Mandibular Fractures

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April 30, 2009
Uniqueness of the Mandible

- U-shaped bone
- Bilateral joint articulations
- Muscles of mastication and suprahyoid muscle groups can lead to instability and fracture displacement
- Only mobile bone of the facial/cranial region
Uniqueness of the Mandible

- Thick cortical bone with single vessel for endosteal blood supply
  - Varies with patient’s age and amount of dentition
  - With atrophic mandibles, endosteal blood supply is decreased and periosteal blood supply is the dominant
Biomechanical Aspects of Mandible Fractures

- Multiple studies have shown that greater than 75% of mandible fractures begin in areas of tension.

- Exception to this is comminuted intracapsular condylar fractures which are totally compression in origin.
  - Evans et al. J Bone Joint Surg 33; 1951
  - Huelke et al. J Dent Res 43; 1964
Biomechanical Aspects of Mandible Fractures
Once the mandible is loaded, the forces are distributed across the entire length of the mandible.

However, due to irregularities of the mandibular arch (foramen, concavities, convexities, ridges, and cross sectional thickness differences) load is distributed differently in areas.
Biomechanical Aspects of Mandible Fractures

- Impacted third molars increases the risk of mandibular angle fractures and decrease the risk of condylar fractures due to inherent weakness in the angle area with impacted teeth.
Epidemiology

- Males > Females
- Age: 16-30 years
- Assault > MVA > Falls > Sports for most common cause of fracture
- With concomitant facial injuries, 45% included at least 1 mandible fracture
Epidemiology

- Mandible fractures in conjunction with other injuries:
  - Generally relevant to mode of injury
    - Assault- 90% mandible only (Ellis Oral Surg Oral Path Oral Med 1985)
    - MVA- 46% with other injuries (Olson JOMS 1982)
    - Spinal Cord injuries- varies according to studies
      - 3-49%
Epidemiology
Classification Schemes

- Multiple schemes exist to classify fractures
- Relate fracture type, anatomic location, muscular relation, dentition relation, etc.
Classification Schemes

- Fracture types:
  - Simple/closed - not opened to the external environment
  - Compound/opened - fracture extends into external environment
  - Comminuted - splintered or crushed
  - Greenstick - only one cortex fractured
  - Pathologic - pre-existing disease of bone lead to fracture
Classification Schemes

- Fracture types:
  - Multiple- two or more lines of fractures on the same bone that do not communicate
  - Impacted- fracture which is driven into another portion of bone
  - Indirect- a fracture at a point distant from the site of injury
  - Complicated/complex- damage to adjacent soft tissue, can be simple or compound
Classification Schemes

- Anatomic Classification:
  - Developed by Dingman and Natvig
    - Symphysis
    - Parasymphyseal
    - Body
    - Angle
    - Ramus
    - Condyle process
    - Coronoid process
    - Alveolar process
Classification Schemes

- Dentition Classification:
  - Developed by Kazanjian and Converse
  - Class I: teeth are present on both sides of the fracture line
  - Class II: Teeth present only on one side of the fracture line
  - Class III: Patient is edentulous
Classification Schemes

- **Muscle Action**

  Classification:
  - Vertically Favorable vs. Non Favorable
    - Resistance to medial pull
  - Horizontal Favorable vs. Non Favorable
    - Resistance to upward movement

- Generally apply to angle and body fractures
Classification Schemes

- Condylar fractures:
  - General classification:
  - In order from most inferior to superior
    - Subcondylar
    - Condylar neck
    - Intracapsular
Diagnosis

- Prior to examination, it is important to gain the following information
  - Mechanism of injury
  - Previous facial fractures
  - Pre-existing TMJ disorders
  - Pre-existing occlusion
  - Past medical history (epilepsy, alcoholic, mental retardation, diabetes, psychiatric, immune status)
Diagnosis

