SELECTION REFERENCES: Surgical Endodontics continued


F: Management of Traumatic Dental Injuries

1. **Enamel Fracture (Uncomplicated Crown Fracture)**

   **Indications for Treatment**
   Treatment of enamel fracture is indicated if any of the following clinical conditions exist:
   a. Enamel fracture.
   b. Chipped enamel not involving underlying dentin.

   **Procedure**
   Enamel fractures usually require minimal treatment; chipped enamel can either be smoothed or repaired with bonded resin.

   **Objectives**
   a. To alleviate present and prevent future adverse clinical signs or symptoms.
   b. To establish an acceptable esthetic and functional tooth.

2. **Crown Fracture Without Pulp Exposure (Uncomplicated Crown Fracture)**

   **Indications for Treatment**
   Treatment of crown fracture involving enamel and dentin, but without direct exposure of the pulp, is indicated when both of the following clinical conditions exist:
   a. The crown fracture involves enamel and dentin with no pulp exposure.
   b. The pulp tests reveal no indication for endodontic treatment.

   **Procedure**
   In addition to restoring the esthetic aspect of the tooth, procedures for treating crown fractures without pulpal exposure are intended to protect the dentin and the underlying vital pulp. In immature teeth, continued root development may take place.

   **Objectives**
   a. To alleviate present and prevent future adverse clinical signs or symptoms.
   b. To establish an esthetic and functional tooth.
   c. To determine radiographic evidence of continued/complete root development in immature teeth.

3. **Crown Fracture With Pulp Exposure (Complicated Crown Fracture)**

   **Indications for Treatment**
   Treatment of crown fracture is indicated when both of the following clinical conditions exist:
   b. The pulp is vital.
Procedure
For immature teeth:
The purpose of treatment is to protect the pulp so that root development may continue to mature. Pulp capping or shallow pulpotomy procedures are indicated. A biologically acceptable material is placed directly in contact with the pulp to maintain the vitality and function of the remaining radicular portion of the pulp. A final restoration is placed. When the root reaches full maturation, nonsurgical root canal treatment and crown placement may be indicated.

For permanent (fully formed) teeth:
If a crown is not necessary for restoring the fractured tooth, it is acceptable to use pulp capping or shallow pulpotomy procedures followed by bonded composite resin or bonded fractured crown segment restorations, if carried out on teeth without clinical signs or symptoms of irreversible pulpitis and in a manner consistent with minimizing bacterial contamination. In any other case, nonsurgical root canal treatment is indicated. If the tooth requires a crown to restore function or esthetics, nonsurgical root canal treatment is an appropriate procedure prior to the crown placement.

Objectives
a. To alleviate present and prevent future adverse clinical signs or symptoms.
b. To place a radiopaque capping material in contact with the pulpal tissue.
c. To establish an acceptable esthetic and functional tooth.
d. To test pulps for vitality.
e. To maintain health and/or promote healing and repair of the periradicular supporting tissue.
f. To observe no resorptive defects or accelerated canal calcification as determined by periodic radiographic evaluation.
g. To promote sufficient root development for endodontic treatment. An increase in root length may be evident.

4. CROWN-ROOT FRACTURE

Indications for Treatment
Crown fracture involves enamel, dentin and cementum that may or may not involve the pulp.

Procedure
For immature teeth, the need for protecting the pulp is most important. Treatment, both immediate and definitive, is more complex and often requires innovative and unusual procedures.

Immature Teeth:
Immediate care. The purpose of treatment is to protect the pulp so that root development may continue. Pulp capping or shallow pulpotomy procedures are indicated. A biologically acceptable material is placed directly in contact with the pulp to maintain the vitality and function of the remaining radicular portion of the pulp. A final restoration is placed. When the root reaches full maturation, nonsurgical root canal treatment and crown placement may be indicated. In addition, soft tissue surgery to allow access to the fracture site may be necessary.

Definitive care. The same procedures as for crown fractures with pulp exposure are indicated.

Fully Formed Teeth:
Immediate and definitive care. Nonsurgical root canal treatment is indicated in most cases. Procedures to facilitate restorations may include, but are not limited to, surgical crown lengthening and root extrusion.

