

Surgical anatomy

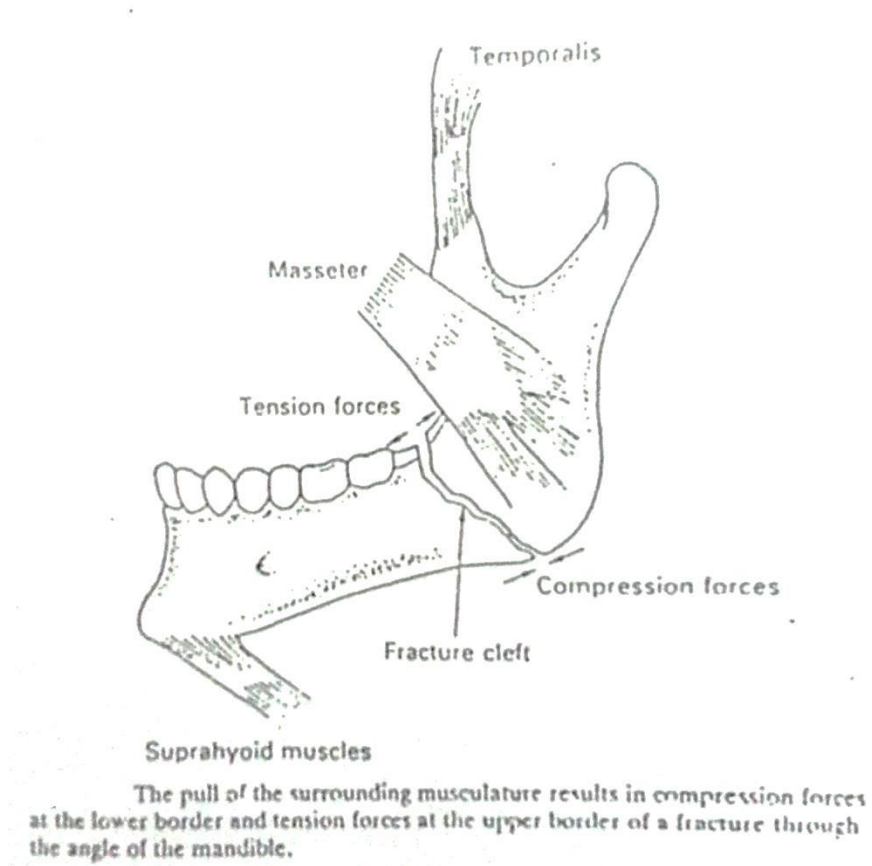
- **Factors related to mandibular fractures:**

1. Prominent mandible
2. Fracture force- degree, direction, site of impaction, sharp or blunt
3. Strength and resilience of mandible- generally speaking the mandible is strongest at point of the chin and weakens towards the condyles. Tensile strain is less resistant to fracture than compressive strain
4. Attached musculature- influences the site of fracture and displacement of fragments

- **Fracture sites**

1. Multiple fractures > single fractures
2. **Symphysis** – thickest and strongest area. Fractures are frequently parasymphyseal and rarely occur in midline
3. **Incisor region**- fractures frequently oblique. Genial muscles displace fragments lingually. Mylohyoid muscle pulls fragments medially, so adjacent incisor teeth overlap
4. **Canine region** – point of weakness associated with long canine tooth
5. **Angle region** – fractures here may result from indirect force:
 - a. weakness due to right angle between body and ramus and also presence of wisdom tooth
 - b. Strength – due to pterygomasseteric sling
 - c. Displacement – due to opposing effects of pterygomasseteric sling and suprahyoid musculature.