- Physical exam:
  - Tenderness- generally non-descript
  - Malocclusion-
    - Anterior open bite- bilateral condylar or angle
    - Unilateral open bite- ipsilateral angle and parasymphyseal fracture
    - Posterior cross bite- symphyseal and condylar fractures with splaying of the posterior segments
    - Prognathic bite- TMJ effusions
    - Retrognathic bite- condylar or angle fractures
Diagnosis

- **Physical exam:**
  - Loss of form- bony contour change, soft tissue depressions, deformities
  - Loss of function- can be from guarding, pain, trismus
    - Deviation on opening towards side of condylar fracture
    - Inability to open due to impingement of coronoid or ramus on the zygomatic arch
    - Premature contacts from alveolar, angle, ramus, or symphysis
Diagnosis

- Physical exam:
  - Edema - non descript
  - Abrasions/lacerations - potential for compound fracture
  - Ecchymosis - especially floor of mouth
    - Symphyseal or body fracture
  - Crepitus with manipulation
  - Altered sensation/parathesia
  - Dolor/Tumor/Rubor - signs of inflammation
Diagnosis
Diagnosis
Diagnosis

- Radiographic Evaluation
  - Panoramic radiograph:
    - Most informative radiographic tool
    - Shows entire mandible and direction of fracture (horizontal favorable, unfavorable)
  - Disadvantages:
    - Patient must sit up-right
    - Difficult to determine buccal/lingual bone and medial condylar displacement
    - Some detail is lost/blurred in the symphysis, TMJ and dentoalveolar regions
Diagnosis

- Radiographic Evaluation
  - Reverse Towne’s radiograph:
    - Ideal for showing lateral or medial condylar displacement
Diagnosis

- Radiographic Evaluation
- Lateral oblique radiograph:
  - Used to visualize ramus, angle, and body fractures
  - Easy to do
  - Disadvantage:
    - Limited visualization of the condylar region, symphysis, and body anterior to the premolars
Diagnosis

- Radiographic Evaluation
  - Posteroanterior (PA) radiograph:
    - Shows displacement of fractures in the ramus, angle, body, and symphysis region
    - Disadvantage:
      - Cannot visualize the condylar region
Diagnosis

- Radiographic Evaluation
  - Occlusal views:
    - Used to visualize fractures in the body in regards to medial or lateral displacement
    - Used to visualize symphyseal fractures for anterior and posterior displacement
Diagnosis

- Radiographic Evaluation
  - Computed tomography CT:
    - Excellent for showing intracapsular condyle fractures
    - Can get axial and coronal views, 3-D reconstructions
    - Disadvantage:
      - Expensive
      - Larger dose of radiation exposure compared to plain film
      - Difficult to evaluate direction of fracture from individual slices (reformatting to 3-D overcomes this)
Diagnosis
Diagnosis

- Radiographic Evaluation
  - Ideally need 2 radiographic views of the fracture that are oriented 90° from one another to properly work up fractures
    - Panorex and Towne’s
    - CT axial and coronal cuts
  - Single view can lead to misdiagnosis and complications with treatment
Diagnosis

- This Towne’s view show a body fracture that is displaced in a medial to lateral direction and a subcondylar fracture with lateral displacement.
Diagnosis

- However, Panorex clearly shows the superior displacement of the right body fracture.
General Principles in the Treatment of Mandible Fractures

1. Patient’s general physical status should be evaluated and monitored prior to any consideration of treating mandible fracture.

2. Diagnosis and treatment of mandibular fractures should not be approached with an “emergency-type” mentality.
General Principles in the Treatment of Mandible Fractures

3. Dental injuries should be evaluated and treated concurrently with the treatment of mandibular fractures.

4. Re-establishment of occlusion is the primary goal in the treatment of mandibular fractures.

5. With multiple facial fractures, mandibular fractures should be treated first.
6. Intermaxillary fixation time should vary according to the type, location, number, and severity of the mandibular fractures as well as the patient’s health and age, and the method used for reduction and immobilization.
General Principles in the Treatment of Mandible Fractures

