TEMPOROMANDIBULAR JOINT ANKYLOSIS

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INTRODUCTION

Ankylosis in the Greek term for ‘‘stiff joint”

TMJ ankylosis is a distressing structural condition that involves pathologic changes in the anatomic and physiologic integrity of the joint surfaces that result in limitations of mandibular movement that vary from slight opening interference to nearly complete inability to open the jaws accompanied by

- Difficulties in chewing and speech
- Poor oral hygiene
- Mandibular growth disturbances that interfere with normal social life

Reza Movahedet al, Management of Temporomandibular Joint Ankylosis; Oral Maxillofacial Surg Clin N Am 27 (2015) 27–35

HISTORICAL PERSPECTIVES

- Burton in 1826 described the treatment of ankylosis by the formation of artificial joints
- Verneuil in 1826 was the first to do gap arthroplasty
- Humphry performed first condylectomy for ankylosis in 1854
- In 1914, Murphy reported the use of autogenous graft as interposition after lysis of TMJ ankylosis
- Risdon applied free muscle to the problem in 1934
- In 1942, Pickerill propounded that the ankylosed TMJ should be reconstructed by means of cartilage graft

- Gordon in 1955 used alloplastic material to replace TMJ disc after discectomy.
- Georgiade first described the use of the dermis as a disc replacement in 1957.
- The use of autogenous auricular cartilage as a replacement for the disc was first introduced by Perko in 1973.
- In 1990 Kaban gave protocol for the management of ankylosis which was modified in 2009.
- Wolford first used specific surgical protocol for management using TMJ prosthesis in 1992

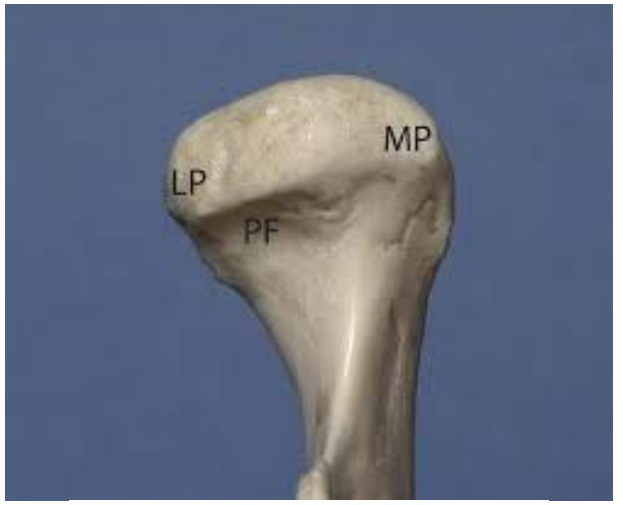
ANATOMY

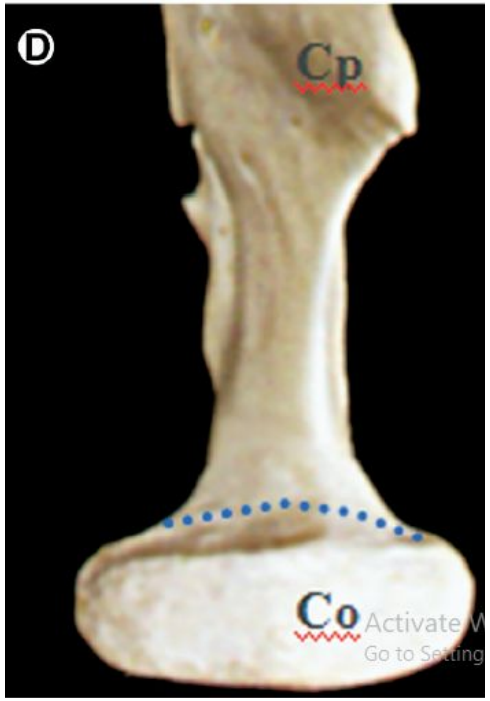
- Temporomandibular joint is a complex structure composed of several components.
- The TMJ is a ginglymoarthrodial joint, a term that is derived from ginglymus, meaning a hinge joint, allowing motion only backward and forward in one plane
- Aarthrodia, meaning a joint of which permits a gliding motion of the surfaces.

Articular Surfaces

Mandibular Component

- Consists of an ovoid condylar process seated atop a narrow mandibular neck. It is 15 to 20 mm side to side and 8 to 10mm from front to back
- The lateral pole of the condyle is rough, bluntly pointed, and projects only moderately from the plane of ramus, while the medial pole extends sharply inward
- Condyle is rounded mediolaterally and convex anteroposteriorly,





Cranial Component

- The articular surface (mandibular fossa) of the temporal bone is situated on the inferior aspect of temporal squama anterior to tympanic plate.
- Articular eminence
- Articular tubercle
- Preglenoid plane
- Posterior articular ridge and the postglenoid process

Articular Disk

- It is a biconcave fibrocartilaginous structure located between the mandibular condyle and the temporal bone.

- Its functions to accommodate a hinging action as well as the gliding actions between the temporal and mandibular articular bone

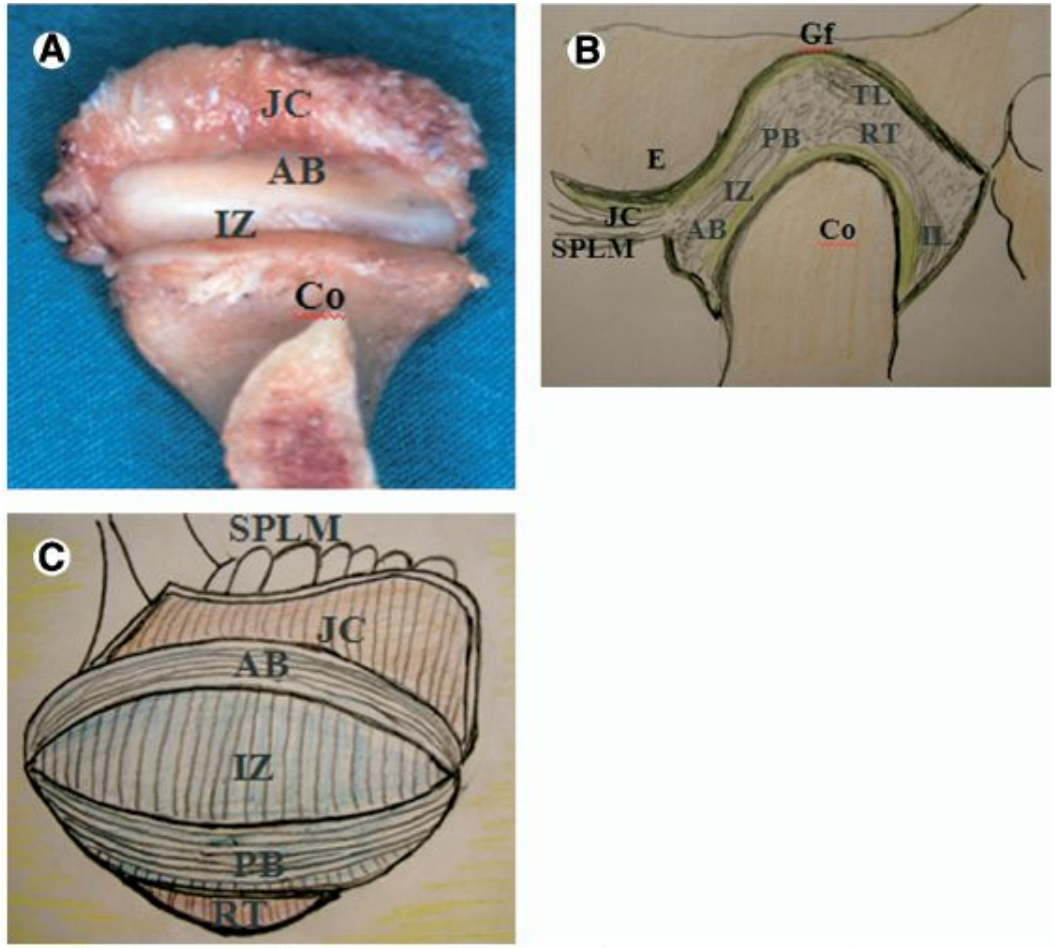


Figure 5 Components of the disk. AB: Anterior band; IZ: intermedius zone; PB; posterior band; SPLM: superior pterigoide lateral muscle; RT: retrodiskal tissue; TL: temporal lamina; IL: inferior lamina; JC: joint capsule; Gf: glenoid fossa; E: articular eminence; Co: condylar head of the mandible. (Color version of figure is available online.)

- Divides the joint into a larger upper compartment and a smaller lower compartment

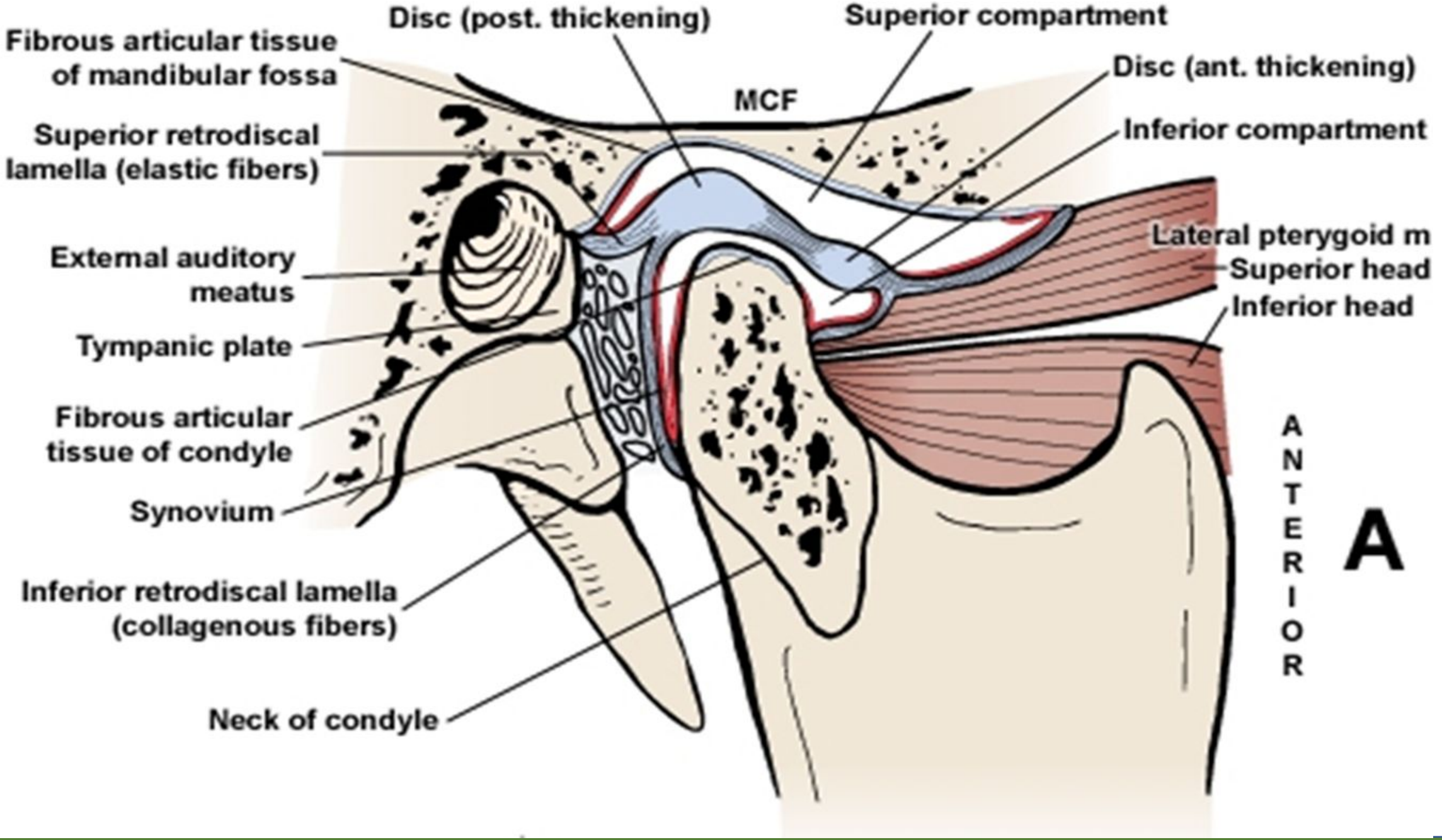
- Divided into an anterior band of 2 mm in thickness, a posterior band 3 mm thick, and thin in the centre intermediate band of 1 mm thickness.

Retrodiskal tissue

- Highly vascular and innervated tissue.

- Articular disk blends with it posteriorly

- It is a bilaminar zone.
- Superior retrodiskal lamina – attaches to the tympanic plate and restricts disk displacement during translatory movement
- Inferior retrodiskal lamina – it connects the articular disk to the posterior margin of the condyle, serves as a check to restrict extreme rotation of the disk


Fibrous articular tissue of mandibular fossa
Disc (post. thickening)
Superior compartment
Disc (ant. thickening)
MCF
Superior retrodiscal lamella (elastic fibers)
Inferior compartment
Lateral pterygoid m
Superior head
Inferior head
External auditory meatus
Tympanic plate
Fibrous articular tissue of condyle
Synovium
Inferior retrodiscal lamella (collagenous fibers)
Neck of condyle
ANTERIOR
A

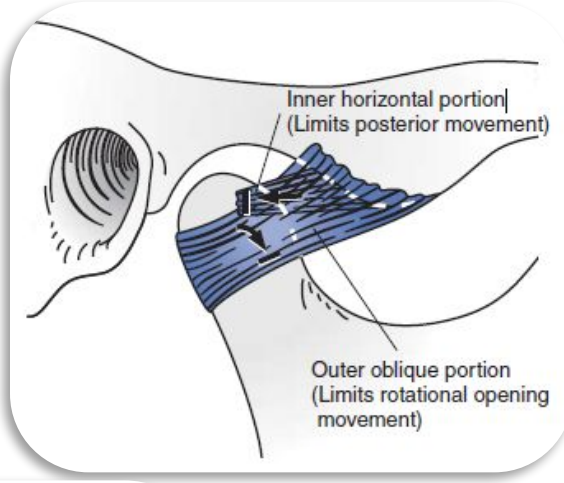
TMJ ligament complex

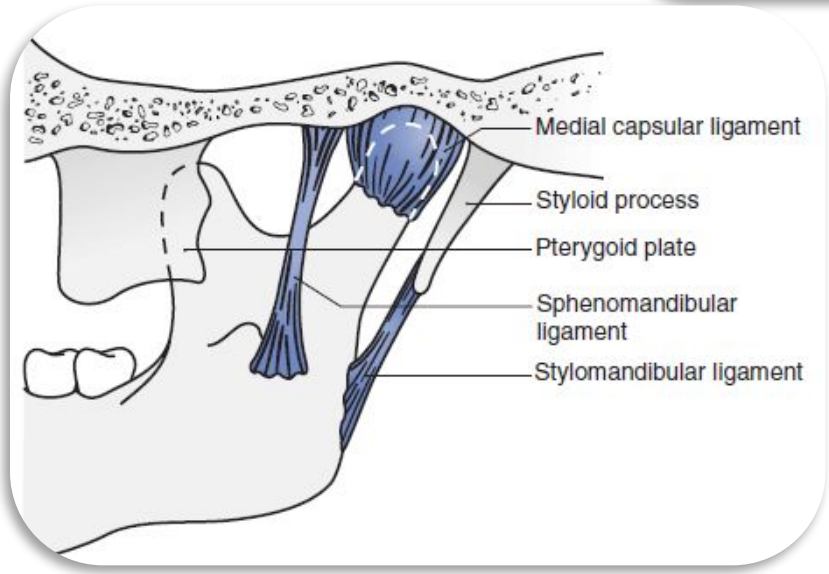
3 functional ligaments

- Collateral
- Capsular
- Temporomandibular or lateral

2 accessory ligaments

- Sphenomandibular
- Stylomandibular





- Ligaments provide stability to the joint

- The disc is attached to the condyle medially and laterally by ***collateral ligament***

- Restricts the movement of the disc away from the condyle as the disc glides anteriorly and posteriorly and also aids in hinging movement of condyle

- ***Capsular ligament*** thin loose envelope attachment above the circumference of the mandibular fossa and articular tubercle below to the neck of the condyle

- ***Temporomandibular ligament*** arises from lateral border of articular eminence and the zygomatic arch insert into posterior border of condylar head and limit the protraction, inferior distraction and posterior movements of the condyle.

- ***Sphenomandibular ligament***: originates from anterior process of malleus, tip of pterygo tympanic fissure and spine of sphenoid and insert into lingula.

