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