

Mandible Fractures

History

- Hippocrates – Described monomaxillary dental fixation and binding
- Sulicetti – 1492 Described “tie teeth of jaw to teeth of uninjured jaw”

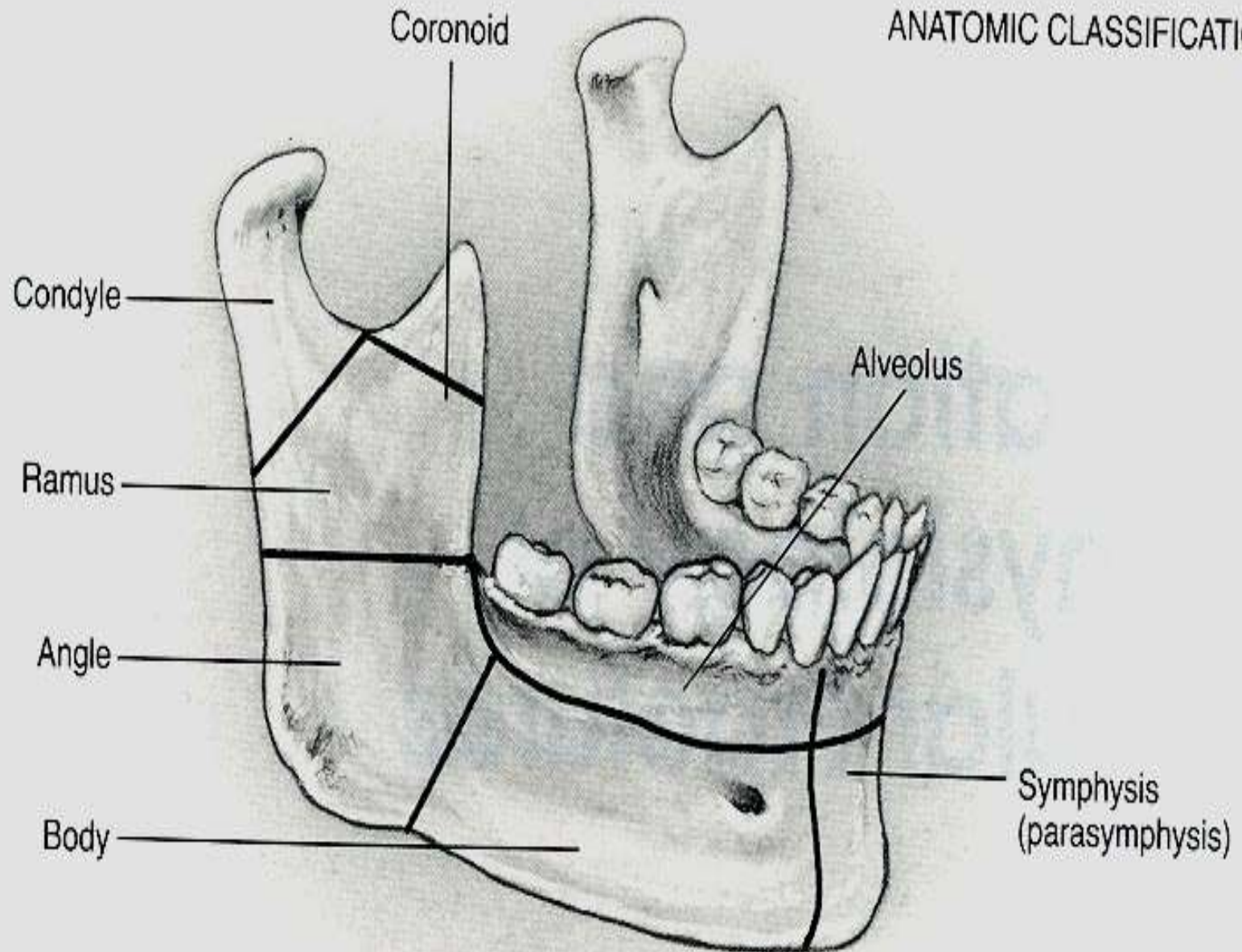
History

- 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

MANDIBULAR FRACTURES

A

ANATOMIC CLASSIFICATION



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

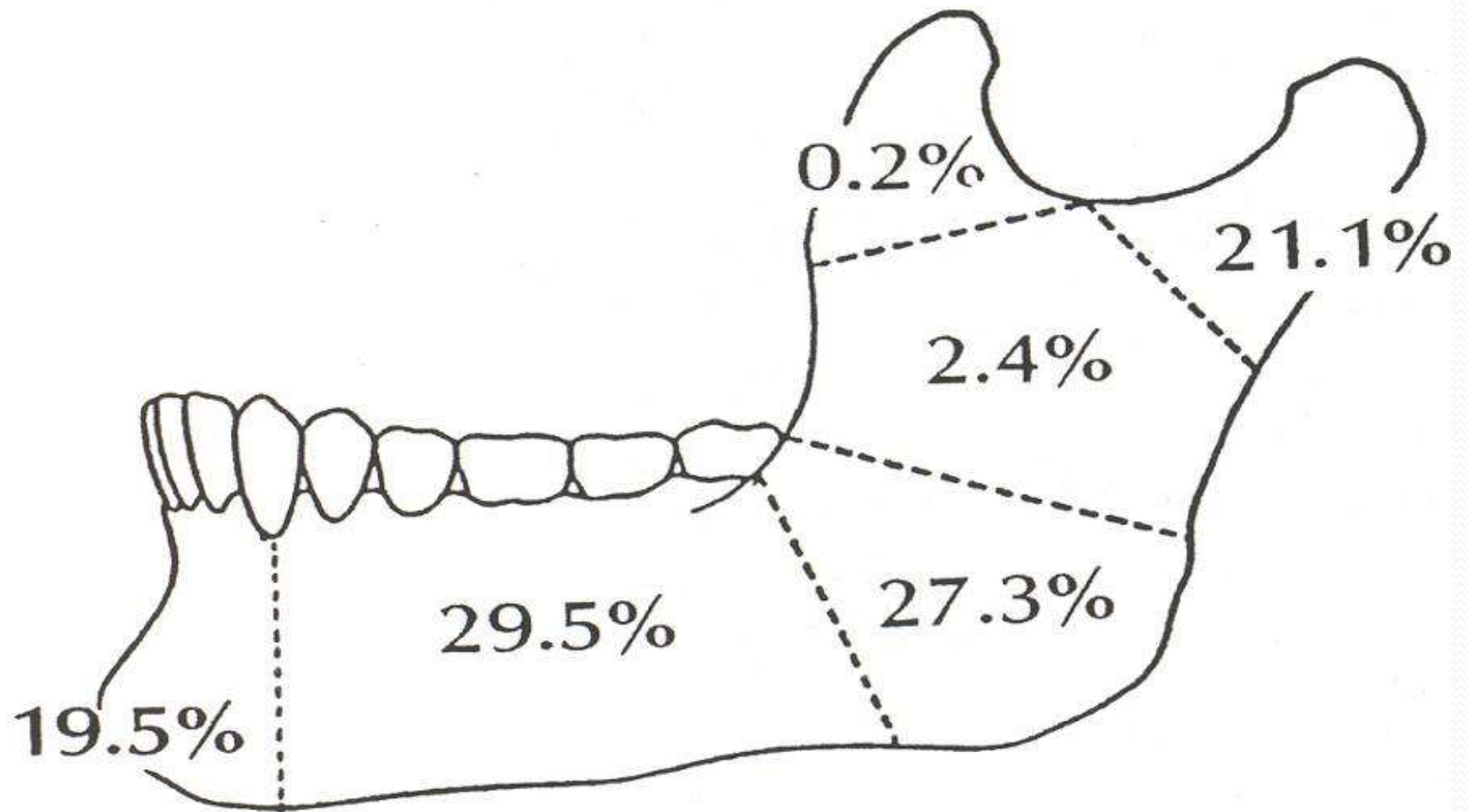
Epidemiology

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

Epidemiology

- Boole et al (laryngoscope) 5196 fractures
 - 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%

Haug et al



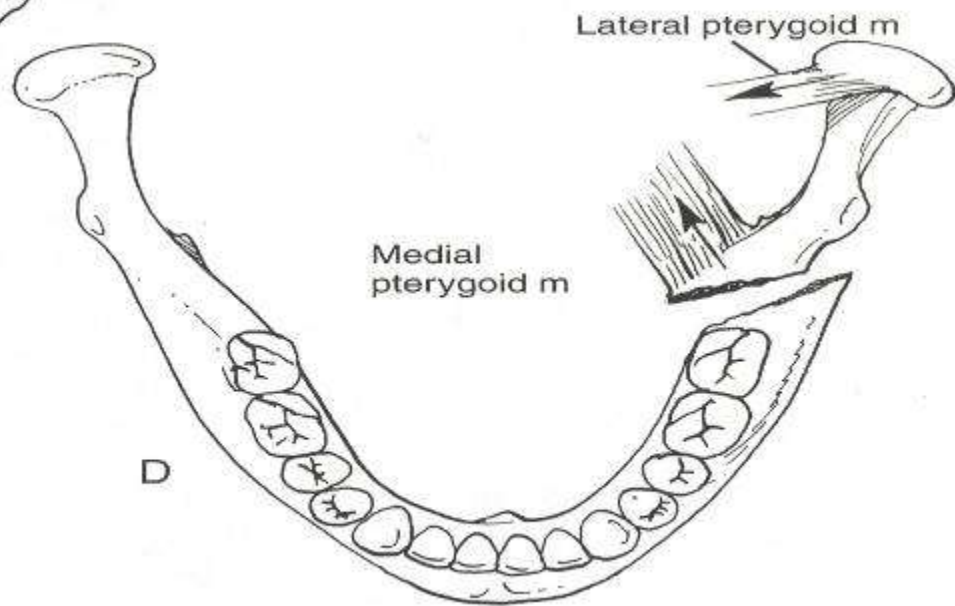
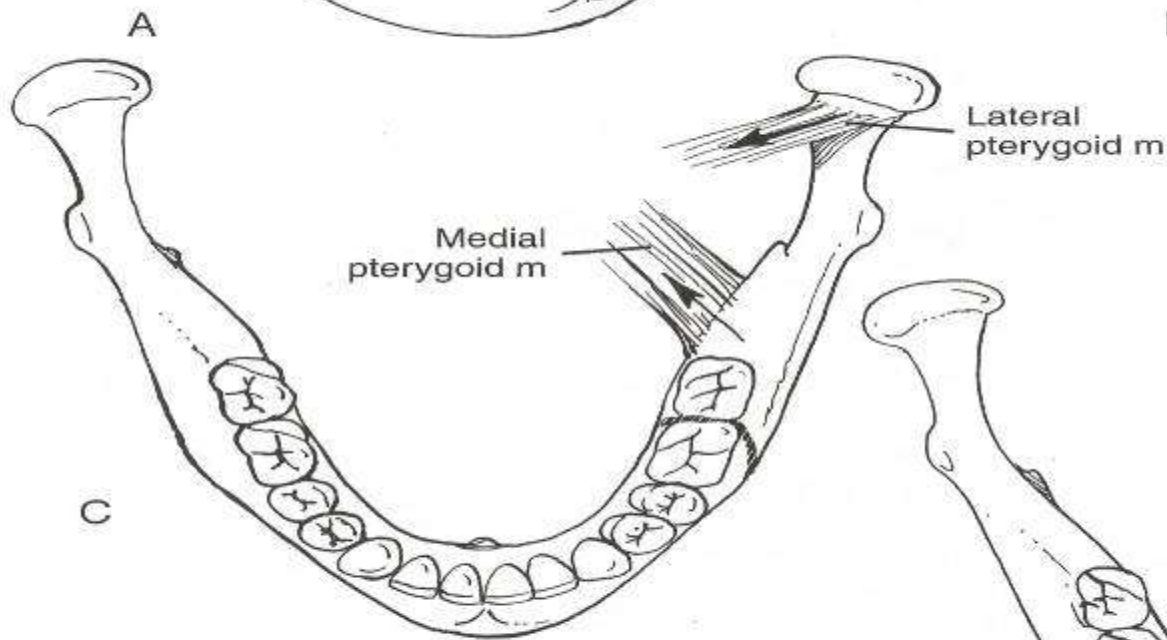
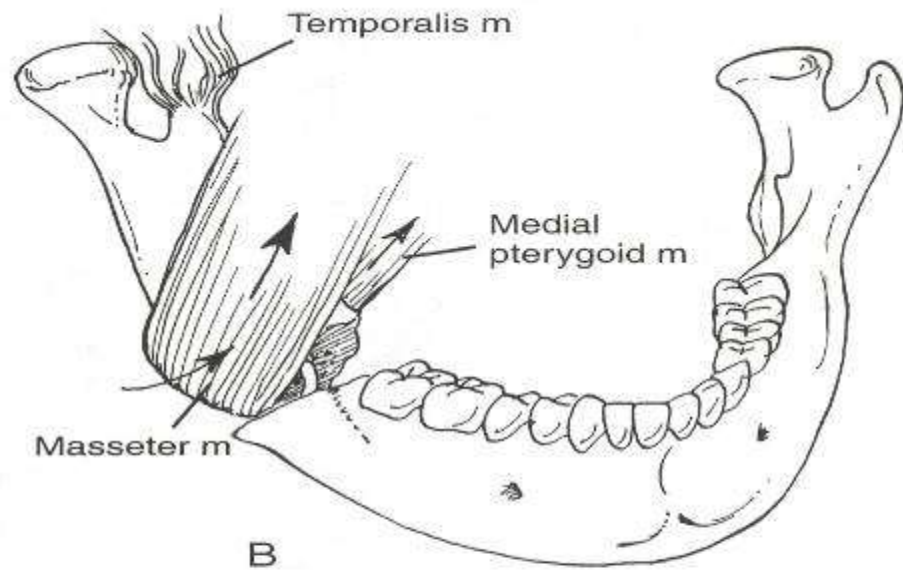
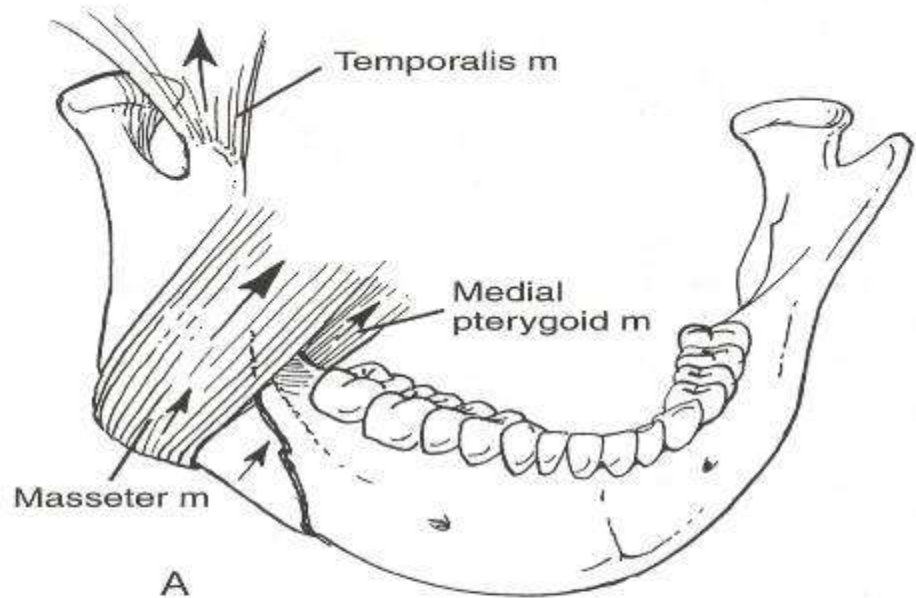
Fischer et al

