Sports Dentistry:
Treating the athletes in your practice.

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Section 1

- Introduction to Sports Dentistry
- Definition
- What is Sports Dentistry and how do the concepts apply to general dental practices?
  - Overview of the topics of interest in Sports Dentistry
  - Prevention and Treatment of dental injuries
  - Dietary issues encountered in athletes
  - Smokeless tobacco use in athletes
  - Traumatic Brain Injuries in athletes
- How to become involved in Sports Dentistry in your community

Section 2

- Dental Trauma
  - Planning for treatment of dental trauma
  - General concepts of treating dental trauma in the general dental practice
  - Overview of common traumatic injuries: diagnosis and treatment.
  - Case presentations

Section 3

- Prevention of dental traumatic injuries
  - General concepts in injury prevention
  - Role of protective equipment and mouth guards in injury prevention
  - Mouth guards: types available, appropriate use and recommendations
  - Fabrication of custom mouth guards
  - Myths and claims

- Mouthguards and athletic performance enhancement
  - A review of literature and an evaluation of manufacturer's claims

Examination of Patients with Dental Trauma

Medical History Allergies, medications, medical problems Consent to examination, treatment, referral **Dental History** Injury History How? Where? When? Why?	**Neurological Exam** Cranial Nerve Assessment Signs / Symptoms of possible concussions
External Examination Soft tissue abrasions contusions lacerations swelling Hard tissue injury mobility crepitus tenderness asymmetry TMJ joint pain muscle pain intraoral opening deviation on opening open/closed lock chewing difficulty	**Intraoral Exam** Oral mucosa gingiva tongue abrasion contusion laceration Occlusion normal vs. post-injury Teeth fractures color changes mobility pain biting pressure lateral pressure cold percussion non-stimulated
Radiographs various angles to evaluate **Photographs** documentation legal post-op	**Treatment plan** prognosis referrals follow-up plan

Dental Trauma

The concepts presented will be based on publications of the International Association of Dental Trauma. The IADT has developed a consensus statement after a review of the dental literature and group discussions. Experienced researchers and clinicians from various specialties were included in the group. In cases where the data did not appear conclusive, recommendations were based on the consensus opinion of the IADT board members. The guidelines represent the current best evidence, based on literature research and professional opinion. As is true for all guidelines, the health care provider must apply clinical judgment dictated by the conditions present in the given traumatic situation. The IADT does not guarantee favorable outcomes from following the Guidelines.

Clinical examination

Detailed description of procedures such as clinical examination in the emergency situation and classification of injuries can be found in current textbooks.

Radiographic examination

As a routine, several projections and angles are recommended:

- 90º 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.

For more detailed information see current textbooks

Sensibility 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.

IADT Guidelines

Treatment guidelines for fractures of teeth and alveolar bone

- Uncomplicated crown fracture
- Complicated crown fracture
- Crown-root fracture
- Root fracture
- Alveolar fracture

Treatment guidelines for luxation injuries

- Concussion
- Subluxation
- Extrusive luxation
- Lateral luxation
- Intrusive luxation

Treatment for avulsed permanent teeth

- Avulsed tooth with a closed apex
- Avulsed tooth with an open apex

Treatment guidelines for fractures of teeth and alveolar bone

Uncomplicated crown fracture

Clinical findings	Radiographic findings	Treatment
• Fracture involves enamel or dentin and enamel; the pulp is not exposed. • Sensibility testing may be negative initially indicating transient pulpal damage; monitor pulpal response until a definitive pulpal diagnosis can be made	• The 3 angulations described in radiographic examination to rule out displacement or fracture of the root. • Radiograph of lip or cheek lacerations is recommended to search for tooth fragments or foreign material	• If tooth fragment is available, it can be bonded to the tooth. • Urgent care option is to cover the exposed dentin with a material such as glass ionomer or a permanent restoration using a bonding agent and composite resin. • Definitive treatment for the fractured crown may be restoration with accepted dental restorative materials

