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БЕЛОРУССКИЙ ГОСУДАРСТВЕННЫЙ МЕДИЦИНСКИЙ УНИВЕРСИТЕТ
КАФЕДРА ЧЕЛЮСТНО-ЛИЦЕВОЙ ХИРУРГИИ

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ПЕРЕЛОМЫ НИЖНЕЙ ЧЕЛЮСТИ: КЛИНИКА, ДИАГНОСТИКА, ЛЕЧЕНИЕ

MANDIBULAR FRACTURE: CLINICAL SIGNS, DIAGNOSTICS, TREATMENT

Учебно-методическое пособие

Минск БГМУ 2022

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В27

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Содержится современная информация по диагностике и методам лечения переломов нижней челюсти.

Предназначено для студентов 4–5-го курсов медицинского факультета иностранных учащихся по специальности «Стоматология», обучающихся на английском языке.

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MOTIVATIONAL CHARACTERISTIC OF THE SUBJECT

Topic: Mandibular fracture: clinical signs, diagnostics, treatment.

The total time of the lesson is 315 minutes.

Traumatic injuries of the lower jaw rank first among injuries of the maxillofacial area. They account for 70 to 90 % of all injuries to the facial skeleton. Majority of patients are men aged 20–40 years. Dentists, regardless of work experience and qualifications, should participate in the provision of medical care for injuries of the mandible. Knowledge of the features of the clinical picture, methods of diagnosis and treatment of injuries of the mandible will help to avoid complications and disability of patients.

Purpose of the lesson: to study the classification of fractures of the mandible and, based on the analysis of anamnesis, subjective, objective, additional examination methods, learn how to diagnose fractures of the mandible, carry out their differential diagnosis and draw up a treatment plan using various methods.

Objectives of the lesson:

1. To study the classification of traumatic fractures of the mandible.
2. To train students in the methods of clinical examination, methods of diagnosis and differential diagnosis of traumatic fractures of the mandible.
3. To train students in the methods of diagnosis and differential diagnosis of traumatic fractures of the mandible.
4. To study the prevention of complications in patients with traumatic fractures of the mandible.
5. To study the average terms of disability in traumatic fractures of the mandible.
6. Teach students to use clinical protocols for traumatic mandibular fractures.

Requirements for the initial level of knowledge:

To fully master the topic, the student must repeat from the sections:

– human morphology: anatomical — topographic structure of the mandibular bone; attachment of muscles to the mandible; features of the blood supply and innervation of the mandible.

– maxillofacial surgery: methods of examination of a patient with maxillofacial pathology; types of anesthesia of the mandible, features of general anesthesia in maxillofacial surgery

– radiation diagnostics: options for X-ray examination of the mandible

– pharmacology: anti-inflammatory drugs; pain relievers; osteotropic and o steoreparative drugs, reparative osteogenesis of bones

– physiotherapy: physical factors and methods of exercise therapy used in the treatment of traumatic injuries of the maxillofacial skeleton.

Test questions from related disciplines:

1. Named the processes of the mandibular bone.

2. Named the main buttresses of the mandibular bone.
3. Named places of attachment of the muscles that lift the mandible.
4. Named places of attachment of the muscles that lower the mandible.
5. Describe innervation and blood supply to the mandibular bone.
6. Objective examination methods used to diagnose diseases of the mandible.
7. Describe basic X-ray general positioning for the mandible examination.
8. Loss of sensitivity zone after mandibular anesthesia.
9. Tools necessary for splinting according to Tigerstedt.
10. Antibiotics with tropism to the bone tissue of the maxillofacial region.
11. Medications and physical factors stimulating bone reparative osteogenesis.

Control questions on the topic of the lesson:

1. Classification of fractures of the mandible
2. Complaints of a patient with a fracture of the mandible.
3. Clinical signs of fractures of the mandible.
4. Factors affecting the nature and degree of displacement of bone fragments in fractures of the mandible.
5. Projections and placement for X-ray diagnosis of mandibular fractures.
6. X-ray diagnostics of a fracture of the mandible in the area of the condylar process.
7. Indication for electroodontodiagnostics (EDI) for fractures of the mandible.

ETIOLOGY OF MANDIBULAR FRACTURES

Mandibular fractures are relatively common especially among young men. Fractures of the mandible have been reported to account for 36–70 % of all maxillofacial fractures. All reports apparently show a higher frequency in males aged 21–30.

The most common causes of fractures:

- assault;
- violence;
- motor vehicle accident (MVA);
- fall;
- sport;
- other.

The prevalence of fractures depending on the location:

- angle: 20–33 %;
- body: 15–25 %;
- condyle or neck: 15–36 %;
- parasymphyseal: 14–15 %;
- ramus: 5 %;

– coronoid process: 1–3 %;
– alveolar ridge: 2 %.

Prevalence of mandibular fractures by type:
– multifocal: 60 %;
– unifocal: 40 %;
– simple: 25 %;
– comminuted: 10 %;
– associated with condylar subluxation: 5 %.

