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ВЫВИХИ И ПЕРЕЛОМЫ ЗУБОВ
DISLOCATIONS
AND FRACTURES OF TEETH

Учебно-методическое пособие



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MOTIVATION CHARACTERISTICS

Total time of class: 225 min.

Fractures and dislocations of teeth are the most frequent injuries in the maxillofacial area. Careful collection of anamnesis, knowledge of clinical symptoms, the ability to conduct correct examination of the patient allows to make a proper diagnosis and treatment. Students need to be taught to recognize the nature of fractures and dislocations, to identify clinical manifestations, to use modern methods of diagnostic of injuries, and to draw up a treatment plan.

Aim of the study: to study clinical features, diagnostic, treatment of fractures and teeth dislocations.

Objectives of the study:

1. Learning how to plan examination of patients;
2. Learning clinical features of fractures and dislocations of teeth;
3. Learning how to make a treatment plan of patients;
4. Learning how to choose a treatment method depending on clinical features.

Test questions on related disciplines:

1. Anatomy of the tooth and periodontal apparatus.
2. Methods of treatment of acute pulpitis and periodontitis.
3. X-ray methods in dentistry.
4. Electric pulp test (EPT) in dentistry.

Test questions:

1. Name the classification of dental injuries.
2. Describe the clinical picture of the fractures of teeth.
3. Name the methods of treatment of the teeth fractures according to the localization of the fracture line.
4. Name the classification of luxation.
5. Describe the clinical picture of concussion.
6. Intrusion. Clinic, diagnostic and treatment.
7. Describe the tactics of treatment of subluxation.
8. Call clinical features of avulsion.
9. Name the steps of tooth replantation.

Dentoalveolar injuries are frequently caused by many types of trauma. The most common causes are falls, motor vehicle accidents, sports injuries, altercations, child abuse and playground accidents. Injuries of teeth and the alveolar process are common and should be considered emergency conditions because a successful outcome depends on prompt attention to the injury. Because proper treatment can be given only after an accurate diagnosis, the diagnostic process should commence immediately.

CLINICAL EXAMINATION

The clinical examination is perhaps the most important part of the diagnostic process. A thorough examination of a patient who has had injury to the dentoalveolar structures should not focus only on that structure. During the clinical examination, the following areas should be examined routinely:

1. *Extraoral soft tissue wounds.* Lacerations, abrasions, and contusions of the skin are common with dentoalveolar injuries and should be noted. If a laceration is present, the depth of it should also be determined.

2. *Intraoral soft tissue wounds.* Injuries to oral soft tissues are commonly associated with dentoalveolar injuries. Before a thorough examination, it may be necessary to remove blood clots, irrigate the area with sterile saline, and cleanse the oral cavity. Soft tissue injuries should be noted, and an examination should ascertain whether any foreign bodies such as tooth crowns or teeth remain within the substance of the lips, or of mouth, cheeks, or other areas.

3. *Fractures of the jaws or alveolar process.* Fractures of the jaws are most readily found on palpation. However, because pain may be severe after the injury, examination may be difficult. Segments of alveolar process that have been fractured are readily detected by visual examination and palpation.

4. *Examination of the tooth crowns for the presence of fractures or pulp exposure.* For adequate examination, teeth should be cleansed of blood. Any fractures should be noted. The depth of the fracture is an important point to note. Does it extend into dentin or into the pulp?

5. *Displacement of teeth.* Teeth can be displaced in any direction. Most commonly, they are displaced in a buccolingual direction, but they may also be extruded or intruded. In the most severe type of displacement, teeth are avulsed, that is, totally displaced out of the alveolar process. Observation of the dental occlusion may provide assistance in determining minimal degrees of tooth displacement.

6. *Mobility of teeth.* All teeth should be checked for mobility in the horizontal and vertical directions. A tooth that does not appear to be displaced but that has considerable mobility may have sustained a root fracture. If adjacent teeth move with the tooth being tested, a dentoalveolar fracture (in which a segment of alveolar bone and teeth are separated from the remainder of the jaw) should be suspected.

