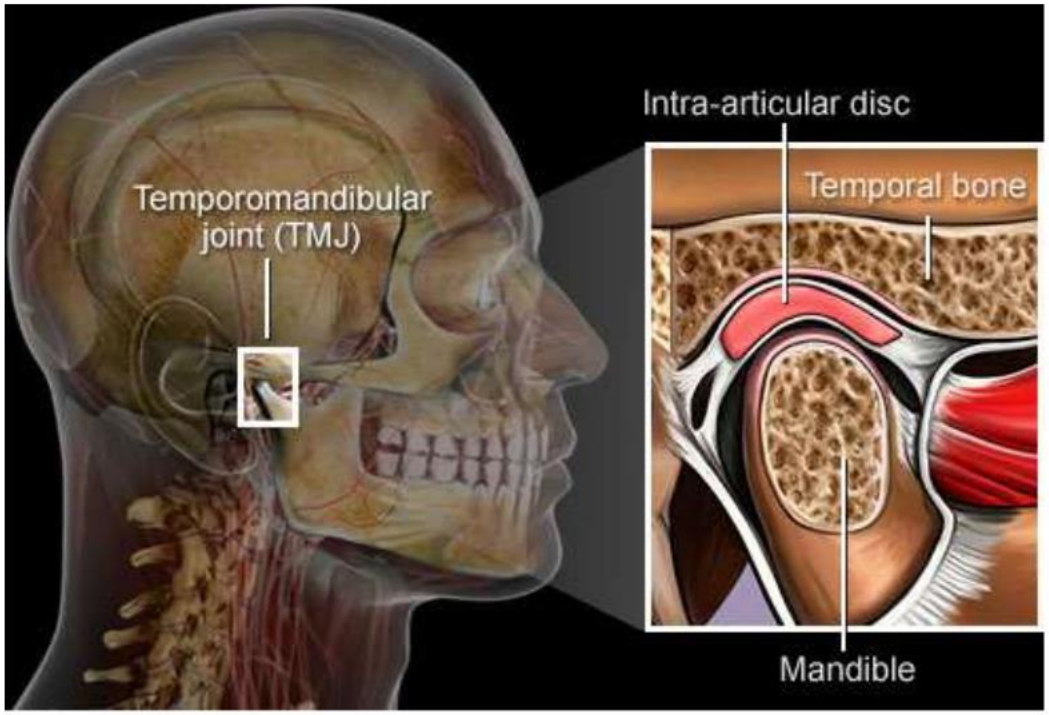
TEMPOROMANDIBULAR JOINT AND PROSTHODONTIC IMPLICATIONS



PhD Oleg Solomon

CONTENTS


TMJ

ACCORDING TO GPT 8

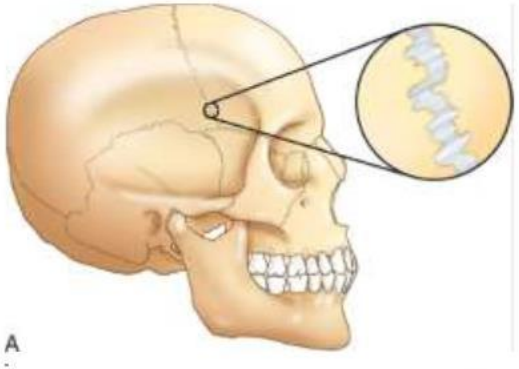
A JOINT is the place of union of two or more bones

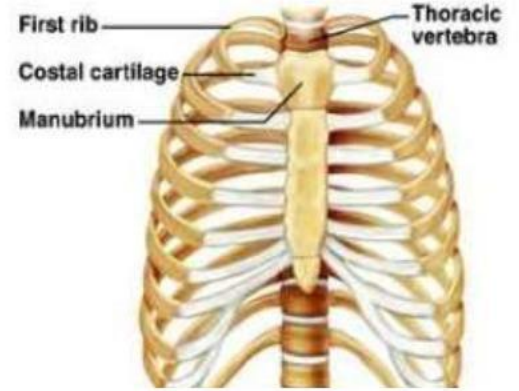
JOINTS CAN BE CLASSIFIED AS

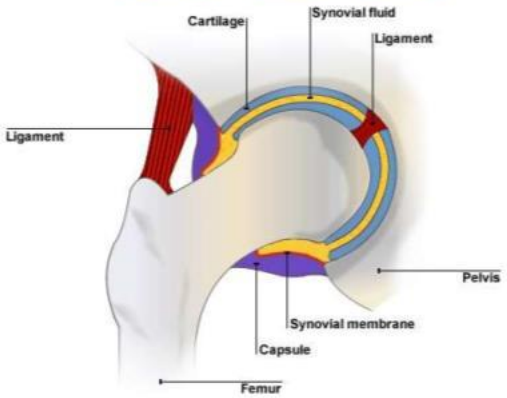
A. Fibrous

B. Cartilaginous

C Synovial



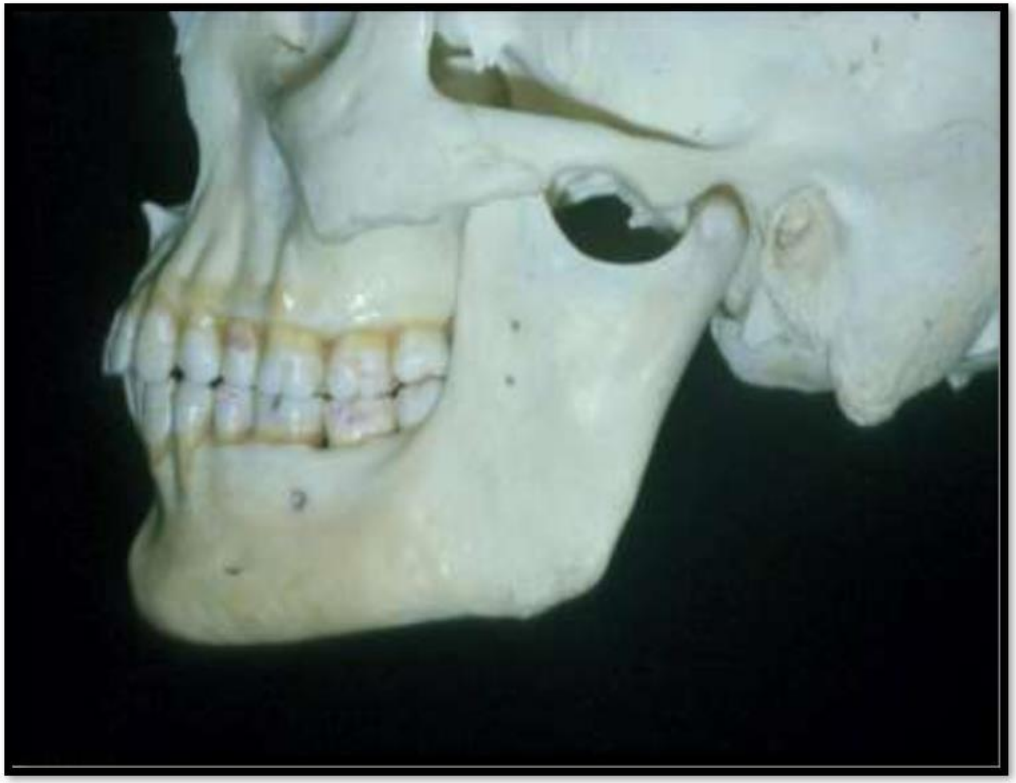




DEFINITION OF TMJ

- The articulation between the temporal bone and the mandible.

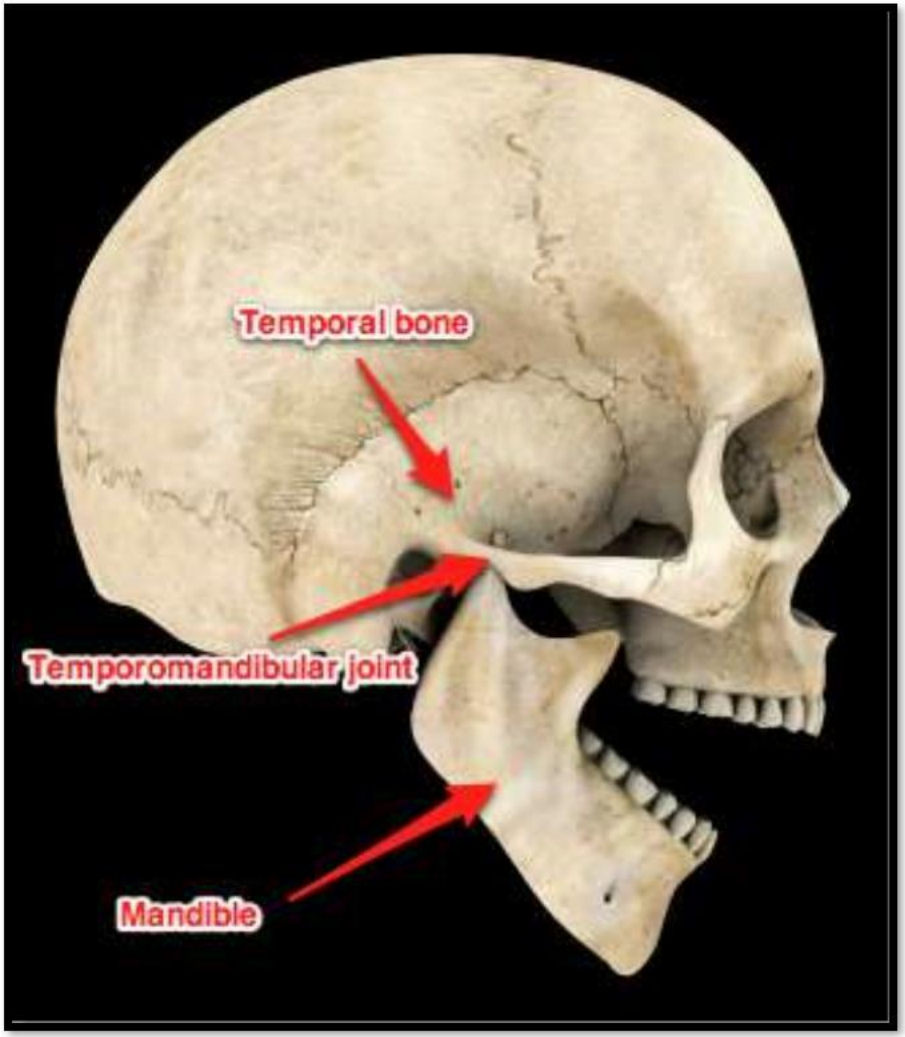
  It is a bilateral diarthrodial and bilateral ginglymoid joint



Glossary of Prosthodontic Terminology-8

TEMPOROMANDIBULAR JOINT IS

- Compound
- Diarthroidal
- Ginglymoid
- Multiaxial
- Secondary
- Squamo-dentary Joint
- Cranio–mandibular articulation



PECULIARITY OF TMJ

1. Bilateral diarthrosis

2. Articular surface is formed by fibrous cartilage instead of hyaline cartilage

3. Only joint in human body to have a rigid endpoint of closure

PECULIARITY OF TMJ……

4. In contrast to other diarthrodial joints TMJ is last joint to develop

5. Develops from two distinct blastema.

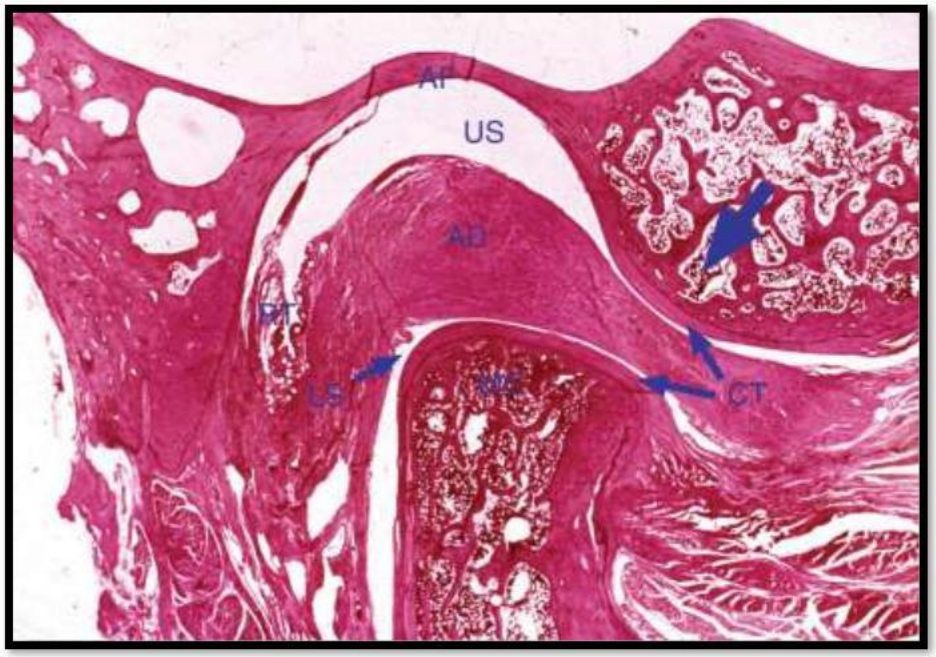
DEVELOPMENT OF TMJ

At 6th week: Articular disc first appears

At 7th week: Meckels cartilage extends from chin to base of skull
acts as scaffolding for mandible development
Two ectomesenchymal condensation appears

