

Recommended Guidelines of the American Association of Endodontists for the **Treatment of Traumatic Dental Injuries**

The *Recommended Guidelines of the American Association of Endodontists for the Treatment of Traumatic Dental Injuries* are intended to aid the practitioner in the management and treatment of dental injuries. Practitioners must always use their own best professional judgment. The AAE neither expressly nor implicitly warrants any positive results associated with the application of these guidelines. Although it is impossible to guarantee permanent retention of a traumatized tooth, timely treatment of the tooth with the proper manner can maximize the chances for success.

The AAE gratefully acknowledges the cooperation of the International Association of Dental Traumatology and Blackwell-Munksgaard who granted permission for the AAE to use substantial portions of the IADT *Recommended Guidelines for the Management of Traumatic Dental Injuries* in the development of the AAE trauma guidelines.

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TABLE 1. Treatment guidelines for tooth and/or bone fractures in the primary dentition

	Crown fracture		Crown-root fracture	Root fracture	Alveolar fracture
	Uncomplicated	Complicated			
Diagnosis and clinical findings	Enamel fracture or enamel-dentin (E/D) fracture.	Same as E/D fracture with pulp exposure.	The coronal fragment is attached to the gingiva and mobile. The pulp may or may not be exposed. Minimal to moderate tooth displacement.	Tooth is mobile and coronal fragment may be displaced.	The tooth-containing segment is mobile and usually displaced. Look for a step or discontinuity.
Radiographic assessment and findings	Take one radiograph. Evaluate size of pulp chamber and stage of root development and resorption.	Take one radiograph. Evaluate size of pulp chamber and stage of root development.	Take one radiograph.	Take one radiograph.	Take one radiograph.
Treatment	Smooth sharp edges. If possible, the tooth can be restored with glass ionomer filling material or composite (SA).	Perform pulpotomy/root canal treatment or extract (SA).	Extract. Do not be overzealous in an attempt to remove root fragments (SA).	If displaced, extract only the coronal fragment. The apical fragment should be left to be resorbed physiologically (SA).	Reposition the segment. Splint to adjacent teeth for 2-3 weeks (A).
Patient instructions	Soft diet for 10-14 days. Brush teeth with a soft toothbrush after each meal Follow up (see Table 2)				

Treatment urgency: A = Acute SA = Subacute D = Delayed

TABLE 2. Follow-up schedule of acute dental trauma – primary dentition

Time	Crown fracture		Crown-root fracture	Root fracture		Alveolar fracture
	Uncomplicated	Complicated		No displacement	Extraction	
1 week	C					
2-3 weeks				C		
3-4 weeks	C	C				S+C
6-8 weeks	C			C		C
6 months						C
1 year			C*	C	C*	C
Each subsequent year until exfoliation				C		

S = Splint removal C = Clinical and radiographic exam * = Radiographic monitoring until eruption of the permanent successors

TABLE 3. Guidelines for luxated and avulsed primary teeth

	Concussion	Subluxation	Lateral luxation	Intrusion	Extrusion	Avulsion
Diagnosis and clinical findings	Tooth tender to touch. No mobility or sulcular bleeding.	Tooth is mobile but not displaced. Sulcular bleeding.	The tooth is displaced laterally with the crown usually in palatal direction.	Tooth is usually displaced through the labial bone plate or toward permanent tooth germ.	Tooth is mobile and extruded from the socket.	Tooth is out of the socket.
Radiographic assessment and findings	Take one periapical radiograph. No radiographic abnormalities are expected.		Take one occlusal radiograph. Increased periodontal space apically is best seen on the occlusal radiograph.	Take two radiographs (periapical and extraoral). When the apex is displaced toward or through the labial bone plate, the apical tip can be visualized and appears shorter than its contralateral. When the apex is displaced towards the permanent tooth germ, the apical tip cannot be visualized and tooth appears elongated.	Take one periapical radiograph.	Take one periapical radiograph. Radiographic examination is essential to ensure that the missing tooth is not intruded.
Treatment	Observation (D)		If there is no occlusal interference, the tooth is allowed to reposition spontaneously; otherwise, reposition and splint as needed (A/SA).	If the apex is displaced toward or through the labial bone plate, the tooth is left for spontaneous re-eruption. If the apex is displaced into the developing tooth germ, extract (SA).	Extract or reposition, and splint as needed (A/SA).	Most often the avulsed primary tooth should not be replanted (A).
Patient instructions	Soft diet for 10-14 days. Brush teeth with a soft toothbrush after each meal. Topical use of chlorhexidine twice a day for one week. Follow up (see Table 4)					

