

Clinical Management of an Avulsed Maxillary Central Incisor: A Case Report

Parthasarathi Mondal¹, Dipanjan Das², Kaushik Mistry¹, Kurchi Mandal¹, Snigdho Das^{3*}, Kallol Kumar Saha¹

¹Department of Conservative Dentistry and Endodontics, Dr. R. Ahmed Dental College and Hospital, Kolkata, West Bengal, India.

²Department of Conservative Dentistry and Endodontics, Haldia Institute of Dental Sciences and Research, Haldia, West Bengal, India.

³Department of Dentistry, Ramakrishna Sarada Mission Matri Bhavan Hospital, Kolkata, West Bengal, India.

Abstract

Avulsion of permanent teeth is one of the most serious dental injuries, and a prompt and correct emergency management is very important for the prognosis. Replantation is the treatment of choice and if the tooth is replanted soon after avulsion, the periodontal ligament has a good chance of healing. The present case report describes the reimplantation of an avulsed permanent maxillary central incisor of a young male patient suffering from a traumatic injury within 60 min after the accident. Evaluation parameters included horizontal and vertical percussion sound and intra-oral periapical radiograph and cone beam computed tomography. At the 3, 6, and 12-month follow-up periods, the clinical and radiographic appearance of the tooth showed resolution of the mobility and no signs of replacement resorption.

Keywords: Avulsion, Periodontal ligament, Replantation, Root resorption, Splinting, Tooth mobility, Traumatic injury.

INTRODUCTION

Tooth avulsion is the complete displacement of a tooth from its socket due to accidental or non-accidental injury.^[1] It rarely occurs, representing only 0.5–3% of all dental injuries.^[2,3] Avulsion of permanent teeth is the most serious of all dental injuries. The most frequently affected teeth are the upper central incisors in children between the ages of 7 and 9 years.^[4]

Replantation of the avulsed tooth is considered the best esthetic and functional solution.^[5] If the tooth is replanted soon after avulsion (immediate replantation), the periodontal ligament (PDL) has a good chance of healing and has been found to have a good prognosis. It is important to preserve the PDL cells and the fibers attached to the root surface by keeping the tooth moist and minimizing the handling of the root.^[6-8]

The decision to replant the avulsed teeth depends on several factors: periodontal damage, intact alveolar socket, extra-alveolar period, and stage of root development.^[9] After replantation of the avulsed tooth, root resorption becomes the greatest danger to the tooth, occurring in 50–76% of cases.^[8,10] It is associated with the length of the extra-alveolar storage period and the storage medium.^[1,11] Several storage media have been investigated for their ability to maintain the viability of the PDL cells and thus to permit longer extra-alveolar periods before replantation. Such media include saliva, milk,

physiological saline, and tissue culture media.^[12-14] However, the best storage medium for avulsed teeth would be the alveolus itself. It is also important to carefully handle the tooth, not touching and/or scraping the PDL.

In most traumatic injuries, supporting tooth structures are also involved apart from the tooth. Splinting is a commonly used technique for repositioning and stabilizing avulsed teeth, improving the healing outcome. Inflammatory and replacement resorption have been identified as a complication of tooth avulsion. Inflammatory resorption may be reversible; progressive replacement resorption is not. Endodontic treatment effectively prevents inflammatory resorption if the necrotic pulp is removed before the initiation of bacterial infection,^[15,16] because the cause of inflammatory resorption is toxic products and bacteria penetrating from the root canal into the periodontal tissues. Therefore, treatment is directed toward minimizing inflammatory resorption and preventing

Address for correspondence: Dr. Snigdho Das,
Department of Dentistry, Ramakrishna Sarada Mission Matri Bhavan
Hospital, Kolkata, West Bengal, India.
Email: snigdho1991@gmail.com

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replacement resorption, so as to improve the prognosis and preserve the PDL.

This case report presents the successful replantation of an avulsed maxillary mature permanent central incisor. No sign of resorption or ankylosis was seen over a follow-up period of 1 year.

