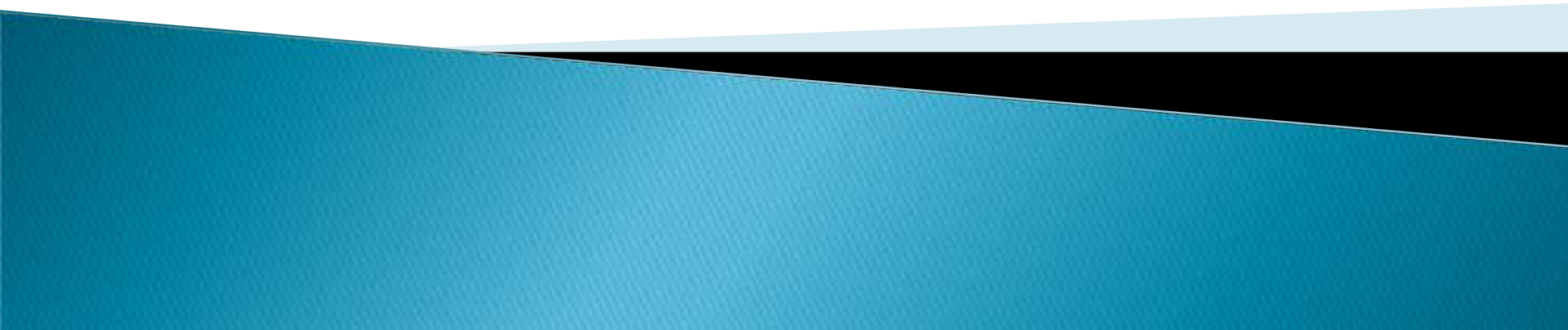


MANDIULAR FRACTURES


RICHARD LEWANDOWSKI




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History

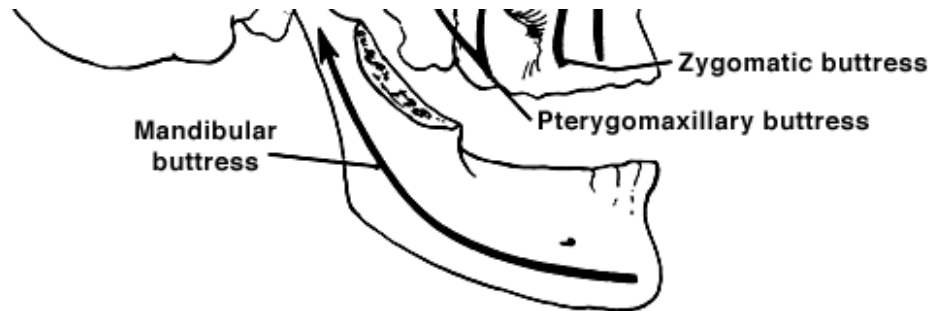
- } Edwin Smith Papyrus 1650 described Hx, Phy, Diagnosis. Often fatal disease
 - } Hippocrates – Described monomaxillary dental fixation and binding
 - } Sulicetti – 1492 Described “tie teeth of jaw to teeth of uninjured jaw”
- 

History

- } Schede 1888 – Bone plate of steel secured with 4 screws
 - } Luhr 1960 – Developed mandibular compression plates
 - } Michelet and Champy 1970's – Placement of small bendable non-compression plates
- 

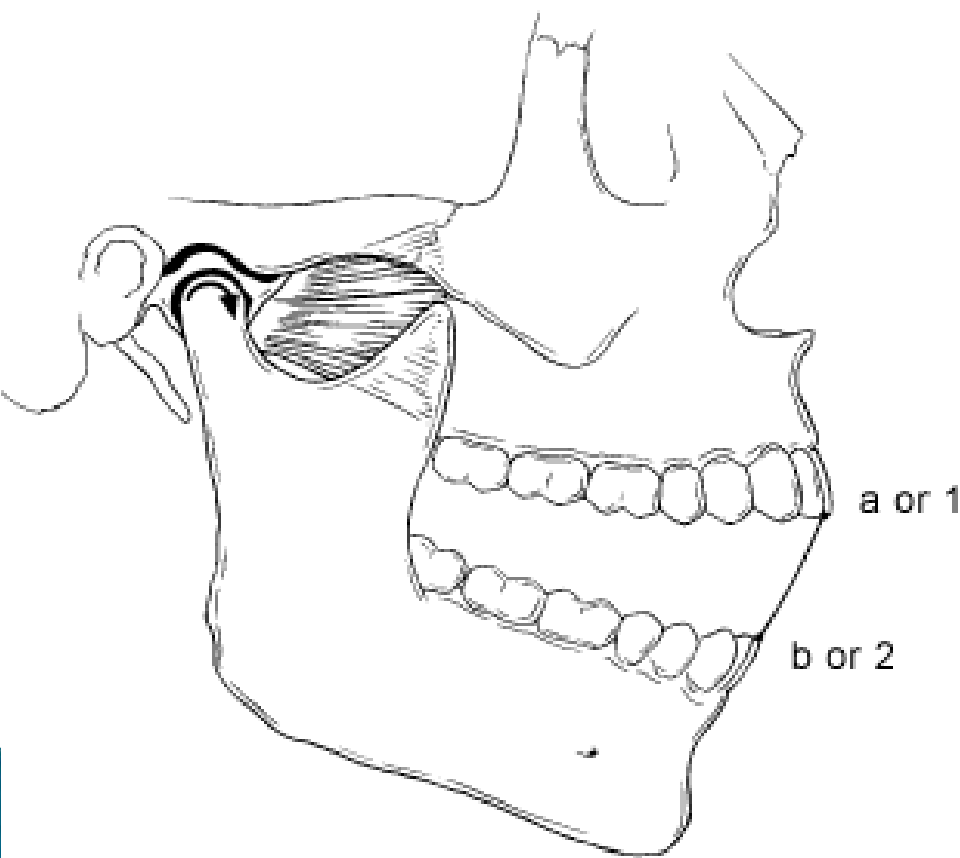
BONES

- alveolar = tooth bearing
- buttresses = load bearing

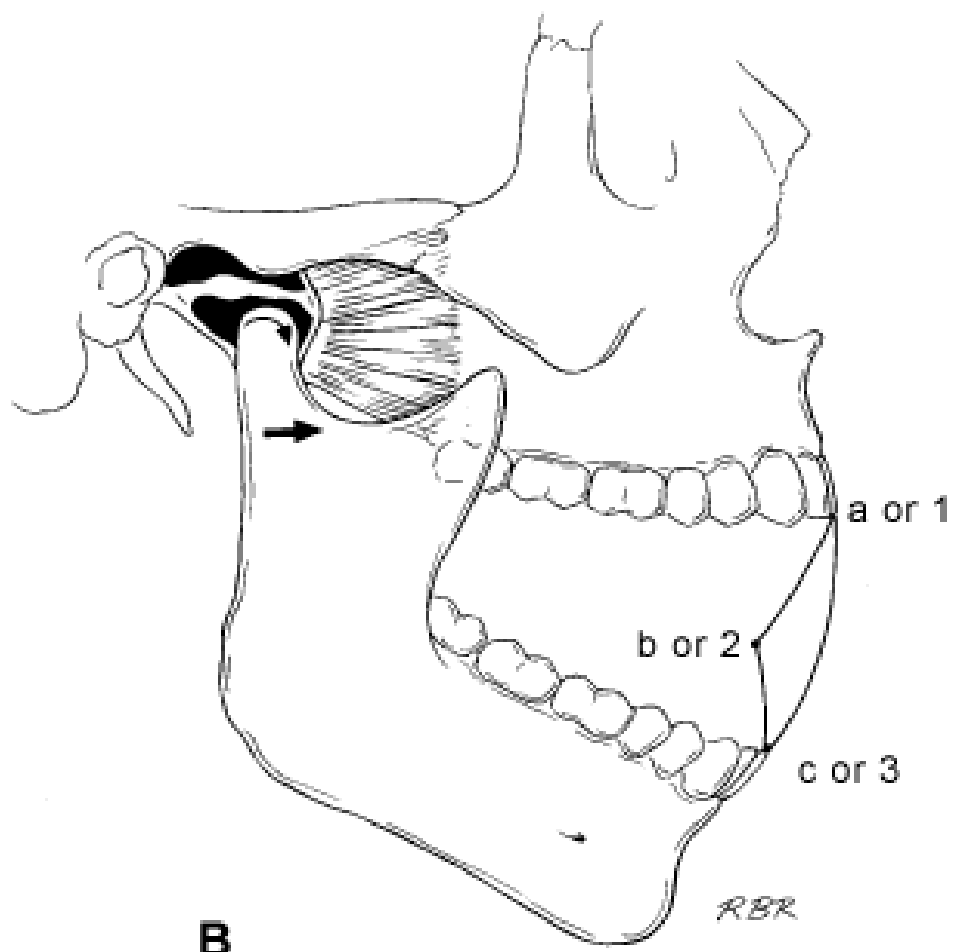


TM JOINTS

- diarthrodial synovial joints
- fibrocartilage lined
- function together
- end point= occlusion
- rotation in lower (ginglymus)
- translation in upper (arthrodial)
- interincisal opening= 25mm + 20mm



