WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Management of Dental Avulsion: A Comprehensive Guide to Tooth Trauma and Immediate Care

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A B S T R A C T

A dental avulsion occurs when a tooth is completely removed from its socket as a result of trauma. In order to maximize the likelihood that the tooth will survive, this serious dental emergency must be handled quickly and appropriately. The etiology, classification, and treatment of dental avulsions are examined in this article, with a focus on current treatment options, long-term prognosis, and urgent care. A thorough grasp of avulsed teeth and how to treat them is provided by looking at current clinical guidelines and evidence-based treatments.

Keywords: avulsion, cell viability, endodontic treatment, periodontal ligament, trauma.

1. INTRODUCTION

Total displacement of the tooth out of its socket is implied by tooth avulsion (exarticulation, total luxation) (Fig. 1A,B). According to some studies, between 0.5 to 16% of traumatic injuries in the permanent dentition result in tooth avulsion, making it a rather uncommon occurrence.1,2. The 7–11 age range has the highest rate of dental trauma, with a 2:1 male to female ratio. Compared to temporary teeth, permanent teeth sustain higher damage (60% vs. 40%, respectively). The biological survival of the periodontal ligament (PDL) cells, which are essential for the tooth's reattachment to the alveolar bone, determines how urgently dental avulsion management must be addressed. The existing body of research emphasizes how urgent action is necessary to increase the chances of a successful re-implantation.

Nomenclature

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ETIOLOGY

Avulsion of the teeth can be caused by a number of traumatic events, such as:

• Sports Injuries: Dental injuries frequently occur in high-contact sports like hockey, basketball, and football.

• Unintentional Falls: Children are especially vulnerable to falls, which can cause avulsed teeth.

• Physical Altercations: Serious dental trauma might result from fights or rough play.

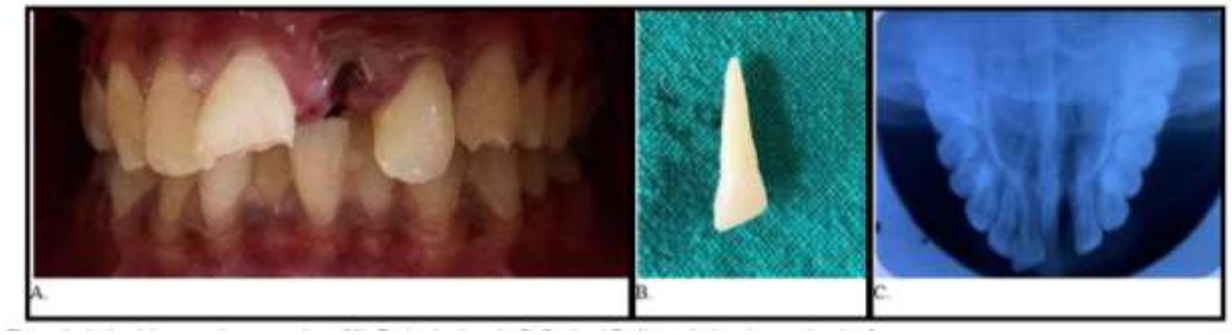

Figure 1. A. Avulsion seen in a young boy (21), B. Avulsed tooth, C. Occlusal Radiograph showing no alveolar fracture.

RISK FACTORS

The following variables may make dental avulsion more likely:

• Age: Children and teenagers are more vulnerable because their low mineralized bone and loosely formed periodontal ligament offer no defence against an extrusive force around erupting teeth.

• Socioeconomic Status: The effects of dental injuries may worsen if there is limited access to dental care.

• Environmental Factors: Injury rates during sports might be raised by unsafe play places or a lack of protective gear.

PATHOPHYSIOLOGY OF DENTAL AVULSION

Avulsion occurs when the tooth completely separates from its socket, cutting the fibers of the periodontal ligament that hold the tooth to the bone. The pulp's blood supply is cut off, and the alveolar bone around it could get hurt. Preserving the periodontal ligament cells on the root surface is essential for managing an avulsed tooth since these cells are essential for healing and successful replantation.

