RMOS

Publié le 24/03/2026

Article original / Original article

Revue Méditerranéenne d'Odonto - Stomatologie

Management of Avulsed Immature Permanent Teeth Complicated by External Inflammatory Root Resorption: A Two-Year Case Report

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Abstract
Dental avulsion of immature permanent teeth represents one of the most severe forms of traumatic dental injury, often complicated by external inflammatory root resorption (EIRR). This case report describes the management of an 11-year-old male patient who sustained avulsion of teeth 21 and 22 and subluxation of tooth 11. Following replantation, a rigid splint was initially placed but later replaced with a flexible splint in accordance with current IADT guidelines. At the three-month follow-up, radiographic examination revealed severe EIRR affecting teeth 21 and 22. Immediate endodontic intervention was initiated with repeated calcium hydroxide dressings over three months, followed by definitive obturation with mineral trioxide aggregate (MTA). Clinical and radiographic evaluations over a two-year period demonstrated cessation of resorption, absence of symptoms, and continued root development of tooth 11. This case highlights the importance of early detection, timely endodontic therapy, and the use of biocompatible materials in the long-term preservation of immature replanted teeth.

Keywords: Tooth avulsion; Immature permanent teeth; Flexible splint; External inflammatory root resorption (EIRR), Endodontic therapy

Introduction

Dental trauma is a significant public health concern, often resulting in functional, esthetic, and psychological consequences for affected children and adolescents(1).Immature permanent teeth, commonly traumatized in school-age children ,present specific biological and endodontic challenges(2). Dental avulsion, defined as the complete displacement of a tooth from its socket with rupture of the periodontal ligament and neurovascular bundle, represents one of the most serious forms of dental trauma. It accounts for approximately 0.5–16% of dental injuries, most frequently involving the maxillary incisors in children between 7 and 12 years of age.(3, 4)

Whenever feasible, tooth replantation is considered the treatment of choice, even in cases of delayed management. Replantation not only preserves alveolar bone integrity but also maintains esthetics during craniofacial growth, which is particularly important in the pediatric population .(5, 6)

Trauma to permanent teeth often results in injury to both the pulp and periodontal ligament, predisposing the affected tooth to pathological root resorption and jeopardizing its long-term prognosis. Root resorption is a well-recognized sequela of severe traumatic dental injuries, with the highest incidence following intrusive luxation and avulsion. Among the different types, external inflammatory root resorption is the most frequently reported.(7, 8) This condition arises from microbial infection of the root canal or contamination of the root surface and requires timely intracanal antimicrobial therapy to halt progressive destruction of root structure.(9)

In this case report, we present the management of replanted immature permanent teeth complicated by external inflammatory root resorption, highlighting the clinical challenges and therapeutic strategies involved.

Case Presentation

An 11-year-old male patient presented to the Department of Pediatric Dentistry with a covering material placed over all of his teeth (Fig. 1). a medical and general history was obtained, which revealed that the patient was in good overall health. He was referred by his private dentist, accompanied by a letter indicating that the patient had sustained dental trauma. According to the referral, the patient had experienced subluxation of tooth 11 and complete extrusion of teeth 21 and 22 (Fig. 1). Following the traumatic incident, teeth 21 and 22 were replanted, and a rigid splint was placed using auto-curing resin.

Figure 1(a) Rigid dental splint made with curing resin (b) Referral letter from the patient's dentist

Upon presentation, a radiograph was obtained to provide a comprehensive assessment. (fig2)The rigid splint was subsequently removed because it compromised oral hygiene and contributed to additional periodontal damage. In accordance with current recommendations for traumatic dental injuries, a flexible wire splint was placed instead (Fig. 2). Clinical and radiographic examinations revealed that the affected teeth exhibited immature root development.

Figure 2. (a) Initial radiograph showing immature roots of teeth 12, 11, 21, and 22 ; (b) Placement of a flexible splint using stainless steel wire ; (c) Post-splint radiograph

The patient was monitored closely, with an initial follow-up at two weeks, during which the flexible splint was removed (Fig. 3). A panoramic imaging was systematically undertaken to provide a broader view of the dentition and surrounding structures, ensuring no additional pathology was present. At each visit, a comprehensive clinical examination was carried out, including assessment of pain, tenderness to percussion or palpation, mobility of the teeth, occlusion, and any signs of swelling or fistula. Pulp vitality testing was performed using thermal pulp tests, with responses remaining positive. A radiographic evaluation was conducted to monitor periapical healing, periodontal ligament space, root development, and to detect any early signs of resorption or ankylosis. Monthly follow-ups were scheduled. (Fig. 3)