At 12th week: Condylar growth cartilage appears & condyle begins to develop

DEVELOPMENT OF TMJ……



At 22nd week: Articular capsule becomes recognizable and merges peripherally with condensation

At 26th week: All components of joint appears except articular eminence

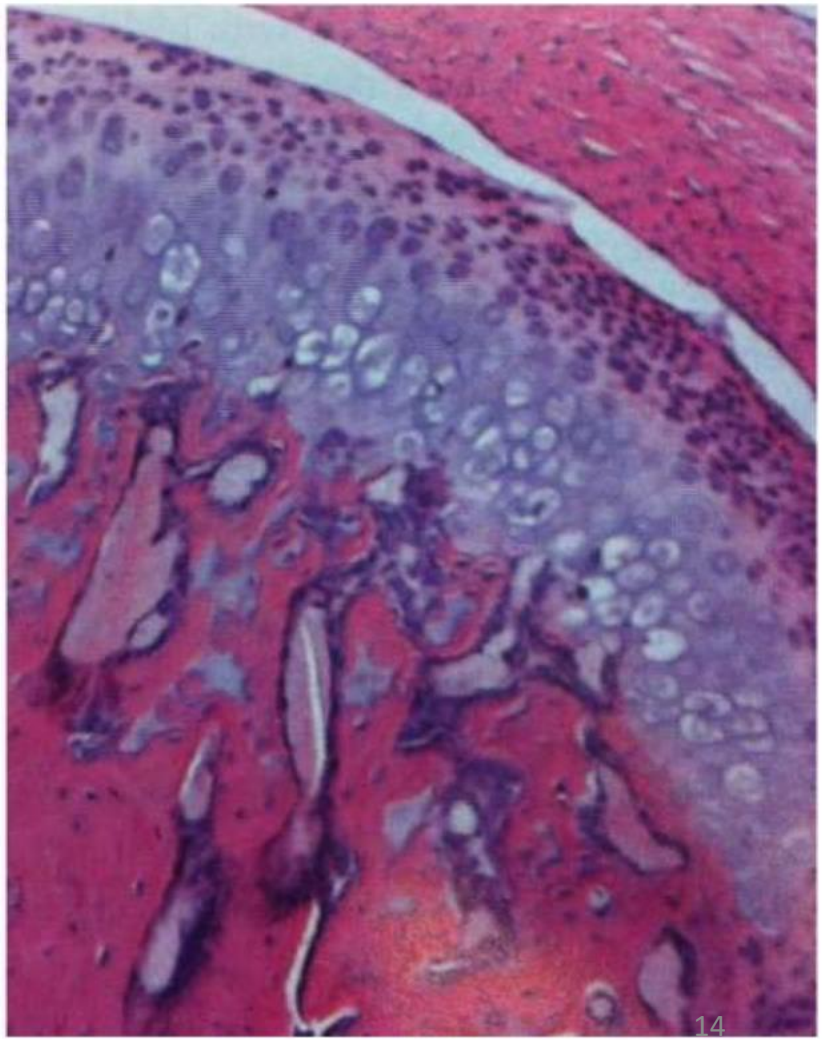
At 31st week: Sphenomandibular ligamnet appears

At 39th week: Ossification of bony components starts and resembles the future joint

HISTOLOGY OF ARTICULAR SURFACES

ARTICULAR SURFACE

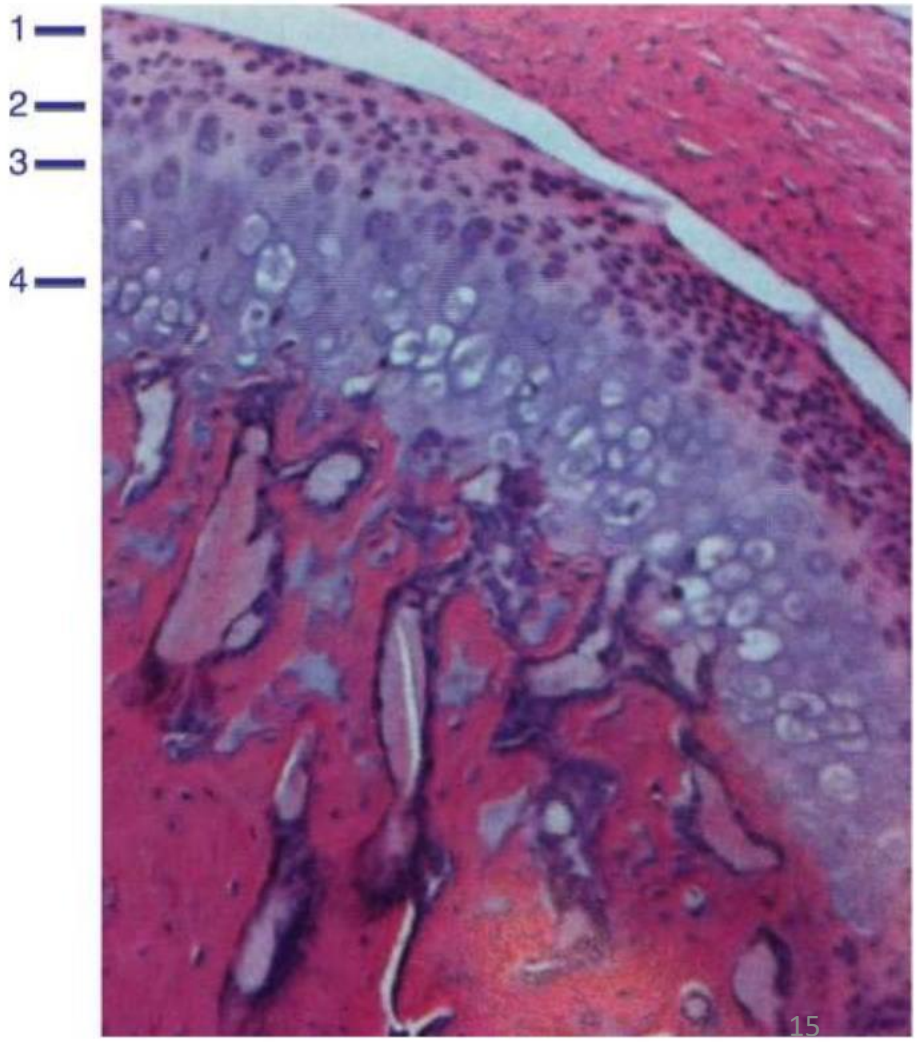
- Dense fibrous connective tissue
- Parallel arrangement- collagen fibers
- Good adaption to sliding movement
- Shock absorber
- High ability to repair
- Less susceptible to the effect of aging



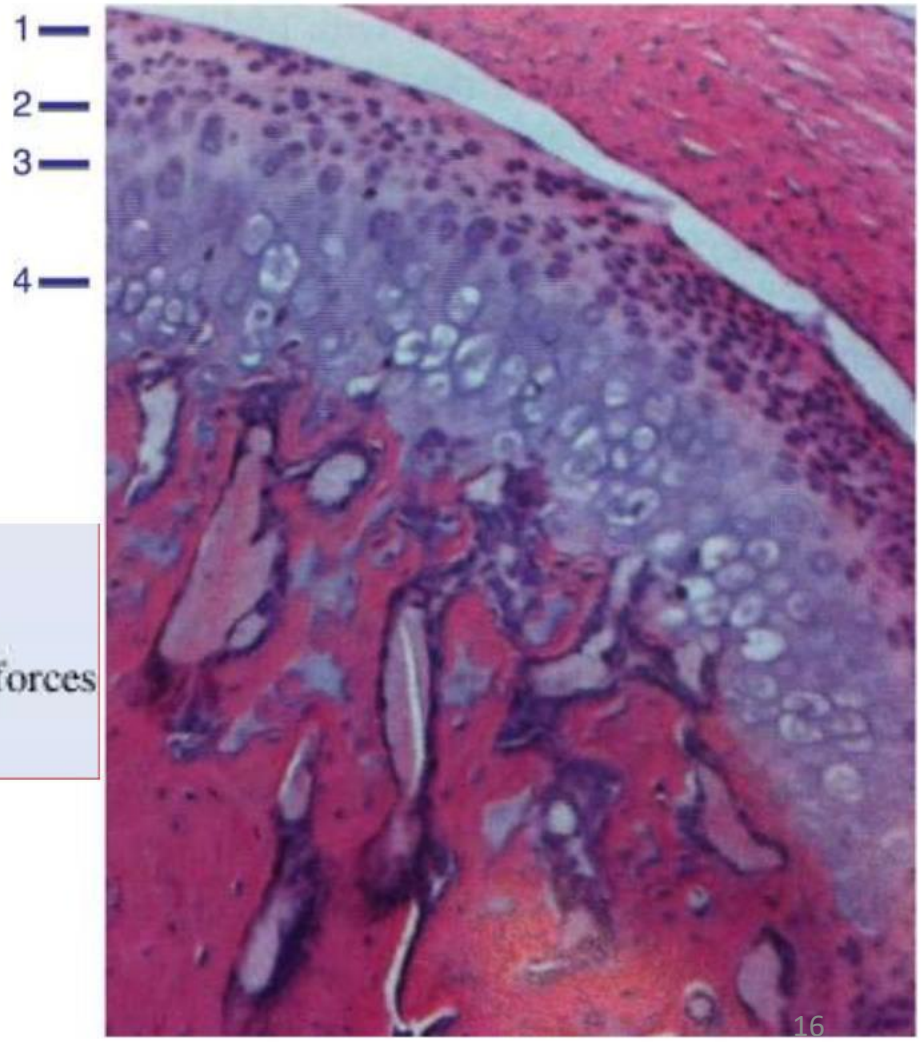
HISTOLOGY OF ARTICULAR SURFACES

PROLIFERATIVE ZONE

- Cellular
- Undifferenciated mesenchymal cell
- Proliferation & regeneration throughout life



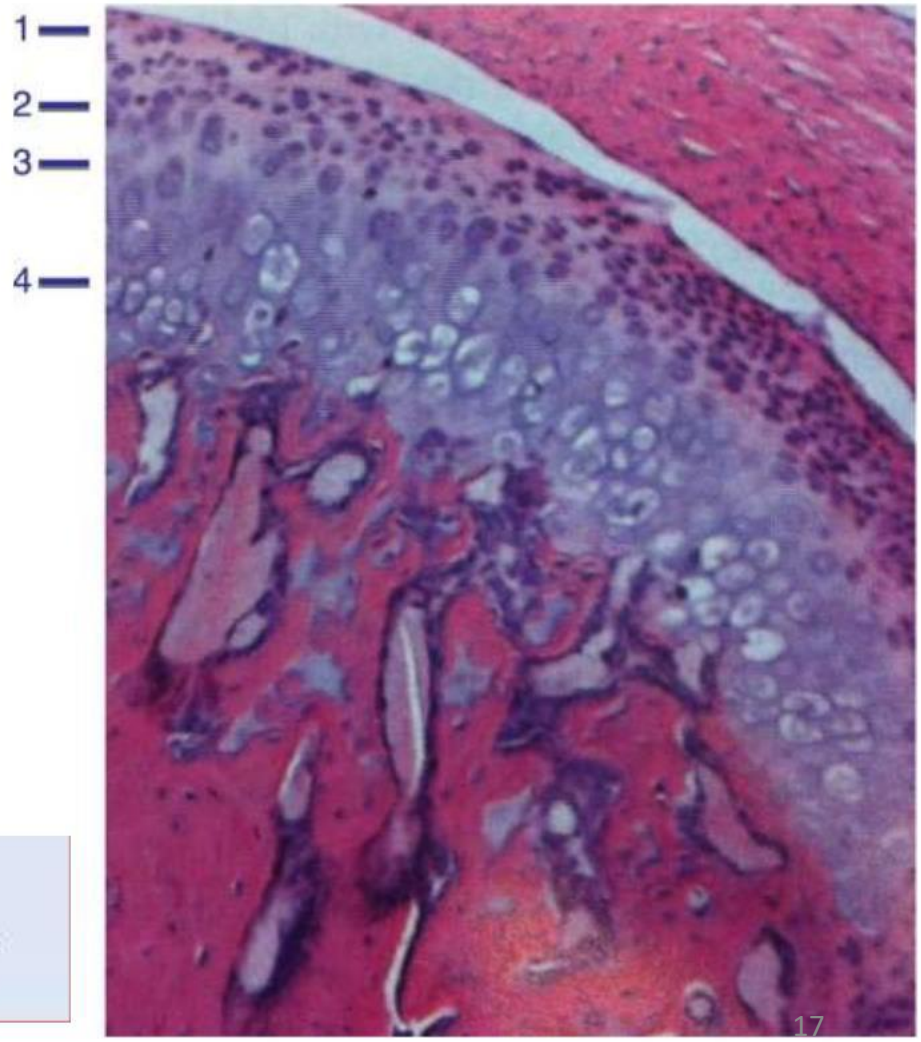
HISTOLOGY OF ARTICULAR SURFACES



FIBRO-CARTILAGINOUS ZONE

- Collagen fibrils- criss-cross pattern
- Offers resistance- compressive & lateral forces
- But becomes thinner with age

