

Dental trauma

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Lecture outline

- ❑ Introduction
 - Epidemiology
 - Aetiology
- ❑ History and examination
 - Dental history
 - Medical history
 - Extra-oral examination
 - Intra-oral examination
 - Radiographic examination and photographic records
- ❑ WHO trauma classification
- ❑ Management of Injuries to dental tissues and pulp

Introduction

Epidemiology

- The oral region represents only 1% of the body's surface area.

YET:

- Injuries to the oral region account for 5% of all bodily injuries.
 - Dental injuries: 92%
 - Soft-tissue injuries: 28%
 - Jaw fractures: 6%
- The anterior teeth, especially the maxillary central incisors are most commonly affected.
- The annual cost of dental injury treatment is \$2–\$5 million per 1 million inhabitants.

Epidemiology

- ❑ The incidence of traumatic dental injuries in children is 1%–3%.
- ❑ The prevalence in the primary dentition is 30%.
- ❑ The prevalence in the permanent dentition is 20%.

Epidemiology

- Oral injuries are most frequent during the first 10 years of life.
- Preschool children: oral injuries make up 17% of all bodily injuries, with injuries to the head being the most common.
- Peak incidence for primary dentition is 2-4 years, and for permanent dentition is 7-10 years.
- Boys are affected twice as often as girls in both permanent and primary dentitions.

Aetiology

- ❑ In young children with primary dentition the majority of injuries occur due to falls in/around the home.
 - Due to poor coordination and judgment.
- ❑ In older children with permanent dentition, the majority of injuries are caused by falls while playing and running.
- ❑ In teenagers, sports are responsible for many of the trauma episodes.
- ❑ In adults, traffic accidents and assaults are a more prominent cause.

Aetiology

- ❑ Important! Don't forget non-accidental injury
 - More than 50% of those children will have orofacial injuries.

Aetiology

- ☐ Some people are more prone to dental injuries than others, due to a variety of factors.
- ☐ Those that had an episode of dental trauma are under higher-risk of having more episodes of trauma.

Risk factors

- ☐ Age: 2-4; 7-10 years.
- ☐ Gender: Male.
- ☐ Socioeconomic status: Deprived.

Risk factors

❑ Oral predisposing factors:

- Increased overjet.
- Inadequate lip closure.
- Anterior open bite.
- Those children are twice as likely to have a trauma incident.

Risk factors

❑ Human behaviour:

- Risk taking.
- Hyperactivity.
- emotionally stressful states.
- Bullying.
- Inappropriate use of teeth.

Risk factors

❑ Presence of illness, learning difficulties or physical limitations:

- Epilepsy.
- Cerebral palsy
- Learning difficulties
- Hearing and visual impairments.

Aetiology

❑ Dental trauma can be divided into two subtypes: direct, indirect.

- Direct trauma: the tooth itself is struck
 - Usually causes injuries to the anterior teeth.
- Indirect trauma: trauma to the chin/jaw causing the dental arches to forcefully close.
 - Usually causes crown and crown-root fractures in the molar and premolar regions
 - Can be associated with jaw fractures in the condylar regions and symphysis.

Aetiology

❑ The outcome of the injury is impacted by:

- Force of impact.
- Resilience of the impacting object.
- Shape of the impacting object.
- The and of direction of the impacting force.

History and Examination

Dental history

☐ When did the injury occur?

- Influences the prognosis for the injury.
- Impacts the clinical treatment decisions.

☐ Where did the injury occur?

- Possible contamination may require tetanus prophylaxis.
- May present legal implications for the patient.

Dental history

☐ How did the injury happen?

- Identification of the impact zones.
- Recognition of injury type expected.
- Discrepancy between history and clinical findings may raise suspicions of physical abuse.

☐ Was there a period of unconsciousness? If so, for how long?

- Amnesia, nausea and vomiting are all signs of brain damage and require medical attention.

Dental history

☐ Are there any lost teeth or fragments?

- History of lost tooth or fragment + loss of consciousness= a chest radiograph is necessary.

☐ Is there any disturbance in the bite?

- May indicate a luxation injury with displacement, an alveolar or jaw fracture or a fracture of the condylar region.