Treatment urgency: A = Acute SA = Subacute D = Delayed

TABLE 4. Follow-up schedule of acute dental trauma – primary dentition

Time	Concussion/ Concussion/Subluxation	Lateral luxation/Extrusion		Intrusion	Avulsion
		Splint used	Spontaneous repositioning		
1 week		S+C		C	C
2-3 weeks		C	C		
3-4 weeks				C	
6-8 weeks	C	C	C	C	
6 months		C	C	C	C
1 year		C	C	C	C
Each subsequent year until exfoliation		C*	C*	C*	C*

S = Splint removal C = Clinical and radiographic exam * = Radiographic monitoring until eruption of the permanent successors

TABLE 5. Treatment guidelines for luxated permanent teeth

	Concussion	Subluxation	Extrusion	Lateral luxation	Intrusion
Diagnosis and clinical findings	Tooth tender to touch (no displacement, no mobility).	Tooth is tender to touch and mobile, but not displaced. Hemorrhage from gingival crevice possible.	Elongated mobile tooth.	The tooth is displaced laterally and is locked into bone. Not tender to touch, not mobile. Percussion test: high, metallic sound (ankylotic tone).	Tooth is displaced deeper into the alveolar bone. Not tender to touch, not mobile. Percussion test: high, metallic sound (ankylotic tone).
Radiographic assessment and findings	Take one radiograph (2). No radiographic abnormalities will be found.	Take two radiographs (1, 2). No radiographic abnormalities will be found.	Take four radiographs (1-4). Increased periodontal space apically.	Take four radiographs (1-4). Increased periodontal space is best seen on eccentric or occlusal exposures.	Take four radiographs (1-4). Radiographs not always conclusive.
Treatment	Flexible splint is optional – can be used for the comfort of the patient for 7-10 days, or according to trauma diagnoses of adjacent teeth (SA).	Flexible splint is optional – can be used for the comfort of the patient for 7-10 days, or according to trauma diagnoses of adjacent teeth (SA).	Reposition. Stabilize the tooth with a flexible splint for up to 3 weeks (A/SA).	Reposition the tooth into normal position (local anesthesia necessary). The tooth must often be extruded (occlusally past the bony lock prior to repositioning). Take one radiograph (2) after repositioning. Stabilize tooth with a flexible splint for up to 3 weeks. In case of marginal bone breakdown, usually observed radiographically (don't probe!) after 3 weeks, add 3-4 weeks extra splinting time (A/SA).	Slightly luxate the tooth with forceps. Spontaneous reposition/re-eruption (teeth with incomplete root formation), orthodontic repositioning (teeth with completed root formation) or surgical repositioning is performed. In case of completed root formation, perform prophylactic extirpation of the pulp 1-3 weeks after injury (SA).
Patient instruction	<p style="text-align: center;">Soft diet. Brush teeth with a soft toothbrush after each meal. Use of chlorhexidine mouthrinse (0.1%) twice a day for 2 weeks. Follow up (see Table 6)</p>				

Radiographs: (1) occlusal (2) periapical central angle (3) periapical mesial eccentric (4) periapical distal eccentric
 Treatment urgency: A = Acute SA = Subacute D = Delayed

TABLE 6. Follow up procedures for traumatized permanent teeth

Time	Concussion/Subluxation	Extrusion	Lateral luxation	Intrusion
Up to 3 weeks	S+C (2)	S+C (2)	C (3)	
3-4 weeks	C (3)			
6-8 weeks	C (1)	C (2A)	C (2A)	C (3)
6 months	C (2A)	C (2A)	C (3)	
1 year	C (1)	C (2A)	C (2A)	C (3)
Yearly for 5 years	NA	C (2A)	C (2A)	C (3)

S = Splint removal NA = Not applicable

C = Clinical radiographic examination. Success/Failure includes some but not necessarily all of the following:

- 1 *Success* – asymptomatic, positive sensitivity, continued root development (immature teeth), intact lamina dura periradicularly
Failure – symptomatic, negative sensitivity, root does not develop (immature teeth), periradicular radiolucencies
- 2 *Success* – minimal symptoms, slight mobility, no excessive lucency periradicularly
Failure – severe symptoms, excessive mobility, clinical and radiographic signs of periodontitis. Initiate endodontics if closed apex and extent of displacement will likely result in necrosis.
- (2A) *Success* – asymptomatic, clinical and radiographic signs of normal or healed periodontium. Marginal bone height corresponds to that seen radiographically after repositioning.
Failure – symptoms and radiographic sign consistent with periodontitis, negative sensitivity, breakdown of marginal bone – splint for additional period 3-4 weeks; initiate endodontic treatment if not previously initiated, chlorhexidine mouthrinse.
- 3 *Success* – tooth in place or erupting, intact lamina dura, no signs of resorption. In mature teeth, start endodontic therapy in first 3 weeks.
Failure – tooth locked in place/ankylotic tone; radiographic signs of apical periodontitis, external inflammatory resorption or replacement resorption.

