Mandibular fractures
And
Dentoalveolar fractures

MANDIBULAR ANATOMY
The mandible is a U- or V-shaped structure consisting of buccal (outer) and lingual (inner) cortical plates sandwiching variable amounts of cancellous bone depending on the location in the mandible (thicker anteriorly, thinner posteriorly). Many of the trabeculae located within the mandible are oriented in a horizontal trajectory in the body and in a vertical trajectory in the ramus. These two major trajectories serve to transmit masticatory forces from the mandible to the base of the skull through the TMJ. Although the mandible is well suited to withstand notable masticatory forces, there are a number of inherently weak areas in it. And these include:

1. Condylar process.
2. Angle of the mandible.
3. Mental foramen.
4. Areas containing impacted teeth.
5. Areas of pathologic involvement by lesions of both dental and non-dental origin.

The mandible can be divided roughly into:

1. Basal bone.
2. Alveolar process, with the amount of bone depending on the presence or absence of teeth. The cortical bone is thicker anteriorly and, in conjunction with the V shape of the bone, makes the anterior, symphyseal region the strongest area of the lower jaw.

Etiology
The literature showed that:

- 43% of mandibular fractures were caused by vehicular accidents.
- 34% were caused by assaults.
- 7% were work related.
- 7% occurred as a result of a fall.
- 4% occurred in sporting accidents.

Age
35 percent of mandibular fractures occur in individuals between the ages of 20-30. 15 percent of mandibular fractures occurring in those in the 40-50 age group.

3 percent occurring after age 60

RADIOGRAPHIC EVALUATION
The selection of the initial imaging study often depends on a number of factors, including the patient’s clinical presentation and the type of equipment available at the examining facility.
Diagnostic studies frequently used in the evaluation of mandibular trauma include

1- The lateral oblique or oblique view of the mandible is intended to provide visualization of the condylar and subcondylar regions, coronoid process, mandibular ramus and angle. The lateral oblique provides only limited visualization of the symphyseal region.

2- The PA view, is an excellent projection demonstrating the entire mandible except for the condyles, which are partially obscured by the superior-imposed temporal bone. The superimposed cervical spine on the symphesial region may partially obscure symphysial fractures. It is an important view for gauging the degree of medial-lateral displacement of fracture fragments in ramus and in the mandibular body areas.
3- The Towne's view provides optimal visualization of the condyle and the subcondylar region {condylar neck}. In addition, it is the view most often used to delineate the degree of medial-lateral displacement or dislocation of condylar or subcondylar fractures. The Towne's view is rarely helpful in visualizing fractures of the anterior mandible.

4- Panoramic Radiography. The panoramic radiograph, often referred to as a “Panorex”, is a popular imaging modality among clinicians for the evaluation of the maxilla and mandible. A correctly obtained panoramic view demonstrates the entire mandible on a single film. It is particularly useful in demonstrating the anterior half of the mandible, which is often suboptimally demonstrated on other plain film projections.
Panoramic radiographic image of a right angle and left symphyseal fracture.

5- *Computed Tomography*, represents a major improvement in the diagnostic imaging of midfacial and mandibular trauma.
Number of fractures per mandible
In patients with mandible fractures, 53% of patients had unilateral fractures, 37% of the patients had 2 fractures, and 9% had 3 or more fractures

Fracture types :

1- **Simple, or closed**: A fracture that does not produce a wound open to the external environment, whether it be through the skin, mucosa, or periodontal membrane. Most simple fractures of the mandible occur in the region of the ramus and condyle.

2- **Compound, or open**: A fracture in which an external wound, involving skin, mucosa, or periodontal membrane, communicates with the break in the bone through a laceration or tooth socket. This category includes all fractures of the tooth bearing portion of the mandible in which the fracture line passes through a tooth socket.

3- **Comminuted**: A fracture in which the bone is splintered or crushed. Communion generally signifies that a greater force produced the injury.

4- **Greenstick**: A fracture in which one cortex of the bone is broken, the other being bent. Although it can occur anywhere in the mandible, it is most prevalent in pediatric patients in the subcondylar region.

5- **Pathologic**: A fracture occurring from mild injury or spontaneously because of pre-existing bone disease. In which the region weakened by preexisting disease (infection, primary tumor, and metastasis).

6- **Multiple**: A variety in which there are two or more lines of fracture on the same bone not communicating with one another.

