Facial Trauma- Mandibular Fractures /P.2

B. Open treatment

It consists of **Open Reduction** and **Internal Fixation** (ORIF) or direct skeletal fixation. In open reduction the fracture site is surgically exposed and the fracture is reduced under direct vision and the fractured fragments are immobilized by different internal fixation methods. **ORIF is now considered the main method of treatment of mandibular fractures**.

The **main indications** for open treatment:

1. Displaced unfavorable fractures.
2. Multiple fractures of the facial bones
3. Fractures of an edentulous mandible with severe displacement.
4. Delay of treatment and interposition of soft tissue between fracture fragments.
5. Special systemic conditions contraindicating IMF.

Depending on the planned method of internal fixation and the site of the fracture, three different surgical approaches to the mandibular body, with slight modifications, are possible: **intraoral, extraoral, or combined access.**

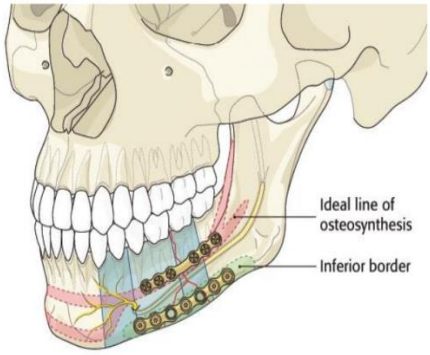
Methods of internal fixation (Osteosynthesis)

I. Interosseous or Transosseous wiring

It is the direct fixation of two or more bone fragments with the aid of wire ligatures pulled through drilled holes, it is considered a **non-rigid fixation method**. It can be applied on the upper or lower border following reduction, but additional fixation of the fractured mandible with IMF is required to maintain stability. Wiring can be in the form of simple ligature, combination of simple ligature and figure-of-eight wiring or in the form of double ligature. The advent of plating techniques has superseded interosseous wiring in most situations especially in developed countries.

II. Miniplates (miniaturized plates)

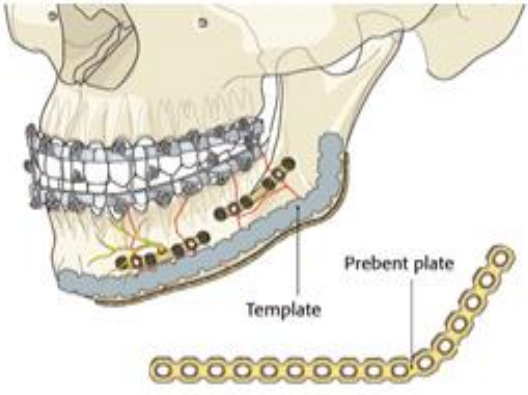
- These are the **most common form of internal fixation** used in the management of mandibular fractures. They provide **semi-rigid or load sharing fixation by intra oral approach.**
- Developed in 1970s and were originally fabricated in stainless steel but titanium is now the metal of choice.
- **Champy's (ideal) line of Osteosynthesis** run along the tension line (note that the tension zone lies in the upper border while the compression zone lies in the lower margin) across the fracture in the body of the mandible from the canine region to the oblique ridge below the apicies of the teeth.



- Two point fixation (two plates) give good stability;it is preferable to place one plate in champy's line and the other in inferior border below the course of mandibular canal. The plate can be anchored using only the outer cortical bone with so-called "**monocortical**" screws which are 2 mm in diameter. Two plates **at least 5 mm apart** are required for the body and anterior mandible.
- The overwhelming advantage of plating techniques is that they are all sufficiently rigid to obviate the need for IMF in most cases.
- **Load sharing** means there is sufficient bone to bone contact across the fracture line (the bone share the load with the plate)
- Any method that does not rely on IMF must ensure the precise restoration of the occlusion. That's why about 25% of cases treated with plates need occlusal adjustment postoperatively.

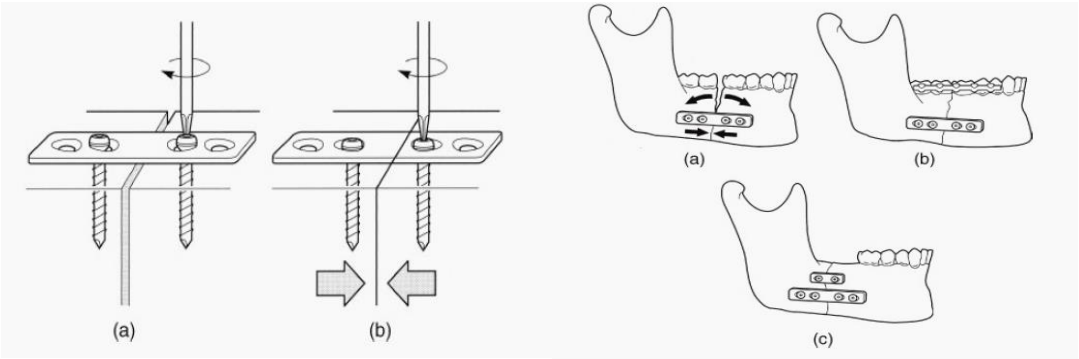
III. Non compression Rigid plates (Reconstruction plates)