Objectives
a. To alleviate present and prevent future adverse clinical signs or symptoms.
b. To place a radiopaque capping material in contact with the pulpal tissue.
c. To establish an acceptable esthetic and functional tooth.
d. To maintain normal responsiveness to electrical and thermal pulp tests.
e. To maintain health and/or promote healing and repair of the periradicular supporting tissue.
f. To minimize resorptive defects or accelerated canal calcification as determined by periodic radiographic evaluation.
g. To promote sufficient root development for endodontic treatment. An increase in root length may be evident.

5. ROOT FRACTURE

Indications for Treatment
Root fracture involves cementum, dentin and pulp, and may be horizontal or oblique.

Procedure
In most cases, immediate care is directed toward reduction and stabilization of the fracture site.

Immediate care. Immediate care includes reduction and stabilization of the fracture site.

Definitive care. Definitive care is limited to periodic radiographic and clinical evaluations. If pulpal necrosis develops, root canal treatment is indicated.

If a root fracture occurs in the apical portion and pulpal necrosis results, the fractured segment may be removed surgically following/or in conjunction with nonsurgical root canal treatment. (See Section E-9)

If coronal tooth structure is lost apical to crestal bone, root extrusion or surgical crown lengthening may be indicated.
Objectives
- To alleviate present and prevent future adverse clinical signs or symptoms.
- To establish an acceptable esthetic and functional tooth.
- To observe radiographic evidence of continued/completed root formation in immature teeth.
- To observe radiographic evidence of root fracture repair (calcific, fibrous/fibrotic or bony).
- To establish minimal tooth mobility.

6. Luxation

Indications for Treatment
Luxation includes slight to severe injuries to teeth and their supporting structures.
- Concussion — Trauma resulting in sensitivity to percussion but no excessive mobility and no displacement.
- Subluxation — Injury to supporting tissues resulting in abnormal loosening of a tooth or teeth without displacement.
- Extrusive luxation — Partial axial displacement of the tooth out of its socket.
- Lateral luxation — Displacement of the tooth in a direction other than axially that can be accompanied by fracture of the alveolar socket.
- Intrusive luxation — Axial displacement of the tooth into the alveolus and can be accompanied by fracture of the alveolar socket.

Procedure
Immediate care. Includes repositioning the tooth and nonrigid stabilization, when needed, to allow re-establishment of periodontal ligament support for the tooth.

Definitive care. Includes nonsurgical root canal treatment in teeth with pulpal necrosis or irreversible pulpitis as determined by appropriate diagnostic procedures.

The treatment for immature teeth varies from fully formed teeth in that efforts must be attempted to allow revascularization of the immature pulps, while fully formed teeth can receive nonsurgical root canal treatment as soon as pulpal necrosis or irreversible pulpitis has been established. In the case of intruded immature permanent teeth with open apices, immediate care can appropriately consist of monitoring on a regular basis for re-eruption.

Objectives
- To alleviate present and prevent future adverse clinical signs or symptoms.
- To create the radiographic appearance of a well-obturated root canal system where the root canal filling extends as close as possible to the apical constriction of each canal. Gross overextension, underfilling in the presence of patent canals, ledges and perforations should be avoided.

7. Avulsion (Exarticulation)

Indications for Treatment
Treatment is indicated when a tooth is completely separated from its alveolus.

Procedure
Immediate care is directed toward timely replantation of the avulsed tooth. The patient should be referred to his or her physician to evaluate the need for a tetanus booster if the avulsed tooth has come into contact with soil or if tetanus coverage is uncertain.

- The following pertains to teeth with less than one hour of extra-oral dry time or teeth transported in an acceptable transport medium.

    Immediate care. Without compromising the root surface, rinse the tooth with sterile saline. Irrigate the tooth socket and gently replace the tooth into its normal position. Stabilize, if necessary, by splinting to adjacent teeth using a nonrigid splint; stabilize for the appropriate time to allow reattachment of periodontal ligament fibers. Systemic antibiotics are advisable.

