

Mandibular fractures: load-sharing and load-bearing



Version 2 (December 12, 2018)

Faculty can add a clinical or imaging picture

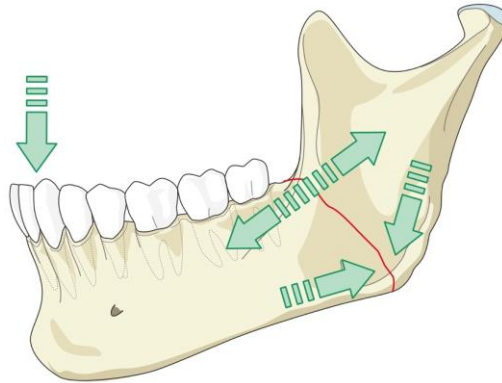
Learning objectives

- Describe lines of compression and tension in the mandible
- Select appropriate imaging modalities and interpret the findings
- Summarize how tension and compression influences method of fixation
- Describe the role of load-bearing osteosynthesis in comminuted, infected, pathological and atrophic fractures of the mandible
- Define principles of management



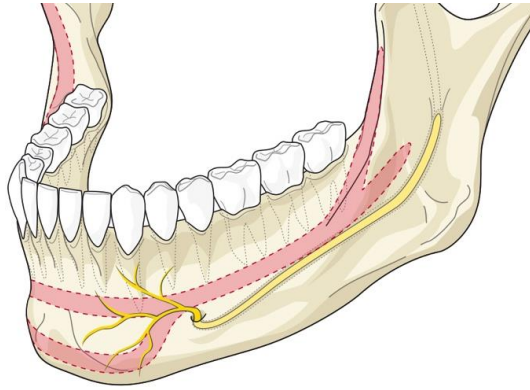
Biomechanics of the mandible

- Bite and muscular forces applied to the mandible determine zones of tension and compression
- **Tension zone**—alveolar portion of mandible
- **Compression zone**—basal portion of mandible



Ideal line of osteosynthesis

- Champy concept of miniplate osteosynthesis in simple fractures
- Consider the position of inferior alveolar nerve



The line between tension and compression zones is biomechanically ideal for osteosynthesis.

Champy and Michelet (1973) described the use of miniplate osteosynthesis

Clinical findings

- Malocclusion
- Difficulty with mouth opening
- Anesthesia, paresthesia
- Fragment mobility



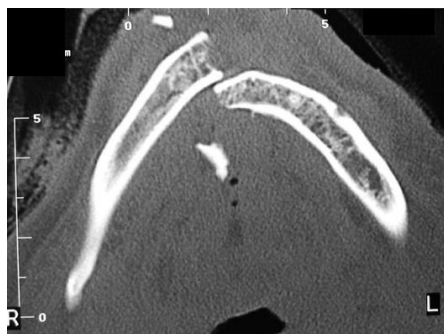
Imaging modalities for mandibular fractures

Orthopantomogram and PA plain x-rays may be sufficient for simple fracture lines



Imaging modalities for mandibular fractures

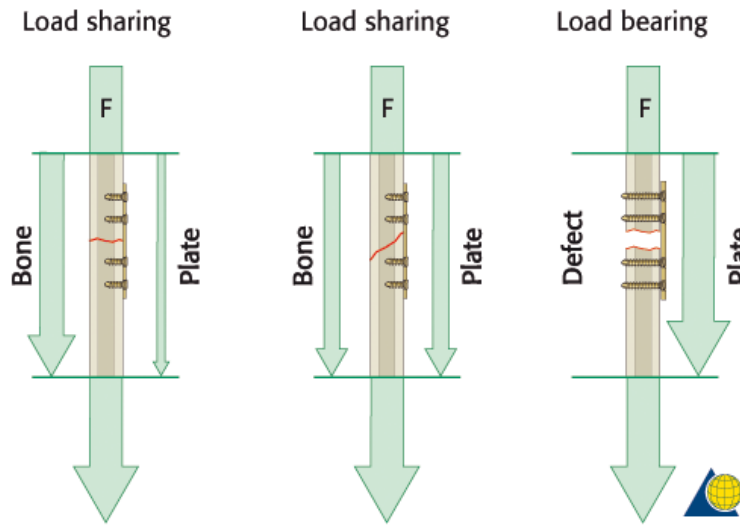
CT scan in axial, coronal, and 3-D views provides additional information



 AOCMF

CT scan is a recommendation in more complex patterns and fractures in the condylar region.

Load-sharing and load-bearing concepts



AOCMF

In the load-sharing situation there are different levels of force distribution between the plate(s) and the bone (left and middle images).

In the load-bearing situation the plate assumes all the forces (right image).

Left-sided arrow on each diagram represents the force undertaken by the bone.

Right-sided arrow on each diagram represents the force undertaken by the plate.