CLASSIFICATION OF MANDIBULAR FRACTURES

There are a lot of classifications concerning mandibular fractures. One of the most famous and utilizes in clinical practice ***is the classification of R. Dingman and P. Natvig from 1969***. According to them fractures are systematized in several categories:

A. According to the direction of the fracture / horizontal,vertical/ and whether it is favourable or not for treatment.

B. According to the severity of the fracture: simple /closed/ and compound / towards the oral cavity or the skin.

C. According to the type of fracture: greenstick fracture, complex fracture, comminuted fracture, impacted fracture and depressed fracture.

D. According to the presence or absence of the teeth in the jaws /dentulous, partially edentulous, edentulous.

E. According to the location.

According to the location:

1. Region of symphysis
2. Canine region
3. Region of body
4. Region of angle
5. Region of ramus
6. Region of condylar process
7. Region of coronoid process

A classification of fractures according to location is simple and correlates anatomic and clinical nomenclature.

According to ***D. Kelly and W. Harrigan*** mandibular fractures were arbitrary devided into six categories for simplification in classification. They are the same as in the above mentioned except the canine region.

This classification contains information not only for the anatomical localization of fractures; it reveals whether they are simple or compound; with or without dislocation; the number and dislocation of the fragments.

Classification of fractures according to the anatomical locations (similar to «E» of Dingman's classification) is the base of the ***classification of D. Sinn, S. Hill and S. Watson***. Fractures are presented in 7 categories:

1. Condylar fractures/intracapsular
2. Subcondilar fractures
3. Coronoidal fractures
4. Fractures of mandibular ramus
5. Fractures of mandibular angle /open through third molar socket
6. Fractures of mandibular body /open through tooth socket
7. Fractures of symphysis.

A. Pogrel and L.Kaban classified mandibular fractures in 5 groups according to the site of injury too:

1. Condylar fractures
2. Ramus fractures
3. Angle fractures
4. Body fracture
5. Fractures of symphysis and parasymphysis

First attempt for unified and standart classification of mandibular fractures is so called formula of fracture of ***A. Gratz***. It consists of alphanumeric symbols analogic to TNM classification of tumours. The author mentions the following categories:

- F-fracture
- L-localization
- S-soft tissues injuries
- A-associated maxillo-facial injuries
- O-occlusal disorders

This classification is not complete, because some very important criteria such as dislocation of fragments, tooth in a fracture line are missing.

According to ***WHO***, the international classification of mandibular fracures is:

S 02.6 — Fractura mandibulae
S 02.60 — Fractura processus alveolaris
S 02.61 — Fractura corpus mandibulae
S 06.62 — Fractura processus articularis/condylaris/
S 06.63 — Fractura processus muscularis /coronoideus/
S 02.64 — Fractura ramus mandibulae
S 02.05 — Fractura symphysis
S 02.66 — Fractura angulus mandibulae
S 02.67 — Fracturae mandibulae multiplex
S 02.68 — Unspecified mandibular fractures

The term «unspecified mandibular fractures» having in mind the contemporary apparatus is not correct.

The most popular classification of mandibular fractures in Russian stomatological practice is the classification of ***Kabakov and Malishev***. According to them fractures are systemized as following:

1. According to localization:

a. mandibular body/with or without teeth in fracture line

b. mandibular ramus with its processes

2. According to the character: with or without dislocation

3. According to the number: single, double, multiple, unilateral, bilateral

The authors themselves found this classification incomplete and inexhaustible.

A. Pankratov and T. Robustova suggest a formula for mandibular fractures in 8 categories with alphanumeric marks. They underline that in comparison with fractures of the upper and middle zones of the face, mandibular injuries are characterized by typical location and configuraration. That's why they use letteral and numerical symbols in formulation the diagnosis. These symbols characterize the line of fracture, involved teeth, presence /or absence/ of dislocated fragments, occlusive disorders, combined in status of soft tissues, presence of inflammation in the fracture line and its severity. These symbols are:

– F — /fracture/: from Fo to F4 and includes: incomplete, simple, double and multiple fractures;

– T — /tooth/: To, T1, T2/T2 c,T2 pu,T2 pe,T2pa — includes information concerning tooth-periodontal or parodontal changes of tooth in the fracture line;

– L — /localisation/: from L1to L8- and includes the following regions: L1 — incisivum L2 — caninum L3 — praemolares – molares; L4 — angulus mandibulae L5 — ramus mandibulae; L6 — proc.condylaris; L7 — processus muscularis /coronoideus/; L8 — processus alveolaris;

– D — /dislocation/: Do, D1, D2 — with luxation;

– O — /occlusion/: Oo, O1, O2 — with or without occlusal changes / including classification of bone atrophy of the mandible/ O2-aI, O2-aII, O2-aIII; a I, II, III mark the bone atrophy of mandible/

– S — /soft tissue/: So-closed mandibular fracture, S1 — open mandibular fracture /communication with oral cavity/, S2 — open combined with skin injuries, S3 — intra and extraoral opened fractures, S4 — open fracture with soft tissue formations

– I — / infection/: Io, I1, I2 — with or without inflammatory changes/ abscessus and flegmons/

– A — /associated/: A0, A1 — combined or not

The effect of muscle action on the fracture fragments is important in classification of mandibular angle and body fractures. Angle fractures may be classified as vertically favorable or unfavorable and horizontally favorable or unfavorable. The muscles attached to the ramus (masseter, temporal, medial pterygoid) pull the proximal segment upward and medially and the symphysis of

the mandible is displaced inferiorly and posteriorly by the pull of the digastric, geniohyoid, and genioglossus muscles (Fig. 1).