Complicated crown fracture

Clinical findings	Radiographic findings	Treatment
• Fracture involves enamel and dentin and the pulp is exposed. • Sensibility testing is usually not indicated initially since vitality of the pulp can be visualized. • Follow-up control visits after initial treatment includes sensibility testing to monitor pulpal status	• The 3 angulations described in radiographic examination to rule out displacement or fracture of the root. • Radiograph of lip or cheek lacerations is recommended to search for tooth fragments or foreign material. • The stage of root development can be determined from the radiographs	• In young patients with immature, still developing teeth, it is advantageous to preserve pulp vitality by pulp capping or partial pulpotomy. This treatment is also the choice in young patients with completely formed teeth. Calcium hydroxide and MTA (white) are suitable materials for such procedures. • In older patients, root canal treatment can be the treatment of choice, although pulp capping or partial pulpotomy may also be selected. • If too much time elapses between accident and treatment and the pulp becomes necrotic, root canal treatment is indicated to preserve the tooth. • In extensive crown fractures a decision must be made whether treatment other than extraction is feasible

Crown-root fracture

Clinical findings	Radiographic findings	Treatment
• Fracture involves enamel, dentin and root structure; the pulp may or may not be exposed. • Additional findings may include loose, but still attached, segments of the tooth • Sensibility testing is usually positive	• As in root fractures, more than one radiographic angle may be necessary to detect fracture lines in the root (see radiographic examination)	• Treatment recommendations are the same as for complicated crown fractures (see above). • In addition, attempts at stabilizing loose segments of the tooth by bonding may be advantageous, at least as a temporary measure, until a definitive treatment plan can be formulated

Root fracture

Clinical findings	Radiographic findings	Treatment
• The coronal segment may be mobile and may be displaced. • The tooth may be tender to percussion. • Sensibility testing may give negative results initially, indicating transient or permanent pulpal damage; monitoring the status of the pulp is recommended. • Transient crown discoloration (red or grey) may occur	• The fracture involves the root of the tooth and is in a horizontal or diagonal plane. Fractures that are in the horizontal plane can usually be detected in the regular 90˚ angle film with the central beam through the tooth. This is usually the case with fractures in the cervical third of the root. If the plane of fracture is more diagonal, which is common with apical third fractures, an occlusal view is more likely to demonstrate the fracture including those located in the middle third	• Reposition, if displaced, the coronal segment of the tooth as soon as possible. Check position radiographically. • Stabilize the tooth with a flexible splint for 4 weeks. • If the root fracture is near the cervical area of the tooth, stabilization is beneficial for a longer period of time (up to 4 months). • It is advisable to monitor healing for at least 1 year to determine pulpal status. • If pulp necrosis develops, root canal treatment of the coronal tooth segment to the fracture line is indicated to preserve the tooth

Alveolar bone fracture

Clinical findings	Radiographic findings	Treatment
• The fracture involves the alveolar bone and may extend to adjacent bone. • Segment mobility and dislocation are common findings. • An occlusal change due to misalignment of the fractured alveolar segment is often noted. • Sensibility testing may or may not be positive	• Fractures lines may be located at any level, from the marginal bone to the root apex. • The panoramic technique is of great help in determining the course and position of fracture lines	• Reposition any displaced segment and then splint. • Stabilize the segment for 4 weeks

Follow-up guidelines for fractures of teeth and alveolar bone

Time:	4 weeks	6–8 weeks	4 months	6 months	1 year	5 years
Uncomplicated crown fracture		C(1)			C(1)	
Complicated crown fracture		C(1)			C(1)	
Crown-root fracture		C(1)			C(1)	
Root fracture	S + C(2)	C(2)	S(*) + C(2)	C(2)	C(2)	C(2)
Alveolar fracture	S + C(3)	C(3)	C(3)	C(3)	C(3)	C(3)

S, splint removal.
S (*), splint removal in cervical third fractures.
C, clinical and radiographic examination.

