Dental trauma in children
Injuries involving periodontal tissues

Trauma 2
PEDO 5DM
Injuries involving periodontal tissues –
(Injuries to the tooth supporting tissues)

Andreasen

- Concussion
- Subluxation
- Intrusion – Intrusive luxation
- Extrusion – Extrusive luxation
- Luxation – Lateral luxation
- Avulsion

IADT CLASSIFICATION describes the nature of the injury and treatment requirements
Injuries involving periodontal tissues

PERMANENT TEETH
Concussion

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

Subjectively: paresthesia and feeling of the tooth higher than others (supraocclusion)
- generated by light strike to the mouth/teeth
- oedema in the periodontal space
Concussion

Clinical picture (CP)

- Not displaced.
- Percussion test - Tender to touch or tapping.
- Mobility test - No increased mobility.
- Pulp sensibility test - Usually a positive result. The test is important in assessing future risk of healing complications. A lack of response to the test indicates an increased risk of later pulp necrosis.
- RTG - No radiographic abnormalities, the tooth is in-situ in its socket.
Concussion

Treatment
- Exclude from articulation
- Monitor pulpal condition for at least 1 year.

Patient instructions
- Soft food for 7-10 days.
- Good healing following an injury to the teeth and oral tissues depends, in part, on good oral hygiene. Brushing with a soft brush and rinsing with chlorhexidine 0.1 % is beneficial to prevent accumulation of plaque and debris.

Follow-up
- Clinical and radiographic control at 4 weeks, 6-8 weeks and 1 year.

Complications
- Necrosis of dental pulp
Subluxation

- An injury to the tooth supporting structures of higher degree resulting in increased mobility, but without displacement of the tooth.

- Subj.: pain at bite
Subluxation

CP

- Not displaced.
- Bleeding from the gingival sulcus
- Percussion test - Positive, dull sound. Tender to touch or tapping.
- Increased mobility (1st degree).
- Sensibility testing may be negative initially indicating transient pulpal damage.

A lack of response at the initial test indicates an increased risk of later pulp necrosis.

- RTG – slightly widened periodontal ligament space.
Subluxation – TH:

- Clean the area with water spray/saline/chlorhexidine.
- Suture gingival lacerations if present.
- In case of pain on occlusion exclude the tooth from occlusion.
- Apply flexible splint for 2 weeks.
Subluxation

Patient instructions

- Soft food for 2 weeks. (until splint removal)
- Brushing with a soft brush and rinsing with chlorhexidine 0.1 %

Follow-up

- Clinical and radiographic control at 4 weeks, 6-8 weeks and 1 year.
- Endodontic treatment may be taken after 3 months if tooth is non-vital
Extrusion – extrusive luxation

- An injury to the tooth characterized by partial or total separation of the periodontal ligament resulting in loosening and displacement of the tooth.
- The alveolar socket bone is intact in an extrusion injury as opposed to a lateral luxation injury.
- Apart from axial displacement, the tooth will usually have an element of protusion or retrusion. In severe extrusion injuries the retrusion/protrusion element can be very pronounced.
Extrusion – extrusive luxation

CP:
- Appears elongated – in supraocclusion
- Percussion test - Tender.
- Mobility test - Excessively mobile (2nd-3rd degree)
- Tooth springy when pressed in the pocket (due to hematoma)
- Sensibility test - Usually lack of response except for teeth with minor displacements.
- In immature, not fully developed teeth, pulpal revascularization usually occurs.
- In mature teeth pulp revascularization sometimes occurs.

RTG - Increased periapical ligament space in apical region.
Radiographs - periapical exposure and view from the mesial or distal aspect of the tooth.
The exposed root surface of the displaced tooth is cleansed with saline before repositioning.

Reposition the tooth by gently re-inserting it into the tooth socket with axial digital pressure (local anesthesia is usually not necessary).

Stabilize the tooth for 2 weeks using a flexible splint (composite or wire and composite).