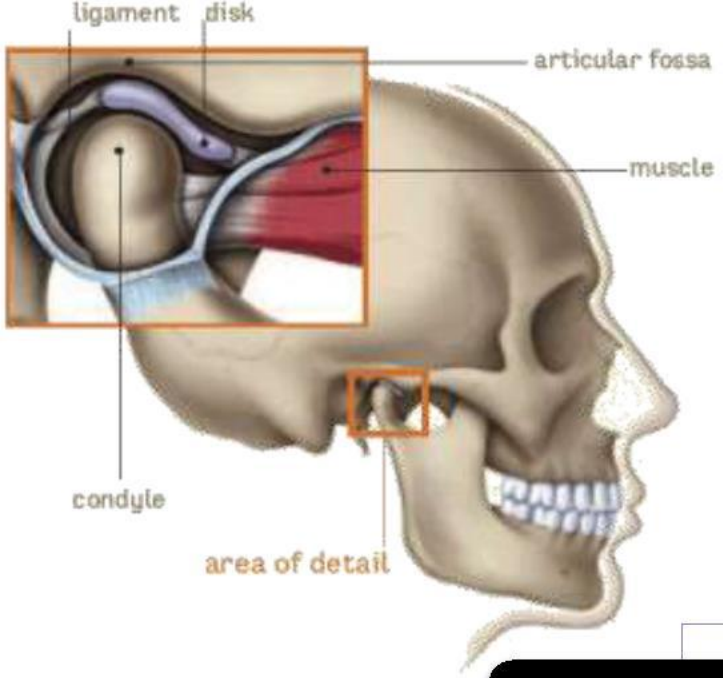
HISTOLOGY OF ARTICULAR SURFACES



CALCIFIED CARTILAGE ZONE

- Chondrocytes, chondroblasts & osteocytes
- Active site for remodeling

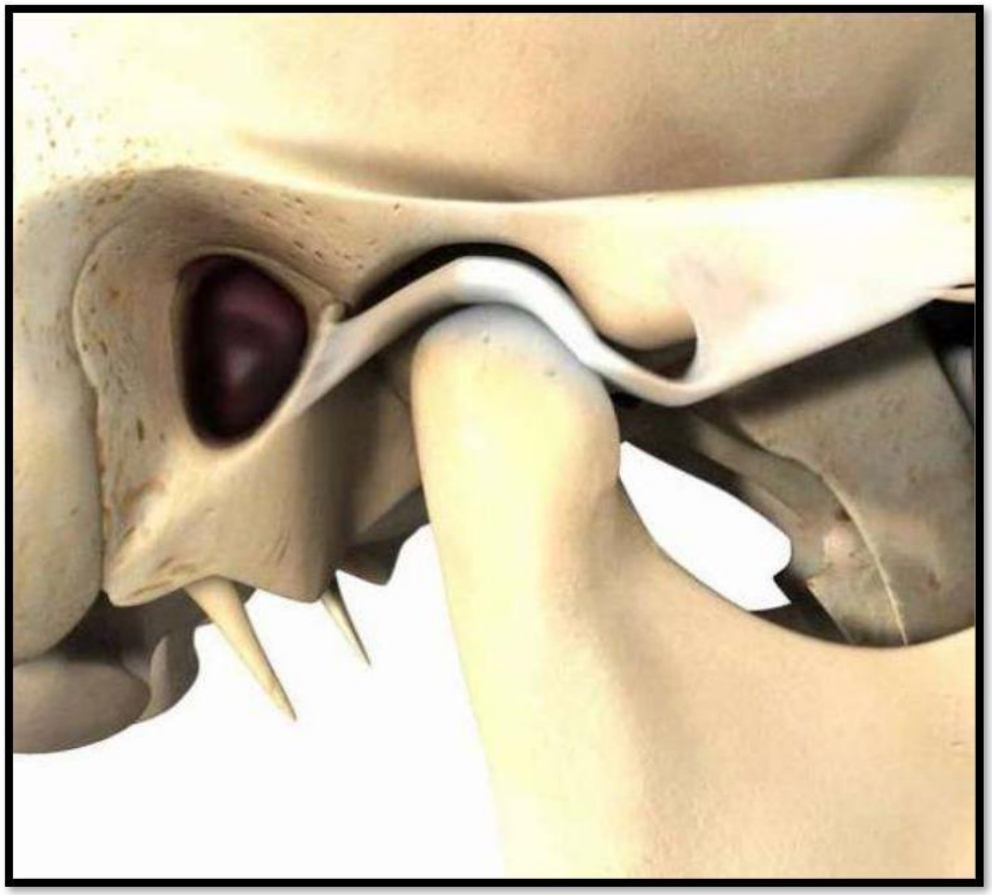
ANATOMICAL COMPONENTS



ANATOMICAL COMPONENTS

- PASSIVE
  - BONY COMPONENTS
  - LIGAMENTS
  - ARTICULAR DISC
- ACTIVE
  - MUSCLES

BONY COMPONENTS

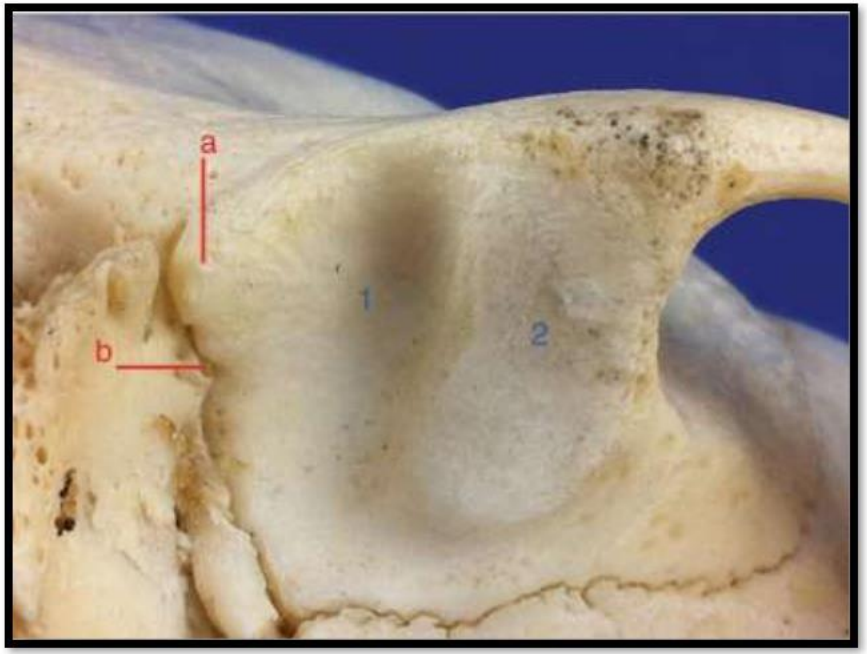


Glenoid fossa

Mandibular condyle

Articular eminence

GLENOID FOSSA



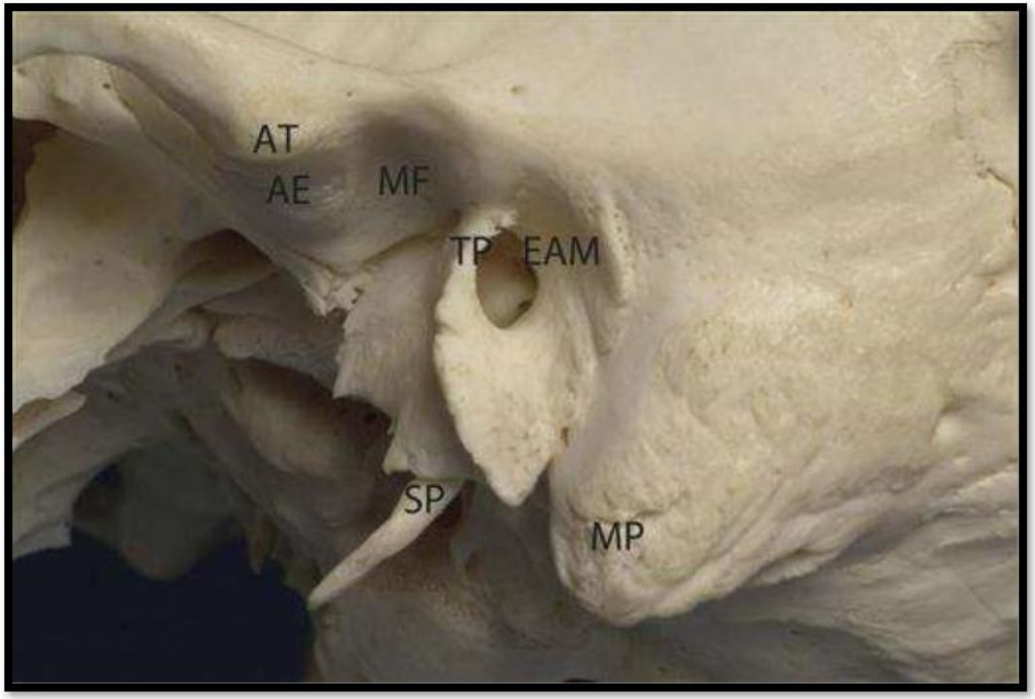
- The squamous portion of the temporal bone (concave)
  Measure approx 23 mm (both A-P and M-L)

- Anterior : a convex bony prominence (tubercle) = articular eminence

-

- Posterior : Post Glenoid Plane
  Prevents forced posterior displacement of condyle

- The posterior roof is thin not designed to sustain heavy force



- The articular eminence consists of thick dense bone to tolerate such forces.