Favorable and unfavorable outcomes include some, but not necessarily all of the following

	Favorable outcome	Unfavorable outcome
1	Asymptomatic; positive response to pulp testing; continuing root development in immature teeth. Continue to next evaluation	Symptomatic; negative response to pulp testing; signs of apical periodontitis; no continuing root development in immature teeth. Root canal treatment is indicated.
2	Positive response to pulp testing (false negative possible up to 3 months). Signs of repair between fractured segments. Continue to next evaluation	Negative response to pulp testing (false negative possible up to 3 months). Clinical signs of periodontitis. Radiolucency adjacent to fracture line. Root canal treatment is indicated only to the line of fracture
3	Positive response to pulp testing (false negative possible up to 3 months). No signs of apical periodontitis. Continue to next evaluation	Negative response to pulp testing (false negative possible up to 3 months). Signs of apical periodontitis or external inflammatory resorption. Root canal treatment is indicated

Treatment guidelines for luxation injuries

Concussion

Clinical findings	Radiographic findings	Treatment
• The tooth is tender to touch or tapping; it has not been displaced and does not have increased mobility. • Sensibility tests are likely to give positive results	• No radiographic abnormalities	• No treatment is needed. Monitor pulpal condition for at least 1 year

Subluxation

Clinical findings	Radiographic findings	Treatment
• The tooth is tender to touch or tapping and has increased mobility; it has not been displaced. • Bleeding from gingival crevice may be noted. • Sensibility testing may be negative initially indicating transient pulpal damage. Monitor pulpal response until a definitive pulpal diagnosis can be made	• Radiographic abnormalities are usually not found	• A flexible splint to stabilize the tooth for patient comfort can be used for up to 2 weeks

Extrusive luxation

Clinical findings	Radiographic findings	Treatment
• The tooth appears elongated and is excessively mobile. • Sensibility tests will likely give negative results. • In mature teeth, pulp revascularization may occur. In immature, not fully developed teeth, pulpal revascularization usually occurs	• Increased periodontal ligament space apically	• Reposition the tooth by gently re-inserting it into the tooth socket. • Stabilize the tooth for 2 weeks using a flexible splint. • Monitoring the pulpal condition is essential to diagnose root resorption. • In immature developing teeth, revascularization can be confirmed radiographically by evidence of continued root formation and pulp canal obliteration and usually return to response to sensibility testing. • In fully formed teeth, a continued lack of response to sensibility testing should be taken as evidence of pulp necrosis together with periapical rarification and sometimes crown discoloration

Lateral luxation

Clinical findings	Radiographic findings	Treatment
• The tooth is displaced, usually in a palatal/lingual or labial direction. It will be immobile and percussion usually gives a high, metallic (ankylotic) sound. • Sensibility tests will likely give negative results. • In immature, not fully developed teeth, pulpal revascularization usually occurs	• The widened periodontal ligament space is best seen on eccentric or occlusal exposures	• Reposition the tooth with forceps to disengage it from its bony lock and gently reposition it into its original location. • Stabilize the tooth for 4 weeks using a flexible splint. • Monitor the pulpal condition. If the pulp becomes necrotic, root canal treatment is indicated to prevent root resorption. In immature, developing teeth, revascularization can be confirmed radiographically by evidence of continued root formation and possibly by positive sensibility testing. In fully formed teeth, a continued lack of response to sensibility testing indicates pulp necrosis, along with periapical rarification and sometimes crown discoloration

Intrusive luxation

Clinical findings	Radiographic findings	Treatment
• The tooth is displaced axially into the alveolar bone. • It is immobile and percussion may give a high, metallic (ankylotic) sound. • Sensibility tests will likely give negative results. • In immature, not fully developed teeth, pulpal revascularization may occur	• The periodontal ligament space may be absent from all or part of the root	• <u>Teeth with incomplete root formation</u>: ○ Allow spontaneous repositioning to take place. If no movement is noted within 3 weeks, recommend rapid orthodontic repositioning. • <u>Teeth with complete root formation</u>: ○ The tooth should be repositioned either orthodontically or surgically as soon as possible. ○ The pulp will likely be necrotic and root canal treatment using a temporary filling with calcium hydroxide is recommended to retain the tooth