CASE REPORT

A 29-year-old male patient reported to the Department of Conservative Dentistry and Endodontics of the Dental College and Hospital after an assault causing avulsion of his maxillary right central incisor within half an hour after trauma. The patient was examined for extraoral signs of injury, including swelling and asymmetry of the face. No other oral injury was clinically detected.

The intraoral examination revealed that the maxillary permanent central incisor (tooth #11) was avulsed with lacerations of gingiva concerning #11 (Figure 1a). The avulsed tooth had been kept in whole milk (Figure 1b) from the moment of trauma until emergency visit within 30 min post-trauma. The crown of the avulsed tooth #11 was intact, and the root had a closed apex. Informed and written consent was taken from the patient. The patient was given a tetanus toxoid injection before initiating any treatment. The root of #11 and the socket were cleaned gently with normal saline and 0.12% chlorhexidine rinse (Hexidine, ICPA Health Product Ltd.). Then, #11 was reimplemented into its socket with the help of finger pressure to its original position under local anesthesia (Lignox 2% A, 1:80000, Indoco Remedies Ltd.). The placement of tooth #11 was confirmed radiographically. Lacerated gingival tissue was sutured with 3-0 black silk suture and the tooth #11 was splinted with a semi-rigid orthodontic wire (0.4 mm stainless steel wire) from tooth #13 to tooth #23 using acid-etch composite resin technique (Figure 1c) for 2 weeks. Systemic

antibiotic therapy was prescribed. A soft diet, good oral hygiene with the use of a soft-bristled toothbrush, and 0.12% chlorhexidine mouth rinse were also prescribed for 2 weeks. The patient was warned about the avoidance of biting his anterior teeth.

On the next visit (7 days post replantation), the sutures were removed and root canal treatment (RCT) was started in #11. The access opening was done under local anesthesia, the working length was determined (Figure 1d), and biomechanical preparation (shaping and cleaning) was completed in #11 using K-files (Mani, Japan) and 3% sodium hypochlorite solution (Prime Dental Products Pvt. Ltd.) as root canal irrigant. The canal was dried with paper points and filled with non-setting calcium hydroxide ($\text{Ca}[\text{OH}]_2$) paste (Ultracal, Ultradent Inc; South Jordan) as an intracanal medicament. The access was sealed with temporary filling material made from zinc oxide eugenol (Cavition; GC Corporation). The patient was advised to maintain good oral hygiene and recalled after 4 weeks whereas the splint was removed after 2 weeks (Figure 1e).

During 1 month follow-up, the tooth #11 was found completely asymptomatic with normal mobility and absence of any gingival inflammation or bleeding on probing (absence of periodontal pocket); this represents a reliable indicator of periodontal stability. Radiographic examinations (IOPAR and cone-beam computed tomography [CBCT]) showed no evidence of external root resorption to #11 (Figure 2a and b [i-iii]). Tooth #11 was obturated with gutta-percha by cold lateral condensation technique using AH Plus sealer (Dentsply, Maillefer) (Figure 2c). The access cavity of #11 was restored with composite resin (Beautifil II, Shofu, Japan). The patient was recalled at 3-month intervals for clinical and radiographic evaluation. Figure 3 depicts the CBCT scans of 3rd, 6th, and 12th-month follow-up at three cross-sections, confirming an absence of either endodontic lesion or inflammatory root resorption or ankylosis.

