

# Management of Avulsed Tooth

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**Abstract:** *Avulsion of permanent teeth is the most serious of all dental injuries. The prognosis depends on the measures taken at the place of accident or the time immediately after the avulsion. Replantation is the treatment of choice, but cannot always be carried out immediately. An appropriate emergency management and treatment plan is important for a good prognosis. Guidelines are useful for delivering the best care possible in an efficient manner. The International Association of Dental Traumatology (IADT) has developed a consensus statement after a review of the dental literature and group discussions. So, this article gives guidelines for management of avulsed permanent teeth are presented.*

**Keywords:** Avulsed tooth, Management

## 1. Introduction

The reported incidence of tooth avulsions ranges from 1%-16% of all traumatic injuries of the permanent dentition. Maxillary central incisors are the most frequently avulsed teeth. Although avulsions may occur at any age, the most common age for the permanent dentition is 8-12 years of age, a time when the loosely structured periodontal ligament surrounding erupting teeth provides only minimal resistance to an extrusive force. The primary etiologic factors for avulsions are fights and sports injuries. (1) Treatment of avulsions is directed at avoiding or minimizing the effects of the two main complications of the avulsed teeth, namely attachment damage and pulpal infection. When a tooth is avulsed the apical blood supply is severed and the periodontal ligament is damaged severely. While it is not possible for the original blood supply to be re-established after avulsion, under special circumstances it is possible for the replanted tooth to become re-vascularized. If the tooth is immature with an open apex, efforts should be made to promote revascularization of the pulp. In the tooth with a closed or open apex in which revascularization is unsuccessful, treatment efforts should be aimed at elimination of potential bacterial toxins from the root canal space. Attachment damage as a direct result of avulsion cannot be avoided; however, considerable additional damage can occur to the periodontal membrane during the time the tooth is out of the oral cavity. Treatment is directed at minimizing this damage so that the fewest number of complications result. When severe additional damage has occurred and replacement resorption (ankylosis) is considered certain, steps should be taken to slow this irreversible resorptive process to maintain the tooth in the mouth for as long as possible.

## 2. First Step

When the decision has been made to replant, the avulsed tooth should be examined for obvious contamination. If visibly contaminated, the tooth surface should be rinsed gently with a stream of saline from a syringe until visible contaminants have been washed away. The debris on the root surface should never be scraped off because then viable periodontal ligament cells could be scraped off as well. It is better to replant the tooth with minor debris on it than risk removing or destroying periodontal ligament cells. No effort

should be made to sterilize the tooth surface because this may damage or destroy vital periodontal tissue and cementum. The alveolar socket should be examined. If needed, the socket can also be rinsed with a flow of saline to remove the contaminated coagulum. If there is evidence of socket collapse or fracture, the fractured bone should be repositioned using a blunt instrument such as a mirror handle to remodel the bony socket. The replanted tooth requires temporary stabilization by splinting. Recent studies have shown that long-term rigid splinting of replanted mature and auto transplanted immature teeth increases the risk of replacement root resorption (ankylosis). Accordingly, replanted teeth should only be splinted for a minimal amount of time (7-10 days) with a flexible wire or monofilament.

## 3. Guidelines for Clinicians

Guidelines contain recommendations for diagnosis and treatment of specific traumatic dental injuries using proper examination procedures. Some general recommendations are as follows:

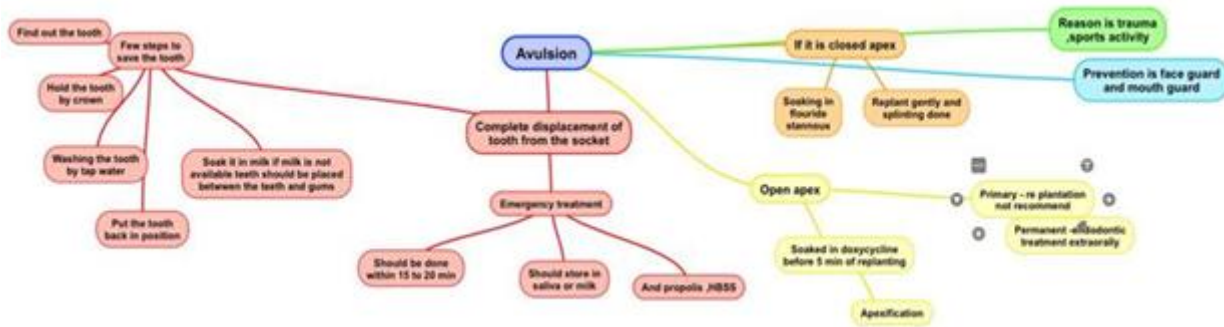
*Clinical examination.* Detailed description of procedures such as clinical examination and classification of injuries can be found in current textbooks and manuals. *Radiographic examination.* As a routine, several projections and angles are recommended:

90° horizontal angle, with central beam through the tooth in question;  
occlusal view;  
lateral view from the mesial or distal aspect of the tooth in question

*Sensitivity tests.* Sensibility testing refers to tests (electric pulp test or cold test) to determine the condition of the tooth pulp. Initial tests following an injury frequently give negative results, but such results may only indicate a transient lack of pulpal response. Follow-up controls are needed to make a definitive pulpal diagnosis.