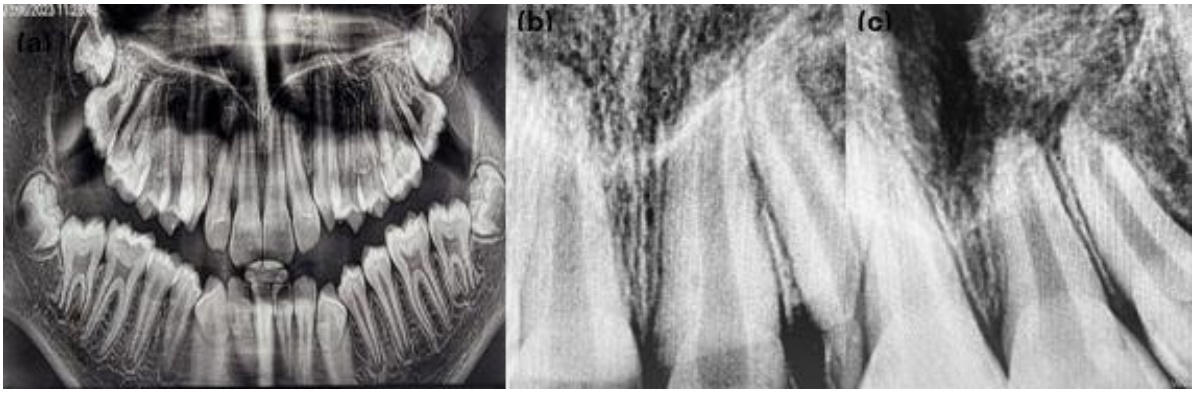

Figure 3. (a) Panoramic radiograph taken two weeks after ; (b, c) Follow-up radiographs at one and two months showing no pathological signs

At the three-month control, radiographic examination revealed severe external inflammatory root resorption affecting teeth 21 and 22. Given the rapid progression and severity of the resorption, immediate endodontic treatment was initiated. The root canals were thoroughly disinfected and medicated with calcium hydroxide ($Ca(OH)_2$). The intracanal dressing was renewed regularly over a three-month period to control the resorption process and eliminate intracanal infection. (Fig4)

Once radiographic stability was achieved, definitive root canal obturation was performed using mineral trioxide aggregate (MTA) in both teeth. (Fig4)

The patient was subsequently placed on a strict long-term follow-up protocol. Clinical and radiographic evaluations were carried out regularly over a two-year period. During this time, no signs of active external resorption were observed. The patient remained asymptomatic, with no clinical evidence of inflammation or infection. At the last follow-up, conducted at the two-year mark, the tooth demonstrated complete absence of pain, mobility, or gingival inflammation. Radiographic assessment confirmed that the resorption process had ceased with no recurrence, and, encouragingly, tooth 11 continued its root development, indicating a favorable long-term prognosis. (Fig4)