Monitoring the pulpal condition is essential to diagnose associated root resorption.
Extrusion – extrusive luxation

Patient instructions
- Soft food for 2 weeks.
- Good oral hygiene, brushing with a soft brush and rinsing with chlorhexidine 0.1 %

Follow-up
- Clinical and radiographic control and splint removal after 2 weeks.
- Clinical and radiographic control at 4 weeks, 6-8 weeks, 6 months, and 1 year
Extrusion – extrusive luxation

- Open apex: Revascularization can be confirmed radiographically by evidence of continued root formation and pulp canal obliteration and usually a return to a positive pulp response to sensibility testing. (wait 3 months)

- Closed apex: A continued lack of pulp response to sensibility testing should be taken as evidence of pulp necrosis together with periapical rarefaction and sometimes crown discoloration – endo th after 4 weeks if nonvital
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.

Lateral luxation injuries, similar to extrusion injuries, are characterized by partial or total separation of the periodontal ligament. However, lateral luxations are 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 (alveolar fractures rarely affect only a single tooth). In most cases of lateral luxation the apex of the tooth has been forced into the bone by the displacement, and the tooth is frequently non-mobile.
Lateral luxation

CP:
- Displaced, usually in a palatal/lingual or labial direction.
- Percussion test - Usually gives a high metallic (ankylosis) sound.
- Mobility test - Usually immobile.
- Sensibility tests will likely give a lack of response except for teeth with minor displacements. (transient non-vital)
- A positive result at the initial examination indicates a reduced risk of future pulp necrosis.
- RTG - Widened periapical ligament space (mostly apical region) best seen on occlusal or eccentric.
Lateral luxation

- Treatment objective - to reposition and splint a displaced tooth to facilitate pulp and periodontal ligament healing.
Lateral luxation - TH

- Rinse the exposed part of the root surface with saline before repositioning.
- Apply a local anesthesia
- Reposition the tooth with forceps or with digital pressure 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. 4 weeks is indicated due to the associated bone fracture.
- Monitoring the pulpal condition is essential to diagnose root resorption. If the pulp becomes necrotic, root canal treatment is indicated to prevent infection related root resorption.

- Complications – root resorption, necrosis, gangrene, obliteration
Lateral luxation

Splint removal
- After the fixation period (4 weeks) resin can be removed.
- If composite is used it should be removed with a bur.
- The tooth must be supported with digital pressure during this procedure.

Patient instructions
- Soft food for 4 weeks.
- Oral hygiene - brushing with a soft brush
- Rinsing with chlorhexidine 0.1 %

Follow-up
- Clinical and radiographic control after 2 weeks.
- Clinical and radiographic control and splint removal after 4 weeks.
- Clinical and radiographic control at 6-8 weeks, 6 months, 1 year and yearly for 5 years.
Lateral luxation

- IPT - revascularization can be confirmed radiographically by evidence of continued root formation, initiation of pulp canal obliteration and usually a return to a positive response to sensibility testing (3-6 months).

- Fully formed teeth - a continued lack of response to sensibility testing (exceeding 3 months) should be taken as evidence of pulp necrosis together with periapical radiolucency and sometimes crown discoloration – perform endo th
Intrusion – intrusive luxation

- Displacement of the tooth into the alveolar bone.
- This injury is accompanied by comminution or fracture of the alveolar socket.
- Force (strike) on the tooth in the direction of long axis of the tooth
- Intrusion – total, partial
Intrusion - CP

- The tooth is displaced axially into the alveolar bone.
- Percussion test - Usually gives a high metallic (ankylosis) sound.
- The tooth is immobile.
- Sensibility test - Lack of response except in rare cases, for teeth with minor displacements.

The test is important in assessing risk of healing complications. If the result is positive at the initial examination the tooth will have a significantly reduced risk of pulp necrosis.

In immature, not fully developed teeth, pulpal revascularization may occur.

Radiographic findings
- The periodontal ligament space may be absent from all or part of the root.

Radiographs recommended:
- As a routine: 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.
Intrusion – TH

Common for all treatments
- Endodontic treatment can prevent the necrotic pulp from initiating infection-related root resorption. This treatment should be considered in all cases with completed root formation where the chance of pulp revascularization is unlikely. Endodontic therapy should preferably be initiated within 3-4 weeks post-trauma.