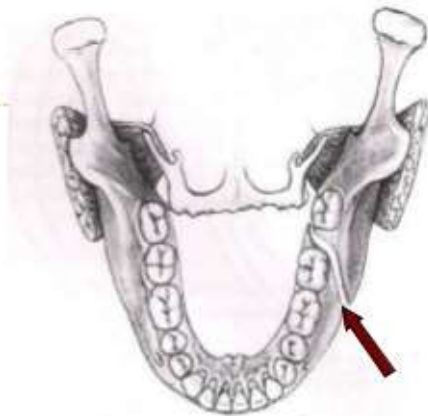
Region	Cases	Percentage
Skull	64	43.2
Face	78	52.7
Neck*	22	14.9
Chest	40	27
Abdomen	28	18.9
Upper extremity	41	27.7
Lower extremity	75	50.7

* Neck injury = cervical spinal injury.

Favorable vs. Unfavorable

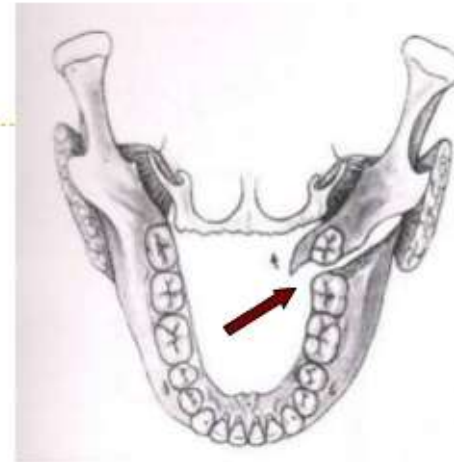
- Masseter, Medial and Lateral Pterygoid, and Temporalis tend to draw fractures medial and superior
- Almost all fractures of angle unfavorable





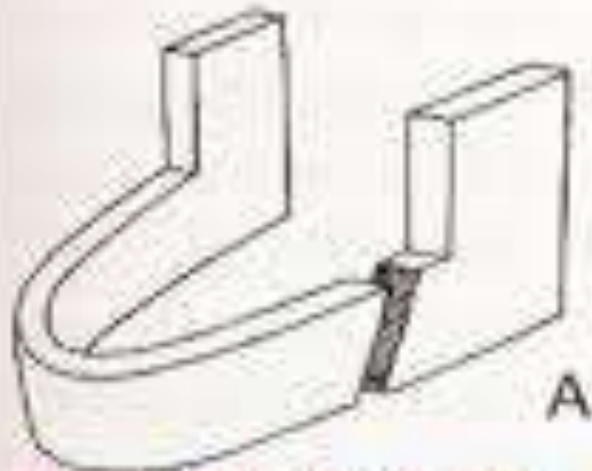
VERTICALLY FAVORABLE

FRACTURE LINE RUNS FROM THE
OUTER BUCCAL PLATE OBLIQUELY
BACKWARDS AND LINGUALLY , MEDIAL
MOVEMENT RESTRICTED



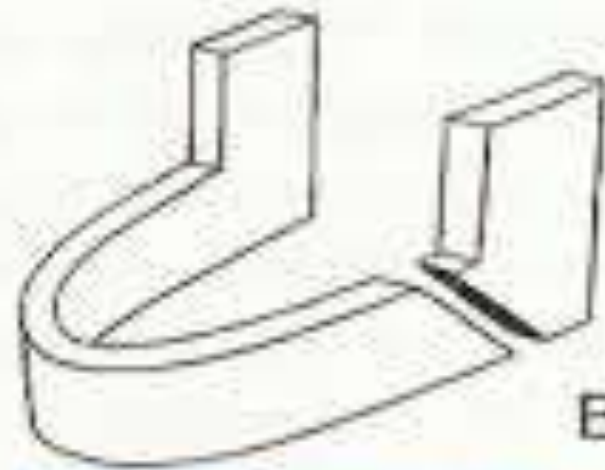
VERTICALLY UNFAVORABLE

FRACTURE LINE RUNS FROM THE
INNER LINGUAL PLATE OBLIQUELY
BACKWARDS AND BUCCALLY , MEDIAL
MOVEMENT UNRESTRICTED



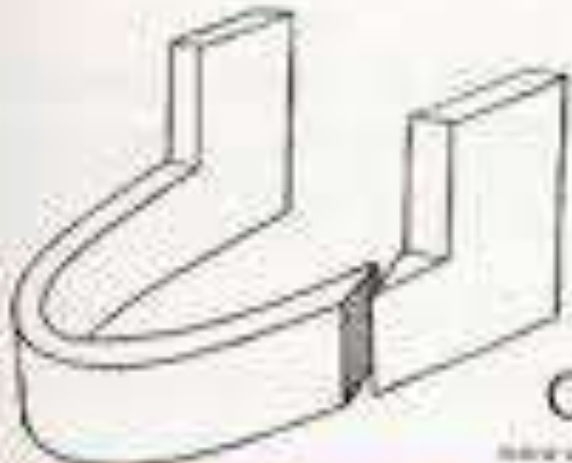
A

Horizontally Favourable



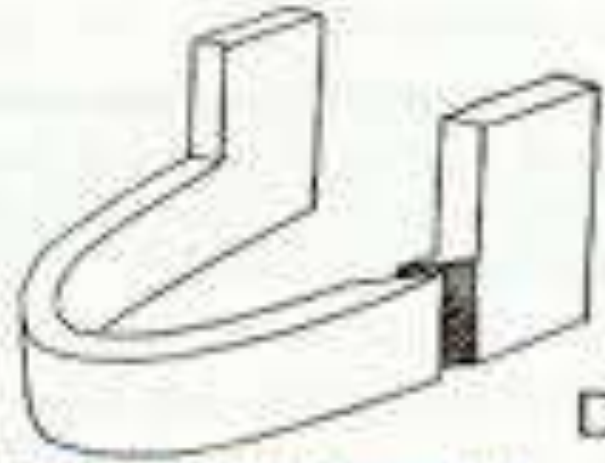
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Horizontally Unfavourable



C

Vertically Favourable



D

Vertically Unfavourable

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Kruger's classification

Classification of mandibular fractures

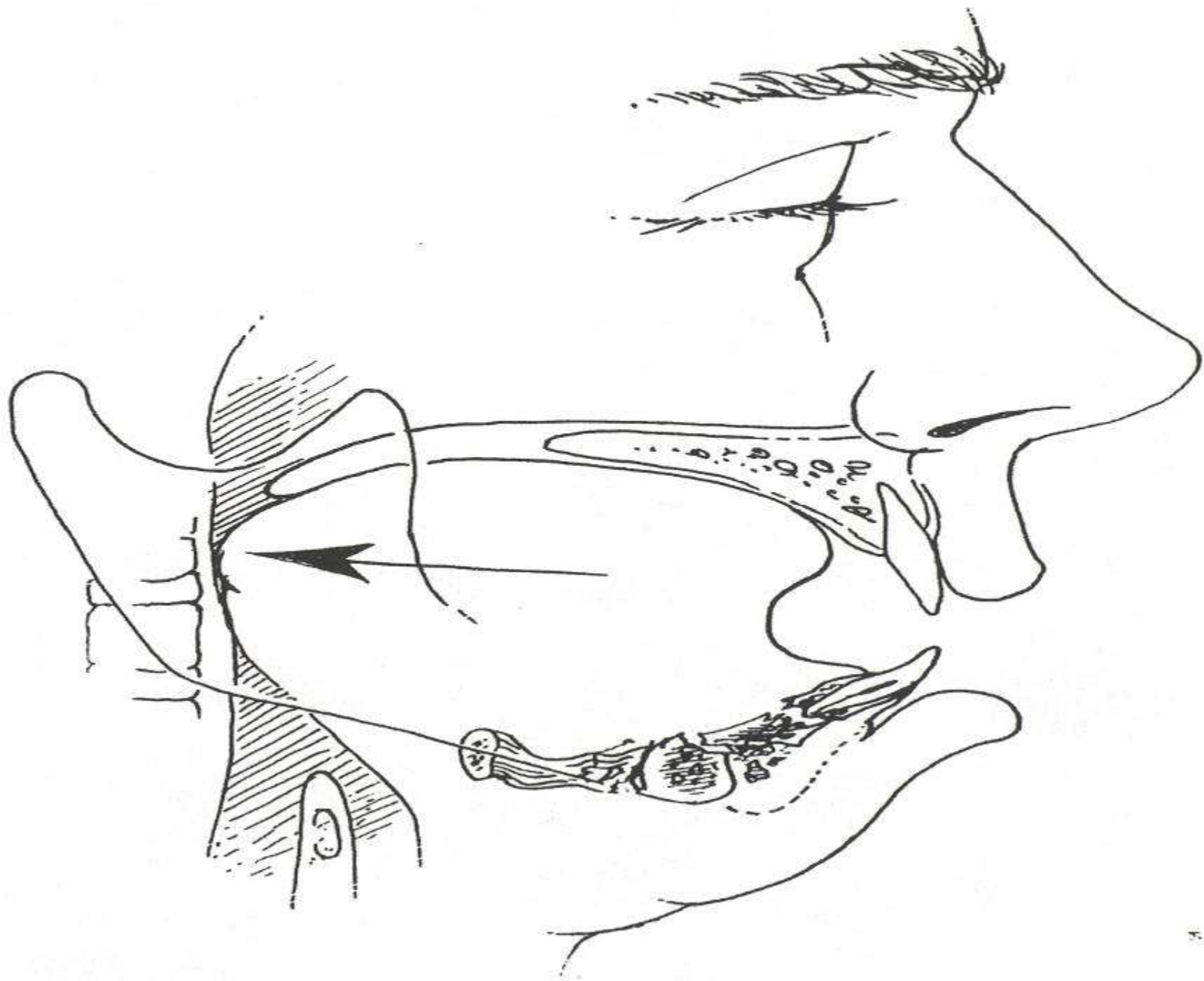
- Simple or closed
- Compound or open
- Comminuted
- Greenstick
- Pathologic
- Multiple
- Impacted
- Atrophic
- Indirect
- Complicated or complex

Greenstick fracture common in children



Evaluation

- Stabilization via ATLS 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)



Evaluation

- Previous occlusion (Class I-III)
- Psychiatric, nutritional, gastrointestinal, seizure disorders
- Previous facial trauma
- Other injuries (c-spine, intra-abdominal, likely prolonged intubation)