7. *Percussion of teeth.* When a tooth does not appear to be displaced but pain is felt in the region, percussion determines whether the periodontal ligament has undergone some injury.

8. *Pulp testing of teeth.* Although rarely used in acute injuries, vitality tests (which induce a reaction from teeth) may direct the type of treatment provided once the injury has healed. False-negative results may occur, so teeth should be retested several weeks later and before endodontic therapy is performed.

CLASSIFICATION OF DENTAL INJURIES

(International Association of Dental Traumatology, 2001)

1. Crown crack.
2. Coronal (crown) fracture.
3. Coronal (crown) and root fracture.
4. Root fracture.
5. Luxations and avulsion (contusion, subluxation, lateral luxation, extrusion, intrusion, avulsion).
6. Fracture of processus alveolaris

The goal in the treatment of dentoalveolar injuries is reestablishing normal form and function of the masticatory apparatus. When the pulp is directly involved, treatment differs from that of tooth injuries in which the pulp is not involved. Because of the training in operative dentistry and endodontics, a dentist has the knowledge, the instruments, and the medications routinely available to manage cases of tooth fracture. **Crown craze or crack.** Because the cracks are limited to the enamel (i.e., enamel infraction) and usually stop before reaching the dentinoenamel junction, no treatment is usually indicated. However, periodic follow-up examinations are valuable, as any force to the tooth can result in injury to the pulp and periodontal tissues. Multiple cracks may be sealed to prevent their becoming stained.

Crown fracture. The depth of tooth tissue involvement determines the treatment of crown fractures (tabl.).

Table

Complicated crown fracture involving enamel and dentine with expose of the pulp

Exposition	Time	Treatment of the injuries	Treatment of the injuries
Small	1–2 hours	Direct pulp capping	CA(OH) ₂ / MTA
Larger than 1 mm	More, than 3 hours	Pulpotomy — partial or total elimination of coronal pulp tissue	– sterile round steel bur or excavator – haemorrhage control – CA(OH) ₂ /MTA + GIC / polikarboxilate cement
X-large	Long time	Pulpectomy — elimination of all the pulp tissue	– CA(OH) ₂ – final root canal filling (closed apex)

For fractures that are only through the enamel or those with minimal amounts of dentin involvement, no acute treatment other than smoothing off the sharp edges is warranted. If reshaping of teeth would leave a noticeable deformity, replacement of the missing enamel by acid-etched composite resin techniques is indicated. The sooner teeth are treated, the better is the prognosis because the risk of in hyperemia of the pulp is decreased. Periodic follow-up examinations are necessary to monitor pulp and periodontal health. If a considerable amount of dentin is exposed, the pulp must be protected. Measures to seal the dentinal tubules and promote secondary dentin deposition by the pulp can be undertaken. Calcium hy-

dioxide has been the traditional material applied to exposed dentin before the fractured part is covered with a suitable restoration, most commonly a composite with or without acid etching. Current recommendations are the placement of a dentin-bonding agent or glass ionomer cement over exposed dentin, followed by the placement of a resin composite restoration. Glass ionomer cements chemically bind to dentin, facilitating placement and restoration. Crown-root fracture. The treatment of crown-root fractures depends on the location of the fracture and local anatomic variance (fig. 1, 2). If the coronal fragment is still in place, it must be removed to assess the depth to which the fracture has gone. If the fracture does not descend too far apically (and the tooth is therefore restorable) and if the pulp has not been exposed, the tooth is treated as already discussed for crown fracture.