- ***Stylomandibuar ligament*** attaches to styloid process above and a posterior border of ramus and accessory ligaments limits extreme of anterior movement of the condyle in relation to fossa

Vascular supply

- Branch of Superficial temporal artery runs deep to parotid, emerges behind the neck of condyle

- Branch of Transverse facial artery

Departs from the superficial temporal artery and travels across the face about 1.5 cm inferior to the zygomatic arch

- Deep Auricular artery, Ascending pharyngeal artery.

- Anterior tympanic artery

Branche of maxillary artery that enter the joint from the anterior and the medial aspect.

Lubrication of the Joint

- The synovial fluid comes from two sources: first
- From plasma by dialysis, and second, by secretion from type A and B synoviocytes with a volume of no more than 2 ml within each TMJ
- Upper compartment could hold approximately 1.2 ml of fluid
- Lower has a capacity of approximately 0.5 – 0.9 ml

Surgical anatomy

Talebzadeh et al

- Outer aspect of zygomatic arch to middle meningeal artery – 31mm
- Antero posterior distance from middle meningeal artery to glenoid fossa – 2.4mm
- Zygomatic arch to carotid artery – 37.5mm
- Zygomatic arch to IJV – 38.3mm
- Height of glenoid fossa to mandibular nerve – 9.2mm

Etiology of Ankylosis

Trauma

- At birth – forceps delivery
- Heamarthrosis (direct/indirect trauma)
- Condylar fracture –intracapsular/ extracapsular
- Glenoid fossa fracture (rare)

Shashikiran et al; Management of TMJ ankylosis in growing children; J of indian Pedo prev dent 2005

Infections

- Otitis media

Inflammation

- Rheumatoid arthritis
- Osteoarthritis
- Septic arthritis – hematogenous spread
- Ankylosing spondylitis

Rare causes

- Polyarthritis
- Measles
- Small pox

Shashikiran etal; management of TMJ ankylosis in growing children; J indian Pedo prev dent 2005

Other causes

- Bifid condyle
- Prolonged trismus
- Prolonged immobilization
- Idiopathic
- Burns
- Tumors

Shashikiran et al; management of TMJ ankylosis in growing children; J indian Pedo prev dent 2005

Etiology of pseudoankylosis

- Depressed zygomatic arch
- Fracture dislocation of condyle
- Hypertrophy of coronoid process
- Fibrosis of temporalis muscle
- Scar contracture
- Tumour of condyle or coronoid

PATHOGENESIS

PATHOPHYSIOLOGY

INTRACAPSULAR FRACTURE OF BONE

↓

BLEEDING WITHIN JOINT CAVITY (HEMARTHROSIS)

↓

BONE FRAGMENTS WITH VERY HIGH OSTEOGENIC POTENTIAL

↓

ORGANISATION OF HAEMATOMA WITHIN JOINT

↓

CONVERSION TO FIBROUS TISSUE

↓

SUBSEQUENTLY TO BONE

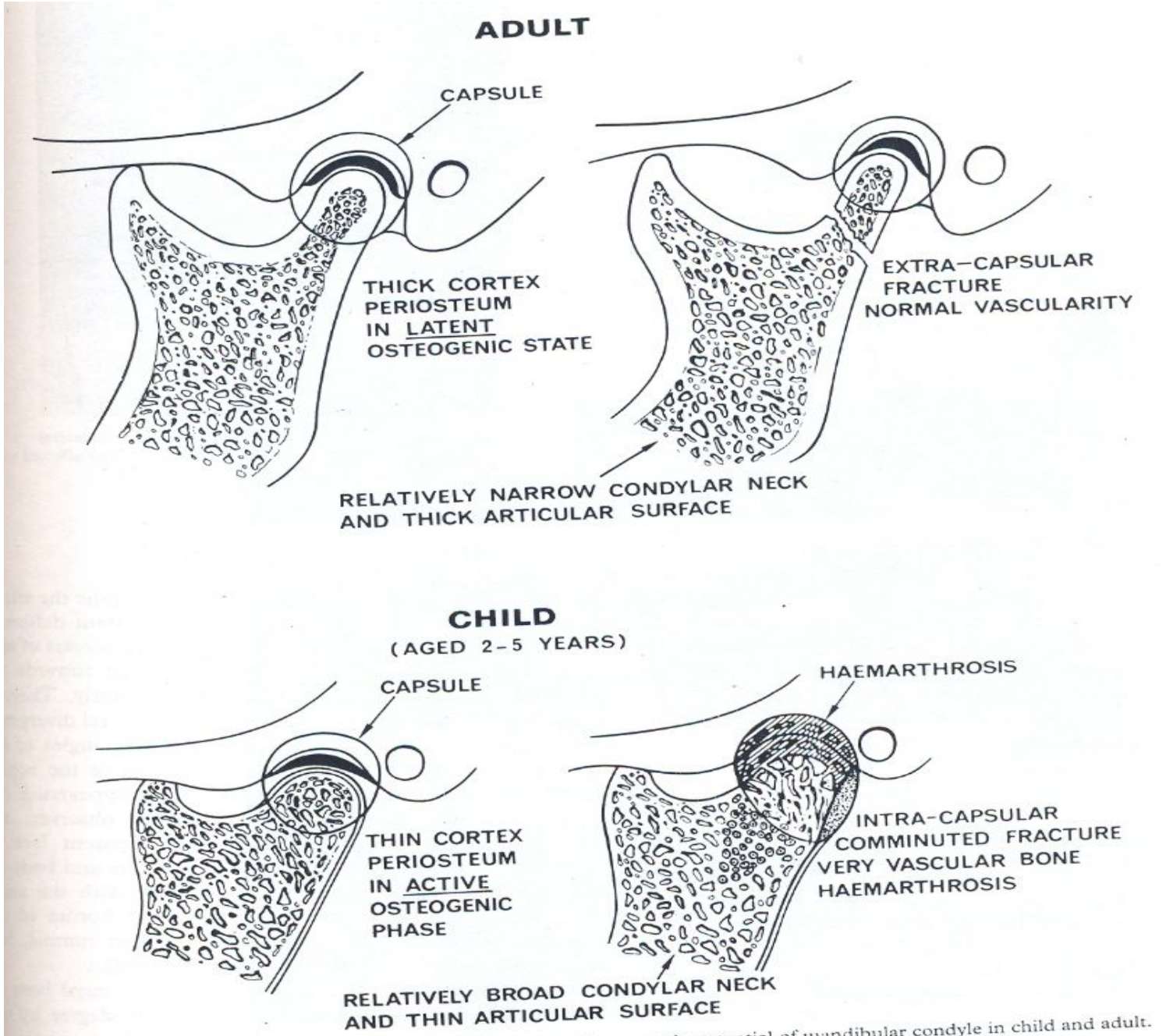


Fig. 14.37 Drawings to show shape, vascularity and osteogenic potential of mandibular condyle in child and adult.

Infection

Organisms may reach the joint by

- Hematogenous
- Contiguous
- Direct inoculation

Organisms responsible for infection of the TMJ-staphylococci, streptococci and occasionally gonococci.

- Markey et al experimented on young moneys to create TMJ ankyloses.
- He attempted a surgical intra capsular fracture followed by IMF.
- It was concluded that trauma followed by long term fixation had no effect in promoting ankylosis or significant limitation of jaw movement.
- It is suggested that when considering the role of trauma in the aetiology of ankylosis, attention be given to those factors which may complicate an existing trauma.

Ronald J. MARKEY, Bryce E. POTTER, Ben C. MOFFETT Condylar Trauma and Facial Asymmetry: An Experimental Study J, max.-fac. Surg. 8 (1980) 38-51

- Hohl et al. subjected the condylar fractures in monkeys with various modalities such as mechanical damage, chemical damage and bone grafting and bacterial infection.

- They concluded that the mechanical damage coupled with bone grafting significantly induced TMJ ankyloses.

Thomas H. Hohl, Peter A. Shapiro, Benjamin C. Moffett, Alison Ross Experimentally Induced Ankylosis and Facial Asymmetry in the Macaque Monkey .J max.-fac. Surg. 9 (1981) 199-210

- Using sheep models Miyamoto et al concluded when mandibular movements are restricted the chance of TMJ ankyloses increased.
- He also showed the disc guards the TMJ from the occurence of intracapsular fibrous ankyloses

Hizuru Miyamoto et al The Effect of Autogenous Costochondral Grafts on Temporomandibular Joint Fibrous and Bony Ankylosis: A Preliminary Experimental Study., **J Oral Maxillofac Surg 64:1517-1525, 2006**

Classification

- True / false
- Complete / partial
- Bony / fibrous / fibro-osseous
- Intra articular / extra articular
- Unilateral / bilateral

Kazanjian (1938):

a. True ankylosis:

Any condition that produced fibrous or bony adhesions between the articular surfaces of the TMJ

b. False ankylosis:

Condition resulting from pathologic condition outside of the joint that resulted in limited mandibular mobility

Joram Raveh and Thierry Vuillemin Classification

Class 1 ankylotic bony tissue limited to the condylar process and articulate fossa

Class 2 the bone mass extends out of the fossa involving the medial aspect of the skull base upto the carotid jugular vessels

Class 3 extension and penetration into the middle cranial fossa

Class 4 combination of class 2 and class 3

JORAM RAVEH et al., Temporomandibular Joint Ankylosis: Surgical Treatment and Long-Term Results, J Oral Mamllofac Surg 47:900-906. 1969

Rowe's Modification (1986):

Based on location:

- Intra articular
- Extra articular

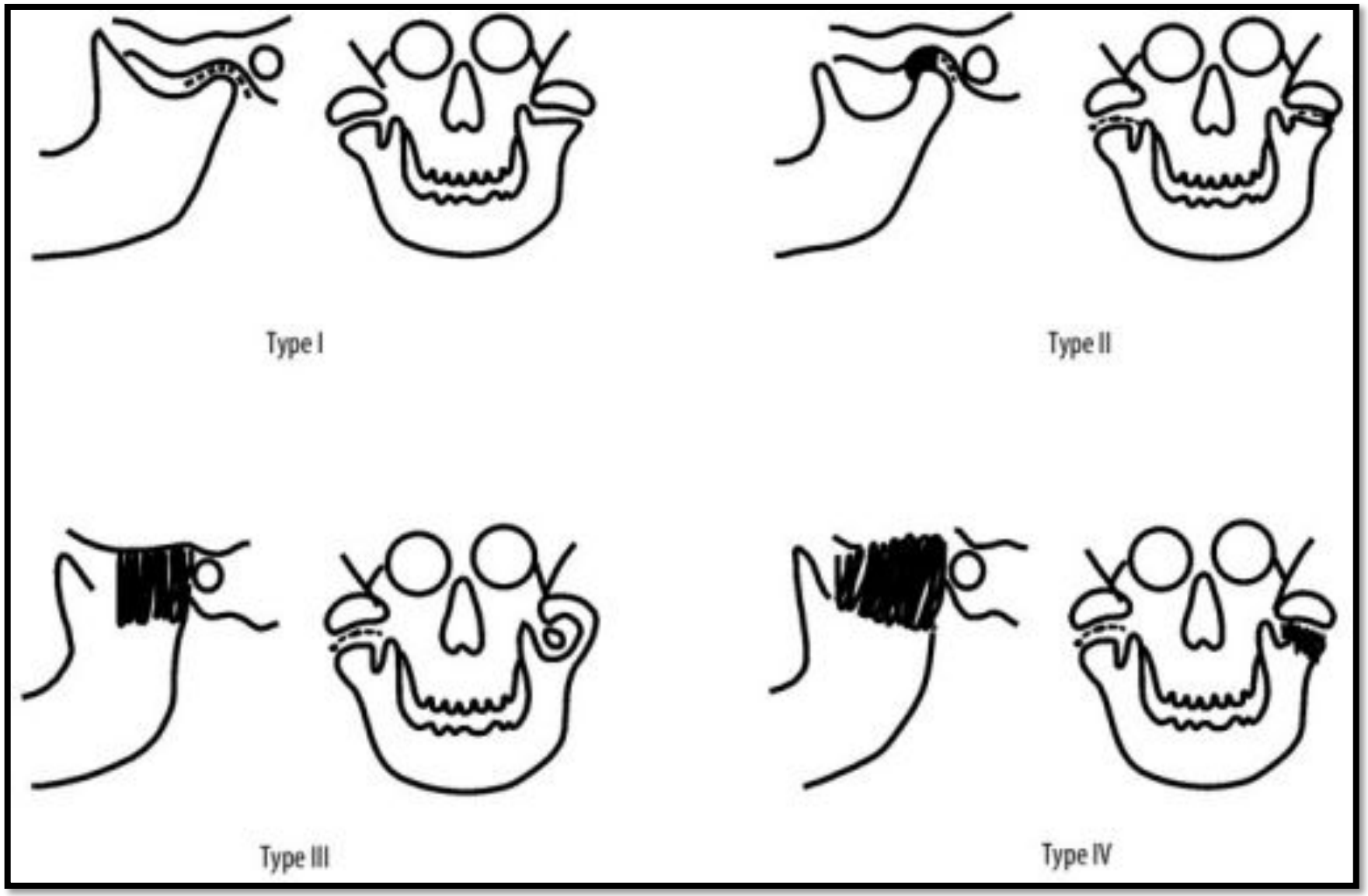
Type of tissue involved

- Bony
- Fibrous
- Fibro osseous

Extent of fusion

- Complete
- Incomplete

Sawhney's classification (1986):



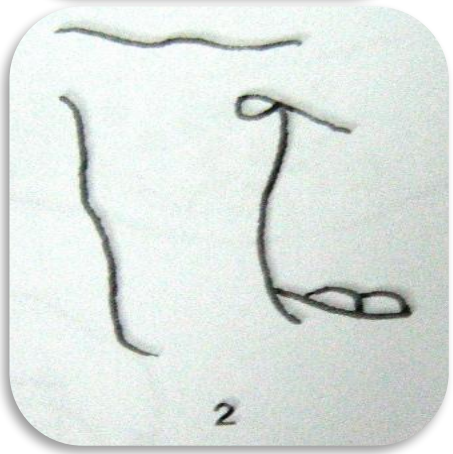
Type I	**– decreased joint space with dense fibrous adhesion (The condyle is present and there are only fibrous adhesions)**
Type II	–decreased joint space with dense fibrous adhesion , which also exhibits lateral lipping and bony bridge. (There is bone fusion, the condyle is remodeled, and the medial pole is intact)
Type III	– broad bony bridging from the lateral ramus to the zygomatic arch . (There is an ankylotic block, the mandibular ramus is fused to the zygomatic arch, the medial pole remains intact)
Type IV	- complete bony fusion.

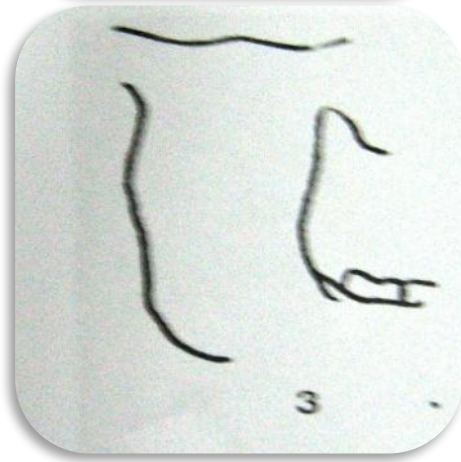
Topazian

Proposed a three-stage classification to grade complete ankylosis as follows:

- **Stage I** ankylotic bone limited to the condylar process;
- **Stage II** ankylotic bone extending to the sigmoid notch;
- **Stage III** ankylotic bone extending to the coronoid process.

Richard G.Topazian Discussion: A Protocol for Management of Temporomandibular Joint Ankylosis J Oral Maxillofac Surg 48:1152, 1990





Classification of TMJ altered morphology based on CT-scan:

Type I: The condyle can be identified even though flattened, irregular, partially resorbed.

- Its usually medially angulated.
- The articular fossa is correspondingly irregular, shallow or deep and usually sclerosed; the sclerosis extended to adjacent areas of the temporal bone.
- There is a mild to moderate amount of bone formation.
- This extended from the lateral superior aspect of the ramus to the squamous temporal bone and / or zygomatic arch, frequently encroaching on the lateral part of the articular fossa.

Sashi Aggarwal, et el ; Bony ankylosis of the temporomandibular joint: A computed tomography study; oral surgery oral pathology oral medicine 1990 69:1128-132

Type II: The joint architecture is completely disrupted with no recognizable condyle or articular fossa.

- There is a large mass of new bone, funnel shaped, extending from the thickened ramus to the grossly sclerosed and irregular base of the skull.

Sashi Aggarwal, et el ; Bony ankylosis of the temporomandibular joint: A computed tomography study; oral surgery oral pathology oral medicine 1990 69:1128-132

Modified classification based on CT-scan:

Class I:

Includes unilateral and bilateral fibrous ankylosis.