*Patient instructions.* Good healing following an injury to the teeth and oral tissues depends, in part, on good oral hygiene. Patients should be advised on how best to care for teeth that have received treatment after an injury. Brushing with a soft brush and rinsing with chlorhexidine 0.1% is beneficial to prevent accumulation of plaque and debris (2)

**Treatment of Avulsed Permanent Tooth**  
 (Tab 1)



**Treatment guidelines for avulsed permanent teeth with closed apex**

Clinical situation	Treatment
The (1a) tooth has been replanted prior to the patient arriving at the dental office or clinic	Clean the area with water spray, saline, or chlorhexidine. Do not extract the tooth. Suture gingival present. Verify normal position of the replanted tooth both clinically and radiographically. Apply a flexible splint for up to 2 weeks.
	Administer systemic antibiotics. Tetracycline is the first choice (Doxycycline 2x per day for 7 appropriate dose for patient age and weight). The risk days at of discoloration of permanent teeth must be considered before systemic administration of tetracycline in young patients. (In many countries tetracycline is not recommended for patients under 12 years of age). In young patients Phenoxy methyl Penicillin (Pen V), in an appropriate dose for age and weight, can be given as alternative to tetracycline.
	If the avulsed tooth has contacted soil, and if tetanus coverage is uncertain, and need for a tetanus booster. refer to physician for evaluation
	Initiate root canal treatment 7–10 days after replantation and before splint as an intra-canal medicament until filling removal. Place calcium hydroxide of the root canal.
	<i>Patient instructions</i>
	Soft diet for up to 2 weeks.
	Brush teeth with a soft toothbrush after each meal. Use a chlorhexidine (0.1%) mouth rinse twice a day for 1 week.
The (1b) tooth has been kept in special storage media (Hank's Balanced Salt Solution), milk, saline, or saliva. The extra- oral dry time is less than 60 min	<i>Follow-up</i>
	If contaminated, clean the root surface and apical foramen with a stream of saline and place the tooth saline. Remove the coagulum from the socket with a stream of saline. in Examine the alveolar socket. If there is a fracture of the socket wall, reposition it with a suitable instrument. Replant the tooth slowly with slight digital pressure. Suture gingival lacerations. Verify normal position of the replanted tooth both clinically and radiographically. Apply a flexible splint for up to 2 weeks.
	Administer systemic antibiotics. Tetracycline is the first choice (Doxycycline 2x per day for 7 appropriate dose for patient age and weight). The risk days at of discoloration of permanent teeth must be considered before systemic administration of tetracycline in young patients. (In many countries tetracycline is not recommended for patients under 12 years of age). In young patients Phenoxy methyl Penicillin (Pen V), at appropriate dose for age and weight, can be given as alternative to tetracycline.
	If the avulsed tooth has contacted soil, and if tetanus coverage is uncertain, evaluation and need for a tetanus refer the patient to a physician for booster.
	Initiate root canal treatment 7–10 days after replantation and before splint as an intra-canal medicament until filling removal. Place calcium hydroxide of the root canal.
	<i>Patient instructions</i>
	Soft diet for up to 2 weeks. Brush teeth with a soft toothbrush after each meal. Use a chlorhexidine (0.1%) mouth rinse twice a day for 1 week.
Extra-oral (1c) dry time longer than 60 min	<i>Follow-up</i>
	Delayed replantation has a poor long-term prognosis. The periodontal ligament will be necrotic and expected to heal. The goal in doing delayed replantation is to promote not alveolar bone growth to encapsulate the replanted tooth. The expected eventual outcome is ankylosis and resorption of the root. In children below the age of 15, if ankylosis occurs, and when the infraposition of the tooth crown is more than 1 mm, it is recommended to perform decoronation to preserve the contour of the alveolar ridge.
	The technique for delayed replantation is:
	Remove attached necrotic soft tissue with gauze.
	Root canal treatment can be done on the tooth prior to replantation, or it can be done 7–10 other replantation. days later as for
	Remove the coagulum from the socket with a stream of saline. Examine the alveolar fracture of the socket wall, reposition it with a socket. If there is a suitable instrument. Immerse the tooth in a 2% sodium fluoride solution for 20 min
Replant the tooth slowly with slight digital pressure. Suture gingival laceration. replanted tooth clinically and Verify normal position of the radiographically.	