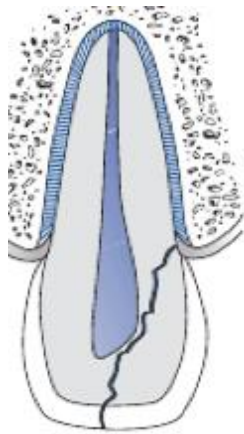


Fig. 1. Uncomplicated crown-root fracture involving enamel and dentin and extending into the root structure. Treatment method: If the fracture line is above or slightly below the alveolar bone level, the tooth can be restored with a crown

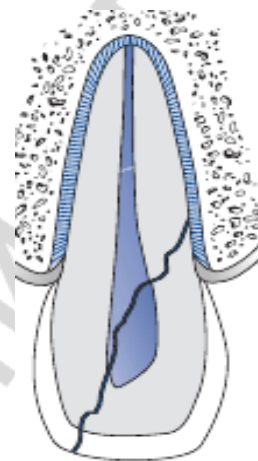


Fig. 2. Complicated crown-root fracture involving enamel and dentin and extending into the root structure with a pulp exposed. Treatment method is root canal filling and crowning of the tooth

Root fracture. When a horizontal or oblique fracture of the root occurs, the main factor in determining the prognosis, and therefore in directing treatment, is the position of the fracture in relation to the gingival crevice. If the fracture is above or close to the gingival crevice, the tooth should be removed or the coronal fragment should be removed and endodontic treatment performed on the root. The root can then be restored with a post and core restoration. Fractures in the middle to apical one third of the root have a good prognosis for survival of the pulp and healing of the root fragments to one another. These fractures should be treated with repositioning (if any mobility is detectable) and immobilization for 2 to 3 months.

Fracture in cervical third (Worst prognosis) (fig. 3):

1. Elimination of coronal part:
 - root canal treatment
 - orthodontic extrusion
 - restoration
2. Extraction + implantation.

Fracture in middle third (fig. 4):

1. Reposition of coronal part
2. Splint (1–2 months)
3. Root canal filling
4. Transradicular fixation can be an option (silver point)

Fracture in apical third (fig. 5) observation:

1. In case of necrosis — $\text{Ca}(\text{OH})_2$, final root canal filling after healing.
2. If coronal part is dislocated — reposition and fixation for 1 month.

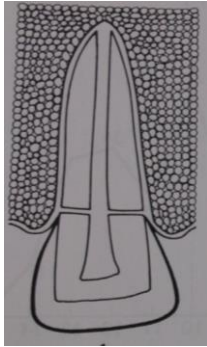


Fig. 3 Fracture in cervical third

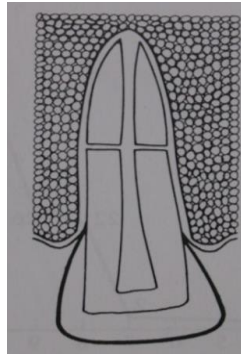


Fig. 4 Fracture in middle third

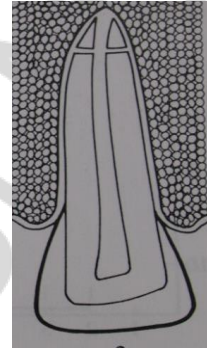


Fig. 5 Fracture in apical third

LUXATION INJURES are loosening of the tooth or a partial displacement of the tooth out of its socket.

CLASSIFICATION OF LUXATION

Classification of luxation (WHO):

1. Concussion.
2. Subluxation.
3. Extrusive luxation.
4. Lateral luxation.
5. Intrusive luxation.

Concussion is the injury to the periodontium producing sensitivity to percussion without loosening or displacement of the tooth.

Clinical findings: tender to touch, not displaced, no increased mobility. Sensitivity test are most likely positive.

Radiographic findings: No abnormalities or widening of the periodontal gap of the damaged tooth.

Treatment of concussion: No special treatment is need, but it is essential to monitor pulpal condition for one year. If features of pulp death appear, endodontic treatment is needed.

In case of **subluxation** the periodontal fibers are loosened but the tooth is not displaced. The injured tooth becomes mobile, sensitive to percussion. On *X-ray* pictures is possible to find widening of periodontal gap of the tooth and

shortening of the root. *Treatment* is consist of on the two main steps: reposition and fixation (immobilization) of the tooth.