7- **Impacted**: A fracture in which one fragment is firmly driven into the other.

8- **Atrophic**: A spontaneous fracture resulting from atrophy of the bone, as in edentulous mandibles.

9- **Indirect**: A fracture at a point distant from the site of injury.
**Complicated or complex:** A fracture in which there is considerable injury to the adjacent soft tissues or adjacent parts (nerve, joint); may be simple or compound. Since the mandible itself contains the inferior alveolar neurovascular bundle, most mandibular fractures can be thought of as complicated fractures.

### Classification of fractures by Anatomic Region

Mandibular fractures are also classified by the anatomic areas of involvement. These are as follows: symphysis, body, angle, ramus, condylar process, coronoid process, and alveolar process. Dingman and Natvig defined these regions as follows:

1. **Parasymphyseal:** Fractures occurring within the boundaries of vertical lines distal to the canine teeth.
2. **Symphysis:** Fracture in the region of the central incisors that runs from the alveolar process through the inferior border of the mandible.
3. **Body:** From the distal parasymphysis to a line coinciding with the alveolar border of the masseter muscle (usually including the third molar).
4. **Angle:** Triangular region bounded by the anterior border of the masseter muscle to the posterosuperior attachment of the masseter muscle (usually distal to the third molar).
5. **Ramus:** Bounded by the superior aspect of the angle to two lines forming an apex at the sigmoid notch.
6. **Condylar Process:** Area of the condylar process superior to the ramus region.
7. **Coronoid Process:** Includes the coronoid process of the mandible superior to the ramus region.
8. **Alveolar Process:** The region that would normally contain teeth.

Kazanjian and Converse classified mandibular fractures by the presence or absence of serviceable teeth in relation to the line of fracture. They felt their classification was helpful in determining treatment. Three classes were defined:

- **Class I:** Teeth are present on both sides of the fracture line.
- **Class II:** Teeth are present on only one side of the fracture line.
- **Class III:** The patient is edentulous.
An important classification of mandibular angle and body fractures relates to the direction of the fracture line and the effect of muscle action on the fracture fragments.

1. Vertically favorable or unfavorable.
2. Horizontally favorable or unfavorable.

In fractures of the angle of the mandible, the muscles attached to the ramus (masseter, temporalis, and medial pterygoid) displace the proximal segment upward and medially when the fractures are vertically and horizontally unfavorable. Conversely, these same muscles tend to impact the bone, minimizing displacement in horizontally and vertically favorable fractures.

The farther forward the fracture occurs in the body of the mandible, the more the upward displacement of those muscles is counteracted by the downward pull of the mylohyoid muscles.

In bilateral fractures in the cuspid areas, the symphysis of the mandible is displaced inferiorly and posteriorly by the pull of the digastric, geniohyoid, and genioglossus muscles.
During examination, we must search for signs and symptoms of mandibular fractures

1-CHANGE IN OCCLUSION
Any change in occlusion is highly suggestive of mandibular fracture. Patients should be asked if their bite feels different. A change in occlusion can result from fractured teeth, fractured alveolar process, fractured mandible at any location, and trauma to the temporomandibular joint and muscles of mastication. Post-traumatic
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premature posterior dental contact or anterior open bite may result from bilateral mandibular condylar or angle fractures as well as from maxillary fractures.

2-ANESTHESIA, PARESTHESIA, OR DYSESTHESIA OF THE LOWER LIP
Although changes in sensation in the lower lip and chin may be related to chin and lip lacerations as well as blunt trauma, numbness in the distribution of the inferior alveolar nerve after trauma is almost pathognomonic of a fracture distal to the mandibular foramen.

3-ABNORMAL MANDIBULAR MOVEMENTS
Most patients presenting with a fractured mandible will have limited opening and trismus owing to guarding of the muscle of mastication. There are, however, certain mandibular fractures or associated facial fractures that will result in predictable abnormal mandibular movements. A classic example is deviation on opening toward the side of a mandibular condylar fracture. Because lateral pterygoid muscle function on the unaffected side is not counteracted on the opposite side by the nonfunctioning lateral pterygoid muscle, deviation results. Inability to open the mandible may be caused by the impingement of the coronoid process on the zygomatic arch either from fractures of the ramus and coronoid process or from depression of a zygomatic arch fracture. Inability to close the jaw can be the result of fractures of the alveolar process, angle, ramus, or symphysis, causing premature dental contact. Lateral mandibular movements may be inhibited by bilateral condylar fractures and fractures of the ramus with bone displacement.