- These plates provide **rigid** or **load bearing fixation**.
- **Load bearing** means the plate bears the load alone, as in lost segment across the fracture line or in comminuted cases.
- These are not used for routine mandibular fracture management
- They are mainly **used in the management of severely comminuted fractures, in fractures where there are continuity defects.**
- Adaptation of the plates is technically more difficult and they are longer than miniplates that **require an extra-oral approach** for accurate placement.
- They require **bicortical screws** (engagement of buccal and lingual corticies) and are fixed in place at or near the lower border of the mandible in order to avoid damage to the inferior alveolar nerve and the dental roots.
- Some modern designs of plates employ **locking screws** that lock into the plate at the completion of insertion in order to avoid any micro-movement between the plate and the screw.



IV. Compression plates

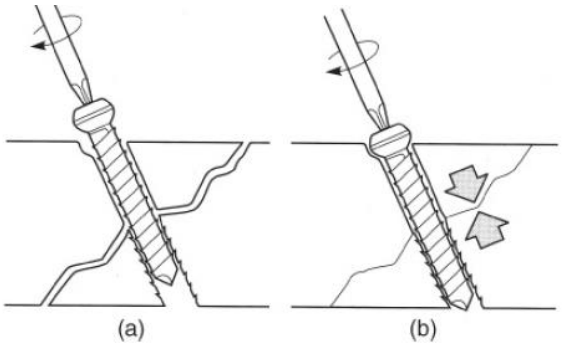
- These plates provide **rigid fixation**.The principle of compression plating is by transforming the downward force of screw insertion into compressive force, this displaces the screw and the fractured fragment in the direction of the opposite fragment, resulting in compression between the bone ends.
- **These plates were abandoned** Because of the difficulty in application and multiple complications (include the **tendency for the fracture line to open**), also they do not offer much advantage to the treatment.

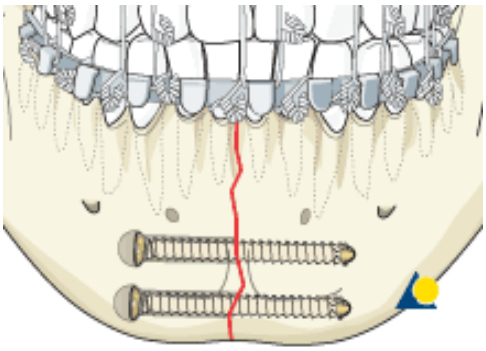


V.

VI. Lag screws

- In **oblique fractures**, **compression lag screws** are placed perpendicularly across the fracture line.
- To produce compression, the proximal bone hole is oversized so that only the distal fragment is engaged by the screw. Tightening applies sufficient compression and consequently fixation of the fracture site.
- It is an effective method, which can be employed transorally in a number of cases. This technique appears to be ideal for **parasymphyseal and symphyseal fractures**, but it becomes technically more difficult in body or angle fractures because the risk of damage to the alveolar inferior nerve increases.





❖ Mandibular fractures that require special considerations

1) Pediatric Fractures

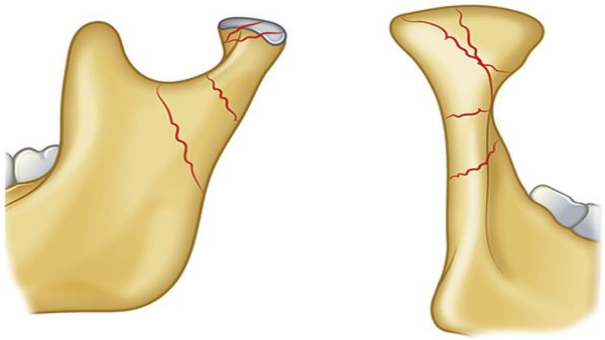
Fractures of the mandible are uncommon in children and some modifications to the principles of treatment are necessary when the fracture occurs in a child. The main characteristics of mandibular fractures in children are:

- ✓ The bone in young children is resilient and greenstick fracture (simple fracture of one cortex and bending of the other) is more likely to occur
- ✓ There is a risk of damage to developing teeth.
- ✓ Mandibular fractures in young children heal very rapidly and some fractures are stable within a week, and firmly united within 3 weeks.
- ✓ **Treatment of mandibular fractures in children is generally of a conservative nature**.
- ✓ Fractures of the condyle require special consideration; because the condyle is a growth center and such fractures may disturb the growth of the mandible.
- ✓ Management:
  - In **very young with unerupted** or **very few deciduous teeth** a **Gunning-type splint** (the same one that is used for edentulous patients) for the lower jaw alone may be used. This is constructed as a simple acrylic and retained by two light circumandibular wires.
  - When **sufficient** firm **erupted deciduous and permanent** teeth are present, **eyelet wires or arch bars can be used.**
  - When there is **significant displacement of fragments**, **open reduction** may be necessary. In this situation any plate or wire fixation must be strictly confined to the lower border to avoid damage to developing teeth. Resorbable plates and screws are preferable in children.
- ✓ Slight imperfection in reduction can be accepted when a fracture is treated, because continuing growth and eruption of teeth will compensate in most cases for the imperfect alignment of the fragments.