If the tooth is not promptly restored or kept in a suitable medium, the damage sets off a series of biological events, including tissue necrosis and inflammatory reactions. Because periodontal ligament cells dry out with increased extra-oral time (time spent outside the mouth), the chance of effective reattachment decreases.

ON- SITE EMERGENCY CARE FOR THE AVULSED TOOTH

The following guidelines should be adhered to if a tooth is avulsed:

1. The patient should be kept calm.
2. The tooth should be found and picked up from crown, without touching the root.
3. The tooth should be replanted or put back in its original location in the jaw after being carefully cleaned in milk, saline, or the patient's saliva.[3, 4]
4. The patient or guardian should be urged to get the tooth replanted right away at the emergency location.
5. The patient should bite on gauze, a handkerchief, or a napkin to keep the tooth in place once it has been repositioned in the jaw.
6. The tooth should be placed as soon as possible in a storage or transport medium that is readily available at the emergency site if replantation at the accident site is not feasible. This should be done as soon as possible to prevent the root surface from being dehydrated, which begins to occur after a few minutes.

The most practical and appropriate storage mediums are HBSS, milk, saliva, saline in decreasing order of preference.

• Hank's Balanced Salt Solution (HBSS): This particular solution is thought to be the best way to preserve avulsed teeth.

• Milk: Because of its favorable pH and osmolality, it supports the preservation of periodontal ligament cells, therefore, cold milk is a convenient and efficient choice.

• Saliva: The patient can keep the tooth moist by inserting it into their cheek if no alternative medium is available. However, because of the possibility of bacterial infection, this should only be used as a last option.

• Saline Solution: If sterile saline solution is available, it may also be utilized.

• Water: Although water is the least ideal medium because of its hypotonicity, which can lead to cell lysis, it is still preferable than letting the tooth dry out.[3, 4]

1. The patient and the tooth should be brought immediately to the emergency room.
2. A dentist or other dental specialist should be consulted right away.

FACTORS TO EVALUATE BEFORE REIMPLANTATION OF AVULSED TOOTH

The choice of treatment is influenced by –

- The maturity of the root (open or closed apex)
- The state of the periodontal ligament, which is dependent on-
    - The time out of the mouth.
    - The storage medium in which the avulsed tooth was kept.

TIME CONSIDERATIONS

Reimplanting a tooth becomes less successful over the time. Ideally, the tooth should be replanted within 15 to 30 minutes of the injury as the PDL cells are most likely viable. When the total extra-oral dry time of the tooth has been <60 minutes, the PDL cells may be viable but compromised, provided that the avulsed tooth was kept in storage medium.[5,6] After 60 minutes, the probability of successful reattachment are drastically reduced due to the non-viability of periodontal ligament cells. However, with differing degrees of success, replanting may still be tried even after protracted dry periods.

TREATMENT GUIDELINES FOR AVULSED PERMANENT TEETH

A. EXTRA-ORAL DRY TIME LESS THAN 60 MINUTES

1. The tooth should be kept or put in a storage medium while taking a history, examining the patient clinically and radiographically, and preparing the patient for the replantation.
2. Water, saline, or 0.12% chlorhexidine should be used to clean the wounded area. Aggressive curettage should be avoided to prevent further damage to the remnants of periodontal ligament.
3. The root surface should be rinsed with a stream of saline or osmolality- balanced media if there is any contamination to remove gross debris.
4. Local anesthesia should be administered, if required, and local anesthesia without vasoconstrictor should be preferred.[15]
5. It is important to inspect the alveolar socket (Fig. 1C). If the socket wall is fractured, reposition the fractured fragment into its original position with an appropriate instrument should be done.
6. It is important to confirm the reimplanted tooth's correct position clinically and radiographically (Fig. 2A,B).
7. Reimplanting the tooth should be done gradually with little digital pressure and excessive force should not be used.
8. A passive flexible splint should be used to stabilize the tooth for two weeks (Fig. 2C).A more rigid splint is recommended in cases with concomitant alveolar or jawbone fractures and should be kept in place for about 4 weeks.7. Gingival lacerations should be sutured, if present.
9. In case of mature teeth with closed apices, root canal treatment should be initiated within 2 weeks after replantation.