☐ Is there any reaction in the teeth to cold and/or heat exposure?

- indicates exposed dentin and/or pulp.

Dental history

☐ What is the previous dental history?

- Previous trauma might affect the response to pulpal sensibility testing and the recuperative capacity of the pulp and periodontium.
- Recurrent trauma might raise suspicion of child abuse.
- Previous treatment experience and attitudes towards dental treatment can affect the choice of treatment

Medical history

- Congenital heart disease
- History of rheumatic fever.
- Severe immunosuppression



➤ Might be a contraindication to endodontic treatment → consult the patient's paediatrician.

Medical history

- Bleeding disorders: very important if tissues are lacerated or extractions are planned
- Allergies: trauma management will sometimes require antibiotic administration.
- Tetanus immunization status: if wound contaminated and the child has not had a booster in the last five years referral for tetanus toxoid injection is necessary.

Extra-oral examination

- ☐ General examination including appearance, pulse and blood pressure.
- ☐ Examination of the face, lips and oral muscles for soft tissue lesions.
- ☐ Palpation of the facial skeleton for signs of fractures.

Extra-oral examination

- Signs of shock (pallor, cold skin, irregular pulse, hypotension) suggest severe injury (brain concussion, maxillofacial fractures).
- Facial swelling, bruises, lacerations may indicate underlying bony and tooth injuries.
- Limitation of mandibular movement or deviation indicate jaw fracture or dislocation.

Intra-oral examination

☐ Soft tissues:

- Record lacerations, haemorrhage, and swellings of the mucosa.
- Examine lacerations for tooth fragments and other foreign materials.

☐ Occlusion:

- Examine for displaced teeth and limitations in opening/closure.

Intra-oral examination

☐ Trauma site:

- Inspect the teeth in the trauma region for:
- Fractures: record teeth and tissues involved (enamel, dentine, pulp, root).
- Tooth displacement: record direction and severity, interference with occlusion.
- Mobility, both vertical and horizontal. (give grade 0-3).
- Response to percussion (vertical and horizontal).
- Colour: record any discoloration of teeth. Examine palatal surface of the gingival third of the crown.

Intra-oral examination

☐ Sensitivity testing:

- Warm gutta-percha
- Ethyl chloride cold test
- Electric pulp tester

- Not very reliable in children.
- A positive response doesn't rule out later pulpal necrosis.
- A negative response indicates pulpal damage but not necessarily necrosis.
- Negative response can be due to transient damage in the apical nerve supply, with normal blood supply.

Intra-oral examination

☐ Always test the contralateral tooth as a reference.

☐ DO NOT just examine the tooth with visually apparent trauma, all teeth in the trauma region should be examined.

Radiographic examination

- Multiple radiographs are needed to detect displacement of the tooth in its socket or the presence of root fractures.
- Periapical radiographs: at least two are needed to rule out root fracture
- Occlusal: especially helpful in detecting root fractures.
- Lateral obliques, lateral skull, AP skull, Occipitomental: in cases of suspected maxillofacial fractures

Radiographic examination

- In the presence of a penetrating lip lesion, a soft tissue radiograph is indicated in order to locate any foreign bodies.
- Place a dental film between the lips and the dental arch and use 25% of the normal exposure time.
- If foreign bodies are revealed, a lateral radiograph can be added (at 50% normal exposure time) to visualize the foreign bodies in relation to the cutaneous and mucosal surfaces of the lips.
- **Note:** The orbicularis oris muscles close tightly around foreign bodies in the lip, making them impossible to palpate.

Photographic records

- ❑ Photographic registration of the trauma is recommended, because:
 - It offers an exact documentation of the extent of injury.
 - It can be used later in treatment planning, legal claims or clinical research.

- Patient consent is required.

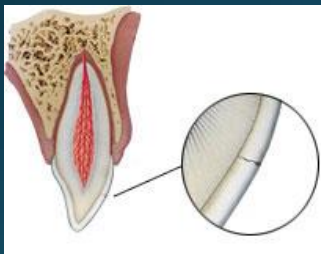
Classification (WHO)

Classification of dento-alveolar injuries.

- Injuries to dental tissues and pulp.
- Injuries to the periodontal tissues.
- Injuries to supporting bone.
- Injuries to gingiva and oral mucosa.

