserve root vitality, minimize growth retardation, and periodontal ligament (PDL) cell loss. Extra-oral time and storage media are the two main factors that affect PDL cell viability [2]. It is considered that after sixty min, PDL cells are unlikely to survive; thus effort should be made to replant the tooth as soon as possible . Many different mediums for storage have been discussed: saliva, milk, antibiotic/corticosteroid solutions, Hank's balanced salt solution, and propolis, just to name a few [3].

Replanted teeth should be immobilized with a splint for about two weeks (longer for cases with alveolar damage), and in teeth with a closed apex, root canal therapy should be conducted in two weeks post-trauma [4]. In teeth with open apices, pulp revascularization may occur spontaneously, so surveillance is the recommended approach until there is clinical or radiographic evidence. It should be noted that traditional physical examinations (*i.e.*, thermal, palpation, and percussion) may come out as negative due to nerve damage, so tests must be directed towards the vascular supply, such as pulse-oximetry [5].

This report describes the diagnosis and staged endodontic management of extensive external inflammatory root resorption affecting the maxillary incisors after avulsion and delayed replantation.

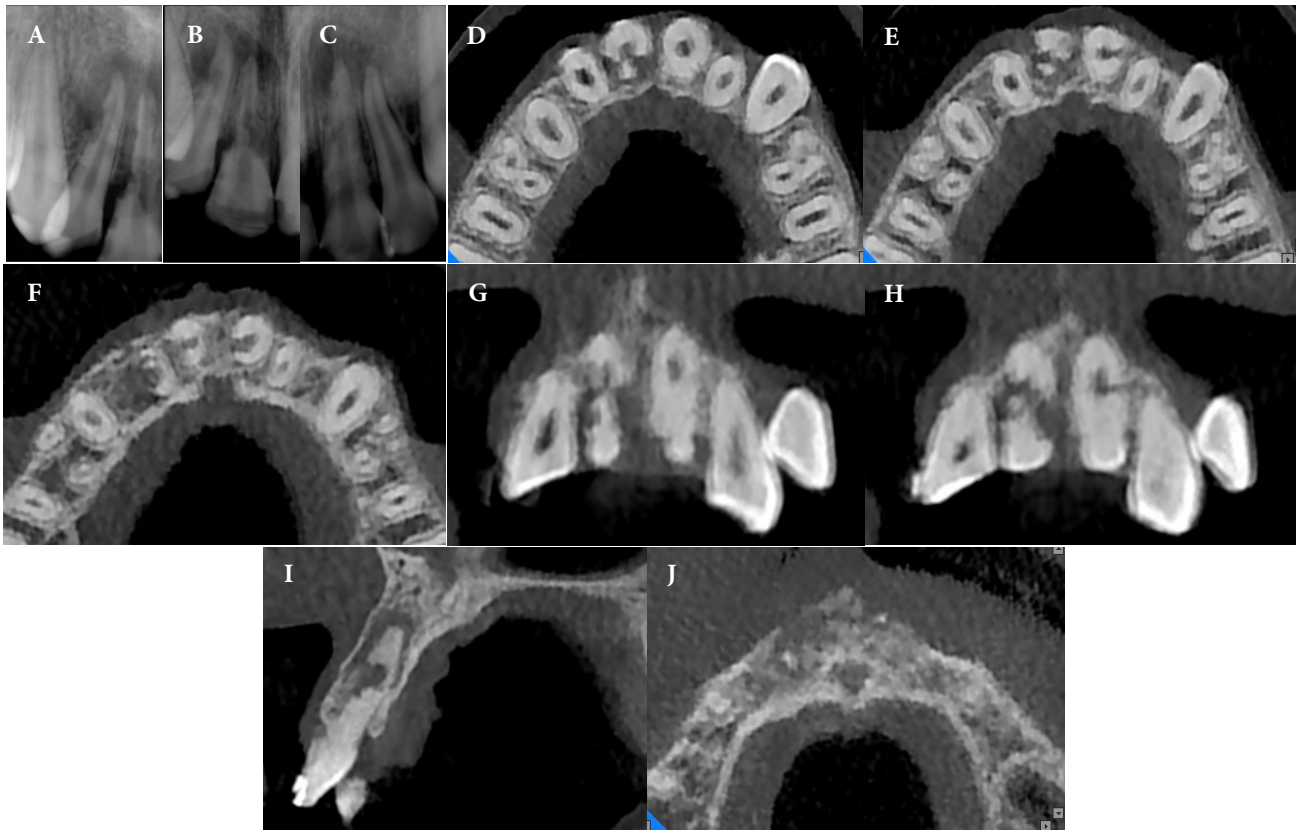

Figure 1. Standard periapical (PA) radiographs of teeth; *A*) #12; *B*)#11; *C*) #21, #22; *D, E* & *F*) Axial CBCT images showing external root resorption in anterior teeth; *G & H*) Coronal CBCT view demonstrating extensive external root resorption with root perforation; *I*) Root perforation with a periapical lesion in anterior teeth on sagittal view; *J*) Perforation of the buccal cortical plate of the