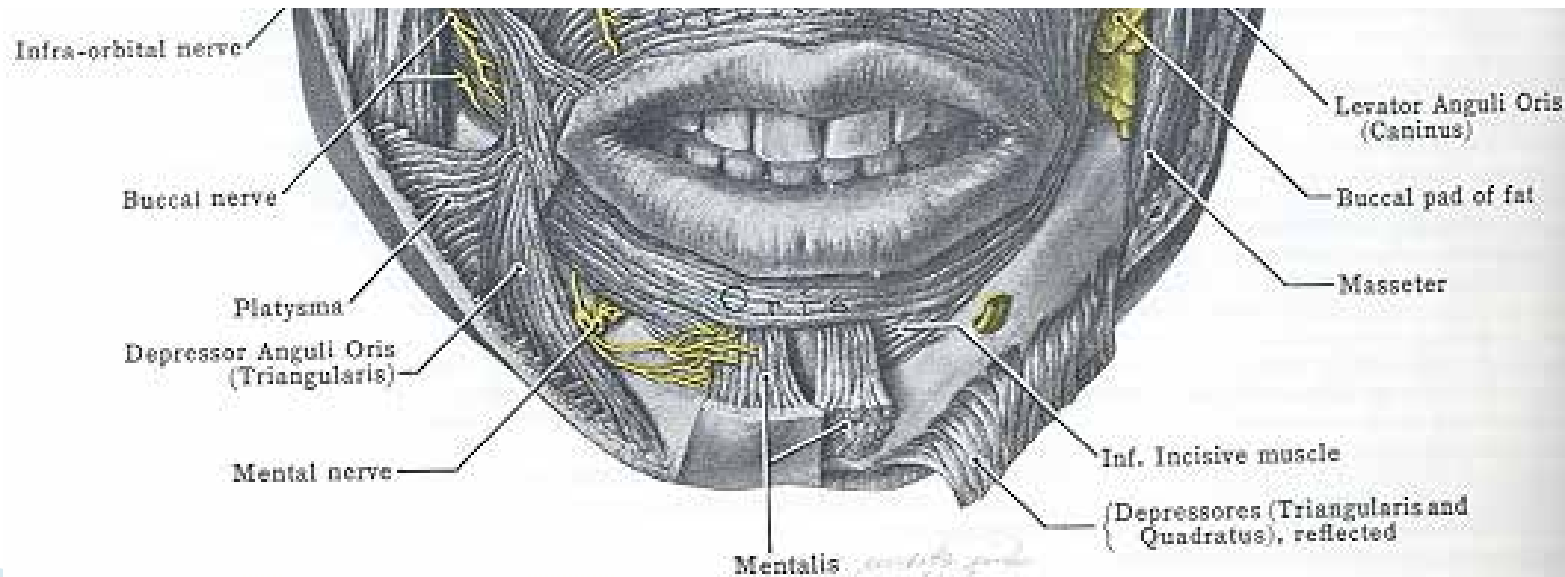
A



B

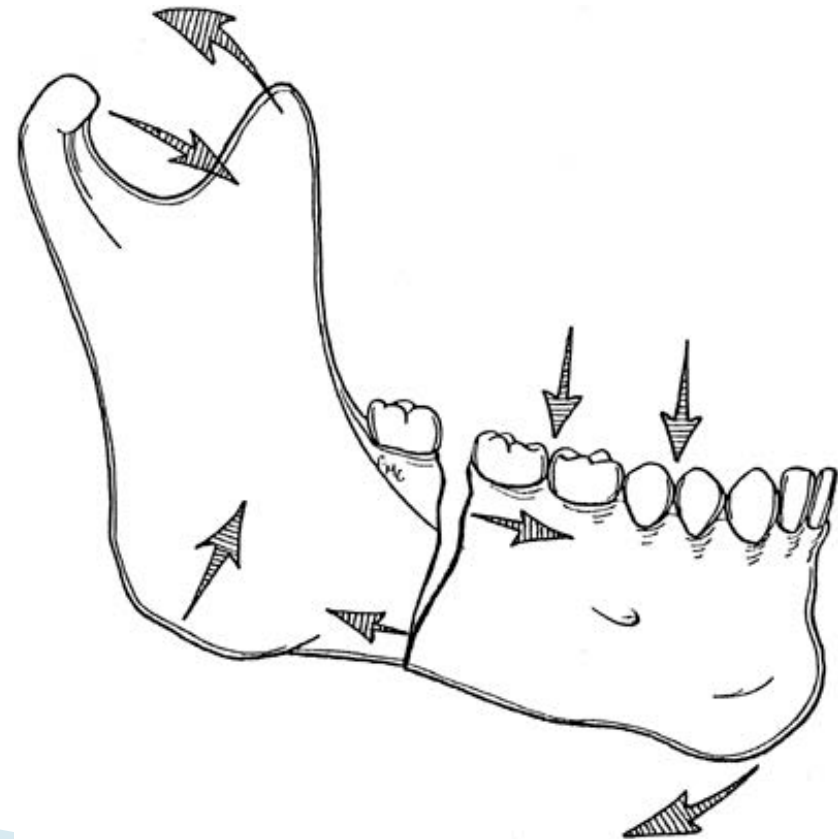
NERVES

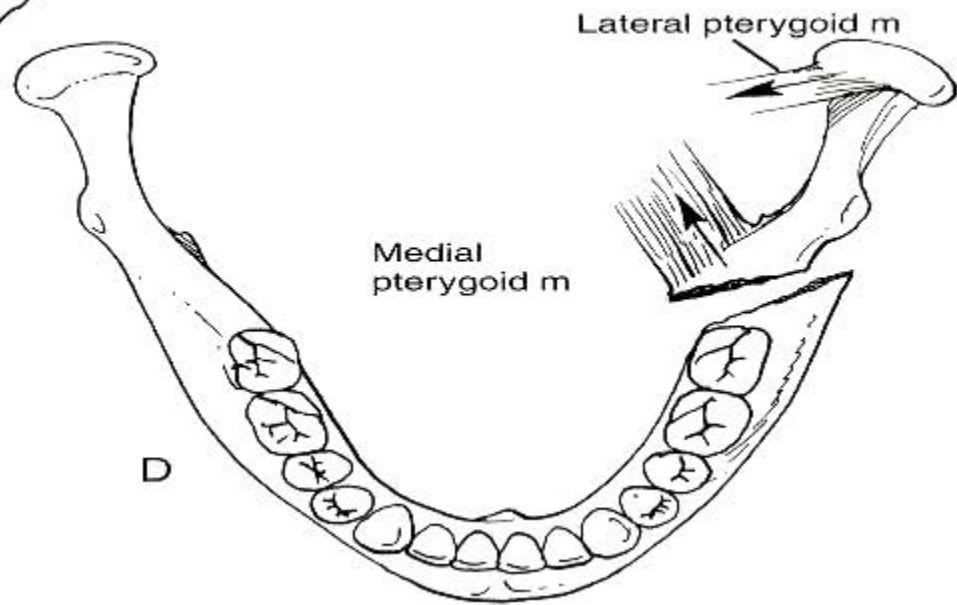
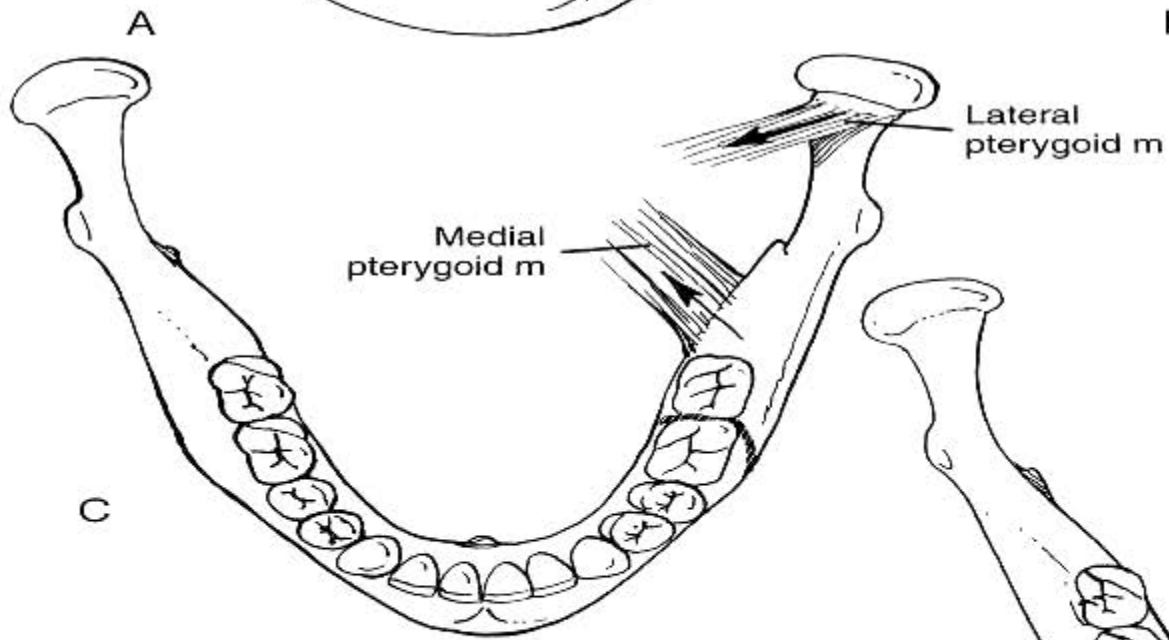
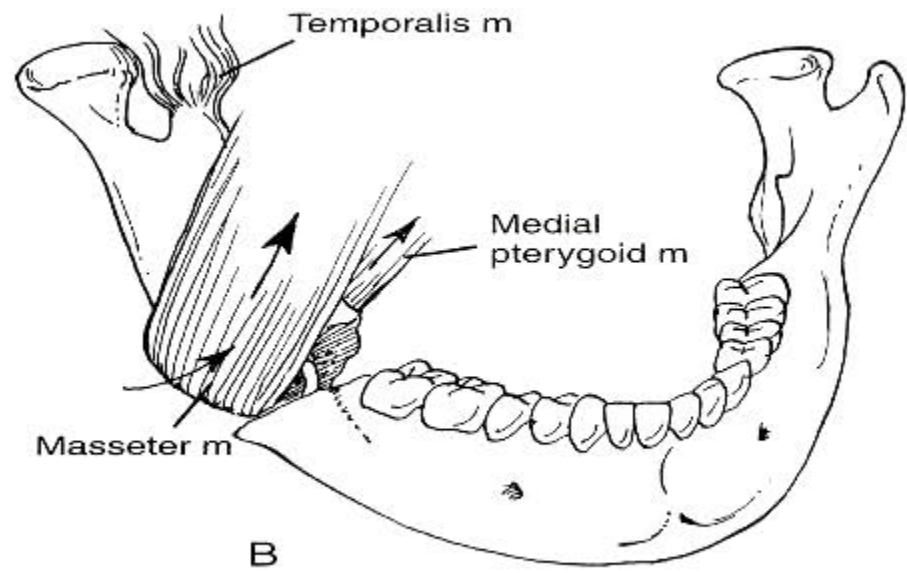
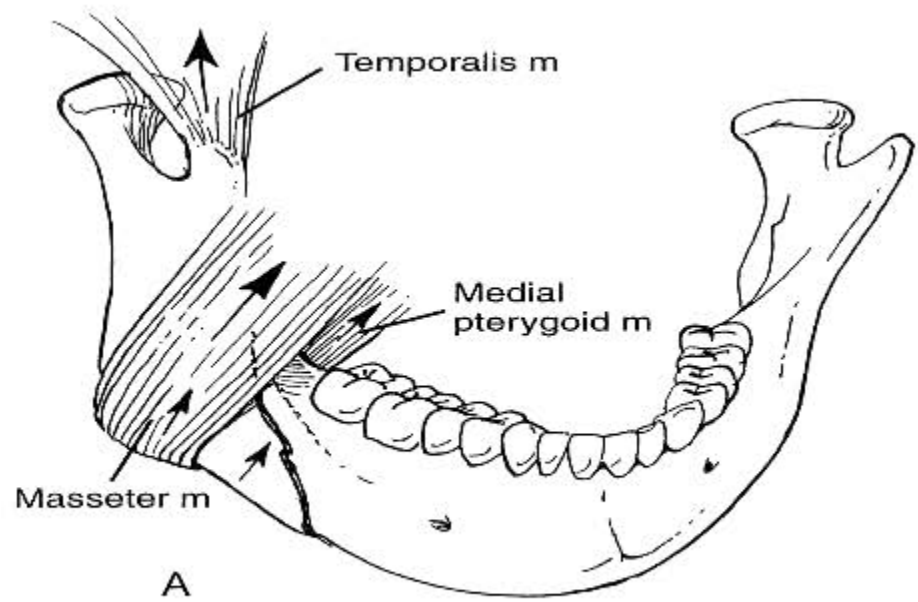
- Inferior Alveolar
- Mental
- Facial




MUSCLE FORCES

- direct skeletal development
- displace fracture fragments
- resist movement of segments
- contribute to relapse after surgery





Epidemiology

- } Mandible most common after nasal fractures
 - } Mandible : Zygoma : Maxilla 6:2:1
 - } Ellis 4711 facial fractures, 45% with mandible fractures
 - } Assault > MVA > Fall > Sports
- 

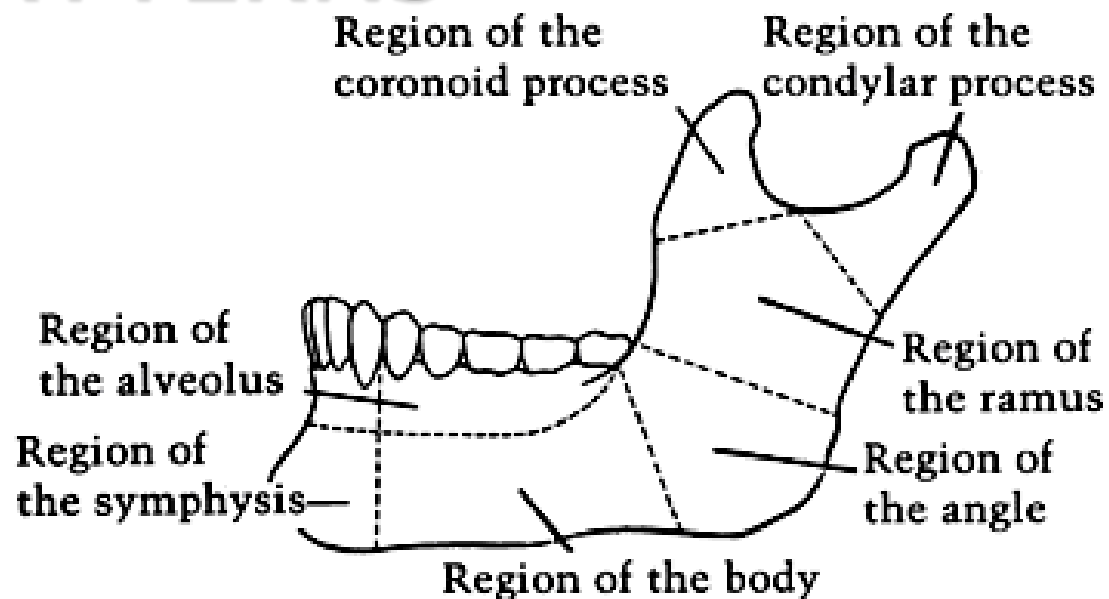
Epidemiology

- } Sites of weakness
 - Third molar (esp. impacted)
 - Socket of canine tooth
 - Condylar neck

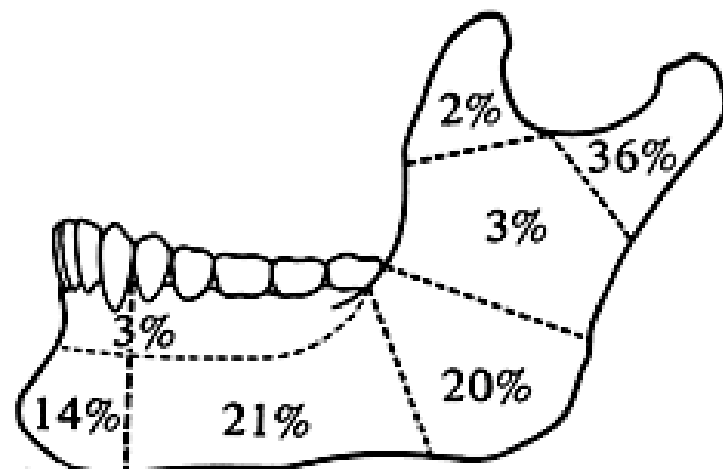
Epidemiology

- } Boole et al (laryngoscope) 5196 fractures
 - Young military men
 - Angle 35%, Symphysis 20%, Body 12%, Condylar 9%, Subcondylar 4%, Ramus 4%, Alveolar 3%, Coronoid 1%
 - 70% 1 fracture, 30% 2 fractures, .2% more than 2
 - Facial lacs 30%, other facial fx. 16%, C-spine 0.8%

FRACTURE PATTERNS



A



Midline
(less than 1%)

B




Physical Exam

- } Complete Head and Neck exam
 - Palpable step off
 - Tenderness to palpation
 - Malocclusion
 - Trismus (35 mm or less)
 - FOM hematoma
 - Altered sensation of V3
 - Crepitus

Physical Exam

} Dental Exam

- Lost, fractured, or unstable teeth
 - Dental Health
 - Relation to fracture
 - Quantity
- 

Physical Exam

} Unilateral fractures of Condyle

- Decreased translational movement, functional height of condyle
- Deviation of chin away from fracture, open bite opposite side of fracture

Bilateral fractures of condyle

- Anterior open bite

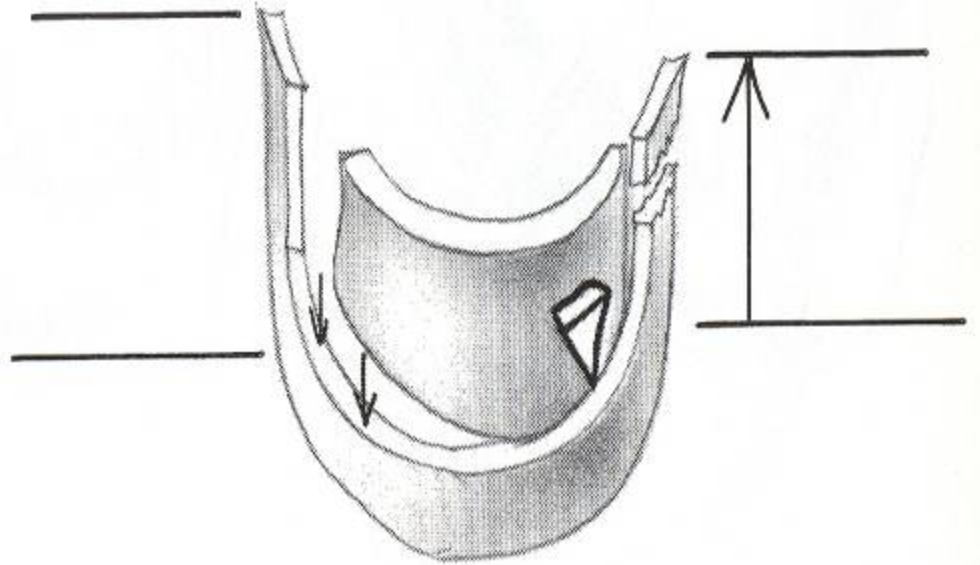
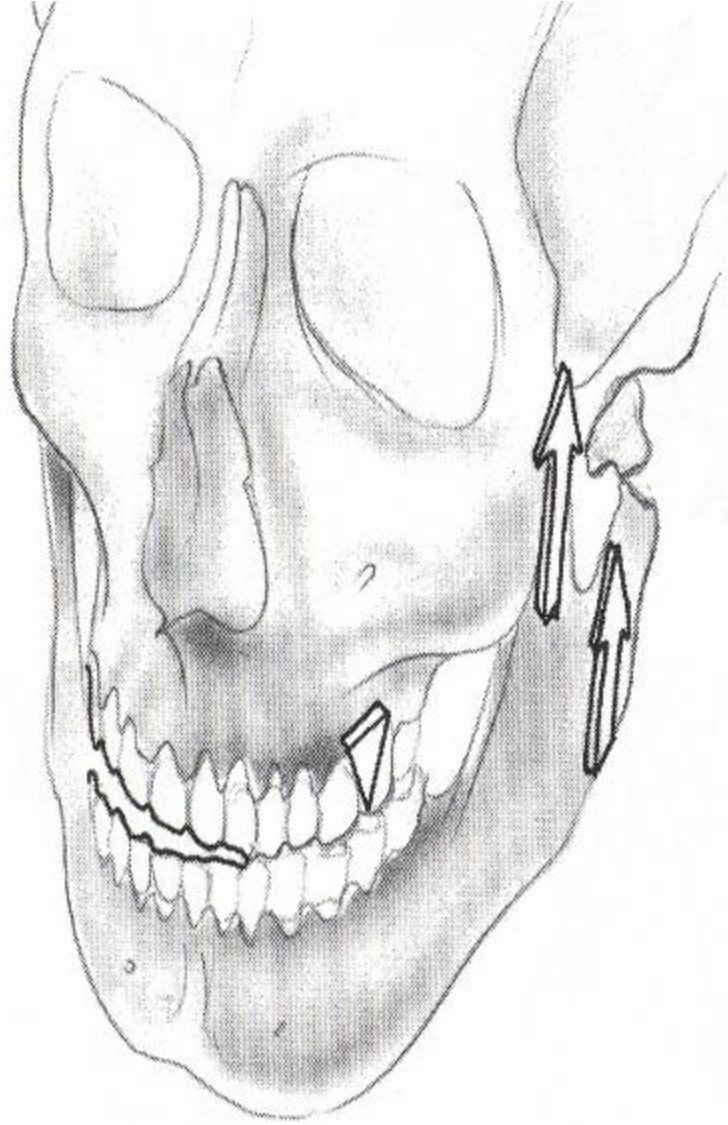


FIGURE 65.5. A fractured condyle usually is distracted anteromedially by the lateral pterygoid muscle. This produces a shortened functional height of the ramus as the masseter, medial pterygoid, and temporalis muscles draw the ramus closer to the skull base. The ipsilateral molar teeth act as a fulcrum to produce a slight contralateral anterior open bite.