Follow-up procedures for luxated permanent teeth

	Up to 2 weeks	4 weeks	6–8 weeks	6 months	1 year	Yearly for 5 years
Concussion/Subluxation		C(1)	C(1)		C(1)	n/a
Extrusive luxation	S+C (2)	C(3)	C(3)	C(3)	C(3)	C(3)
Lateral luxation	C(3)	S	C(3)	C(3)	C(3)	C(3)
Intrusive luxation	C(4)		C(4)	C(4)	C(4)	C(4)

S, splint removal.
C, clinical and radiographic examination.
NA, not applicable.

Favorable and unfavorable outcomes include some, but not necessarily all of the following

	Favorable outcome	Unfavorable outcome
1	Asymptomatic; positive response to pulp testing (false negative possible up to 3 months); continuing root development in immature teeth; intact lamina dura	Symptomatic; negative response to pulp testing (false negative possible up to 3 months); no continuing root development in immature teeth, periradicular radiolucencies
2	Minimal symptoms; slight mobility; no excessive radiolucency periradicularly	Severe symptoms; excessive mobility; clinical and radiographic signs of periodontitis. Root canal treatment is indicated in a closed apex tooth. In immature teeth, apexification procedures are indicated
3	Asymptomatic; clinical and radiographic signs of normal or healed periodontium; positive response to pulp testing (false negative possible up to 3 months). Marginal bone height corresponds to that seen radiographically after repositioning	Symptoms and radiographic sign consistent with periodontitis; negative response to pulp testing (false negative possible up to 3 months); breakdown of marginal bone. Splint for additional 3- to 4- week period; root canal treatment is indicated if not previously initiated; chlorhexidine mouth rinse
4	Tooth in place or erupting; intact lamina dura; no signs of resorption. In mature teeth, start the root canal treatment within the first 3 weeks	Tooth locked in place/ankylotic tone; radiographic signs of apical periodontitis; external inflammatory resorption or replacement resorption

First aid for avulsed teeth

Dentists should always be prepared to give appropriate advice to the public about first aid for avulsed teeth. An avulsed permanent tooth is one of the few real emergency situations in dentistry. In addition to increasing the public awareness by, e.g. mass media campaigns, healthcare professionals, parents and teachers should receive information on how to proceed following these severe unexpected injuries. Also, instructions may be given by telephone to parents at the emergency site. If a tooth is avulsed, make sure it is a permanent tooth (primary teeth should not be replanted).

- Keep the patient calm.
- Find the tooth and pick it up by the crown (the white part). Avoid touching the root.
- If the tooth is dirty, wash it briefly (10 seconds) under cold running water and reposition it.
- Try to encourage the patient/parent to replant the tooth.
- Bite on a handkerchief to hold it in position.
- If this is not possible, place the tooth in a suitable storage medium, e.g. a glass of milk or in saline.
- The tooth can also be transported in the mouth, keeping it between the molars and the inside of the cheek. Avoid storage in water.
- Seek emergency dental treatment immediately.

Guidelines for the clinician

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:
    - 90º 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.

Treatment guidelines for avulsed permanent teeth

1. Tooth with a **closed apex**.
   a. The tooth has already been replanted.
   b. The 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.
   c. Extra-oral dry time longer than 60 min.

Avulsed permanent teeth – closed apex

Clinical situation	Treatment

Closed apex (1a) The 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 lacerations if 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 days at appropriate dose for patient age and weight). The risk 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 Phenoxymethyl 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, refer to physician for evaluation and need for a tetanus booster.
	• Initiate root canal treatment 7–10 days after replantation and before splint removal. Place calcium hydroxide as an intra-canal medicament until filling of the root canal.
	• Patient instructions:
	  • 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.
	• See Follow-up procedures for avulsed permanent teeth.

