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Case Report

Management of avulsion-induced external root resorption of permanent maxillary left central and lateral incisors - a one-year follow-up case report

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ABSTRACT

The presented case elicits the successful management of external root resorption in an avulsed permanent central and lateral incisor due to failure to initiate root canal treatment (RCT) at the right time and prolonged splinting. A 13-year-old female child reported a complaint of pain in her upper anterior teeth region. The child gave a history of avulsed 21 and 22, which was replanted. External inflammatory root resorption in (21 and 22) and peri apical abscess (11) was noted in the radiograph. External inflammatory root resorption was treated endodontically with corticosteroid-antibiotic medicaments and obturated with mineral trioxide aggregate (MTA). Obturation was done only after restoring tooth stability and symptom resolution. Replacement resorption was noted radiographically during the follow-up visit. This case underscores the importance of meticulous endodontic care and adherence to treatment timelines, providing valuable insights for clinicians managing similar challenging cases.

Keywords: Tooth avulsion, incisor, root resorption, mineral trioxide aggregate, intracanal medicament

INTRODUCTION

Dental avulsion is defined as the total displacement of the tooth from its alveolar socket. This phenomenon is observed in 0.5% to 16% of all dental traumas, with the permanent maxillary central incisor being the predominantly affected tooth in instances of dental avulsion.[1] The ideal course of action for maximizing a tooth's survival after avulsion is prompt replantation during the first 20–30 minutes of the damage. However, this may not be possible in all situations where prompt management immediately may be compromised. In these situations, the pulp and periodontal ligament (PDL) complexes' ability to recover is significantly influenced by the storage media utilized, the length of time the tooth is left outside the socket (the extra-alveolar period), and how it is treated during this time. Ultimately, these aspects play a pivotal role in determining the prognosis of the treatment.[2] Immediate replantation leads to various pulpodentinal responses. These responses include the formation of various reparative dentines, such as regular tubular and irregular dentin. Osteodentin, irregular immature bone, or lamellate bone is also included in this spectrum. In some instances, there might be indications of internal resorption, and pulp necrosis may occur in more severe cases.[3] Similarly, PDL healing can take a variety of paths, including healing with normal PDL, replacement resorption, external inflammatory resorption, or surface resorption.[4] The guidelines for prompt treatment and

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management of avulsed permanent teeth have been given by The International Association of Dental Traumatology (IADT). Generally, splinting is done for two weeks if no associated alveolar bone fracture is seen. If so, the period of splinting may be prolonged to 4-6 weeks. Endodontic management of the avulsed tooth, if planned intra-orally after replantation, should be initiated within two weeks of replantation.[5] The postponement of the commencement of Root Canal Treatment (RCT) can impact the vitality of the remaining PDL, as the necrotic pulp has the potential to release toxins through different pathways, including lateral canals and the apical foramen.[6]

The primary aim of this article was to document and visually depict the successful management of avulsed permanent teeth after one year of replantation with external root resorption due to prolonged splinting and failure to initiate RCT. Furthermore, the case report explains the successful management of severe external inflammatory root resorption and follow-up, drawing upon a meticulous review of pertinent literature in the field.

CASE REPORT

Patient information

A 13-year-old female patient reported to the Department of Pediatric and Preventive Dentistry with the chief complaint of pain in the upper anterior teeth region. The patient gave a dental history of avulsed maxillary left permanent central (21) and lateral incisor (22) two years back and luxation of the maxillary right permanent central incisor (11) due to a road traffic accident. Both the teeth (21,22) were carried in the dry environment within 1 hour, and the patient had undergone replantation treatment previously elsewhere for avulsed 21 and 22 two years back, followed by splinting at the time of replantation itself. There were no dental records of previous pre-treatment status and management of root surface before replantation. The patient was currently symptomatic with pain and no history of swelling previously. No relevant medical or family history was present.

Clinical and radiographic findings

On further intraoral clinical examination, it was noted that splinting was present for the past two years in the maxillary anterior teeth region from maxillary right permanent canine (13) to maxillary left permanent canine (23) in the buccal surfaces (Figure 1A). The patient had tenderness on percussion in relation to 11, 21 and 22. Mild dis-coloration was present in 21 and 22. Periodontal probing depths were normal. Radiovisiography (RVG) revealed a radiolucent area involving the root surface and surrounding bone in relation to 21 and 22. Periapical radiolucency with widening of PDL space was present in relation to 11 (Figure 2A). Thus, external inflammatory root resorption was present in relation to 21 and 22, and periapical abscess in relation to 11 was noted.