6. **Inferior dental bundle:** fibrous sheath provides support and protection for vessels and nerve. This accounts for the low incidence of permanent nerve damage after fracture between mandibular foramen and mental foramen
7. **Combination fractures** – e.g. Guardsman fracture consisting of symphyseal fracture plus both condylar necks OR body fracture on one side and condylar neck on other side



❖ Fracture healing and blood supply to mandible

1) Multifactorial blood supply :

- a. Endosteal – inferior dental artery
- b. Periosteal- facial, lingual, buccal and mylohyoid arteries
- c. Muscles- genial muscles at symphysis, pterygomasseteric sling and temporalis muscle at ramus

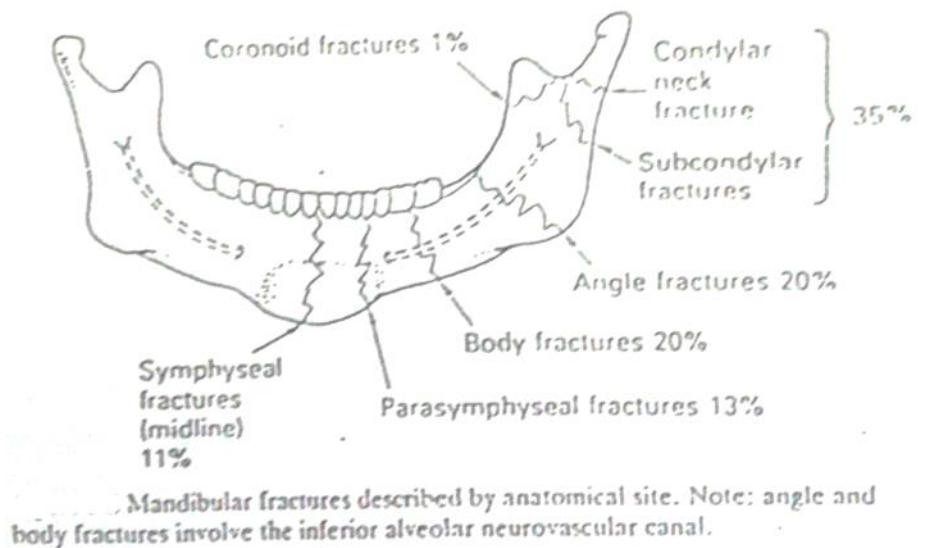
2. Healing potential:

- Endosteal supply to body of mandible decreases with increasing age
- Atrophic edentulous mandibles receive only periosteal blood supply. If it is stripped for plating may result in non-union of fractures
- Stripping pterygomasseteric sling off ramus may result in avascular necrosis

Classification

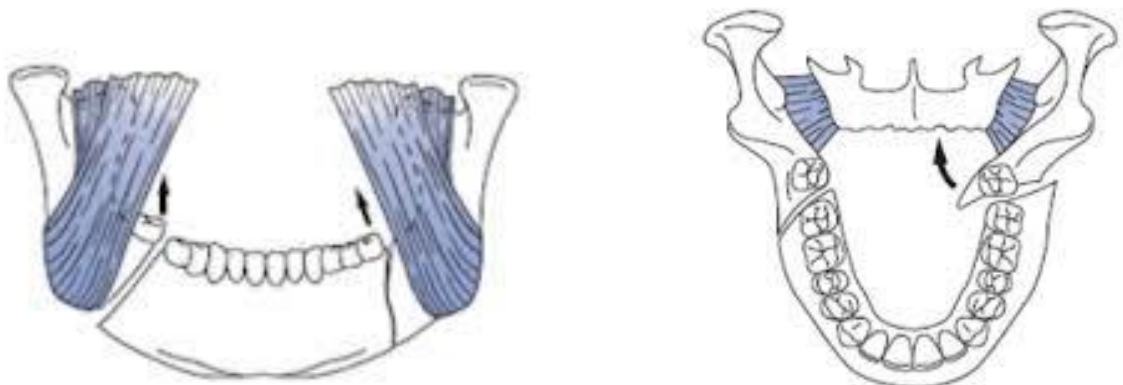
1. Anatomical

Condylar neck	35%
Angle	20%
Body	20%
Parasymphysis	13%
Symphysis	11%
Coronoid	1%



2. Potential

- Horizontally favourable or unfavourable
- Vertically favourable or unfavourable