Physical Exam

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

COLEMAN'S SIGN



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

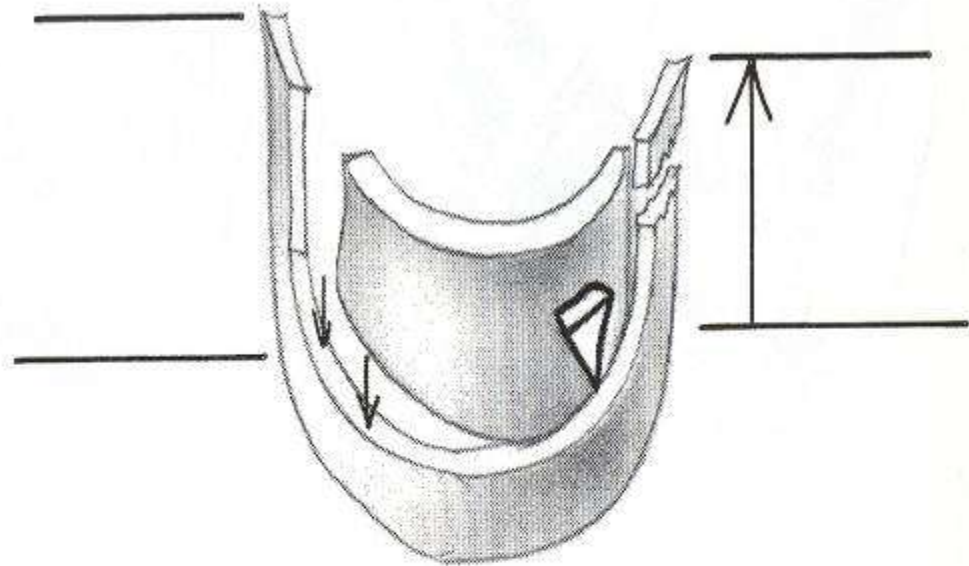
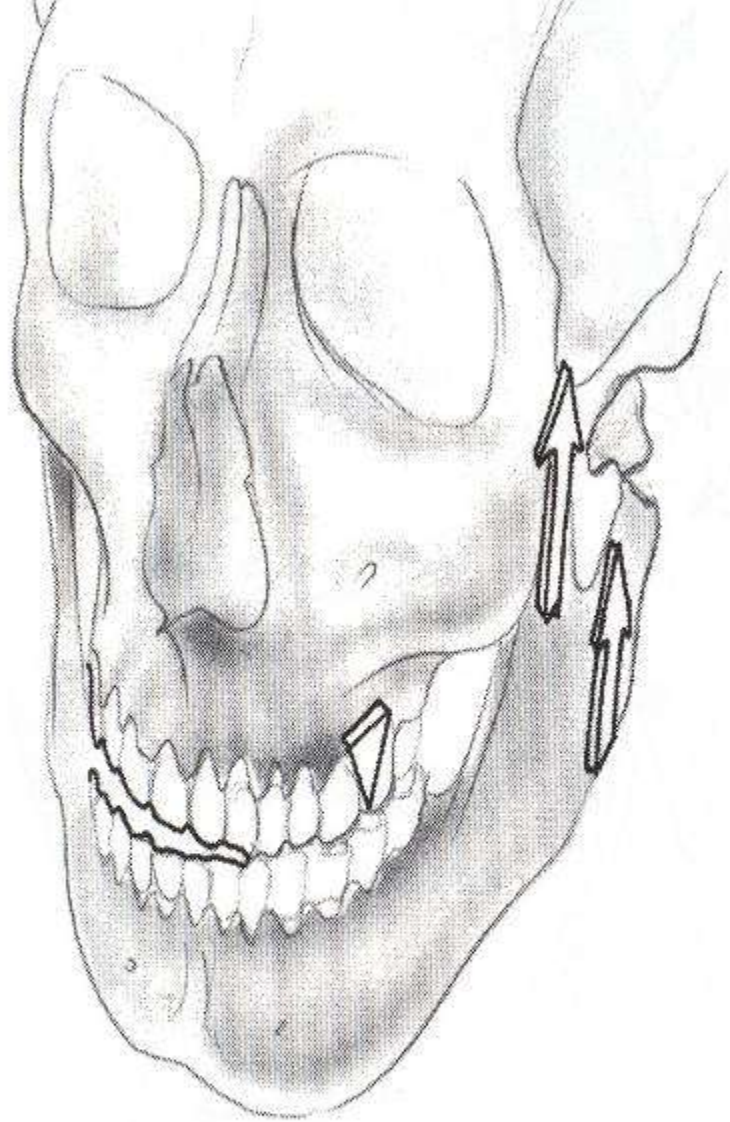


FIGURE 65.5. A fractured condyle usually is distracted anteromedially by the lateral pterygoid muscle. This produces a shortened functional height of the ramus as the masseter, medial pterygoid, and temporalis muscles draw the ramus closer to the skull base. The ipsilateral molar teeth act as a fulcrum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

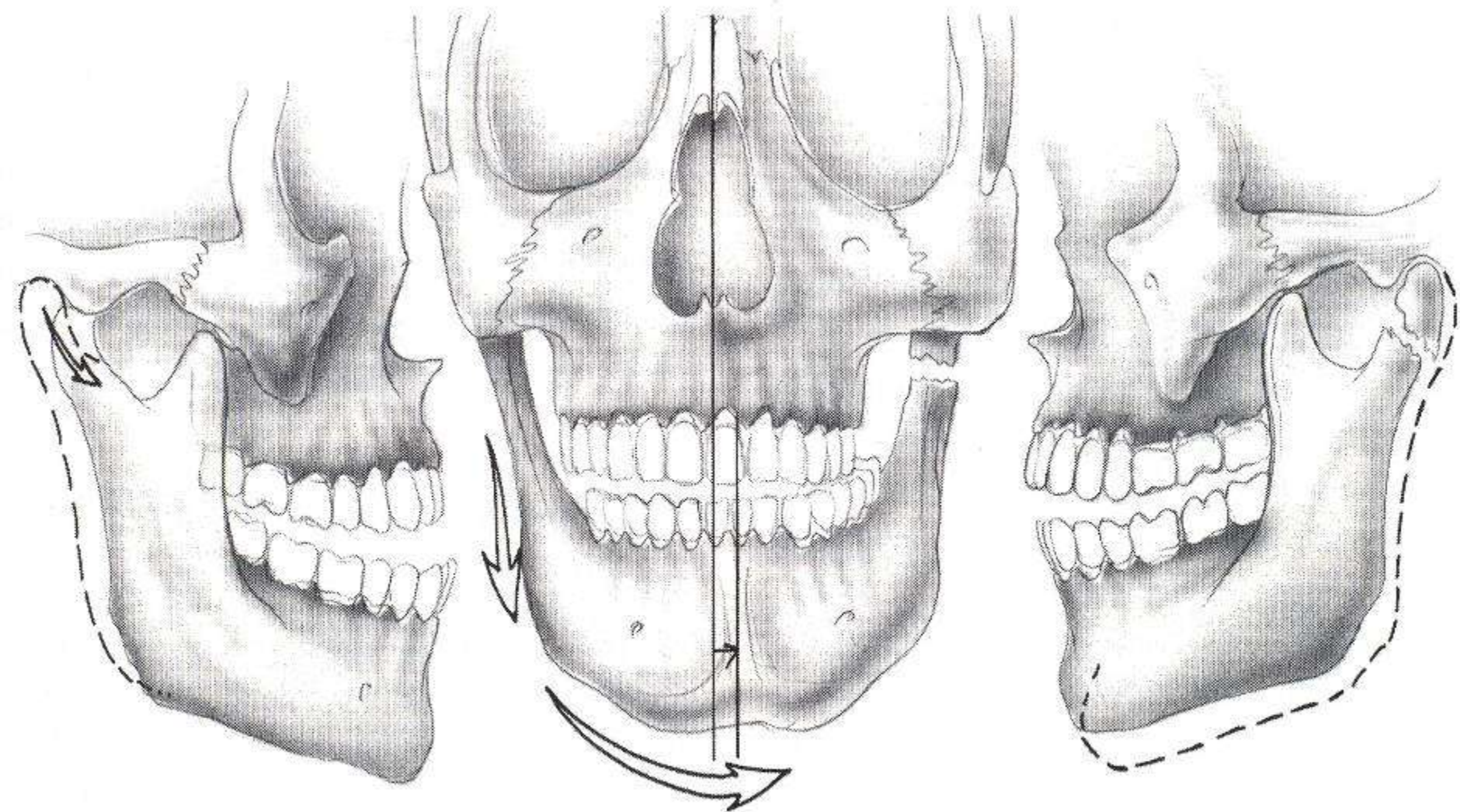


FIGURE 65.4. A fractured condyle does not translate down the articular eminence on jaw opening. The unopposed translational movement of the opposite condyle deviates the chin toward the side of the fractured condyle.

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

Physiology

- Primary Healing
 - In rigid fixation techniques
 - Lag screws, compression plates, Recon plate, external fixation, Wire fixation, Miniplate fixation
 - No callus formation
 - Question of bone resorption

Physiology

- Secondary bone healing
 - Callus formation
 - Remodeling and strengthening
 - MMF, Wire fixation, Miniplate fixation

Closed Reduction

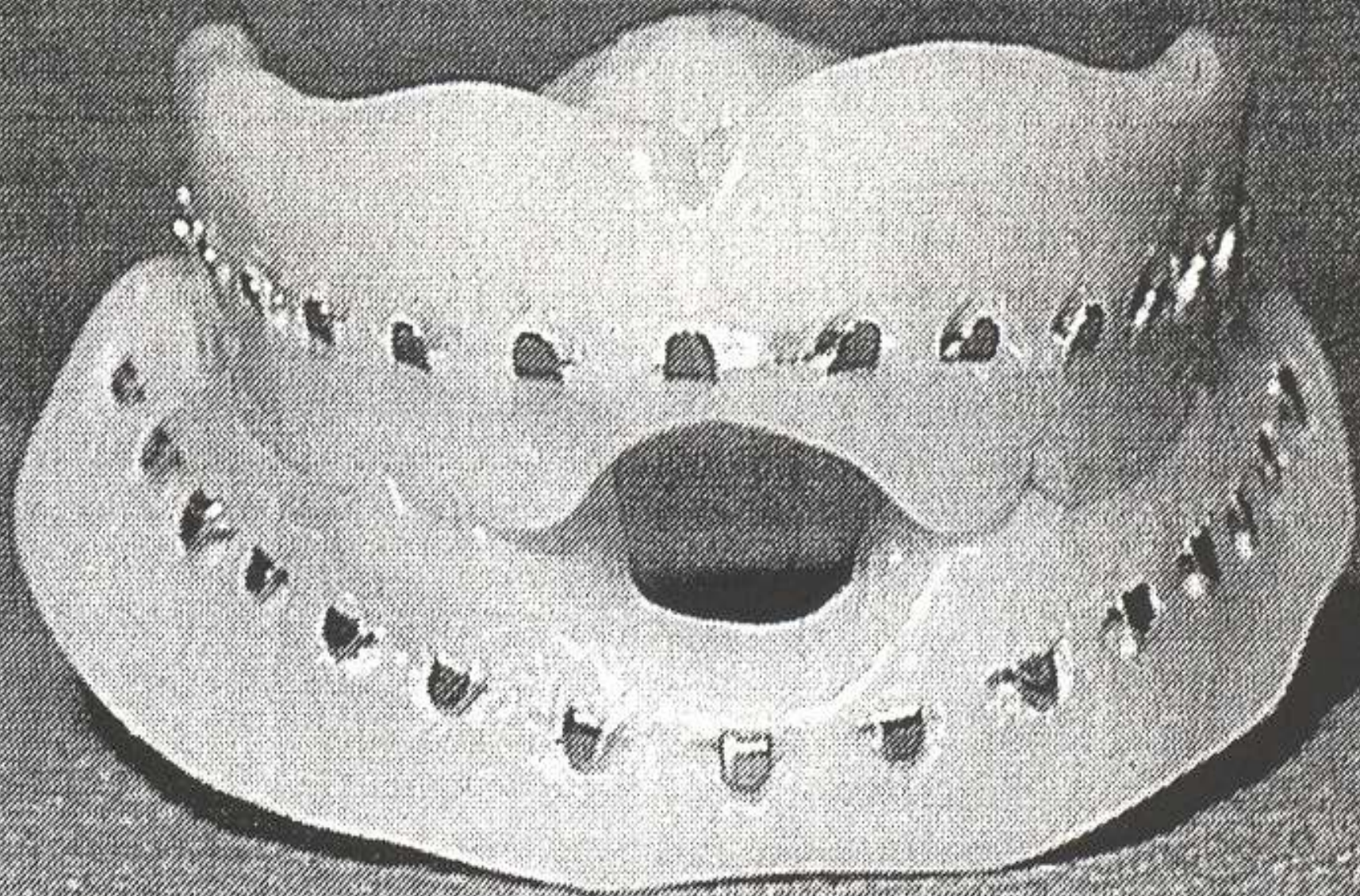
- Favorable, non-displaced fractures
- Grossly comminuted fractures when adequate stabilization unlikely
- Severely atrophic edentulous mandible
- Children with developing dentition
- Coronoid fracture

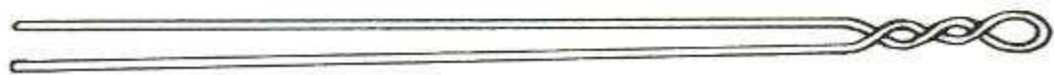
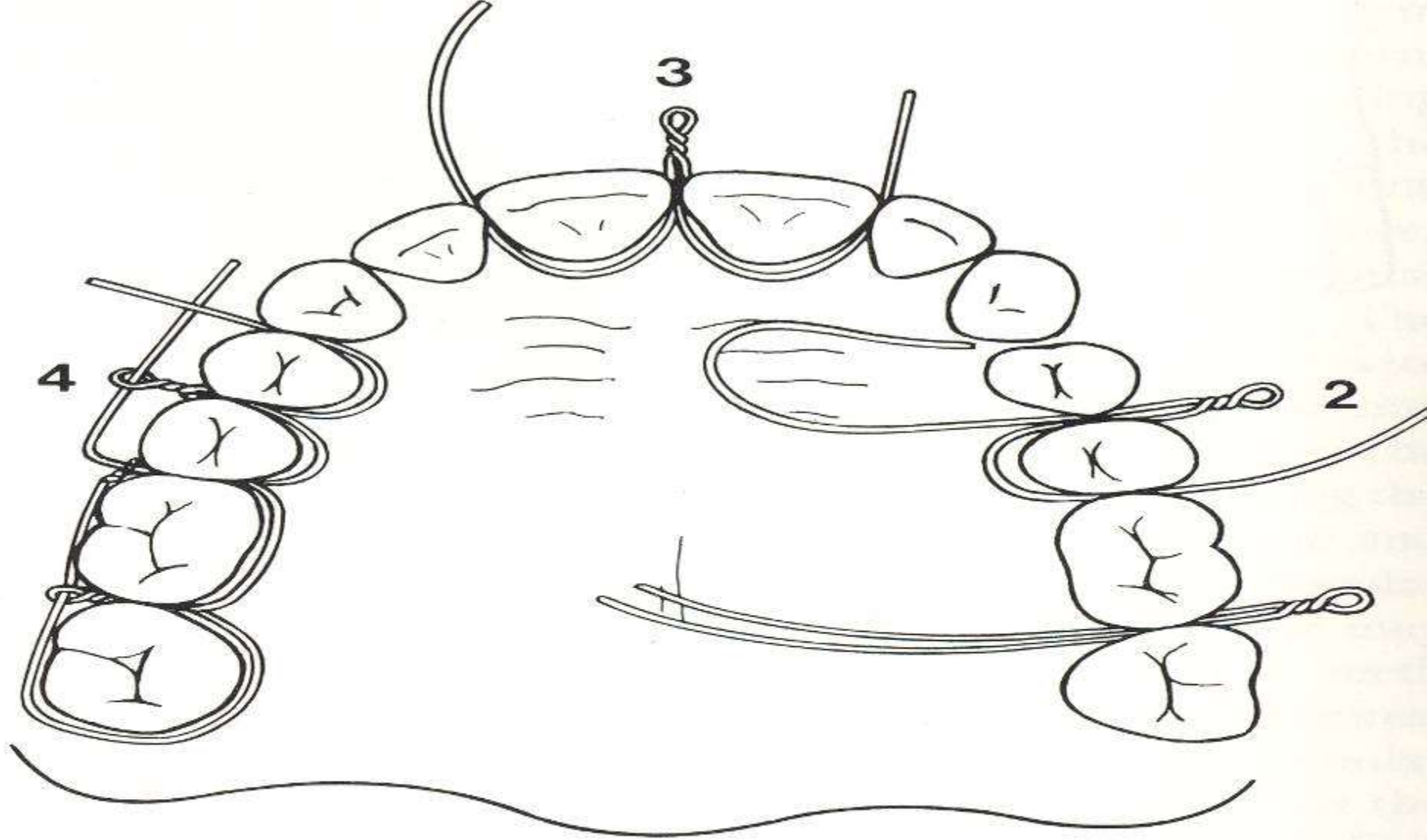
Closed Reduction