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<thead>
<tr>
<th>AGE</th>
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<th>REPOSITION</th>
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<tbody>
<tr>
<td>Intrusion</td>
<td>Spontaneous reeruption</td>
<td>orthodontic</td>
</tr>
<tr>
<td>Opened apex</td>
<td>6 - 11</td>
<td>&lt; 7 mm</td>
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Intrusion – TH

- Tooth intrusion is associated with a potential risk of tooth loss due to progressive root resorption (ankylosis or infection related resorption).

- 3 methods of TH:

**Spontaneous eruption**
- This is the treatment of choice for deciduous/primary teeth and for permanent teeth with incomplete root formation. This treatment has been shown to lead to significantly fewer healing complications than orthodontic and surgical repositioning.

**Orthodontic repositioning**
- This treatment may be preferred for patients with closed apex or coming in for delayed treatment. This treatment method enables repair of marginal bone in the socket along with the slow repositioning of the tooth (4 weeks).

**Surgical repositioning**
- This treatment technique is preferable in the acute phase. Intrusion with major dislocation of the tooth (approximately more than half a crown length) may be an indication for surgical repositioning.
Intrusion – TH

- Surgical repositioning procedure:
  1. Clean the area
  2. Reposition of the tooth with forceps
  3. Manual reposition of bone
  4. Flexible splint for 4 weeks

More frequent late complications in this method then after orthodontic reposition.
Intrusion – TH

Endodontic treatment
- in all cases of closed apex (finished development of root
- prevention of inflammatory root resorption after trauma
- initiation of treatment within 3 – 4 weeks after trauma, before splint removal
- treatment is started with temporary filling of root canal with Ca(OH)2
- definitive root filling after stabilisation of tooth in the new position
Intrusion

Patient instructions
- squashed food for 1 week, soft food for the whole period with splint 4 weeks.
- good oral hygiene.
- brushing with a soft brush
- rinsing with chlorhexidine 0.1 %

Follow-up
- Clinical control after 2 weeks.
- Clinical and radiographic control and splint removal after 4 weeks.
- Clinical and radiographic control at 6-8 weeks, 6 months, 1 year and yearly for 5 years.
Avulsion

- Most severe type of trauma involving periodontal tissues
- Traumatic loss of the tooth
- Damaged tissues are:
  - Gingival epithelial junction
  - Periodontal ligaments
  - Cementum
  - Alveolar bone – socket
  - Pulpal nerve - vascular bundle
- Avulsion occurs especially in younger age, frequently in young permanent teeth
Avulsion - CP

- Complete displacement of the tooth out of its socket.
- Visual signs - The tooth is removed from its socket, damage of marginal gingiva
- Percussion, Mobility, Sensibility tests - not indicated.

DIF.DG.:
- Total intrusion, root fracture with loss of coronal segment

RTG
- Periapical, OPG – to confirm diagnosis

- Prognosis of the injury depends on the treatment received at the scene or immediately after, and on the long-term treatment plan.
Avulsion – procedure for replantation at the scene – advice for parents

- 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 a special storage media for avulsed teeth if available. 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.
**Closed Apex:**
Tooth replanted prior to the patient's arrival at the dental office or clinic

- Leave the tooth in place.
- Clean the area with water spray, saline, or chlorhexidine.
- 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. (PNC for 7 days)
- If the avulsed tooth has been in contact with soil, and if tetanus coverage is uncertain, refer to physician for a tetanus booster.
- Initiate root canal treatment 7-10 days after replantation. Place calcium hydroxide as an intra-canal medicament for up to 1 month followed by root canal filling with an acceptable material.
Patient instructions
- Soft food 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.

Follow-up
- Clinical control once a week during the first month.
- Root canal treatment 7-10 days after replantation.
- Splint removal and clinical and radiographic control after 2 weeks.
- Clinical and radiographic control after 4 weeks, 3 months, 6 months, 1 year and then yearly thereafter.
Tooth was not replanted at the scene, but has been kept in physiologic storage media (Hank's Balanced Salt Solution), milk, saline or saliva Extraoral dry time less than 60 min. Closed apex:

- Clean the tooth with saline.
- Irrigate the socket with saline.
- Examine the alveolar socket. If there is a fracture of the socket wall, reposition it with a suitable instrument.
- Replant the tooth with gentle pressure.
- 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. PNC
- If the avulsed tooth has been in contact with soil, and if tetanus coverage is uncertain, refer to physician for a tetanus booster.
- Initiate root canal treatment 7-10 days after replantation and before splint removal.
**Patient instructions**

- Soft food 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.