When the fractures are vertically and horizontally unfavorable, the fragments tend to be displaced (Fig. 2).

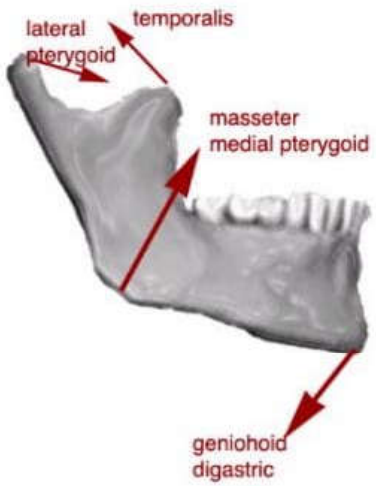


Fig. 1. The muscular forces acting upon the mandible (https://emedicine.medscape.com/article/1283150-overview)

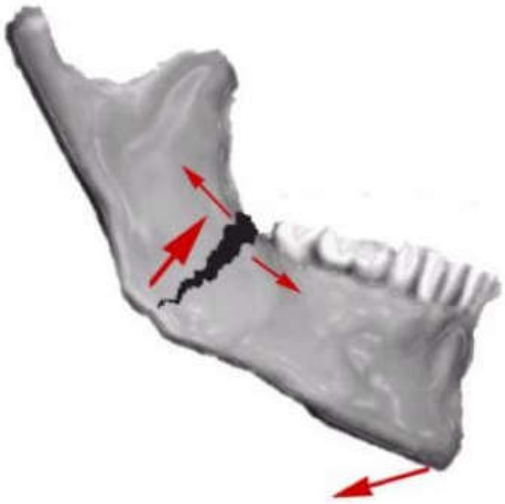


Fig. 2. An «unfavorable» angle fracture with distracting muscular forces (https://emedicine.medscape.com/article/1283150-overview).

Conversely, these same muscles tend to stabilize the bony fragments in horizontally and vertically favorable fractures (Fig. 3).

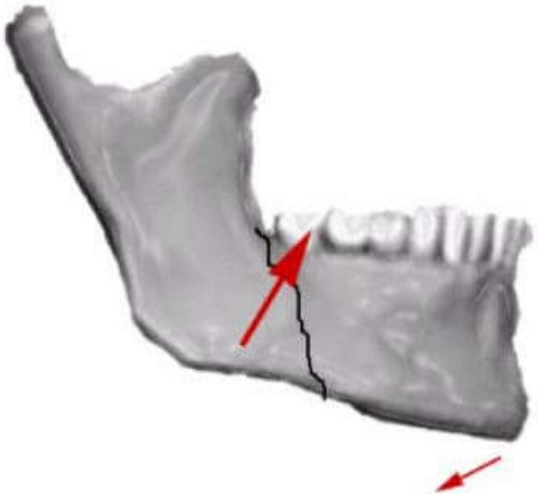


Fig. 3. A «favorable» body fracture with muscular force not tending to distract the fracture (https://emedicine.medscape.com/article/1283150-overview)

Condylar fractures are classified as extracapsular, subcondylar, or intracapsular. The lateral pterygoid tends to cause anterior and medial displacement of the condylar head. Five types of condylar fractures are described in order of increasing severity:

Type I is a fracture of the neck of the condyle with relatively slight displacement of the head. The angle between the head and the axis of the ramus varies from 10–45°.

Type II fractures produce an angle from 45–90°, resulting in tearing of the medial portion of the joint capsule.

Type III fractures are those in which the fragments are not in contact, and the head is displaced medially and forward. The fragments are confined within the area of the glenoid fossa. The capsule is torn, and the head is outside the capsule.

Type IV fractures of the condylar head articulate on or in a forward position with regard to the articular eminence.

Type V fractures consist of vertical or oblique fractures through the head of the condyle.

DIAGNOSTICS OF MANDIBULAR FRACTURES

Presenting complaints of mandibular fractures will include:

– pain;

– chin paresthesia (damage to the mental nerve, a terminal branch of the inferior alveolar nerve);

– malocclusion;

– trismus;

– dental damage;

– abnormal mobility;

– laceration of the skin and mucousa of oral cavity.

Clinical examination:

1. Facial lacerations, swellings, deformity and hematomas.

A common site for a laceration is under the chin, and this should alert the clinician to the possibility of an associated subcondylar or symphysis fracture. From behind the supine or seated patient, bimanually palpate the inferior border of the mandible from the symphysis to the angle on each side. Note areas of swelling, step deformity, or tenderness. Palpate the movement of the condyle through the external auditory meatus. Pain elicited through palpation of the preauricular region should alert the clinician to a possible condylar fracture.

2. Paresthesia, dysesthesia, or anesthesia along the distribution of the inferior alveolar nerve.

Numbness in this region is almost pathognomonic of a fracture distal to the mandibular foramen.