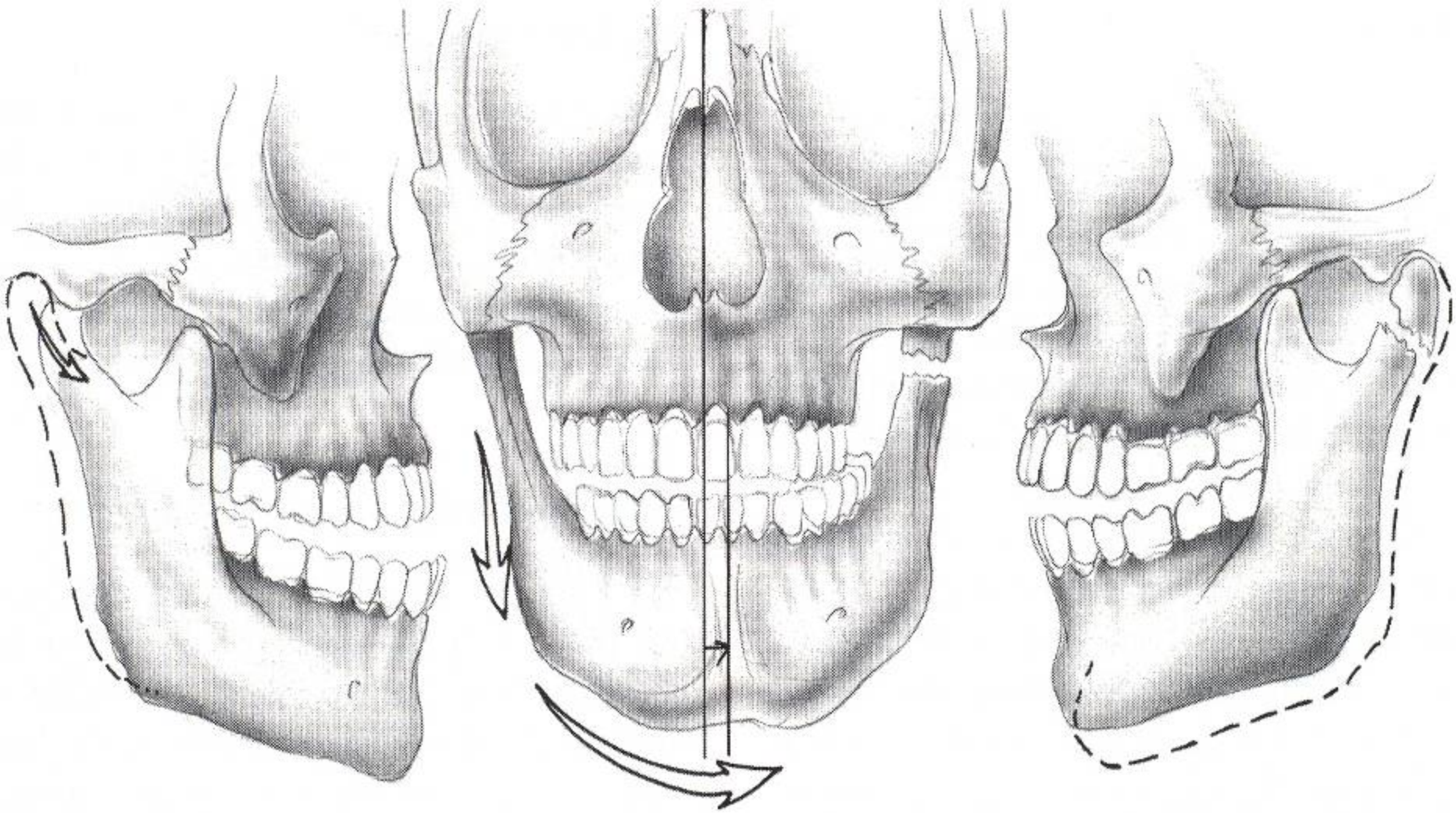




FIGURE 65.4. A fractured condyle does not translate down the articular eminence on jaw opening. The unopposed translational movement of the opposite condyle deviates the chin toward the side of the fractured condyle.


Mandible Fracture

- } Very often more than one fracture present
 - } May result in airway compromise (acute or delayed)
 - } Elevated risk of c-spine injury
 - } Almost always considered contaminated
- 

Evaluation

- } Stabilization via EMST protocol
 - } Part of secondary survey
 - Pain, malocclusion, trismus, V3 sensory deficit
 - History of TMJ (earlier mobilization)
 - Blow to face favors parasymphyseal fracture and contralateral angle fracture
 - Fall to chin (bilateral condylar fractures)
- 

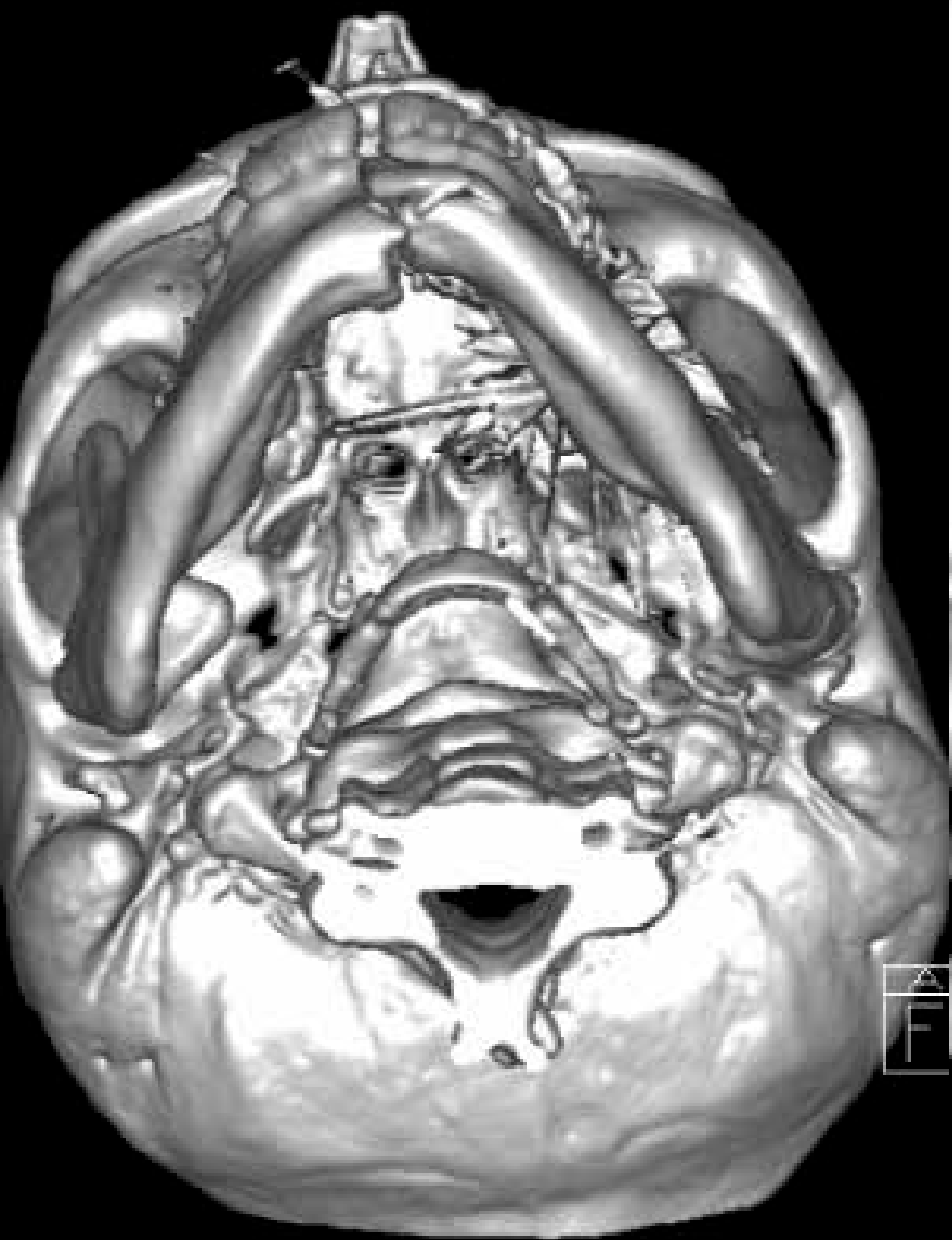
Immediate Management

- } Rule out other significant injury including brain and c-spine
 - } Monitor for airway issues – repeat exam, monitored bed
 - } Start antibiotics immediately
 - } Pain management
 - } Document CN function (esp inf alveolar)
- 

Evaluation

- } Panorex, mandible series
- } CT scan
 - Not as diagnostic as plain films for nondisplaced fractures of mandible.
 - Most useful for coronoid and condylar fractures, associated midface fractures






F




R


Favorable vs. Unfavorable

- } Masseter, Medial and Lateral Pterygoid, and Temporalis tend to draw fractures medial and superior
 - } Almost all fractures of angle unfavorable
- 


Considerations In Mandible Fx

- } Much of the morbidity of these injuries is attributed to improper management.
 - } Infection risk increases with passage of time, substantially higher after 72h.
 - } Risks of nonunion, malunion, malocclusion, plate fracture, plate extrusion, TMJ fixation, jaw restriction, poor cosmetic outcome
- 


Steps to Avoid Problems

- } Proper diagnosis
 - } Consider Co-morbid Conditions
 - } Consider Patient Personality/Occupation
 - } Proper management plan for the circumstances
 - } Proper technique (MMF, bending, drilling, screw placement, nerves, tooth roots)
 - } When in doubt, use a LARGER plate.
- 

Concepts in Reduction

- } Patient's baseline occlusion is first priority.
 - } Class I, II, III ... Crossbite?
 - } Observe wear facets
 - } Do not force class I if it doesn't line up with wear facets.
 - } Verify occlusion at beginning, mid, end of case. Remove MMF to verify if necessary.
- 

Closed Reduction

- } Favorable, non-displaced fractures
 - } Grossly comminuted fractures when adequate stabilization unlikely
 - } Severely atrophic edentulous mandible
 - } Children with developing dentition
- 

Closed Reduction

} Length of MMF


- De Amaratunga – 75% of children under 15 healed by 2 weeks, 75% young adults 4 wks
- Juniper and Awty – 82% had healed at 4 wks
- Longer period for edentulous fractures 6-10wks

Closed Reduction

} Edentulous fractures

- Bradley found absent inferior alveolar artery in 40% 60-80 yo's
- Periosteal blood supply disturbed by stripping
- Up to 20% non-union despite type of treatment
- May consider Gunning Splints

Open Reduction


- } Displaced unfavorable fractures
 - } Mandible fractures with associated midface fractures
 - } When MMF contraindicated or not possible
 - } Patient comfort
 - } Facilitate return to work
- 

Open Reduction


} Contraindications

- General Anesthetic risk too high
- Severe comminution and stabilization not possible
- No soft tissue to cover fracture site
- Bone at fracture site diffusely infected (controversial)

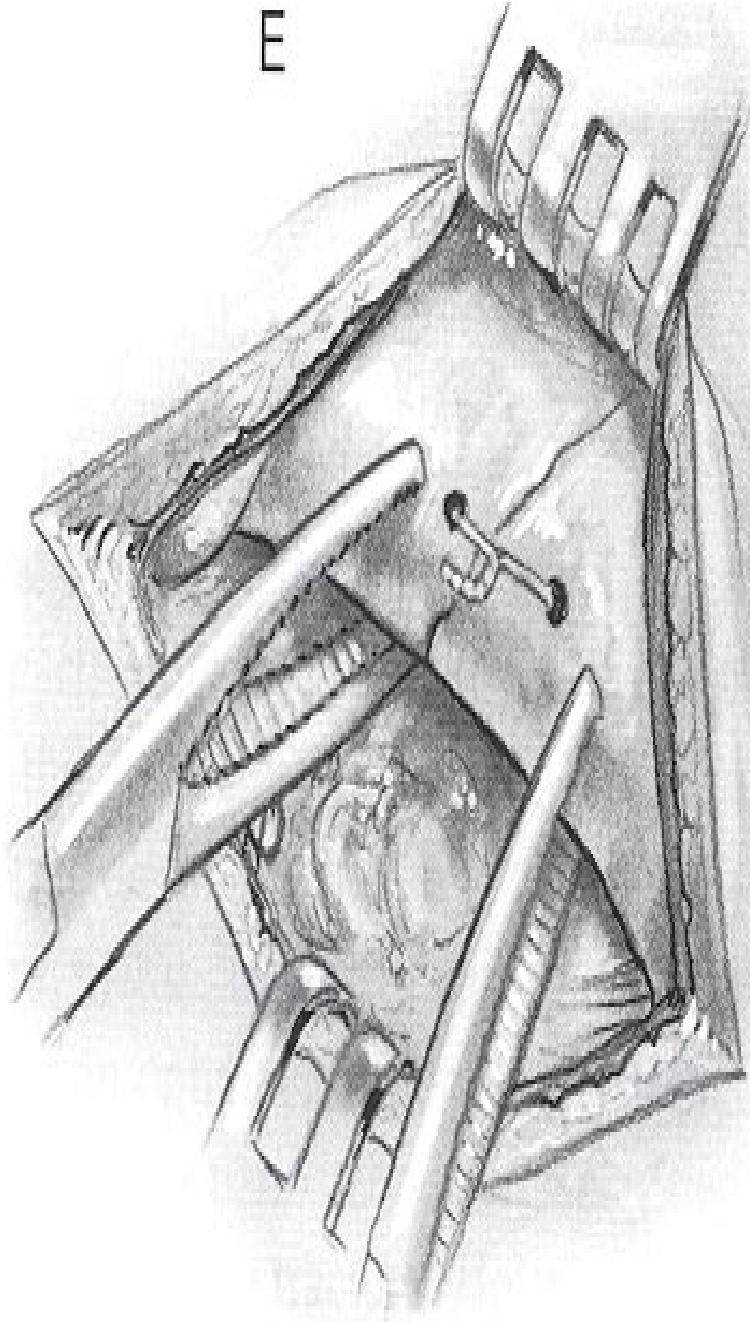
Open Reduction

- } Associated condylar fracture
 - } Associated Midface fractures
 - } Psychiatric illness
 - } GI disorders involving severe N/V
 - } Severe malnutrition
 - } To avoid tracheostomy in patients who need postoperative intubation
- 