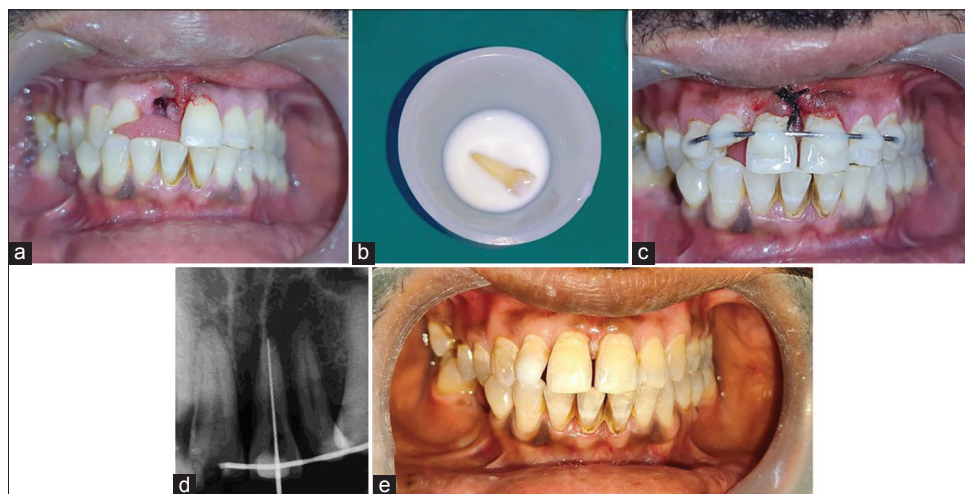


Figure 1: Procedural steps in management of avulsed maxillary permanent central incisor (Tooth #11): (a) Clinical image showing empty socket of avulsed #11, (b) Avulsed tooth stored in milk, (c) Splinting with a semi-rigid orthodontic wire (0.4 mm stainless steel wire) from tooth #13 to tooth #23, (d) Working length determination after ensuing Endodontic treatment after 1 week of splinting, (e) Clinical image showing removed splint after 2 weeks

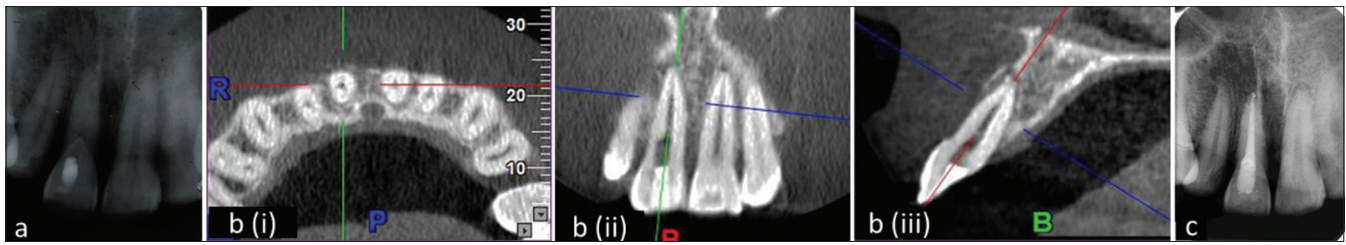


Figure 2: 1-month follow-up: (a) Periapical radiograph showing no evidence of external root resorption, (b) Cone-beam computed tomography scans confirming Periapical radiographic findings as seen in (i) Axial, (ii) Coronal and (iii) Sagittal views, (c) Periapical radiograph showing completion of obturation