3. Opening of the mouth.

Classically, deviation on opening is toward the side of the mandibular condyle fracture. Note any limited opening and trismus that may be a result of reflex muscle spasm, temporomandibular effusion, or mechanical obstruction to the coronoid process resulting from depression of the zygomatic bone or arch.

4. Changes in occlusion.

A change in occlusion may be due to a displaced fracture, fractured teeth and alveolus, or injury to the temporomandibular joint.

5. Mucosal or gingival tears.

Floor of the mouth ecchymosis may indicate a mandibular body or symphyseal fracture.

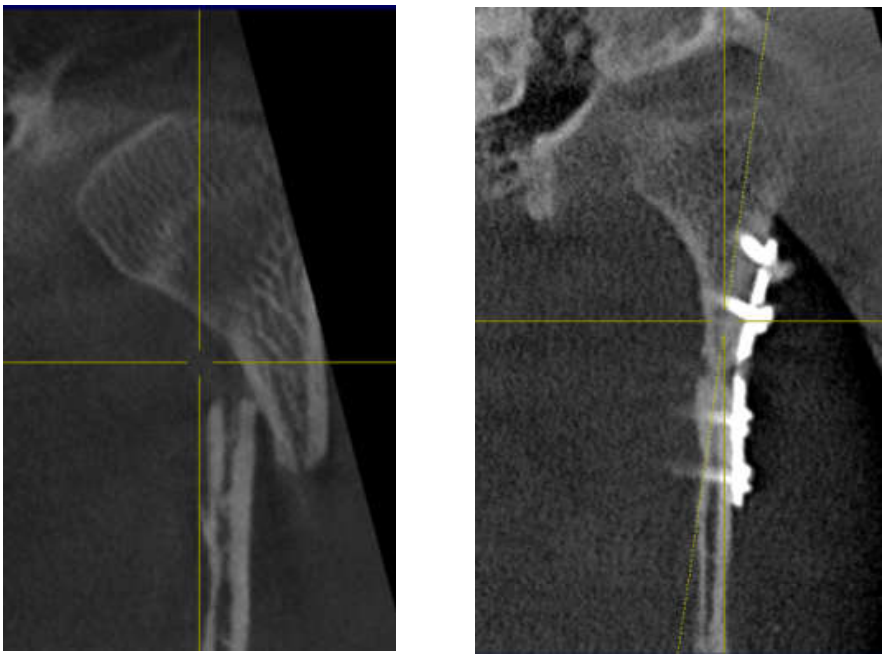
6. Pathological mobility.

If a fracture site along the mandible is suggested, grasp the mandible on each side of the suspected site and gently manipulate it to assess mobility.

Radiographic examination

Panoramic radiography (Fig. 4) has become the standard of care for the evaluation of mandibular fractures in many clinics. The ability to obtain these views while the patient is in the supine position is a great asset in trauma centers where the patient may be unstable, and in patients for whom the cervical spine (C-spine) has not been cleared. Panoramic views with posteroanterior or reverse Towne's views are likely to give a higher yield than the panoramic view alone. The method of cone-beam computed tomography is the most informative. Especially with intra-articular fractures. Three-dimensional CT may have an important role for evaluating pre- and postreduction techniques, particularly of subcondylar fractures (Fig. 5, *a*, *b*).

Fig. 4. Panoramic radiogram of a patient with a fracture of the mandible.



a ***b***

Fig. 5. CBCT scan of condylar process fracture:
a — before surgery; *b* — after osteosynthesis

TREATMENT OF MANDIBULAR FRACTURES

Treatment can be conservative or involve formal reduction (which may be open or closed). Closed reduction may be supported with intermaxillary fixation or splints. Closed reduction and fixation of the fracture with splints is an orthopedic method of treatment (ORIF).

Indications for closed reduction:

– Nondisplaced favorable fractures: Open reduction carries an increased risk of morbidity, thus use the simplest method to reduce and fixate the fracture.

– Grossly comminuted fractures: Generally, these are best treated by closed reduction to minimize stripping of the periosteum of small bone fragments.

– Fractures in children involving the developing dentition: Such fractures are difficult to manage by open reduction because of the possibility of damage to the tooth buds or partially erupted teeth. A special concern in children is trauma to the mandibular condyle. The condyle is the growth center of the mandible, and trauma to this area can retard growth and cause facial asymmetry. Early mobilization (7–10 day of intermaxillary fixation) of the condyle is important. If open reduction is necessary because of severe displacement of the fracture, the use of resorbable fixation or wires along the most inferior border of the mandible may be indicated.

– Coronoid fractures: These fractures usually require no treatment unless impingement on the zygomatic arch is present.

– Treatment of condylar fractures: This is one of the more controversial topics in maxillofacial trauma. Indications for open reduction are discussed below. If condylar fractures do not fall within this criteria, they can be treated with closed reduction for a period of 2–3 weeks to allow for initial fibrous union of the fracture segments.

The splinting of the jaws is more often carried out by means of dental steel wire splints made by the doctor before fixing them.