2) Fractures of the Condyle

- Fractures involving the mandibular condyle are the only facial bone fractures that involve a synovial joint.
- These are the **most common fractures of the mandible** and are the most commonly missed on clinical examination.
- Fractures of the neck of the condyle can be regarded as a safety mechanism that protects the patient from the serious consequences of a middle cranial fossa fracture.
- Unfortunately, despite much recent interest in open reduction techniques, there are still no definitive guidelines for the treatment of fractures of the mandibular condyle and this remains a controversial topic.
- Condylar fractures may be unilateral or bilateral and they may either involve the joint compartment (intracapsular fractures) or the condylar neck (extracapsular fractures). The latter are the more common.

- An intracapsular fracture of the condylar head will frequently cause a **haemarthrosis** (hemorrhage within the joint). If this occurs in a young child it can **predispose to fibrous or bony ankylosis** of the temporomandibular articulation and interference with the growth potential of the condyle.



- The **meniscus** is an important component of the temporomandibular joint. Routine radiographs do not delineate this structure although it can be **visualized by magnetic resonance imaging**. Tearing of the meniscus along with haemarthrosis predisposes to late fibrous or bony ankylosis.
- **The commonest displacement is antero-medial** owing to the direction of pull of the lateral pterygoid muscle that is attached to the condylar head and also to the meniscus.
- Displacement of the condyle from the fossa, or over-riding of the fractures **('telescoping'),** shortens the ramus on the affected side and produces premature contact of the occlusion on the ipsilateral molar teeth. In case of bilateral subcondylar fractures with over-riding rami; **anterior open bite will result.**
- The mandible deviates on opening **towards the side of the fracture** and there is usually painful limitation of protrusion and lateral excursion to the opposite side.
  - In children: all intracapsular fractures and all fractures in growing children should be treated conservatively. Immediate or early mobilization should be encouraged. If the occlusion is disturbed IMF is applied and maintained until stable union can be expected to be present, the period of immobilization should not exceed 10-21 days.
  - In adults: subcondylar fractures can be treated by closed or open reduction and fixation.

Complications

- Malocclusion.
- Limitation of range of movement.
- **Ankylosis of the TMJ**; fractures that involve the joint space, particularly in pediatric patients, seem most prone to result in this complication. Ankylosis can be fibrous or bony. Predisposing factors include:

1. **Age:** the major incidence is below the age of 10 years.
2. **Type of injury**: intracapsular trauma with crushing of the condyle.
3. **Damage to the disc**: disruption of the disc is likely to occur in two particular types of fracture: a severe intracapsular compression injury or a fracture dislocation.

3) Fractures of the Edentulous Mandible

The physical characteristics of the mandible are altered considerably following the loss of the teeth:

- ✓ The alveolar process undergoes resorption and the mandible becomes atrophic and thin.
- ✓ The resistance of the bone to trauma is further reduced by changes in the structure of the bone associated with the process of ageing.
- ✓ The blood supply of the edentulous mandible is more periosteal due to the diminished endosteal blood supply of the mandible.
- ✓ The healing potential of the bone is reduced and the healing of the fracture is a slow process and the complications such as nonunion are more likely to occur.
- ✓ The absence of teeth means that precise anatomical reduction is not necessary as any inaccuracy is easily compensated by adjustment of dentures.

Treatment

- Undisplaced fractures require no active treatment.
- The edentulous mandibular fractures can be treated by closed reduction using the Gunning type splints or if the patient is a denture wearer, the dentures can be modified to allow IMF, which can be used as a splint.
- When ORIF is required, reduction should be made with minimum exposure of the fracture site to minimize interference with the periosteal blood supply. Fixation methods include; transosseous wiring and bone plates.
- Very thin mandible may not unite satisfactorily with conventional methods of reduction and fixation and in these cases autogenous bone grafting should be used to stabilize and augment the fracture where the patient's general condition permits.

4) Comminuted Mandibular Fractures

Comminuted mandibular fractures result from high energy injuries such as missile injuries, these injuries are associated with soft tissue damage and many of these fractures are open (compound) and contaminated. The bone fragments are often difficult to manipulate and secure with maintaining their soft tissue attachments and are therefore at risk of becoming loose or devitalized later on.

Successful management seeks to combine adequate immobilization and vascularization of the fragments. The traditional method of treatment of these fractures used closed techniques, thereby avoiding periosteal stripping and further devitalizing the bone. However, these techniques do not guarantee adequate immobilization of all the fragments, although clinically they work well in selected cases. Recently ORIF has been advocated to provide a load bearing fixation and stability across the fracture.

This is the End of the Lecture, Good Luck