3. Dental

- Class I – teeth present on both sides of fracture line
- Class II- teeth present on one side of fracture line
- Class III- no teeth present on either fragment

Clinical features

Signs and symptoms

1. Laceration – bleeding
2. Swelling
3. Ecchymosis- sublingual haematoma signifies fracture of lingual plate
4. Visible and palpable deformity of bone
5. Abnormal mobility and crepitus of mandible
6. Malocclusion and step deformity of teeth
7. Palpable tenderness
8. Inferior dental nerve disruption- paraesthesia or anaesthesia of lower lip
9. Damaged teeth- loose or missing including missing fragments
10. Bleeding from ear- tear of skin of external auditory meatus due to anatomical proximity of mandibular condyle

Teeth in fracture line

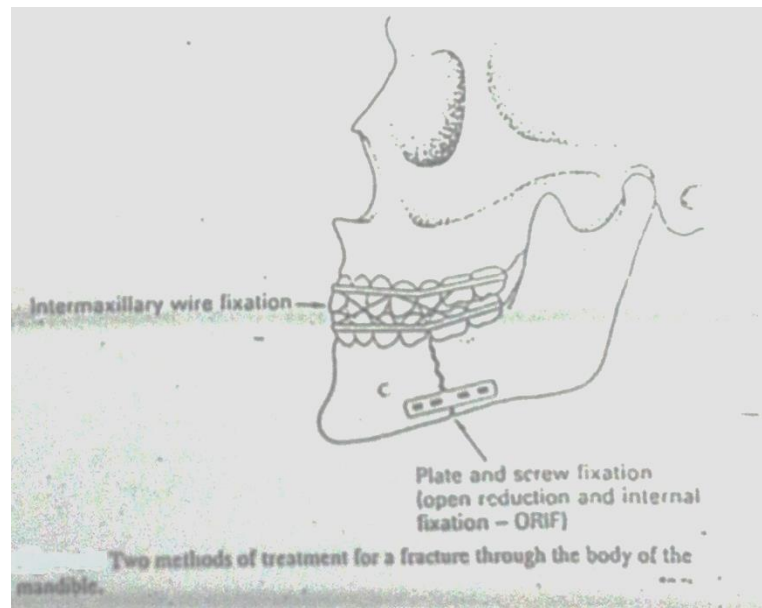
Potential impediment to healing because of infection:

1. Compound fracture into mouth via open periodontal membrane
2. Tooth may become non-vital
3. Pre-existing periodontal disease

Treatment

❖ Basic principles

1. Debridement
2. Reduction – open / closed
3. Fixation – internal / external
4. Immobilisation
5. Functional rehabilitation



❑ Intermaxillary fixation

This is a form of immobilisation which stabilizes bone fragments in a blind manner, sometimes resulting in non-precise anatomical alignment and prolonged secondary bone healing with large callus formation.

1. Eyelet wiring
2. Arch bars
3. Cast-cap silver splints
4. Gunning splint

➤ External pin fixation

Bone pins inserted transcutaneously into main anterior and posterior fragments and joined by universal joints and connecting rods or plastic splints .

✓ Advantages (uses)

- I. Discontinuity defects – tumor resection, avulsive trauma, to maintain major fragments in correct anatomical position prior to bone grafting
- II. Pathological fractures

- III. Gunshot injuries
- IV. Infected fracture sites

- ✓ **Disadvantages**

- I. Non-precise anatomical alignment
- II. Restricts patient activity because of risk of knock to pins
- III. Infection and scarring around pin sites
- IV. Insertion of pin into inferior dental nerve- paraesthesia or anaesthesia

- **Internal fixation**

Permit more precise anatomical reduction:

- 1. Transosseous wiring – upper border, lower border or mid-body
- 2. Intramedullary pins – Kirschner wire / Steinmann pin
- 3. Rigid internal fixation
 - a. Adaptational- plates, titanium mesh, bicortical screws
 - b. Compression – plates, lag screws