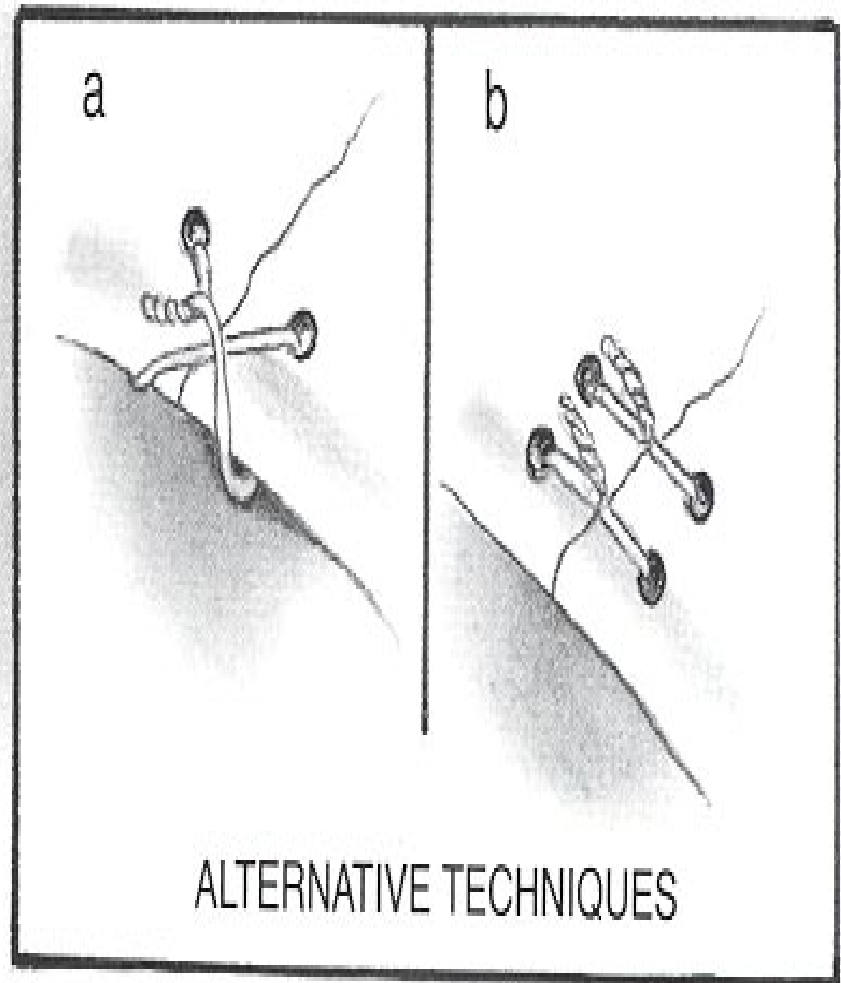
Open Reduction

- } Intraosseous wiring
 - Semirigid fixation
 - Cheap
 - Technically difficult
 - Primary and Secondary bone healing
- 

E




Wire fixation



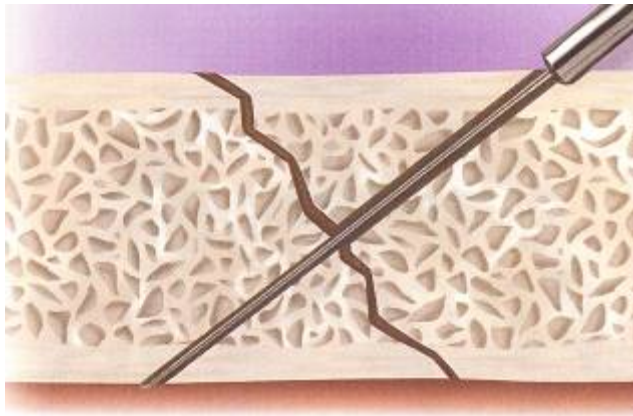
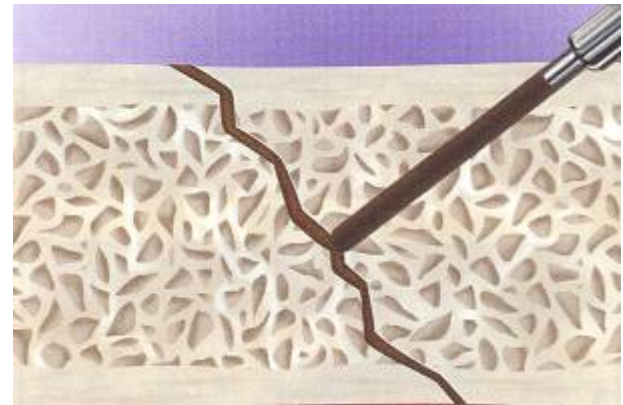
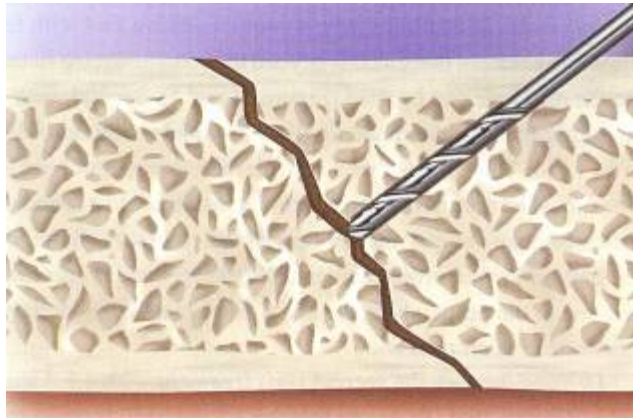
ALTERNATIVE TECHNIQUES

Open Reduction

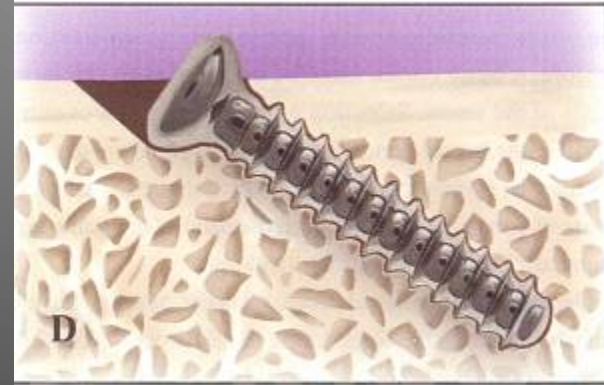
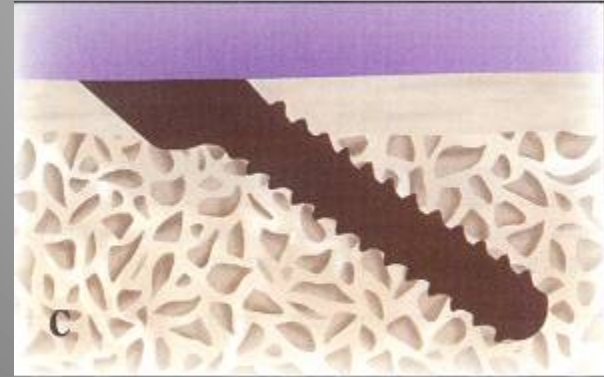
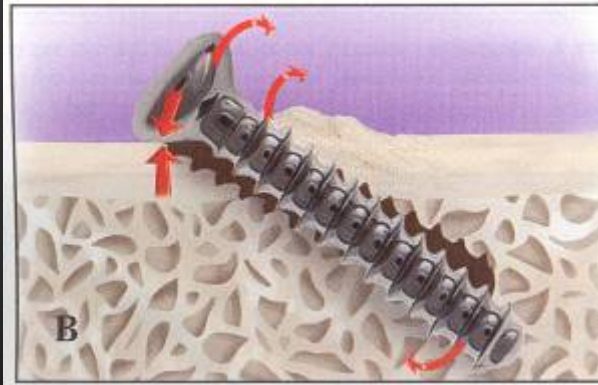
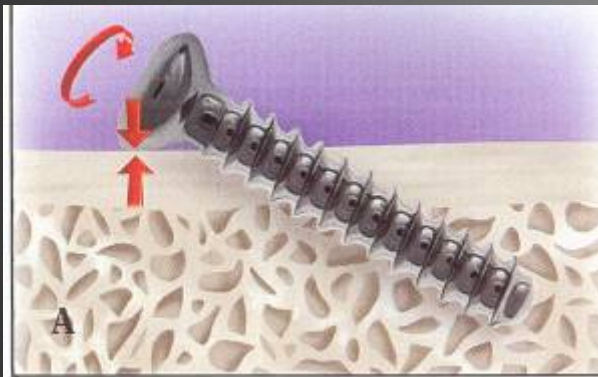
} Lag Screws

- Rigid fixation (Compression)
 - Good for anterior mandible fractures, Oblique body fractures, mandible angle fractures
 - Cheap
 - Technically difficult
 - Injury to inferior alveolar neurovascular bundle
- 

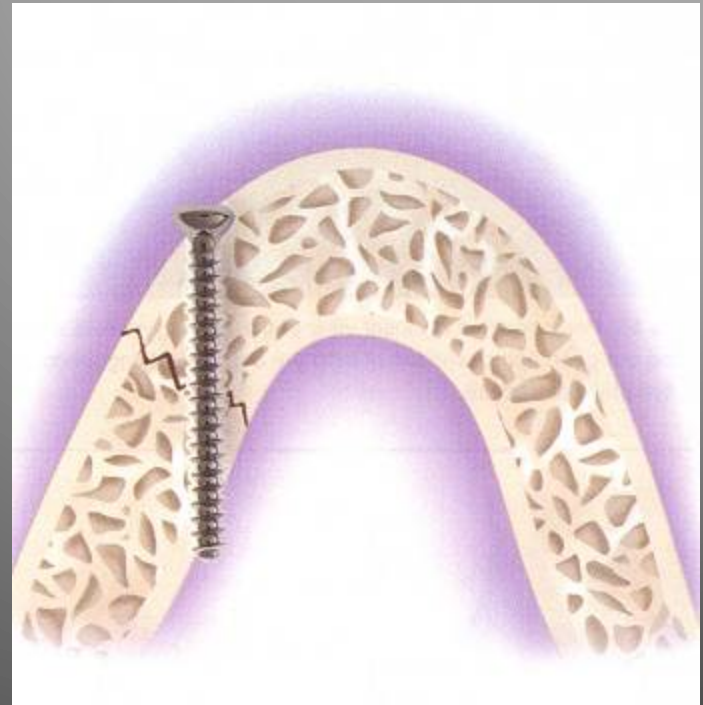
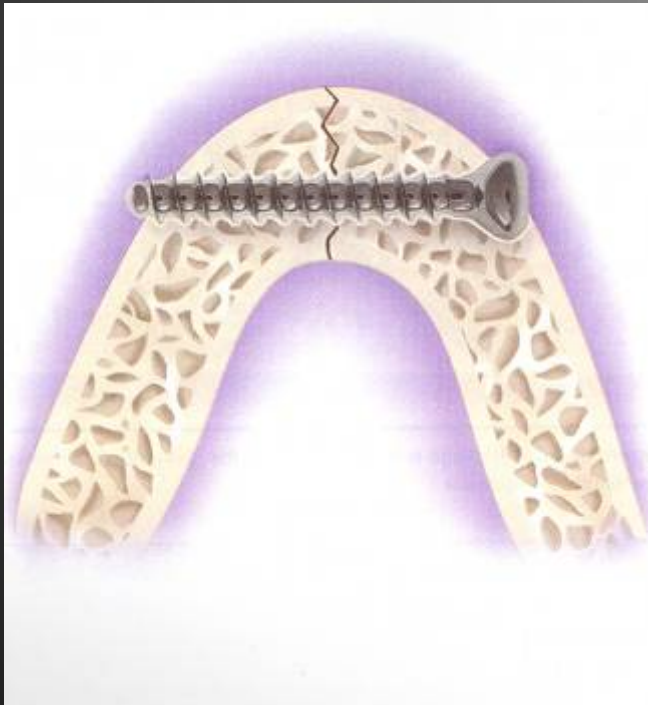
Lag Screw Technique




Lag Screw Technique



Lag Screw Technique



Open reduction

- } Ellis 41 patients with anterior lag screw technique
 - } 4.9% infection rate
 - } No malocclusion
 - } No Non-union
- 

Rigid Fixation

} Miniplates

- Semi-rigid fixation
- Allows primary and secondary bone healing
- Easily bendable
- More forgiving
- Short period MMF Recommended

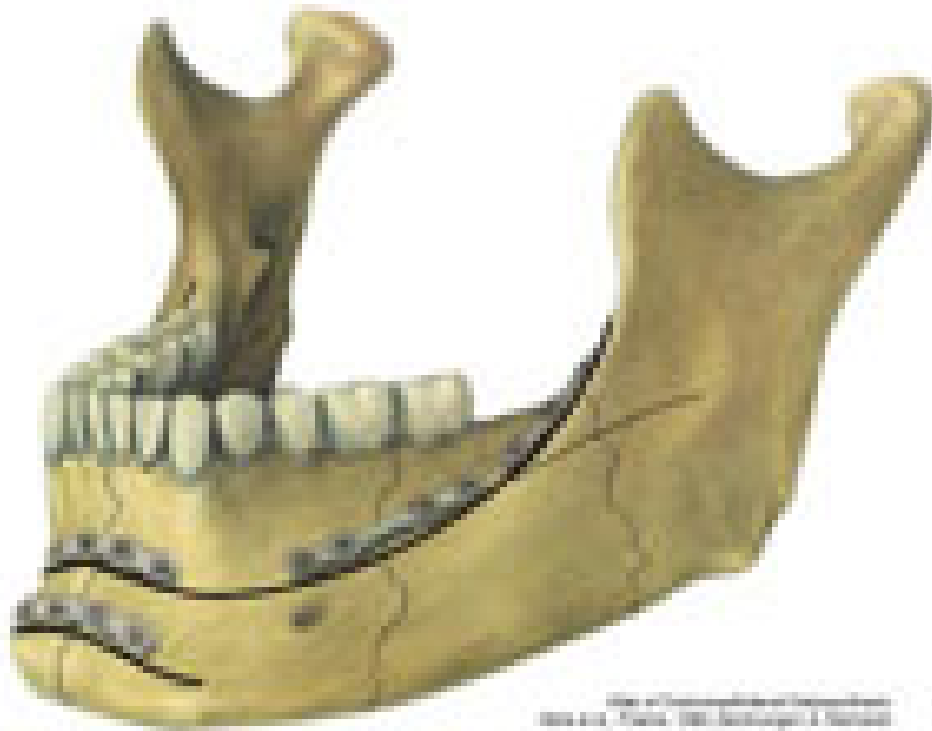
Rigid Fixation

- } Reconstruction Plates
 - Good for comminuted fractures
 - Bulky, palpable
 - Difficult to bend
 - Locking plates more forgiving

Rigid Fixation


- } Compression plates
 - Rigid fixation
 - Allow primary bone healing
 - Difficult to bend
 - Operator dependent
 - No need for MMF

Know Champy Lines

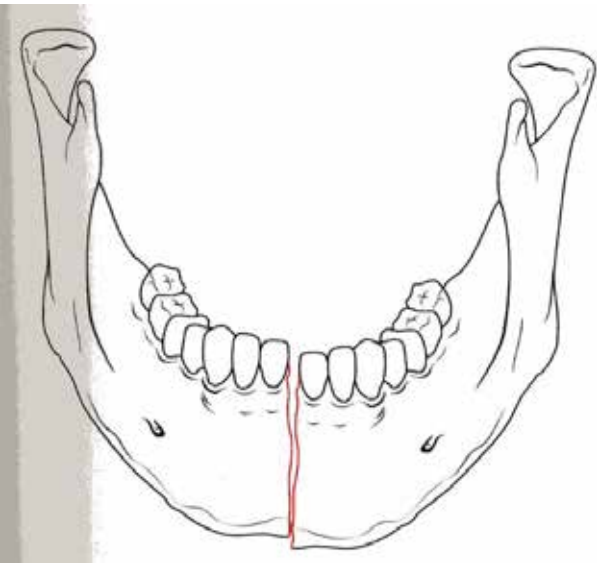


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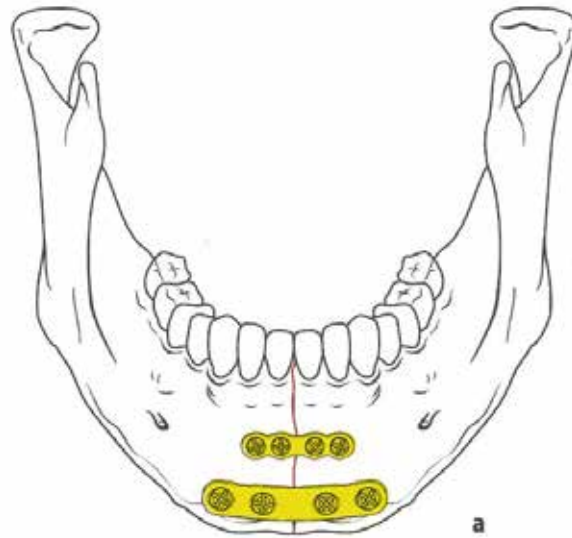
Fracture Types