- 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

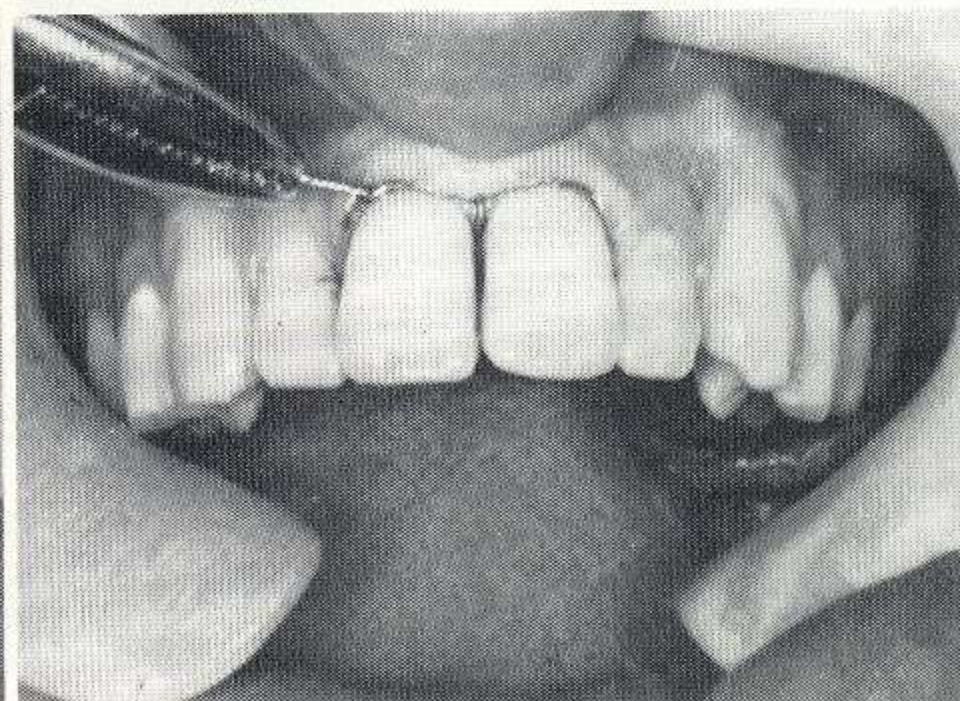
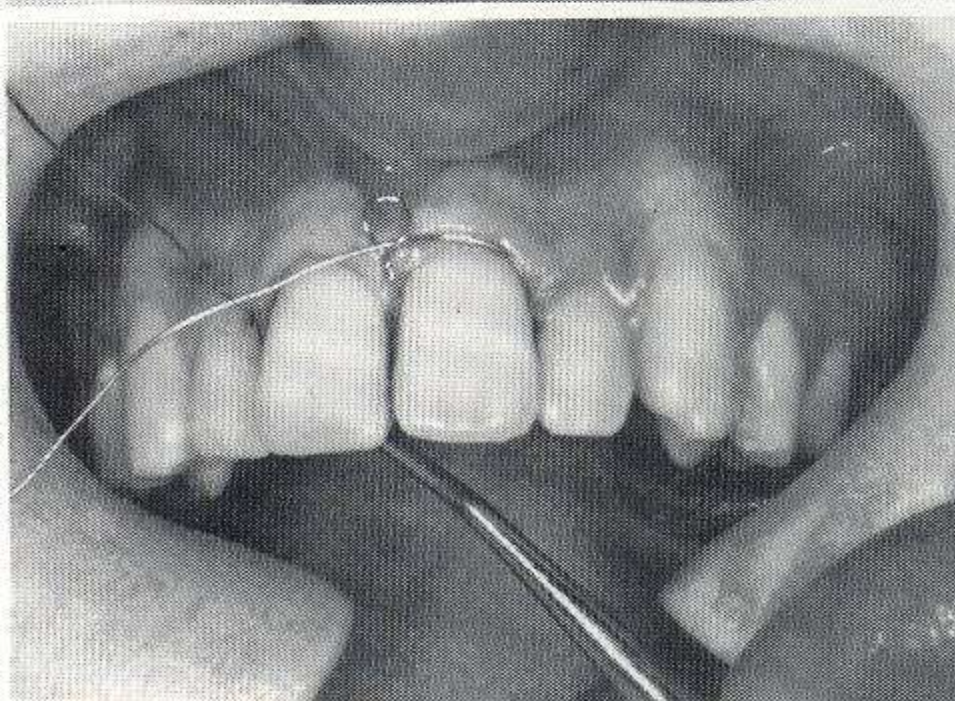
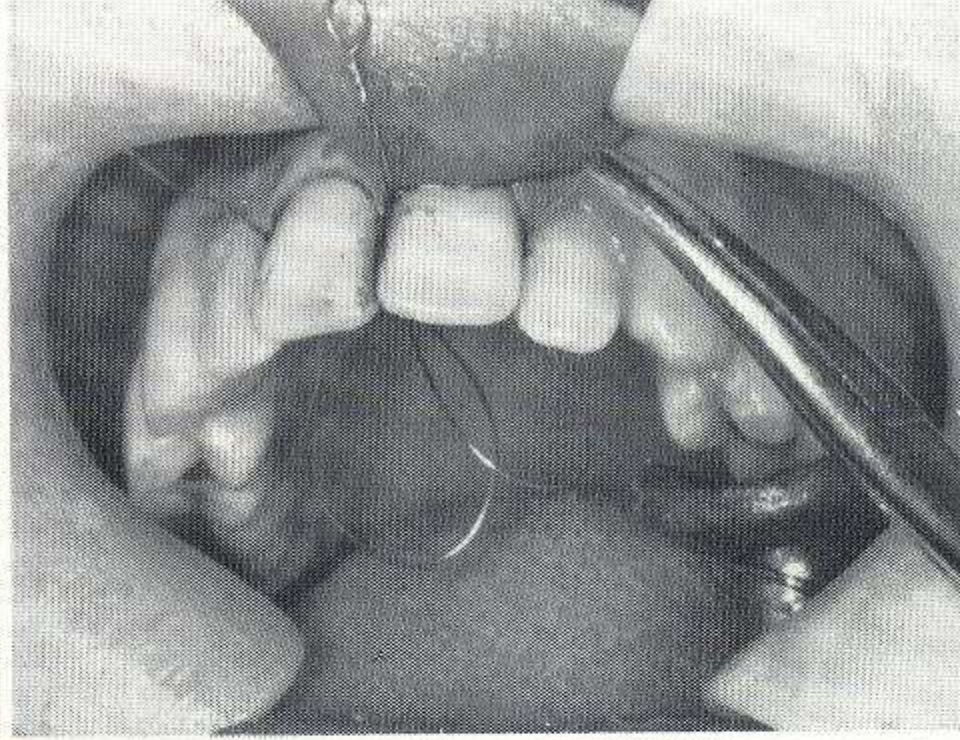
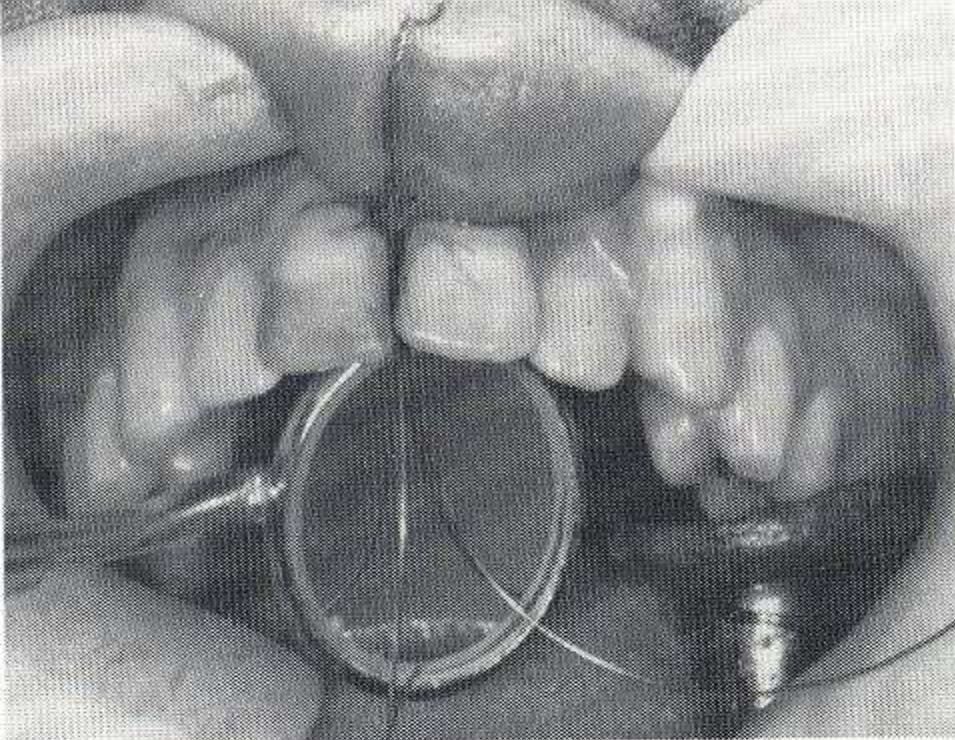
Closed Reduction

- 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





Eyelet wire



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)