In case of immature teeth with open apices, the dentist may delay or avoid endodontic treatment to allow for potential revascularization of the pulp. Pulp revascularization, can lead to further root development, which is the goal when replanting immature teeth in children. The risk of external infection-related (inflammatory) root resorption should be weighed against the chances of revascularization. Such resorption is very rapid in children. Hence, endodontic treatment should not be initiated unless there are definite signs of pulp necrosis and infection of the root canal system at follow-up appointments.[21]

10. Systemic antibiotics should also be given.[7,8]
11. Tetanus status should be looked.[9]
12. Post-operative instructions should be given.
13. Follow up (Replanted teeth should be monitored clinically and radiographically at 2 weeks [when the splint is removed], 4 weeks, 3 months, 6 months, one year, and yearly thereafter for at least five years).

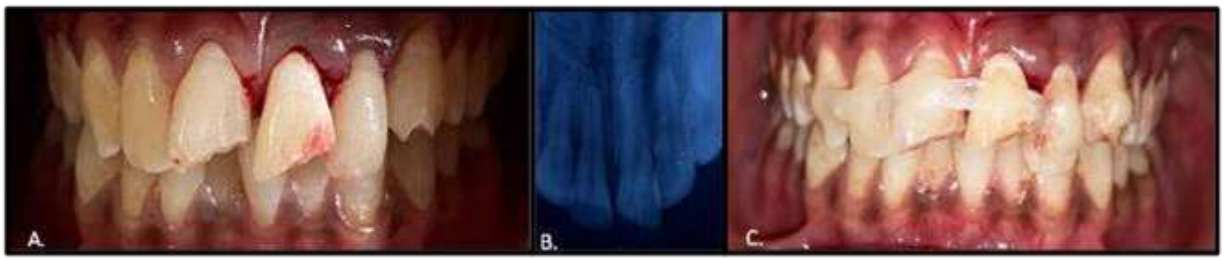

Figure 2. A. Clinical picture of reimplanted avulsed tooth (21), B. Confirming the correct placement of avulsed tooth radiographically (21), C. Avulsed tooth stabilized for 2 weeks using a passive flexible splint.

B. EXTRA-ORAL DRY TIME MORE THAN 60 MINUTES

1. Loose debris and obvious contamination should be removed from the tooth by agitating the tooth in physiologic storage medium, or with gauze soaked in saline.
2. To slow down the osseous replacement of the tooth, the root surface should be treated with fluoride (2% sodium fluoride solution for 20 min) prior to replantation but it should not be seen as an absolute recommendation.
3. Local anesthesia should be administered, if required, and local anesthesia without vasoconstrictor should be preferred.[15]
4. The socket should be irrigated with sterile saline.
5. It is important to inspect the alveolar socket (Fig. 1C). If the socket wall is fractured, reposition the fractured fragment into its original position with an appropriate instrument should be done.
6. Root canal treatment of avulsed tooth can be carried out prior to replantation or later.[11,12]
7. If an intracanal corticosteroid medication is chosen to be used as an anti-inflammatory, anticlastic medicament, it should be placed immediately or shortly following the replantation and left for at least 2 weeks. Calcium hydroxide is suggested as an intracanal medication for up to 4 weeks followed by root canal filling.
8. Tooth should be reimplanted slowly with slight digital pressure. It should not be forced back to place.
9. It is important to confirm the reimplanted tooth's correct position clinically and radiographically (Fig.2A,B).
10. A passive flexible splint should be used to stabilize the tooth for two weeks (Fig. 2C).A more rigid splint is recommended in cases with concomitant alveolar or jawbone fractures and should be kept in place for about 4 weeks.
11. Gingival lacerations should be sutured, if present.
12. Systemic antibiotics should also be given.[7,8]
13. Tetanus status should be looked.[9]
14. Post-operative instructions should be given.[10]
15. Follow up (Replanted teeth should be monitored clinically and radiographically at 2 weeks [when the splint is removed], 4 weeks, 3 months, 6 months, one year, and yearly thereafter for at least five years).