Closed apex (1b) The tooth has been kept in special storage media (Hank's Balanced Salt Solution), milk, saline, or saliva. The extraoral dry time is less than 60 minutes.	• If contaminated, clean the root surface and apical foramen with a stream of saline and place the tooth in saline.
	• 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.
	• 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 days at appropriate dose for patient age and weight). The risk 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 Phenoxymethyl 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, refer the patient to a physician for evaluation and need for a tetanus booster.
	• Initiate root canal treatment 7–10 days after replantation and before splint removal. Place calcium hydroxide as an intra-canal medicament until filling of the root canal.
	• Patient instructions
	  • 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.
	  • See Follow-up procedures for avulsed permanent teeth.

Avulsed permanent teeth – closed apex (continued)

Closed apex (1c) Extra-oral dry time longer than 60 min	• 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 is to promote 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 days later as for other replantations.
	  • 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% sodium fluoride solution for 20 min
	  • Replant the tooth slowly with slight digital pressure. Suture gingival laceration. Verify normal position of the replanted tooth clinically and radiographically.
	• Stabilize the tooth for 4 weeks using a flexible splint.
	• Administration of systemic antibiotics, see (1a).
	• Refer to physician for evaluation of need for a tetanus booster if the avulsed tooth has contacted soil or tetanus coverage is uncertain.
	• <u>Patient instructions</u>
	  • 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.
	  • See Follow-up procedures for avulsed permanent teeth.

Treatment guidelines for avulsed permanent teeth

2. Tooth with **open apex**
   a. The tooth has already been replanted
   b. The 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 minutes
   c. Extra-oral dry time longer than 60 minutes

Avulsed permanent teeth with open apex

Clinical situation	Treatment

Open apex (2a) The tooth has already been replanted prior to the patient arriving in the dental office or clinic.	• Clean the area with water spray, saline or chlorhexidine. Do not extract the tooth. Suture gingival lacerations if present. Verify normal position of the replanted tooth both clinically and radiographically. Apply a flexible splint for up to 2 weeks.
	• Administer systemic antibiotics. For children 12 years and younger: Penicillin V at an appropriate dose for patient age and weight.
	• Refer the patient to a physician for evaluation of need for a tetanus booster if avulsed tooth has contacted soil or if tetanus coverage is uncertain.
	• The goal for replanting still-developing (immature) teeth in children is to allow for possible revascularization of the tooth pulp. If that does not occur, root canal treatment may be recommended – See Follow-up procedures for avulsed permanent teeth.
	• Patient instructions
	  • 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.
	  • **See Follow-up procedures for avulsed permanent teeth.**

Open apex (2b) The tooth has been kept in special storage media (Hank's Balanced Salt Solution), milk, saline, or saliva. The extraoral dry time is less than 60 min	• 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 and then replant the tooth. If available, cover the root surface with minocycline hydrochloride microspheres (ArestinTM, OraPharma Inc, Warminster, PA, USA) before replanting the tooth.
	• 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 radiographically.
	• Apply a flexible splint for up to 2 weeks.
	• Administer systemic antibiotics. For children 12 years and younger: Penicillin V at appropriate dose for patient age and weight.
	• Refer to physician for evaluation of need for a tetanus booster if avulsed tooth has contacted soil or if tetanus coverage is uncertain.
	• The goal for replanting still-developing (immature) teeth in children is to allow for possible revascularization of the tooth pulp. If that does not occur, root canal treatment may be recommended – see Follow-up procedures for avulsed permanent teeth.
	• Patient instructions
	  • 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.
	  • See Follow-up procedures for avulsed permanent teeth.

Avulsed permanent teeth with open apex (continued)

Open apex (2c) Extra-oral dry time longer than 60 min	• **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.**
	• **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 through the open apex.**
	  • **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% sodium fluoride solution for 20 min**
	  • **Replant the tooth slowly with slight digital pressure. Suture gingival laceration. Verify normal position of the replanted tooth clinically and radiographically.**
	• **Stabilize the tooth for 4 weeks using a flexible splint.**
	• **Administration of systemic antibiotics, see (2a).**
	• **Refer the patient to a physician for evaluation of need for a tetanus booster if the avulsed tooth has contacted soil or tetanus coverage is uncertain.**
	• **Patient instructions**
	  • **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.**
	  • **See Follow-up procedures for avulsed permanent teeth.**

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 post replantation. 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 apexes, 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.