Diagnostic assessment

Following clinical and radiographic examination, the pre-existing splint was removed to assess the vitality and mobility if present. Electrical and thermal pulp testing gave no response. 21 and 22 exhibited grade 2 and grade 1 mobility, respectively.

Timeline

Treatment was planned for a period of 6 to 12 weeks, from the start of access cavity preparation to obturation.

Case management

Therapeutic intervention

Endodontic management of 11,21 and 22 was planned. Before the commencement of the treatment, the prognosis of

Figure 1. Clinical images: **A.** Pre-existing splint extending from 13 to 23 done two years back elsewhere without initiation of root canal treatment and failure to remove the splint at the appropriate time. **B.** Pre-existing splint was removed, and a flexible splint was placed from 13 to 23 for stabilization. **C.** Clinical image at the end of 12 months with no mobility or discoloration.

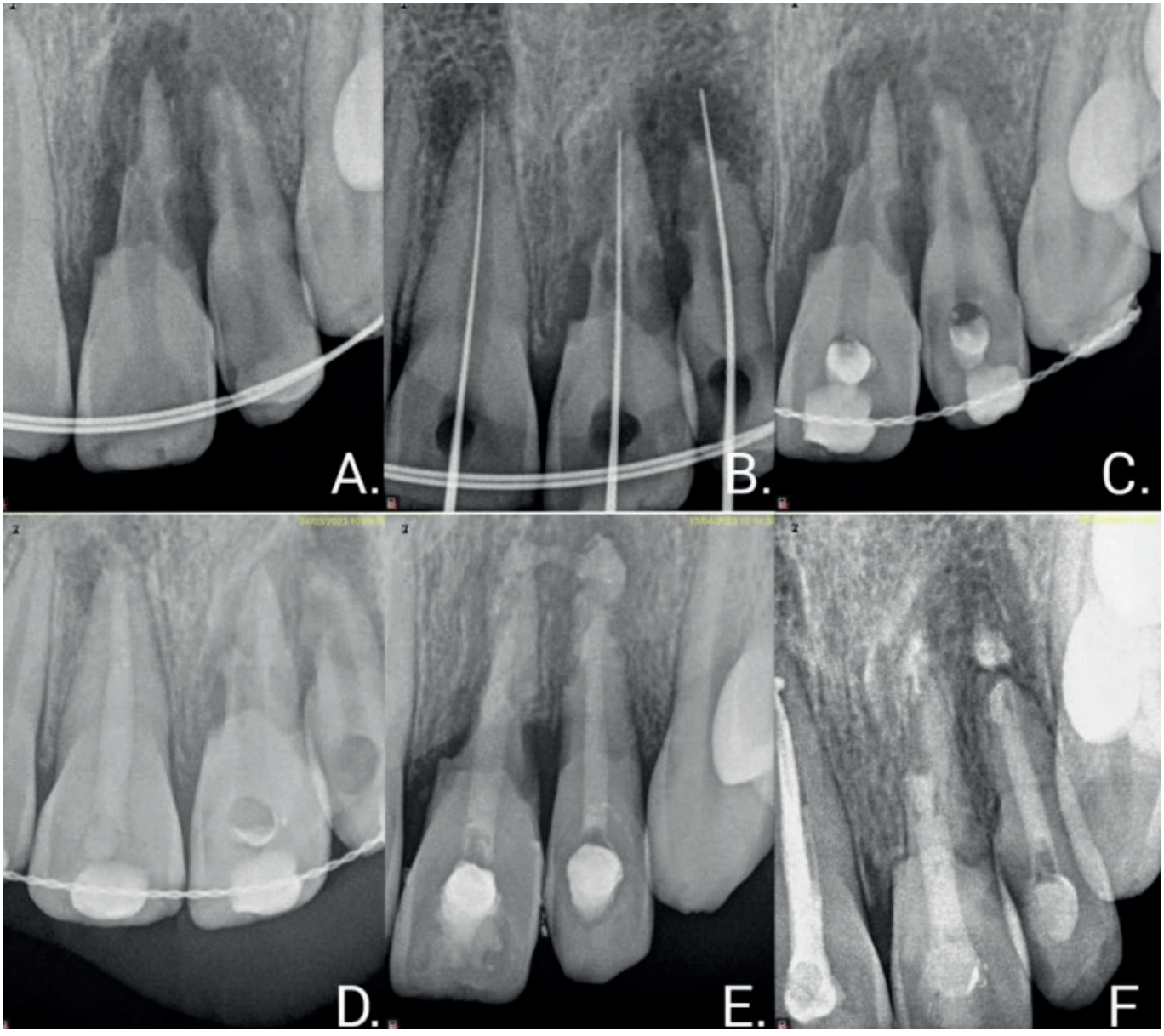

Figure 2. Radiographic image: **A.** Pre-operative radiograph **B.** Working length determination **C.** Intracanal medicament placement with CaOH placement in relation to 11 and a combination of Triamcinolone acetonide, doxycycline, and metronidazole placed in relation to 21 and 22 **D.** Splinting at the end of 14th day. **E.** After obturation. **F.** 12 months follow up.

endodontic management of 21 and 22 was explained to the patient and the parent due to severe external inflammatory root resorption, and written consent was obtained. Access cavity preparations were done in 11, 21, and 22. All three teeth were found to be non-vital with no purulent exudate from the canals. Canals were completely derided and irrigated using saline. Working length was determined for all three canals using 25mm 20, 40, and 35 size K file (MANI ® Kfiles Tochigi, Japan) (Figure 2B), and complete Biomechanical preparation was done in 11 using ProTaper NiTi rotary instruments (Dentsply Maillefer, Ballaigues, Switzerland). However, the conventional step-back technique was used with minimal preparation in 21 and 22 to preserve the remaining tooth structure. 1.25% sodium hypochlorite (Vensons India, Bangalore, India) was used for irrigation between instrumentation and finally rinsed with saline. The canals were dried using paper points, and Calcium hydroxide (Rc Cal, Prime Dental Pvt Ltd., Maharashtra, India) intracanal medicament was placed in 11 and temporized with Intermediate Restorative Material (IRM) (Dentsply Sinora, Charlotte, North Carolina, USA). A combination of triamcinolone acetate (Kenacort 0.1% buccal