- 7. Prophylactic antibiotics should be used for mandibular fractures
- 8. Nutritional needs should be monitored closely postoperatively
- 9. Most mandibular fractures can be treated with closed reduction
Bone Healing

- Bone healing is altered by types of fixation and mobility of the fracture site in relation to function.
- Can be primary or secondary bone healing.
Bone Healing

- Primary bone healing:
  - No fracture callus forms
  - Heals by a process of 1) haversian remodeling directly across the fracture site if no gap exists (Contact healing), or 2) deposition of lamellar bone if small gaps exist (Gap healing)
  - Requires absolute rigid fixation with minimal gaps
Bone Healing

Contact Healing

Gap Healing
Bone Healing

- Secondary bone healing:
  - Bony callus forms across fracture site to aid in stability and immobilization
  - Occurs when there is mobility around the fracture site
Bone Healing

Secondary bone healing involves the formation of a subperiosteal hematoma, granulation tissue, then a thin layer of bone forms by membranous ossification. Hyaline cartilage is deposited, replaced by woven bone and remodels into mature lamellar bone.
Bone Healing
Closed Reduction

- Fracture reduction that involves techniques of not opening the skin or mucosa covering the fracture site
- Fracture site heals by secondary bone healing
- This is also a form of non-rigid fixation
Closed Reduction

- Indications:
  - “It is safe to say that the vast majority of fractures of the mandible may be treated satisfactorily by the method of closed reduction” Bernstein Acad Ophthalmol Otolaryngol 74;1970
  - “If the principle of using the simplest method to achieve optimal results is to be followed, the use of closed reduction for mandibular fractures should be widely used” Peterson’s Principle of Oral and Maxillofacial Surgery 2nd edition
Closed Reduction

- Indications:
  - Simply stated as all cases that open reduction is not indicated or is contraindicated
  - Comminuted fractures - especially gunshot wounds
  - Lack of soft tissue covering for avulsive type injuries
Closed Reduction

- Indications:
  - Nondisplaced favorable fractures
  - Mandibular fractures in children with developing dentition
  - Condylar fractures
  - Edentulous fractures with use of prosthesis with circummandibular wires
Closed Reduction

- **Contraindications:**
  - Medical conditions that should avoid intermaxillary fixation
    - Alcoholics
    - Seizure disorder
    - Mental retardation
    - Nutritional concerns
    - Respiratory diseases (COPD)
  - Unfavorable fractures
Closed Reduction

- Advantages:
  - Low cost
  - Short procedure time
  - Can be done in clinical setting with local anesthesia or sedation
  - Easy procedure
  - No foreign body in patients
Closed Reduction

- Disadvantages:
  - Not absolute stability (secondary bone healing)
  - Oral hygiene difficult
  - Possible TMJ sequelae
    - Muscular atrophy/stiffness
    - Myofibrosis
    - Possible affect on TMJ cartilage
    - Decrease range of motion
  - Non-compliance
Closed Reduction

- Techniques:
  - Arch bars
  - Erich arch bars
  - Ivy loops
  - Essig Wire
  - Intermaxillary fixation screws
  - Splints
  - Bridal wires
Closed Reduction
Closed Reduction

- **Length of Intermaxillary fixation:**
  - Based on multiple factors
    - Type and pattern of fracture
    - Age of patient
    - Involvement of intracapsular fractures
  - Average adult: 3-4 weeks
  - Children 15 years or younger: 2-3 weeks
  - Elderly patients: 6-8 weeks
  - Condylar fractures: 2-4 weeks
Closed Reduction

- **Intermaxillary fixation:**
  - Multiple studies show clinical bone union (no mobility, no pain, reduced on films) in 4 weeks in adults and 2 weeks in children
    - Amaratunga NA. J Oral Maxillofac Surg 1987;45
  - Condylar process fractures tend to need only short periods of IMF to aid with pain and occlusion; usually 2 weeks
    - Walker RV. J Oral Surg 1966;24
External Pin Fixation

- Technique of fracture repair by using transcutaneous pins threaded into the lateral surface of the mandible. The pin segments are then connected together with an acrylic bar, metal framework, or graphite rods.