Injuries to dental tissues and pulp

- **Enamel infraction:** An incomplete fracture (crack) of the enamel without loss of tooth structure.



Injuries to dental tissues and pulp

☐ Enamel infraction – diagnosis:

Test	Finding
Visual examination	Visible fracture line on the surface of the tooth
Mobility test	Normal mobility
Percussion test	No tenderness, normal percussion sound.
Sensibility pulp test	Usually positive. Negative result at the initial examination indicates an increased risk of pulp necrosis later

Injuries to dental tissues and pulp

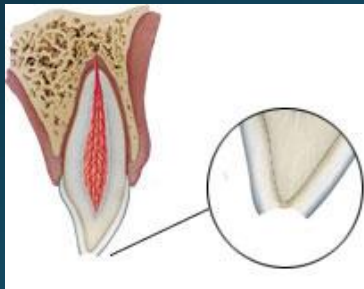
☐ Enamel infraction – radiography:

- Only a periapical view is needed unless other symptoms are present.
- No radiographic abnormalities



Injuries to dental tissues and pulp

- **Enamel fracture:** A fracture confined to the enamel with loss of tooth structure.



Injuries to dental tissues and pulp

□ Enamel fracture – diagnosis:

Test	Finding
Visual examination	Visible loss of enamel. No visible sign of exposed dentin.
Mobility test	Normal mobility
Percussion test	No tenderness, normal percussion sound.
Sensibility pulp test	Usually positive. Negative result at the initial examination indicates an increased risk of pulp necrosis later

Injuries to dental tissues and pulp

□ Enamel fracture – radiography:

- The enamel loss is visible.
- Periapical, occlusal and eccentric exposures recommended in order to rule out the possible presence of a root fracture or a luxation injury.



Injuries to dental tissues and pulp

- **Uncomplicated Enamel-dentin fracture:** A fracture confined to enamel and dentin with loss of tooth structure, but not involving the pulp.



Injuries to dental tissues and pulp

□ Uncomplicated Enamel-dentin fracture – diagnosis:

Test	Finding
Visual examination	Visible loss of enamel and dentin. No visible sign of exposed pulp tissue.
Mobility test	Normal mobility.
Percussion test	No tenderness, normal percussion sound.
Sensibility pulp test	Usually positive. Negative result at the initial examination indicates an increased risk of pulp necrosis later

Injuries to dental tissues and pulp

□ Uncomplicated Enamel-dentin fracture – radiography:

- The enamel-dentin loss is visible.
- Periapical, occlusal and eccentric exposure recommended to rule out displacement or root fracture.
- Radiograph of lip or cheek lacerations to search for tooth fragments or foreign material



Injuries to dental tissues and pulp

- **Complicated Enamel-Dentin fracture:** fracture involving enamel and dentin with loss of tooth structure and exposure of the pulp.



Injuries to dental tissues and pulp

□ Complicated Enamel-Dentin fracture – diagnosis:

Test	Finding
Visual examination	Visible loss of enamel and dentin and exposed pulp tissue.
Mobility test	Normal mobility.
Percussion test	No tenderness, normal percussion sound.
Sensibility pulp test	Usually positive. Negative result at the initial examination indicates an increased risk of pulp necrosis later

Injuries to dental tissues and pulp

□ Uncomplicated Enamel-dentin fracture – radiography:

- The enamel-dentin loss with pulp exposure is visible.
- Periapical, occlusal and eccentric exposure recommended to rule out displacement or root fracture.
- Radiograph of lip or cheek lacerations to search for tooth fragments or foreign material



Injuries to dental tissues and pulp

- **Uncomplicated crown-root fracture:** A fracture involving enamel, dentin and cementum with loss of tooth structure, but not exposing the pulp.



Injuries to dental tissues and pulp

□ Uncomplicated crown-root fracture – diagnosis:

Test	Finding
Visual examination	Crown fracture extending below gingival margin.
Mobility test	Coronal fragment is mobile.
Percussion test	Tender.
Sensibility pulp test	Usually positive for apical fragment.