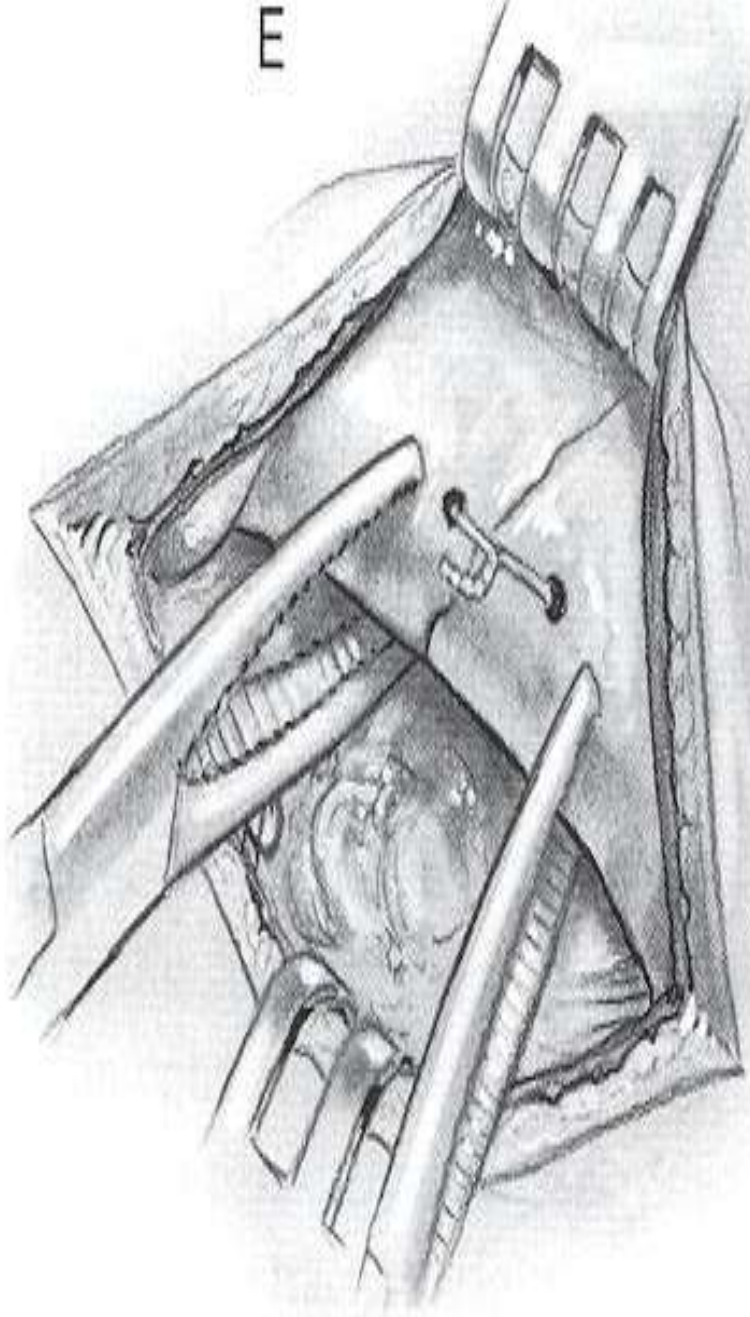
Open Reduction

- 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

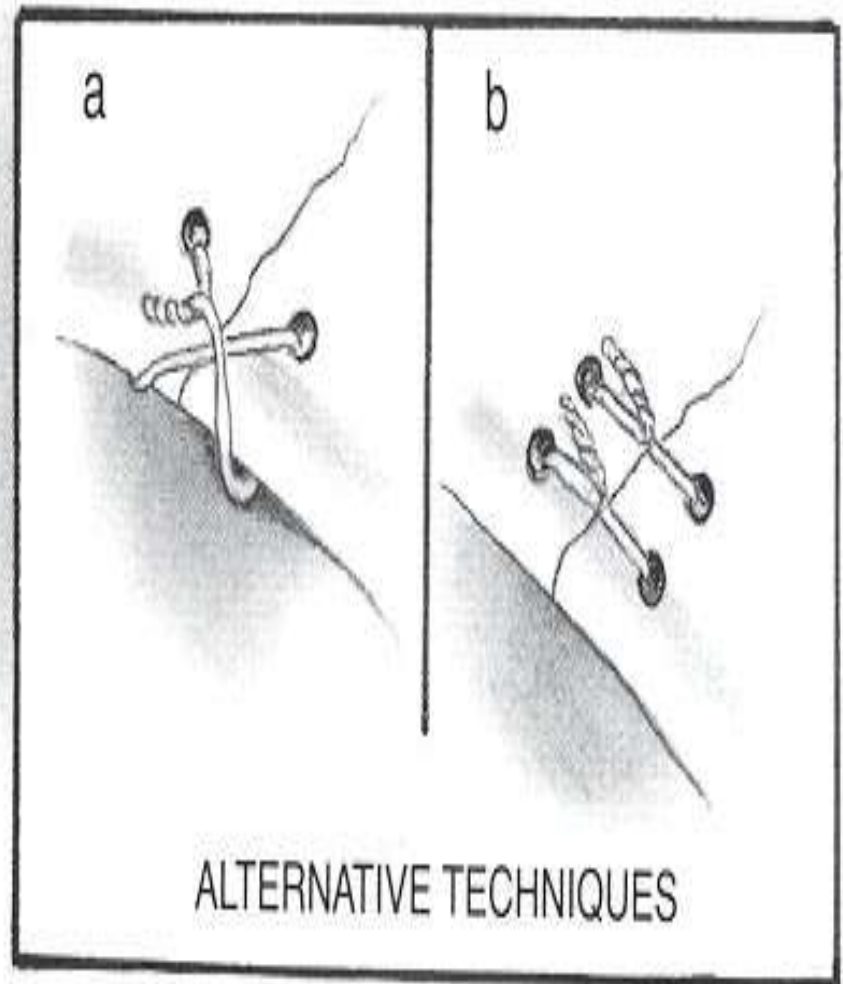
Open Reduction

- 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

Fixation type

Rigid fixation

DCP

EDCP

LAG SCREWS

RECON PLATES

THORP

Semi rigid fixation

MINIPLATES

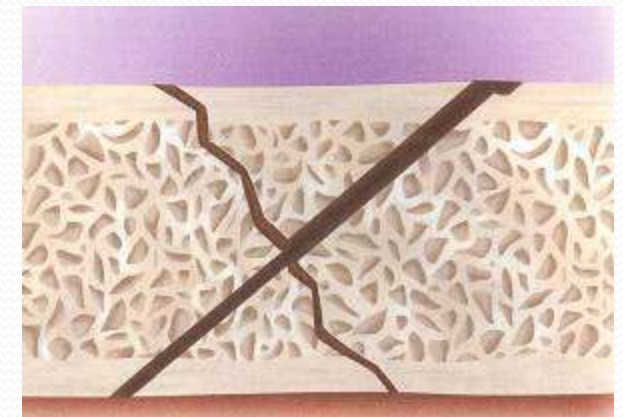
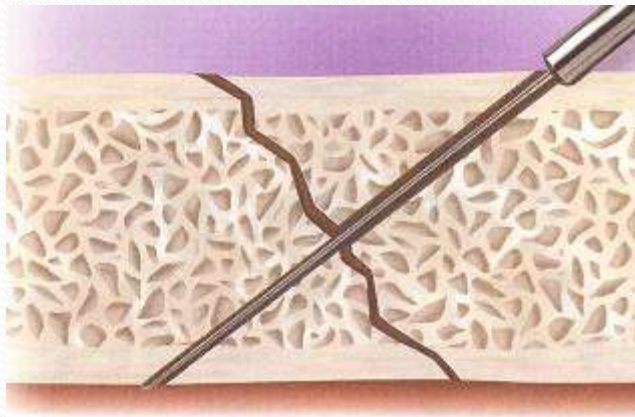
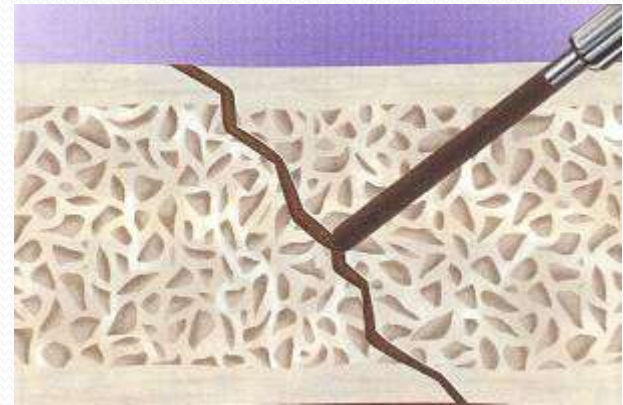
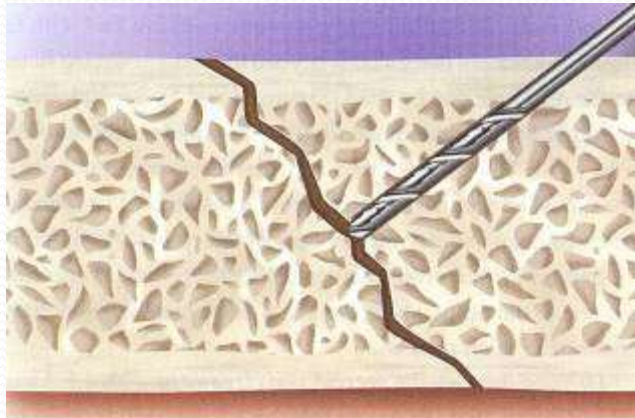
Non Rigid Fixation Wire

OSTEOSYNTHESIS

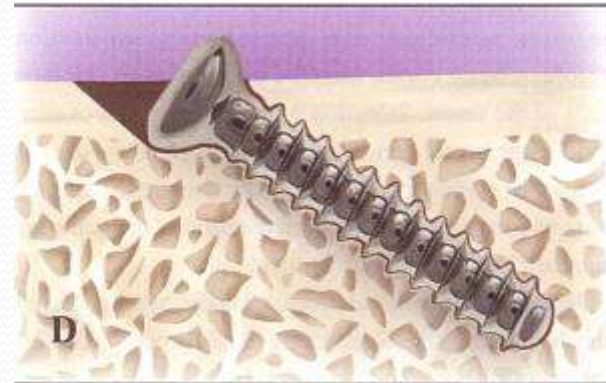
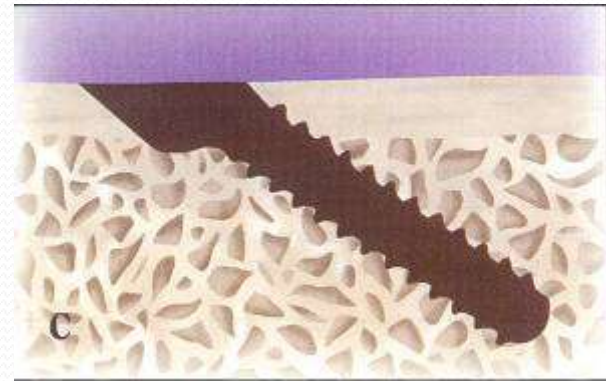
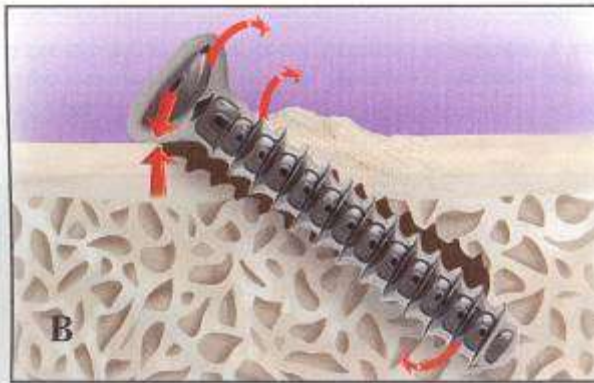
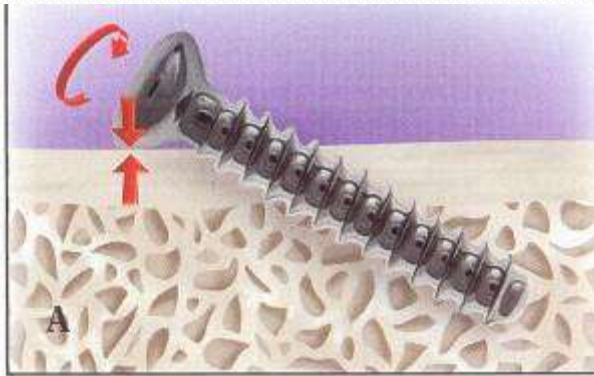
Open reduction

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

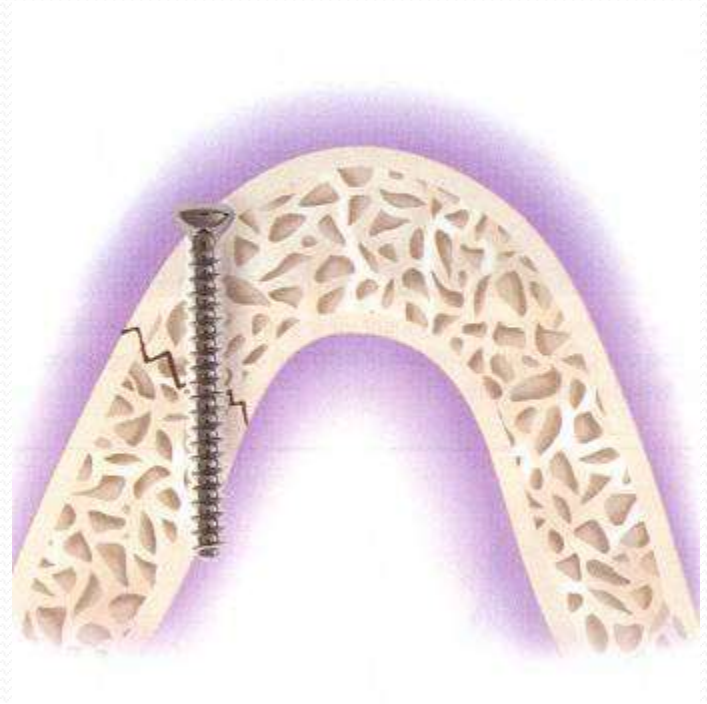
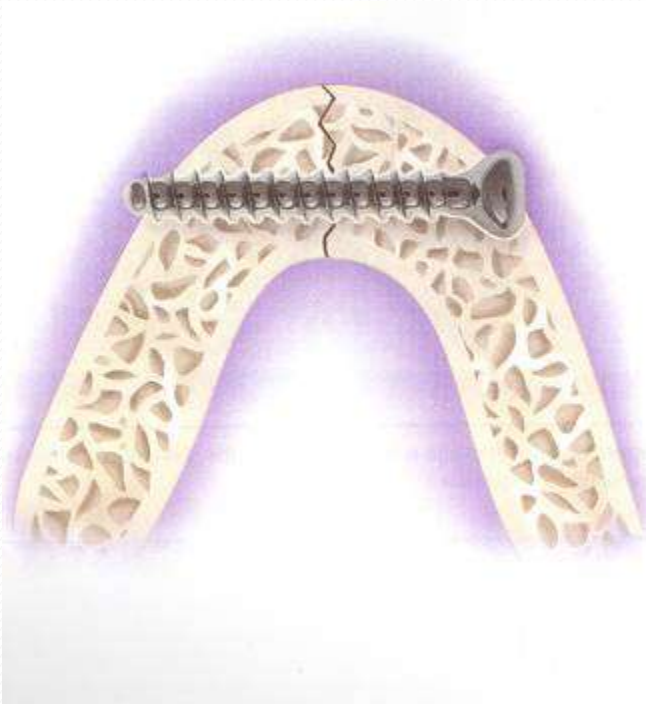
Lag Screw Technique