The condyle and glenoid fossa retain their original shape, and the maxillary artery is in normal anatomical relation to the ankylosed mass.

Class II:

There is unilateral or bilateral bony fusion between the condyle and the temporal bone.

The maxillary artery lies in normal anatomical relation to the ankylosed mass.

El-Hakim etal; Imaging of temporomandibular joint ankylosis. A new radiographic classification; Dentomaxillofacial Radiology (2002) 31, 19±23.

Class III:

The distance between the maxillary artery and the medial pole of the mandibular condyle is less on the ankylosed side than in the normal side. This is best seen on coronal CT.

Class IV:

The ankylosed mass appeared fused to the base of the skull and there is extensive bone formation, especially from the medial aspect of the condyle to the extent that the ankylosed bony mass is in close relationship to the vital structures at the base of the skull such as the pterygoid plates, the carotid and jugular foramina and foramen spinosum

No joint anatomy can be defined from the radiograph. This is best visualized on axial CT.

El-Hakim etal; Imaging of temporomandibular joint ankylosis. A new radiographic classification; Dentomaxillofacial Radiology (2002) 31, 19±23.

Ninth Shangai Classification

Type A1 fibrous ankylosis without bony fusion of the joint

Type A2 ankylosis with bony fusion on the lateral side of the joint, while the residual condyle fragment is bigger than 0.5 cm of the condylar head in the medial side

Type A3 similar to A2, but the residual condylar fragment is smaller than 0.5 cm of the condylar head.

Type A4 is ankylosis with complete bony fusion of the joint

Dongmei He et al., Traumatic Temporomandibular Joint Ankylosis: Our Classification and Treatment Experience J Oral Maxillofac Surg 69:1600-1607, 2011

UNILATERAL ANKYLOSIS

- Gross facial asymmetry
- Deviation to affected side
- Hypoplastic mandible on affected side
- Prominent Antegonial notch
- Convex profile
- No cervico mental angle
- Condylar movements absent/ reduced on affected side
- Microgenia

Intra oral

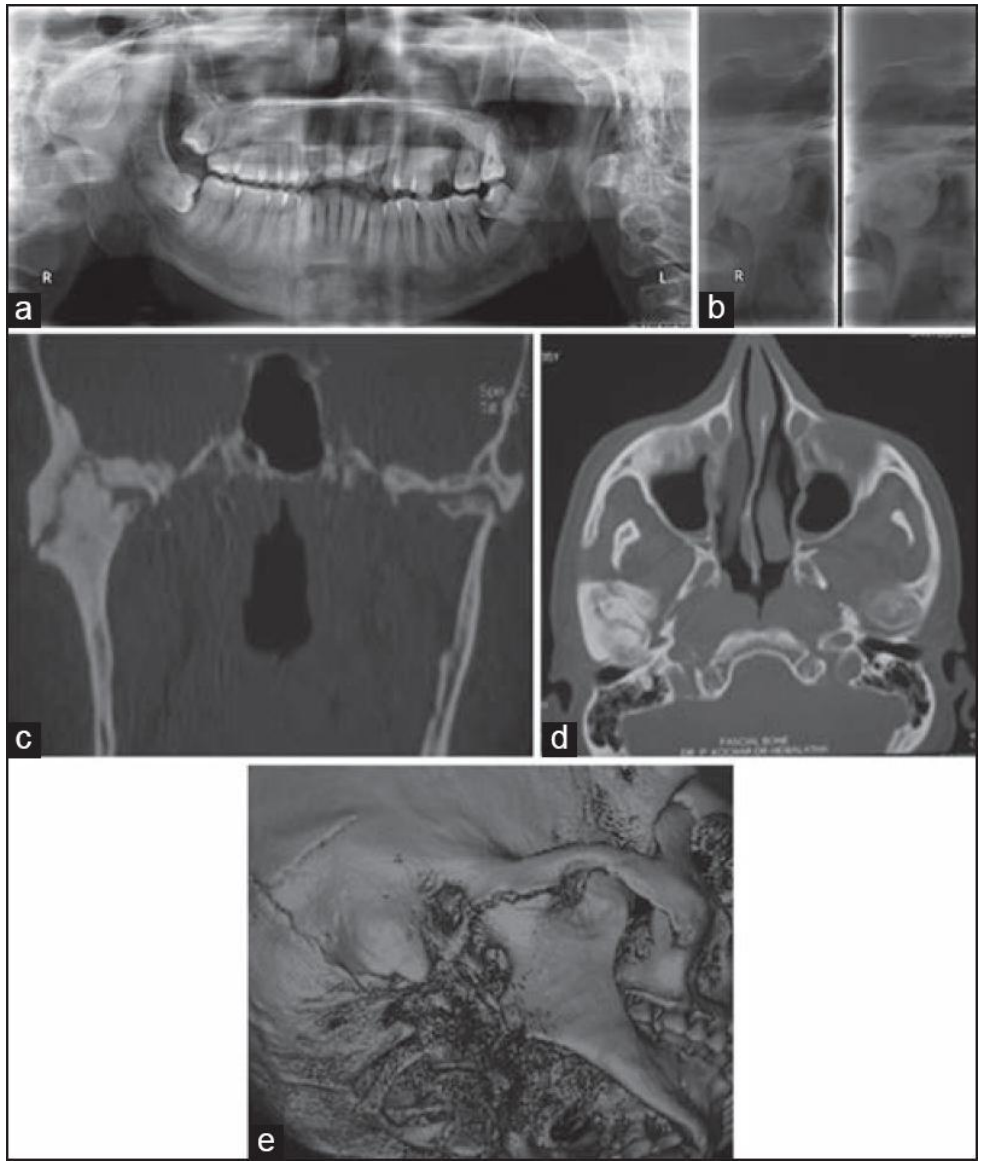
- Occlusal cant
- Class II malocclusion
- Cross bite may be seen
- Periodontal diseases
- Multiple impacted/supernumerary teeth
- Decreased interincisal opening

BILATERAL ANKYLOSIS

- Mouth opening decreased or absent
- Mandible is micrognathic, retrognathism
- Bird face deformity (Andy gump)
- Neck chin angle is reduced or absent
- Multiple carious tooth
- Convex profile
- Upper incisors often protrusive
- No joint movements palpated
- Markedly elongated coronoid process
- Double chin

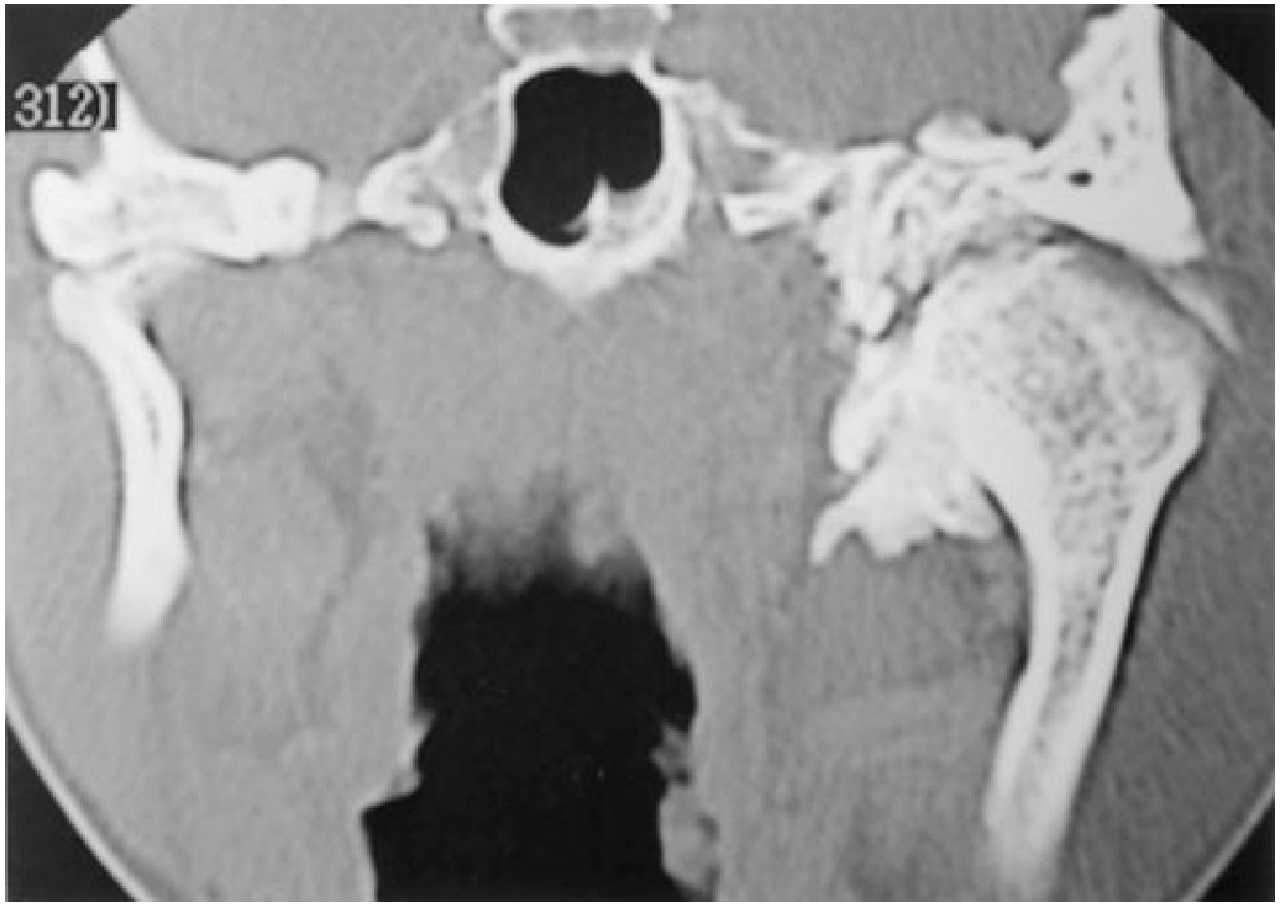
IMAGING MODALITIES

- OPG
- Trans cranial, transpharengeal
- Trans maxilary/ trans orbital
- Reverse towns
- Lateral oblique
- CT
- MRI
- CBCT
- Stereolithographic models



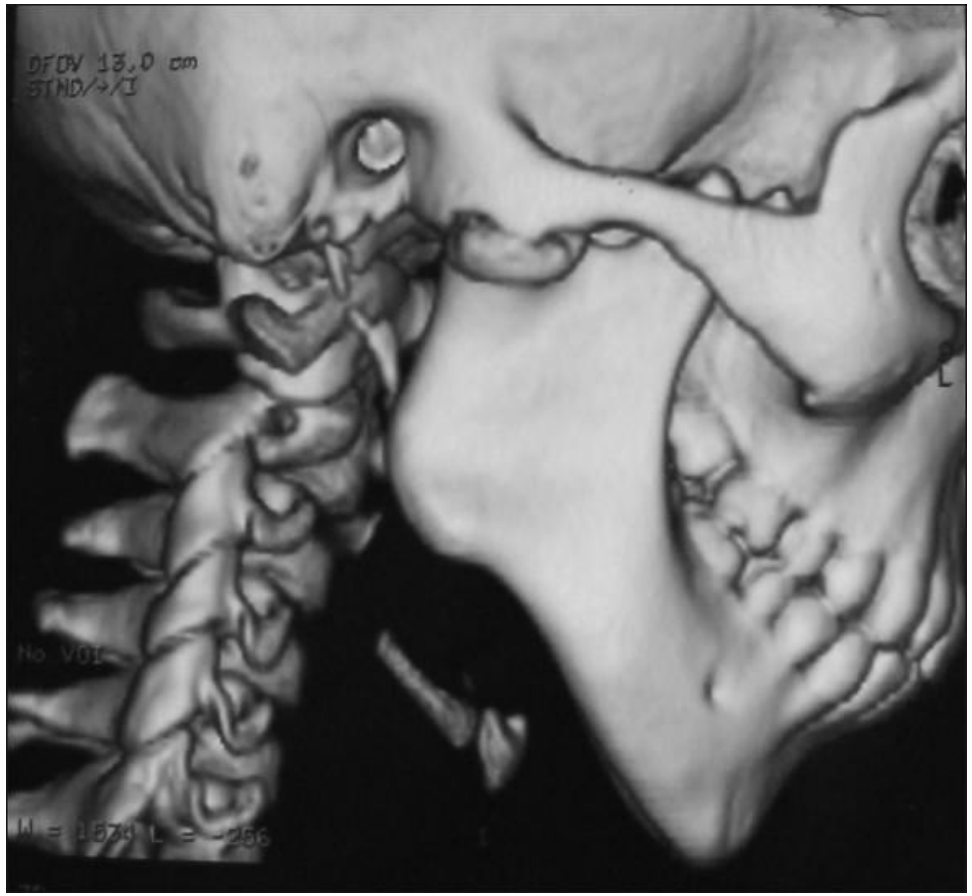
Panoramic views

- Do not reveal the nature & extent of the pathology, in particular the medial & lateral extension of the ankylosed bony mass, & its relation to surrounding vital structures.



Coronal CT showing bony exostoses in the glenoid fossa superiorly as well as medial on the condylar head, resulting in bony ankylosis

El-Hakim etal; Imaging of temporomandibular joint ankylosis. A new radiographic classification; Dentomaxillofacial Radiology (2002) 31, 19±23.



3D CT of an ankylosed joint with an elongated coronoid process that projects clearly under the zygomatic arch

El-Hakim etal; Imaging of temporomandibular joint ankylosis. A new radiographic classification; Dentomaxillofacial Radiology (2002) 31, 19±23.

TREATMENT OBJECTIVES

- Restore mouth opening
- Restore joint function
- Correct facial profile
- Relieve upper airway obstruction

Kaban's protocol

1. Aggressive resection
2. Ipsilateral coronoidectomy
3. Contralateral cornoidectomy (if necessary)
4. Lining of TMJ with temporalis fascia or cartilage
5. Reconstruction of ramus using costochondral graft
6. Rigid fixation of the graft
7. Early mobilization and aggressive physiotherapy

Leonard .B Kaban : protocol for the management of the temporomandibular joint ankylosis JOMS 48; 1145-1151 ;1990

Table 1. PROTOCOL FOR MANAGEMENT OF TMJ ANKYLOSIS IN CHILDREN

1. Aggressive excision of fibrous and/or bony mass
2. Coronoidectomy on affected side
3. Coronoidectomy on opposite side if steps 1 and 2 do not result in MIO of >35 mm or to point of dislocation of opposite side
4. Lining of joint with temporalis fascia or the native disc, if it can be salvaged
5. Reconstruction of RCU with either DO or CCG and rigid fixation
6. Early mobilization of jaw; if DO used to reconstruct RCU, mobilize day of surgery; if CCG used, early mobilization with minimal intermaxillary fixation (not >10 days)
7. Aggressive physiotherapy

Kaban ; protocol for the management of tmj ankylosis in children joms 67:1966-1978,2009

Intubation Techniques

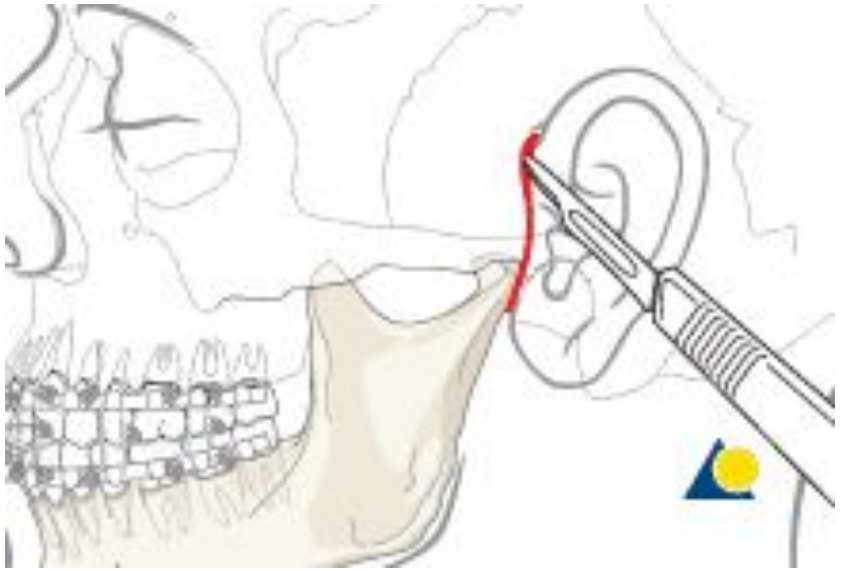
- Blind awake intubation
- Fibreoptic guided intubation
- Retrogade intubation
- Tracheostomy
- Light inhalation anesthesia with speedy release of ankyloses followed by intubation

SURGICAL APPROACHES

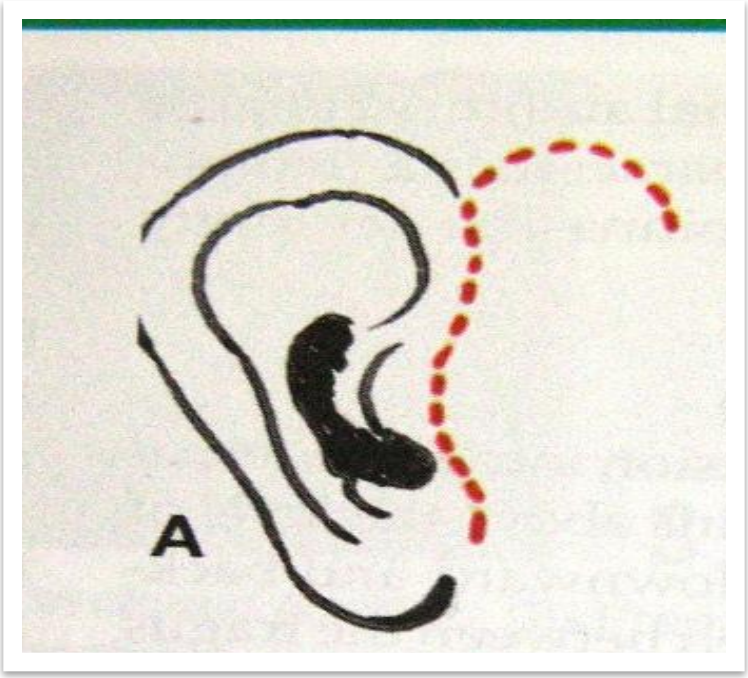
- PREAURICULAR
  - Alkyat bramley
  - Blair and Ivy
  - Thoma
  - Popowich
- POSTAURICULAR
- SUBMANDIBULAR
- POSTRAMAL (HIND'S)
- ENDAURAL
- RHYTIDECTOMY
- HEMICORONAL OR BICORONAL

Pre-auricular incision- Dingman

- The preauricular approach can be used to access and treat fractures in the mandibular condylar head and neck region.
- Many surgeons perform temporal mandibular joint (TMJ) surgery and routinely use this incision to access the superior portion of the mandibular condylar process.