- The steepness of the articular eminence surface dictates the pathway of the condyle
CONDYLAR GUIDANCE

THE MANDIBULAR CONDYLE

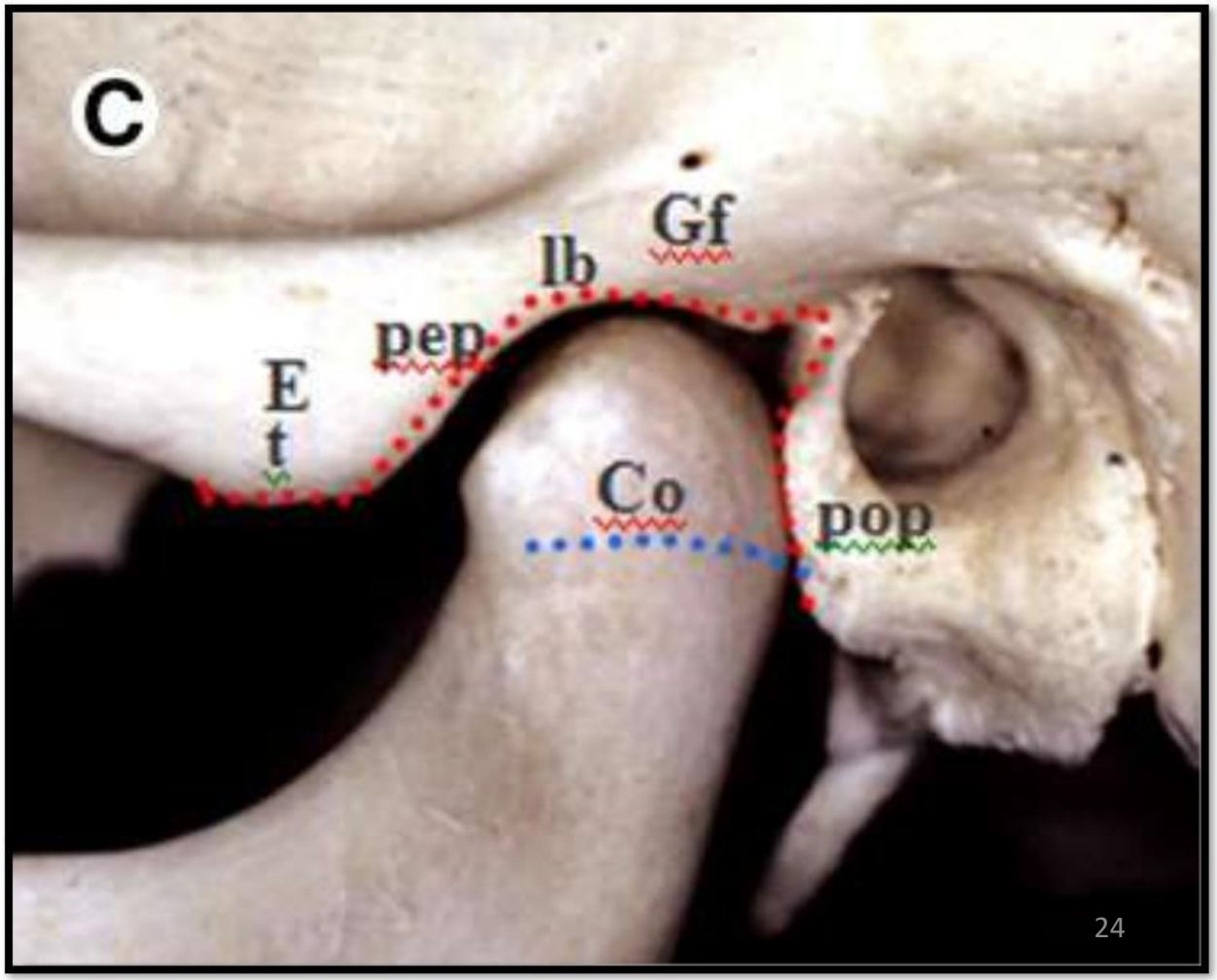
HEAD OF CONDYLE

-Mediolateral : 15 – 20 mm
-Anteroposterior : 7 – 10 mm

-Anterior view : medial & lateral poles,
the medial pole more prominent

-The actual articulating surface ~
extends anteriorly and posteriorly to the most superior aspect (P > A)

The articular surface lies on its anterosuperior aspect, thus facing the posterior slope of the articular eminence of the temporal bone.



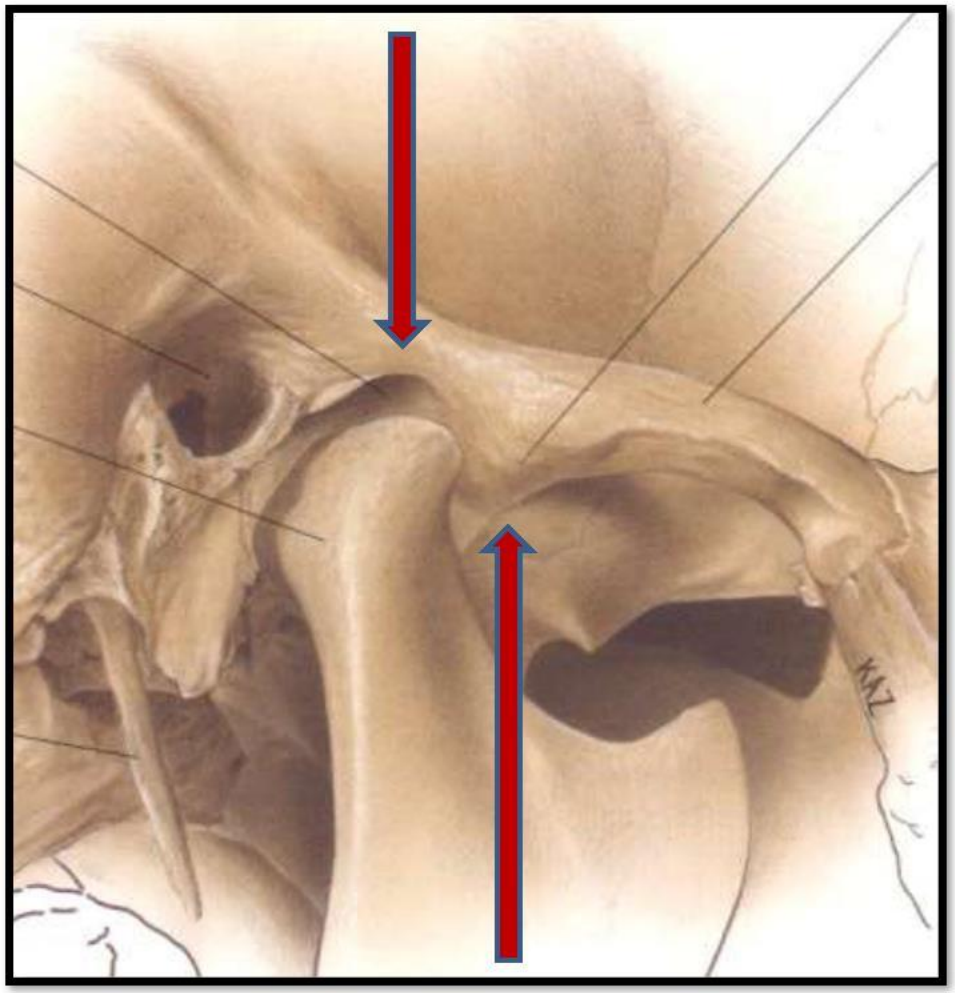
The imaginary lines connecting the medial and lateral poles of the condyles are posteriorly and medially directed toward the anterior border of the foramen magnum.

ARTICULAR EMINENCE

Transverse bony bar that forms the root of zygomatic process

This articular surface have dense bone and is most heavily traversed by condyle and disk during forward and backward movements of jaw

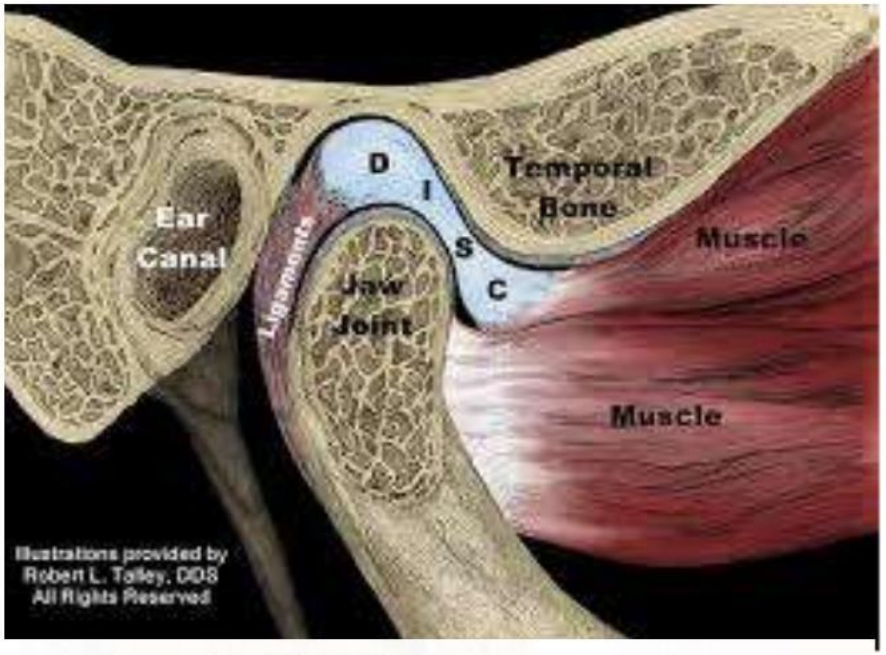
Squamous temporal bone



Articular eminence

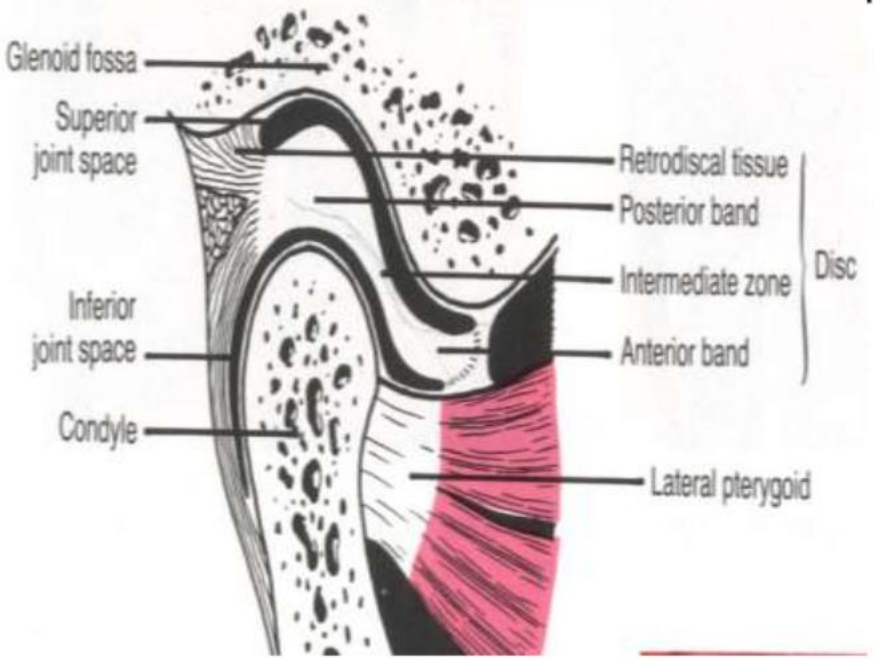
ARTICULAR DISC

It is a BICONCAVE FIBROCARTILAGINOUS structure located between the mandibular condyle and the temporal bone.



- **The superior** surface **of the disc SADDLE-SHAPED to fit into the cranial contour**,

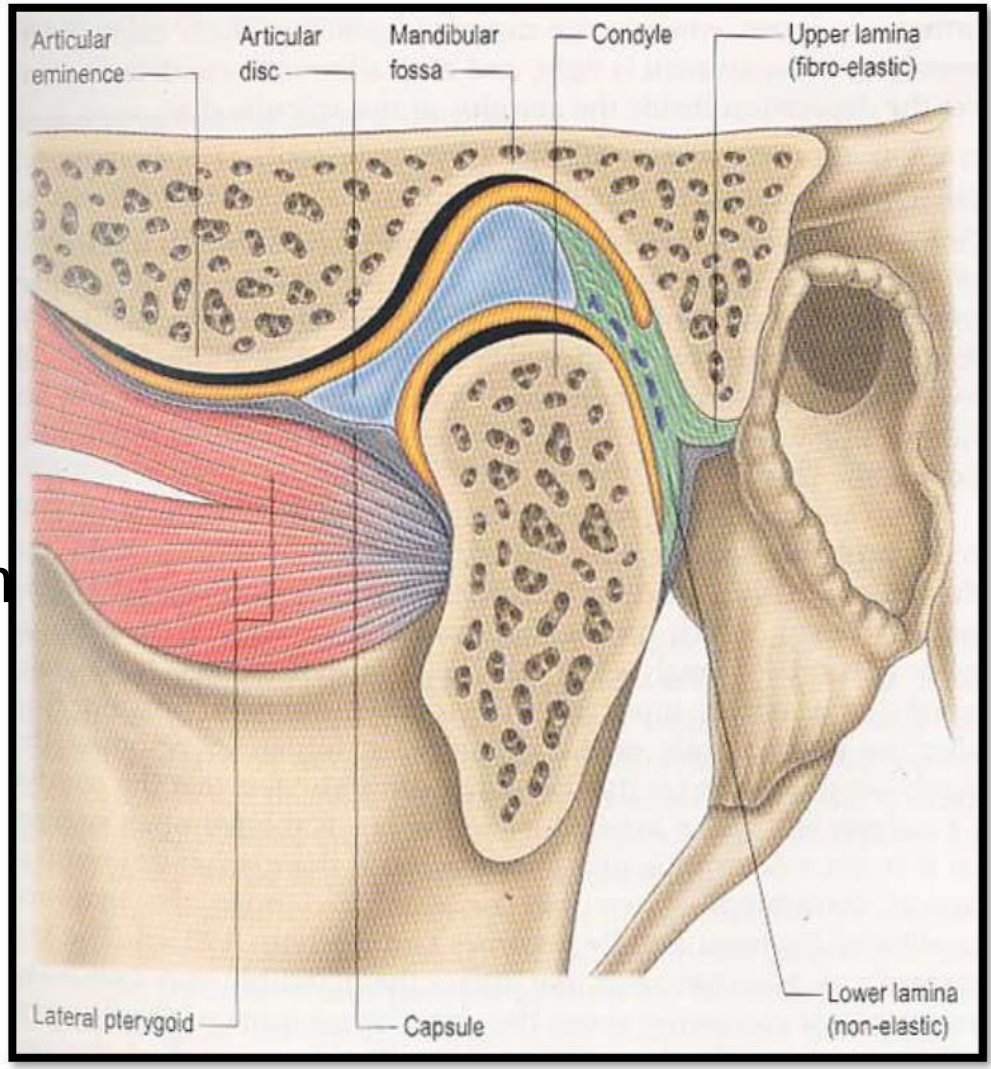
- **The inferior surface -CONCAVE to fit against the mandibular condyle**.