Case Presentation

A 14-year-old female presented with pain in the anterior upper maxillary region. She reported a sports injury approximately 12 months earlier that avulsed the maxillary central incisors (teeth #11 and 21, according to FDI classification). She recalls that the avulsed teeth were wrapped in dry cloth for 60 min before arrival at a dentist, where they were immediately replanted and splinted with round stainless-steel wire and composite. Splints were removed after 4 months. No follow-up occurred. The patient reported no systemic disease and was taking no regular medications.

On physical examination, several abnormalities were spotted: a pair of intra-oral sinus tracts, an anterior open bite, and crowding of the front teeth. The cold test was negative in all maxillary incisors, and the sinus tracts could be traced to the maxillary central incisors. Responses to percussion, palpation, and probing tests were normal, and all of the involved teeth had grade 1 mobility [6].

Standard parallel style periapical radiographs (Figs. 1A, 1B, 1C) showed irregular external root surface radiolucency along teeth #11, 12, 21, 22, and confirmed external inflammatory root resorption, with associated apical rarefactions (*i.e.*, chronic apical abscess). To delineate the extent of disease and assess bone integrity, a cone-beam computed tomography (CBCT) was performed (Figs. 1D-1J). Fig. 1I shows periapical lesions, Figs 1D-1I significant root perforation and Fig. 1J buccal cortical plate perforation, where bone and the root have open communication. No ankylosis-like loss of periodontal ligament space was identified.

The various treatment options and the advantages and disadvantages of each were explained to the patient's parents. Informed consent was obtained, and treatment began. With the patient's age in mind, root canal therapy was initiated. Treatment lasted five sessions over four months.

Visit one: Local Anesthesia was administered, and isolation with rubber dam was performed. Guided by pre-operative radiographs, an access cavity was created and the working length was determined: 21 mm for teeth #11 and 12, and 20 mm for teeth #21 and 22. Pulpectomy was performed, and irrigation with 17% EDTA (Cobalt, Tehran, Iran), along with 5.25% sodium hypochlorite (Golrang, Tehran, Iran) with ultrasonic activation was performed to dissolve organic tissue and disinfect the canal. Non-setting calcium hydroxide (Nikdarman, Tehran, Iran) was used as interim dressing until next visit.