**Follow-up**

- Clinical control once a week during the first month.
- Root canal treatment 7-10 days after replantation. Place calcium hydroxide as an intra-canal medicament for up to 1 month followed by root canal filling with an acceptable material.
- Splint removal and clinical and radiographic control after 2 weeks.
- Clinical and radiographic control after 4 weeks, 3 months, 6 months, 1 year and then yearly thereafter.
Extraoral dry time exceeding 60 min or longer storage in non-physiologic media (in dry conditions) - Closed apex:

- Irrigate the tooth in saline
- Remove attached necrotic soft tissue with gauze.
- Root canal treatment can be performed prior to replantation, or it can be done 7-10 days later.
- Immerse the tooth in a 2% sodium fluoride solution for 20 min.
- Irrigate the socket with saline.
- Examine the alveolar socket. If there is a fracture of the socket wall, reposition it with a suitable instrument.
- Replant the tooth with gentle pressure.
- Suture gingival lacerations if present.
- Verify normal position of the replanted tooth clinically and radiographically.
- Stabilize the tooth for 4 weeks using a flexible splint.
- Administer systemic antibiotics.
- If the avulsed tooth has been in contact with soil, and if tetanus coverage is uncertain, refer to physician for a tetanus booster.
Patient instructions
- Soft food for up to 4 weeks.
- Brush teeth with a soft toothbrush after each meal.
- Use a chlorhexidine (0.1%) mouth rinse twice a day for 1 week.

Follow-up
- Clinical control once a week during the first month.
- If root canal treatment was not performed at the initial treatment session then root canal treatment should be performed 7-10 days after replantation.
- Splint removal and radiographic control after 4 weeks.
- Clinical and radiographic control after 4 weeks, 3 months, 6 months, 1 year and yearly thereafter.
Teeth with opened apex – unfinished root development

- Endodontic therapy before replantation in case of extraalveolar time longer than 60 min. and the tooth was stored in dry conditions.

- Endodontic therapy after replantation in cases of pulp necrosis, which is confirmed radiographically and clinically.
Signs of successful replantation

- Teeth with completed root development:
  - Replanted tooth is asymptomatic
  - Has physiological mobility
  - Sound on percussion is the same as in the uninjured teeth
  - X-ray without evidence of resorption, without peri-radicular translucency
Signs of successful replantation

- **Teeth with incomplete root development:**
  - Replanted tooth is asymptomatic
  - Has physiological mobility
  - Sound on percussion is the same as in the uninjured teeth
  - on x-ray continuous or slightly delayed root development, pulp cavity obliteration finding is frequent (increased storage of osteodentine into the pulpal cavity occurs after restoration of blood supply to the ischemic pulp)
Signs of unsuccessful replantation

- **Teeth with completed root development:**
  - replanted tooth is moving, or vice versa ankylosed
  - the sound on percussion of ankylosis has metallic character
  - X-ray signs of inflammatory resorption associated with bone substitution
Follow up after replantation

- It is necessary to monitor replanted teeth in long-term clinically and radiographically.
- First month every week, then in 3, 6 and 12 months.
- Complications after replantation:
  - Root resorption
  - Pulp cavity obliteration
  - Ankylosis
Late effects of injuries of permanent teeth

- Discoloration of the tooth crown
- Obliteration of root canal
- Traumatic death of dental pulp
- Chronic periodontitis
- Inflammatory resorption of HDT
- Changes in marginal periodontium
Injuries involving periodontal tissues

MILKY TEETH
Injuries involving periodontal tissues of deciduous teeth

Management of treatment of deciduous teeth is different from the procedures for the permanent teeth.

It is important to keep in mind the relationship between the apex of milky tooth and permanent tooth germ.