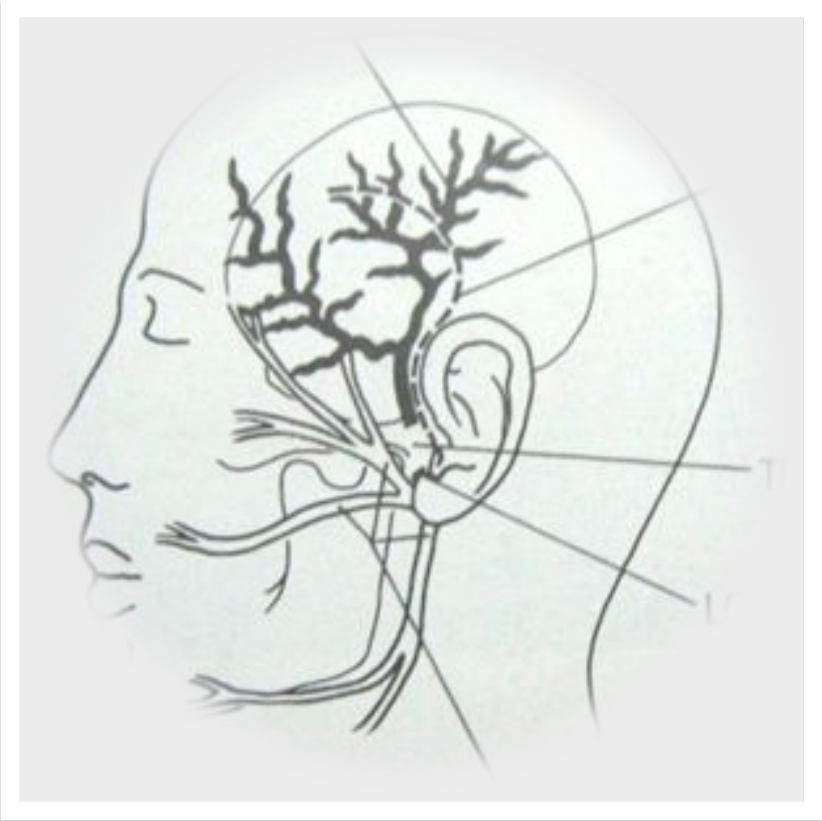


Blair and Ivy in 1936- inverted hockey stick

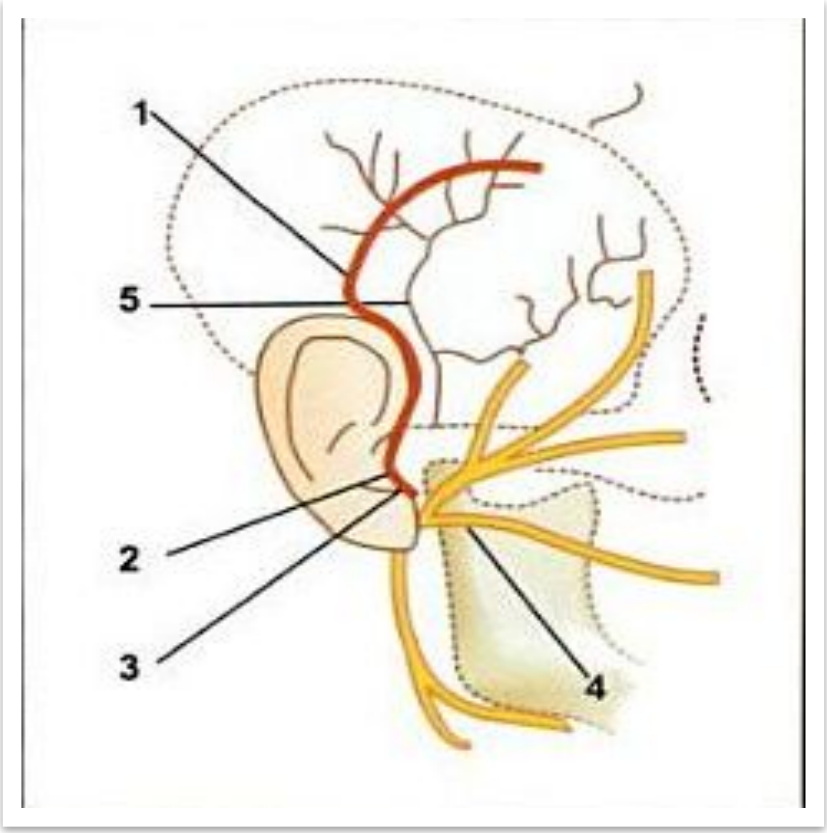


Thoma in 1958- angulated vertical incision

Al-Kayat & Bramley in 1979- modified preauricular approach

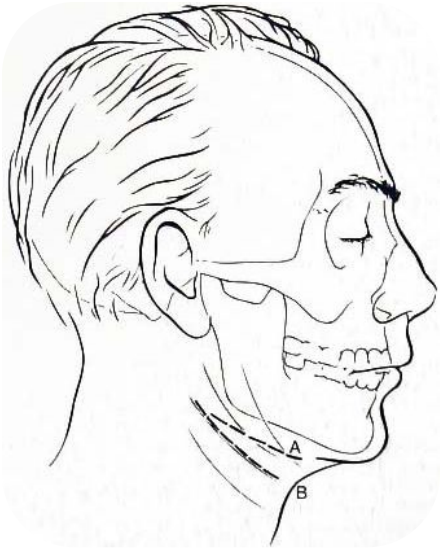


Popowich and Crane in 1982- question mark



Submandibular approach

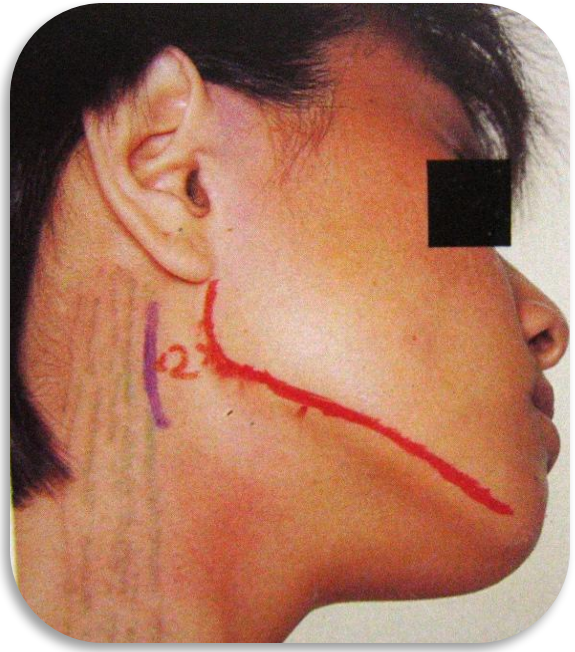
- Atleast 2cm below mandible



- In cases where access through preauricular approach alone may be unsatisfactory

Postramal incision (Hinds)

- Incision runs parallel and posterior to the ascending ramus at a distance of 2cm

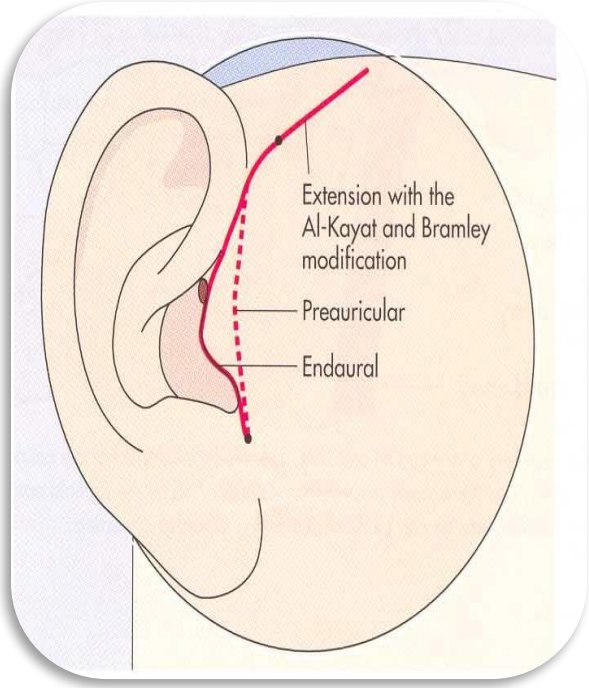


Coronal approach

- Versatile approach to the upper & middle regions of the facial skeleton
- Minimum complications
- Scar hidden within the hairline

Endaural incision

- Short facial skin incision with extension into the EAM
- Excellent cosmetics
- Limited access
- Possibility of meatal stenosis

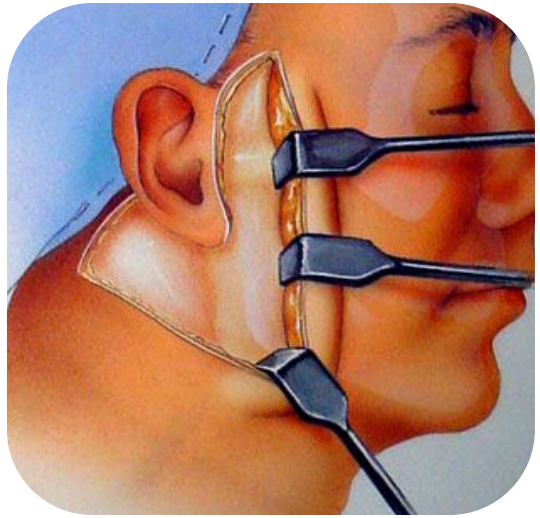


Postauricular approach

- Excellent exposure of the entire joint
- Ability to camouflage the scar in patients

Rhytidectomy approach- Zide & Kent

- The facelift approach provides the same exposure as the retromandibular and preauricular accesses combined



History

- A submandibular, retromolar approach to TMJ was described by Risdon in 1937
- A combined preauricular and coronal approach to TMJ by Poswillo in 1974
- The preauricular approach with temporal extension by Al Khayat and Bramley in 1981