These include:

– splinting according to Tigerstedt (Fig. 6), using smooth staple splints, staple splints with a spacer element (bend) (Fig. 7) and splints with hook loops;

– splinting according to Rauer (Fig. 8 *a*, *b*);

– Splinting with laboratory-made splints:

– Vasiliev's splint (Fig. 9);

– Weber's dental-supragingival splint;

– Vankevich's splint (Fig. 10).

Fig. 6. Tigerstedt splint

Fig. 7. Staple splint with a spacer element (bend)

Fig. 8. *a* — Rauer splint; *b* — fixed Rauer splint

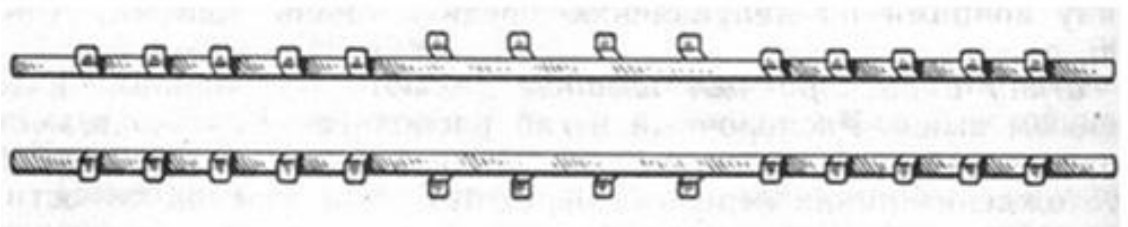


Fig. 9. Vasiliev's splint

Fig. 10. Vankevich's splint

Protocol of Closed Reduction.

Initially, use a wire of sufficient length to accommodate the maxillary and mandibular arches from second molar to contralateral second molar.

Next, use stainless steel circumdental wires at the first bicuspid positions, one on each side of the arch to secure the arch bar.

At this point, tightly place circumdental wires along the greater segment of the fracture. The greater segment is the fracture segment; that is the most tooth-bearing segment.

Loosely place circumdental wires along the lesser segment of the fracture. The lesser segment is the fracture segment that bears the least amount of teeth.

Then tightly place circumdental wires along the opposing arch.

Place the patient into his or her preinjury occlusion. With the patient held into occlusion, tighten the looser segment circumdental wires. This prevents arch bar placement from interfering with proper occlusion.

Place interarch stainless steel box wires along the molar/premolar region and the premolar/canine region bilaterally.

Placement of arch bars can be difficult when dentition is poor, the fracture is unstable and comminuted, and dentoalveolar fractures are present.

Indications for open reduction

Displaced unfavorable fractures through the angle of the mandible: Often, the proximal segment is displaced superiorly and medially and requires an open technique for proper reduction.

Severely atrophic edentulous mandibles: These have little cancellous bone remaining and minimal osteogenic potential, and fracture healing may be delayed.

Complex facial fractures: Such fractures can be reconstructed best after open reduction and fixation of the mandibular segments to provide a stable base for restoration.

Condylar fractures: Although strong evidence supporting open reduction of condylar fractures is lacking, a specific group of individuals benefit from surgical intervention.

Absolute indications:

1. Displacement of the condyle into the middle cranial fossa.
2. Inability to obtain adequate occlusion by closed techniques.
3. Lateral extracapsular dislocation of the condyle.

Relative indications:

1. Bilateral condylar fractures in an edentulous patient when splints are unavailable or impossible because of severe ridge atrophy.
2. Unilateral or bilateral condylar fractures when splinting is not recommended because of concomitant medical conditions or when physiotherapy is not possible.
3. Bilateral fractures associated with comminuted midfacial fractures

Mandibular nonunions require open access for debridement and subsequent reduction.

Malunions after improper reduction often require osteotomies through open surgical approaches to correct mandibular discrepancies.

Means of open reduction in mandibular fractures include the following:

- Wire osteosynthesis
- Plate fixation
- Compression screws

Open reduction: wire osteosynthesis

This is rarely used for definitive fixation since the advent of rigid fixation. However, it may be useful for help in alignment of fractured segments prior to rigid fixation.

This can be placed either by an intraoral or extraoral route. The wire should be a prestretched soft stainless steel.

A straight wire can be used across the fracture site. This is placed so the direction of pull of the wire is perpendicular to the fracture site. This can be placed as a monocortical or bicortical wire.

A figure-of-8 wire can provide increased strength at the superior and inferior borders compared to the straight wire.

Open reduction: plate fixation

Plate fixation can be of a «load-bearing» or a «load-sharing» construct:

- In load-bearing osteosynthesis, a rigid plate bears the forces of function at the fracture site. Indications are the management of atrophic edentulous fractures, comminuted fractures, and other complex mandibular fractures (Fig. 11).
- In load-sharing osteosynthesis (Fig. 12), stability at the fracture site is created by the frictional resistance between the bone ends and the hardware used for fixation. This requires adequate bone stock at the fracture site. Examples of load-

sharing osteosynthesis include lag-screw fixation and compression plating. Another form of load-sharing osteosynthesis is the miniplate fixation technique popularized by Champy. Load-sharing osteosynthesis cannot be used in comminuted fractures, owing to the lack of bony buttressing at the fracture site.