Injuries to dental tissues and pulp

□ Uncomplicated crown-root fracture – radiography:

- Apical extension of fracture usually not visible.
- Periapical, occlusal and eccentric exposures recommended in order to detect fracture lines in the root.
- A cone beam exposure can reveal the whole fracture extension.



Injuries to dental tissues and pulp

- **Complicated crown-root fracture:** A fracture involving enamel, dentin, and cementum with loss of tooth structure, and exposure of the pulp.



Injuries to dental tissues and pulp

□ Complicated crown-root fracture – diagnosis:

Test	Finding
Visual examination	Crown fracture extending below gingival margin.
Mobility test	Coronal fragment is mobile.
Percussion test	Tender.
Sensibility pulp test	Usually positive for apical fragment.

Injuries to dental tissues and pulp

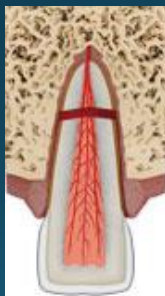
❑ Complicated crown-root fracture – radiography:

- Apical extension of fracture usually not visible.
- Periapical, occlusal and eccentric exposures recommended in order to detect fracture lines in the root.
- A cone beam exposure can reveal the whole fracture extension.



Injuries to dental tissues and pulp

- **Root fracture:** A fracture confined to the root of the tooth involving cementum, dentin, and the pulp.



Injuries to dental tissues and pulp

☐ Root fracture – diagnosis:

Test	Finding
Visual examination	Transient crown discoloration (red or grey) may occur. Bleeding from the gingival sulcus may be noted.
Mobility test	Coronal segment may be mobile and in some cases displayed.
Percussion test	Tooth may be tender.
Sensibility pulp test	Usually negative except for teeth with minor displacements. A positive sensibility test at the initial examination indicates a significantly reduced risk of later pulp necrosis.

Injuries to dental tissues and pulp

☐ Root fracture – radiography:

- Fracture line is usually visible.
- Periapical, occlusal and eccentric exposures.
- An occlusal exposure is optimal for locating root fractures in the apical and middle third.
- Bisecting angle exposure or 90° degree angulation exposure is needed to locate the fractures in the cervical third of the root.



Injuries to the periodontal tissues

- Concussion: An injury to the tooth-supporting structures without increased mobility or displacement of the tooth, but with pain to percussion.



Injuries to the periodontal tissues

□ Concussion – diagnosis:

Test	Finding
Visual examination	No signs.
Mobility test	Normal mobility.
Percussion test	Tooth is tender. Normal percussion sound.
Sensibility pulp test	Usually a positive result. A negative result at the initial examination indicates a significantly increased risk of later pulp necrosis.

Injuries to the periodontal tissues

☐ Concussion – radiography:

- No radiographic abnormalities, the tooth is in-situ in its socket.
- Periapical, occlusal and eccentric exposures to rule out displacement or root fracture.



Injuries to the periodontal tissues

- **Subluxation:** An injury to the tooth supporting structures resulting in increased mobility, but without displacement of the tooth. Bleeding from the gingival sulcus confirms the diagnosis.



Injuries to the periodontal tissues

☐ Subluxation – diagnosis:

Test	Finding
Visual examination	Bleeding from the gingival sulcus. Tooth not displaced
Mobility test	Increased mobility.
Percussion test	Tooth is tender. Dull percussion sound.
Sensibility pulp test	Positive result in half of the cases. A negative result at the initial examination indicates a significantly increased risk of later pulp necrosis.

Injuries to the periodontal tissues

☐ Subluxation – radiography:

- Usually no radiographic abnormalities.
- Periapical, occlusal and eccentric exposures to rule out displacement or root fracture.



Injuries to the periodontal tissues

- Extrusion: Partial displacement of the tooth out of its socket.



Injuries to the periodontal tissues

□ Extrusion – diagnosis:

Test	Finding
Visual examination	Tooth appears elongated, displaced vertically out of its socket.
Mobility test	Increased mobility.
Percussion test	Tooth is tender. Dull percussion sound.
Sensibility pulp test	Usually negative except in minor displacement cases.

Injuries to the periodontal tissues

☐ Extrusion – radiography:

- Increased periapical ligament space apically.
- Periapical, occlusal and eccentric exposures to confirm diagnosis and rule out root fracture.