paste, Abbott Healthcare Pvt. Ltd, Mumbai, India) doxycycline 100 mg (DOxy-T, Frankel Health care Pvt Ltd., Mumbai, India) and metronidazole 400 mg (Aristogyl, Aristo Pharmaceuticals Pvt Ltd., Mumbai, India) paste was prepared and was used as an intracranial medicament in 21 and 22 followed by temporization with IRM (Figure 2C). A flexible splint was placed from 13 to 23 for stabilization (Figure 1B). The patient was recalled after 14 days and was assessed clinically and radiographically (Figure 2D). The patient was completely asymptomatic, and the splint was removed. Mobility was reduced to grade 1 in 21 and 22. Radiographically, no changes were observed. Thus, the intracranial medicament was left undisturbed for six weeks. At the end of the sixth week, the intracanal medicaments in 21 and 22 were changed to CaOH. At eight weeks, the canals were re-entered and completely derided of their content. Canals were irrigated using 1.25% sodium hypochlorite followed by saline. Canals were dried, and 11 were obturated with 30 sizes 6% Gutta Percha (Dentsply Maillefer, Ballaigues, Switzerland) and AH plus sealer (Dentsply DeTrey, Konstanz, Germany). In 21 and 22, canals were dried using paper points, and mineral trioxide aggregate (MTA) (Angelus Dental, Londrina, Brazil) was placed at the apex till the predetermined apical stop (Figure 2E). The remaining part of the canals, both in 21 and 22 were obturated using MTA. After confirming the absence of voids in the obturation of 11, 21, and 22 using multiple-angle RVG, the access cavity was filled with type II Glass Ionomer Cement (GIC).

Follow-up and outcome

At the end of the 12th week, GIC was changed to composite restoration, and 21 and 22 were firm and free of mobility. Both post-operatively and intra-operatively, the patient was informed about the poor prognosis of the teeth. The child was asked to avoid biting hard food onto the front tooth region and was instructed to take the food to the back and chew. Maintain a good oral hygiene by gently brushing and flossing. The patient was asked to avoid habits like nail-biting, chewing on pens, or using teeth to open packages. Properly Scheduled follow-up appointments to monitor the healing process and assess the stability of the tooth. The patient was periodically followed up at the 3rd, 6th, and 12th month. At the end of 12 months (Figures 1C and 2F), the patient was completely asymptomatic, and radiographic evidence of bone deposition was noted around 21 and 22, indicating replacement resorption and complete periapical healing with the formation of hard tissue around 11,21 and 22.