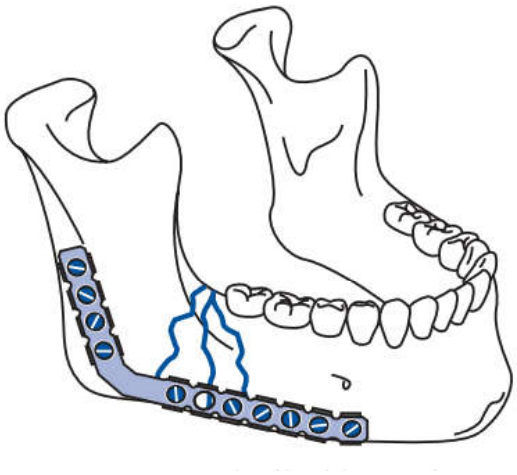


Fig. 11. Example of load-bearing fixation

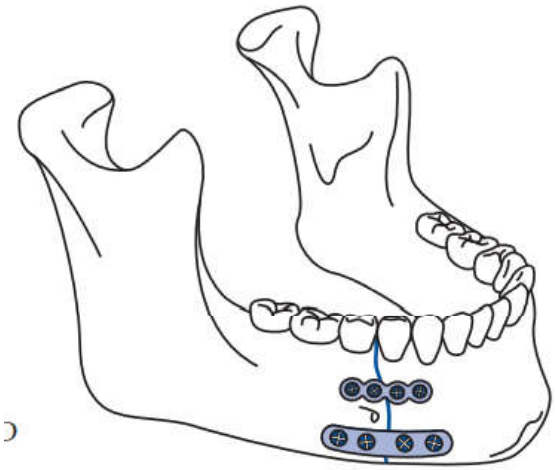


Fig. 12. Example of load-sharing fixation

(Peterson's principles of oral and maxillofacial surgery / G. E. Ghali [et al.]. 2nd ed.)

Ellis, in several large series of angle fractures treated with open reduction internal fixation, showed that a load-sharing mini-plate fixation had markedly less major complications than a rigidly fixated load-bearing fixation.

Open reduction: compression screws

In certain fracture patterns, such as anterior parasymphysial simple fracture, the compression lag screw may be used for fixation. This is a load-sharing construct, dependent on the integrity of the cortical bone for strength. Goyal et al found that compression screw fixation offered several advantages over plate fixation, including rapid bone healing and fewer complications.

Surgical Approaches

Intraoral approach

Advantages over the extraoral approach are that it is quicker to perform, results in no extraoral scar and less risk to the facial nerve, and can be performed under local anesthesia. Complication rates and infection rates appear to be similar between the intraoral and extraoral approaches when large numbers of patients are studied. Symphysis and parasymphysis fractures can be accessed through a genioplasty-type incision. Identification of the mental neurovascular bundle is important to preserve its integrity. Body, angle, and ramus fractures can be accessed through a vestibular incision that may extend onto the external oblique ridge as high as the mandibular occlusal plane. Extending the incision higher predisposes the buccal fat pad to prolapsing onto the surgical field. The entire surface of the

ramus and the subcondylar region can be exposed by stripping the buccinator and temporal tendon.

Submandibular approach

The submandibular approach often is referred to as the Risdon approach since he first described it in 1934.

Make the skin incision approximately 2 cm below the angle of the mandible in a natural skin crease. Dissect the subcutaneous fat and superficial cervical fasciae to reach the platysma muscle. Sharply dissect the platysma to reach the superficial layer of the deep cervical fascia. The marginal mandibular nerve runs just deep to this layer. Carry dissection to bone through the deep cervical fascia with the aid of a nerve stimulator. Carry the dissection down to the level of the pterygomasseteric sling. Sharply divide the sling to expose the bone.

Retromandibular approach

Hinds first described this approach in 1958.

Make the incision approximately 0.5 cm below the lobe of the ear and continue it inferiorly 3-3.5 cm. Place it just behind the posterior border of the mandible; it may extend below the level of the mandibular angle. Carry the dissection through the scant platysma, superficial musculoaponeurotic layer (SMAS), and parotid capsule. The marginal mandibular branch and the cervical branch of the facial nerve may be encountered. The retromandibular vein runs vertically in this region and commonly is exposed. This vein rarely requires ligation unless it has been transected inadvertently. Carry out sharp incision through the pterygomasseteric sling. Strip the muscle off the lateral surface of the mandible superiorly, which gives access to the ramus and subcondylar region of the mandible.

Preauricular approach

This approach is excellent for exposure to the temporomandibular joint. Make the incision sharply in the preauricular folds, approximately 2.5-3.5 cm in length. Take care not to extend the incision inferiorly, since it may encounter the facial nerve as it enters the posterior border of the parotid gland.Carry the incision and dissection along the perichondrium of the tragal cartilage. Some surgeons advocate making the incision through the tragus. The temporal fascia is encountered along the superior portion of the incision. Take care to be sure one is deep to the superficial temporal fascia or the temporoparietal fascia. Make an incision through the superficial (outer) layer of the temporalis fascia beginning from the root of the zygomatic arch just in front of the tragus anterosuperiorly toward the upper corner of the retracted flap. Insert the sharp end of a periosteal elevator in the fascial incision, deep to the superficial layer of temporalis fascia, and sweep it back and forth. Once the periosteal elevator dissection is approximately 1 cm below the arch, sharply release the intervening tissue posteriorly along the plane of the initial incision. Retract the entire flap anteriorly, exposing the joint capsule. Fracture location dictates whether the capsule is opened.

