MANAGEMENT AND 4 YEARS FOLLOW-UP OF AN AVULSED MAXILLARY CENTRAL INCISOR FOLLOWING A TRAFFIC ACCIDENT: A CASE REPORT

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Abstract

Dental avulsion is one of the most severe traumatic dental injuries and is defined as the complete displacement of a tooth from its alveolar socket. This condition most frequently affects the maxillary central incisors, particularly in children and young adults, due to their anterior position and increased exposure during high-impact trauma. Traffic accidents are among the leading causes and can result in complex dental and periodontal damage. Successful outcomes depend on rapid and appropriate emergency management. Critical factors include the extra-alveolar period, storage medium, replantation technique, splinting method, and the timing of endodontic treatment. Even with correct protocols, complications such as external root resorption, ankylosis, or tooth loss may occur.

This case report describes the clinical management and 4-year follow-up of a 16-year-old male who experienced avulsion of tooth #21 and luxation injury of tooth #11 following a traffic accident. The avulsed tooth was replanted within approximately one hour at a general hospital and initially splinted with stainless steel wire. Upon referral to Ankara University, inadequate splinting was corrected using a semi-rigid fiber splint to minimize additional trauma and provide physiological mobility. Root canal treatment of both teeth was initiated on day 5, and calcium hydroxide was used as an intracanal medicament before final obturation with gutta-percha and AH Plus sealer. At 3 months, tooth #21 demonstrated class I mobility and apical resorption but remained asymptomatic. Four-year follow-up revealed an increase in resorption areas but maintained function and no signs of infection. This case highlights the importance of early replantation, proper splinting, and timely endodontic treatment in achieving favorable long-term outcomes after avulsion. Continuous clinical and radiographic follow-up remains essential to detect and manage potential resorptive changes over time.

Keywords: dental avulsion, replantation, endodontic treatment, trauma management.

1. Introduction

Dental avulsion is defined as the complete displacement of a tooth from its alveolar socket as a result of trauma, and it is considered one of the most complex and urgent injuries in dental traumatology. It accounts for approximately 0.5–3% of all traumatic dental injuries, with a higher incidence in children and adolescents, particularly those aged 7–14 years, due to increased physical activity and the resilience of developing alveolar bone (Glendor, 2009; Andreasen and Andreasen, 2007). An avulsed permanent tooth poses an immediate risk to long-

term function, aesthetics, and oral health, making rapid and appropriate emergency management essential for a favorable prognosis.

Clinical management should begin with thorough extraoral and intraoral examination supported by radiographic assessment to determine tooth condition, alveolar socket integrity, and possible associated fractures (Flores et al., 2007). The most critical factor influencing survival of a replanted tooth is preservation of periodontal ligament (PDL) cell viability. PDL cells are highly sensitive to desiccation; viability decreases significantly after 15–30 minutes of dry storage and is largely lost after 60–120 minutes (Andreasen et al., 1981; Sigalas et al., 2004). When possible, immediate replantation provides the best chance of maintaining function and limiting complications such as root resorption and ankylosis (Trope, 2002).

If immediate replantation is not feasible, the tooth should be stored in a physiological medium such as Hank's Balanced Salt Solution, saline, milk, or saliva to prolong PDL survival and reduce resorption risk (Blomlöf et al., 1981; Krasner and Person, 1992). For teeth with closed apices, the likelihood of spontaneous pulpal revascularization is minimal; therefore, endodontic treatment is usually initiated within 7–10 days to prevent pulp necrosis and inflammatory root resorption. Calcium hydroxide is widely used as an intracanal medicament due to its antimicrobial and anti-resorptive effects (Tronstad, 1988; Trope, 2011).

This case report presents the clinical management and long-term follow-up of a traumatically avulsed maxillary central incisor in a young patient. Emphasis is placed on the timing of replantation, splinting strategy, endodontic procedures, and biological response during follow-up to highlight key factors influencing prognosis and tooth retention.

2. Case Presentation

A 16-year-old male patient was referred to Ankara University, Department of Endodontics the day after a traffic accident. He had suffered complete avulsion of tooth #21 and luxation of tooth #11. According to the medical history, tooth #21 had been replanted by a dentist within approximately 1 hour at a general hospital, and semi-rigid splinting was applied (Figure 1, Figure 2). The patient was also prescribed amoxicillin.

Clinical examination revealed hematoma and edema of the oral mucosa and lips. Teeth #11 and #21 were very sensitive to percussion and the patient reported severe pain (Figure 3, Figure 4). Initial splinting was found to be insufficient, with persistent mobility in tooth #21.

To avoid additional trauma, the existing splint was not removed but reinforced using a semi-rigid fiber trauma splint (Angelus, Brasil) from canine to canine (Figure 5). Premature occlusal contacts were adjusted. Hydrogen peroxide was applied topically to soft-tissue wounds, and the patient was advised to maintain a soft diet and use chlorhexidine mouthwash.