- The ARTICULAR DISC is a roughly oval, firm, fibrous plate.

PARTS:

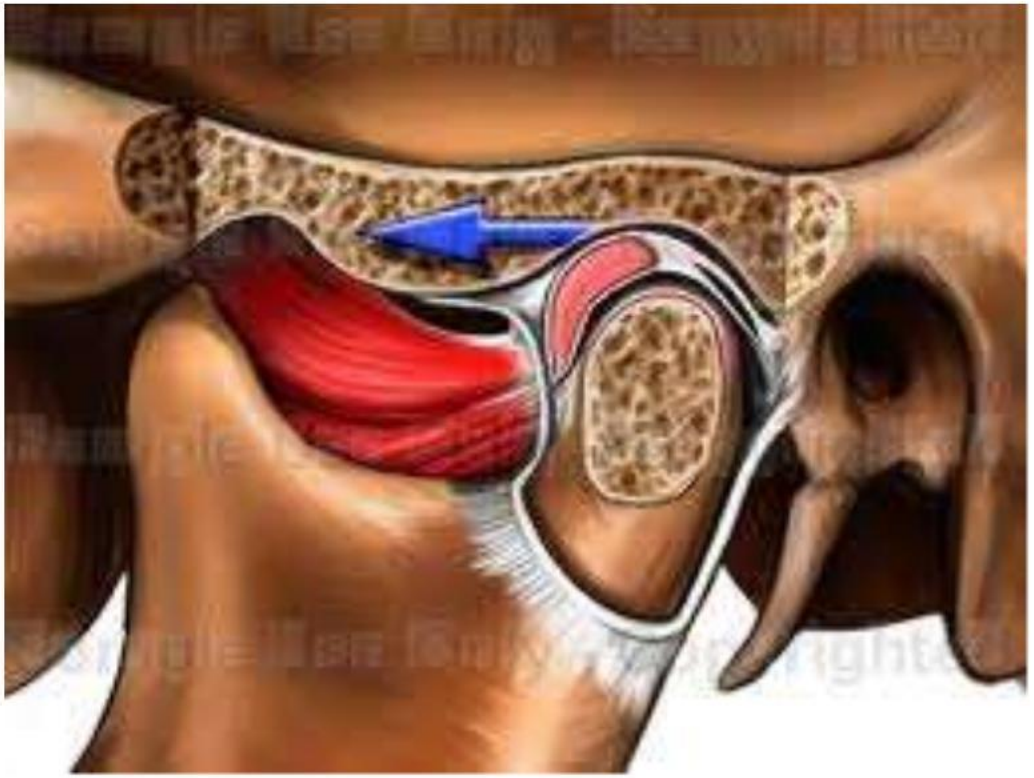
1. ANTERIOR BAND = 2 mm thick
2. POSTERIOR BAND = 3 mm thick,
3. INTERMEDIATE BAND of 1 mm thickness.



Larger upper compartment

and

Smaller lower compartment.



- Hinging movements take place in the lower compartment and gliding movements take place in the upper compartment.

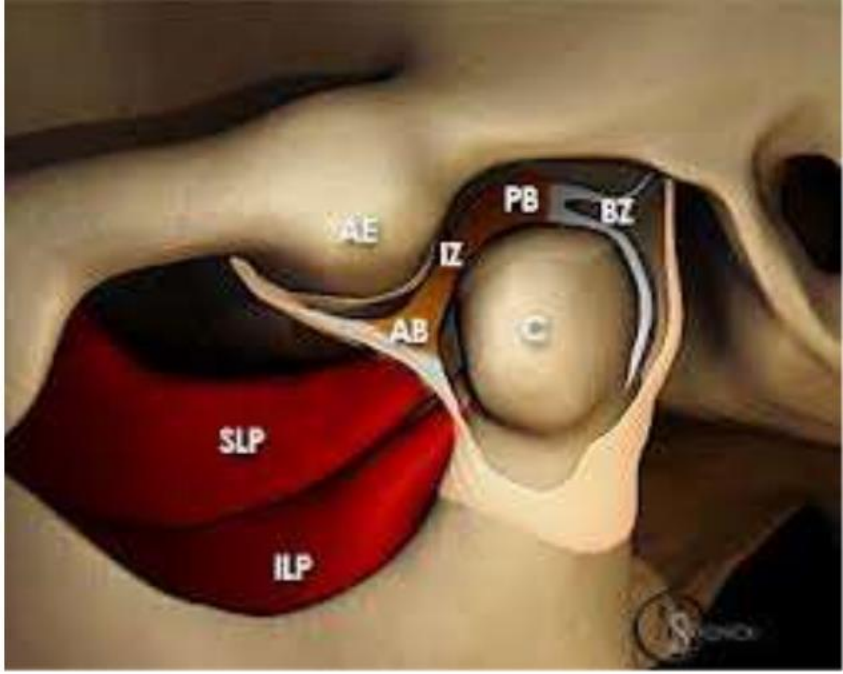
ATTACHMENTS OF DISC

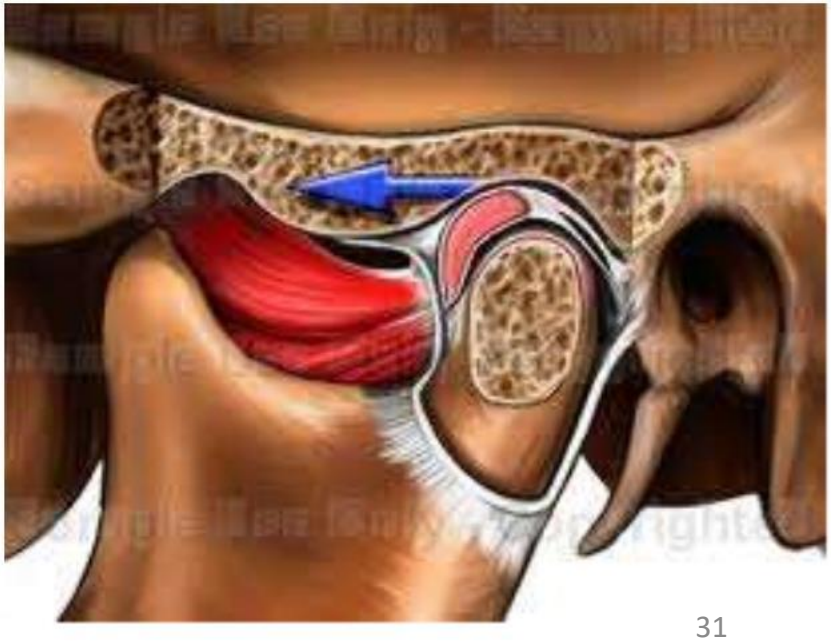
ANTERIORLY:

Anterior region of the disc is attached to the capsular ligament

Anterio-Superior : anterior margin of the articular surface of the temporal bone

-Anterio-Inferior : anterior margin of the articular surface of the condyle

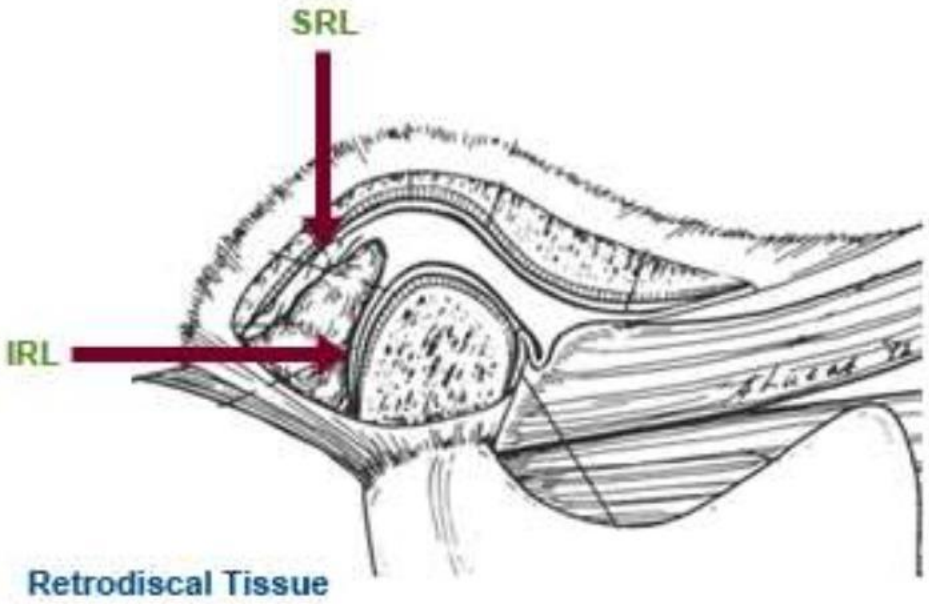




POSTERIORLY:

RETRODISCAL TISSUE

It is a loose connective tissue region that is highly vascularized and innervated.

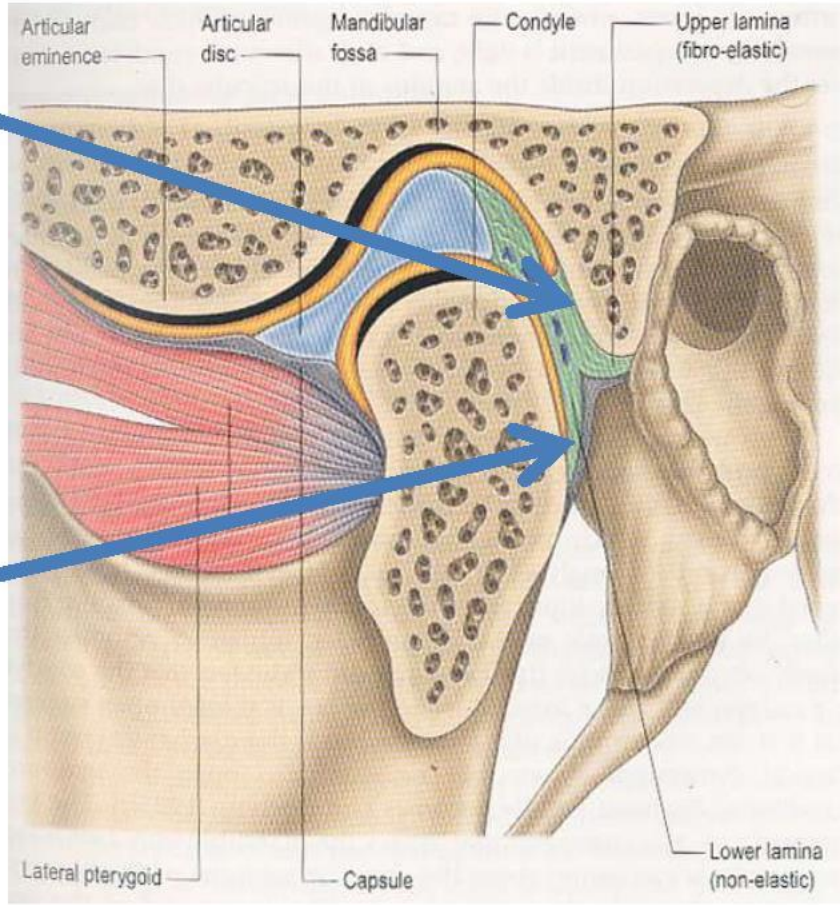


SUPERIOR : Upper lamina
(CONTAINS MAINLY ELASTIC FIBERS)

It attaches the disc posteriorly to the tympanic plate & prevents slipping of the disc while yawning.

INFERIOR : lower lamina
(COMPOSED CHIEFLY COLLAGENOUS FIBERS)

It prevents excessive rotation of the disc over the condyle.