Concomitant dentoalveolar injuries should be evaluated and treated concurrently with treatment of mandibular fractures. Teeth in the line of fracture should be evaluated and if necessary, extracted. The following criteria for removal of teeth in the line of fracture are:

– Excessive mobility
– Root exposure due to distraction of the fracture
– Tooth fracture with pulp exposure
– Caries with pulp exposure

The following recommendations concerning teeth in the line of mandibular fracture:

– Intact teeth in the fracture line should be left if they show no evidence of severe loosening or inflammatory change.

– Impacted molars, especially full bony impactions, should be left in place to provide a larger repositioning surface. Exceptions are partially erupted molars with pericoronitis or those associated with a follicular cyst.

– Teeth that prevent reduction of fractures should be removed.

– Teeth with crown fractures may be retained provided emergency endodontics is performed.

– Teeth with fractured roots must be removed.

– Teeth with exposed root apices tend to develop pulpal or periodontal complications.

– Teeth that appear nonvital at time of injury should be treated conservatively due to potential for recovery.

– Perform primary extraction when there is extensive periodontal damage.

COMPLICATIONS OF MANDIBULAR FRACTURES

Complications of mandibular fractures:

– ***Osteomyelitis***.
– ***Permanent malocclusion***.
– ***Malunion***. Malunion is defined as improper alignment of the healed bony segments. When a dentate portion is involved in the malunion, a malocclusion can result. These malocclusions may be treated with orthodontics or osteotomies after complete consolidation of fracture lines.

– ***Ankylosis***. It is most likely to occur in children and is associated with intracapsular fractures and immobilization of the mandible. Ankylosis is believed to occur secondary to intra-articular hemorrhage, leading to abnormal fibrosis and ultimately ankylosis. Ankylosis may result in disturbed growth and underdevelopment of the affected side in children. The use of only short periods

of intermaxillary fixation in children can help reduce the occurrence of this complication.

– ***Nerve injury***. The inferior alveolar nerve and its branches are the most commonly injured nerves. The prominent sign of inferior alveolar nerve deficit is numbness or other sensory changes in the lower lip and chin. Damage to the marginal mandibular branch of the facial nerve is rare. More commonly seen is nerve damage caused by trauma in the region of the condyle, ramus, and angle of the mandible and by lacerations along its course. Most of the sensory and motor functions of these nerves improve and return to normal with time.

– ***Root impingement***. Fixation screws may inadvertently impinge the roots of teeth. However, minimal adverse consequences result from inadvertent tooth root transfixion by osteosynthesis screws.

CONTROL TEST

1. What anatomical structure is not included in mandible:

a) body;
b) angle;
c) alveolar part;
d) lower edge;
e) ramus;
f) the condylar process;
g) the coronoid process;
h) styloid process.

2. What processes does the mandibular bone have:

a) condylar;
b) coronoid;
c) zygomatic;
d) alveolar;
e) incisor.

3. Changes in the contours of the face with a fracture of the mandible may be due to:

a) traumatic edema of the near mandiblelar tissues;
b) the presence of subcutaneous emphysema;
c) damage to the facial nerve;
d) damage to the branches of the trigeminal nerve;
e) displacement of bone fragments.

4. In the presence of two lines of fracture in one side of mandible, traumatic fractures are classified:

a) single;
b) double;
c) bilateral;
d) plural.

5. For X-ray examination of the fracture in the angle on the left, it is necessary to take an X-ray of the mandible:

a) in direct projection;
b) lateral projection on the left;
c) lateral projection on the right.

6. If you suspect a traumatic bilateral fracture of the mandible in the angle, an X-ray of the mandible should be performed:

a) in direct projection;
b) lateral projection on the right;
c) lateral projection on the left;
d) orthopantomography;
e) computed tomography;
f) lateral projection on the left and right.

7. The main groups of non-gunshot fractures of the lower jaw:

a) fractures of the jaw body within the dentition;
b) fractures of the jaw body in the presence of toothless fragments;
c) fractures behind the dentition;
d) true a), b) and c);
e) true a) and c).

8. The orthopedic treatment plan for jaw fractures depends on:

a) location of the fracture;

b) the nature of the fracture;

c) the condition of the teeth on the preserved fragments of the jaws;

d) true a), b) and c);

e) true a) and b).

9. To provide first aid for jaw fractures, use:

a) standard transport splint;

b) reposition of fragments;

c) Tigerstedt wire splint;

d) Vasiliev's splint.

10. Possible complications of incorrectly consolidated fractures:

a) periodontal disease;

b) TMJ diseases;

c) Incorrect occlusal contacts;

d) trigeminal neuropathy.

11. In case of a bilateral fracture of the lower jaw, the medial fragment is displaced:

a) back;

b) forward;

c) up;

d) down.

12. In case of a bilateral fracture of the lower jaw, the lateral fragments are displaced:

a) back;

b) forward;

c) up;

d) inward.