- **Transosseous wires**

- ✓ **Advantages**

- a. Permits precise anatomical bone reduction
- b. Fairly easy to apply
- c. Increased stability

- ✓ **Disadvantages**

- a. Poor rigidity and directional control – very little wire/bone contact

- b. Often requires additional intermaxillary fixation
- c. Wire may pull out from bone leading to delayed or poor bone healing

Intramedullary pins

✓ **Advantages**

- a. Rapid stabilization of bone fragments
- b. For reducing displaced condylar fractures when surgery necessary
- c. Limited operating time, e.g. very sick patient

✓ **Disadvantages**

- a. Difficult to use in oblique fractures
- b. Fractures may be displaced around long axis of pin
- c. Requires intermaxillary fixation

Rigid internal fixation

The use of plates and screws in the direct fixation of fractures

✓ **Advantages**

- a. permits primary bone healing
- b. Increased three dimensional, mechanical and functional stability
- c. Precise anatomical reduction and enhanced bone healing
- d. No additional fixation required
- e. Greater patient comfort- function restored early
- f. Intermaxillary fixation not needed- airway maintained and patient can eat

✓ **Disadvantages**

- a. Stress-shielding
- b. Expense
- c. May interfere with CT scans and radiotherapy
- d. Intermaxillary fixation may be necessary as well
- e. Risk of screws damaging inferior dental nerve or teeth
- f. Infection may necessitate removal of plate
- g. Wound dehiscence

❖ **Metallic mesh implants or trays**

- I. Much thinner than bone plates with greater surface area
- II. Adaptable internal rigid fixation used for treatment of:
 - a. Non-unions
 - b. Discontinuity defects- hold bone grafts, ideally of cancellous bone

☐ **Teeth in fracture line**

▪ **Management**

1. X-rays (including periapical radiographs- usually only to establish fracture of tooth when in doubt)
2. Antibiotics
3. Follow up with immediate extraction if infection ensues

▪ **Indication for removal of teeth in fracture line**

1. Infected fracture line
2. Subluxed tooth

3. Fractured tooth root
4. Pre-existing periapical or gingival infection
5. Advanced caries

Postoperative care

➤ Immediate

1. Monitor vital signs- temp., BP, PR, RR.
2. soft diet and good oral hygiene – liquid diet necessary if IMF present
3. Monitor fluid balance
4. Analgesics, antibiotics
5. Post-reduction X-rays

➤ Late

1. Testing of union and removal of IMF if present
2. Occlusal adjustment – with elastic IMF if necessary
3. Monitor recovery of nerve dysfunction and vitality of teeth
4. Encourage jaw function

Complications

➤ Preoperative

1. Risk to airway
2. Bleeding
3. Displacement of loose fragments – into soft tissue or aspiration of teeth

Intraoperative

1. Nerve damage
2. Inadequate fracture reduction
3. Access difficulty, e.g. placing of plate across angle fracture

Postoperative

1. Infection/wound dehiscence
2. Malocclusion
3. Malunion, delayed union, or non-union
4. Temporomandibular joint derangement
5. Non-vital teeth – infection
6. Problems with fixation

Management of atrophic edentulous mandible

- Ideally open reduction and internal fixation
- If possible, two plates should be applied suprapariosteally near lower border
- In event of non-union consider freshening bone ends and a bone graft in a rigidly fixed titanium mesh tray as the probable best form of treatment

References:

- 1- Peterson, Larry J. Peterson's principles of oral and maxillofacial surgery. Vol. 1. PMPH-USA, 2012.
- 2- Hupp, James R., Myron R. Tucker, and Edward Ellis. Contemporary Oral and Maxillofacial Surgery-E-Book. Elsevier Health Sciences, 2013.
- 3- Andersson, Lars, Karl-Erik Kahnberg, and M. Anthony Pogrel, eds. Oral and maxillofacial surgery. John Wiley & Sons, 2012.
- 4- APA Dimitroulis, George, and Brian Avery. Maxillofacial injuries: a synopsis of basic principles, diagnosis and management. Butterworth-Heinemann Medical.