Mandible Fractures

Karen Stierman, M.D.

Faculty Advisor: Byron J. Bailey, M.D., FACS

The University of Texas Medical Branch

Department of Otolaryngology

Grand Rounds Presentation

June 14, 2000
Anatomy

- Mandible interfaces with skull base via the TMJ and is held in position by the muscles of mastication.
- Divided into components with weakest sites being the third molar area, socket of the canine tooth, and the condyle.
Anatomic units of the mandible
Innervation

- Mandibular nerve through the foramen ovale
- Inferior alveolar nerve through the mandibular foramen
- Inferior dental plexus
- Mental nerve through the mental foramen
Anatomy - Mental foramen
Anatomy - Mandibular foramen
Arterial supply

- Internal maxillary artery from the external carotid
- Inferior alveolar artery through the mandibular foramen
- Mental artery through the mental foramen
Angle’s classification

FIG. 70-1. Angle’s classification of occlusion is based on the relationship of the mesiobuccal cusp of the maxillary first molar to the buccal groove of the mandibular first molar.
Classification of teeth

FIG. 70-2. The universal numbering system for the permanent dentition begins with the maxillary right third molar. Similarly, the 20 teeth of the deciduous dentition are lettered from A to T, beginning with the maxillary right second deciduous molar.
**Table 1**

Demographic and Fracture Statistics of Study Group

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Mean</td>
<td>23.5</td>
</tr>
<tr>
<td>Age Range</td>
<td>16–62</td>
</tr>
<tr>
<td>Males</td>
<td>87</td>
</tr>
<tr>
<td>Females</td>
<td>56</td>
</tr>
<tr>
<td>Patients with single fracture</td>
<td>83</td>
</tr>
<tr>
<td>Patients with multiple fractures</td>
<td>60</td>
</tr>
</tbody>
</table>
Fracture Frequency

15.1 Frequencies of fractures of the mandible.

- Condyle: 36%
- Coronoid: 2%
- Ramus: 3%
- Angle: 20%
- Alveolar: 3%
- Body: 21%
- Sympathetic (Midline): 1%
- Parasymphysis: 14%
Mandibular Forces

Protrusion
- Lateral pterygoid

Elevation
- Temporalis
- Masseter
- Medial pterygoid
- Lateral pterygoid

Depression, retraction
- Digastric
- Geniohyoid
- Genioglossus
- Mylohyoid

Inward displacement
- Lateral pterygoid
- Medial pterygoid
Evaluation - History

- Mechanism of injury
  - MVA associated with multiple comminuted fx
  - Fist often results in single, non-displaced fx
  - Anterior blow to chin - bilateral condylar fx
  - Angled blow to parasymphysis can lead to contralateral condylar or angle fx
  - Clenched teeth can lead to alveolar process fx
Past Medical History

- Pmhx
- bone disease
- neoplasia
- arthritis, tmj (risk for ankylosis)
- collagen vascular disease, endocrine d/o
- nutrition and metabolic disorders, including alcohol abuse
- seizure d/o
Physical Exam - Occlusion

- Change in occlusion - determine preinjury occlusion
- Posterior premature dental contact or an anterior open bite is suggestive of bilateral condylar or angle fractures
- Posterior open bite is common with anterior alveolar process or parasymphyseal fractures
- Unilateral open bite is suggestive of an ipsilateral angle and parasymphyseal fracture
- Retrognathic occlusion is seen with condylar or angle fractures
- Condylar neck fx are assoc with open bite on opposite side and deviation of chin towards the side of the fx.
Malocclusion
Physical Exam

- Anesthesia of the lower lip
- Abnormal mandibular movement
  - unable to open - coronoid fx
  - unable to close - fx of alveolus, angle or ramus
  - trismus
- Lacerations, Hematomas, Ecchymosis
- Loose teeth
- Palpation
Evaluation - Panorex
Evaluation - Mandible films
## Associated Injuries