4-CHANGE IN FACIAL CONTOUR AND MANDIBULAR ARCH FORM
Although facial contour may be masked by swelling, the clinician should examine the face and mandible for abnormal contours. A flattened appearance. Disfigurement, disproportion, retruded chin or face
The same holds true for mandibular arch form. If there is a deviation from the normal U-shaped curve of the mandible, fracture should be suspected.

5-LACERATIONS, HEMATOMA, AND ECCHYMOSIS
The direction and type of fracture may be visualized directly through the laceration, thus gaining diagnostic information that may be impossible to ascertain clinically or radiographically.
The diagnostic sign of ecchymosis in the floor of the mouth indicates mandibular body or symphyseal fracture.

6-LOOSE TEETH AND CREPITATION ON PALPATION
A force strong enough to loosen teeth certainly can fracture the underlying bone. Multiple fractured teeth that are firm indicate that the jaws were clenched during traumatic insult, thus lessening the effect on the supporting bone.
The mandible should be palpated using both hands, with the thumb on the teeth and the fingers on the lower border of the mandible. By slowly and carefully placing pressure between the two hands, crepitation can be noted in a fracture. Too often, this simple diagnostic technique will be overlooked in favor of extensive (and expensive) radiographic diagnostic methods.

**7-DOLOR, TUMOR, RUBOR, AND COLOR**
Pain, swelling, redness, and localized heat have been noted as signs of inflammation since the time of the ancient Greeks. All of these are excellent primary signs of trauma and can greatly increase the index of suspicion for mandibular fracture.

**8- CONDYLAR MOVEMENT:**
Standing in front of the patient, 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.

**# by location**

1. **Condylar and subcondylar fractures**

Condylar and subcondylar fractures usually occur indirectly following direct trauma to another segment of the mandible. Direct injuries to this area are uncommon because this portion of the mandible is well protected by surrounding structures (e.g., zygomatic arch and temporal bone). Intracapsular or intraarticular fractures are rare and usually occur in children following a severe blow to the chin.

In contrast to the rarity of intracapsular fractures, extracapsular fractures are relatively common. Unilateral fractures are more common than bilateral fractures and are frequently associated with contralateral angle fractures. Bilateral fractures usually occur as a result of a blow to the chin. The fracture line often extends posteriorly in an oblique or transverse direction from the mandibular notch. Subcondylar fractures can demonstrate notable displacement of the proximal fracture fragment, and this displacement can occur in any direction.

The Towne’s projection is essential in determining angulation and displacement in the lateral and medial dimension, whereas the lateral view is useful in assessing displacement in the AP direction.

2. **Coronoid Process and Ramus Fractures.**

Mandibular coronoid process and ramus fractures are rare, with each having an incidence of only 1-2%.

*Coronoid process* fractures are rare because of the protection afforded by the zygoma. These fractures when present may exhibit superior displacement as a result of the pull of the temporalis muscle. In cases of severe trauma to the zygoma or zygomatic arch,
however, the coronoid can be fractured, with the fracture line extending anywhere from the sigmoid notch region of the mandible to the retromolar area. *Ramus* fractures are also uncommon, owing to the (1)Dense bone composing the ramus and (2)Protection provided by the masseter and internal pterygoid muscles. It is usually fractured by a direct blow. Ramus fractures rarely show notable displacement because the fragments are well splinted by their muscular sling.

**3- Angle of Mandible Fractures**

Fractures involving the angle of the mandible are the most common single fractures seen. The incidence ranges from 11% to 30% depending on the study quoted and the cause of the fracture (e.g., fall versus motor vehicle accident). The fracture line usually extends from the alveolar process in the region of the third molar, then downward and posteriorly to the region on the anatomic angle of the mandible, resulting in a horizontally unfavorable fracture. Angle fractures are usually the result of a blow to the chin from the contralateral side or a blow to the mandibular body region on the ipsilateral side. Angle fractures are often associated with the contralateral subcondylar or mandibular body fractures. The angle region is prone to fracture because of inherent weaknesses produced by (1) Developing third molars. (2) Changes in bony trabecular alignment. (3) The attachments of the masseter and internal pterygoid muscles. The delineation of favorable versus unfavorable relates to the ability of the muscles that attach to the fractured segments to reduce the fracture (favorable) or distract the fracture (unfavorable).