The long-term outcome for delayed replantation is not good.[10] The periodontal ligament will be necrotic and are not expected to heal. Maintaining the alveolar contour while temporarily restoring the tooth to the dentition for functional, psychological, and cosmetic reasons is the aim of delayed replantation. The root will eventually experience ankylosis and resorption.

IMAGING AND RADIOGRAPHIC ASSESSMENT AND FINDINGS

1. Two periapical radiographs from mesial and distal.[21]
2. To verify the tooth's repositioning and rule out an alveolar bone fracture, CBCT should be taken into consideration.[21]

ANTIBIOTICS

It has been suggested that systemic antibiotics be used following avulsion and replantation in order to reduce the likelihood of inflammatory root resorption and to avoid infection-related responses. Furthermore, antibiotic coverage may be justified due to the patient's medical condition or concurrent injury. Because of their low frequency of adverse effects and effectiveness against oral bacteria, amoxicillin and penicillin continue to be the first choices. It has been shown that tetracycline given right after avulsion and replantation is effective. In particular, doxycycline's antibacterial, anti-inflammatory, and anti-

resorptive properties make it a suitable antibiotic. However, before giving a tetracycline systemically to young patients, the possibility of permanent tooth discolouration must be taken into account. In general, patients younger than 12 should not take tetracycline or doxycycline.[16]

- In patients younger than 12 years old: Amoxicillin for seven days, at appropriate dose for patient's age and weight.[21]
- In patients older than 12 years old: Doxycycline for seven days, at appropriate dose for patient's age and weight.[21]

See a doctor for a tetanus booster if the avulsed tooth has come into touch with dirt and if the level of tetanus coverage is unclear.

PATIENT INSTRUCTIONS

1. Take a minimum of two weeks off from playing contact sports.
2. Depending on the patient's tolerance, continue a soft diet for up to two weeks.[17]
3. After every meal, give their teeth a gentle brushing.
4. For two weeks, rinse your mouth twice a day with a mouthwash containing 0.12% chlorhexidine.

ENDODONTIC CONSIDERATIONS

If the extra oral dry time is less than 60 minutes, endodontic therapy should begin within 2 weeks of the replantation; if it is more than 60 minutes, endodontic treatment should begin either before or just after the reimplantation.

Endodontic treatment should always be done after isolation with the dental dam. This may be achieved by placing the dental dam retainer on adjacent uninjured teeth to avoid further trauma to the injured tooth/teeth.

Calcium hydroxide is suggested as an intracanal medicament for up to 1 month followed by root canal filling.[13,14]

If a corticosteroid or corticosteroid/antibiotic mixture is chosen to be used as an anti-inflammatory and anti-resorptive intracanal medicament, it should be placed immediately or shortly after replantation and left in situ for at least 2 weeks.[18,19]

FOLLOW UP PROCEDURES

Replanted teeth should be monitored clinically and radiographically at 2 weeks (when the splint is removed), 4 weeks, 3 months, 6 months, one year, and yearly thereafter for at least five years.[20]

COMPLICATIONS OF REPLANTED TEETH

The long-term success of replantation depends on several factors, including the time the tooth spent out of the socket, the storage medium used, and the overall health of the periodontal ligament cells. Common complications include:

- External Root Resorption: This occurs when the body's immune system begins to resorb the tooth's root structure. There are two main types:
  - Inflammatory Resorption: Triggered by infection and usually results from delayed or inappropriate treatment.
  - Replacement Resorption (Ankylosis): The tooth becomes fused to the bone, leading to gradual resorption of the root and loss of the tooth over time.
- Pulp Necrosis: Without immediate revascularization, the pulp tissue inside the tooth often becomes necrotic, necessitating endodontic treatment.

CONCLUSION

A dental avulsion is a severe damage that needs to be treated right away in order to increase the tooth's chances of survival. It is frequently possible to effectively replant an avulsed tooth with the right first aid procedures and prompt professional assistance. However, a number of variables, such as the amount of time that has passed since the accident and the level of care used when handling and storing the tooth, affect the long-term prognosis.

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