TABLE 7. Treatment guidelines for avulsed permanent teeth with closed apex

Diagnosis and clinical situation	The tooth has already been replanted.	The tooth has been kept in special storage media, milk, saline or saliva. The extra-oral dry time is <60 minutes.	Extra-oral dry time is >60 minutes.
Treatment	Clean affected area with water spray, saline or chlorhexidine. Do not extract the tooth (SA).	If contaminated, clean the root surface and apical foramen with a stream of saline. Remove the coagulum from the socket with a stream of saline. Examine the alveolar socket. If there is a fracture in the socket wall, reposition it with a suitable instrument. Replant slowly with slight digital pressure (A).	Remove debris and necrotic periodontal ligament. Remove the coagulum from the socket with a stream of saline. Examine the alveolar socket. If there is a fracture of the socket wall, reposition it with a suitable instrument. Immerse the tooth in a 2.4% sodium fluoride solution acidulated to a pH 5.5 for a minimum of 5 minutes or, if available, fill the socket with Emdogain®. Replant slowly with slight digital pressure (SA).
Additional treatment	Suture gingival laceration, especially in the cervical area. Verify normal position of the replanted tooth radiographically. Apply a flexible splint for 1 week.		
Antibiotics	Administer systemic antibiotics: Doxycycline 2x per day for 7 days at appropriate dose for patient age and weight, or penicillin 4x per day for 7 days at appropriate dose for patient age and weight. Refer to physician to evaluate need for a tetanus booster if avulsed tooth has come in contact with soil or if tetanus coverage is uncertain.		
Patient instruction	Soft diet for 2 weeks. Brush teeth with a soft toothbrush after each meal. Use a chlorhexidine mouthrinse (0.1%) twice a day for 1 week. Follow up (see Table 9)		

Treatment urgency: A = Acute SA = Subacute D = Delayed

TABLE 8. Treatment guidelines for avulsed permanent teeth with open apex

Diagnosis and clinical situation	The tooth has already been replanted.	The tooth has been kept in special storage media, milk, saline or saliva. The extra-oral <i>dry time</i> is <60 minutes.	Extra-oral dry time is >60 minutes.
Treatment	Clean affected area with water spray, saline or chlorhexidine rinse. Do not extract the tooth (SA).	If contaminated, clean the root surface and apical foramen with a stream of saline. Place the tooth in doxycycline (~1 mg/20 ml saline). Remove the coagulum from the socket with a stream of saline. Examine the alveolar socket. If there is a fracture to the socket wall, reposition it with a suitable instrument. Replant slowly with slight digital pressure (A).	Replantation usually is not indicated.
Additional treatment	Suture gingival laceration, especially in the cervical area. Verify normal position of the replanted tooth radiographically. Apply a flexible splint for 1 week.		
Antibiotics	Administer systemic antibiotics: Penicillin V 1000 mg stat and 500 mg 4x per day for 7 days; or, for patients not susceptible to tetracycline staining, Doxycycline 2x per day for 7 days at appropriate dose for patient age and weight. Refer to physician to evaluate need for a tetanus booster if avulsed tooth has come into contact with soil or tetanus coverage is uncertain.		
Patient instruction	Soft diet for 2 weeks. Brush teeth with a soft toothbrush after each meal. Use a chlorhexidine mouthrinse (0.1%) twice a day for 1 week. Follow up (see Table 9)		

Treatment urgency: A = Acute SA = Subacute D = Delayed

■ TABLE 9. Follow-up procedure for traumatized permanent teeth

Time	Closed apex	Open apex
1 week	S	S
Initiate endodontic treatment		
2-3 weeks	C	C
3-4 weeks	C	C
6-8 weeks	C	C
6 months	C	C
1 year	C	C
Yearly for 5 years	C	C

S = Splint removal C = Clinical and radiographic examination

Possible outcomes:

Closed Apex

- (1) **Satisfactory outcome** – *Clinical:* asymptomatic, normal mobility, normal sound on percussion
Radiographic: no periradicular radiolucencies indicative of progressive external inflammatory root resorption (>2x normal lamina dura) or loss of lamina dura indicative of ankylosis and replacement resorption
- (2) **Unsatisfactory outcome** – *Clinical:* symptomatic and/or high pitch percussion sound
Radiographic: periradicular radiolucencies in the root and bone, or radiographic replacement of the root with bone

Endodontic treatment: At 7-10 days endodontic treatment should be initiated and calcium hydroxide placed. Calcium hydroxide can be replaced by gutta-percha when an intact lamina dura can be traced around the entire root surface. Usually, if the root canal treatment is initiated at the end of the ideal 7-day period, external inflammatory root resorption is prevented, and obturation can take place within a month. If, however, the endodontic treatment is initiated when root resorption is already visible, calcium hydroxide is needed for an extended period before obturation can take place. The status of the lamina dura and the presence of the calcium hydroxide in the canal should be evaluated every 3 months.

