Rigid Internal Fixation for Mandibular Fractures- A Comprehensive Study

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Review

Rigid Internal Fixation for Mandibular Fractures- A Comprehensive Study

In the Preantibiotic era, closed reduction of fractures was understandably the rule for most fractures. However, when closed reduction was insufficient, external fixation appliances served to maintain skeletal units in position, frequently without the need for MMF (Maxillo-mandibular fixation). Following the development of antibiotics, the open treatment of fractures began to be used on a more frequent basis.

Rigid internal fixation (RIF) is “Any form of fixation applied directly to the bones which is strong enough to permit active use of the skeletal structure during the healing phase and also helps in healing”.

Mechanical Stress on Bone under Function

The force of the masseter, medial pterygoid, and temporalis muscle results in upward and forward vector of force on the posterior aspect of the mandible. The suprahyoid musculature places a downward and posterior force on the anterior portion of the mandible. With the pterygomasseteric sling functioning as a point of fulcrum, the superior border of the angle/posterior mandible is placed under tension while the inferior border is placed under compression.

Fractured Angle Mandible

When fracture occurs at the angle, the upward and forward rotation of the posterior mandible combined with the downward and posterior movement of the anterior mandible results in distraction at the superior border and with bony contact remaining at the inferior border of the mandible.

Goals of RIF (AO/ASIF)

The goal of the AO/ASIF (Arbeitsgemeinschaft fur Osteosynthesefragen/ Association for the study of Internal Fixation) is RIF with primary bone healing, even under functional loading.

Four basic principles for RIF

1) Accurate reduction of the bone fragments
2) Stable fixation of the fragments
3) Preservation of the adjacent blood supply
4) Early functional mobilization.

Techniques of RIF

A) Simple Single – Plate Rigid Stabilization

Christiansen (1945)[1] used an extremely rigid reconstruction type plate or multihole rigid fracture plate at the inferior border. According to him, it prevents distraction in the area of tension & bony continuity at the inferior border is maintained. The design of the plate may or may not allow compression at the site of plate fixation.

B) Dynamic Compression Plates (DCP)

During the mid-1960, Luhr[2,3] used vitallium mandibular compression bone plate. DCP incorporates the concept of horizontal displacement resulting from forces generated by a spherical surface against an inclined plane. In DCP, when screw head tightened, it slides down an inclined plane within the plate causing underlying bone to translate toward fracture site. DCP, has two compression holes, one on either side of fracture line & two passive holes placed on either end of plate to eliminate rotational movements. Each compression hole causes movement of around 0.8mm, therefore both holes cause movement of 1.6mm. While adapting the plate to the buccal cortex, plate must be overbent by about 1mm to prevent a gap on lingual aspect of cortex as compression is activated. The drill is used through drill guide. It has 2 numbers on its surface: 0.8mm & 0mm. If side marked 0.8mm towards fracture line used, screw placed will cause compression across fracture. If 0mm towards # line, screw will be placed in passive position. A depth gauge is used to establish the proper length screw. Activation of a DCP at inferior portion in the angle or body region has shown to result in distraction of the superior border of the mandible during function. To neutralize this gap formation at the alveolus, the tension band was introduced.

C) Eccentric Dynamic Compression Plate (EDCP)

Schmoker[4] and Niederfellmann[5] (1973) developed EDCP. The principle of the EDCP depends on the activation of compression holes in two different planes. It’s useful in cases of impacted third molar, an edentulous mandible, or avulsion of bone from the fracture. EDCP has two compression holes on either side of fracture lines similar to DCP + has two obliquely placed compression holes on ends of plate. On insertion of screws in holes closest to the fracture site, compression is applied at the inferior border whereas completion of screw insertion and tightening in the lateral holes produces rotation around the holes closest to the fracture site resulting in compression at the superior border.
RIF allows immediate limited function rather than requiring time-honoured maxillomandibular fixation (MMF) during the convalescent period. The techniques are all based on precise alignment of the dentition and the bone with plate and/or screw osteosynthesis, with or without axial compression of the bone ends.

References

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