Injuries to the periodontal tissues

- **Lateral luxation:** Displacement of the tooth *other than axially*. Displacement is accompanied by comminution or fracture of either the labial or the palatal/lingual alveolar bone.



Injuries to the periodontal tissues

❑ Lateral luxation:

- Complicated by fracture of either the labial or the palatal/lingual alveolar bone and a compression zone in the cervical and sometimes the apical area.
- If both sides of the alveolar socket have been fractured, the injury should be classified as an alveolar fracture.

Injuries to the periodontal tissues

❑ Lateral luxation – diagnosis:

Test	Finding
Visual examination	Tooth is displaced, usually in a palatal/lingual or labial direction.
Mobility test	Decreased mobility.
Percussion test	Tooth gives a high metallic sound. Not necessarily tender.
Sensibility pulp test	Usually negative except in minor displacement cases.

Injuries to the periodontal tissues

☐ Lateral luxation – radiography:

- Widened periapical ligament space best seen on occlusal or eccentric exposures.
- Periapical, occlusal and eccentric exposures.



Injuries to the periodontal tissues

- **Intrusion:** Displacement of the tooth *into* the alveolar bone. This injury is accompanied by comminution or fracture of the alveolar socket.



Injuries to the periodontal tissues

- Intrusion – diagnosis:

Test	Finding
Visual examination	The tooth is displaced axially into the alveolar bone, appears shorter.
Mobility test	Decreased mobility.
Percussion test	Tooth is tender. High metallic sound.
Sensibility pulp test	Usually negative.

Injuries to the periodontal tissues

- Intrusion – radiography:

- The periodontal ligament space may be absent from all or part of the root.
- The cemento-enamel junction is located more apically in the intruded tooth than in adjacent non-injured teeth, at times even apical to the marginal bone level.



Injuries to the periodontal tissues

☐ Intrusion – radiography:

- Occlusal, periapical exposure and lateral view from the mesial or distal aspect of the tooth in question.
- If the tooth is totally intruded a lateral exposure is indicated to make sure the tooth has not penetrated the nasal cavity.

Injuries to the periodontal tissues

- **Avulsion:** The tooth is completely displaced *out* of its socket. Clinically the socket is found empty or filled with a coagulum.



Injuries to the periodontal tissues

- Avulsion – diagnosis:

Test	Finding
Visual examination	The tooth is completely removed from its socket.
Mobility test	Not applicable.
Percussion test	Not applicable.
Sensibility pulp test	Not applicable.

Injuries to the periodontal tissues

- Avulsion – radiography:
- If the visual appearance of the injury raises suspicion of a possible intrusion, root fracture, alveolar fracture or jaw fracture an occlusal radiograph should be taken to confirm the diagnosis.

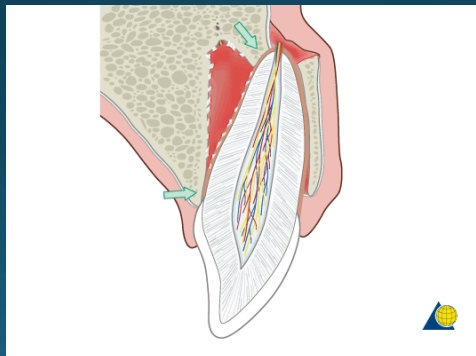


Injuries to supporting bone

- **Communion of alveolar socket wall:** crushing and compression of alveolar socket associated with lateral luxation and intrusion injuries.

Injuries to supporting bone

- **Fracture of alveolar socket wall:** fracture confined to labial or lingual/palatal socket wall. (associated with lateral luxation)



Injuries to supporting bone

- **Alveolar fracture:** A fracture of the alveolar process; may or may not involve the alveolar socket.



Injuries to supporting bone

□ Alveolar fracture - diagnosis:

Test	Finding
Visual examination	Displacement of an alveolar segment. An occlusal change due to misalignment of the fractured alveolar segment is often noted.
Mobility test	Entire segment mobile and moves as a unit.
Percussion test	Tender
Sensibility pulp test	Usually negative.

Injuries to supporting bone

❑ Alveolar fracture – radiography:

- The vertical line of the fracture may run along the PDL or in the septum.
- The horizontal line may be located at any level, from the marginal bone to the basal bone.
- An associated root fracture may be present.