- } Condylar / Subcondylar
 - } Ramus
 - } Angle
 - } Body
 - } Parasymphaseal
 - } Symphaseal
 - } Alveolar Ridge
- 

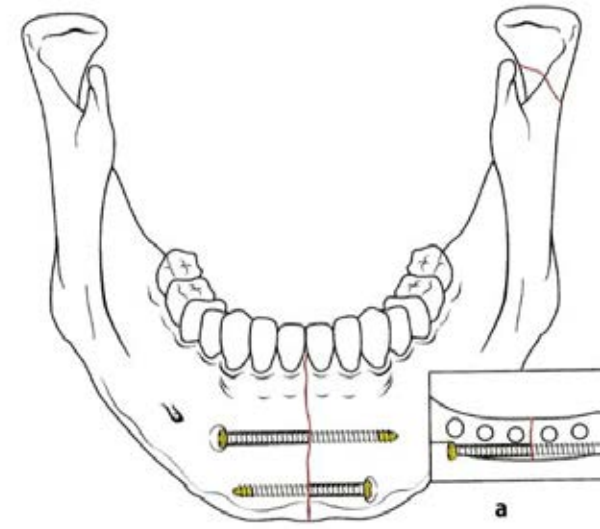
Type and Management



Symphyseal

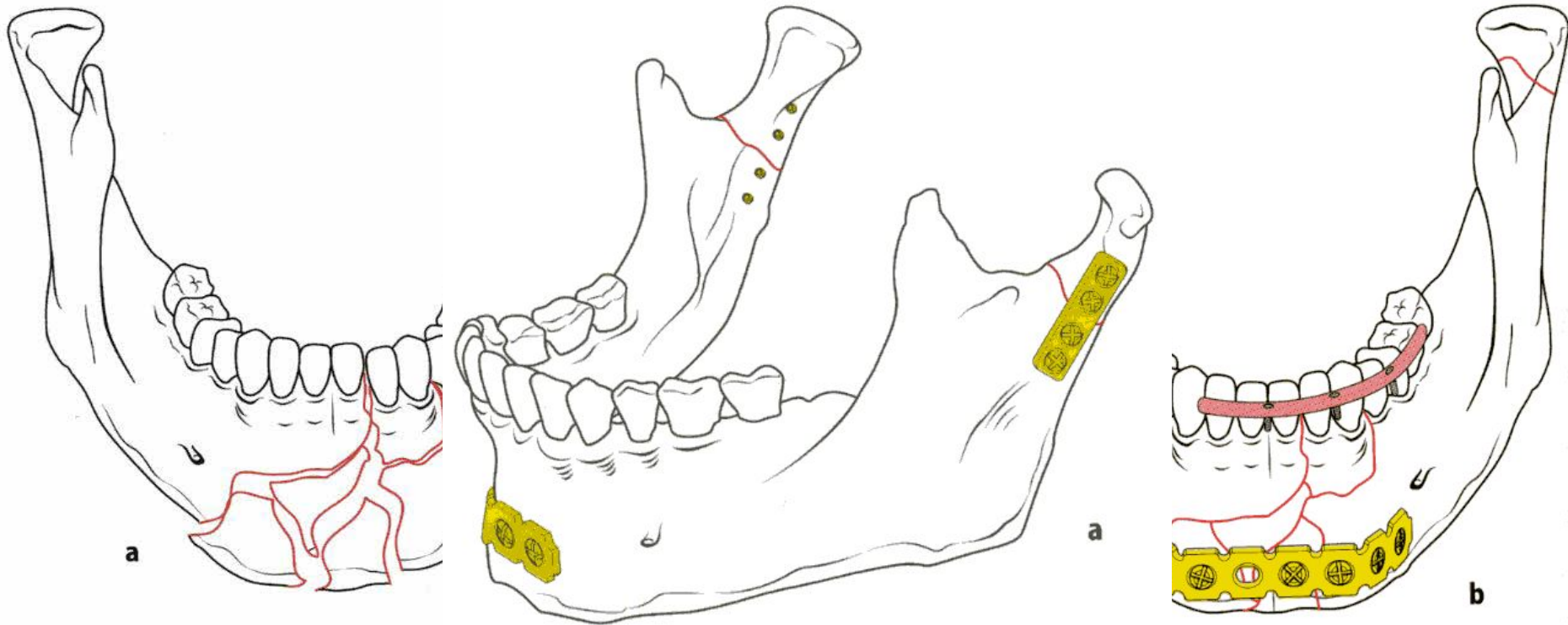


2.0 L Compression + TB



Lag Screws

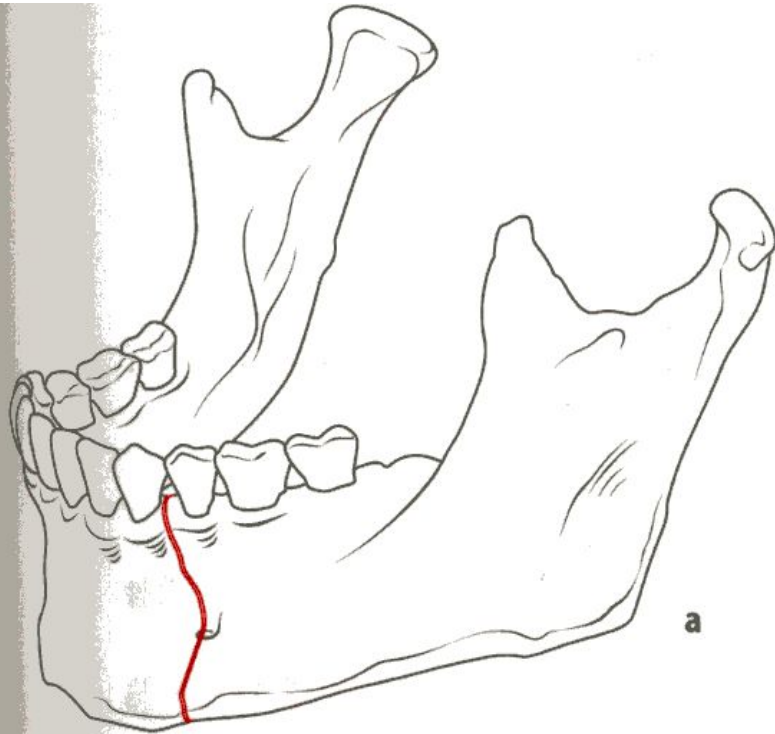
Type and Management



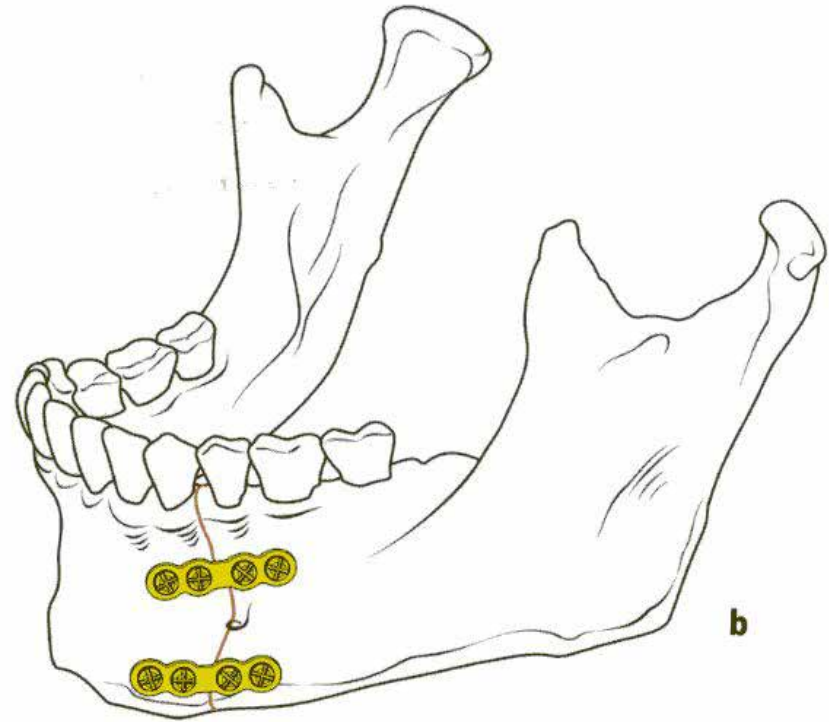
Comminuted Symphyseal
Left Subcondylar

2.4 Locking Recon Plate + TB

Type and Management

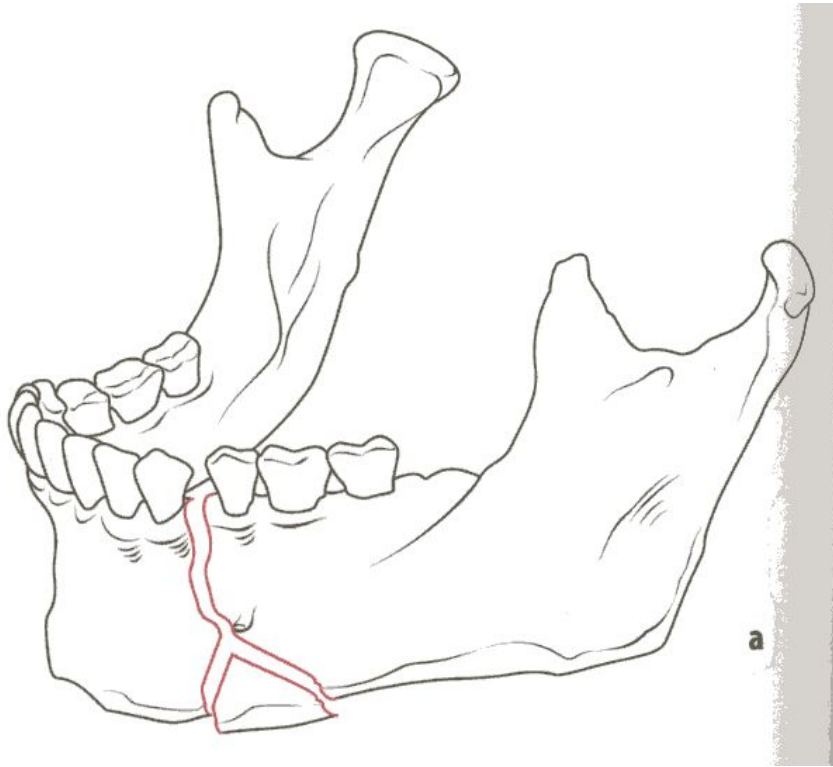


Parasymphseal

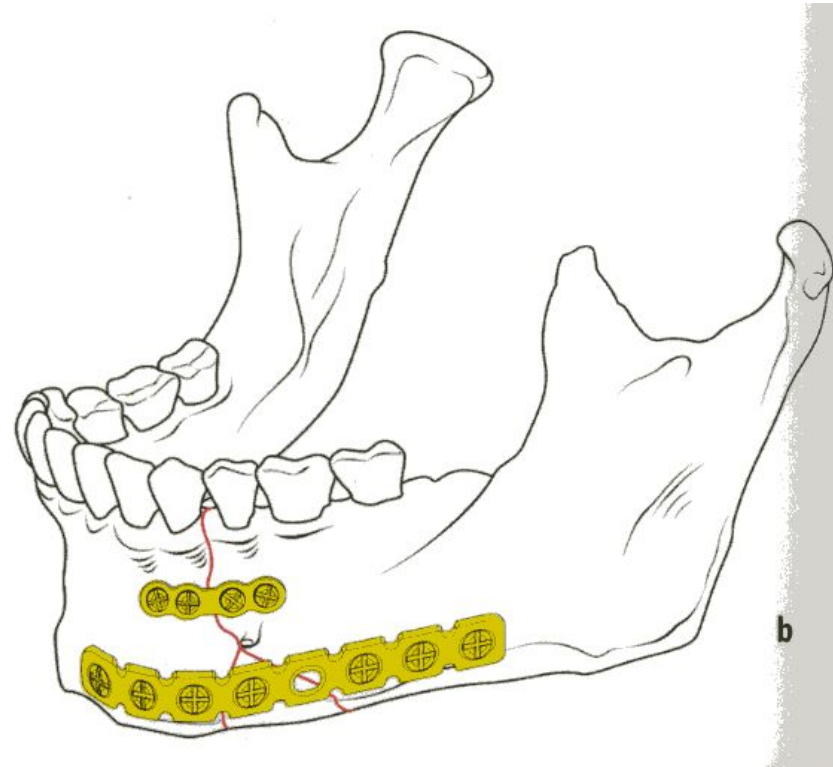


Two Miniplates?