Lag Screw Technique

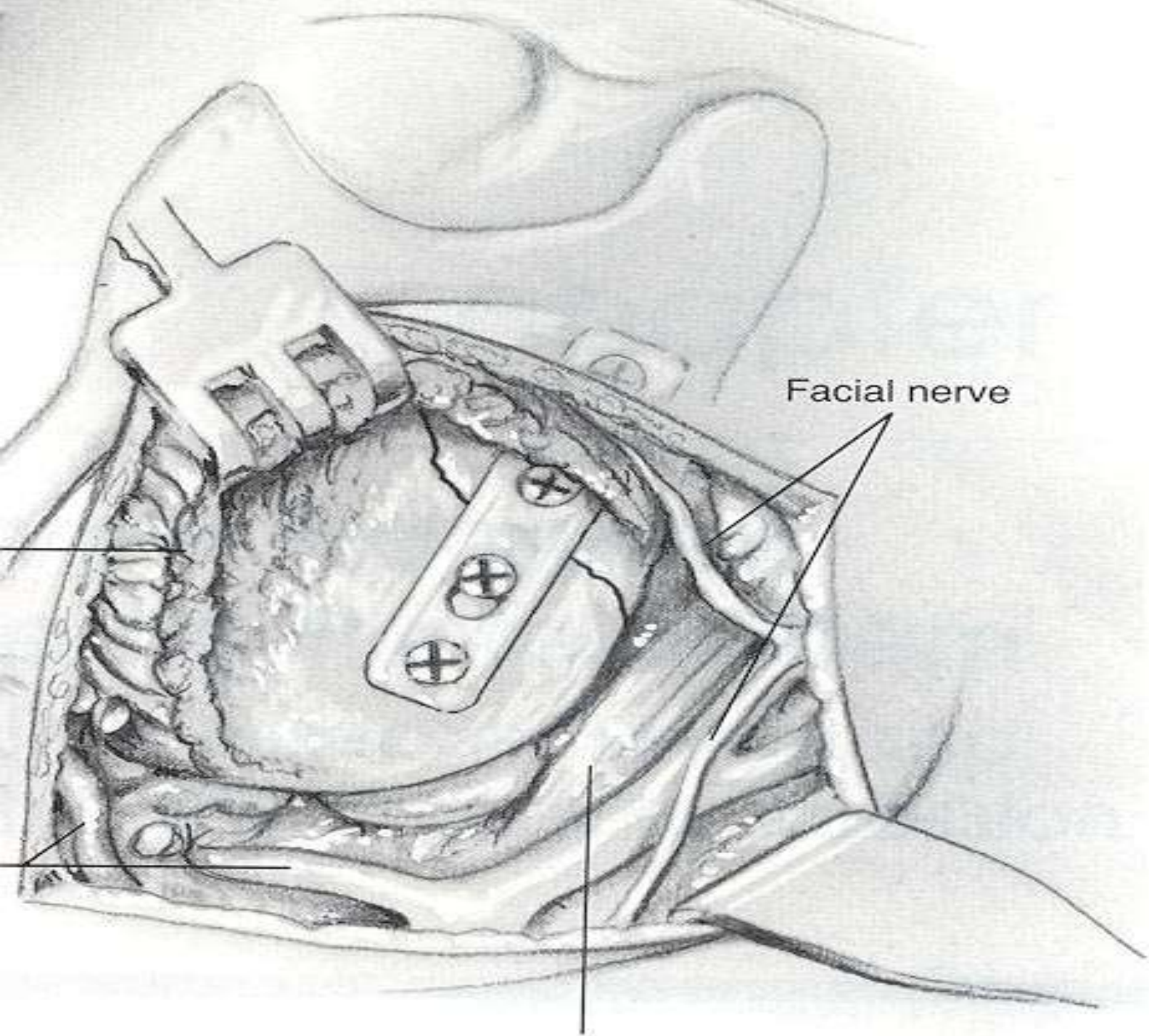


Lag Screw Technique

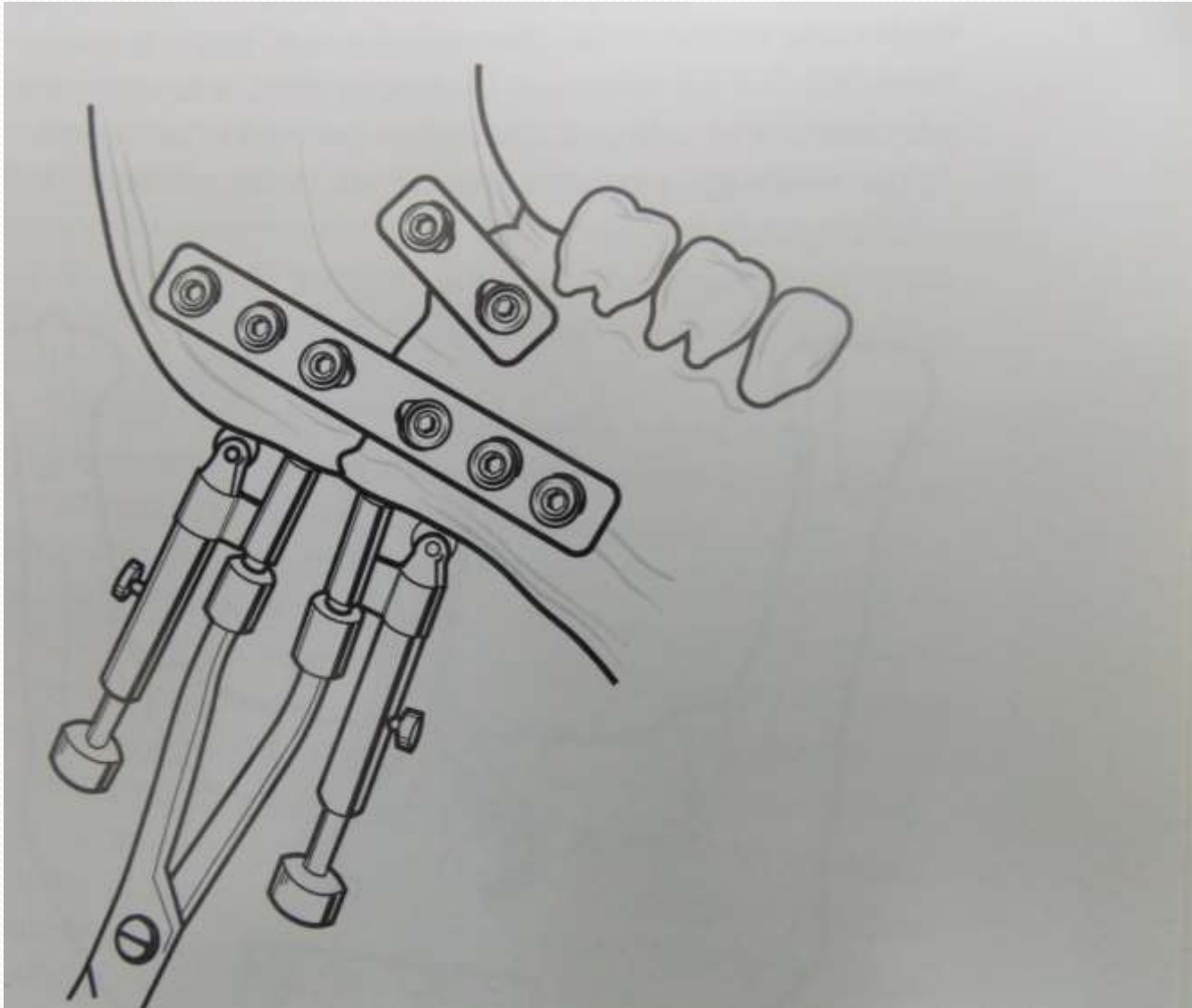


Rigid Fixation

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



Facial nerve



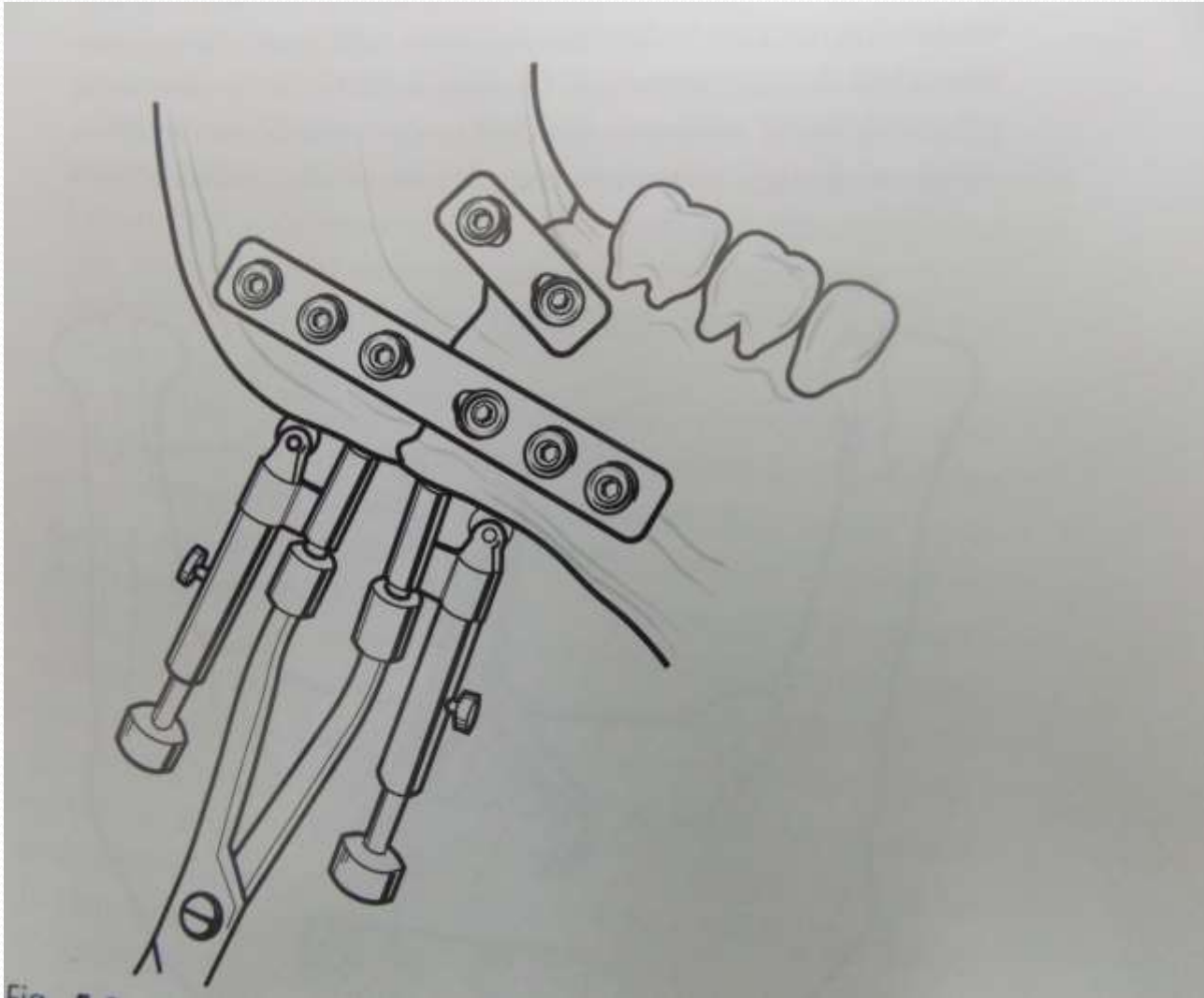
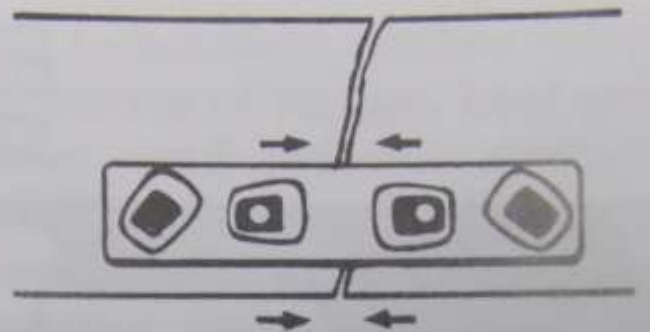
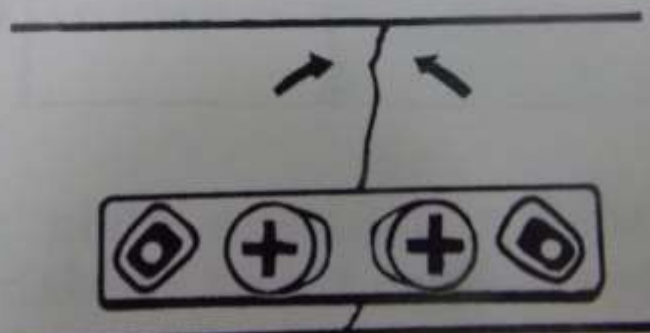