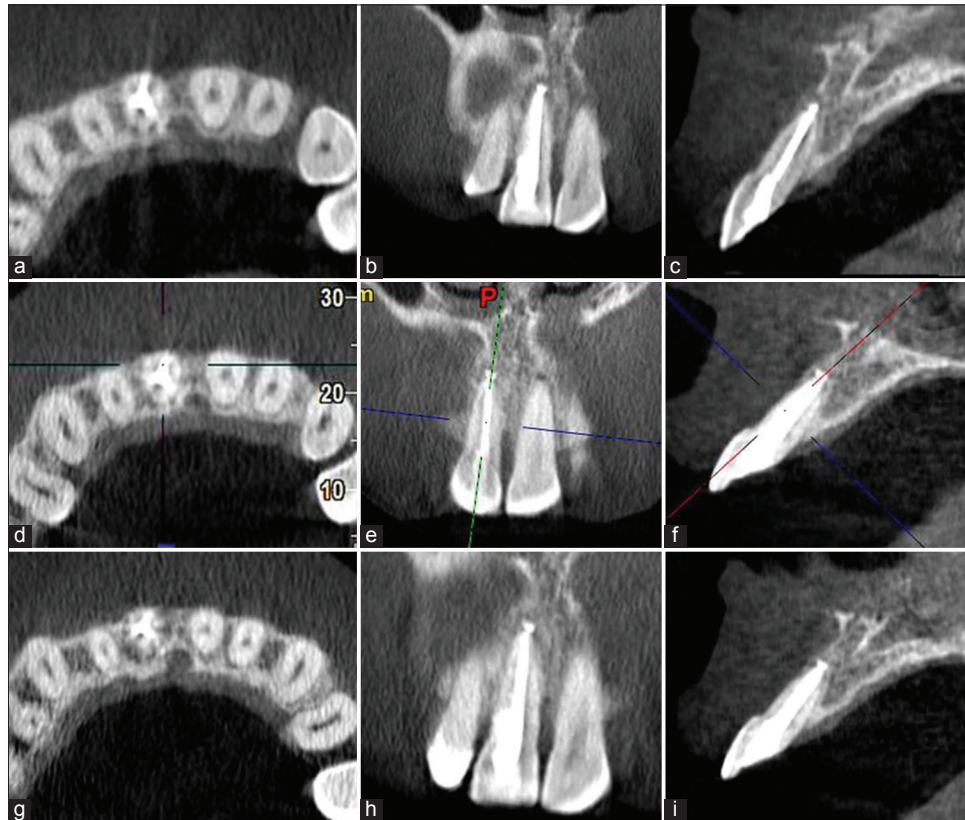


Figure 3: Cone beam computed tomography images illustrating the healing progress of an avulsed tooth following reimplantation at follow-up intervals of 3 months (a-c), 6 months (d-f), and 12 months (g-i). Coronal sections are displayed in (a, d, and g), axial sections in (b, e, and h), and sagittal sections in (c, f, and i), demonstrating progressive periapical healing and changes in root resorption over time

DISCUSSION

The most preferable management for the avulsed tooth is replantation within 20–30 min. after the injury or keeping in an appropriate storage medium until the patient can be seen by a dentist for replantation.^[8,17] The choice of treatment is related to the maturity of the root (open or closed apex) and the condition of the PDL cells. In our present case, the avulsed maxillary permanent central incisor was replanted into its socket and splinted with adjacent teeth within 1 h after injury.

Mature avulsed teeth, when replanted, cannot be expected to re-establish pulpal blood supply.^[18] Revascularization may occur in immature teeth with wide open apices, but it is unpredictable and must be evaluated at regular intervals of 2,

6, and 12 months after replantation.^[19] In the mature replanted tooth, RCT is definitely indicated and ideally should be started 7–10 days after replantation and before the splint is removed. The splint stabilizes the tooth during the procedure.^[19] In the present case, RCT was started 7 days post replantation and Ca(OH)₂ was used as an intra-canal medication for 1 month. The use of Ca(OH)₂ as an antimicrobial intracanal inter-appointment medicament may be helpful,^[20] particularly if the root canal is infected.

The incidence of the external root resorption (Inflammatory/replacement) can be high and varies between 59% and 80% in patients with so-called correct replantation.^[21] Several studies have investigated the effect of dry storage that plays an important role in the viability of the PDL cells and may be

responsible for the occurrence of inflammatory resorption. It has also been shown that PDL cells can survive a drying time of 10–15 min, but the possibility of their survival beyond this time where the drying time exceeds 60 min, maybe very limited; as a result, the risk of early resorption increases.^[22,23]

In our present case, the avulsed tooth #11 was stored in milk before replantation, and the approximate time from the extra-oral avulsion to the completion of replantation was 60 min. The most common storage medium is Hank's Balanced Salt Solution,^[24] but if it is not available, milk is an excellent alternative,^[24] as used in our case. Saliva is acceptable, whereas water is not good for maintaining root surface cell vitality.^[7,8,18] Milk has been shown to be superior to saliva with respect to the number of viable cells, cell size, ability to recover, and to heal experimentally produced wounds.^[12,25,26]