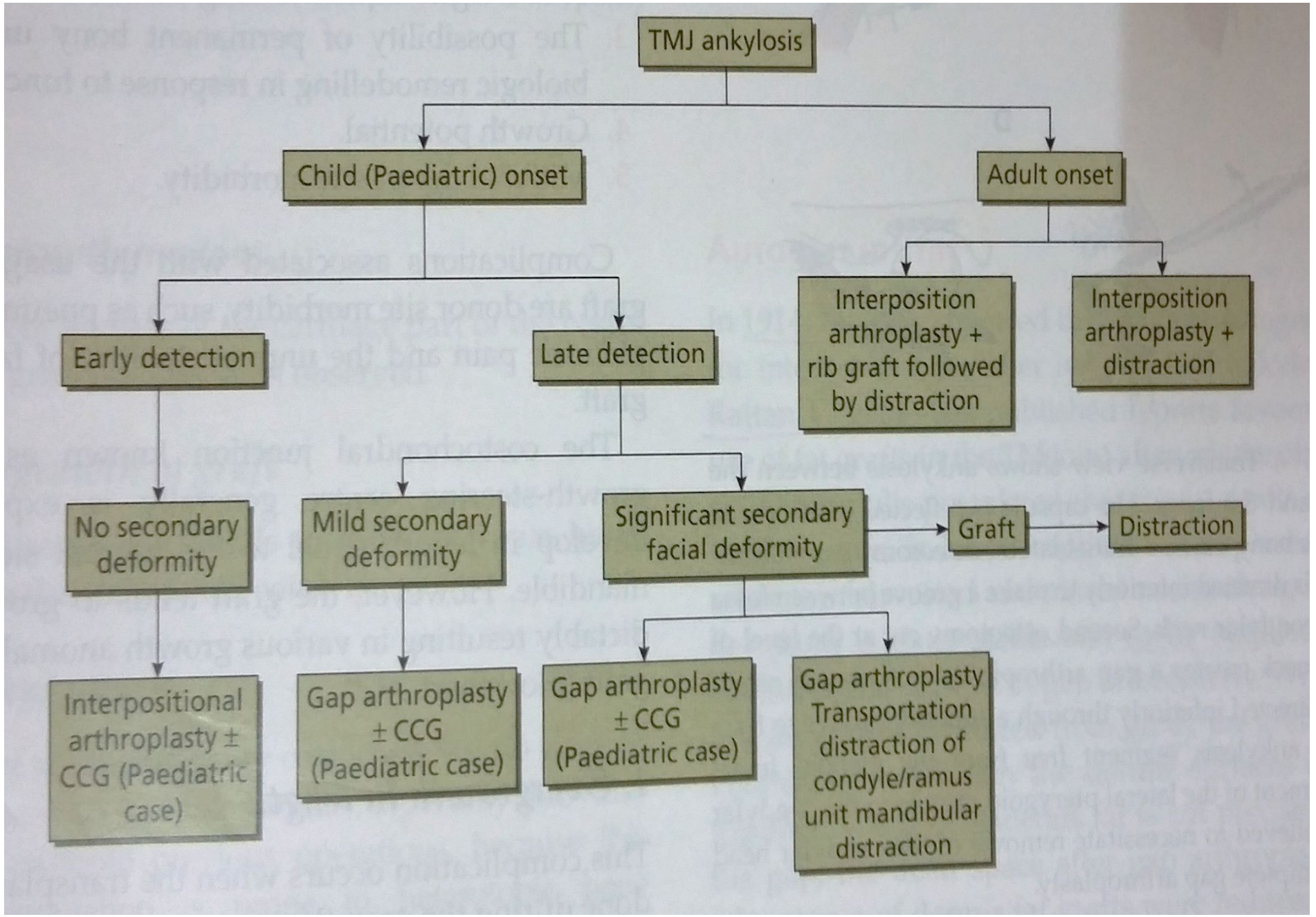
Objectives

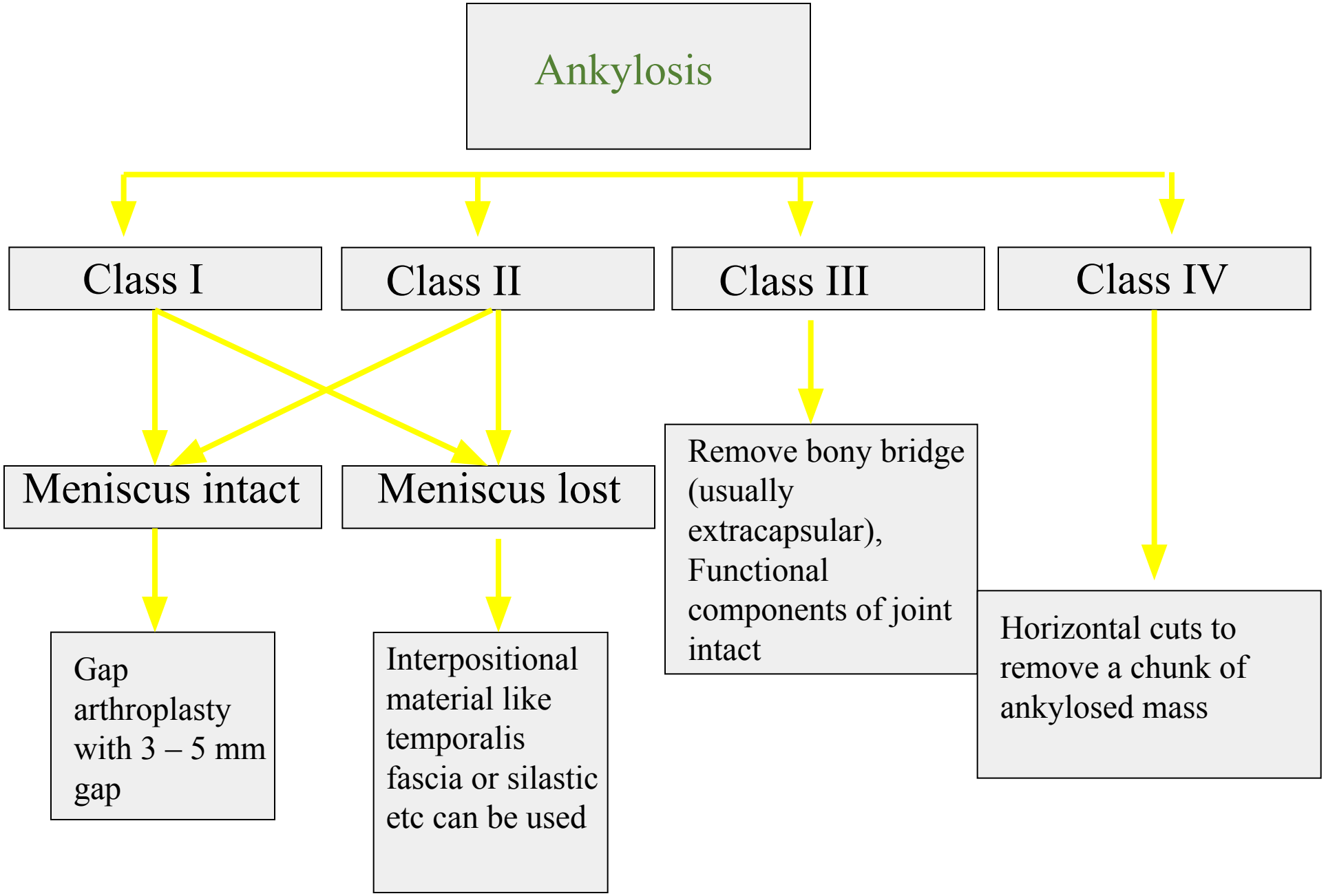
- Maximize exposure
- Prevent Facial nerve damage
- Prevent injury to major vessels
- Prevent parotid gland damage
- Maximize use of skin creases

TREATMENT OPTIONS

- Gap arthroplasty
- Interpositional arthroplasty
- Total joint reconstruction (TJR)

Reza Movahedet al, Management of Temporomandibular Joint Ankylosis; Oral Maxillofacial Surg Clin N Am 27 (2015) 27–35


TMJ ankylosis
Child (Paediatric) onset
Adult onset
Early detection
Late detection
Interposition arthroplasty + rib graft followed by distraction
Interposition arthroplasty + distraction
No secondary deformity
Mild secondary deformity
Significant secondary facial deformity
Graft
Distraction
Interpositional arthroplasty ± CCG (Paediatric case)
Gap arthroplasty ± CCG (Paediatric case)
Gap arthroplasty ± CCG (Paediatric case)
Gap arthroplasty Transportation distraction of condyle/ramus unit mandibular distraction



Sawhney 1986

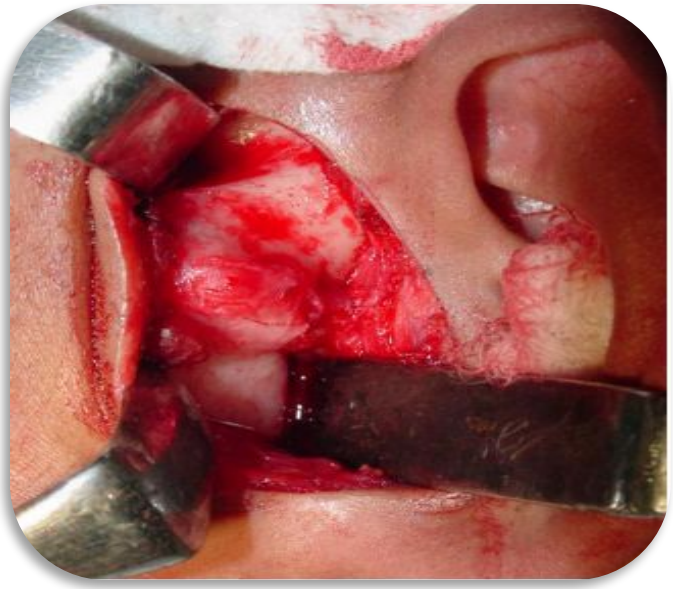
El – Sheikh 1999

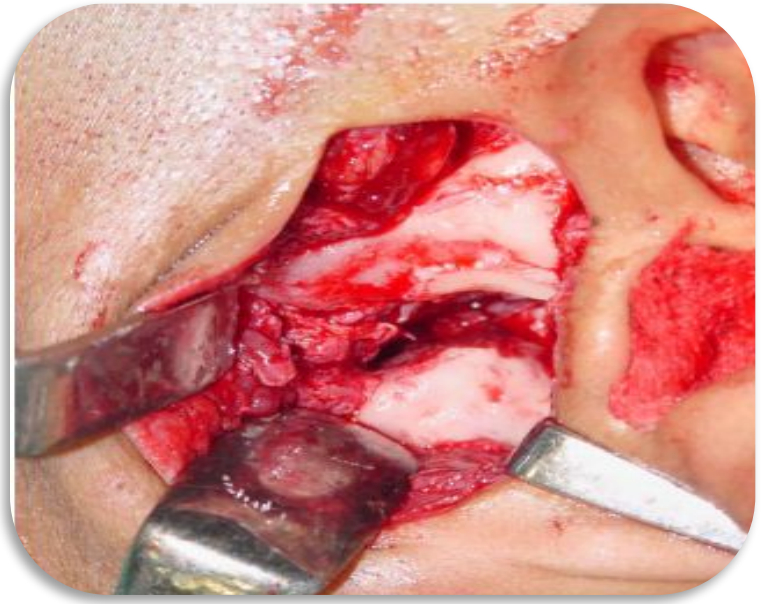
- Radical resection of the ankylosed mass via wide surgical exposure.
- Release of pterygo masseteric sling with resection of the condylar process.
- Restoration of the vertical ramal height and condylar head by CCG.
- Simultaneous correction of jaw bone deformities at the same time as release of the ankylosis.
- Careful selection of the patients who are expected comply with postoperative functional rehabilitation and regular follow up atleast 1 year.

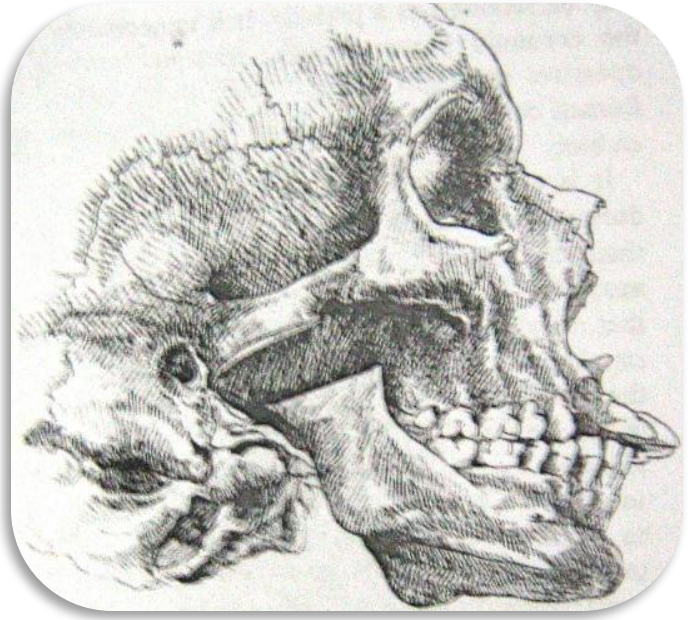
Gap arthroplasty

- Verneuil in 1826 was the first to do gap arthroplasty.
- The ankylotic mass is shaved to a flat ramus surface.
- If we find a cleavage line, it is used as the superior bony cut plane.
- If there is no cleavage line, an imaginary line through the lower border of the zygomatic arch is considered.
- A gap 7-9 mm wide is then created and measured with the mandible in a resting position.
- If the disc is present in good condition it is used to line the glenoid fossa at the gap.

Ahmed; Conservative gap arthroplasty in temporomandibularankylosis not involving the sigmoid notch:a selected age group study; British Journal of Oral and Maxillofacial Surgery (2016) 1–6







Advantages

- Simplicity
- Short operating time

Disadvantages

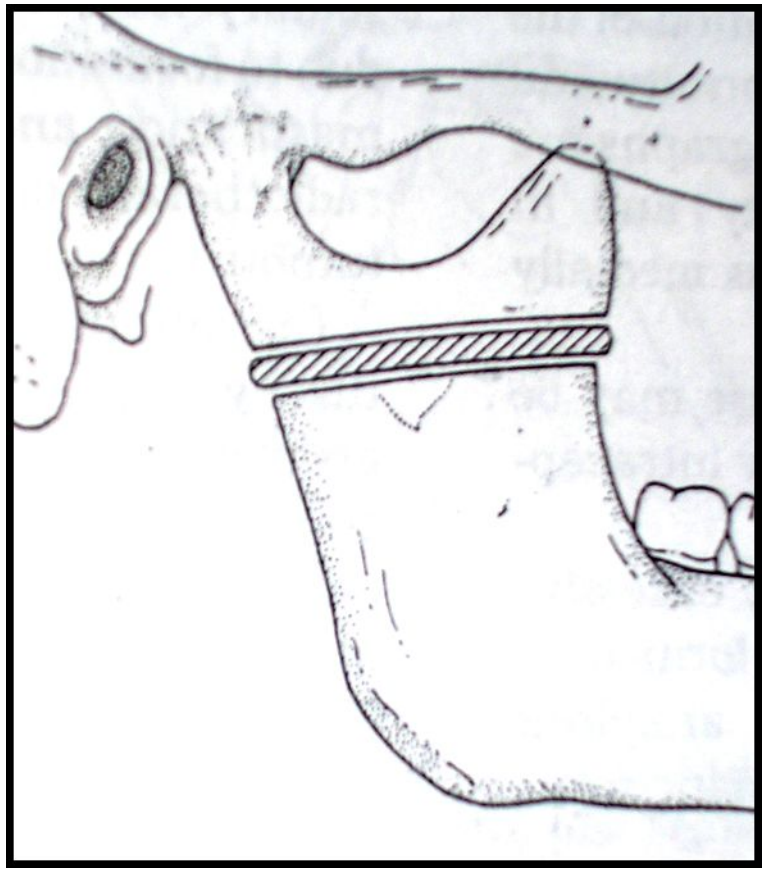
- Pseudo-articulation
- Short ramus height
- Failure to remove all bony disease
- Development of open bite
- Recurrent ankylosis (60%)

Vasconcelos et al; Treatment of temporomandibular joint ankylosis by gap arthroplasty **;** Med Oral Patol Oral Cir Bucal 2006;11:E66-9.

Interpositional arthroplasty

- First introduced by Verneuil in 1860

It minimizes reduction in the vertical height of ramus and reduce the risk of relapse and malocclusion



Junli Ma et al; Interpositional arthroplasty versus reconstruction arthroplasty for tmj ankylosis: A systematic review and meta-analysis; J of Cranio-Maxillo-Facial Surgery 43 (2015) 1202e1207

Interpositional materials

Autogenous	Allogenous	Alloplastic
Costochondral	Chromatized submucosa of pig bladder	Metallic- tantalum foil/ plate
Metatarsal	Lyophilized bovine cartilage	316L stainless steel
Sternoclavicular		Titanium
Auricular cartilage		Gold
Temporal fascia		Nonmetallic
Fascia lata		Silastic
Dermis Temporalis muscle		Teflon
		Acrylic
		Nylon
		Proplast
		Ceramic implants

Ideal requisites of interpositional materials

- Cost effective
- Cosmetic consequences of harvesting should be minimal
- Stable under masticatory force
- Minimal risk of infection
- Obliterate dead space
- Prevent recurrence caused by heterotrophic calcification

Basal et al; Interpositional arthroplasty versus reconstruction arthroplasty for temporomandibular joint ankylosis: A systematic review and meta-analysis BJOMS 2015

Disadvantages of interpositional materials

Alloplastic materials

- Foreign body reaction
- Instability
- Infection
- Extrusion

Autogenous materials

- All have some donor site morbidity
- Muscle flaps tend to contract and become fibrous
- Cartilage may calcify
- Thin grafts such as skin, dermis and auricular cartilage may not maintain the height of the ramus adequately, and may perforate under pressure from the condyle

Lokesh Babu et al; Is aggressive gap arthroplasty essential in the management of tmj ankylosis?—a prospective clinical study of 15 cases; *BJOMS 51 (2013) 473–478*

Temporalis fascia

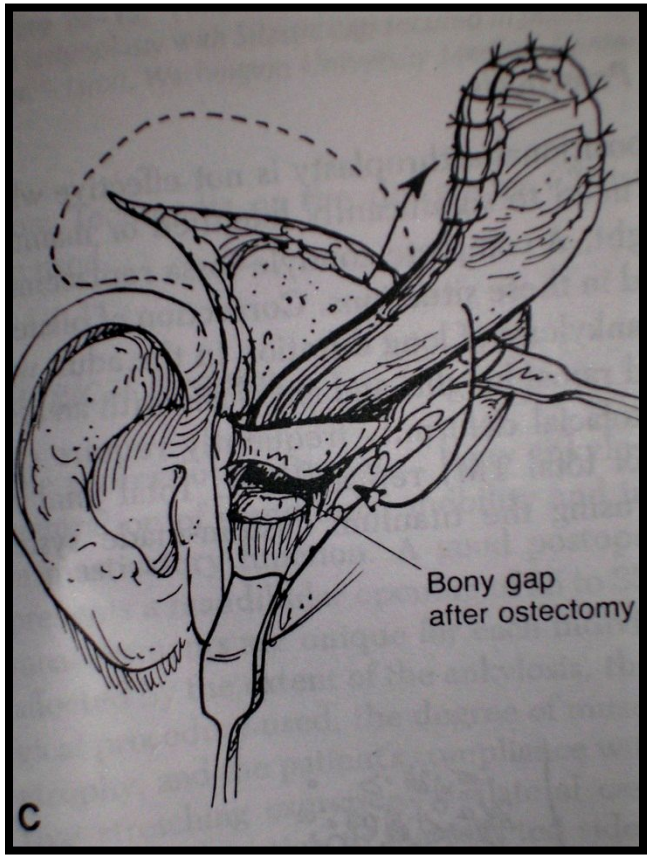
- The deep temporal fascia is supplied by the middle temporal artery, a branch of the superficial temporal artery.

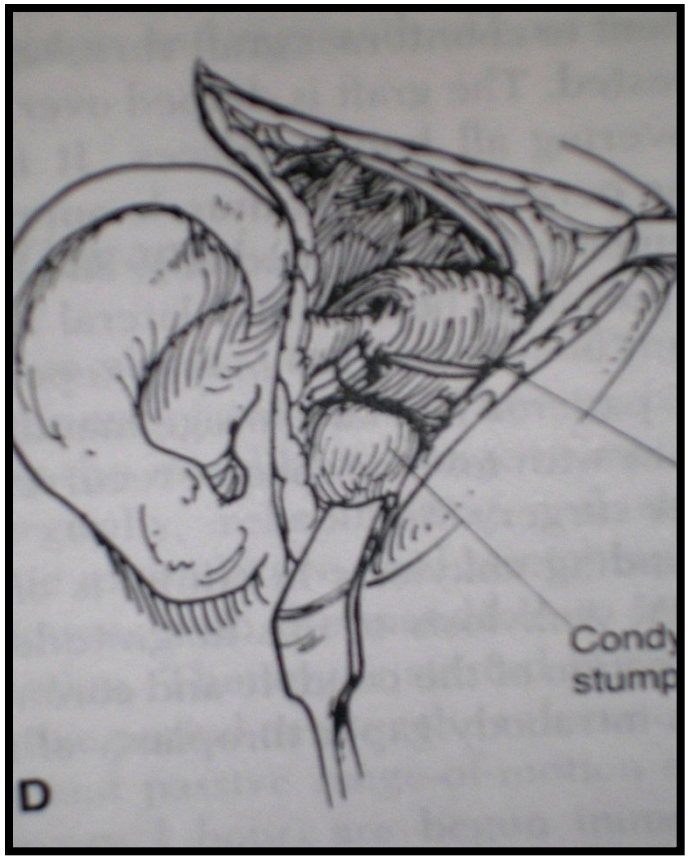
- A temporal fascia (vascularised) flap is a locally available axial pattern flap that has fewer chances of absorption and fibrosis.