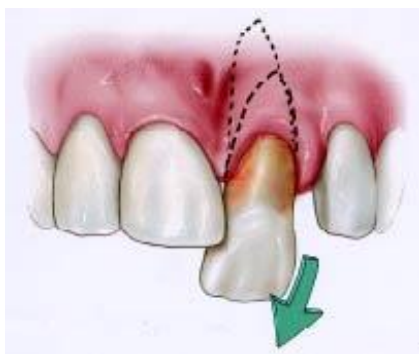


Fig. 6. Extrusive luxation

With **extrusive luxation** (Fig. 6), the tooth is very mobile because of the partial displacement out of the socket. *Clinical Findings:* Tooth appears elongated and is excessively mobile. Sensitivity test give negative results

Radiographic findings: Increased periodontal ligament space apically

Treatment: Reposition tooth by gently re-inserting it into the socket. Stabilize for 2 weeks with a flexible splint. In mature tooth pulp necrosis is expected. With immature teeth watch for signs and symptoms of pulpal necrosis. Endodontic therapy indicated.

Lateral Luxations. Clinical findings: displacement usually palatal/lingual direction (fig. 7). Often immobile and percussion gives metallic sound. **Fracture of alveolar process is present.** Negative pulp tests.



Fig. 7. Lateral luxation of the upper incisor

Radiographic findings: obvious widen PDL, best seen on occlusal exposure. *Treatment:* Reposition digitally to disengage from its boney lock and gently reposition to original location. Stabilize 4 weeks with flexible splint. Monitor vitality. If necrotic endodontic therapy is indicated to prevent root resorption.

Intrusion. Traumatic intrusion of teeth indicates that the alveolar socket has sustained a compression fracture to permit the new tooth position. On percussion, the tooth emits a metallic sound

similar to that by an ankylosed tooth, distinguishing it from a partially erupted or unerupted tooth. The intrusion may be so severe that the tooth actually appears to be missing on clinical examination. Traumatic tooth intrusion is less frequent than lateral displacements; when seen, intrusion usually involves maxillary teeth.

The treatment of intruded teeth is controversial. Some clinicians favor surgically repositioning and splinting these teeth; however, this treatment has resulted in serious periodontal and pulpal consequences. Others think that if left alone, many intruded teeth will re-erupt. Others use orthodontic forces to assist re-eruption.

When orthodontic assisted eruption is used, the tooth should be extruded slowly, over a 3–4-week period. Once the tooth is in position within the dental arch, it is splinted for 2–3 months. Recent evidence suggests that immediate application of orthodontic force is necessary to prevent ankylosis in the intruded position. The decision to perform endodontic treatment is based on the follow-up findings of each case.

AVULSION

Total avulsion (fig. 8) from its socket is the worst situation for a tooth because the health of the pulp and periodontal tissues is in severe risk. The factors most important to determining how successful treatment measures will be are the length of time the tooth has been out of the socket, the state of the tooth and periodontal tissues, and the manner in which the tooth was preserved before replantation. The sooner the tooth can be replanted, the better is the prognosis. Therefore, when the dentist receives a call from a patient regarding a totally avulsed tooth, the dentist should direct the caller to rinse the tooth immediately with the patient's saliva, tap water, or saline solution and to replant the tooth. The patient should hold the tooth by the crown, while trying not to touch the root, and then hold the tooth in place and go immediately to the dentist. If the patient cannot replace the tooth, it should be placed into an appropriate medium until care can be delivered by a dentist.



Fig. 8. Avulsion of tooth 2.1

Transport media for the avulsed tooth (fig. 9):

1. In the tooth socket.
2. Saliva (in the mouth).
3. Milk.
4. Hank's balanced salt solution.
5. ViaSpan cold storage solution.