- Synonymous with the Joe Hall Morris appliance
External Pin Fixation

- **Indications:**
  - Comminuted mandible fractures with/without displacement
  - Avulsive gunshot wounds
  - Edentulous mandible fractures
  - Can be used on patients that are poor candidate for open reduction and closed reduction (may increase likelihood of follow-up)
External Pin Fixation

- Joe Hall Morris appliance applied to mandibular defect
Regional Dynamic Forces

- Different portions of the mandible will undergo different patterns of force in relation to loading.
Regional Dynamic Forces

- Mandibular Angle Region:
  - Generally vertical pull due to masseter, medial pterygoid, and temporalis muscle
  - Rarely is there any medial or lateral rotational forces
  - Therefore, fixation/stabilization is to address the vertical component
Mandibular Body Region:
- Transitional zone
- Contains both vertical and horizontal movements
- Fixation/stabilization is directed towards countering both directions
Regional Dynamic Forces

- Anterior Mandible:
  - Direction of forces tends to alter with function
  - Zones of compression and tension may actually alter with function
  - Undergoes shearing and torsional forces
Open Reduction

- Implies the opening of skin or mucosa to visualize the fracture and reduction of the fracture.
- Can be used for manipulation of fracture only.
- Can be used for the non-rigid and rigid fixation of the fracture.
Open Reduction

- **Indications:**
  - Unfavorable/unstable mandibular fractures
  - Patients with multiple facial fractures that require a stable mandible for basing reconstruction
  - Fractures of an edentulous mandible fracture with severe displacement
Open Reduction

- Indications:
  - Edentulous maxillary arch with opposing mandible fracture
  - Delayed treatment with interposition of soft tissue that prevents closed reduction techniques to re-approximate the fragments
Open Reduction

Indications:

- Medically compromised patients
  - Gastrointestinal diseases
  - Seizure disorders
  - Compromised pulmonary health
  - Mental retardation
  - Nutritional disturbances
  - Substance abuse patients
Open Reduction

- **Contraindications:**
  - If a simpler method of repair is available, may be better to proceed with those options
  - Severely comminuted fractures
  - Patients with healing problems (radiation, chronic steroid use, transplant patients)
  - Mandible fractures that are grossly infected
Open Reduction: Rigid Fixation

- Rigid fixation:
  - Any form of fixation that counters any biomechanical forces that are acting upon the fracture site
  - Prevents any inter-fragmentary motion across that fracture site
  - Heals with primary (contact or gap) bone healing, produces no callus around fracture site
Open Reduction:
Rigid Fixation

- Lag screw technique:
  - Utilizes screws that create a compression of the fracture segments by only engaging the screw threads in the remote segment and screw head in the near cortex
  - Should be used to gain rigid fixation
Open Reduction:

Rigid Fixation

- Lag screw technique:
  - Advantages:
    - Low cost, less equipment
    - Faster technique than plating
    - Rigid fixation
  - Disadvantages:
    - Screw must be placed perpendicular to fracture
    - Can be technique sensitive
Open Reduction:

Rigid Fixation

- Lag screw technique:
  - Utilizes 2-3 screws to overcome rotational forces
  - Must be placed at a divergent angle of 7’ from one another
  - Smaller diameter drill used to for portion of screw engaged in distant segment
  - A single lag screw can be placed in the angle region to resist tension
Open Reduction:
Rigid Fixation
Open Reduction:
Rigid Fixation

- Compression plate technique:
  - Technique that creates rigid fixation
  - When screws engage plate, they impart compression across the fracture segments
  - Results in the fragments being brought together with compression and interfragmentary friction
Open Reduction:
Rigid Fixation
Open Reduction:

Rigid Fixation

- Compression plate technique:
  - Advantages:
    - Rigid fixation
    - Thicker hardware
  - Disadvantages:
    - Technique sensitive- plates must be adapted properly or mal-alignment can occur
    - More expensive then miniplates
    - Bicortical screws
Open Reduction:

Rigid Fixation

- Compression plate technique:
  - With regards to the regional dynamic forces of the mandible, the ideal area to place the compression plate would be the alveolus (due to tension). However, due to the presence of the dentition, bicortical screws cannot be placed.
Open Reduction:

Rigid Fixation

- Compression plate technique:
  - Therefore, compression plates are placed at the inferior border of the mandible with bicortical screws.
  - Must utilize a tension band at the superior surface to counteract compressive spread of superior surface by the compression plate
    - Arch bars
    - Miniplates with monocortical screws (3 on each side ideal)
  - Tension band placed prior to compression plate
Open Reduction:

Rigid Fixation

- Compression plate technique:
  - Two types of compression plates exist
    - Dynamic compression plates (DCP)- require tension band, can be placed intra-orally
    - Eccentric dynamic compression plate (EDCP)- designed with the most lateral holes angled in a superior/medial direction to impact compression at the superior region. Must be placed extra-orally. Avoids use of tension band
Open Reduction: Rigid Fixation

- Reconstruction plate:
  - Rigid fixation technique
  - Large plates that are load-bearing (can bear entire load of region)
  - Consist of plates that utilize screws greater than 2mm in diameter (2.3, 2.4, 2.7, 3.0)
  - Can use non-locking and locking type plates
  - Must use 3 screws on each side of fracture (maximum strength with 4)
Open Reduction:
Rigid Fixation

- Reconstruction plate:
  - Advantages:
    - Rigid fixation with load-bearing properties
    - Low infection rates in the literature, especially in the mandibular angle region
    - Can be used for edentulous and comminuted fractures
  - Disadvantages:
    - Expensive
    - Requires larger surgical opening
    - Can be palpated by patient if in body or symphysis region
Open Reduction:
Rigid Fixation
Open Reduction:

Rigid Fixation

- Rigid fixation:
  - Includes the use of:
    - Reconstruction plate with 3 screws on each side of the fracture
    - Large compression plates
    - 2 lag screws across fracture
    - Use of 2 plates over fracture site
    - 1 plate and 1 lag screw across fracture site
Open Reduction:

Rigid Fixation

- Examples of rigid fixation schemes for the mandibular body fracture
  - 1 plate and 1 lag screw
  - 2 plates non compression mini plates with inferior bicortical screws
  - Compression plate
Open Reduction:

Rigid Fixation

- Rigid fixation of mandibular angle fractures:
  - 2 non compression mini-plates with inferior plate with bicortical screws
  - Reconstruction plate
Open Reduction:

Rigid Fixation

- Rigid fixation for symphyseal fractures:
  - Compression plate with arch bar
  - 2 lag screws
  - 2 miniplates, inferior is bicortical and may be compression plate
Open Reduction:
Non-rigid Internal Fixation

- Non rigid internal fixation:
  - Bone fixation that is not strong enough to prevent interfragmentary motion across a fracture site
  - Heals by secondary bone healing with callus formation
  - Consists of miniplate application with functional stable fixation and intraosseous wiring
Open Reduction:

Non-rigid Internal Fixation

- Non rigid internal fixation:
  - Functional stable fixation:
    - Term used when there is enough fixation that allows skeletal mobility/function but still forms a bony callus and secondary bone healing
    - Consists of miniplates opposing tension or compression
    - Relies on the buttressing effects of the bone (more bone height, more buttressing) or the vertical distance of placement of miniplates
Open Reduction:

Non-rigid Internal Fixation

- Non rigid fixation with functional stable fixation:
  - 2 plates that are spread apart are better able to resist the load
Open Reduction:
Non-rigid Internal Fixation

- Non rigid fixation with functional stable fixation:
  - Single plate placed in a mandible with greater vertical height will be more rigid due to buttressing effects of the thicker bone.
Open Reduction:

Non-rigid Internal Fixation

- Non rigid fixation with functional stable fixation:
  - Technique pioneered by Champey
  - Developed mathematical models to determine forces on the mandible in relation to the inferior alveolar canal, root apices, and bone thickness
Open Reduction:
Non-rigid Internal Fixation

- Non rigid fixation with functional stable fixation:
  - Developed guidelines for the use of plates in relation to the mental foramen in regards to ideal lines of osteosynthesis
    - Posterior to mental foramen - 1 plate applied just below root apices/above IAN
    - Anterior to mental foramen - 2 plates
    - Utilizes monocortical miniplates only
Open Reduction:
Non-rigid Internal Fixation
Open Reduction:
Non-rigid Internal Fixation

- Non rigid fixation with functional stable fixation:
  - This technique is recommended with early mandibular fracture treatment (within 1st 24 hours) due to increased failure with delays
  - Intra-oral technique
  - Utilizes IMF for short periods of time
  - Literature complication rates are extremely variable
Open Reduction: Intraosseous Wires

- Non rigid fixation with intraosseous wiring:
  - Use of wire for direct skeletal fixation
  - Keeps the fragments in an exact anatomical alignment, but must rely on other forms of fixation to maintain stability (splints, IMF).
  - Not rigid to allow function.
  - Low cost, fast to perform, must rely on patient compliance as does closed reduction techniques.
Open Reduction:

Intraosseous Wires

- Non rigid fixation with intraosseous wiring:
  - Simple straight wire - direction of pull is perpendicular to fracture
  - Figure of eight wire - increased strength at superior and inferior regions compared to straight wire
  - Transosseous/circum-mandibular wire - used for oblique type fractures - passes wire from skin with the use of an awl
Open Reduction:

Intraosseous Wires

- Non rigid fixation with intraosseous wiring:
  - Straight wire
  - Figure of eight
  - Transossseous-circum-mandibular
Open Reduction:

Intraosseous Wires

- Non rigid fixation with intraosseous wiring:
  - Mostly used in the mandibular angle as a superior border wire with simultaneous removal of third molar from fracture site
  - Can be used in the inferior border of symphyseal and parasymphyseal fractures
Edentulous Fractures

- Biomechanics differ for edentulous fractures compared to others
  - Decrease bone height leads to decreased buttressing affect (alters plate selection)
  - Significant bony resorption in the body region
  - Significant effect of muscular pull, especially the digastric muscles
Edentulous Fractures

- Incidence and location of mandible fractures in the edentulous mandible
  - Highest percent in the body
  - Atrophy creates saddle defect in body
Edentulous Fractures

- Biological differences
  - Decreased inferior alveolar artery (centrifugal) blood flow
  - Dependent on periosteal (centripetal) blood flow
  - Medical conditions that delay healing
  - Decreased ability to heal with age
Edentulous Fractures

- Classification of the edentulous mandible:
  - Relates to vertical height of thinnest portion of the mandible
    - Class I - 16-20mm
    - Class II - 11-15mm
    - Class III - <10mm
Edentulous Fractures

- **Closed Reduction**
  - Use of circummandibular wires fixated to the pryriform rims and circumzygomatic wires with patient’s denture or splints
  - Requires IMF - usually longer periods of time
  - Generally used to repair Class I type fractures or thicker
Edentulous Fractures

- **External pin fixation:**
  - May be used for fixation with/without the use of IMF
  - Avoids periosteal stripping
  - Used for comminuted edentulous fractures
  - Can be used in patients that an open procedure is contraindicated
  - Must use large diameter screws (4mm) for fixation, may be difficult in Class III patients
Edentulous Fractures

- Open reduction techniques:
  - Recommended for fractures that have not healed from other treatments, IMF contraindicated, splints/dentures unavailable, or the mandible is too atrophic for success with closed reduction
  - Utilizes rigid fixation techniques
  - Can utilize simultaneous bone grafting with severely atrophic mandibles if there is the possibility of inadequate bony contact
Edentulous Fractures