### Table 1

Associated Injuries of Patients With Mandibular Fractures

<table>
<thead>
<tr>
<th>Area of injury</th>
<th>Number</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No other injuries</td>
<td>173</td>
<td>40.80%</td>
</tr>
<tr>
<td>Chest*</td>
<td>60</td>
<td>14.15%</td>
</tr>
<tr>
<td>Upper/lower extremities</td>
<td>49</td>
<td>11.56%</td>
</tr>
<tr>
<td>Brain injury</td>
<td>38</td>
<td>8.96%</td>
</tr>
<tr>
<td>Trachea</td>
<td>32</td>
<td>7.55%</td>
</tr>
<tr>
<td>Base of skull</td>
<td>23</td>
<td>5.42%</td>
</tr>
<tr>
<td>Pelvis</td>
<td>15</td>
<td>3.54%</td>
</tr>
<tr>
<td>Epidural and subdural hemorrhage</td>
<td>12</td>
<td>2.83%</td>
</tr>
<tr>
<td>Skull (fractures)</td>
<td>11</td>
<td>2.59%</td>
</tr>
<tr>
<td>Cervical spine</td>
<td>11</td>
<td>2.59%</td>
</tr>
<tr>
<td>Total</td>
<td>424</td>
<td>99.99%</td>
</tr>
</tbody>
</table>

*Includes pneumothorax, hemothorax, lung contusion, fracture of ribs, fracture of sternum, and fracture of the clavicle.
Cervical spine injury

Figure 2. Illustration depicting the types of cervical spine injuries, as designated C1 through C7.
Cervical spine injury

Figure 1. Lateral radiograph of cervical spine fracture (small arrow) in association with mandibular angle fracture (large arrow).
General Principles of treatment

• Tetanus
• Nutrition
• Almost all can be considered open fx as they communicate with skin or oral cavity
• Reduction and fixation
• Post-op monitoring for N/V, use of wire cutters
• Oral care - H2O2, irrigations, soft toothbrush
• Biweekly exam - hardware, occlusion, weight
Treatment options

- No treatment
- Soft diet
- Maxillomandibular fixation
- Open reduction - non-rigid fixation
- Open reduction - rigid fixation
- External pin fixation
- Lag screw, DCP
Maxillomandibular fixation
Maxillomandibular fixation
Alternative - Ivy loops

ALTERNATIVE TECHNIQUE OF IVY LOOPS

a. Initial loop placement
b. Intermaxillary adjustment

c. Circumdental wiring
d. Tightening wires

Intermaxillary adjustment
Maxillomandibular fixation
Open reduction - nonrigid fixation

Wire fixation

ALTERNATIVE TECHNIQUES
Open reduction - Rigid fixation
External Fixation
Lag screw
Injury to teeth

- Fractured teeth can become infected and cause malunion.
- Extraction necessary if root of tooth is fractured.
- A tooth that is intact but in the line of the fracture can be left in place and protected by antibiotics.
  - may need extraction later.
# Treatment options for dentate patients

## TABLE 70-2. Treatment Options for dentate adult patients

<table>
<thead>
<tr>
<th></th>
<th>Closed reduction</th>
<th>Open with nonrigid fixation</th>
<th>Open with rigid fixation</th>
<th>Observation only</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condyle</td>
<td>+</td>
<td>-</td>
<td>Rare</td>
<td>Unilateral, nondisplaced with normal occlusion</td>
</tr>
<tr>
<td>Ramus Angle</td>
<td>+ (Favorable only)</td>
<td>-</td>
<td>Rare</td>
<td>Inferior border compression plate plus tension band plate</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tension band miniplate only</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Double miniplate</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lag screw</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Compression plate plus tension band arch bar</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lag screw plus tension band miniplate</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Lag screws</td>
<td></td>
</tr>
<tr>
<td>Symphysis/parasymphysis</td>
<td>+</td>
<td>+</td>
<td></td>
<td>Compression plate plus tension band arch bar</td>
</tr>
<tr>
<td></td>
<td>May require acrylic lingual splint</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*+ indicates that the treatment is generally applicable; – indicates that the treatment is generally not applicable. Unique situations and favorable operator experience with a specific technique may alter these guidelines.*
### Special Considerations - Indications for ORIF of Condylar Fractures