Type and Management

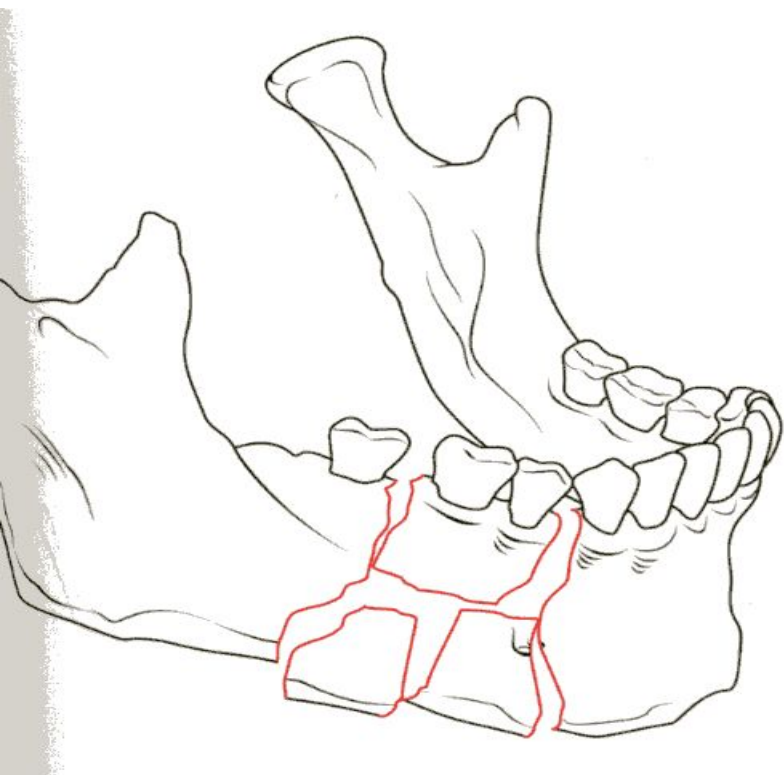


Comminuted Parasymphseal

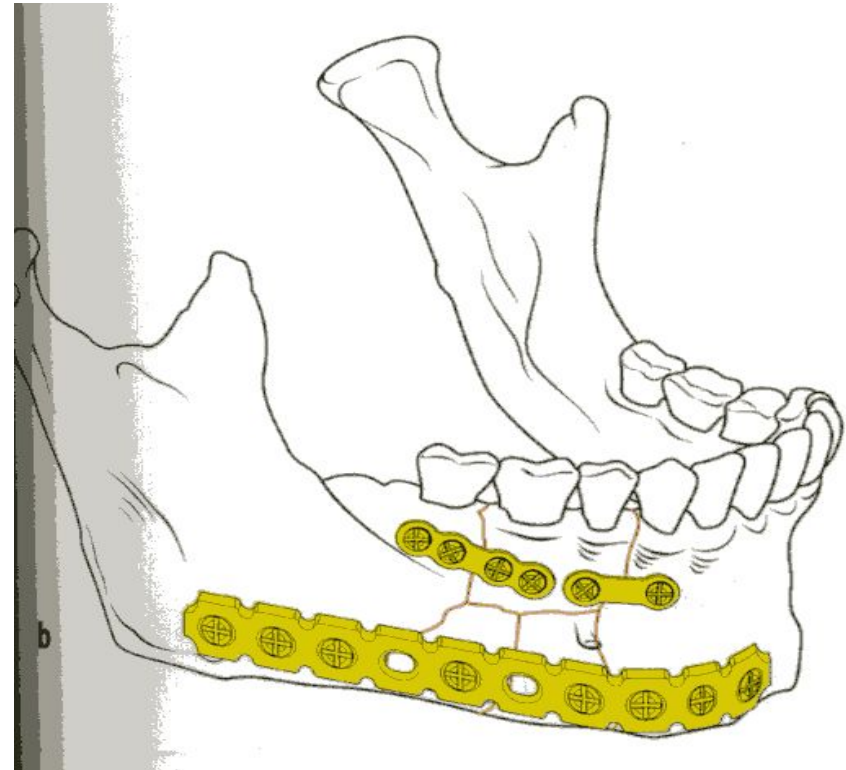


2.4 Locking Recon Plate with TB

Type and Management

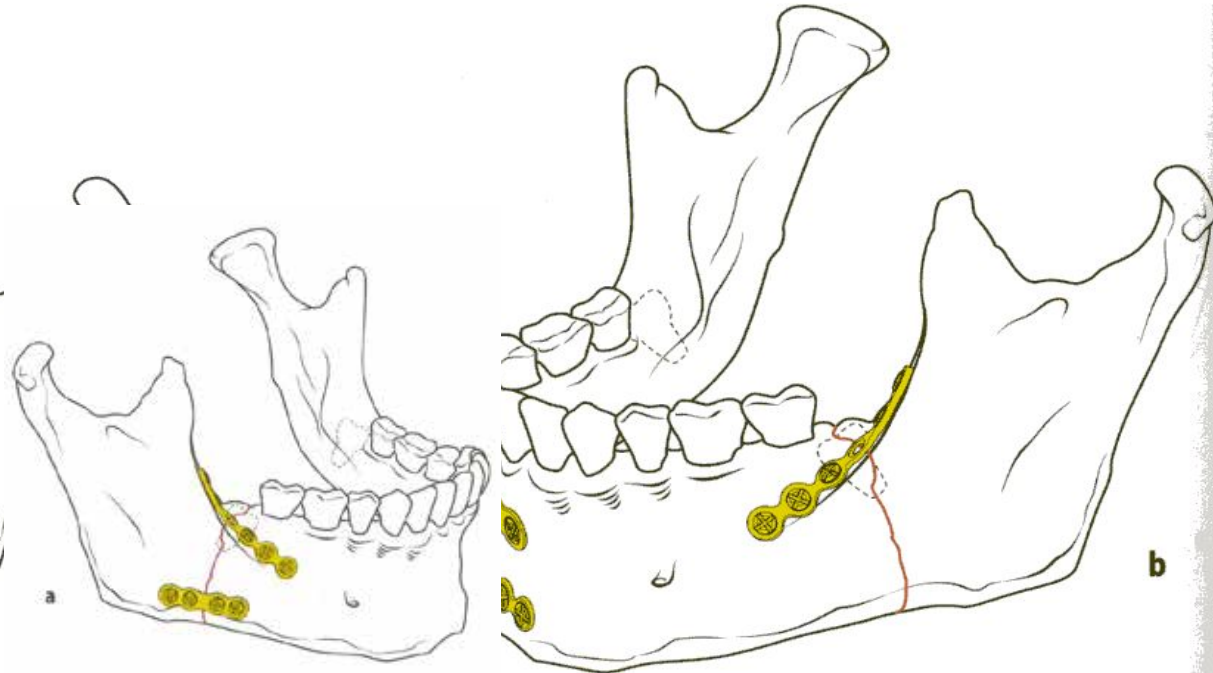
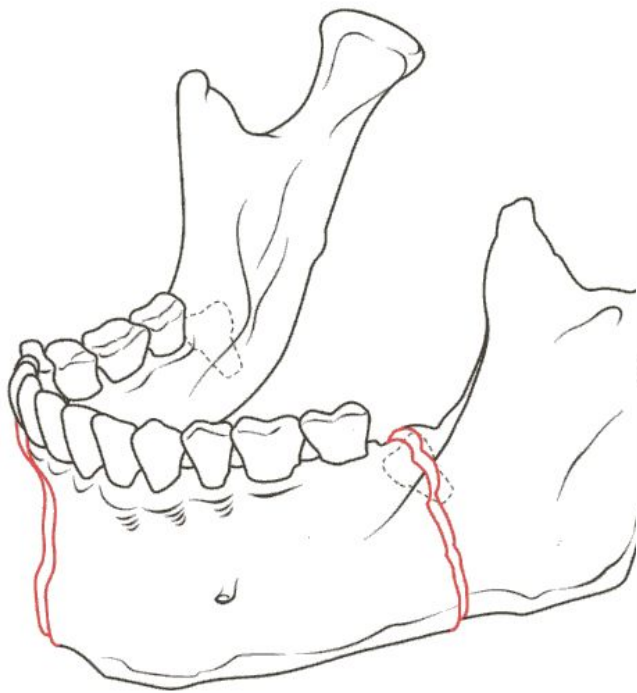