- Open reduction techniques:
  - Studies indicate that the lowest complication rates occur with extra-oral approaches with rigid fixation, especially with class III atrophic mandibles
    - Bruce et al. J Oral Maxillofac Surg 1993;51
Pediatric Mandible Fractures

- Relatively uncommon type of injury
- Incidence of fractures in children under 15 years - 0.31/100,000
- Usually represent less than 10% of all mandible fractures for children 12 years or younger
- Less than 5% of all mandible fractures for children 6 years or younger
Pediatric Mandible Fractures

- **Uniqueness of children:**
  - Nonunion and fibrous union are rare due to osteogenic potential of children. They heal rapidly.
  - Due to growth, imperfect fracture reduction can be “compensated with growth”. Therefore, malocclusion and malunions usually resolve with time.
Pediatric Mandible Fractures

- **Uniqueness of children:**
  - The mandible tends to be thinner and has a less dense cortex (could affect hardware placement)
  - Presence of tooth buds in the lower portions of the mandible (could affect hardware placement)
  - Short and less bulbous deciduous teeth make arch bar application difficult
Pediatric Mandible Fractures

- Treatment modalities:
  - Due to rapid healing, closed reduction techniques may be tolerated
  - Most fractures can be treated with follow-ups and soft/non-functional diet or closed reduction with arch bars or acrylic splint
  - Open reduction only advocated for severely displaced unfavorable fractures, in delayed treatment (>7 days) due to soft tissue in-growth, or patients with airway/medical issues
Pediatric Mandible Fractures

- Treatment of condylar fractures:
  - Treatment goals are to restore mandibular function, occlusion, prevent growth disturbances, and maintain symmetry
  - Must avoid ankylosis
  - Use short periods of IMF (7-14 days), then jaw opening exercises; in children under 3 years, immediate function necessary to prevent ankylosis
Pediatric Mandible Fractures

- Most studies show minimal risk for growth disturbances for fractures of the mandibular body, angle, symphysis, or ramus.
- Most disturbances occur from intracapsular condylar fractures
- Low rate of malunion, nonunion, or infections for pediatric fractures
Condylar Process Fractures

- **Incidence:**
  - Represent 25-35% of all mandible fractures
- **Location:**
  - 14% intracapsular (41% in children <10)
  - 24% condylar neck (38% in adults >50)
  - 62% subcondylar
  - 84% unilateral
  - 16% bilateral
Condylar Process Fractures

Classifications:

- Wassmund Scheme:
  - I- minimal displacement of head (10-45’)
  - II- fracture with tearing of medial joint capsule (45-90’), bone still contacting
  - III- bone fragments not contacting, condylar head outside of capsule medially and anteriorly displaced
  - IV- head is anterior to the articular eminence
  - V- vertical or oblique fractures through condylar head
Condylar Process Fractures

- Classifications:
  - Lindahl classification:
    - I- nondisplaced
    - II- simple angulation of displacement, no overlap
    - III- displaced with medial overlap
    - IV- displaced with lateral overlap
    - V- displaced with anterior or posterior overlap
    - VI- no contacts between segments
Condylar Process Fractures

- **Classifications:**
  - MacLennan classification:
    - I - nondisplaced
    - II - deviation of fracture
    - III - displacement but condyle still in fossa
    - IV - dislocation outside of glenoid fossa
Goals of condylar fracture repair:

- 1) Pain-free mouth opening with opening of 40mm or greater
- 2) Good mandibular motion of jaw in all excursions
- 3) Restoration of preinjury occlusion
- 4) Stable TMJs
- 5) Good facial and jaw symmetry
Condylar Process Fractures

- Growth alteration from condylar fractures:
  - Estimated that 5-20% of all severe mandibular asymmetry is from condylar trauma
  - Believed to be from shortening of the ramus or alterations in muscle action leading to growth changes
Condylar Process Fractures