Fig. 1.1



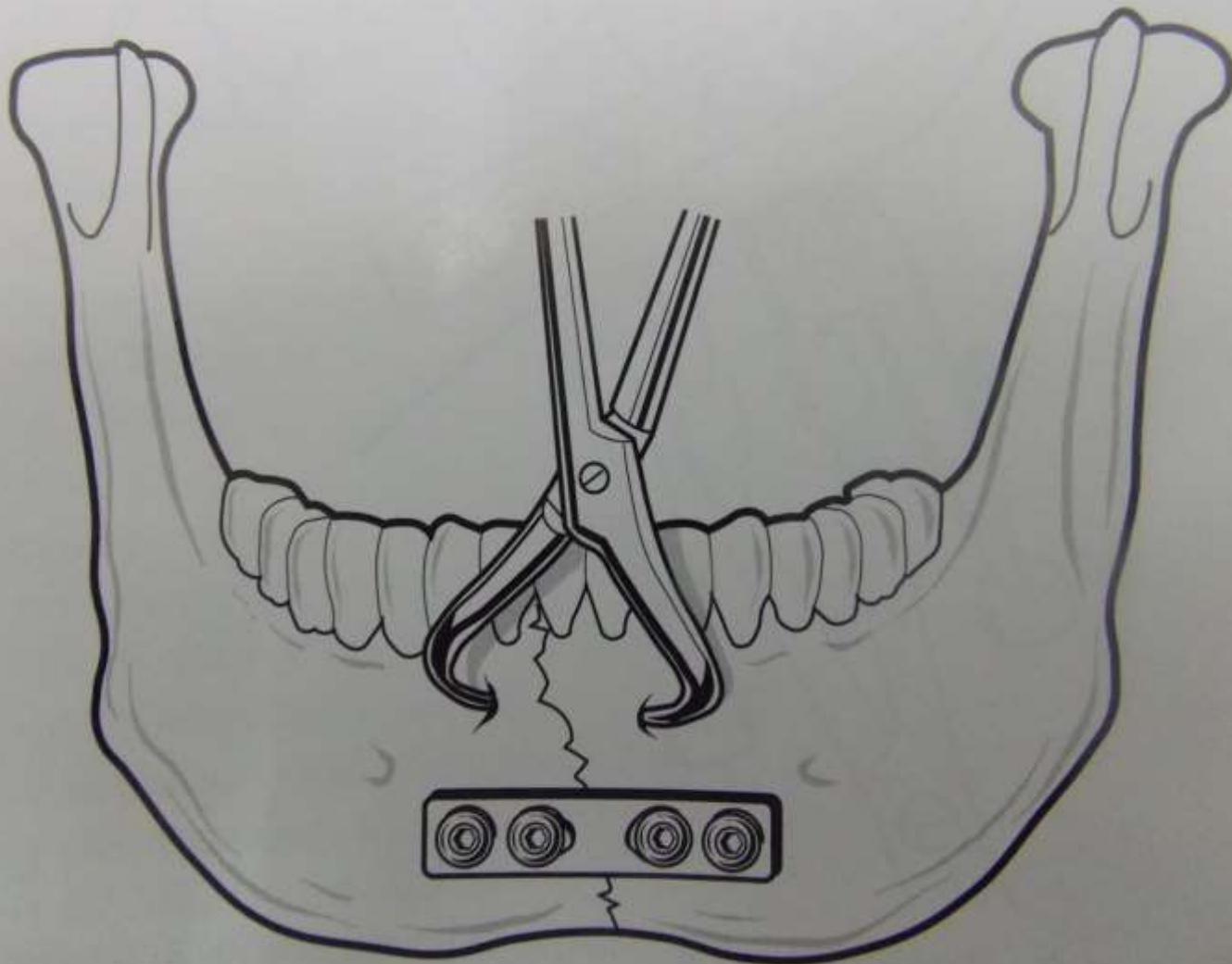
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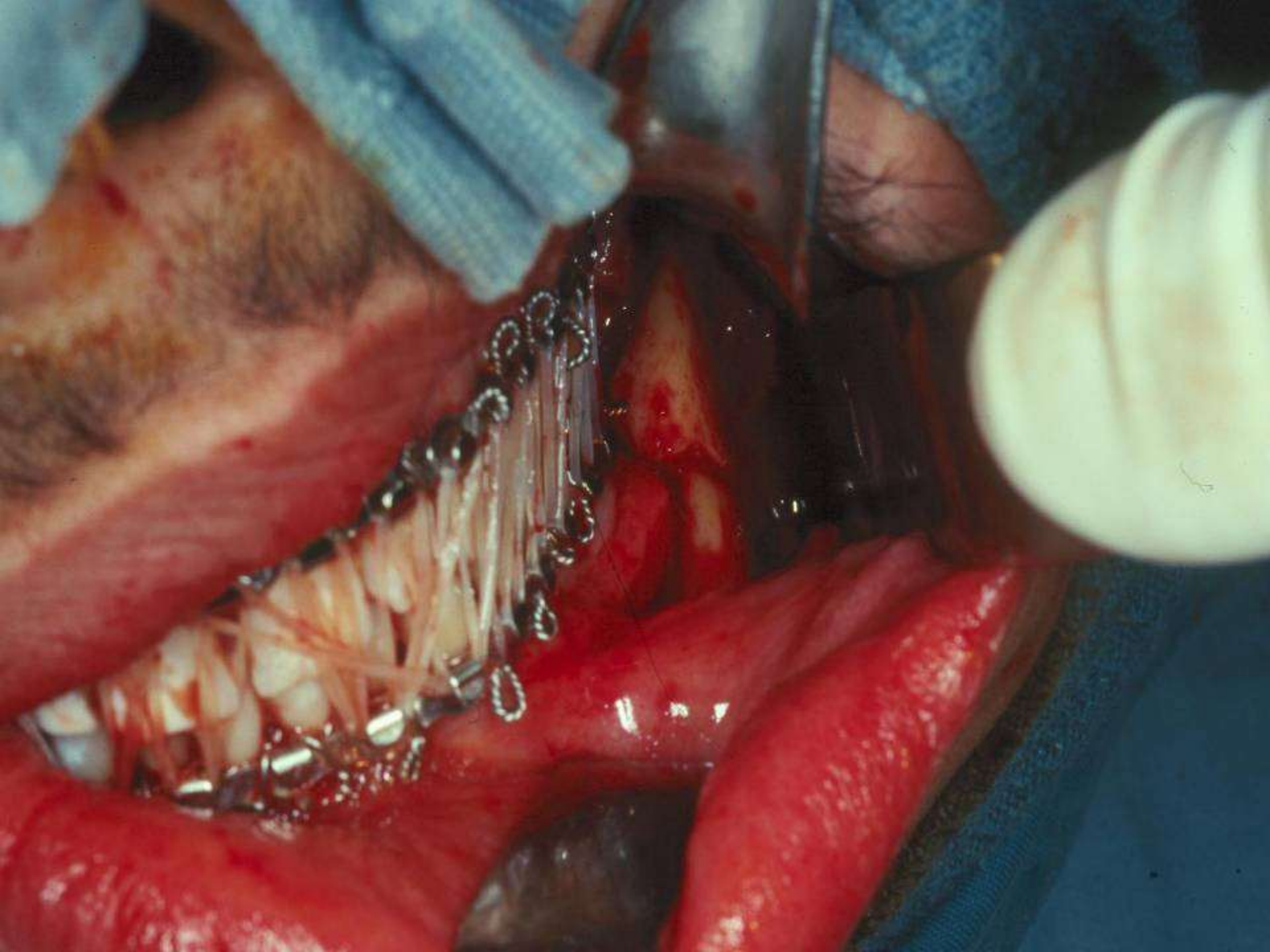


B

ERR

After drawing, measure the depth





Rigid Fixation

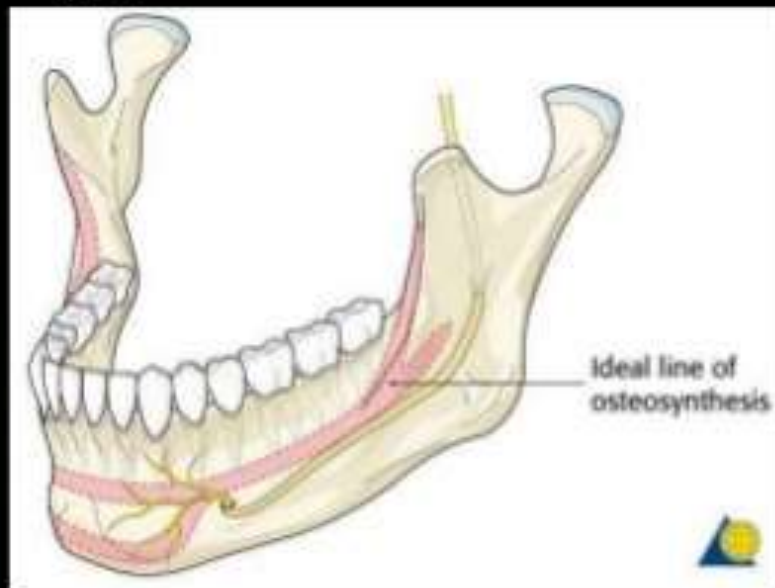
- Miniplates
 - Semi-rigid fixation
 - Allows primary and secondary bone healing
 - Easily bendable
 - More forgiving
 - Short period MMF Recommended

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

Management of Fracture of the Body of Mandible

- ▶ Simple fractures involving the body of the mandible can be effectively treated with one miniplate along the Champy line of osteosynthesis.
- ▶ Dissection should be done avoiding the damage to mental nerve which supplies the lower lips.

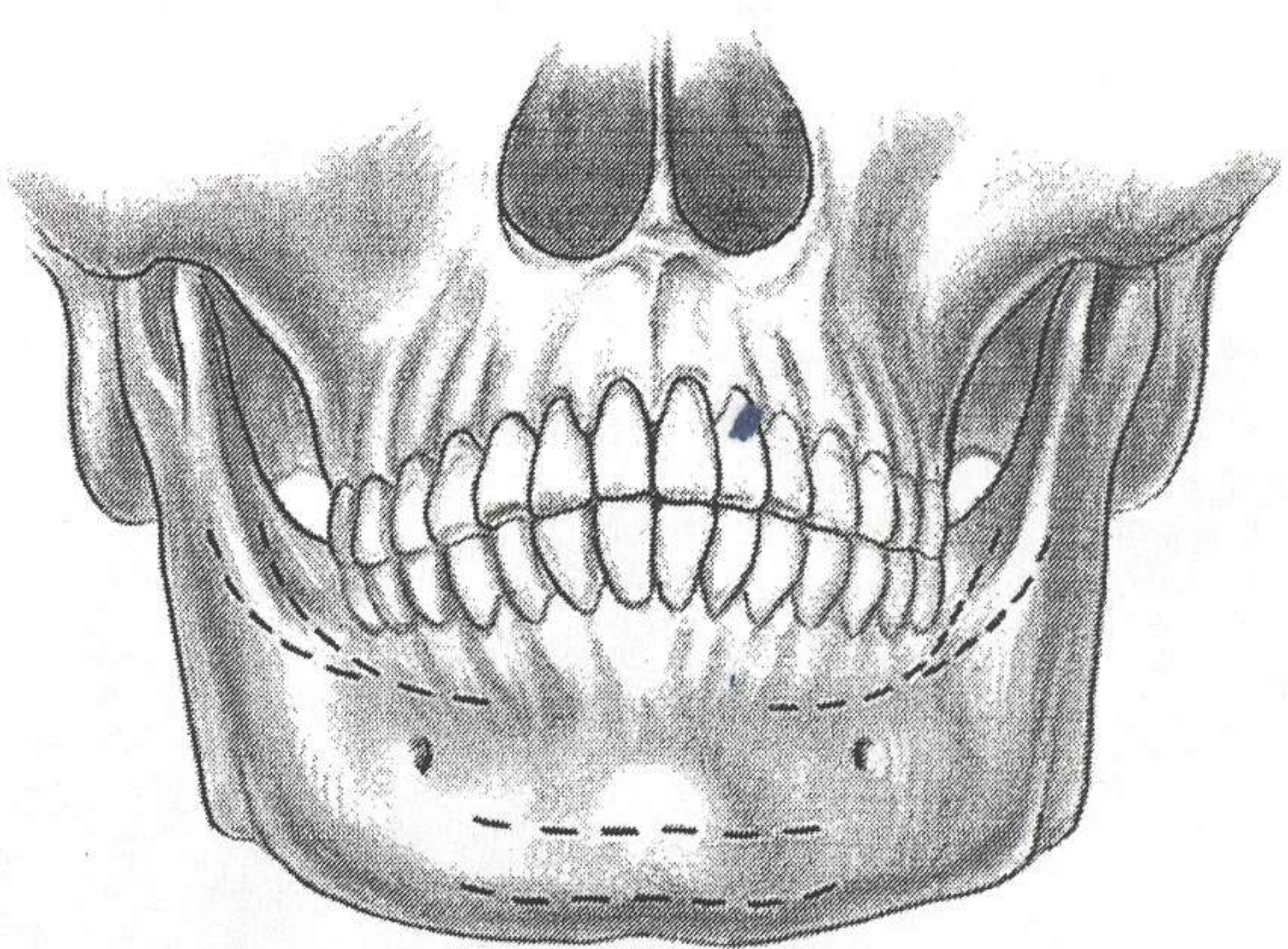


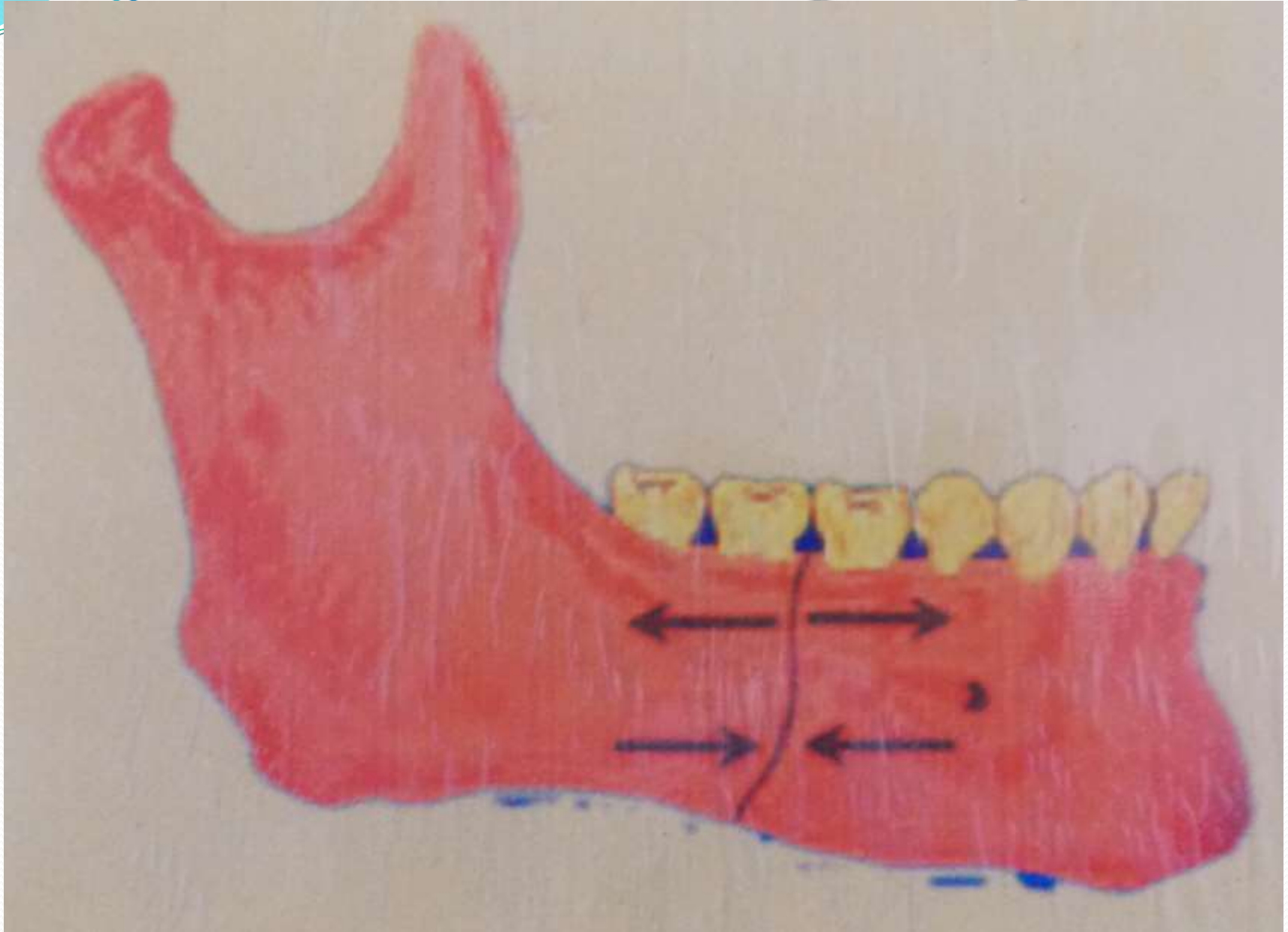
Champy popularized the treatment of mandible fractures with miniplate fixation along the ideal lines of osteosynthesis. This is a form of load-sharing osteosynthesis to be applied in simple fracture patterns having an acceptable amount of bone stock.