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.

Favorable outcome

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

(2) **Open apex**.
Asymptomatic, normal mobility, normal percussion sound
Radiographic evidence of arrested or continued root formation and eruption. Pulpcanal obliteration is the rule.

Unfavorable outcome

(1) **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)

(2) **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 tooth/bone fractures and luxated/avulsed teeth

2 Weeks	**Extrusive luxation** **Subluxation** **Avulsion**
4 Weeks	**Lateral luxation** **Root fracture (middle third)** **Alveolar fracture**
4 Months	**Root fracture (cervical third)**

IADT Guidelines - References:

Flores MT, Andersson L, Andreasen JO, Bakland LK, Malmgren, B, Barnett F, Bourguignon C, DiAngelis A, Hicks L, Sigurdsson A, Trope M, Tsukiboshi M, von Arx T.

Guidelines for the management of traumatic dental injuries. I. Fractures and luxations of permanent teeth. Dental Traumatology 2007; 23: 66–71

Guidelines for the management of traumatic dental injuries. II. Avulsion of Permanent Teeth. Dental Traumatology 2007; 23: 130–136

Injury Prevention
Depends on recognition of potential for injury and use of proper equipment and techniques
Protective equipment includes mouth guards, face masks, use of the proper helmet

Mouth Guards: Injury Reduction vs. Injury Prevention
Reduce / "Prevent" injuries to the teeth, soft tissue, support tissues; concussions?

Types of Mouth Guards:
1. Stock (one size fits all): not adjustable, bulky or loose; difficulty in breathing or speaking
2. Mouth formed: a) Shell / liner: better fit; outer shell bulky and not extended; liner can separate
b) Thermoplastic: better fit, coverage? Breathing / speaking better but still difficult
3. Custom: best fit, thin (2-4 mm) remains in place the best, best for speech and breathing, preferred

Fabrication of Custom-formed Mouth Guards:

Impression

- Choose a tray by approximating the size of the arch, then try-in, adjust if necessary
- Mix alginate with warmer water to speed the set; do not change ratio of water to powder
- Seat posterior of the tray first allowing the alginate to fill the vestibule as it pushes forward and pushes out air in front of it
- Be sure to allow the front of the tray to clear the anterior teeth by 3-4 mm
- Muscle trimmed, as a denture impression
- Palatal vents if desired
- Once impression is completed, label tray with player's name

Models

- Poured in dental stone, trimmed to expose extent of vestibule, open palate
- Remove positives, score cast at gingival margin (on tooth)
- Fill in all voids with block-out resin or stone
- Draw margins of mouth guard on cast to guide trimming
- Extend margins as far as possible without impinging on vestibule (minimum of 5 mm above the gingival margin)
- Trim extension over distal-most molar that was accurately captured in impression (minimum 1st molar)
- Always label casts, before and after trimming

Vacuforming (Pressure Lamination: follow manufacturer's instructions)

- ¼ – ½ -inch sag in heated material (depending on machine)
- Vacuum is on for 40 sec to 2 minutes (depending on machine)
- Carefully remove from vacuformer platform to avoid pulling mouth guard material away from the cast
- Place in cold water and allow to cool completely prior to trimming

Trimming

- Excess is trimmed with scissors
- Remaining borders trimmed with hot knife
- Extension over last present molar, can end 1/2-way over occlusal surface, (minimal extension over first molars)
- Border extends at least 3-5mm above the gingival margins
- Relieve muscle attachments

Finishing

- Contoured with acrylic burs (e-cutters)
- Polished with rag wheels or other polishers (optional)
- Flamed to round and smooth the borders