Injuries to supporting bone

- Alveolar fracture – radiography:
- Occlusal, periapical and eccentric exposure. A panoramic or a cone beam exposure may be useful.

Injuries to supporting bone

- **Jaw fracture:** A fracture involving the base of the mandible or maxilla and often the alveolar process. The fracture may or may not involve the alveolar socket.



Injuries to supporting bone

□ Jaw fracture – diagnosis:

Test	Finding
Visual examination	Displacement of an alveolar segment. An occlusal change due to misalignment of the fractured segment is often noted.
Mobility test	Mobility along the fracture line.
Percussion test	Tender.
Sensibility pulp test	Might be positive or negative, depending on fracture site.

Injuries to supporting bone

□ Jaw fracture – radiography:

- The vertical line of the fracture line may run along the PDL or in the septum.
- Periapical and panoramic exposure.
- Supplementary exposures are necessary according to fracture location.
- Cone beam exposure may be of value.



Injuries to gingiva and oral mucosa

- Laceration of gingiva or mucosa: mucosal/gingival wound or tear



Injuries to gingiva and oral mucosa

- Contusion of gingiva or mucosa: bruise not accompanied by a break in the mucosa. Usually associated with submucosal haemorrhage.



Injuries to gingiva and oral mucosa

- Abrasion of gingiva or mucosa: superficial wound produced by rubbing or scraping the mucosal surface

Management of Injuries to dental tissues and pulp

General aims and principles of trauma management

- 1. Emergency:
 - Retain vitality of tooth.
 - Treat exposed pulp tissues.
 - Reduce and immobilize displaced teeth.
 - Antiseptic mouthwash +/- antibiotic and tetanus prophylaxis.

General aims and principles of trauma management

■ 2. Intermediate:

- Pulp therapy if needed.
- Minimally invasive crown restoration.

General aims and principles of trauma management

□ 3. Permanent:

- Apexogenesis/Apexification
- RCT + root extrusion.
- Gingival and alveolar modification.
- Permanent coronal restoration.

Enamel infraction

➤ Treatment:

- In case of marked infractions, etching and sealing with resin to prevent discoloration of the infraction lines.
- Otherwise no treatment is necessary.

➤ **Follow up:** Not needed except if associated with other injuries.

➤ **Prognosis:** Usually very good.

Enamel fracture

➤ Treatment:

Depends on extent and location of fracture and the presence of fracture fragment.

- Smoothen sharp enamel edges if necessary.
- Restore with composite resin.
- If fragment is available it can be bonded to the tooth.

Enamel fracture

- **Follow up:** Clinical and radiographic at 6-8 weeks and after 1 year.
- **Prognosis:** Generally very good.

Uncomplicated enamel-dentin fracture

➤ **Treatment:**

1. Emergency treatment:

- Clean the injury area with water, saline or chlorhexidine.
- Disinfect fracture with sodium hypochlorite or chlorhexidine.
- Provide emergency GI or resin bandage on fracture area to protect exposed dentine.

If the fracture is too large, consider using an ortho-band to hold GI bandage.

Uncomplicated enamel-dentin fracture

2. Definitive treatment:

Composite restoration

Or

Fragment reattachment

How to reattach a tooth fragment?

1. Confirm pulp vitality.
2. Check fragment fit.
3. Clean fragment with pumice and water.
4. Isolate tooth with rubber dam
5. Attach fragment to a piece of sticky wax to ease handling
6. Etch enamel for 30 seconds on both fracture surface. Wash and dry
7. Apply bonding agent + primer to both surfaces and light cure.
8. Place appropriate composite shade to both surfaces and position fragment
9. Remove excess, light cure, and finish and polish restoration

How to reattach a tooth fragment?

10. Remove a 1mm gutter of enamel on the fracture line palatally and labially to a depth of 0.5 mm using a small round bur. The finish line should be irregular to increase retention.

11. Etch, wash, dry, apply composite, cure and finish.

How to reattach a tooth fragment?



Uncomplicated enamel-dentin fracture

- **Follow up:** clinical and radiographic at 6-8 weeks and 1 year.
- **Prognosis:** Generally very good. A few teeth (less than 5%) can lose vitality.