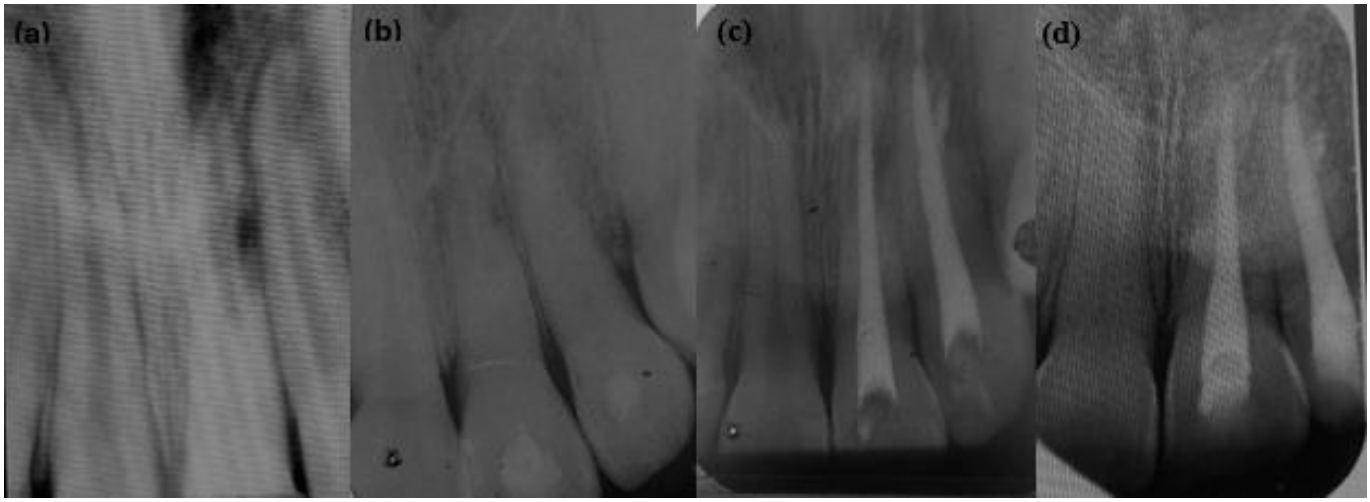

Figure 4. (a) External inflammatory root resorption (EIRR) in teeth 21 and 22 observed at the third follow-up ; (b) Medication with calcium hydroxide ; (c) Final obturation using mineral trioxide aggregate (MTA) ; (d) Two-year follow-up showing maintained a favorable outcome with continued root development of tooth 11.

Discussion :

The management of avulsed immature permanent teeth is replantation. IADT guidelines emphasize minimizing extra-oral dry time, storage in physiologic media, gentle handling of the root, flexible splinting, and close follow-up.(10) Short-term, passive, and flexible splints are preferred, as they allow slight mobility and functional loading. This can be achieved using stainless steel wire up to 0.016 inches (0.4 mm) or nylon fishing line 0.13–0.25 mm, bonded with composite resin. (11)These splints permit good oral hygiene and patient comfort.(12) In our case, the initial resin-based splint was replaced with a flexible splint consistent with current recommendations. Evidence shows that flexible splints yield higher rates of functional

healing, whereas rigid splints result in ankylosis or infection-related resorption in nearly 90% of cases.(2)
Close follow-up was performed at 2 weeks, then at 1, 2, 3, and 6 months, at 1 year, and annually thereafter, in line with IADT recommendations for teeth with open apices. Clinical and radiographic evaluations were scheduled at shorter intervals due to the high risk of inflammatory resorption and rapid loss of alveolar bone if complications are missed.(10)
Avulsion injuries significantly compromise long-term survival compared with other luxation injuries, (13)and immature roots are particularly vulnerable to resorption and post-traumatic complications.(3) In our case, inflammatory resorption was detected three months after trauma, prompting early endodontic intervention.
For high-risk injuries such as avulsion with prolonged dry time, early root canal treatment with intracanal medicaments is essential to prevent external inflammatory root resorption (EIRR).(14) Calcium hydroxide remains the standard multi-visit medicament, inhibiting resorption and promoting hard tissue repair.(15) Although mineral trioxide aggregate (MTA) has been proposed for single-visit obturation, evidence remains limited compared with calcium hydroxide.(9) In this patient, repeated calcium hydroxide dressings were followed by obturation of teeth 21 and 22 with MTA. Calcium silicate–based materials, including MTA and bioceramics, have demonstrated effectiveness in stabilizing immature teeth affected by resorption.(16, 17)
Supporting this approach, a reported case of an immature replanted incisor treated with MTA showed no progression of resorption over four years and remained asymptomatic at a 10-year follow-up.(17) Similarly, in our case, the treated teeth remained asymptomatic, with no radiographic evidence of advanced resorption after two years. While bioceramic root fillings remain the mainstay of management, regenerative endodontic therapy (RET) has recently been reported to resolve resorption while supporting continued root maturation and revascularization.(18) However, current evidence is limited to case reports and series, and RET should be considered a promising but experimental option requiring careful case selection and long-term monitoring.(19)

Conclusion

This case illustrates that avulsed immature permanent teeth can be preserved when evidence-based protocols are followed. Immediate replantation, flexible splinting, and close monitoring allowed early detection of external inflammatory resorption. Timely endodontic therapy with calcium hydroxide, followed by MTA obturation, successfully halted the resorptive process. After two years, the teeth remained asymptomatic, with no recurrence and continued root development. Long-term preservation is achievable with early intervention, appropriate materials, and vigilant follow-up. Ongoing advances in therapeutic techniques highlight that resorption remains a critical clinical challenge, and the scientific community is in continuous pursuit of strategies to optimize treatment outcomes.

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