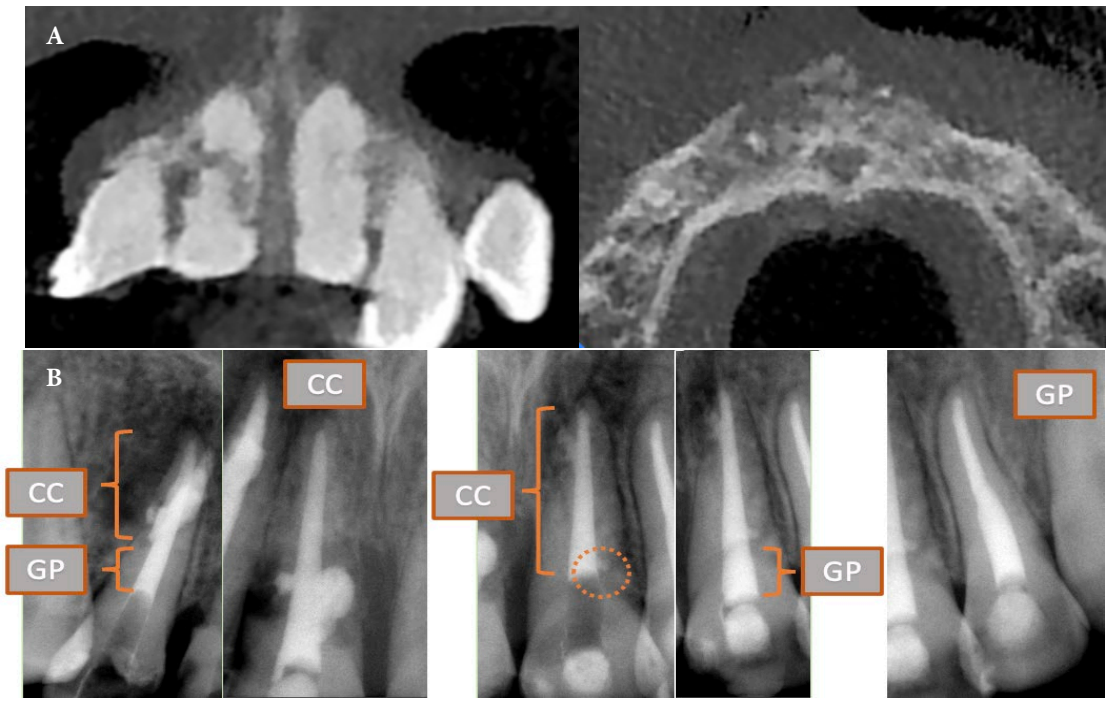

Figure 2. *A)* Arrest of inflammatory process and healing of the periapical lesion on axial and coronal CBCT views; *B)* Obturation with CEM Cement(CC) and gutta percha (GP)

Visit two (one week later): pain had decreased substantially, but sinus tracts remained unchanged. Irrigation, along with activation, was performed again, and a calcium hydroxide dressing was placed. Visit three (four weeks after session two): persistent resorption activity warranted renewal of calcium hydroxide. Visit four (two months after session three): the sinus tract for tooth #21 had resolved, a small tract adjacent to tooth #11 persisted, but was not traceable to the canal on re-assessment. All signs and symptoms were completely resolved. Calcium hydroxide was refreshed. Visit five (one month after session four): the canal was dry and without exudate/hemorrhage, and radiologic defects had stabilized compared to the last visit. A final CBCT was taken to confirm the arrest of the inflammatory process. We proceeded to finish the treatment. The canals were irrigated once more, the level of perforation was estimated through CBCT (Fig. 2A), and teeth were obturated with calcium-enriched mixture (CEM) cement up to the level of perforation, and with gutta-percha (GP, Meta-Biomed, Cheongju City, Korea) for the rest .Tooth #11 was entirely obturated with CEM cement due to extensive perforation. Because of extensive external perforations that complicated obturation, a modified bio-obturation technique using CEM cement was employed. Initially, a more flowable mixture of CEM was prepared and carefully applied to seal the external perforation walls and canal surfaces. To facilitate initial setting and improve adaptation to the canal walls, paper points were placed in the canal for approximately five min to absorb excess moisture. After this step, a denser consistency of CEM was incrementally packed to complete the obturation. This approach allowed effective sealing of the canal and perforation areas without extrusion of material beyond the root surface (Fig. 2B). Tooth #22 had none, so it was obturated with GP only. Finally, the canals were sealed with AH-26 root canal sealant (Dentsply Maillefer, Ballaigues, Switzerland), and the patient was dismissed.

A patient with an avulsed tooth should be followed up at 3, 6, 12, 18, and 24 months, and then annually for up to 5 years. The reported patient was visited at 3 months, 6 months, and 12 months. She reported no symptoms, and radiographic features were stable (Fig. 3).

Discussion

Avulsion outcomes hinge on PDL cell viability, which is dictated by extra-oral dry time and storage medium [2]. After 30 min of extra oral dry time, most PDL cells are non-viable, and ≥60 min is treated as non-viable PDL regardless of storage medium, with a high expectation of ankylosis even if the tooth is replanted correctly [2]. The International Association of Dental Traumatology (IADT) Guidelines, therefore, divide avulsed teeth into three risk groups: viable with immediate replantation, compromised with less than sixty min of extraoral dry time in physiologic medium, and non-viable with more than 60 min