Advantages :

- Relatively simple and easy to raise
- Rich blood supply
- Minimal donor site morbidity
- The donor site was close at hand, and it was always available

Lokesh Babu etal; Is aggressive gap arthroplasty essential in the management of temporomandibular joint ankylosis?—a prospective clinical study of 15 cases; *BJOMS 51 (2013) 473–478*

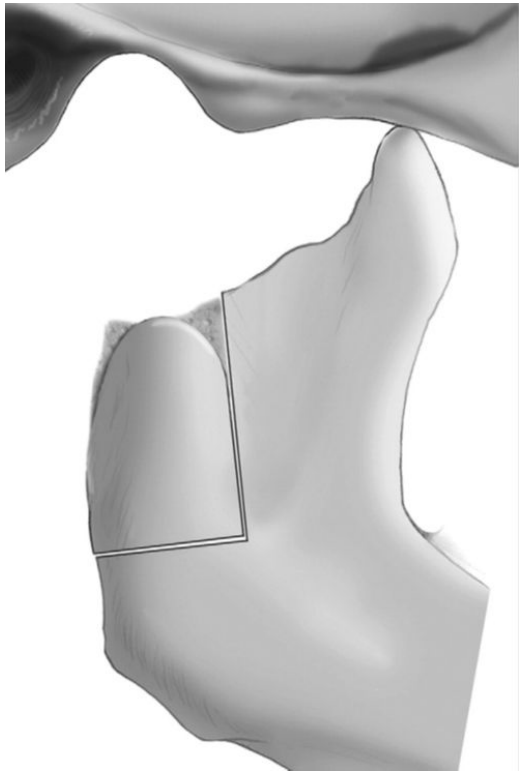




K. Su-Gwan: Treatment of temporomandibular joint ankylosis with temporalis muscle and fascia flap. Int. J. Oral Maxillofac. Surg. 2001; 30: 189–193.

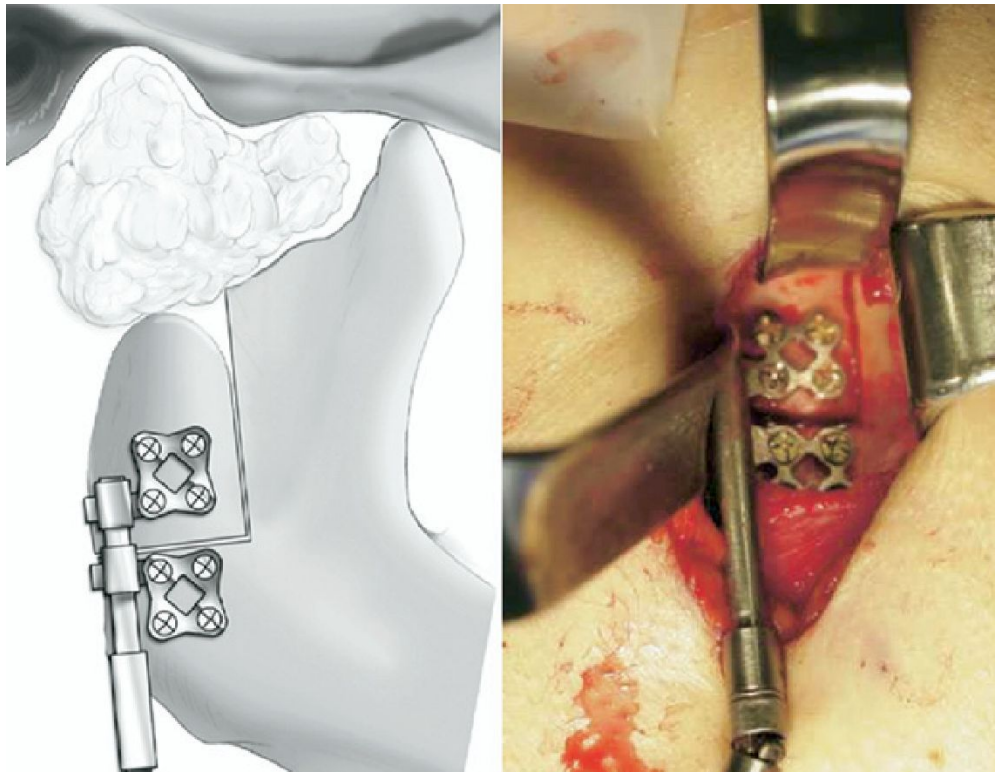
Distraction Osteogenesis for TMJ Reconstruction

- An L-osteotomy is used to create the transport disc.
- The vertical limb of the “L” parallels the vector that will take the disc into the glenoid fossa.
- The superior portion of the disc is rounded to make a new articular surface.
- A small portion of the osteotomy is left incomplete to stabilize the disc during placement of the distractor.
- The vascular attachments on the medial aspect of the disc are maintained.



Harry C. Schwartz, and Robert J. Relle, Distraction Osteogenesis for Temporomandibular Joint Reconstruction J Oral Maxillofac Surg 66:718-723, 2008

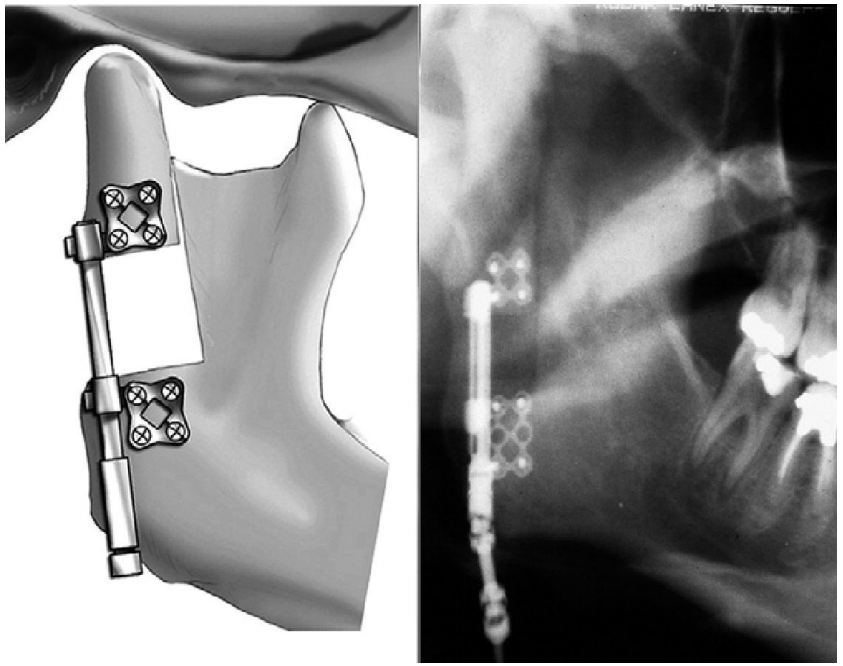
- A distractor length ranged between 13 and 30 mm is used.
- Attachment plates are chosen and trimmed according to the anatomy. At least 3 screws are placed in each plate.
- The dead space is filled with a fat graft (left) or temporalis flap, to inhibit heterotopic bone formation.



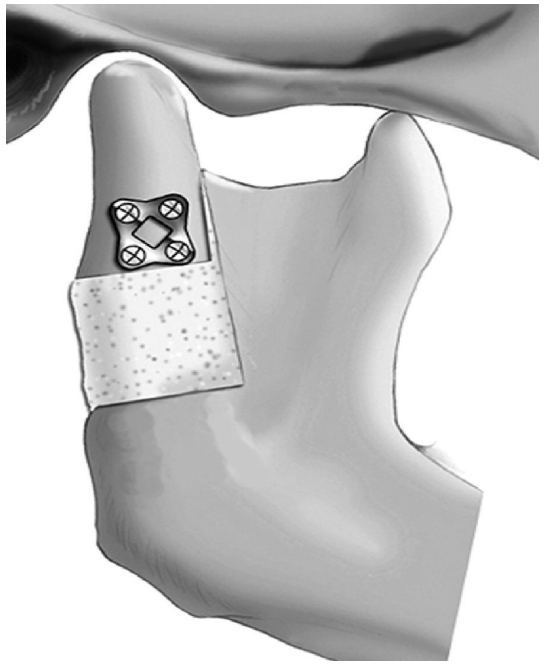
Harry C. Schwartz, and Robert J. Relle, Distraction Osteogenesis for Temporomandibular Joint Reconstruction J Oral Maxillofac Surg 66:718-723, 2008

- The distraction rod is brought through the skin of the neck through a separate stab incision.
- After a latency period of 7 days, distraction of 0.5 mm is carried out twice daily.
- Mobilization is begun immediately and maintained throughout distraction.
- This is a major advantage of the technique.

Harry C. Schwartz, and Robert J. Relle, Distraction Osteogenesis for Temporomandibular Joint Reconstruction J Oral Maxillofac Surg 66:718-723, 2008



Distraction is discontinued when the occlusion reaches the desired position. Overcorrection may be used. The activation rod is removed or cut short below the skin. The distractor acts as a rigid fixator while callus produces new bone in the distraction gap.



After 3 months, the distractor is removed through the same submandibular incision. The superior attachment plate has moved far from the incision and is left in place. Callus in the distraction gap has formed woven bone, which is remodelling into solid lamellar bone.

Harry C. Schwartz, and Robert J. Relle, Distraction Osteogenesis for Temporomandibular Joint Reconstruction J Oral Maxillofac Surg 66:718-723, 2008

Advantage of DO

- Eliminates donor site morbidity
- Allows immediate mobilization of the jaw
- Relapse rate is much less
- Early mobilization

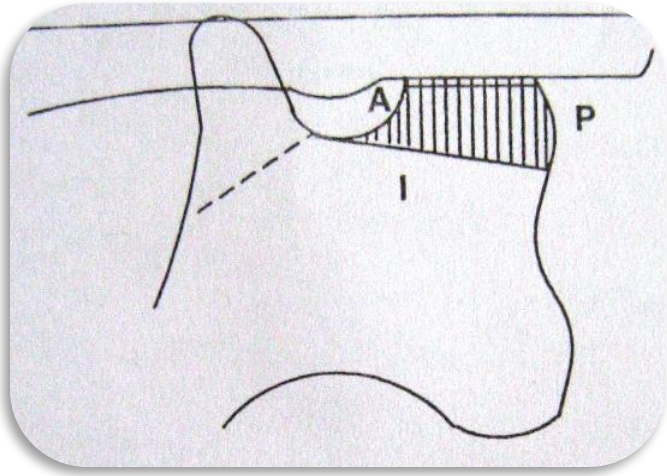
Disadvantage

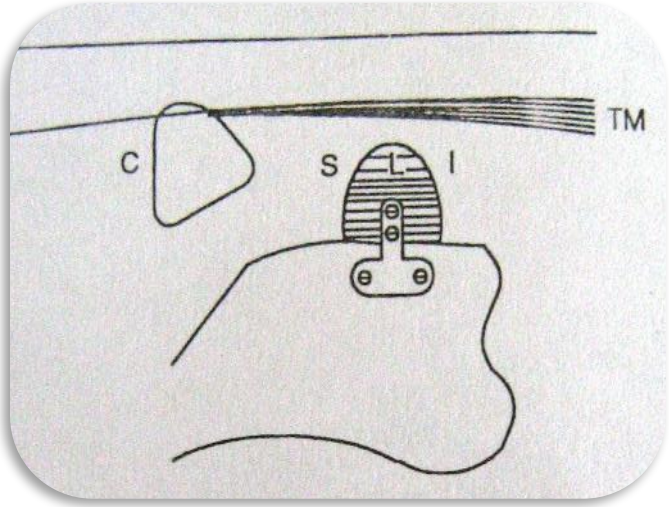
- Additional operations might be necessary to correct any residual asymmetry after the end of growth
- Duration is longer
- Patients compliance
- Device failure
- Infection

Kaban et al; A Protocol for Management of Temporomandibular Joint Ankylosis in Children; *J Oral Maxillofac Surg 67:1966-1978, 2009*

Residual ankylotic mass

- The reconstruction of the condyle with ankylotic bone was first described by Gunaseelan in 1997

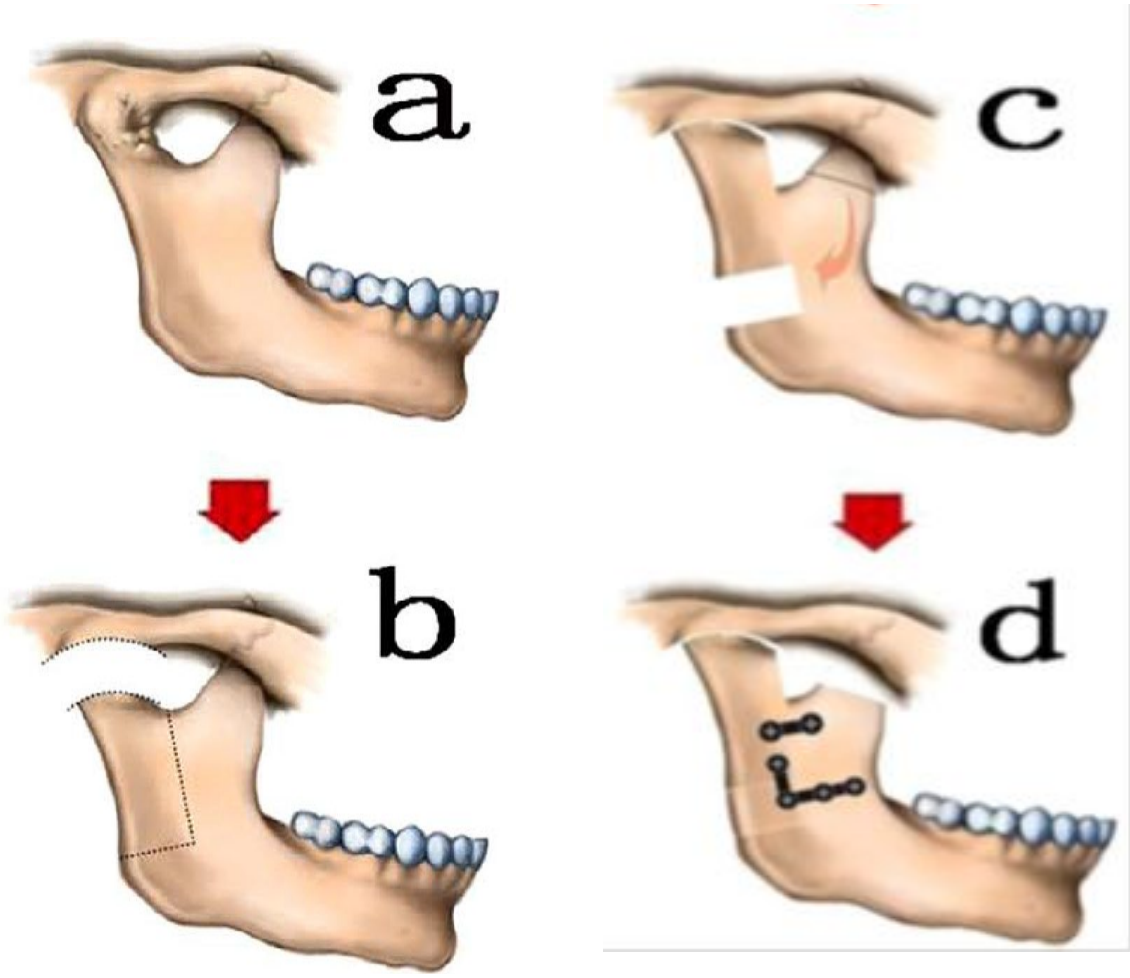




Bansal etal; Coronoid process and residual ankylotic mass as anautograft in the management of ankylosis of thetemporomandibular joint in young adolescent patients:a retrospective clinical investigation ; BJOMS 54 (2016) 280–285