DISCUSSION

Injuries to the periodontal ligament (PDL) can trigger initial resorption cavities on the tooth surface. When coupled with exposed dentinal tubules, necrotic pulp, local toxins, and contamination, this process amplifies inflammatory resorption on the tooth surface, potentially advancing to the root canal and penetrating the dentinal tubules. Without intervention, heightened microbial virulence can lead to complete root resorption within a few months. Observable changes may manifest as early as 6-10 years; however, endodontic intervention at the right time can shift the condition from inflammatory resorption to replacement resorption. Radiographically, inflammatory resorption appears as cavities on the root surface with accompanying bone excavation. The affected tooth will exhibit looseness, extrusion, and sensitivity to percussion, accompanied by a dull note.[7,8] Prolonged splinting of avulsed teeth (>1 year) may lead to root resorption, impaired periodontal health, and compromised tooth stability.

Due to their biological properties, Corticosteroids can effectively suppress the body's inflammatory response. Consequently, they alleviate or eliminate pain associated with inflamed tissue.[9] According to the IADT guidelines, when opting for a corticosteroid or a combination of corticosteroid and antibiotic as an intracanal medicament for its anti-inflammatory and anti-resorptive properties, it is recommended to administer it promptly or shortly after the tooth's replantation. The medicament should be left in place for a minimum of 6 weeks.[5] Triamcinolone exhibits a controlled release pattern as it diffuses through the dentinal tubules and cementum, eventually reaching the surrounding periapical and periodontal tissues. The release profile is characterized by an initial burst, with approximately 30% of the medication being dispensed within the first 24 hours. Subsequently, the remaining seventy percent of the drug is steadily released over a more extended period, spanning 14 weeks. This sustained release mechanism allows for a prolonged therapeutic effect, contributing to Triamcinolone's anti-inflammatory and anti-resorptive actions in the targeted dental and periodontal regions.[10] Corticosteroids, along with antibiotics, have been known to have anti-inflammatory properties and reduce microbial load.

Boukpessi et al.[11] successfully treated traumatized immature permanent teeth by applying an MTA plug. Additionally, Al-Kahtani[12] demonstrated successful management of avulsed immature permanent teeth through reimplantation, followed by obturation with MTA. Kirakozova et al.[13] analyzed the impact of intracanal corticosteroids following delayed replantation. The findings indicated that corticosteroid treatment proved effective in addressing external root resorption. This suggests the potential therapeutic efficacy of corticosteroids in mitigating adverse outcomes associated with delayed replantation of teeth. However, corticosteroids may cause local effects like delayed wound healing and systemic effects, including

immunosuppression. Antibiotics can lead to microbial resistance and adverse drug reactions, such as allergies and gastrointestinal disturbances. In the present case report, failure to initiate endodontic management within two weeks of replantation, along with prolonged splinting for more than one year had led to the development of external inflammatory root resorption due to persistent immobilization and necrotic 21 and 22. Though the tooth was indicated for extraction, an attempt was made to arrest the resorption and endodontically manage the mobile teeth. With the arrest of inflammatory resorption, the surrounding bone can undergo progressive, transient, or internal tunneling replacement resorption depending on the amount of remaining vital PDL.[14] In the present case, progressive replacement resorption was noted in 21, and transient replacement resorption was noted in 22.

CONCLUSION

In summary, this case report illustrates the successful management of avulsed permanent teeth with external root resorption, emphasizing the crucial role of timely endodontic intervention. Despite a history of dental trauma, prolonged splinting, and delayed treatment initiation, a comprehensive approach involving corticosteroid-antibiotic medicaments and MTA obturation led to restored tooth stability, symptom resolution, and favorable radiographic outcomes after 12 months. This highlights the potential for successful outcomes in challenging cases through meticulous endodontic care and adherence to treatment timelines.

The approach employed here serves as a valuable reference for clinicians facing similar cases, emphasizing the potential for favorable results.

Ethical approval

The case was managed according to the guidelines of International Association of Dental Traumatology. Ethical clearence is not required as it is not a prospective research paper. Written and informed consent was obtained from the participant and parent.

Author contribution

Surgical and Medical Practices: PB, DS, SE; Concept: PB, DS, SE; Design: PB, DS, SE; Data Collection or Processing: PB, DS, SE; Analysis or Interpretation: PB, DS, SE; Literature Search: PB, DS, SE; Writing: PB, DS, SE. All authors reviewed the results and approved the final version of the article.

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Conflict of interest

The authors declare that there is no conflict of interest.

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