    Definitive care. For immature teeth with wide open apices, pulpal revascularization may occur and definitive care consists of monitoring on a regular basis for evidence of pulpal revascularization and continued root formation. For immature teeth in which revascularization does not take place, apexification procedures are followed by nonsurgical root canal treatment.
For mature teeth, timely nonsurgical root canal treatment that includes intracanal procedures to minimize resorption is indicated following replantation. Primary teeth are not suitable for replantation.

- **The following pertains to teeth with greater than one hour of extra-oral dry time.**

**Immediate care.** Remove debris and necrotic periodontal ligament from the root surface, immerse the tooth in a sodium fluoride solution, flush the socket with saline to remove coagulum and gently replace the tooth into its normal position. Stabilize, if necessary, by splinting to adjacent teeth using a nonrigid splint; stabilize for the appropriate time to allow reattachment of periodontal ligament fibers. Systemic antibiotics are advisable. The patient should be referred to his or her physician to evaluate the need for a tetanus booster if the avulsed tooth has come into contact with soil or if tetanus coverage is uncertain.

**Definitive care.** For mature teeth, timely nonsurgical root canal treatment that includes intracanal procedures to minimize resorption is indicated following replantation.

Permanent teeth with immature apices and an extra-oral dry time of greater than one hour are not suitable for replantation.

**Objectives**

- To establish revascularization in teeth with immature root development.
- To achieve re-attachment of periodontal ligament fibers and establish a normal periodontal ligament space.
- To re-establish a fully functioning tooth.
- To alleviate present and prevent future adverse clinical signs or symptoms.
- To create the radiographic appearance of a well-obturated root canal system, as close as possible to the apical constriction of each canal. Gross overextension or underfilling in the presence of patent canals, ledges and perforations should be avoided.
- To maintain health and/or promote healing and repair of periradicular tissues:
  - If a tooth had a normal periodontal ligament space and an intact lamina dura surrounding the root(s) at the time of obturation, the subsequent postoperative radiographic appearance should remain unchanged after a suitable period of time for resolution of any transitory radiographic changes.
  - If the radiolucent area is decreasing in size or not enlarging and the tooth is asymptomatic, healing is considered to be incomplete, and additional follow-up visits with radiographic or digital radiographic images are indicated.
  - If a tooth had a preoperative periradicular radiolucency, the follow-up radiographs or digital radiographic images should optimally demonstrate an intact lamina dura and a normal periodontal ligament space around the root(s) under observation. There may be periradicular bone healing without reformation of a normal periodontal ligament space.
  - Periradicular surgery may become indicated.

**B. ALVEOLAR FRACTURE INVOLVING TEETH**

**Indications for Treatment**

Treatment is indicated when there is an alveolar fracture that involves the socket of the tooth.

**Procedure**

**Immediate care.** Requires reduction of the fractured alveolar segment and rigid splinting for an appropriate period of time.

**Definitive care.** Involves the evaluation of the pulpal status of the associated teeth and completing nonsurgical root canal treatment when indicated.

**Objectives**

- To achieve satisfactory healing of the alveolar fracture.
- To provide nonsurgical root canal treatment when indicated.

*(See the Recommended Guidelines of the American Association of Endodontists for the Treatment of Traumatic Dental Injuries for specific information.)*
**G. Intracoronal Bleaching**

**Indications for Treatment**

An intracoronal bleaching procedure is indicated for a tooth that has both of the following clinical conditions:

- The tooth is discolored from an internal source.
- Acceptable root canal treatment has been performed if possible.

**Procedure**

The intracoronal bleaching procedure uses oxidizing agents within the coronal portion of an endodontically treated tooth to remove tooth discoloration. Dental dam isolation is essential. The degree of restoration to a normal color and return of the coronal translucency is dependent upon the cause, severity and duration of the discoloration.

To reduce the potential for resorption, a cement barrier must be placed to minimize penetration of the oxidizing agent into dentinal tubules in the cervical area. The use of heat in combination with 30% hydrogen peroxide should be avoided.

**Objectives**

- To alleviate present and prevent future adverse clinical signs or symptoms.
- To reduce or eliminate discoloration.
- To improve the degree of translucency.
- To minimize potential resorption.