FUNCTIONS

- To accommodate a hinge as well as the gliding actions
- Stablize the condyle within TMJ
- Articular disc may also reduce wear
- Aid lubrication of the joint by storing fluid squeezed out from loaded area

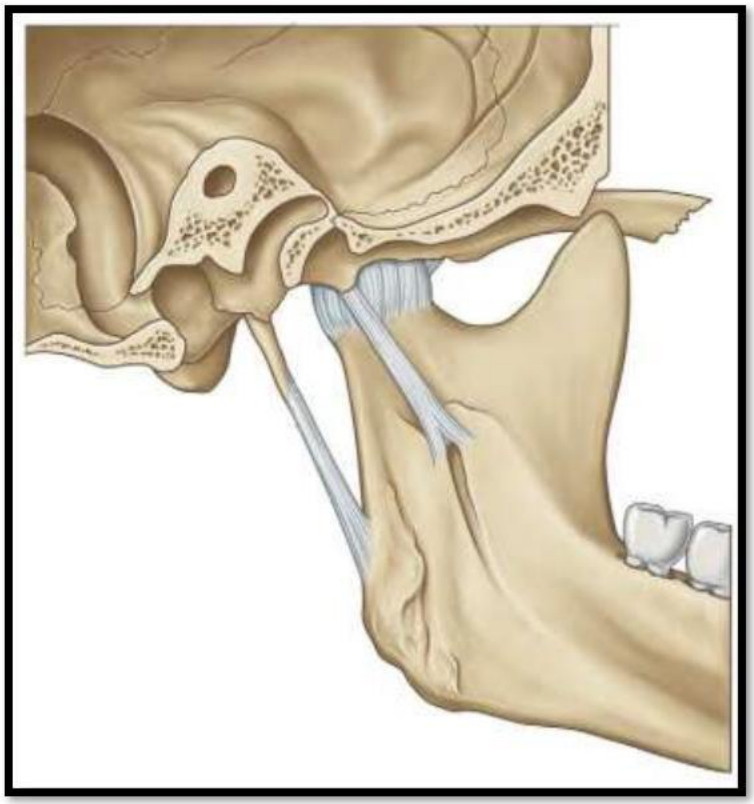
LIGAMENTS

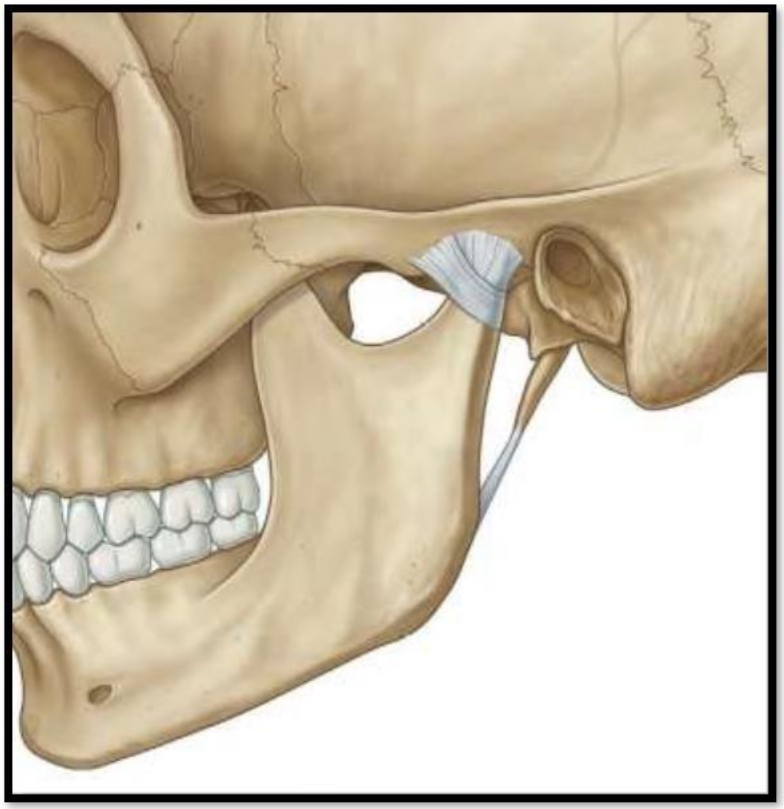
Primary

1 Fibrous Capsule

2 Collateral

3 Temporomandibular





Acessory

4 Sphenomandibular

5 Stylomandibular

PRIMARY LIGAMENTS

1. **CAPSULAR LIGAMENT/ FIBROUS CAPSULE**

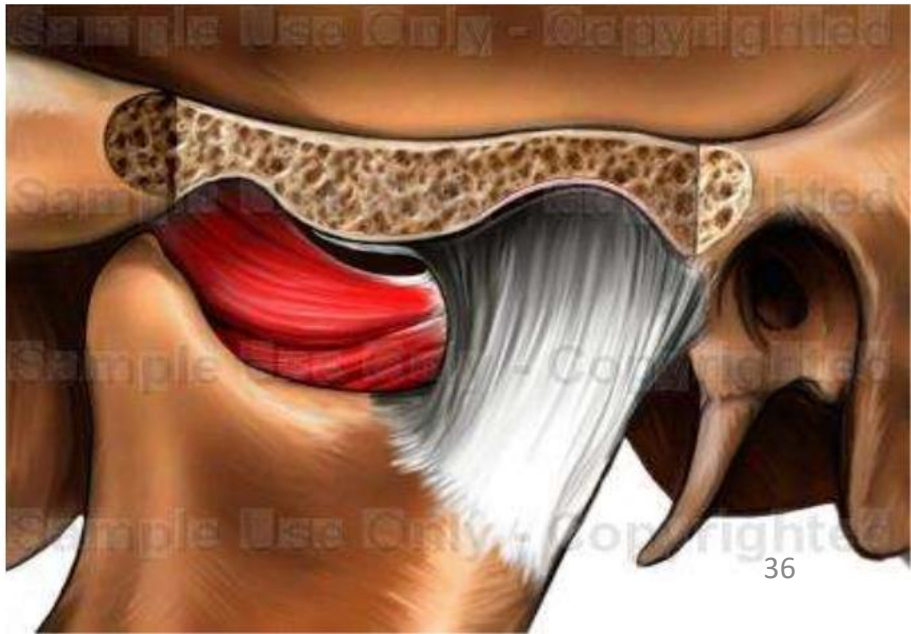
THIN SLEEVE OF FIBROUS TISSUE surrounding the entire TMJ

- Superior attachment

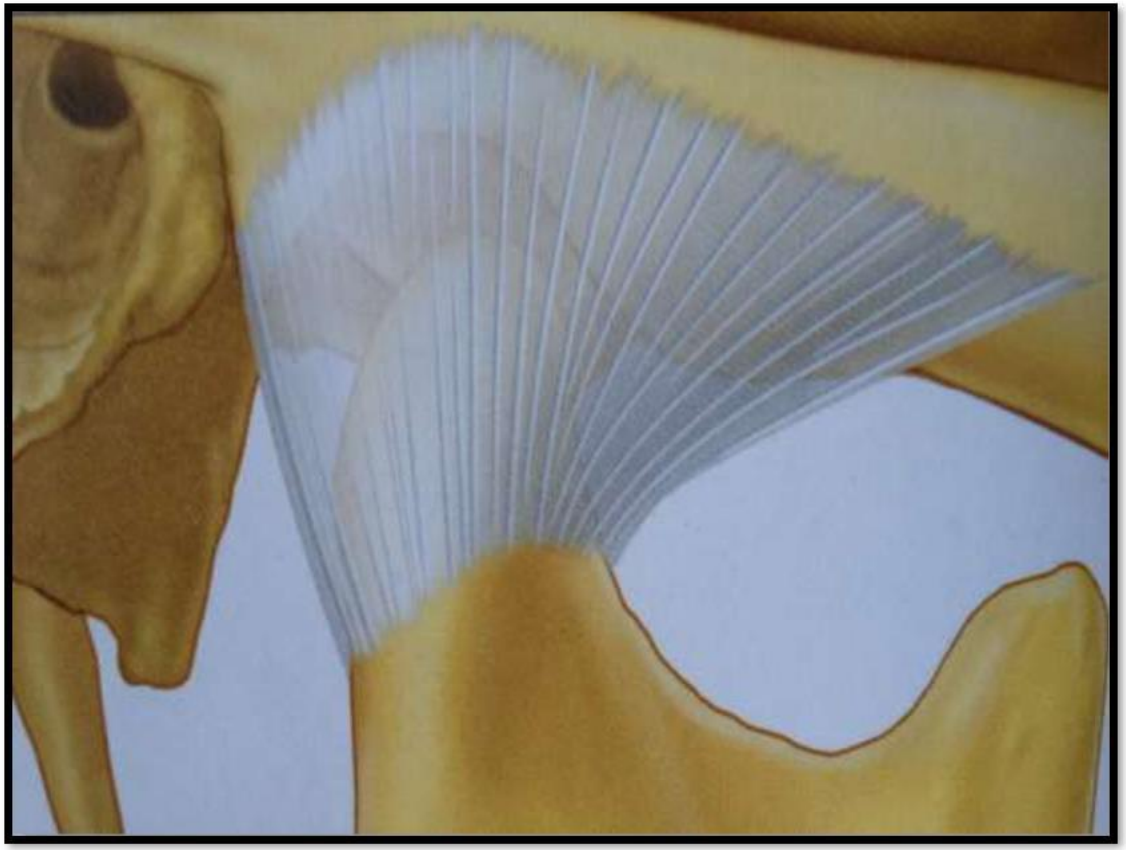
the borders of the articular surface of the glenoid fossa and anterior edge of preglenoid plane of articular tubercle

- Inferior attachment

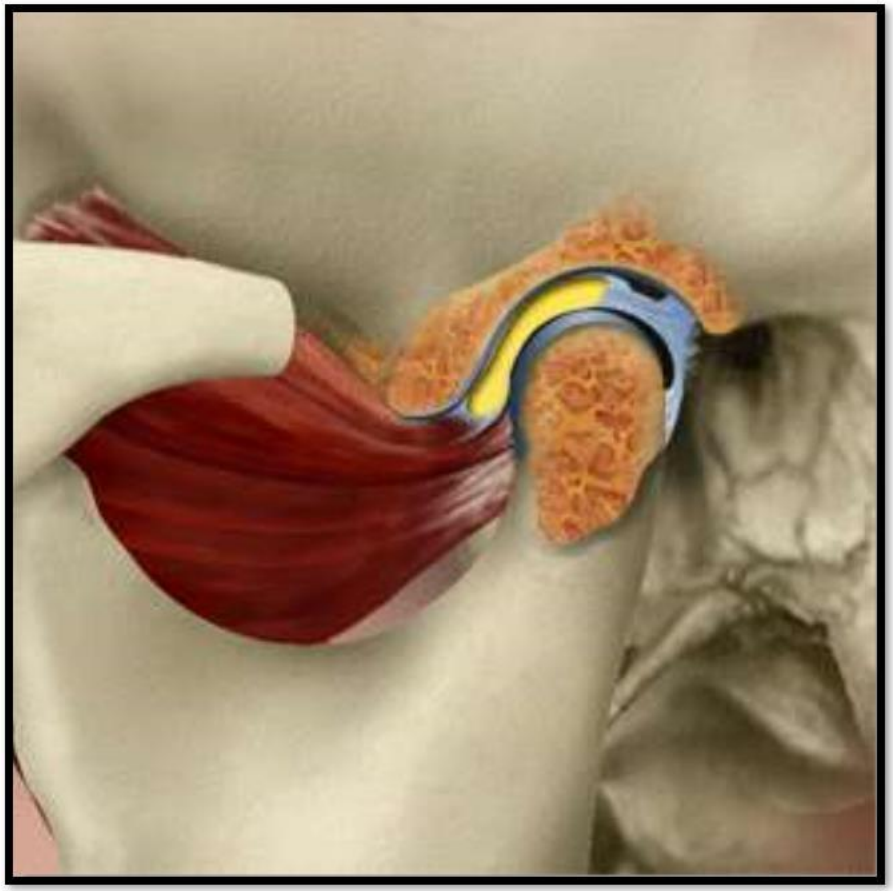
periphery of neck of mandibular condyle



- This capsule is reinforced more laterally by an external Temporomandibular ligament, which also limits the distraction and the posterior movement of the condyle.



- Anteriorly, the capsule has an orifice through which the tendon of lateral pterygoid muscle passes.
- This area of relative weakness in the capsular lining becomes a source of possible herniation of intra-articular tissues
- May allow forward displacement of the disk.