Principles of fixation

- ❖ Usually one plate with 4 cortices of fixation are required for adequate immobilisation
- ❖ Anterior to mental foramen, 2 levels of fixation are required to overcome torsional forces
- ❖ Unfavourable fractures usually require 2 levels of fixation for stability
- ❖ Fixation along Champy's line allows better fixation due to the strong buttress structure











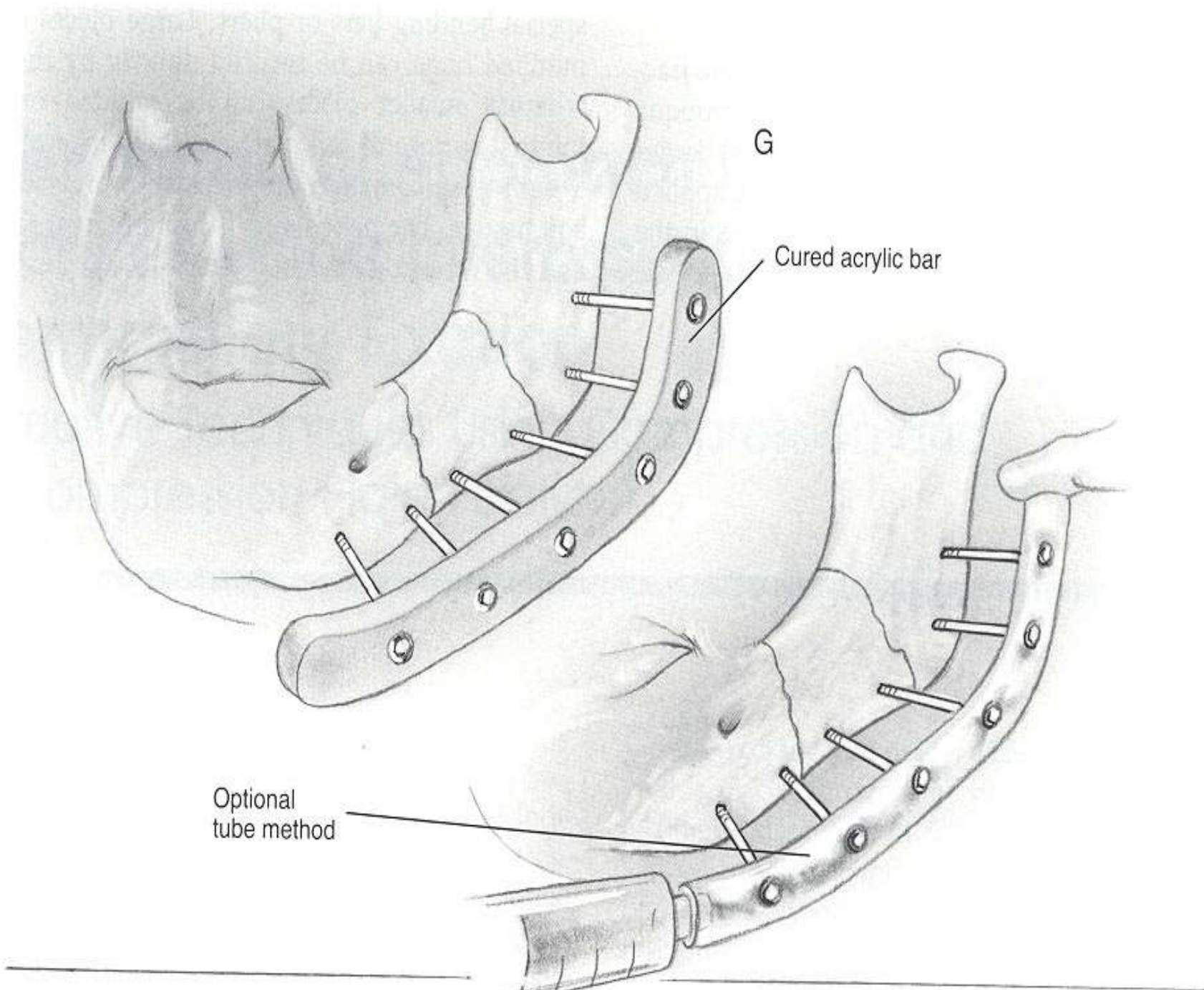


Rigid Fixation

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

External Fixation

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



G

Cured acrylic bar

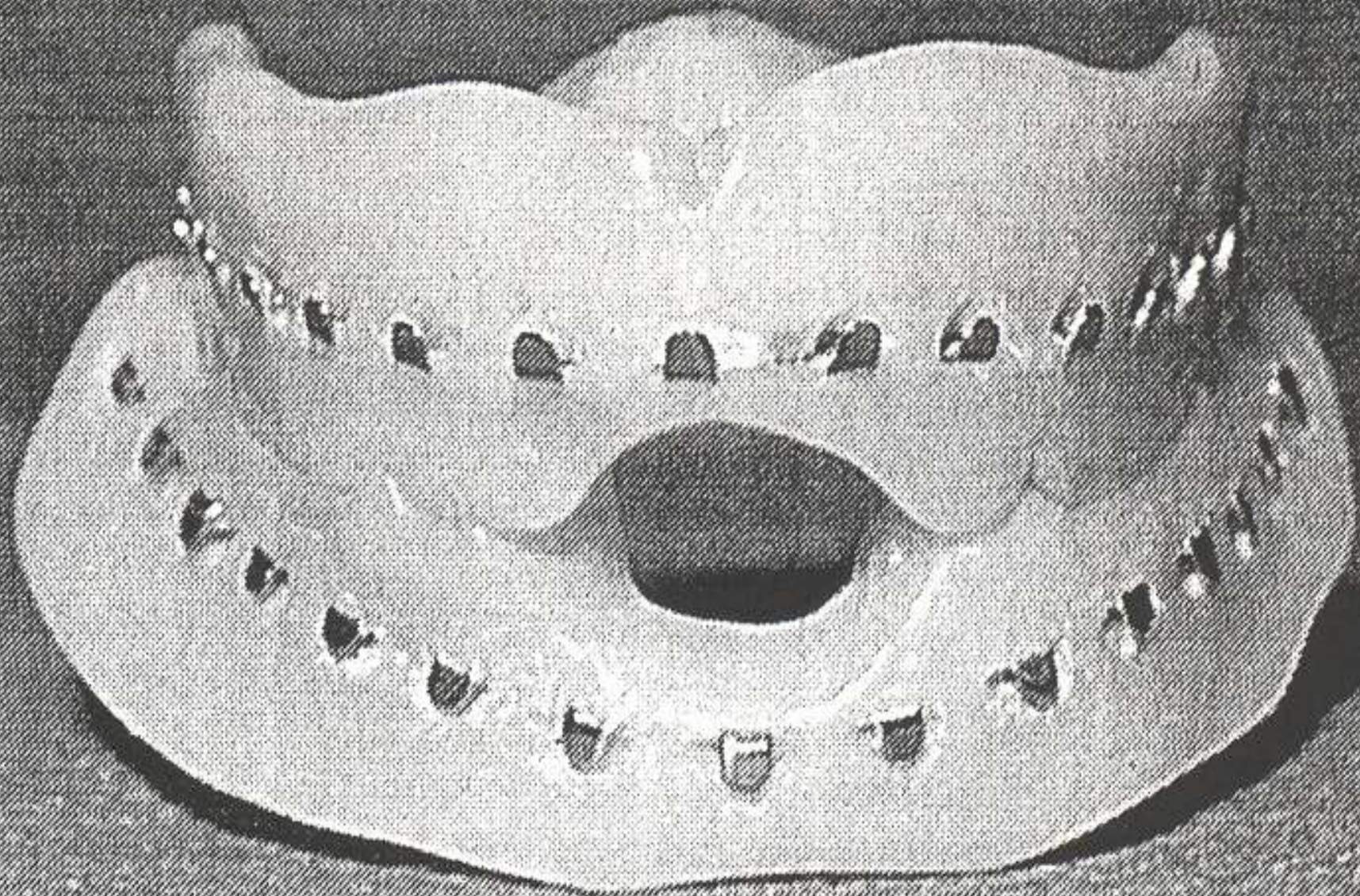
Optional tube method

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



- The most common site of fracture is bilateral body region (bucket handle fracture)- which may compromise the airway and mandibular angle



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

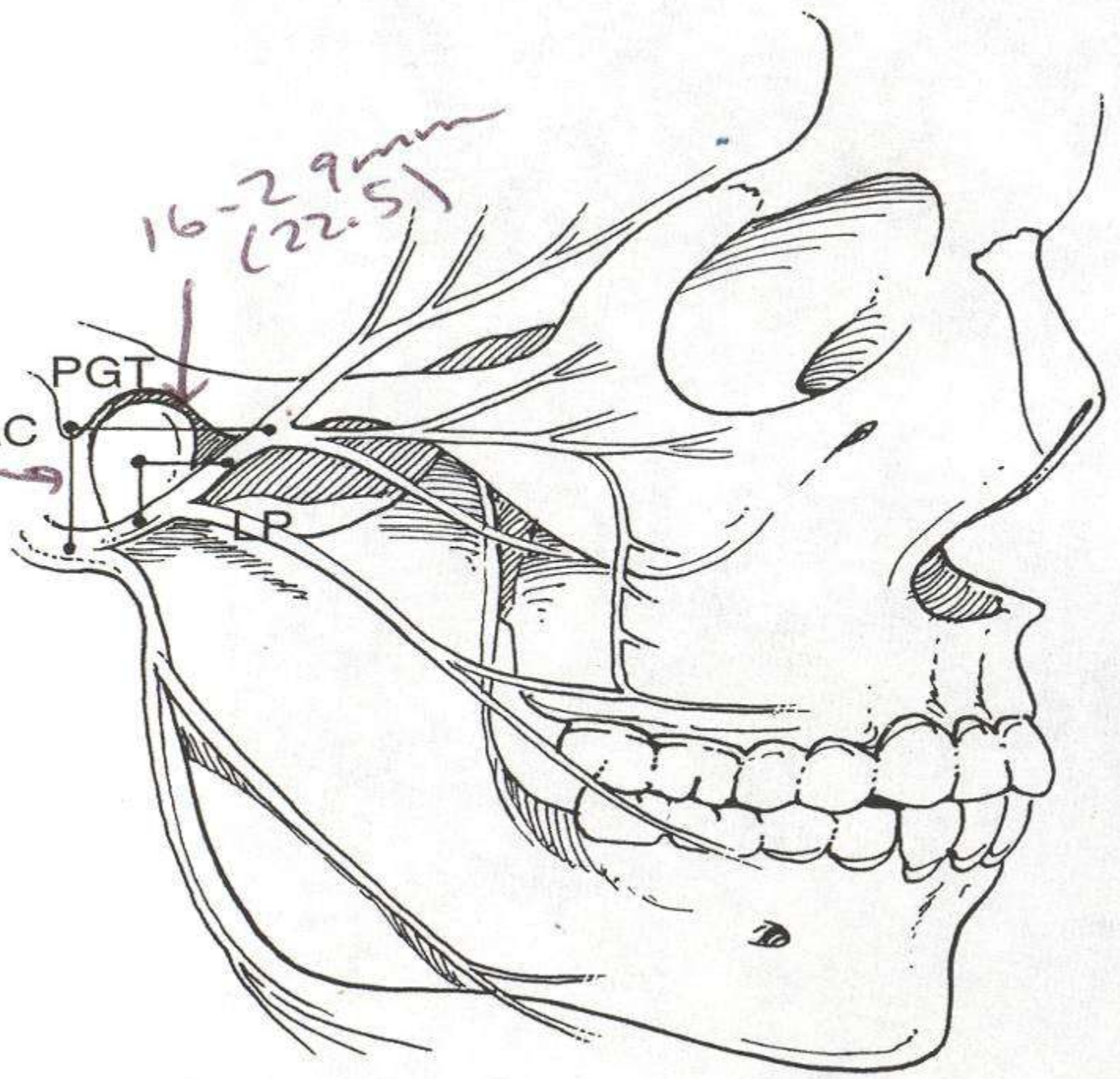
Condylar and Subcondylar

- 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

12-20mm
(15.6)

EAC
PGT
LP

16-29mm
(22.5)



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