**4- Mandibular Body Fractures.**

Mandibular body fractures constitute 16-36% of the fractures seen, with their highest incidence occurring in patients involved in motor vehicle accidents. These fractures primarily result from direct insult to the area. All fractures in this region (unless in an edentulous patient with no violation of mucosa or skin) must be considered compound fractures. The fracture lines are usually located at the site of the molars (since this is where the blow lands) or at the area of the canine (since this is an area of high strain resulting from the trauma).

**5- Mandibular Symphysis and Parasymphysis Fractures.**

Mandibular symphysis and parasymphysis fractures account for 11.7-24% of the mandibular fractures. These fractures are rarely straight but rather most often run in an oblique direction. Can be detected by panoramic, CT scan, and intraoral radiographs to be delineated.
As with bilateral body fractures, bilateral parasymphyseal fractures can lead to mechanical airway obstruction because of posterior prolapse of the distal segment as a result of the action of the suprahyoid muscles.

6- Dentoalveolar Injuries.
The incidence, frequency, and type of dentoalveolar injury seen with facial trauma vary greatly, depending primarily on the nature of the insult and age of the patient (presence of primary versus adult dentition). The reported incidence of dentoalveolar injuries varies widely, ranging from 0.8% to 14%. It is likely that these injuries occur far more commonly but are not included in incidence reporting in the emergency department site. Importantly, the studies reporting the highest incidence of dentoalveolar fractures involve the pediatric population, although this population constitutes only a small percentage of total facial fractures.

TREATMENT OPTION

1- Closed reduction (CR) that required IMF (MMF) with wire osteosynthesis for an average of 6 weeks (for satisfactory healing. Difficulties associated with this extended period of immobilization include
A- Airway problems.
B- Poor nutrition.
C- Weight loss.
D- Poor hygiene.
E- Phonation difficulties.
F- Insomnia.
G- Social inconvenience.
H- Patient discomfort.
I- Work loss.
J- Difficulty recovering normal range of jaw function. In contrast, rigid and semirigid fixation of mandible fractures allow early mobilization and restoration of jaw function, airway control, improved nutritional status, improved speech, better oral hygiene, patient comfort, and an earlier return to the workplace.

A- Closed Reduction of Dentate Patients

Arch bar (Erich type arch bars)

- Initially, use a bar of sufficient length to accommodate the maxillary and mandibular arches from first molar to contralateral first molar.
Next, use 24-gauge stainless steel circumdental wires to secure the arch bar to both arches.
Place the patient into his or her preinjury occlusion. With the patient held into occlusion, tighten the circumdental wires.

Ivy loops

Ivy loops are used for intermaxillary fixation when full dentition is present in good condition and the fracture is displaced minimally.
Construct a loop in the middle of a 24-gauge wire.
Pass the loose ends of the wire interproximal to two stable teeth.
Loop the wire ends around the mesial and distal sides of the teeth.
Pass the distal wire under or through the loop and then tighten it to the mesial wire in an apical direction.
Accomplish the same procedure on the opposite arch directly opposing the first wire.
Pass a 25-gauge interarch wire through the two opposing loops and tighten it in a clockwise fashion.
At least one ivy loop on each side is necessary
If dentures are available, they can be secured with circummandibular wires, circumzygomatic wires, or palatal screws. Dentures also can be fabricated with incorporated arch bars as well as a space in the anterior for feeding (Gunning splint). They are secured in the same fashion with circummandibular wires, circumzygomatic wires, or palatal screws. Biphasic pin fixation (external pin fixation or Joe Hall Morris appliance) also is used for edentulous patients. Its indications for use are as follows:

1. In edentulous patients with a discontinuity defect because of either severe trauma or resection
2. In severely comminuted fractures
3. When intermaxillary or rigid fixation cannot be used

Biphasic pin fixation using two pins on both the proximal and distal fragments.
Gunning- splints heat-cured acrylic. Note the arch bars secured in the acrylic away from the splint flanges. The hole in the anterior region of the splint facilitates the intake of nourishment.