- Treatment alternatives:
  - Non-surgical - diet, observation and physical therapy
  - Closed reduction - utilizes a period of IMF the physical therapy
  - Open reduction
Closed reduction:

- Indications:
  - Split condylar head
  - Intracapsular fracture
  - Small fragments from comminuted condyle
  - Risk of devascularization of the condylar segment with ORIF

- Treated with short course of IMF with post-operative physical therapy
Condylar Process Fractures

- Open reduction:
  - Zide’s absolute indications:
    - 1) middle cranial fossa involvement with disability
    - 2) inability to achieve occlusion with closed reduction
    - 3) invasion of joint space by foreign body
Condylar Process Fractures

- Open reduction:
  - Zide’s relative indications:
    - 1) bilateral condylar fractures where the vertical facial height needs to be restored
    - 2) associated injuries that dictate early or immediate function
    - 3) medical conditions that indicate open procedures
    - 4) delayed treatment with malalignment of segments
Condylar Process Fractures

- Open reduction techniques:
  - Multiple approaches and fixation have been developed and used
Condylar Process Fractures

- Studies have shown that closed reduction techniques rarely produce pain, limit function, or produce growth disturbances.
- Open reductions techniques show an early return to normal function, but are technique sensitive, time extensive, and can lead to facial nerve dysfunction depending upon surgical approach.
Complications

- **Infection:**
  - Studies have looked at infection rates for different types of techniques: Highly variable in literature
  - Most early studies indicate a decrease in infection rates with plating after time (experience)
    - Closed reduction- 0%
    - Wire osteosynthesis- 20%
    - Rigid fixation- 6.3%
  - Assael J Oral Maxillofac Surg 1987;45
    - Closed reduction- 8%
    - Wire osteosynthesis- 24%
    - Rigid fixation- 9%
Complications

- Infection:
  - Studies show variation of infection rates with rigid vs. non rigid fixation schemes
  - Most show that wire osteosynthesis techniques have the highest infection rates due to the higher level of mobility at fracture site, leading to vascular damage and percolation of bacteria into fracture site. Is this due to early mobilization of patient??
Complications

- Due to dirty environment of oral cavity, mandible fractures should be on antibiotics to decrease infections, especially with fractures in the dento-alveolar portion.
- Difficult to get a consensus of infection rates due to wide range and case report citations in the literature.
Complications

- Malocclusion:
  - More difficult to manage with rigid fixation
  - Most studies have shown that malocclusion occur more frequently with rigid fixation
  - May be due to plate mal-positioning/iatrogenic
  - Low risk in pediatric fractures due to growth and dentition reposition
Complications

- Malunion and nonunion:
  - Most nonunions occur from infections of the fracture or teeth in the line of fracture
  - Malunions are usually tolerated well by the patient, most malunions of the body, symphysis, or angle can result in malocclusions. This is harder for the patient to tolerate. More common with improper use of fixation technique.
Teeth in the Fracture Line

- Should a tooth in the line of fracture be removed?
  - If the periodontium is reasonably intact, the tooth can be left
  - If the tooth has not sustained major structural or pulpal injury, it can be left
  - If the tooth does not interfere with fracture reduction, it can be left
  - Patients with teeth in the line of fracture are considered to have open fractures and should be placed on antibiotic coverage
  - Removal of a tooth in the fracture line can lead to displacement and difficulty in fracture reduction
Conclusions

- Simplest method is probably the best method
- Just because something can be done, should it?
- If the prognosis of a tooth is in question, remove it.
Conclusions

- Closed reduction techniques are much better in pediatric and condylar fractures.
- Antibiotics should be used in all mandible fractures except fractures only in the ramus, coronoid, or condylar region that are closed.
Complications

- Get the proper occlusion prior to plating. Malunions/malocclusions poorly tolerated by patients.
- The literature is highly variable on complication rates. The technique utilized is really up to the surgeon and their perceived comfort. No true standard of care for mandible fractures.