	<p>Stabilize the tooth for 4 weeks using a flexible splint.</p> <p>Administration of systemic antibiotics, see (1a).</p> <p>Refer to physician for evaluation of need for a tetanus booster if the avulsed tetanus coverage is uncertain. tooth has contacted soil or</p> <p style="text-align: center;"><i>Patient instructions</i></p> <p>Soft diet for up to 2 weeks.</p> <p>Brush teeth with a soft toothbrush after each meal.</p> <p>Use a chlorhexidine (0.1%) mouth rinse twice a day for 1 week.</p> <p style="text-align: center;"><i>Follow-up</i></p>
The (2a) tooth has already been replanted prior to the patient arriving in the dental office or clinic.	<p>Clean the area with water spray, saline or chlorhexidine. Do not extract present. Verify the tooth. Suture gingival lacerations if normal position of the replanted tooth both clinically and radiographically. Apply a flexible splint for up to 2 weeks.</p> <p>Administer systemic antibiotics. For children 12 years and younger: Penicillin V at patient age and weight. an appropriate dose for</p> <p>Refer the patient to a physician for evaluation of need for a tetanus booster if or tetanus coverage is uncertain. avulsed tooth has contacted soil</p> <p>The goal for replanting still-developing (immature) teeth in children is to allow the tooth pulp. If that does not occur, for possible revascularization of root canal treatment may be recommended –</p> <p style="text-align: center;"><i>Patient instructions</i></p> <p>Soft diet for up to 2 weeks.</p> <p>Brush teeth with a soft toothbrush after each meal.</p> <p>Use a chlorhexidine (0.1%) mouth rinse twice a day for 1 week.</p> <p style="text-align: center;"><i>Follow-up</i></p>
The tooth has been (2b) kept in special storage media (Hank's Balanced Salt Solution), milk, saline, or saliva. The extra- oral dry time is less than 60 min	<p>If contaminated, clean the root surface and apical foramen the socket with a stream of with a stream of saline. Remove the coagulum from saline and then replant the tooth. If available, cover the root surface with minocycline hydrochloride microspheres (Arestin™, OraPharma Inc, Warminster, PA, USA) before replanting the tooth.</p> <p>Examine the alveolar socket. If there is a fracture of the socket wall, reposition it with a suitable instrument. Replant the tooth slowly with slight digital pressure. Suture gingival lacerations, especially in the cervical area. Verify normal position of the replanted tooth clinically and 2 radiographically. Apply a flexible splint for up to weeks.</p> <p>Administer systemic antibiotics. For children 12 years and younger: Penicillin V at age and weight. appropriate dose for patient</p> <p>Refer to physician for evaluation of need for a tetanus booster if avulsed tooth coverage is uncertain. has contacted soil or tetanus</p> <p>The goal for replanting still-developing (immature) teeth in children is to allow the tooth pulp. If that does not occur, for possible revascularization of root canal treatment may be recommended – <i>For</i></p> <p style="text-align: center;"><i>Patient instructions</i></p> <p>Soft diet for up to 2 weeks.</p> <p>Brush teeth with a soft toothbrush after each meal.</p> <p>Use a chlorhexidine (0.1%) mouth rinse twice a day for 1 week.</p> <p style="text-align: center;"><i>Follow-up</i></p>
Extra-oral dry time (2c) longer than 60 min	<p>Delayed replantation has a poor long-term prognosis. The periodontal ligament will be necrotic and not expected to heal. The goal in doing delayed replantation of immature teeth in children is to maintain alveolar ridge contour. The eventual outcome is expected to be ankylosis and resorption of the root. It is important to recognize that if delayed replantation is done in a child, future treatment planning must be done to take into account the occurrence of tooth ankylosis and the effect of ankylosis on the alveolar ridge development. If ankylosis occurs, and when the infraposition of the tooth crown is more than 1 mm, it is recommended to perform decoronation to preserve the contour of the alveolar ridge.</p> <p style="text-align: center;">The technique for delayed replantation is:</p> <p style="text-align: center;">Remove attached necrotic soft tissue with gauze.</p> <p style="text-align: center;">Root canal treatment can be done on the tooth prior to replantation through the open apex.</p> <p>Remove the coagulum from the socket with a stream of saline. Examine the alveolar fracture of the socket wall, reposition it with a socket. If there is a suitable instrument.</p> <p style="text-align: center;">Immerse the tooth in a 2% sodium fluoride solution for 20 min</p> <p>Replant the tooth slowly with slight digital pressure. Suture gingival laceration. replanted tooth clinically and Verify normal position of the radiographically.</p> <p style="text-align: center;">Stabilize the tooth for 4 weeks using a flexible splint.</p> <p style="text-align: center;">Administration of systemic antibiotics, see (2a).</p> <p>Refer the patient to a physician for evaluation of need for a tetanus booster if soil or tetanus coverage is uncertain. the avulsed tooth has contacted</p> <p style="text-align: center;"><i>Patient instructions</i></p> <p>Soft diet for up to 2 weeks.</p> <p>Brush teeth with a soft toothbrush after each meal.</p> <p>Use a chlorhexidine (0.1%) mouth rinse twice a day for 1 week.</p> <p style="text-align: center;"><i>Follow-up</i></p>