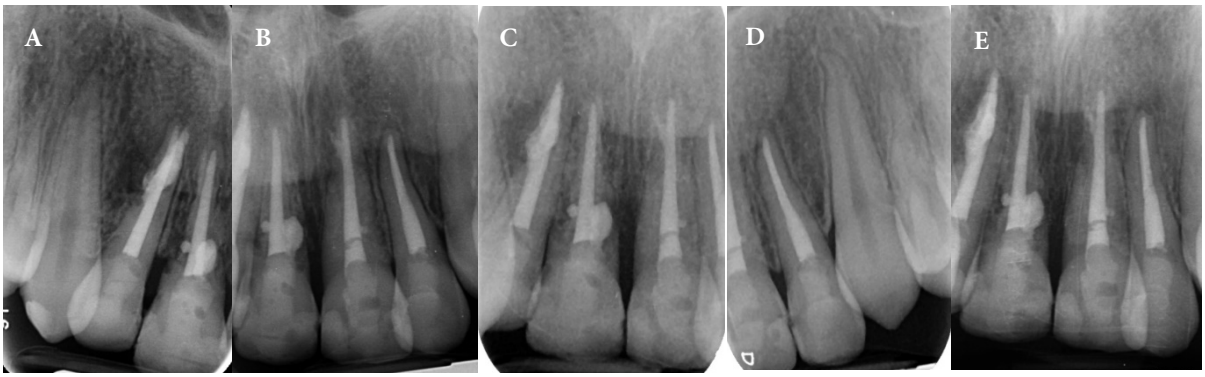

Figure 3. Follow-up periapical radiographs; *A and B*) At 3 months; *C and D*) At 6 months; *E*) At 12 months

of extra oral dry time regardless of storage. Our patient's extra oral time of about 60 min in dry cloth and prolonged splinting placed her squarely in the highest risk category for ankylosis [4, 7, 8]. Moreover, no decision was made about root canal therapy, which may have led to external inflammatory root resorption.

Given the late presentation with established resorption, we prioritized sequential calcium hydroxide dressings to arrest resorptive activity. External inflammatory resorption in the context of trauma runs on two engines: microbial activity in the infected root canal system and acidic resorption, where clasts dissolve minerals in response to inflammation [9]. Calcium hydroxide raises pH, which disables both mechanisms that sustain resorption [10]. Corticosteroid–antibiotic pastes were not employed as their benefit is greatest immediately post-trauma, and we similarly avoided triple antibiotic paste protocols given their limited indication outside refractory infection [11-13]. Clinically, calcium hydroxide is used and refreshed every session until symptoms disappear, the canal is dry, and the radiographic progression of resorption has resolved [4]. In our case, this process took about four months. However, this process is not bereft of downsides, as it has been shown that prolonged calcium hydroxide therapy may increase the risk of root fracture [14]. The selection of CEM cement for the definitive bio-obturation in this case was based on its well-documented bioactivity and sealing properties, which are critical for managing extensive perforative defects. CEM cement actively promotes hard tissue deposition and periodontal regeneration by inducing the formation of hydroxyapatite-like crystals and releasing bioactive molecules that upregulate cementoblast activity [15]. This regenerative potential is paramount for healing the communication between the root canal system and the periodontal ligament. Furthermore, its excellent sealing ability, comparable to or surpassing that of MTA, ensures a predictable fluid-tight barrier against bacterial microleakage, a key factor in arresting external inflammatory root resorption [11]. While MTA is an established biomaterial, CEM cement was chosen specifically for its faster setting time, easier handling characteristics, and reported lower potential for causing tooth discoloration compared to white MTA formulations [16]. These properties made it particularly suitable for the modified bio-obturation technique in the esthetically sensitive anterior region, facilitating the controlled, sequential application required to seal the complex, multi-level perforations without material extrusion.

Although our treatment of this patient was successful, we should set realistic expectations. Real-world survival of replanted teeth is limited (about 50% at 5.5 years) [17]. As previously stated, our patient is at high risk for ankylosis, another major complication of avulsion. This is a progressive and largely untreatable condition where the tooth fuses with alveolar bone and stops growing with neighboring structures, which leads to a step-down appearance called infra-occlusion [18, 19]. The tooth is gradually replaced by bone and may be lost [18, 20-22].

Patients and parents need to be educated about the prognosis, and a structured follow-up plan must be set. The patient may need decoronation and subsequent implantation in the coming years.

Conclusions

Conservative management using calcium hydroxide followed by bio-obturation with CEM cement can arrest external inflammatory root resorption and preserve traumatized replanted teeth when mobility, function, and occlusion are maintained. This approach is suitable for localized resorption without ankylosis or infra-occlusion, provided infection control and close radiographic monitoring are ensured. Careful case selection and long-term follow-up remain essential to confirm sustained healing and prevent late complications.

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Conflict of interest
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Authors' contributions
Conceptualization: AH/ZK; Methodology: SS/ZK; Formal Analysis and Investigation: AH/ZK; Writing-Original Draft Preparation: SS/AH/ZK; Writing-Review and Editing: SS/AH; Supervision: AH. All authors read and approved the final manuscript.