**TABLE 70-4. Indications for open reduction of mandibular condyle fractures**

<table>
<thead>
<tr>
<th>Absolute indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Displacement into the middle cranial fossa</td>
</tr>
<tr>
<td>2. Impossibility of obtaining adequate occlusion by closed reduction</td>
</tr>
<tr>
<td>3. Lateral extracapsular displacement of the condyle</td>
</tr>
<tr>
<td>4. Invasion by a foreign body (e.g., gunshot wound)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Relative indications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Bilateral condylar fractures in an edentulous patient when splinting is impossible</td>
</tr>
<tr>
<td>2. Unilateral or bilateral condylar fractures when splinting is not recommended for medical reasons or adequate postoperative physiotherapy is impossible</td>
</tr>
<tr>
<td>3. Bilateral condylar fractures associated with comminuted midfacial fractures</td>
</tr>
<tr>
<td>4. Bilateral condylar fractures associated with significant preinjury malocclusion.</td>
</tr>
</tbody>
</table>
Deciduous teeth vs. permanent
- Fractures with deciduous dentition can be treated with MMF for 2-3 weeks. Rigid techniques can harm the tooth bud.

Growth center
- The most feared complication of a pediatric mandible fx is ankylosing of the TMJ with impact on jaw growth that causes severe facial deformity - prevent with weekly mobilization
Special considerations - pedi

ERUPTION

Shedding

<table>
<thead>
<tr>
<th>Tooth Type</th>
<th>Shedding Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central incisors</td>
<td>6–8 yr</td>
</tr>
<tr>
<td>Lateral incisors</td>
<td>7–8 yr</td>
</tr>
<tr>
<td>Cusps</td>
<td>9–12 yr</td>
</tr>
<tr>
<td>First molars</td>
<td>10–11 yr</td>
</tr>
<tr>
<td>Second molars</td>
<td>10–11 yr</td>
</tr>
</tbody>
</table>
Special considerations - pedi
Special considerations - Edentulous patients

- Dentures
- Splint
- Cirumzygomatic and circummandibular fixation
Splint fabrication
Splint fabrication
Splint fabrication

- Holes for wiring
- Grooves for circummandibular wire
- Occlusal index
- Optional groove
- Completed acrylic splint
Application of Splints
Application of splints
Denture preparation
Complications

• Socioeconomic condition greatly affects outcome

• Infection - In a prospective study by James of 422 fx, infection rate was 7% of which 50% were associated with fx or carious teeth, of the 177 fx requiring ORIF, 12% became infected
Complications

- Delayed healing (3%) and nonunion (1%)
  - most common cause in infection
  - second most common cause is noncompliance
  - inadequate reduction, metabolic or nutritional deficiency can play a role
- Nerve paresthesia’s (Inf. Alveolar nerve) occur in 2%
- Malocclusion and malunion
- TMJ problems
Complications

• A study out of UCSF showed no statistically significant difference in complication rate between pts treated with miniplates versus MMF and wire fixation.

• Another study based on a group of patients with angle fx all treated at Parkland with nonrigid fixation or AO recon plate or lag screw or 2 - 2.0 dcp’s or 2 - 2.4 dcp’s, or 2 - 2.0 miniplates or one 2.0 miniplate showed the lowest complication rate with the one 2.0 miniplate with arch bar as tension band.
Conclusions

• With multiple techniques available, there is still controversy over the best treatment for each type of mandible fracture
  – The decision is a clinical one based on patient factors, the type of mandible fracture, the skill of the surgeon, and the available hardware
  – Further studies are in progress
Case presentation

- 25 yom s/p assault present to ER with complaint of mandibular pain and malocclusion.
History

- PMHx: previously healthy
- Associated symptoms: denies neck pain
- Mechanism of injury - fist to jaw
Physical Exam

- Determine pre-injury occlusion- pt with slight overbite preoperatively
- C/o V3 paresthesia
- Trismus
- No loose teeth
- Point tenderness to palpation over the right angle and left parasympyphyseal region
- Denies neck pain
Panorex
Mandible Series
Mandible series
Mandible series
Treatment

- ORIF of both fractures sites
- Post op monitor for nausea/vomiting
- Mouth care
- Clinda or pcn
- D/C with wire cutters
- F/U in 2 weeks