Sliding reconstruction of the condyle using posterior border of mandibular ramus in TMJ ankylosis

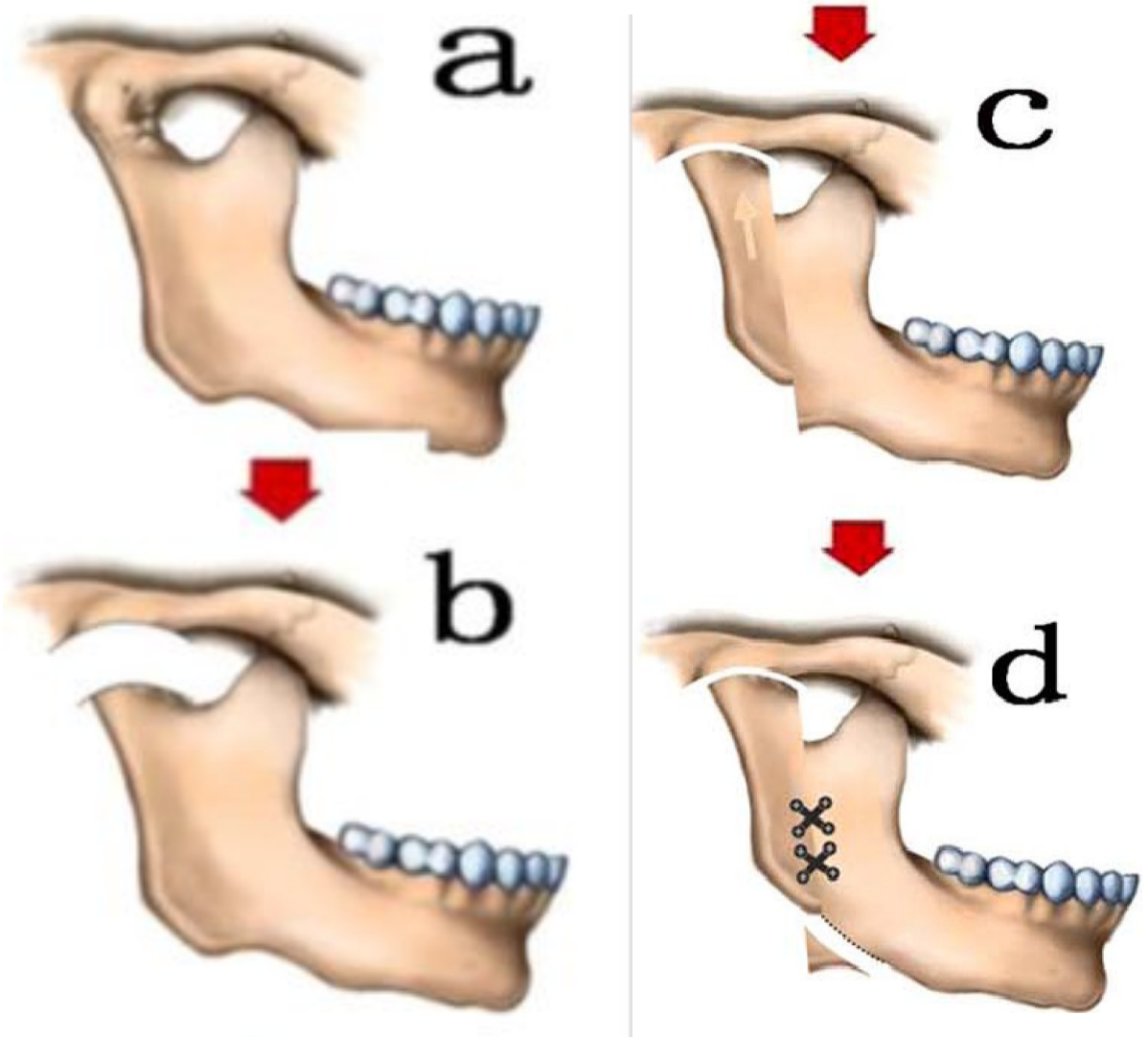
- Vertical osteotomy was performed on the proximal posterior border of the mandibular ramus till 1.0 cm above the angle and the osteotomized segment was moved up.
- The ipsilateral autogenous coronoid was implanted in the gap and fixed with titanium miniplates.



Y. Liu, A. et al: Sliding reconstruction of the condyle using posterior border of mandibular ramus in patients with temporomandibular joint ankylosis. Int. J. Oral Maxillofac. Surg. 2011; 40: 1238–1245.

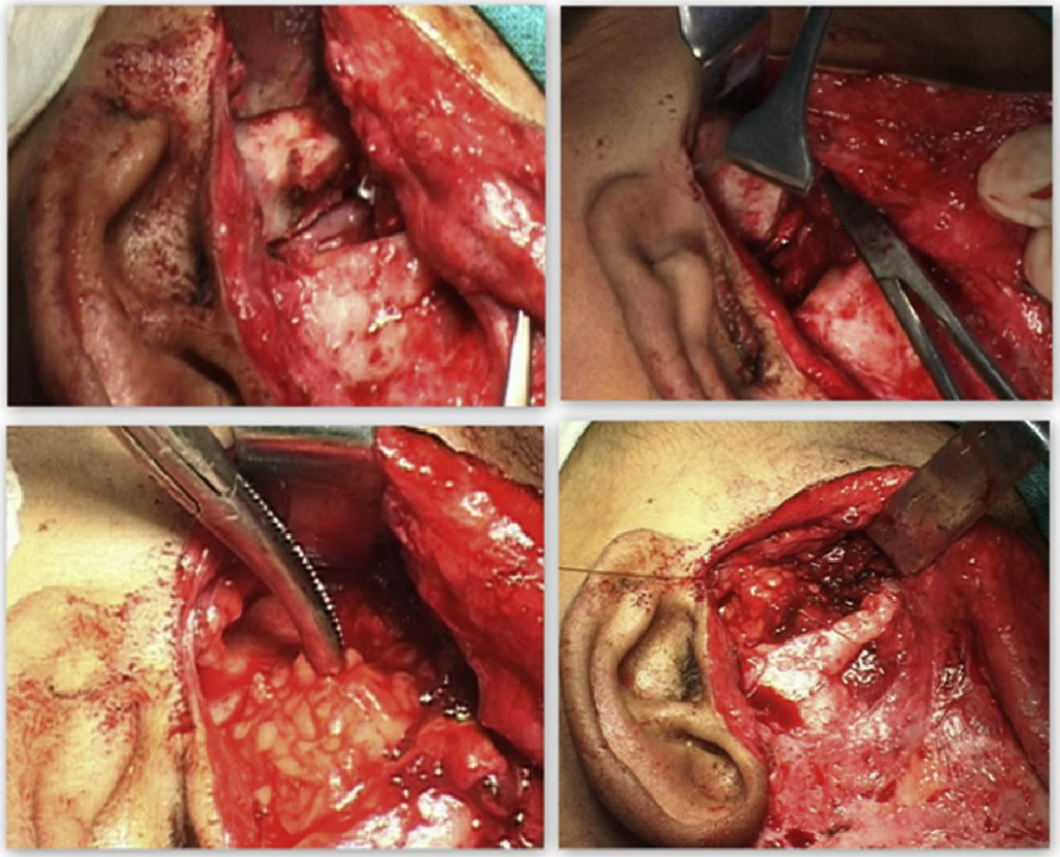
The bony block and prominent antegonial notch.

- The bony block was resected and the glenoid fossa was recreated.
- Vertical osteotomy was performed on the entire posterior border of the mandibular ramus and then moved up.
- Fixation of the bone graft with titanium miniplates and resection of prominent antegonial notch.



Y. Liu, A. et al: Sliding reconstruction of the condyle using posterior border of mandibular ramus in patients with temporomandibular joint ankylosis. Int. J. Oral Maxillofac. Surg. 2011; 40: 1238–1245.

Buccal fat pad



Advantages

- Less chance of resorption
- Good long term interpositional material

The long-term fate of pedicled buccal pad fat used for interpositional arthroplasty in TMJ ankylosis; J of Plast, Reconst & Aesthetic Surgery (2012) 65, 1468e1473

Coronoid process- Youmans and Russell 1969

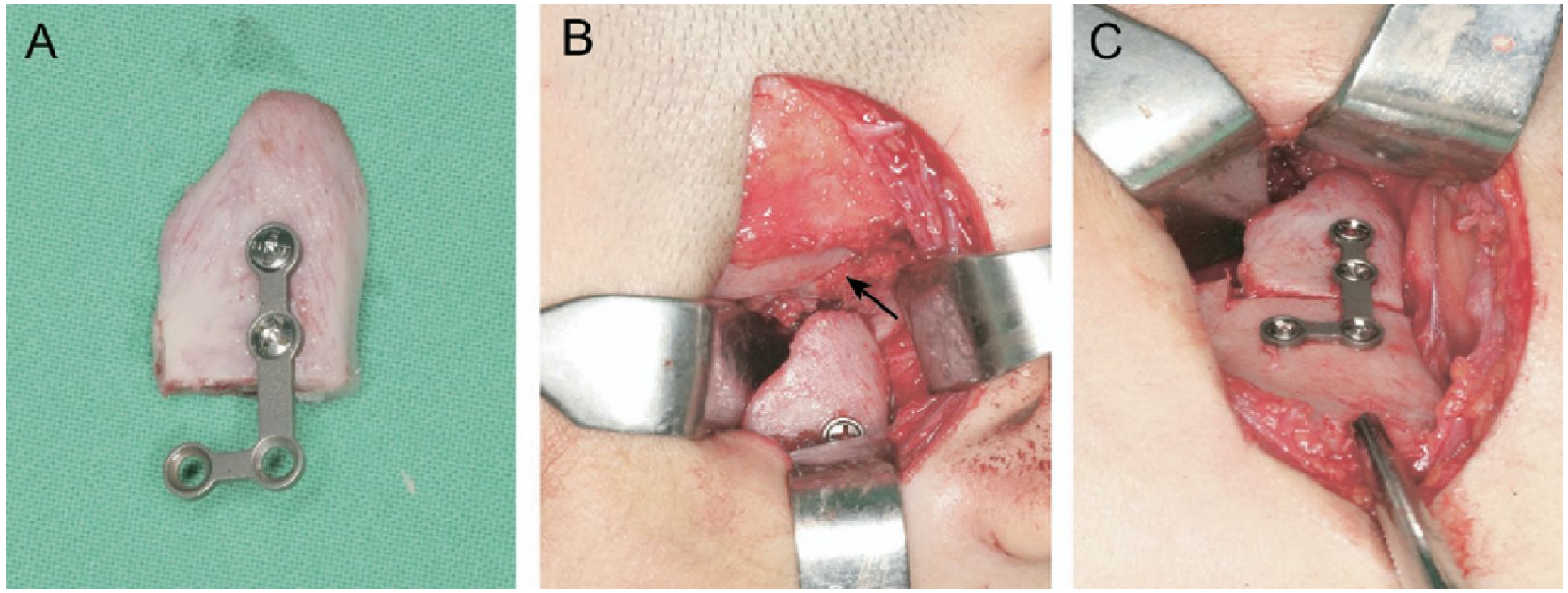
- In patients with ankylosis of the TMJ the coronoid is thicker than the normal one, so it can provide sufficient strength for loading of the TMJ after condylar replacement.

- Avoids a second surgical site and the related donor-site complications, which facilitated the operation and reduced the intervention.

- Less resorption

Zhu et al; Free grafting of autogenous coronoid process for condylar reconstruction in patients with temporomandibular joint Ankylosis; (Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2008;106:662-7)

A: The coronoid process prepared for grafting. **B:** The use of native articular disc as an interpositional tissue (*arrow*). **C:** The fixation of coronoid process.



Zhu et al; Free grafting of autogenous coronoid process for condylar reconstruction in patients with temporomandibular joint Ankylosis; (Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2008;106:662-7)

Fat Graft

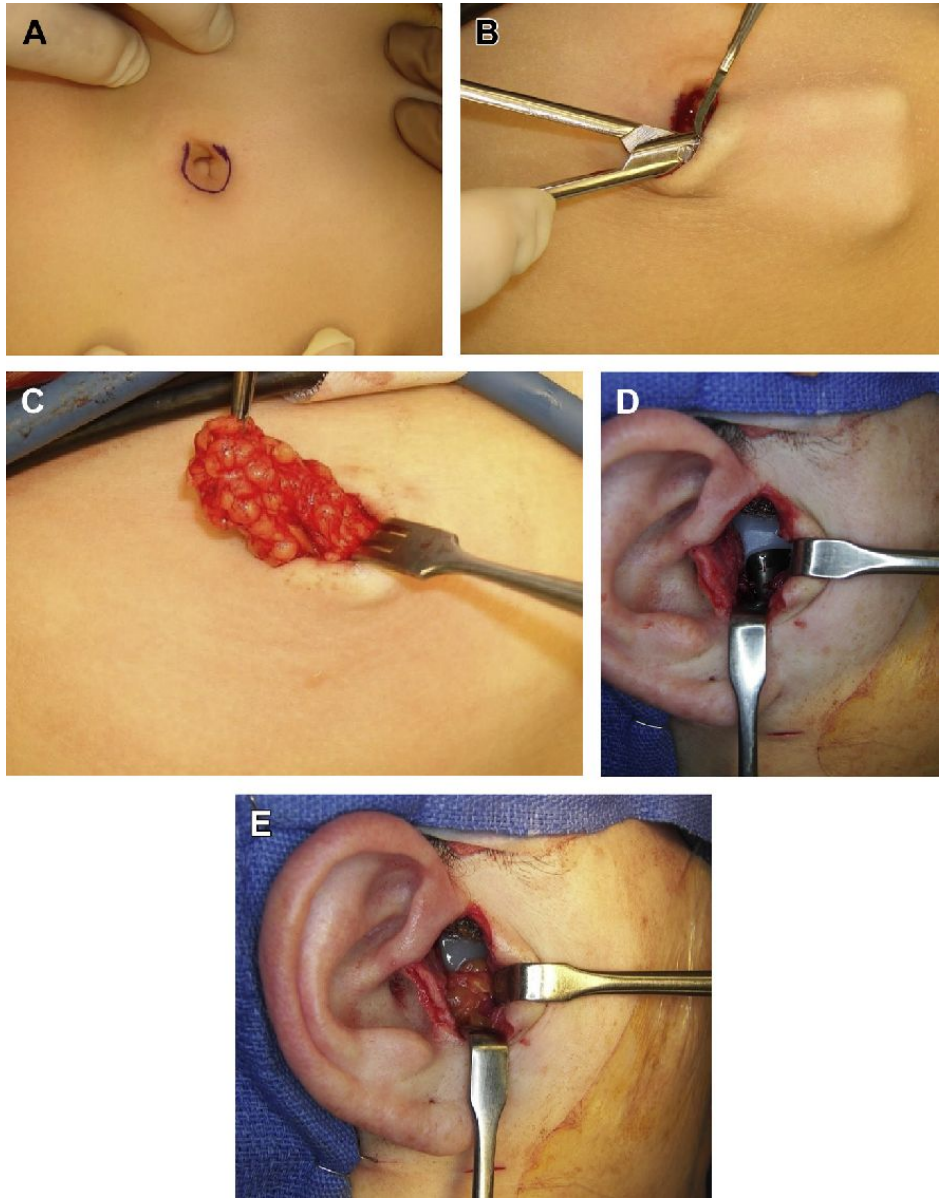
(A) Marked periumbilical incision for harvest of abdominal fat graft.

(B) Undermining of skin and fat before harvest.

(C) Composite harvest of abdominal fat.

(D)Exposure of graft site for circumferential augmentation of fat graft.