13. An obligatory stage in the diagnostics of mandibular fractures is:

a) radiography;

b) osteometry;

c) tomography;

d) electromyography;

e) rheography;

14. In case of a fracture of the lower jaw in the region of the base of the condylar process with displacement of bone fragments and dislocation of the articular head, it is indicated:

a) bimaxillary splinting with the imposition of a repositioning pad;

b) bimaxillary splinting, transfocal osteosynthesis with a system of mini-plates;

c) bimaxillary splinting, open reduction of the articular head, transfocal osteosynthesis with a mini-plate system;

d) bimaxillary splinting.

15. Indications for osteosynthesis of the lower jaw:

a) fractures of the edentulous jaws with the presence of complete removable orthopedic prostheses;

b) insufficient number of teeth on displaced fragments of the jaw;

c) interposition of soft tissues in the fracture line;

d) all open fractures;

e) all types of fractures with preservation of displacement of bone fragments after splinting;

f) fractures in the area of the condylar process.

16. The sequence of stages of the operation of the lower jaw osteosynthesis with a system of titanium mini-plates:

a) open reduction of bone fragments;
b) preparation of the operating field;
c) anesthetic aid;
d) implementation of operational access to the fracture zone;
e) fixing the mini-plate with screws;
f) revision of the fracture line;
g) wound stitches.

17. The control of the correct open reduction of the fragments of the lower jaw during the osteosynthesis operation is:

a) minimal mobility of the repositioned bone fragments;
b) maximum congruence of the edges of bone fragments;
c) stopping bleeding from the fracture gap;
d) restoration of bite when applying intermaxillary traction;
e) maximum mouth opening.

18. Average terms of immobilization in traumatic uncomplicated fracture of the lower jaw in the frontal region:

a) 8–10 days; c) 21–23 days; e) 40–42 days.
b) 14–18 days; d) 28–30 days;

19. Average terms of immobilization of the lower jaw with preservation of intermaxillary traction in case of unilateral traumatic uncomplicated fracture in the area of the body or angle, or branch:

a) 8–10 days; c) 21–23 days; e) 40–42 days.
b) 14–18 days; d) 28–30 days;

20. The type of occulusion with a bilateral fracture of the lower body:

a) open; c) medial; e) deep.
b) cross; d) distal;

Answers: **1** – h; **2** – a, b; **3** – a, e; **4** – b; **5** – a, b; **6** – a, d, e, f; **7** – d; **8** – d; **9** – a; **10** – b, c, d; **11** – a, d; **12** – c, d; **13** – a; **14** – c; **15** – a, b, c, e; **16** – b, c, d, f, a, e, g; **17** – b, d; **18** – c; **19** – c; **20** – a.

REFERENCES

1. *Laub, D. R.* Mandibular fractures [Electronic resource] / D. R. Laub ; chief ed. D. Narayan // Medscape. Mode of access: https://emedicine.medscape.com Date of access: 25.11.2021.
2. *Peterson's* principles of oral and maxillofacial surgery / G. E. Ghali [et al.]. 2nd ed. Hamilton ; London : B. C. Decker, 2004. 1502 p.
3. *Mihailova, H.* Classifications of mandibular fractures-review / H. Mihailova // J. of IMAB. 2006. Vol. 12, № 2. P. 3–5.
4. *Association* between third molar and mandibular angle fracture: a systematic review and meta-analysis / F. Giovacchini [et al.] // J. of Cranio-Maxillofacial Surgery. 2018. Vol. 46, № 4. P. 558–565.
5. *Multi-institutional* analysis of surgical management and outcomes of mandibular fracture repair in adults / D. Zavlin [et al.] // Craniomaxillofacial Trauma a. Reconstruction. 2018. Vol. 11, № 1. P. 41–48.
6. *Occlusal* instability results in increased complication rates after treatment of mandibular fractures / P. D. Ribeiro-Junior [et al.] // J. of Oral a. Maxillofacial Surgery. – 2020. Vol. 78, № 7. P. 1163.e1–1163.e7.
7. *Contemporary* management of mandibular fracture nonunion – a retrospective review and treatment algorithm / B. T. Ostrander [et al.] // J. of Oral a. Maxillofacial Surgery. 2018. Vol. 76, № 7. P. 1479–1493.
8. *Chocron, Y.* Resorbable implants for mandibular fracture fixation: a systematic review and meta-analysis [Electronic resource] / Y. Chocron, A. J. Azzi, S. Cugno // Plastic a. Reconstructive Surgery – Global Open. 2019. Vol. 7, № 8. Mode of access: https://europepmc.org Date of access: 25.11.2021.
9. *Mechanics* in the production of mandibular fractures: a clinical, retrospective case-control study [Electronic resource] / H. Zhou [et al.] // PLoS One. 2016. Vol. 11, № 2. Mode of access: https://journals.plos.org. Date of access: 25.11.2021.
10. *Nabil, Y.* Evaluation of the effect of different mandibular fractures on the temporomandibular joint using magnetic resonance imaging: five years of follow-up / Y. Nabil // Intern. J. of Oral a. Maxillofacial Surgery. 2016. Vol. 45, № 11. P. 1495–1499.

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