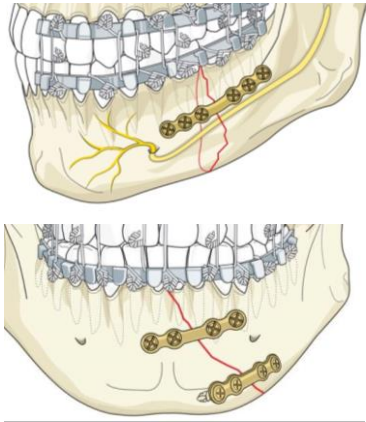
Also refer to AO Surgery Reference

Requirements for bone buttressing

- Anatomical reduction
- Interfragmentary contact
- No comminution
- Good bone stock



Load-sharing situation



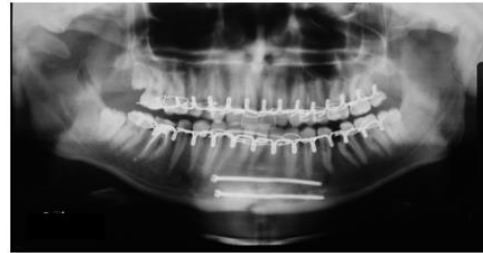
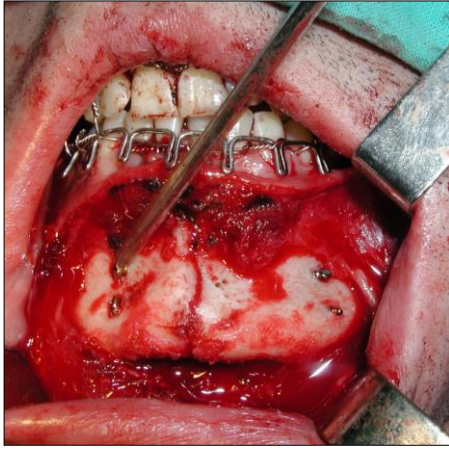
- Only simple fractures can provide bone buttressing
- Bone shares load with the plate



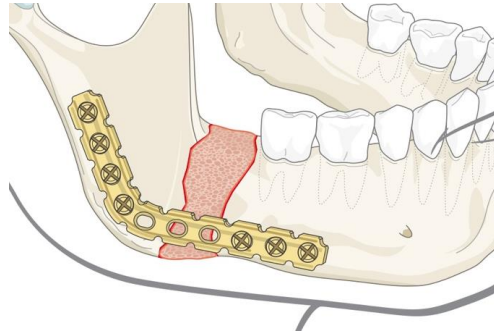
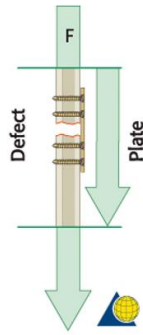
Note: faculty must explain that stability at the fracture site is created by the frictional resistance between the bone ends and the hardware used for fixation.

Another way to achieve load sharing

Two lag screws



Load-bearing situations

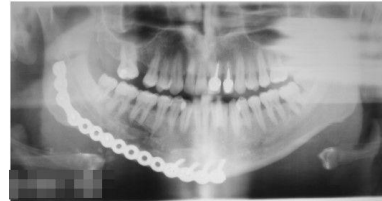


- The affected bone area is not able to share any load with the implant
- The implant assumes the functional load entirely
- A reconstruction plate is required



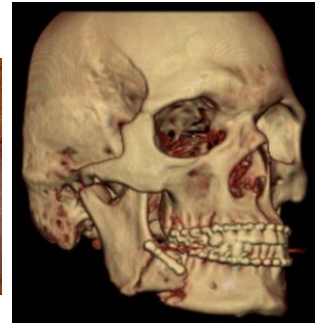
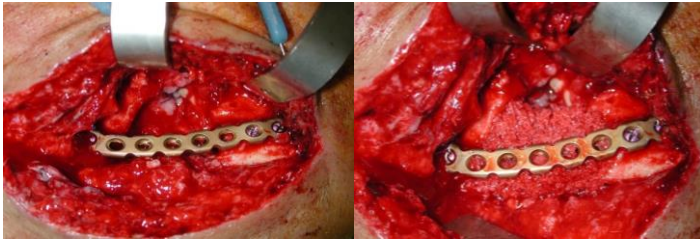
The right image is an example of load-bearing osteosynthesis for the treatment of a defect fracture in the angular region. The osteosynthesis assumes all masticatory loads while the bone graft matures and consolidates in a protected environment.

Complex fractures requiring load-bearing fixation



- **Comminuted or defect fractures**
- Chronically infected fractures
- Fractures in atrophic mandible

Complex fractures requiring load-bearing fixation



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Complex fractures requiring load-bearing fixation



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Take-home messages

- Load sharing in simple fractures
- Load bearing for all other situations, eg:
 - Comminuted patterns
 - Chronically infected fractures
 - Fractures in atrophic mandible