Root canal treatments were initiated for both teeth on day 5 post-trauma. After access cavity preparation, canals were chemomechanically prepared using 2 mL of 5.25% NaOCl (Probita, Guangzhou, China) after each file change, followed by saline irrigation. The canals were dried with paper points, and calcium hydroxide was placed as an intracanal medicament (Ivoclar Vivadent AG, Schaan, Liechtenstein).

One week later, the teeth were asymptomatic, and it was decided to complete root canal treatment. After removal of calcium hydroxide with H-files (VDW Dental, München, Germany) and NaOCl solution, final irrigation was performed with 17% EDTA (Meta Biomed,

Cheongju-si, Korea), NaOCl, and saline. The canals were dried with paper points and obturated using AH Plus sealer (Dentsply, Germany) and gutta-percha with lateral condensation. After obturation, the splint was removed, and the anterior teeth were temporarily restored with composite resin (KERR, Orange). Post-operative periapical radiographs and clinical photographs were taken (Figure 6, Figure 7).

At the 3-month follow-up, tooth #21 showed class I mobility and signs of apical resorption, but no pain, percussion sensitivity, or sinus tract (Figure 8).

At the 3-year follow-up, both teeth exhibited no sinus tract, mobility, or percussion sensitivity, but tooth #11 showed apical external resorption (Figure 9).

At the 4-year follow-up, both teeth demonstrated normal clinical findings, with no evidence of sinus tract formation, pathological mobility, or percussion sensitivity. However, tooth #11 exhibited progressive apical external resorption (Figure 10). A cone-beam computed tomography (CBCT) scan was recommended for detailed evaluation, but the patient declined due to radiation concerns and financial limitations. The case continues to be monitored with periodic clinical and radiographic examinations.

Discussion

This case highlights the importance of timely and evidence-based management following traumatic dental avulsion. According to the International Association of Dental Traumatology (IADT), replantation within 15–20 minutes yields the highest probability of periodontal ligament (PDL) survival and favorable long-term prognosis (Flores et al., 2007). Although replantation in the present case occurred after approximately 60 minutes of extra-alveolar time, the use of systemic antibiotics, calcium hydroxide as an intracanal medicament, and semi-rigid splinting contributed to satisfactory healing outcomes, consistent with previous findings (Trope, 2002; Tronstad, 1988).

Calcium hydroxide was selected due to its strong antimicrobial activity and its ability to inhibit osteoclastic resorption, thereby preventing or limiting external inflammatory root resorption (Tronstad, 1988). Semi-rigid splinting also plays a critical role in periodontal healing, as physiologic mobility reduces the risk of ankylosis. Current IADT guidelines recommend splinting for 1–2 weeks in avulsion cases without alveolar fracture, and 4–8 weeks when a fracture is present (Flores et al., 2007).

External root resorption (ERR) remains one of the most clinically significant complications of avulsion and replantation. ERR reflects the degree of PDL necrosis and the biologic status of the root surface. Three main patterns have been described: surface resorption, external inflammatory resorption, and replacement (ankylotic) resorption (Andreasen & Andreasen, 2018). Surface resorption is transient and self-limiting, whereas external inflammatory resorption develops when infected necrotic pulp provides inflammatory mediators that sustain clastic activity on an unprotected root surface (Trope, 2011). Radiographically, this presents as irregular radiolucencies along the root and adjacent bone. In contrast, replacement resorption results from extensive PDL loss and direct ankylosis between root and bone. Progressive replacement of dental tissues with bone produces a metallic percussion sound, root outline disruption, and infraocclusion in younger patients (Fouad et al., 2020; Andreasen & Andreasen, 2018).

Major risk factors for ERR include prolonged dry storage, lack of physiologic storage medium, PDL crush injury, and delayed endodontic disinfection, particularly in teeth with closed apices (Trope, 2011; Fouad et al., 2020). Management depends on the resorption subtype: external inflammatory resorption requires immediate intracanal disinfection—often with calcium hydroxide followed by obturation or bioceramic sealing—while replacement resorption lacks predictable treatment. In growing patients, decoronation may preserve alveolar architecture for future implant-supported restoration (Malmgren et al., 2000). Long-term clinical and radiographic monitoring, and CBCT imaging when indicated, are essential for detecting progression and timing intervention (Patel et al., 2009).

This case also emphasizes the value of patient and parental education. Immediate replantation or storage of the avulsed tooth in physiologic media such as milk or saline significantly increases survival potential (Sigalas et al., 2004; Krasner & Person, 1992). Public awareness of proper emergency protocols remains a key determinant of clinical outcome.