**Indications for closed reduction**

1- Nondisplaced favorable fractures: Open reduction carries an increased risk of morbidity, thus use the simplest method to reduce and fixate the fracture. 
2- Grossly comminuted fractures: Generally, these are best treated by closed reduction to minimize stripping of the periosteum of small bone fragments. 
3- Fractures in children:  
   A- Fractures 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. 
   B- Fracture involving 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) days of intermaxillary fixation) of the condyle is important. 
4- Coronoid fractures: These fractures usually require no treatment unless impingement on the zygomatic arch is present. 
5- 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. If the condylar fracture is in association with another fracture of the mandible, treat the non-condylar fracture with ORIF, and treat the condylar fracture with closed reduction. 

**Contraindications to closed reduction:**

- Patients with poorly controlled seizure history 
- Patients with compromised pulmonary function (ie, moderate-to-severe asthma, chronic obstructive pulmonary disease) 
- Patients with psychiatric or neurologic problems 
- Patients with eating or GI disorders 

**2- Open Reduction (Surgical Therapy)**

**A- 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.
**B- Plate fixation**

Plate fixation can be of a "load-bearing" or a "load-sharing" construct, as follows:

- 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.
- In load-sharing osteosynthesis, 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.

**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 with a notched ramus retractor and periosteal elevator.

**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.
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 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.
Indications for open reduction

1- 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.

2- Severely atrophic edentulous mandibles: These have little cancellous bone remaining and minimal osteogenic potential, and fracture healing may be delayed. Open reduction and grafting may be the good option for such fractures.

3- 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.

4- Condylar fractures: Although strong evidence supporting open reduction of condylar fractures is lacking, a specific group of individuals benefit from surgical intervention. The classic article by Zide and Kent lists absolute and relative indications for open reduction of the fractured mandibular condyle.

A- 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

B- Relative indications
   1. Bilateral condylar fractures in an edentulous patient when splints are unavailable or impossible because of severe ridge atrophy condylar fractures.
   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
   4. Mandibular nonunions or malunion require open access for debridement and subsequent reduction.
Timing of open reduction

Traditional teaching has been that mandible fractures should be reduced within 24 hours of injury. Recent studies have shown no correlation of complications and delay of repair of over 2 weeks with exception of technical difficulty.

Complications:-

1- Delayed union and nonunion

- Delayed union and nonunion occur in approximately 3% of fractures.
- Delayed union is a temporary condition in which adequate reduction and immobilization eventually produce bony union.
- Nonunion indicates a lack of bony healing between the segments that persists indefinitely without evidence of bone healing unless surgical treatment is undertaken to repair the fracture.
- Nonunion is characterized by pain and abnormal mobility following treatment.
- Radiographs demonstrate no evidence of healing and in later stages show rounding off of the bone ends.
- The most likely cause for delayed union and nonunion
  - A- Poor reduction, fixation and immobilization.
B- Infection is often an underlying cause. Carefully assess teeth in the line of fractures for possible extraction or they may be a nidus for infection.
C- Decreased blood supply can lead to a delay in healing. Excessive stripping of the periosteum, especially in comminuted and edentulous fractures, can lead to delayed healing.
D- Alcoholics have been shown to have an increased incidence of delayed union and nonunion. Whether metabolic and vitamin deficiencies, poor compliance with intermaxillary fixation, poor bone quality, or, most likely, a combination of the above reasons is the cause for an increased incidence of nonunion and delayed union is unknown.

2- Infection
- Infection may occur in about 50% of patients.
- Systemic factors include alcoholism, an immunocompromised patient, and lack of antibiotic coverage.
- Local factors include poor reduction and fixation, fractured teeth in the line of fracture, and comminuted fractures.
- When infection is present it must be managed with debridement of sequestra, drainage, and antibiotic therapy.

3- Malunion
- Malunion is defined as improper alignment of the healed bony segments. It is usually the result of inadequate reduction, inadequate stabilization and fixation, development of a postoperative infection, or some combination of these factors.
- These resulting malocclusions may be treated with orthodontics or osteotomies after complete bony union.

4- Ankylosis
- Ankylosis is a rare complication of mandibular fractures.
- 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.
- Fibrous or bony ankylosis of the condyle to the glenoid fossa and zygoma. The potential for development of ankylosis is dependent on several factors, including the location and extent of condylar injury, associated trauma to contiguous structures, age of the patient, and the post-treatment immobilization period.

5- 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.

6- Root impingement
• Fixation screws may inadvertently impinge the roots of teeth.