Fig. 9. Hank's balanced salt solution, commercially available as: Save-A-Tooth (Phoenix Lazarus, Inc.)

Treatment aim: replantation and stabilization as soon as possible! The periodontal ligaments and cells lose their vitality after 1 hour. Factors to be considered before replanting avulsed teeth:

- The avulsed tooth should have no advanced periodontal disease.
- The alveolar socket should be reasonably intact to provide a seat for the avulsed tooth.

- No orthodontic contraindications of teeth should exist.
- The extra-alveolar period should be considered; periods exceeding 2 hours are usually associated with poor results. If the tooth is replanted within the first 30 minutes, excellent results can be expected.
- The stage of root development should be evaluated. Survival of the pulp is possible in teeth with incomplete root formation if replantation is accomplished within 2 hours after injury.

Steps of avulsed tooth replantation:

1. Preparation of the tooth and the alveolar socket.
2. Set to the correct position / reposition.
3. *Stabilization* — using the neighboring teeth for splinting:
 - acrylic splint
 - composite bonding with orthodontic archwire
 - brackets
4. Wound treatment (debridement, suturing, hemorrhage control)
5. Root canal treatment (pathological sign)

Stabilization of an avulsed tooth can be achieved using a variety of materials such as wires, arch bars, and splints.

On removal of the stabilization device, the tooth will still be mobile. Therefore, it is important that the stabilization device be removed with great care and that the patient be instructed to avoid this region during mastication. If, however, the apical foramen is wide open, pulp may survive and revascularize. To promote this possibility, the tooth is usually stabilized for 3 to 4 weeks instead of the shorter time for apically mature teeth.

The patient should be told that several outcomes are possible after replantation. The best result to be expected is a relatively normal, functional tooth that in most instances will require endodontic therapy. However, varying amounts of root resorption and ankylosis may occur. The development of these signs determines the prognosis of the tooth. Although acute dental infection is rare, it can lead to loss of the replanted tooth. These patients must be followed carefully at regular and frequent intervals for some time after replantation.

SELF-CONTROL TESTS

1. In the longitudinal tooth root fracture characteristic radiographic picture shows:

- a) bleaching streak going in the longitudinal direction of the root;
- b) absence of periodontal ligament at the apex;
- c) absence of the periodontal ligament along the entire length of the root;
- d) bleaching streak going in the transverse direction of the root.

2. In incomplete dislocation of the tooth, radiography shows:

- a) loose fossa;

- b) absence of the periodontal ligament along the entire the root;
- c) extension of the periodontal ligament, and the alveoli bottom free from the root apex at the apex;
- d) absence of periodontal ligament at the apex.

3. Luxations of teeth may be:

- a) intrusion;
- b) extrusion;
- c) subluxation;
- d) crack.

4. Where are more frequent fractures happen?

- a) frontal teeth on the upper jaw;
- b) frontal teeth on the lower jaw;
- c) molars on the upper jaw;
- d) molars on the lower jaw.

5. On X-ray of subluxation will be detected:

- a) widening of the PDL;
- b) empty socket;
- c) absence of periodontal gap;
- d) fracture in the middle third of the root.

6. Fractures of teeth possible be:

- a) crack;
- b) avulsion;
- c) crown-root fracture;
- d) concussion.

7. The reposition of subluxed tooth is conducted by:

- a) the fingers of operator very gently;
- b) dental forceps;
- c) special repositioning instruments.

8. Contraindications for replantation of avulsed teeth:

- a) temporary teeth;
- b) permanent teeth with root fractures;
- c) destruction of the tooth socket;
- d) development of purulent inflammation in the tooth socket.

9. What immobilization is used for replanted teeth?

- a) composite bonding with orthodontic archwire;
- b) kappa;
- c) uncoupling plate;
- d) acrylic splint.

10. What type of luxation is more accompanied with the fracture of alveolar process?

- a) lateral luxation;
- b) intrusion;
- c) extrusion;
- d) subluxation.

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