(E) Adaptation of fat graft before closure



Reza Movahed et al, Management of Temporomandibular Joint Ankylosis; Oral Maxillofacial Surg Clin N Am 27 (2015) 27–35

TMJ RECONSTRUCTION

Goals

- Restoration of normal joint function
- Restoration normal posterior vertical dimensions and length
- Stable skeletal occlusal relationship
- Maintenance of facial symmetry
- Lifetime maintenance of restored function, comfort and esthetics

Autogenous TMJ replacement

- 1909 – Bardenheur - replaced condyle - 4th metatarsal
- 1920 - Gillies used costochondral graft

Donor site alternatives

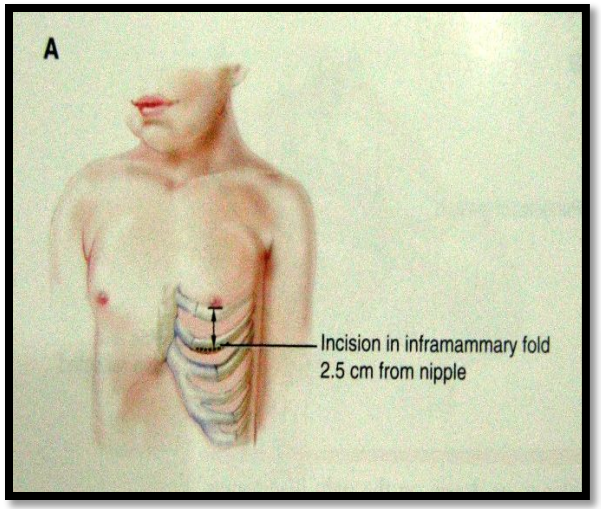
Ramus condylar unit

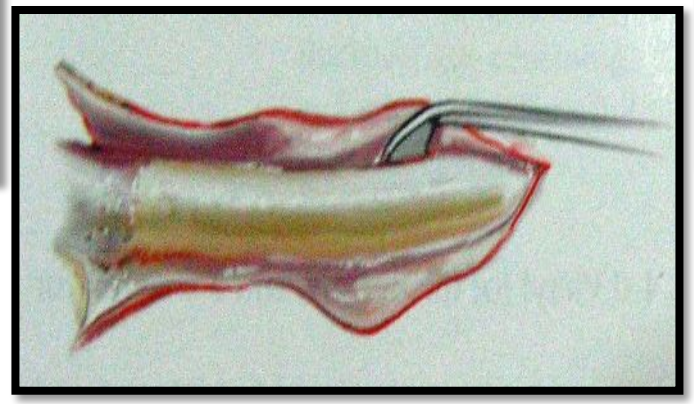
- Costochondral graft
- Metatarsal graft
- Sternoclavicular joint graft
- Fibula graft
- Iliac graft

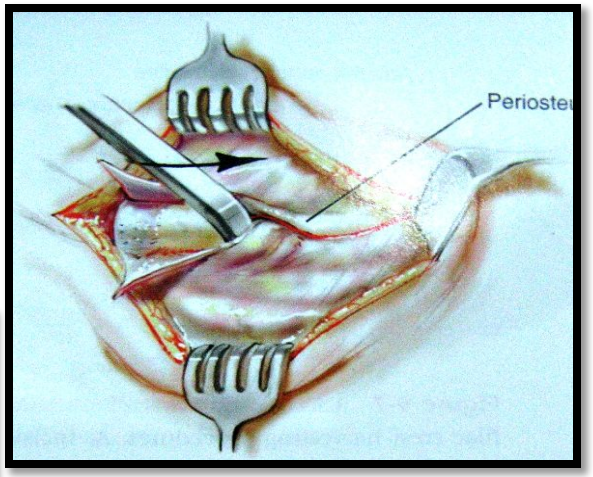
Glenoid fossa lining

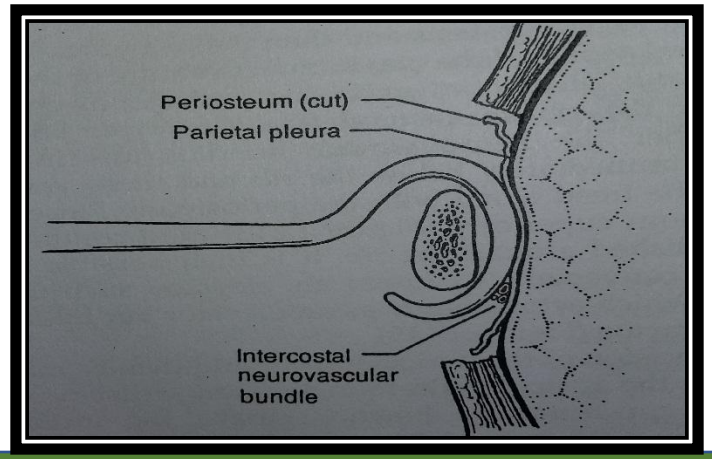
- Dermis graft
- Auricular cartilage graft
- Temporalis myofascial flap

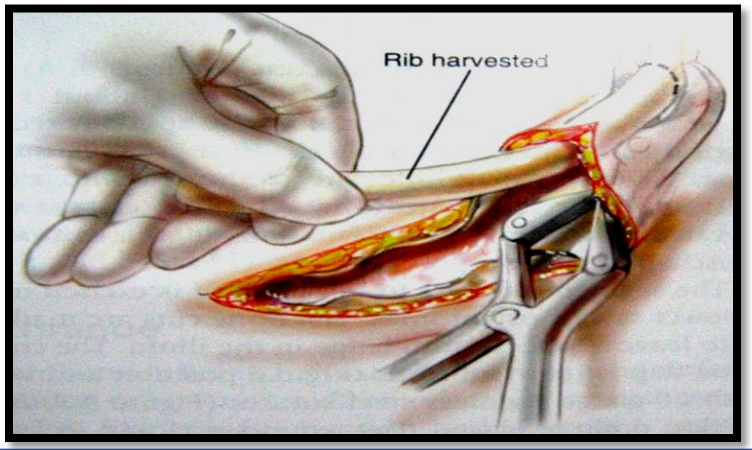
RCU reconstruction- CCG











CCG

Advantages:

- Most widely used
- Has a cartilage cap, mimicking both the bone and cartilaginous components
- Has intrinsic growth potential
- Easy accessibility and adaptation
- Gross anatomical similarity to the mandibular condyle

Limitations:

- Unpredictable growth
- Poor bone quality
- Possible separation of cartilage from bone

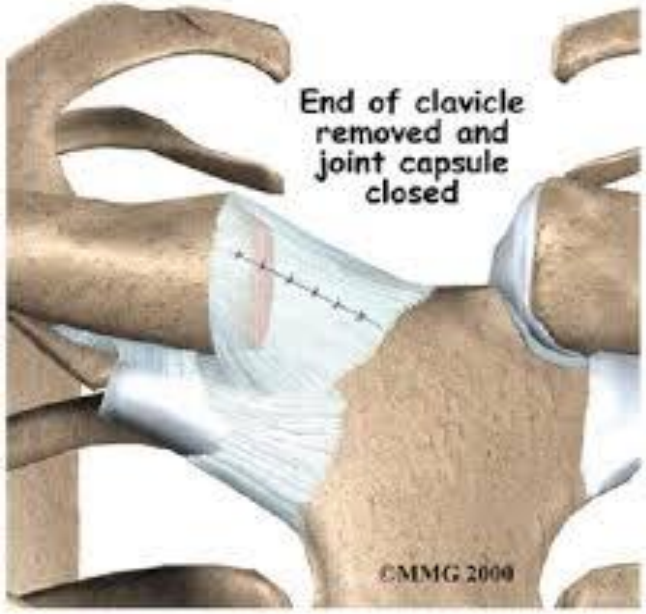
Donor-site complications:

- Pleural tear
- Pneumothorax
- Pleural effusion

Sternoclavicular

Advantages

- Similar anatomical and physiological characteristics.
- Consists of a cartilaginous cap.
- Option for a whole joint graft.
- Has the potential for growth.
- Probability of regeneration at donor site



Donor site complications:

- Damage to the great vessels.
- Instability of the clavicle under stress with resulting shoulder instability.
- Clavicle fracture.

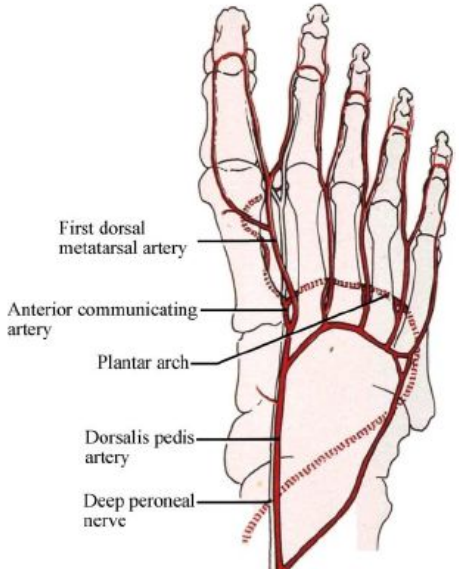
Metatarsophalangeal

Advantages:

- Combination of articular cartilage and bone.
- Fitting anatomy because of small size.
- Has potential for growth.

Donor-site complications:

- Aesthetic loss of a toe.
- MTP joint being a simple hinge joint does not follow the same movements as the TMJ



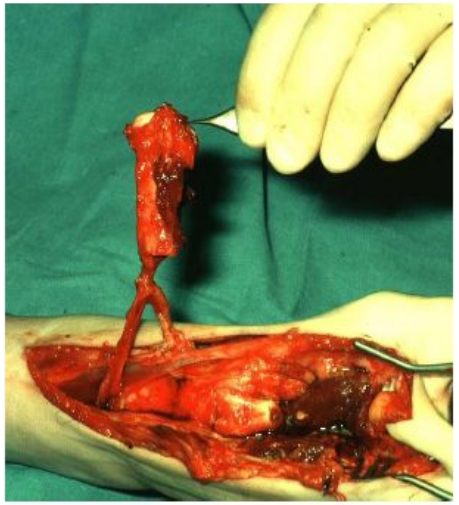
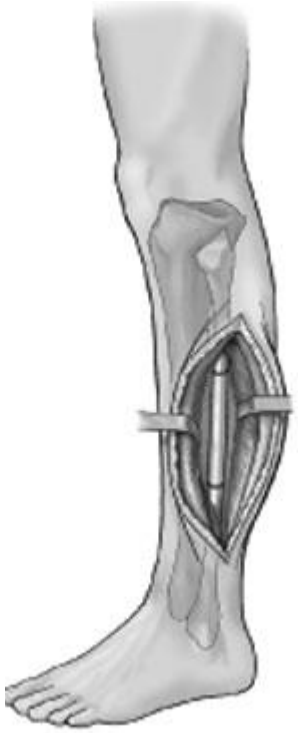


Figure 2 Disarticulated second metatarsal before division of the pedicle.

Fibula

Advantages

- Tubular in shape and densely cortical.
- Vascularized graft has better survival rate.
- More suitable for large mandibular defects



Limitations

- Lacks articular cartilage

Donor-site complications

- Ankle stiffness, instability and weakness
- Numbness of the lateral side of the leg
- Pedal ischaemia and foot oedema

Iliac crest

Advantages:

- Has a cartilage cap, mimicking both the bone and cartilaginous components.
- Has potential for growth
- More suitable for large mandibular defects

Donor-site complications:

- Altered gait
- Poor scar
- Ilium fracture
- Peritonitis
- Retroperitoneal haematoma

Alloplastic joint replacements

History

- 1840– John Murray treated ankylosis - wood block
- 1890– Gluck - ivory prosthesis
- 1933 – Risdon – gold foil
- 1947 – Goodsell - titanium foil
- Total joint - Kent-Vitek prosthesis in 1970
- Christensen – 1964 - lined glenoid fossa —vitallium
- Chase – 1995 - chromium cobalt head

Protocol for joint replacement

- Release the ankylosed joint.
- Remove the heterotopic and reactive bone with thorough debridement.
- Reconstruct the TMJ with a total joint prosthesis.
- Pack a fat graft around the articulation area of the prosthesis.
- Perform indicated orthognathic surgery in a single surgery.

Wolford et al; Temporomandibular Joint Ankylosis Can Be Successfully Treated With TMJ Concepts Patient-Fitted Total Joint Prosthesis and Autogenous Fat Grafts; j.joms.2016.01.017

Indications

- Ankylosed, degenerated or resorbed joints with severe anatomic discrepancies.
- Failed autogenous bone grafts.
- Recurrent ankylosis

Relative contraindications

- Patient age
- Lack of understanding of the patient
- Uncontrolled systemic disease
- Allergic to materials used in devices
- Active infection at implantation site

Advantages

- Physical therapy can begin immediately.
- No need for second donor site.
- Reduced surgical time.
- Alloplasts – mimic normal anatomic contours, better adapted to the bony surfaces.
- Stable occlusion post-operatively.
- Decreased hospital stay.
- Opportunity to manipulate prosthesis design to discourage heterotrophic bone formation

Wolford et al; Temporomandibular Joint Ankylosis Can Be Successfully Treated With TMJ Concepts Patient-Fitted Total Joint Prosthesis and Autogenous Fat Grafts; j.joms.2016.01.017

Disadvantages

- Cost of prosthesis
- Material wear and failure
- Long term stability
- Inability to follow patients growth
- Potential for severe giant cell reactions
- Fit limitations of stock prosthesis

Muralee Mohan et al; RECONSTRUCTION OF CONDYLE FOLLOWING SURGICAL CORRECTION OF TEMPOROMANDIBULAR JOINT ANKYLOSIS: CURRENT CONCEPTS AND CONSIDERATIONS FOR THE FUTURE; NUJHS Vol. 4, No.2, June 2014, ISSN 2249-7110

Alloplastic TMJ prosthesis

- Fossa prosthesis
- Condylar prosthesis
- Total joint prosthesis

- Kent- Viket
- Synthes
- Delrin -Timesh
- Christensen
- Biomet Lorenz

Alloplastic condylar prostheses. *Left to right:* Kent-Vitek, Synthes, Delrin-Timesh, Type I–Christensen, Type II–Christensen, and Biomet-Lorenz.

Biomet Lorenz Prosthesis

- The mandibular component is manufactured from Co-Cr alloy with a roughened titanium plasma coating on the host bone side of the ramal plate

- The condylar component is secured to the ramus with self retaining, cross drive 2.7-mm self-tapping bone screws made of titanium alloy

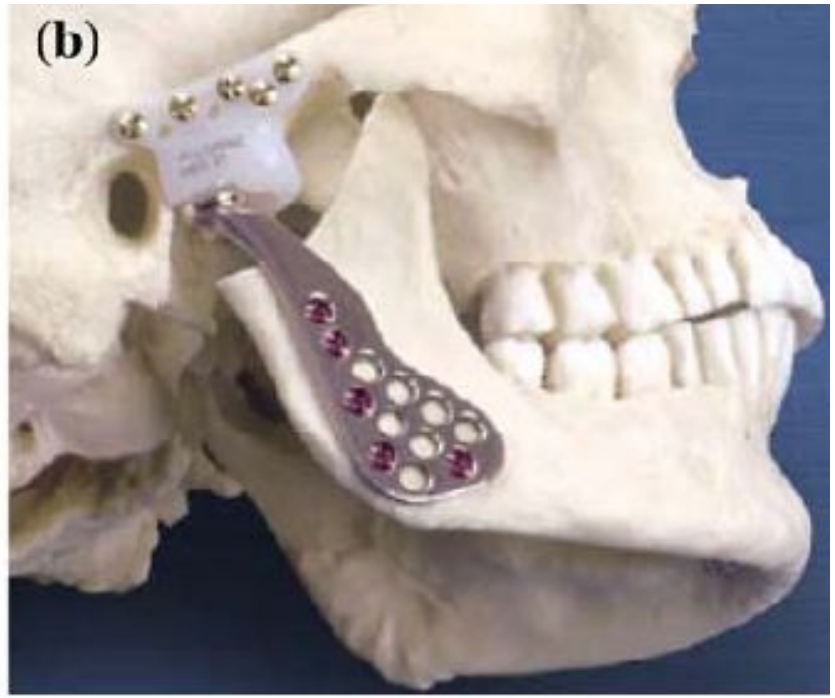
- The ramus of the mandibular component is currently manufactured in lengths of 45 mm, 50 mm, and 55 mm

Muralee Mohan et al; RECONSTRUCTION OF CONDYLE FOLLOWING SURGICAL CORRECTION OF TEMPOROMANDIBULAR JOINT ANKYLOSIS: CURRENT CONCEPTS AND CONSIDERATIONS FOR THE FUTURE; NUJHS Vol. 4, No.2, June 2014, ISSN 2249-7110

- The fossa component is manufactured from a specific grade of ultrahigh molecular weight polyethylene called Arcom manufactured by Biomet.

- The fossa is fixed to the zygomatic arch with self-retaining, self tapping 2-mm cross drive screws

Lorenz Prosthesis



Christensen

- The Christensen TMJ fossa eminence prosthesis (FEP) is designed to be used alone as a partial joint for treatment of
  - Severe internal derangement
  - Adhesions
  - Disc perforation
  - Ankylosis
- The condylar prosthesis is always used in conjunction with a FEP and constitutes a total joint replacement.

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Complications of TMJ surgery

Intra op

- Hemorrhage
- Damage to external acoustic meatus
- Parotid gland fistula
- Damage to auriculotemporal nerve
- Damage to zygomatic and temporal branch of facial nerve

Post op

- Transient facial nerve weakness
- Infection
- Auriculotemporal nerve injury- Frey’s syndrome

Long term complication

- Partial graft resorption
- Loose hardware
- Facial scarring
- Condylar overgrowth
- Limited mouth opening
- Reankylosis