#### 4. Follow-Up Procedures for Avulsed Permanent Teeth

##### Root canal treatment

If root canal treatment is indicated (teeth with closed apex), the ideal time to begin treatment is 7–10 days postreplantation. Calcium hydroxide is recommended for intra-canal medication for up to 1 month followed by root canal filling with an acceptable material. An exception is a tooth that has been dry for more than 60 min before replantation – in such cases the root canal treatment may be done prior to replantation.

In teeth with open apices, that have been replanted immediately or kept in appropriate storage media, pulp revascularization is possible. Root canal treatment should be avoided unless there is clinical and radiographic evidence of pulp necrosis.

##### Clinical control

Replanted teeth should be monitored by frequent controls during the first year (once a week during the months 1, 3, 6, and 12) and then yearly thereafter. Clinical and radiographic examination will provide information to determine outcome. Evaluation may include the findings described as follows.

##### Favorable outcome

\**Closed apex.* Asymptomatic, normal mobility, normal percussion sound. No radiographic evidence of resorption or periradicular osteitis; the lamina dura should appear normal.

\**Open apex.* Asymptomatic, normal mobility, normal percussion sound. Radiographic evidence of arrested or continued root formation and eruption. Pulp canal obliteration is the rule.

##### Unfavorable outcome

\**Closed apex.* Symptomatic, excessive mobility or no mobility (ankylosis) with high-pitched percussion sound. Radiographic evidence of resorption (inflammatory, infection-related resorption, or ankylosis-related replacement resorption).

\**Open apex.* Symptomatic, excessive mobility or no mobility (ankylosis) with high-pitched percussion sound. In the case of ankylosis, the crown of the tooth will appear to be in an infra-occlusal position. Radiographic evidence of resorption (inflammatory, infection-related resorption, or ankylosis-related replacement resorption)

##### Splinting guidelines for avulsed teeth

Replanted permanent teeth should be splinted up to 2 weeks. Wire-composite splint has been widely used to stabilize avulsed teeth because it allows good oral hygiene and are well tolerated by the patients (7-11).

##### New treatment regimens and rationale

Enhancing revascularization -the use of topical antibiotics for immature teeth. The decision analysis and protocol for management differs for immature versus mature teeth. Because patient age is a poor prediction of tooth maturation, the clinician should rely upon apical closure as an indication of tooth maturation. An immature tooth (open apex) can establish revascularization while a mature tooth (closed apex) has no chance of revascularization. Cvek and

colleagues (3) demonstrated that immature teeth soaked in Doxycycline soDoxycycline solution have a greater rate of pulpal revascularization. It appears that antibiotic treatment reduces the chances of micro-abscesses in the pulpal lumen and this enhancement aids revascularization. These findings have recently been corroborated by Yanpiset and Trope (4). While these were animal studies, based on these findings it is recommended that immature teeth should be soaked in a 1% Doxycycline solution for five minutes (5,6). A 1% Doxycycline solution can be prepared as follows: 1 mg/20 ml Doxycycline solution or 50 mg/Doxycycline capsule/1000 ml saline.

##### The Use of Adjunctive Systemic Antibiotics

Hammarstrom and colleagues found that systemic antibiotics (Pen V K) given at time of replantation were effective in preventing bacterial invasion of necrotic pulp, thus reducing inflammatory root resorption and is the current American Association of Endodontics recommendation. Sae-Lim and colleagues found tetracycline likewise to be effective. Doxycycline has been found to be even more effective in reducing inflammatory root resorption. Thus, this decision analysis recommends: 1) For patients not susceptible to tetracycline staining. RX: Doxycycline 4.4 mg/kg/day q 12h on day one, then 2.2-4.4 mg/kg/day for seven days, and 2) For patients susceptible to tetracycline. RX: Pen VK 500 mg QID or child equivalent dose for seven days (12,13)

#### 5. Conclusion

The decision trees in tab 1 offer the busy clinician a contemporary, logical, and easy-to-follow approach to management of avulsed permanent tooth.

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