Comminuted Body/Parasymph



2.4 Locking Recon Plate with MPs

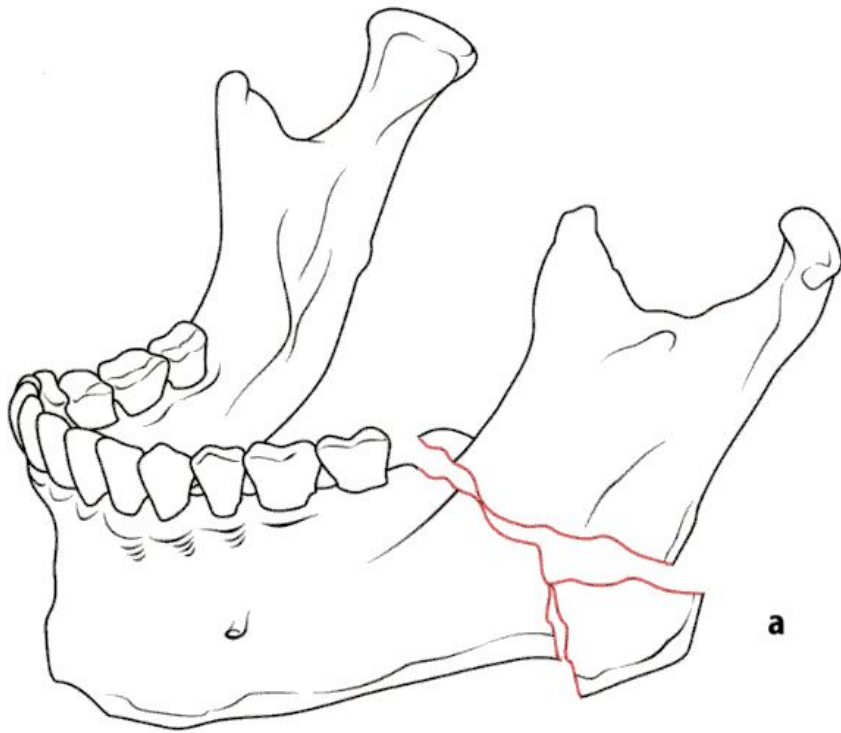
Type and Management



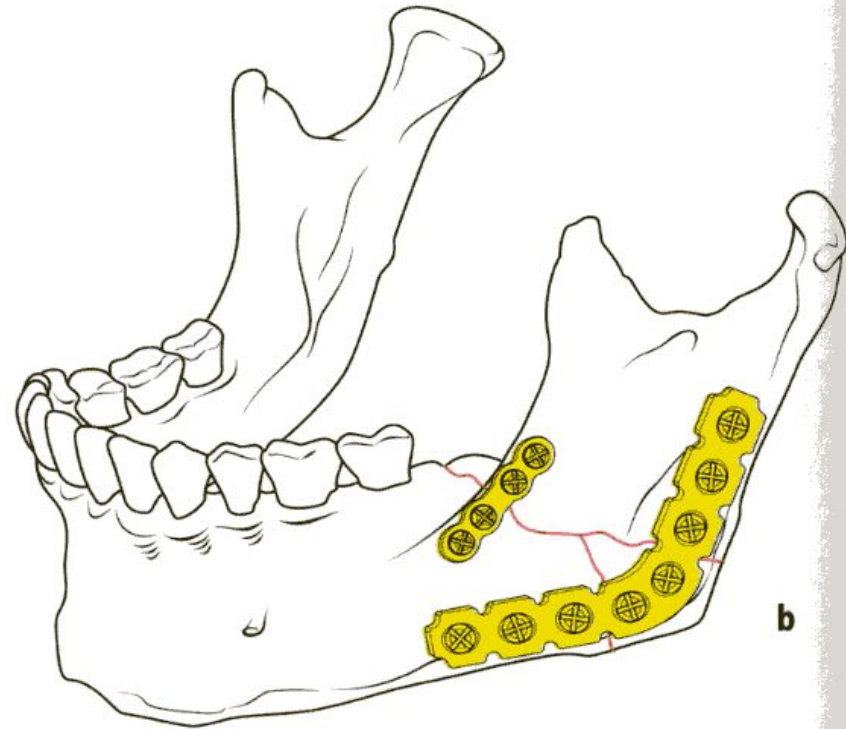
Symphyseal and Angle, 3rd Molar

Single Champy MP at Angle

Type and Management

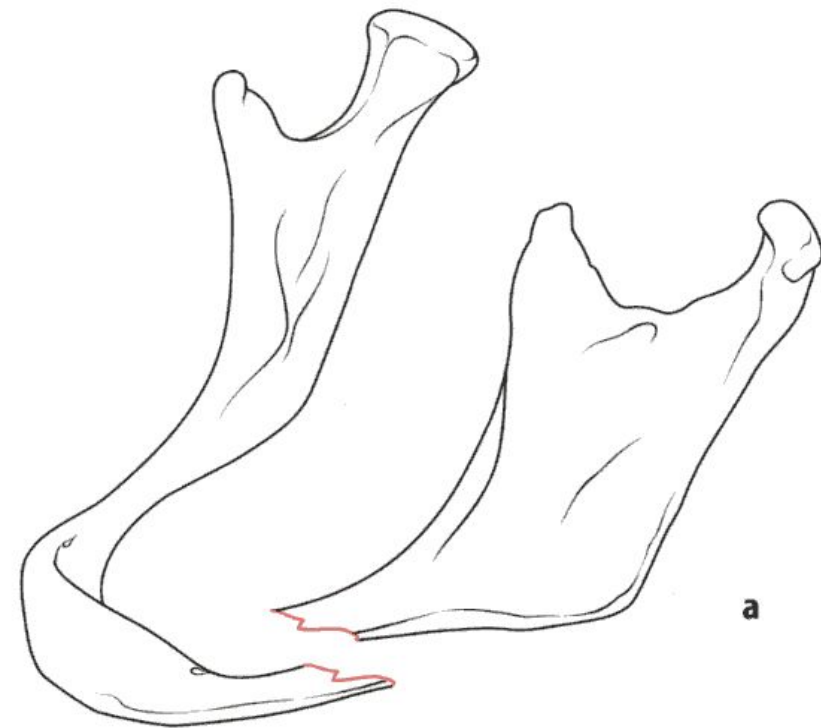


Disloc Angle w/ Basal Triangle

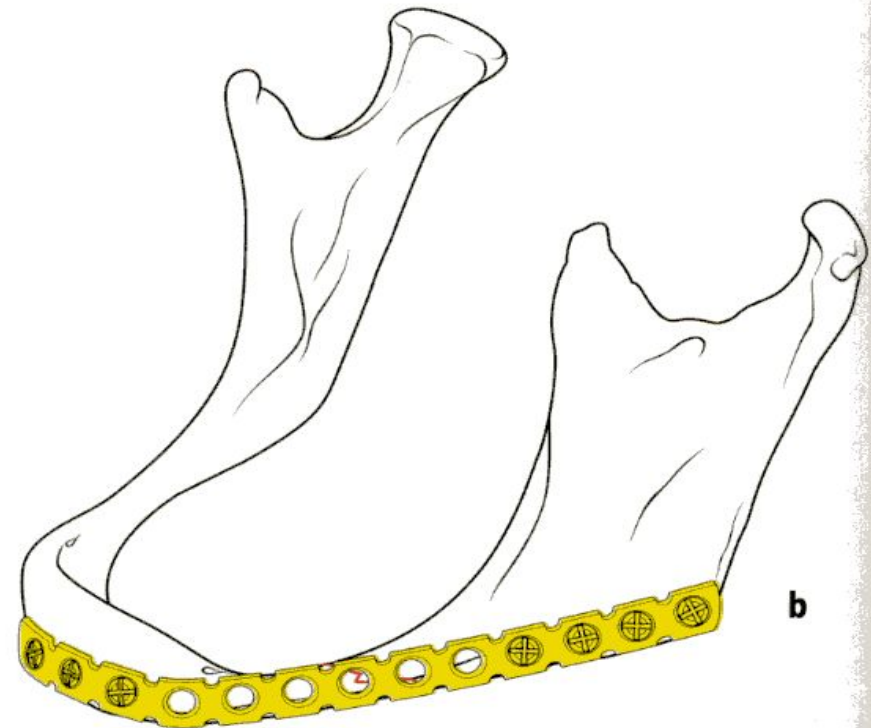


2.4 Locking Recon Plate with 2.0 MP

Special Case

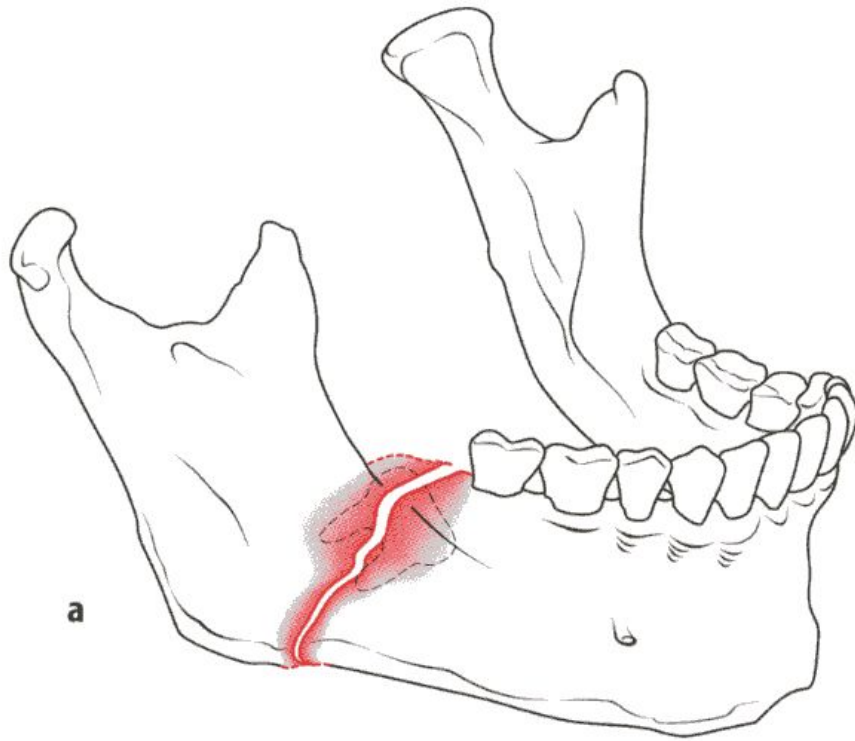


Edentulous Body Fracture

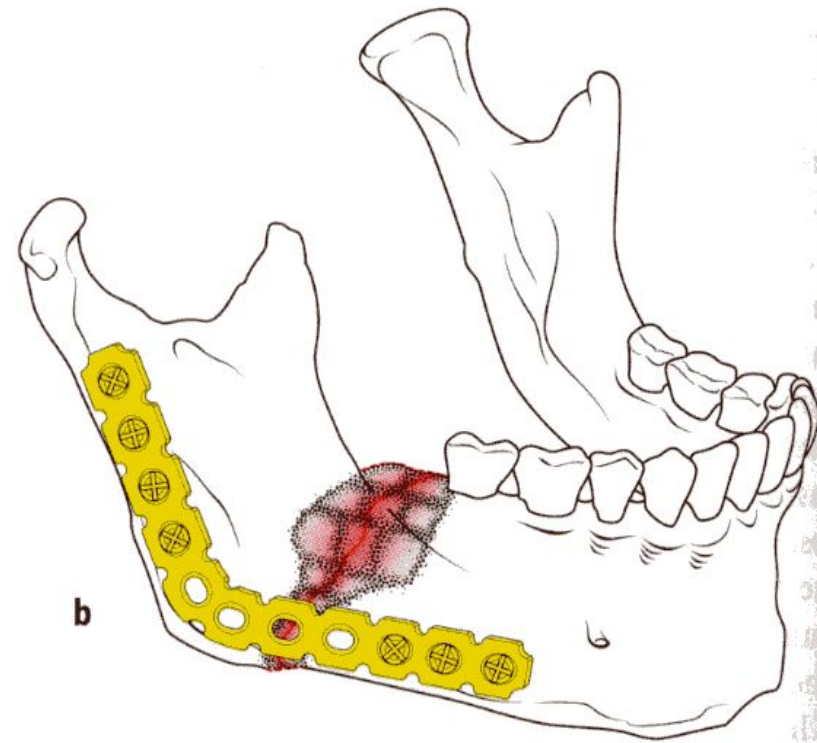


2.4 Locking Recon Plate, 4 screws

Another Special Case




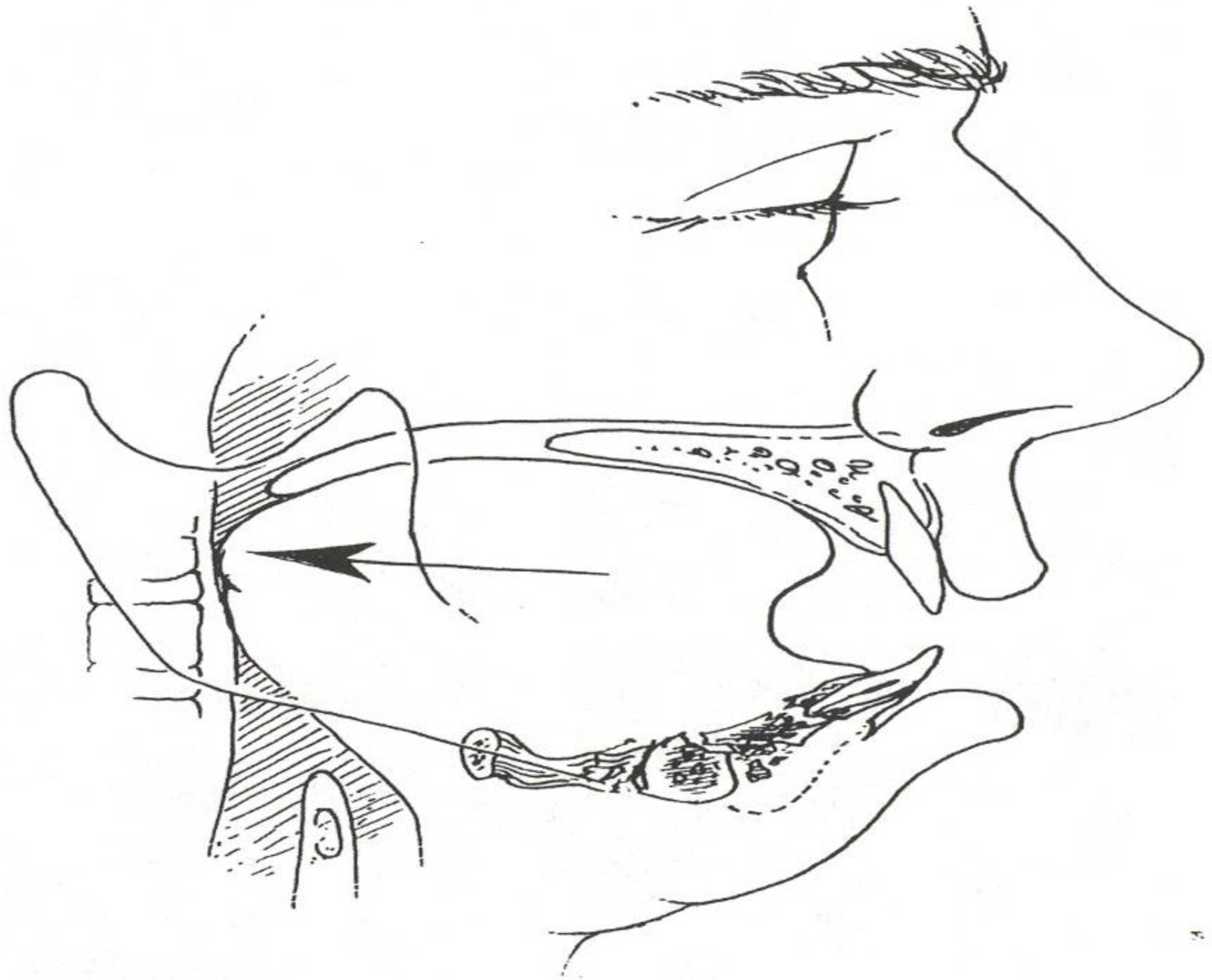
Infected Angle Fracture



2.4 Locking Recon Plate

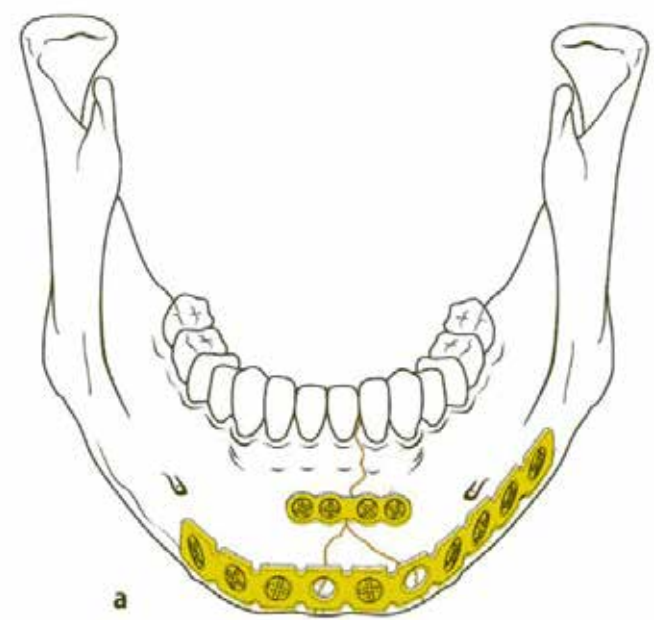
Other Special Cases

- } **Bilateral Parasymphaseal** – Geniohyoid origin lost, tongue prolapses into airway.
 - } **Bilateral subcondylar** – prone to TMD, loss of height, retrusion and increased width of mandible.
 - } **Pediatric Fractures** – remove plates or use absorbable, minimize MMF.
 - } **Loss of Bone** – from infection, severe trauma or nonunion.
- 




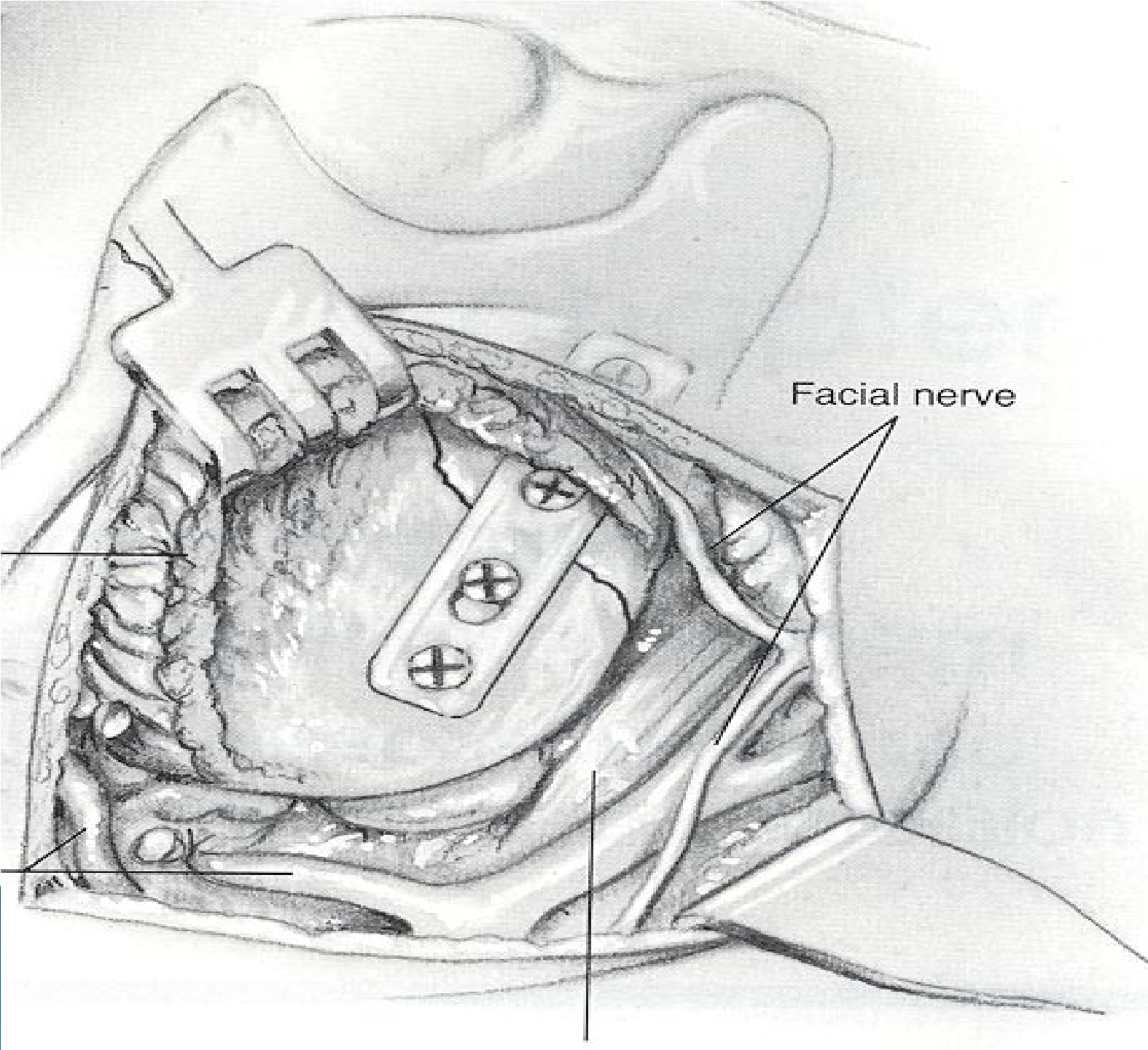
R

SUPINE

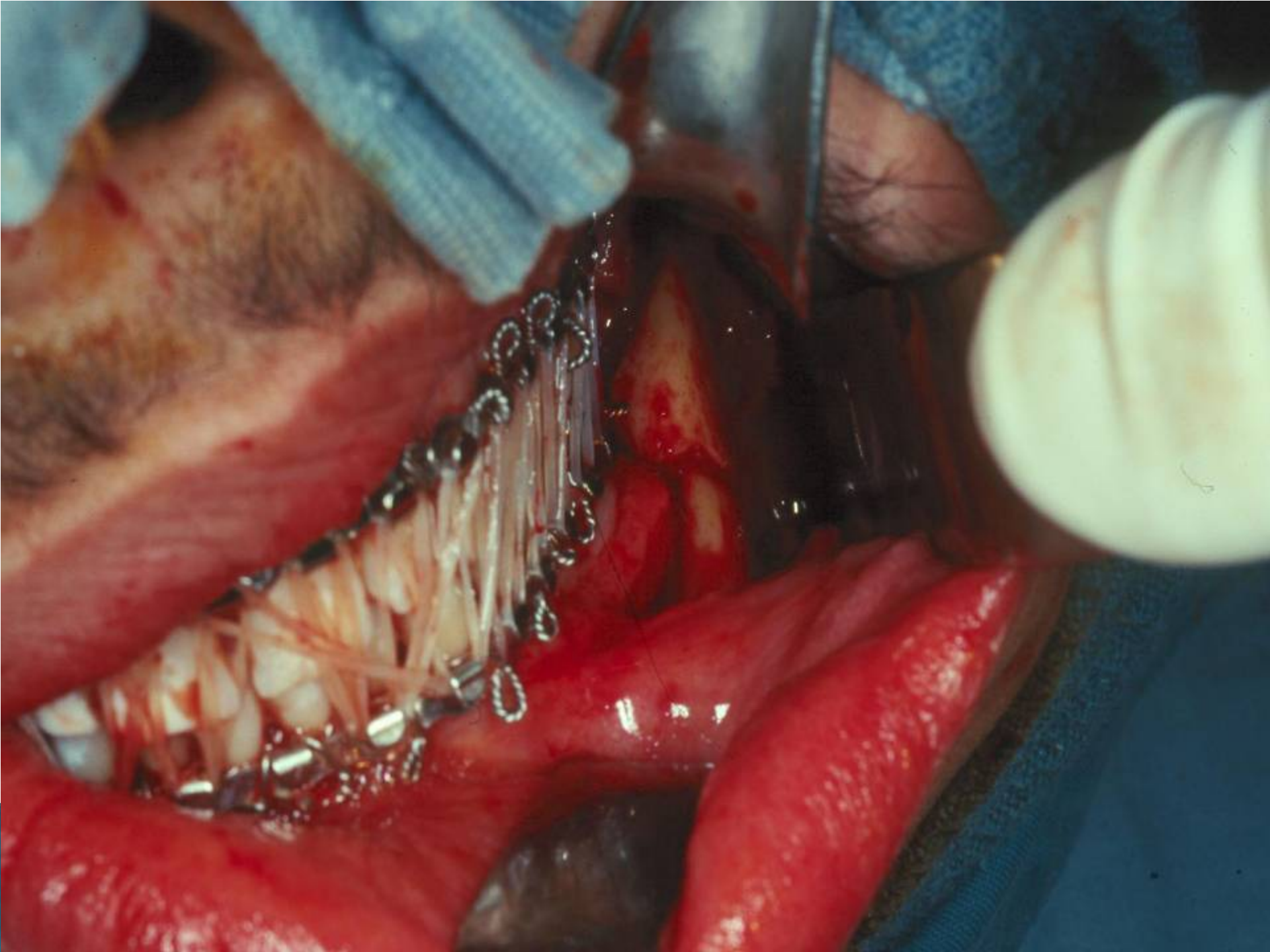


Controversies / Difficulties

- } When to perform ORIF on subcondylar
 - } Tooth in the fracture line
 - } Stops for unilateral subcondylar
 - } Missing Teeth (but not edentulous)
 - } When to go extra-oral route
 - } How long to continue abx postop (Ali?)
- 