FUNCTION

- To resist any lateral or downward forces that tends to separate or dislocate the articular surface

- To retain the synovial fluid

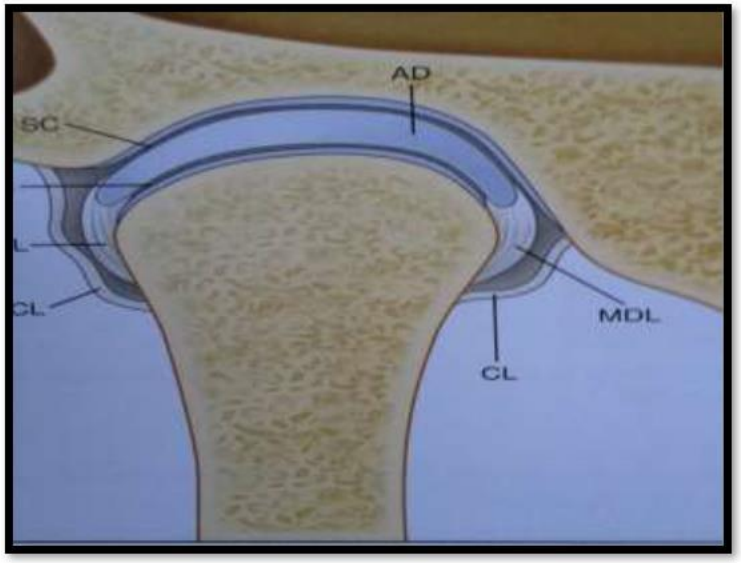
- Proprioception

COLLATERAL (DISCAL) LIGAMENTS

- From medial and lateral borders of the disc to the poles of the condyle

  Medial discal ligament

  Lateral discal ligament



- Dividing the joint mediolaterally into superior and inferior joint cavities

Function :

- Allow the disc to move passively with the condyle as it glides A - P

- Permit the disc to be rotated A-P on the articular surface of the condyle

- These ligaments are RESPONSIBLE FOR THE HINGING MOVEMENT BETWEEN THE CONDYLE AND THE ARTICULAR DISC

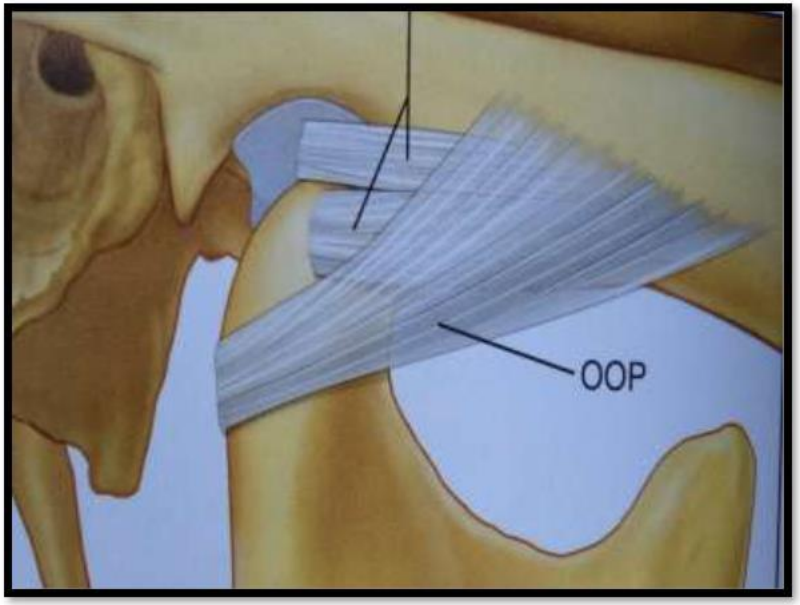
- They have a vascular supply and are innervated

3.TEMPOROMANDIBULAR LIGAMENT

It lies at the lateral aspect of the capsular ligament

Attached above to articular tubercle

Below attached to lateral and posterior surface of neck of condyle



FUNCTION

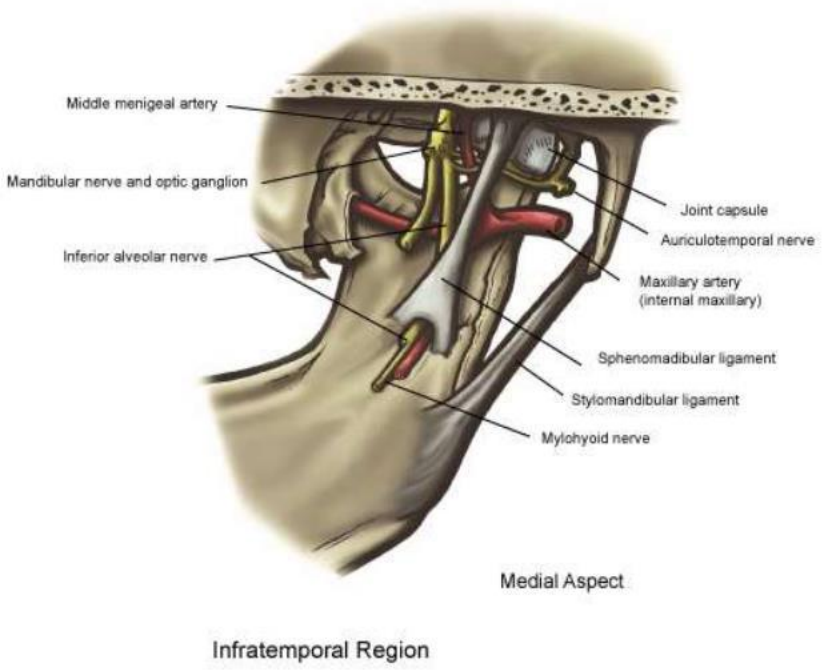
Resists excessive dropping of the condyle so limits the extent of mouth opening

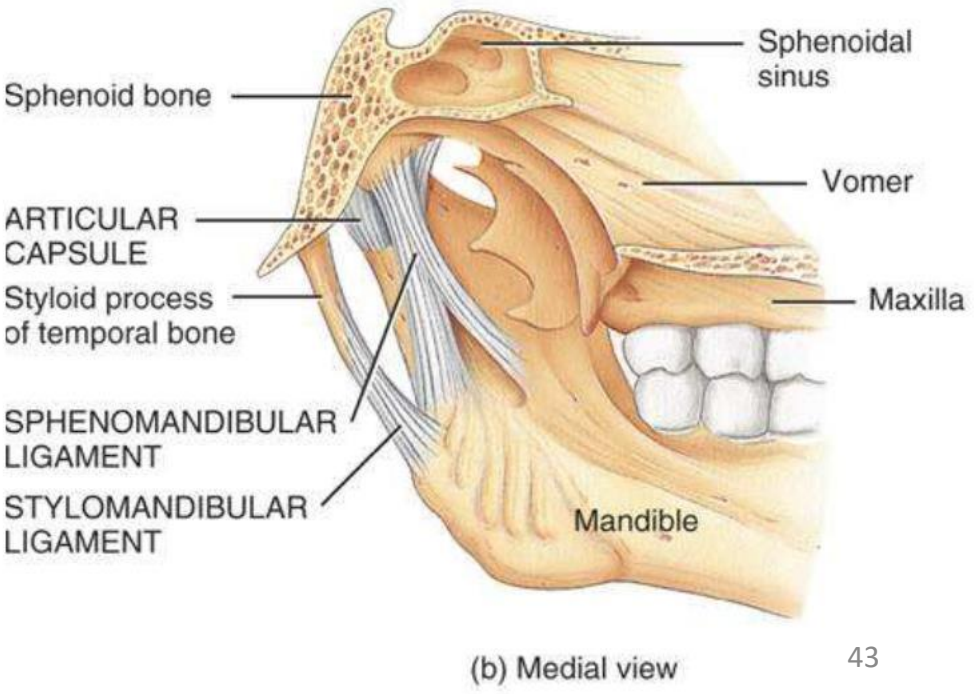
ACCESORY LIGAMENTS

4.Sphenomandibular ligament

From the spine of the sphenoid bone

& extends downward to lingula of mandible

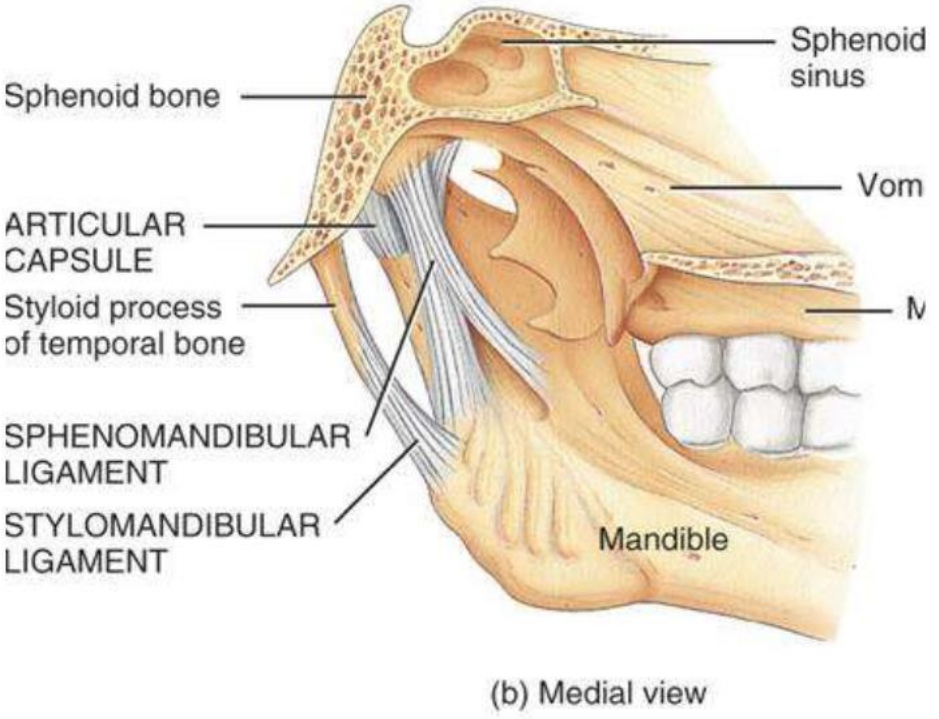




5.Stylomandibular ligament

- Second accesory ligament.

- This is a specialized dense, local concentration of deep cervical fascia



- From the styloid process & extends downward and forward to the angle and posterior border of the ramus of mandible

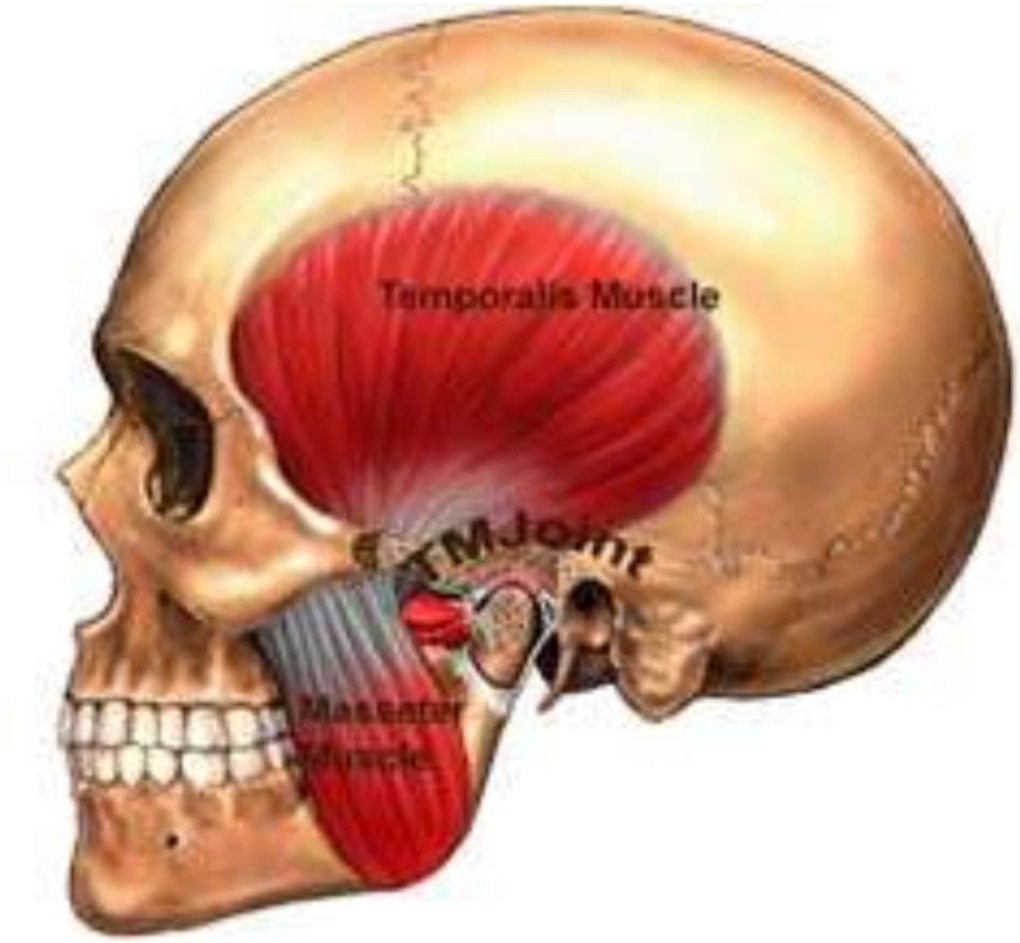
FUNCTION

- It limits excessive protrusive movements of the mandible

- This ligament becomes tense only in extreme protrusive movements.