The replanted #11 was splinted for 2 weeks with a non-rigid orthodontic wire-composite resin splint. The 2-week time period of splinting was followed according to the recommendations by Goswami and Erankkall^[27] and Flores *et al.*^[4] for management of avulsed tooth. Splinting periods of 30 days or more appeared to increase root resorption and enhanced ankylosis. Rigid splinting also increases the potential for ankylosis. Wire-composite splint has been widely used to stabilize avulsed teeth because it allows good oral hygiene and well-tolerated by the patients.^[4] The procedures for placement of these splints are very simple and it does not traumatize other teeth. It also does not cause any interference with vitality testing and endodontic procedures.^[27]

It has been shown that if an avulsed tooth has been out of the alveolar socket for longer than 1 h (and has not been kept moist in a suitable medium), PDL cells and fibres will not survive, regardless of the stage of root development. Replacement root resorption (characterized by ankylosis) is likely to be the eventual sequel of replantation. Moreover, inflammatory resorption is difficult to eliminate once it begins if endodontic treatment is delayed more than 3 weeks after replantation.^[15] The delayed endodontic treatment sequence may have been a critical factor in the resorption prognosis.

Calcium hydroxide paste is traditionally used for canal disinfection and resorption control in luxation injuries due to its effectiveness in managing inflammatory resorption.^[28] In our case, a water-based Ca(OH)₂ paste was applied. Advanced imaging like CBCT provides superior sensitivity in detecting apical changes and root resorption compared to periapical radiographs.^[29] CBCT scans in our case confirmed no external root resorption or periapical radiolucency in #11 or adjacent teeth (#12, #21, #22) at the 12-month follow-up.

CONCLUSION

Tooth avulsion is a dental emergency that requires immediate attention. Being aware of the causes, taking prompt action, and adopting preventive measures can contribute to better outcomes in cases of dental avulsion. Timely intervention,

accurate diagnosis, and appropriate management strategies are essential for achieving the best possible outcomes. In our present case, it was seen that up to 1-year follow-up, there were no signs of resorption or ankylosis. The treatment can be considered successful with a favorable prognosis. However, regular follow-up of these cases is required to avoid further trauma-related complications in the future.