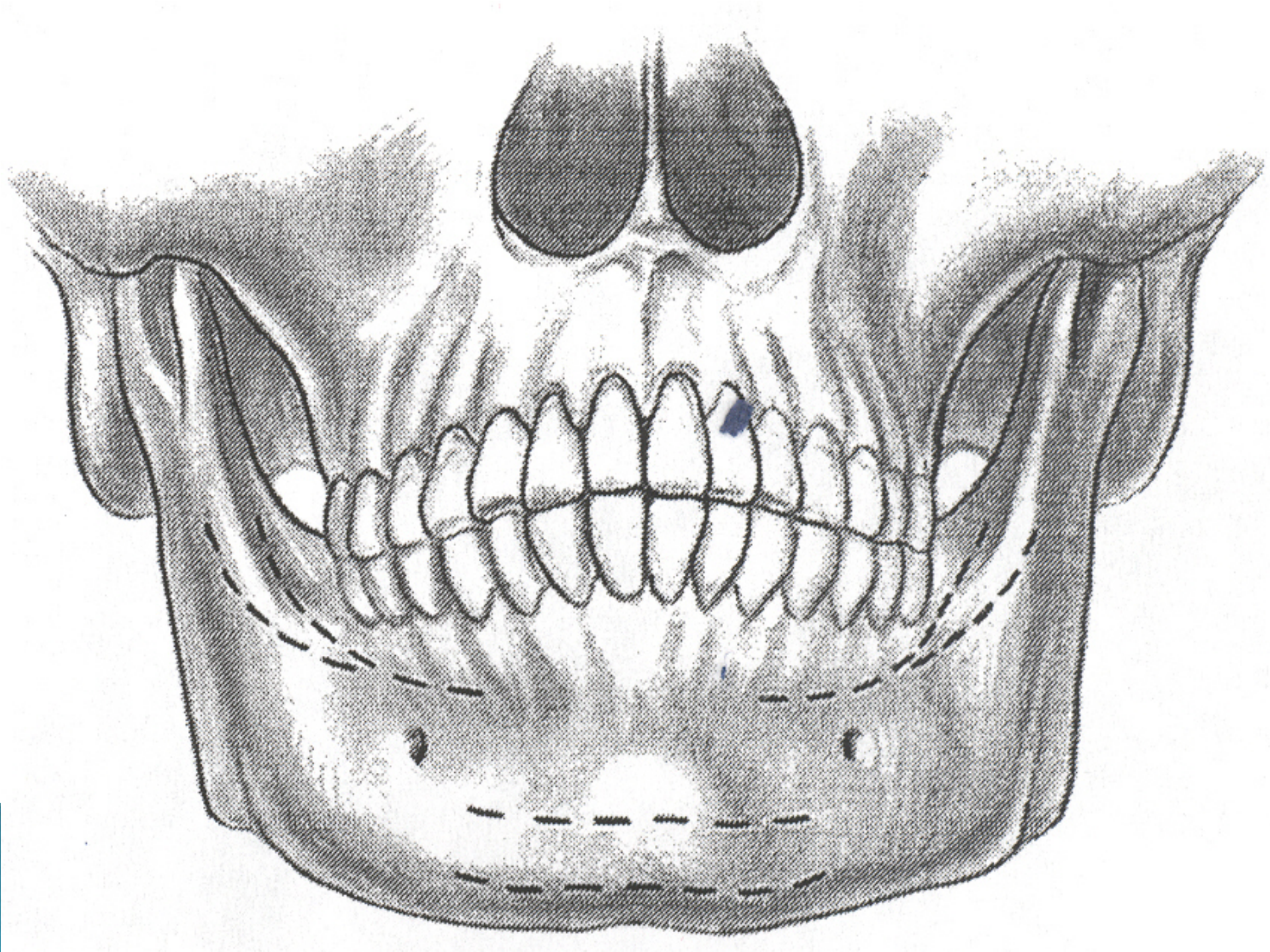


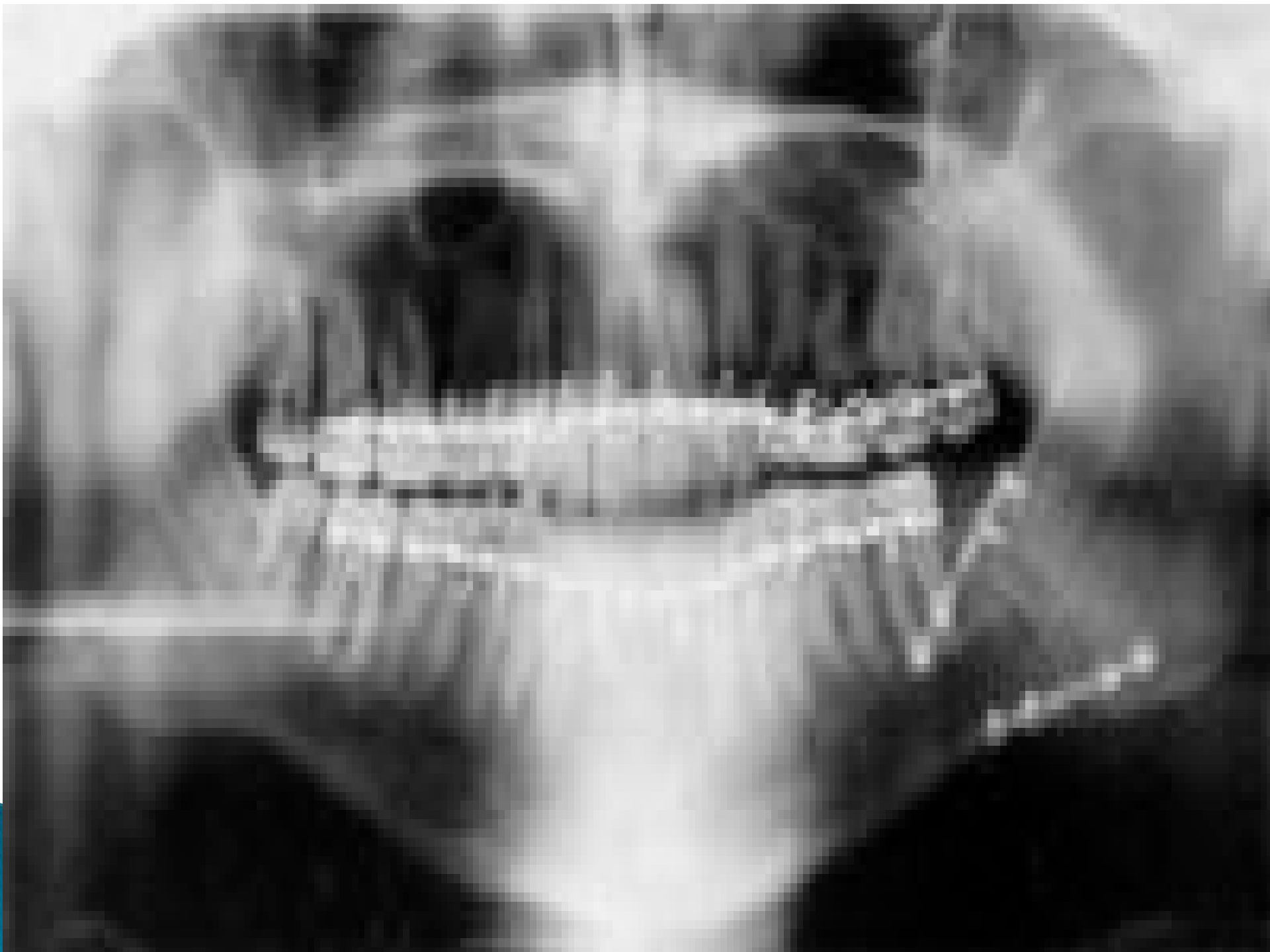
Facial nerve




Rigid Fixation

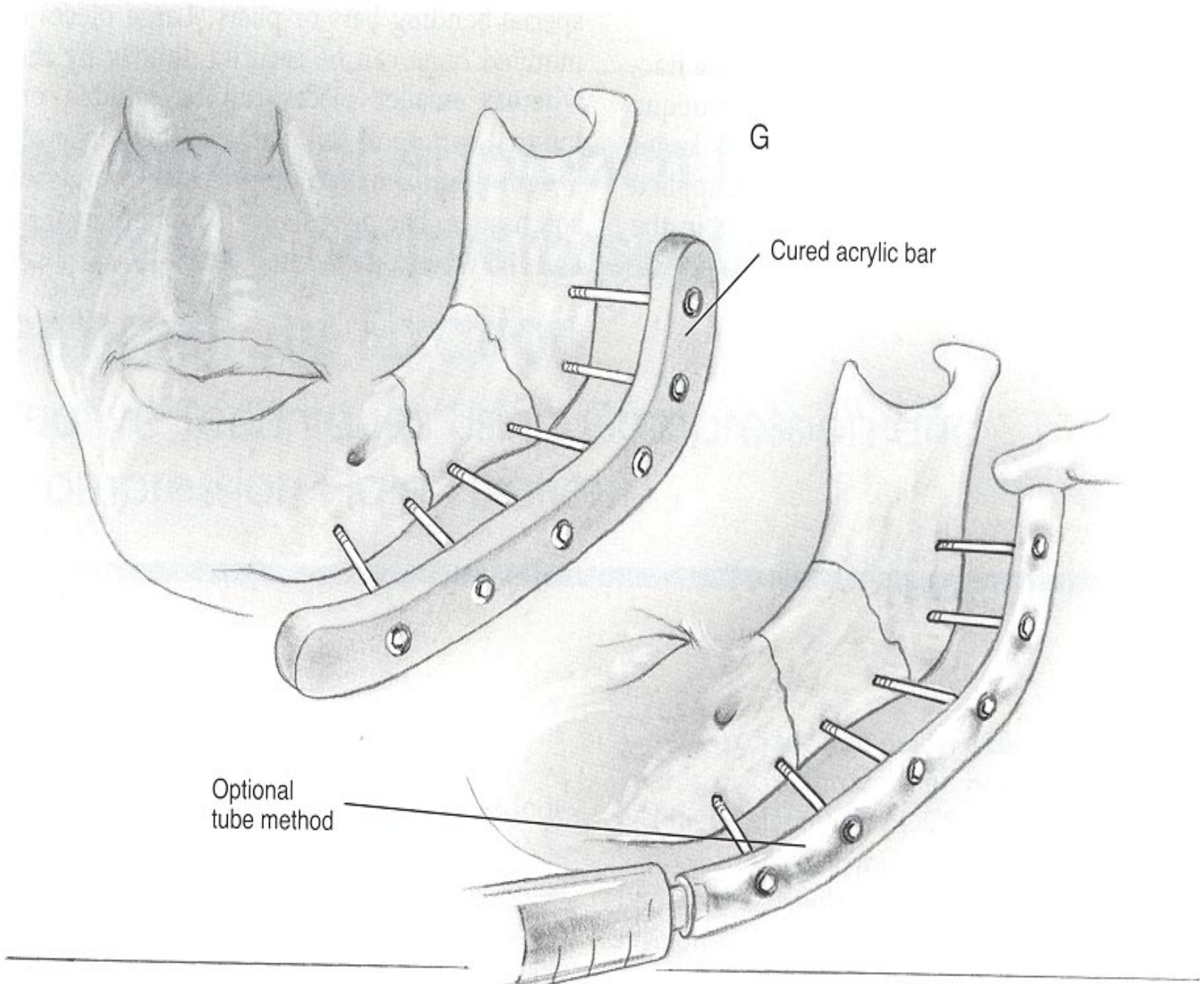
- } Schierle et al studied experimental model, then applied in patients.
 - Model suggested two plates more stable
 - Patients divided into two groups with equal complication rates, equal functional results





External Fixation

- } Alternative form of rigid fixation
 - } Grossly comminuted fractures, contaminated fractures, non-union
 - } Often used when all else fails
- 



G

Cured acrylic bar

Optional tube method

Edentulous Fractures

- } Chalmers and Lyons 1976 – Recommended closed reduction to preserve periosteal blood supply
- } Chalmers and Lyons 1995
 - 167 fractures in edentulous mandibles
 - ORIF 82%
 - 15% complications
 - 12% Fibrous union

Edentulous Fractures

} ORIF

- Inferior alveolar canal more superior in location
- Vertical height 20mm compatible with standard plating systems
- Vertical height 10mm or less, likely need rib graft
- Plate removal after fracture healing if interferes with denture placement

Teeth in line of fracture

- } Keep teeth if
 - Previously healthy
 - Peridontal plexus intact
 - No major structural injury
 - Tooth does not interfere with reduction of fracture

Teeth in line of fracture

} Neal and associates

- 32% incidence of morbidity with teeth in line of fracture
- No statistical difference if tooth was removed

Teeth in line of fracture

} Amaratunga

- 16% complication rate in retained teeth
- 13% in removed teeth
- Retain teeth for 4-6 weeks if important for MMF

Condylar and Subcondylar

- } Lindhal and Hollender
 - Closed reduction in children, teens, adults
 - Intracapsular fractures
 - Higher incidence of postoperative sequelae in adults
 - Children and Teens with less sequelae, more remodeling

Condylar and Subcondylar

} Norholt

- Children 5-20 with intracapsular condylar fractures
- Increased dysfunction with increasing age

Condylar and Subcondylar

- } Closed reduction with arch bars MMF 2-3 weeks mainstay for youths
 - Ankylosis of TMJ and facial asymmetry most feared complication
 - Less effective for
 - increasing age
 - decreased ramus height
 - more displaced

Condylar and Subcondylar

- } ORIF, Absolute indications
 - Displacement into middle cranial fossa
 - Inability to achieve occlusion with closed reduction
 - Foreign body in joint space

Condylar and Subcondylar

} Relative indications

- Bilateral condylar fractures to preserve vertical height
- Associated injuries that dictate earlier function
 - Soft tissue swelling causing airway compromise with MMF
 - Intracapsular fracture on opposite side where early mobilization important

Immediate Mobilization

- } Kaplan et al.
 - Studied ORIF in two groups, one with MMF for 2 weeks, one with immediate mobilization
 - No statistical difference in rates of complications, postoperative pain, dental health, nutritional status

Bioabsorbable Plates

- } Plating can relieve stress, no bone remodeling
- } Bulky plates, thermal sensitivity, palpable
- } Absorbable plates expensive
- } Better in children?
- } Use of poly-L-lactide in 69 fractures by Kim et al
 - 12% complication
 - 8% infection
 - No malunion

SUMMARY

- } occlusion is the key
 - } simple dental anatomy is within the scope of Plastic Surgery
 - } basic principles most important
- 