Complicated enamel-dentin fracture

- **The major aim of treatment in immature teeth is to preserve pulp vitality and allow continued root growth.**
- **Treatment:**
 - Direct pulp capping with CaOH or MTA. (only if injury happened less than 24 hours ago)
 - Partial Pulpotomy.
- If the apex is closed and the injury is associated with luxation and displacement, root canal treatment is usually the treatment of choice.

Complicated enamel-dentin fracture

➤ **Follow up:** Clinical and radiographic control at 6-8 weeks and 1 year.

- In open apex teeth, monitor:
 - Root growth in length.
 - Narrowing of root canal.

➤ **Prognosis:** Generally good, especially when apex is open.

Uncomplicated crown-root fracture

➤ **Treatment:**

☐ Emergency:

- Temporary stabilization of a loose segment to adjacent teeth can be performed until a definitive treatment plan is made.
- Soft food for 1 week.
- Brushing with a soft brush and rinsing with chlorhexidine 0.1 % is beneficial to prevent accumulation of plaque and debris.

Uncomplicated crown-root fracture

□ Definitive treatment:

1. Removal of a superficial coronal crown-root fragment and subsequent restoration of exposed dentin above the gingival level.

**For superficial fractures, easiest to perform.*

1. Removal of coronal fragment with subsequent endodontic treatment and gingivectomy (sometimes ostectomy).

**Indicated in crown-root fractures with palatal subgingival extension. (where esthetics won't be impaired)*

Uncomplicated crown-root fracture

3. Removal of the coronal segment with subsequent endodontic treatment and orthodontic extrusion of the remaining root.

**There needs to be sufficient length after extrusion to support a post-retained crown.*

**Time consuming with late completion of final restoration.*



Uncomplicated crown-root fracture

4. Removal of the mobile fractured fragment with subsequent surgical repositioning of the root in a more coronal position.

**A rotation of the root (90 or 180) may offer a better position for periodontal ligament healing because the fracture site becomes exposed labially and thereby more periodontal ligament can be saved.*

**Some risk of root resorption and marginal breakdown of periodontium.*

Uncomplicated crown-root fracture

5. Decoronation (Root submergence).

**Implant solution is planned, the root fragment may be left in situ after in order to avoid alveolar bone resorption and thereby maintaining the volume of the alveolar process for later optimal implant installation.*

6. Extraction with immediate or delayed implant-retained crown restoration or a conventional bridge.

**Extraction is inevitable crown-root fractures with a severe apical extension, the extreme being a vertical fracture.*

Uncomplicated crown-root fracture

- **Follow-up:** clinical and radiographic after 6-8 weeks and 1 year.
- **Prognosis:** depends on root development, injury severity and treatment modality.

Complicated crown-root fracture

➤ **Treatment:**

☐ **Emergency:**

- Temporary stabilization of a loose segments to adjacent teeth.
- In patients with open apices, it is advantageous to preserve pulp vitality by a partial pulpotomy. This treatment is also the choice in young patients with completely formed teeth.



Complicated crown-root fracture

□ Definitive treatment:

- Similar to options available in uncomplicated crown-root fracture

Root fracture

➤ **Treatment:**

- Rinse exposed root surface with saline before repositioning.
- If displaced, reposition the coronal segment of the tooth as soon as possible.
- Check that correct position has been reached radiographically.

Root fracture

- Stabilize the tooth with a **flexible splint** for **4 weeks** in **apical** third and **mid-root** fractures. 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**).



Root fracture

- Advise soft diet for 1 week.
- Advise brushing with a soft brush and rinsing with chlorhexidine 0.1% for 1 week.

Root fracture

➤ Follow up:

- Clinical and radiographic control after 6-8 weeks, 4 months, 6 months, 1 year and yearly for 5 years.
- Follow-up may include endodontic treatment of the coronal fragment if pulp necrosis develops.

Root fracture

- The decision for endodontic treatment may be taken after three months of follow-up if the tooth still does not respond to electrometric or thermal pulp testing and if radiographs show a radiolucency next to the fracture line.
- **Prognosis:** Generally moderate. Depends on root development and injury location and severity.

Thank you