REFERENCES

- Koca H, Topaloglu-Ak A, Sutekin E, Koca O, Acar S. Delayed replantation of an avulsed tooth after 5 hours of storage in saliva: A case report. *Dent Traumatol* 2010;26:370-3.
- Glendor U, Halling A, Andersson L, Eilert-Peterson E. Incidence of traumatic tooth injuries in children and adolescents in the country of Västmanland, Sweden. *Swed Dent J* 1996;20:15-28.
- Andreasen JO, Andreasen FM, Avulsions. In: Andreasen JO, Andreasen FM, Andersson L, editors. *Textbook and Color Atlas of Traumatic Injuries to the Teeth*. 4th ed. Oxford, UK: Wiley-Blackwell; 2007. p. 444-88.
- Flores MT, Andersson L, Andreasen JO, Bakland LK, Malmgren B, Barnett F. Guidelines for the management of traumatic dental injuries. II. Avulsion of permanent teeth. *Dent Traumatol* 2007;23:130-6.
- Roskamp L, Westphalen VP, Carneiro E, Fariniuk LF, Silva Neto UX. The positive influence of atopy on the prognosis of avulsed and replanted teeth despite differences in post-trauma management. *J Endod* 2011;37:463-5.
- 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;28:88-96.
- Andreasen JO, Borum MK, Jacobsen HL, Andreasen FM. Replantation of 400 avulsed permanent incisors. 4. Factors related to periodontal ligament healing. *Endod Dent Traumatol* 1995;11:76-89.
- Andreasen JO, Borum MK, Jacobsen HL, Andreasen FM. Replantation of 400 avulsed permanent incisors. 1. Diagnosis of healing complications. *Endod Dent Traumatol* 1995;11:51-8.
- Andreasen JO, Andreasen F. *Textbook and Color Atlas of Traumatic Injuries to the Teeth*. 4th ed. Copenhagen, Denmark: Munksgaard; 2007. p. 912.
- Majorana A, Bardellini E, Conti G, Keller E, Pasini S. Root resorption in dental trauma: 45 cases followed for 5 years. *Dent Traumatol* 2003;19:262-5.
- Heithersay GS. Management of tooth resorption. *Aust Dent J* 2007;52:S105-21.
- Blomlof L, Lindskog S, Andersson L, Hedström KG, Hammarström L. Storage of experimentally avulsed teeth in milk prior to replantation. *J Dent Res* 1983;62:912-6.
- Trope M, Friedman S. Periodontal healing of replanted dog teeth stored in Viaspan, milk and Hank's balanced salt solution. *Endod Dent Traumatol* 1992;8:183-8.
- Trope M, Hupp JG, Mesaros SV. The role of the socket in the periodontal healing of replanted dogs' teeth stored in viaspan for extended periods. *Endod Dent Traumatol* 1997;13:171-5.
- Andersson L, Bodin I, Sörensen S. Progression of root resorption following replantation of human teeth after extended extraoral storage. *Endod Dent Traumatol* 1989;5:38-47.
- Hammarstrom L, Blomlof L, Feiglin B, Andreasen L, Lindskog S. Replantation of teeth and antibiotic treatment. *Endod Dent Traumatol* 1986;2:51-7.
- American Association of Endodontists. Treatment of the avulsed permanent tooth. recommended guidelines of the American association of endodontists. *Dent Clin North Am* 1995;39:221-5.
- Andreasen JO, Borum MK, Jacobsen HL, Andreasen FM. Replantation of 400 avulsed permanent incisors. 2. Factors related to pulpal healing. *Endod Dent Traumatol* 1995;11:59-68.
- Torabinejad M, Walton RE. Management of traumatic dental injuries. In: *Endodontics: Principles and Practice*. 5th ed., Ch. 11. Netherlands:

- Elsevier; 2015. p. 189.
20. Trope M, Moshonov J, Nissan R, Buxi P, Yesilsoy C. Short vs. long-term calcium hydroxide treatment of established inflammatory root resorption in replanted dog teeth. *Endod Dent Traumatol* 1995;11:124-8.
21. Mazur M, Marasca R, Ottolenghi L, Vozza I, Covello F, Zupancich A, *et al.* Different resorptive patterns of two avulsed and replanted upper central incisors based on scanning electron microscopy and stereomicroscopic analysis: A case report. *Appl Sci* 2020;10:3551.
22. Andreasen JO. *Atlas of Replantation and Transplantation of Teeth*. Philadelphia, PA: W. B. Saunders; 1992.
23. Trope M. Clinical management of the avulsed tooth: Present strategies and future directions. *Dent Traumatol* 2002;18:1-11.
24. Blomlöf L. Storage of human periodontal ligament cells in a combination of different media. *J Dent Res* 1981;60:1904-6.
25. Blomlöf L. Milk and saliva as possible storage media for traumatically exarticulated teeth prior to replantation. *Swed Dent J Suppl* 1981;8:1-26.
26. Blomlöf L, Otteskog P. Viability of human periodontal ligament cells after storage in milk or saliva. *Scand J Dent Res* 1980;88:436-40.
27. Goswami M, Eranhikkal A. Management of traumatic dental injuries using different types of splints: A case series. *Int J Clin Pediatr Dent* 2020;13:199-202.
28. Golpayegani MV, Tadayon N. A multidisciplinary approach to the treatment of traumatically intruded immature incisors. A 6-year follow up. *Iran Endod J* 2006;1:151-5.
29. Patel S, Foschi F, Mannocci F, Patel K. External cervical resorption: A three-dimensional classification. *Int Endod J* 2018;51:206-14.