Open Apex

- (1) **Satisfactory outcome** – *Clinical:* asymptomatic, normal mobility and eruption pattern, normal sound on percussion, positive sensitivity test
Radiographic: As with closed apex. *Continued root development, pulp lumen obliteration is very common.*
- (2) **Unsatisfactory outcome** – *Clinical:* symptomatic and/or high pitched percussion sound, tooth in infra-occlusion
Radiographic: As with closed apex. *Root fails to develop; the pulpal lumen does not change in size.*

Endodontic treatment: If revascularization is a possibility, avoid endodontic treatment unless obvious signs of failure are present. Sensitivity test may take up to 3 months to respond positively. If endodontic treatment is necessary, follow recommendations for apexification.

TABLE 10. Treatment guidelines for tooth fractures and alveolar fractures in the permanent dentition

	Crown fracture		Crown-root fracture	Root fracture	Alveolar fracture
	Uncomplicated	Complicated			
Diagnosis and clinical findings	Enamel fracture or enamel-dentin (E/D) fracture.	Same as E/D fracture, with pulp exposure.	The coronal fragment is attached to the gingiva and mobile. The pulp may or may not be exposed. The apical segment is usually not displaced.	Tooth is usually mobile and sometimes displaced.	The bone segment containing the involved tooth/teeth is mobile.
Radiographic and clinical assessment and findings	Take one radiograph (2). Evaluate size of pulp chamber and stage of root development. Sensitivity test.	Take one radiograph (2). Evaluate the size of pulp chamber and stage of root development. Sensitivity test.	Take one radiograph (2). The oblique fracture line is usually perpendicular to the central X-ray beam. Sensitivity test.	Take four radiographs (1-4). Radiographs taken at different angulations are useful. Sensitivity test.	Take four radiographs (1-4). Radiographs taken at different angulations are useful. Sensitivity test.
Treatment	Account for fractured segment. Radiograph soft tissue lacerations for tooth fragments or other foreign bodies. Provide a temporary glass-ionomer cement bandage or a permanent restoration using a bonding agent and composite resin. If very close to pulp, consider Ca(OH) ₂ base. If an intact fragment exists, a bonding procedure may be carried out (SA/D).	<i>In immature tooth:</i> Perform pulp capping or partial pulpotomy with calcium hydroxide and bacteria tight coronal seal. <i>In mature tooth:</i> As with immature tooth or pulpectomy and root canal filling (SA).	In an emergency, stabilize the coronal fragment with an acid etch/resin splint to adjacent teeth. Expose subgingival fracture site by: a) Gingivectomy b) Orthodontic or surgical extrusion. If root formation is complete, root canal treatment is indicated. Otherwise, pulp capping or pulpotomy, and wait for completion of root formation (SA).	Reposition the coronal fragment as soon as possible. Check position radiographically. Stabilize the tooth with a splint (A/SA).	Reposition the fragment. Stabilize the fragment to adjacent teeth with a splint (A).
Patient instruction	Soft diet. Brush teeth with a soft toothbrush after each meal. Use chlorhexidine mouthrinse (0.1%) twice a day for 7 days. Follow up (see Table 11)				

Radiographs: (1) occlusal (2) periapical central angle (3) periapical mesial eccentric (4) periapical distal eccentric
Treatment urgency: A = Acute SA = Subacute D = Delayed

TABLE 11. Follow-up procedures for fractured permanent teeth and alveolar fractures

Time	Crown fracture		Root fracture	Alveolar fracture
	Uncomplicated	Complicated		
1 week				
2-3 weeks				
3-4 weeks			S+C (2)	S+C (2)
6-8 weeks	C (1)	C (1)	C (2)	C (3)
6 months			C (2)	C (3)
1 year	C (1)	C (1)	C (2)	C (3)
Yearly for 5 years			C (2)	C (3)

S = Splint removal

C = Clinical and radiographic examination

- Success* – positive sensitivity, root development continues (immature teeth). Continue to next evaluation
Failure – negative sensitivity, signs of apical periodontitis, root development does not continue (immature teeth). Start endodontic therapy
- Success* – positive sensitivity (false negative possible at 3-4 week evaluation). Signs of repair of fractured segments. Continue to next evaluation
Failure – negative sensitivity (false negative possible at 3-4 week evaluation). Clinical signs of periodontitis. Radiolucency adjacent to fracture line. Start endodontic therapy to level of fracture line
- Success* – positive sensitivity (false negative possible at 3-4 week evaluation). No signs of apical periodontitis. Continue to next evaluation
Failure – negative sensitivity (false negative possible at 3-4 week evaluation). Signs of apical periodontitis or external inflammatory resorption. Start endodontic therapy.