Conclusion

Early and appropriate intervention following dental avulsion is critical for long-term prognosis. In this case, replantation within approximately one hour, combined with semi-rigid splinting and timely endodontic therapy, resulted in functional and aesthetic preservation. However, clinicians should remain vigilant, as external root resorption may still occur despite optimal management. Long-term clinical and radiographic follow-up is mandatory to identify resorptive changes early and implement appropriate treatment when necessary.

Declaration of Author Contributions

All authors contributed equally to study design, clinical management, writing, and approval of the final manuscript.

Declaration of Conflicts of Interest

The authors declare no conflict of interest related to this article.

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Ethical Committee Approval

Written informed consent was obtained from the patient’s legal guardian for publication of this case report and accompanying images.

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Refrences

Andreasen, J.O., Andreasen, F.M., 2007. Textbook and color atlas of traumatic injuries to the teeth (4th ed.). Wiley-Blackwell, Oxford.

Andreasen, J.O., Andreasen, F.M., 2018. Textbook and color atlas of traumatic injuries to the teeth (5th ed.). Wiley-1Blackwell, Oxford.

Andreasen, J.O., Borum, M.K., Jacobsen, H.L., Andreasen, F.M., 1995. Replantation of 400 avulsed permanent incisors: 4. factors related to periodontal ligament healing. Endodontics & Dental Traumatology, 11(2): 76–89.

Andreasen, J.O., Kristerson, L., Andreasen, F.M., 1981. The effect of limited drying or removal of the periodontal ligament and its influence upon periodontal healing after replantation of permanent incisors in monkeys. Endodontics & Dental Traumatology, 9(1): 43–47.

Blomlöf, L., Otteskog, P., Hammarström, L., 1981. Effect of storage in media with different ion strengths and osmolalities on human periodontal ligament cells. Scandinavian Journal of Dental Research, 89(2): 180–187.

Flores, M.T., Andersson, L., Andreasen, J.O., et al., 2007. Guidelines for the management of traumatic dental injuries. I. fractures and luxations of permanent teeth. Dental Traumatology, 23(2): 66–71.

Fouad, A.F., Abbott, P.V., Tsilingaridis, G., Cohenca, N., Lauridsen, E., Bourguignon, C., O'Connell, A., Flores, M.T., Day, P.F., Andreasen, J.O., 2020. International association of dental traumatology (IADT): guidelines for the management of traumatic dental injuries — avulsion of permanent teeth. Dental Traumatology, 36(4): 331–342.

Glendor, U., 2009. Aetiology and risk factors related to traumatic dental injuries – a review of the literature. Dental Traumatology, 25(1): 19–31.

Krasner, P., Person, P., 1992. Preserving avulsed teeth for replantation. Journal of the American Dental Association, 123(5): 80–88.

Malmgren, B., 2000. Decoronation: how, why, and when? Journal of the California Dental Association, 28(11): 846–854.

Malmgren, B., Malmgren, O., Frykholm, A., 2000. Decoronation of ankylosed teeth to preserve the alveolar process prior to implant placement. Pediatric Dentistry, 22(2): 93–98.

Patel, S., Dawood, A., 2009. The use of cone beam computed tomography in the management of external cervical resorption lesions. International Endodontic Journal, 42(9): 831–838.

Sigalas, E., Regan, J.D., Kramer, P.R., Witherspoon, D.E., Opperman, L.A., 2004. Survival of human periodontal ligament cells in media proposed for transport of avulsed teeth. Journal of Endodontics, 30(3): 206–209.

Trope, M., 2002. Clinical management of the avulsed tooth: present strategies and future directions. Dental Traumatology, 18(1): 1–11.

Trope, M., 2011. Avulsion of permanent teeth: theory to practice. Dental Traumatology, 27(4): 281–294.

Tronstad, L., 1988. Root resorption: etiology, terminology and clinical manifestations. Endodontics & Dental Traumatology, 4(6): 241–252.

Figures

Figure 1. Initial panoramic radiograph of the patient.

Figure 2. Periapical radiograph of teeth #11 and #21 at initial examination.

Figure 3. Initial intraoral photograph showing hematoma on the lips and oral mucosa.

Figure 4. Extraoral clinical photograph showing soft-tissue injuries following trauma.

Figure 5. Extraoral photograph after reinforcement of splint with semi-rigid fiber splint.

Figure 6. Post-operative periapical radiograph after completion of root canal treatments of teeth #11 and #21.

Figure 7. Extraoral photograph of the patient after splint removal and temporary restoration.

Figure 8. Periapical radiograph at 3-month follow-up showing apical resorption on tooth #21.

Figure 9. Periapical radiograph at 3-year follow-up showing external resorption in tooth #11.,

Figure 10. Periapical radiograph at 4-year follow-up showing progression of apical external resorption on tooth #11.