Possible consequences deciduous teeth injuries must be taken into account when deciding about therapy.
1. Contusion MD

- without treatment, observation
  a soft food for 1 week, 0.1% chlorhexidine rinses to the affected area
  guidance for parents of possible complications – pulp necrosis (discoloration, fistula)
  clinical control: 1 w., 6 - 8 w
2. Subluxation MD

- without treatment, observation
  a soft food for 1 week, 0.1% chlorhexidine rinses to
  the affected area
  guidance for parents of possible complications – pulp
  necrosis (discoloration, fistula)
  clinical control: 1 w., 6 - 8 w
3. Extrusive luxation MD

- Treatment depends on the degree of dislocation, mobility, tooth root development stage, the child's cooperation
- Extrusion > than 3 mm, completed root development: extraction
- Extrusion < than 3 mm: bidigital repositioning, observation, inspection in 2w, 6w, 6m, 1 year
- soft food 1 week, 0.1% chlorhexidine rinse to the affected area
- Inform the parent about possible complications: tooth discoloration, swelling, fistula, mobility
4. Lateral luxation MD

- **Protrusion:**
  a) Severe protrusion of tooth: TH = extraction
  b) Slight protrusion: leave for spontaneous repositioning

- **Retrusion:**
  a) The tooth is articulatory barrier: manual repositioning
  b) The tooth is not articulatory barrier: spontaneous repositioning

- soft food 14 days
- advice parents of complications
- Clinical control after 2-3 weeks.
- Clinical and radiographic control at 6-8 weeks and 1 year.
5. Intrusive luxation MD

- partial, total
- potential damage to the permanent tooth bud
  
  (*permanent tooth bud damage, abscess of pericoronal sac, Turner's tooth*)
5. Intrusive luxation MD

a) Spontaneous eruption in cases of displacement of the apex in labial direction (up to 4 weeks)
b) Extraction if the displacement of the apex is orally – damage of the permanent germ
c) Extraction in case of total intrusion,
   X-ray comparison of angle of permanent tooth germ compared with the neighboring germ
   soft food 14 days

Controls: 1w, 6w, 6m., 1 year
advice parents of complications
6. Avulsion MD

- DO NOT REPLANT
  Clin.pic.: empty socket, soft tissue injuries
  Dif.dg. total intrusion, crown fracture (X-ray)
  if the tooth is not found – aspiration and swallowing has to be excluded – send to pediatrician (x-ray)
  soft food 1 week
  dental hygiene with a soft brush
Damage to permanent tooth germs

- Type of injury determines the degree and type of developmental disturbances of permanent tooth bud
- The highest frequency of developmental disorders show avulsion and intrusive luxation.
- Subluxation and extrusive luxations are lower risk
- The most serious consequences when injured during the initial stage of development of permanent teeth.
- The peak incidence of injuries of deciduous teeth is between 2 - 3.5 years, therefore affecting the developmental changes in incisal and middle third of the crowns of permanent successor.
- After the fourth year of age the number of post-traumatic malformations decreases
Classification of anatomical and histological damage due to injury of germ (Andreasen)

1. White and yellow discoloration of enamel
   - Most often, 20%
   - Any type of milk tooth injury from 2 - 7 years of age

2. White and yellow enamel discoloration with circular enamel hypoplasia
3. Dilaceration of crown
   - Sharp curvature in any part of the tooth crown
   - bizarre angle between pretraumatic and traumatic part of the tooth
   - ½ of cases remain impacted
   - Occurs during the second year of age when about half of the crown is formed

4. Malformations resembling odontoma
   - Milk tooth root causes fragmentation of the germ
5. Double root
   - Very rare, two separate roots develop
6. Vestibular root angulation
   - Tooth remains impacted
7. Lateral root angulation
   - Spontaneously erupts
8. Partial or complete cessation of root development
   - Injury after the creation of the crown, at the time of root development
   - 5 - 7. years of age
9. Sequestration of permanent tooth bud
   - infections spreads to dental crypt
   - Result of jaw fractures complicated by inflammation
   - Spontaneous sequestration of germs

10. Failure of eruption
    - Often delayed eruption as a result of scar tissue in the synovial tissue