References

1. Feliciano KM, de França Caldas A, Jr. A systematic review of the diagnostic classifications of traumatic dental injuries. Dent Traumatol. 2006;22(2):71-6.
2. Goswami M, Chaitra T, Chaudhary S, Manuja N, Sinha A. Strategies for periodontal ligament cell viability: An overview. J Conserv Dent. 2011;14(3):215-20.
3. Kostka E, Meissner S, Finke CH, Mandirola M, Preissner S. Multidisciplinary treatment options of tooth avulsion considering different therapy concepts. Open Dent J. 2014;8:180-3.
4. Andersson L, Andreasen JO, Day P, Heithersay G, Trope M, Diangelis AJ, et al. International Association of Dental Traumatology guidelines for the management of traumatic dental injuries: 2. Avulsion of permanent teeth. Dent Traumatol. 2012;28(2):88-96.
5. Gopikrishna V, Tinagupta K, Kandaswamy D. Comparison of electrical, thermal, and pulse oximetry methods for assessing pulp vitality in recently traumatized teeth. J Endod. 2007;33(5):531-5.
6. Kim GY, Kim S, Chang JS, Pyo SW. Advancements in Methods of Classification and Measurement Used to Assess Tooth Mobility: A Narrative Review. J Clin Med. 2023;13(1).
7. Kahler B, Hu JY, Marriot-Smith CS, Heithersay GS. Splinting of teeth following trauma: a review and a new splinting recommendation. Aust Dent J. 2016;61 Suppl 1:59-73.
8. Lauridsen E, Andreasen JO, Bouaziz O, Andersson L. Risk of ankylosis of 400 avulsed and replanted human teeth in relation to length of dry storage: A re-evaluation of a long-term clinical study. Dent Traumatol. 2020;36(2):108-16.
9. Galler KM, Grätz EM, Widbiller M, Buchalla W, Knüttel H. Pathophysiological mechanisms of root resorption after dental trauma: a systematic scoping review. BMC Oral Health. 2021;21(1):163.
10. Mohammadi Z, Dummer PM. Properties and applications of calcium hydroxide in endodontics and dental traumatology. Int Endod J. 2011;44(8):697-730.
11. Asgary S, Parhizkar A. Management of External Inflammatory Root Resorption following Tooth Autotransplantation Using a Modified Combination of Triple Antibiotics. Case Rep Dent. 2022;2022:5178339.
12. Kirakozova A, Teixeira FB, Curran AE, Gu F, Tawil PZ, Trope M. Effect of intracanal corticosteroids on healing of replanted dog teeth after extended dry times. J Endod. 2009;35(5):663-7.
13. Day PF, Gregg TA, Ashley P, Welbury RR, Cole BO, High AS, et al. Periodontal healing following avulsion and replantation of teeth: a multi-centre randomized controlled trial to compare two root canal medicaments. Dent Traumatol. 2012;28(1):55-64.
14. Andreasen JO, Farik B, Munksgaard EC. Long-term calcium hydroxide as a root canal dressing may increase risk of root fracture. Dent Traumatol. 2002;18(3):134-7.
15. Asgary S, Eghbal MJ, Parirokh M, Ghoddusi J. Effect of two storage solutions on surface topography of two root-end fillings. Aust Endod J. 2009;35(3):147-52.
16. Asgary S, Aram M, Fazlyab M. Comprehensive review of composition, properties, clinical applications, and future perspectives of calcium-enriched mixture (CEM) cement: a systematic analysis. Biomed Eng Online. 2024;23(1):96.
17. Bücher K, Neumann C, Thiering E, Hickel R, Kühnisch J. Complications and survival rates of teeth after dental trauma over a 5-year period. Clin Oral Investig. 2013;17(5):1311-8.
18. Andersson L, Blomlöf L, Lindskog S, Feiglin B, Hammarström L. Tooth ankylosis. Clinical, radiographic and histological assessments. Int J Oral Surg. 1984;13(5):423-31.
19. Albertsson J, Lauridsen E, Andreasen JO, Gerds TA, Andersson L. The risks of ankylosis of 89 avulsed human teeth stored in saliva prior to replantation-A re-evaluation of a long-term clinical study. Dent Traumatol. 2021;37(4):537-45.
20. Moradian H, Badakhsh S, Rahimi M, Hekmatfar S. Replantation of an avulsed maxillary incisor after 12 hours: three-year follow-up. Iran Endod J. 2013;8(1):33-6.
21. Heydari A, Tahmasbi S, Badiee M, Izadi S, Mashhadi Abbas F, Mokhtari S. The Effect of Root Coating with Titanium on Prevention of Root Resorption in Avulsed Teeth: An Animal Study. Iran Endod J. 2016;11(4):309-14.
22. Asgary S. Bio-obturation: A Novel Approach in Root Canal Treatment Using Endodontic Biomaterials. Iran Endod J. 2025;20(1):e15.

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