MUSCULAR COMPONENT

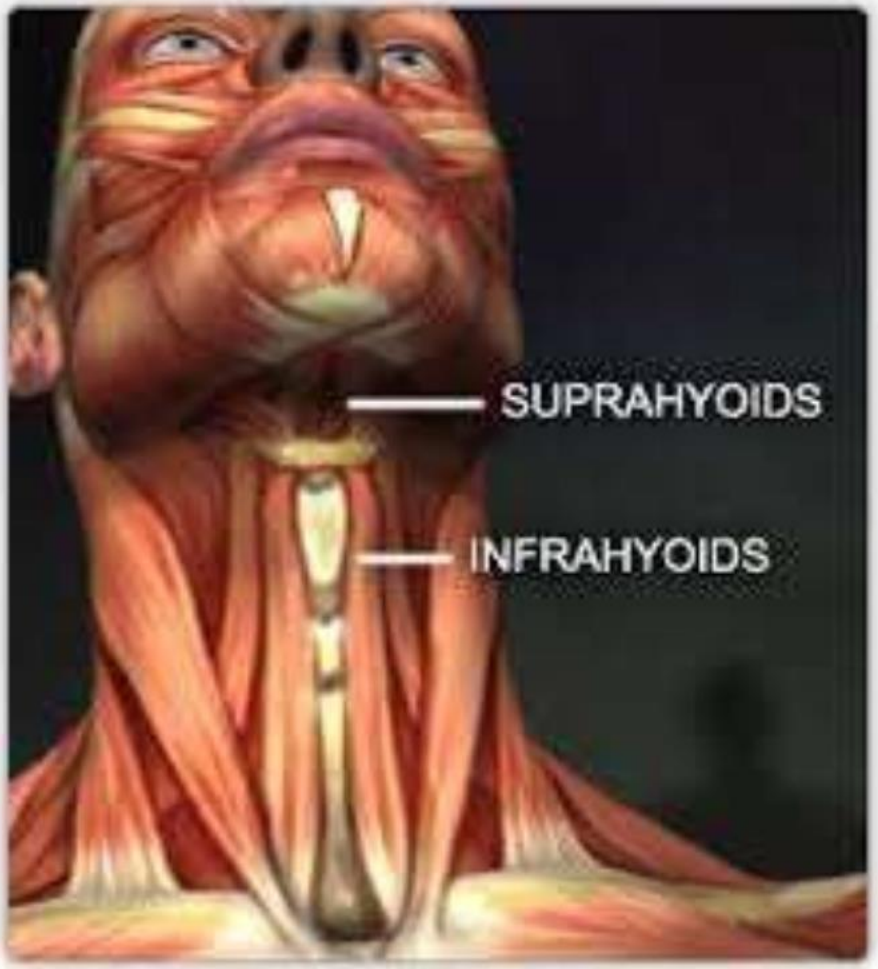
PRIMARY MUSCLES OF MASTICATION



- MASSETER
- TEMPORALIS
- LATERAL PTERYGOID
- MEDIAL PTERYGOID

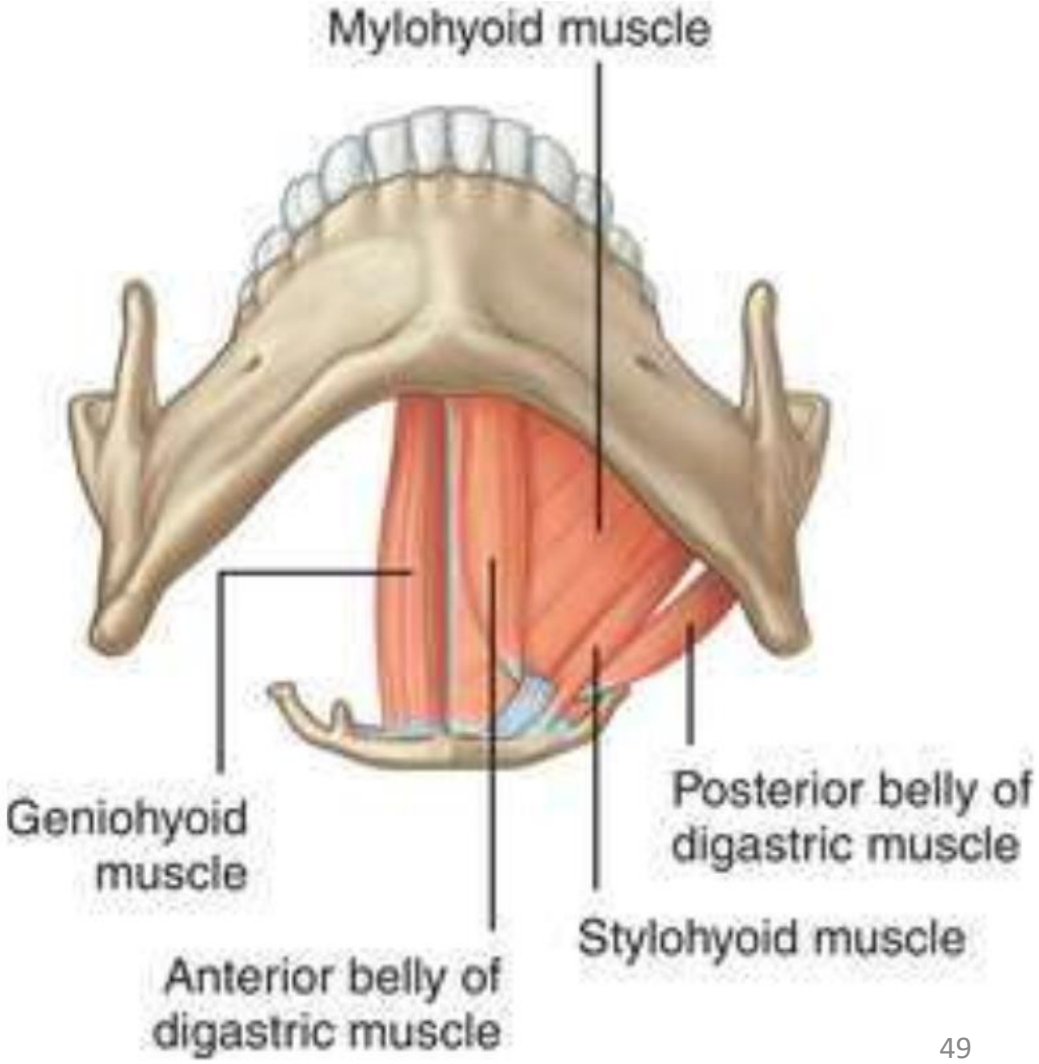
SECONDARY MUSCLES OF MASTICATION

- Suprahyoid muscles
- Infrahyoid muscles



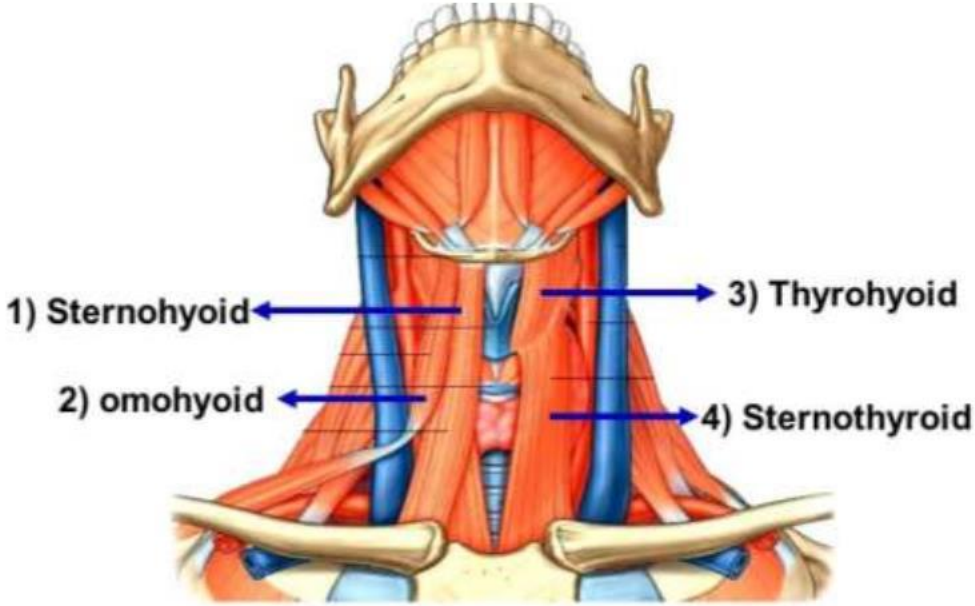
SUPRAHYOID GROUP

- DIGASTRIC
- MYLOHYOID
- GENIOHYOID
- STYLOHYOID



INFRAHYOID MUSCLES

STERNOHYOID
STERNOTHYROID
THYROHYOID
OMOHYOID



&
STERNOCLEIDOMASTOID
&
TRAPEZIUS

MASSETER

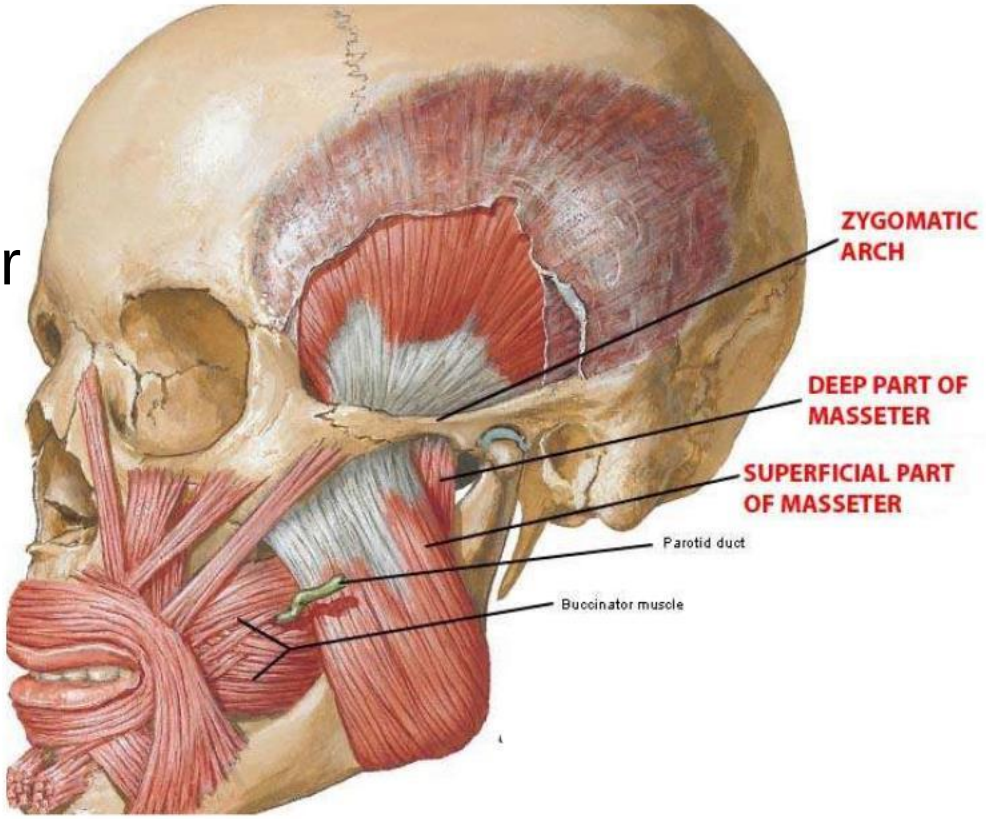
- Voluntary
- Multipennate
- Quadrilateral
- Antigravity
- Elevator

ORIGIN

The superficial layer

The maxillary process of the zygomatic bone

The anterior 2/3rd of the inferior border of the zygomatic arch.



The middle layer

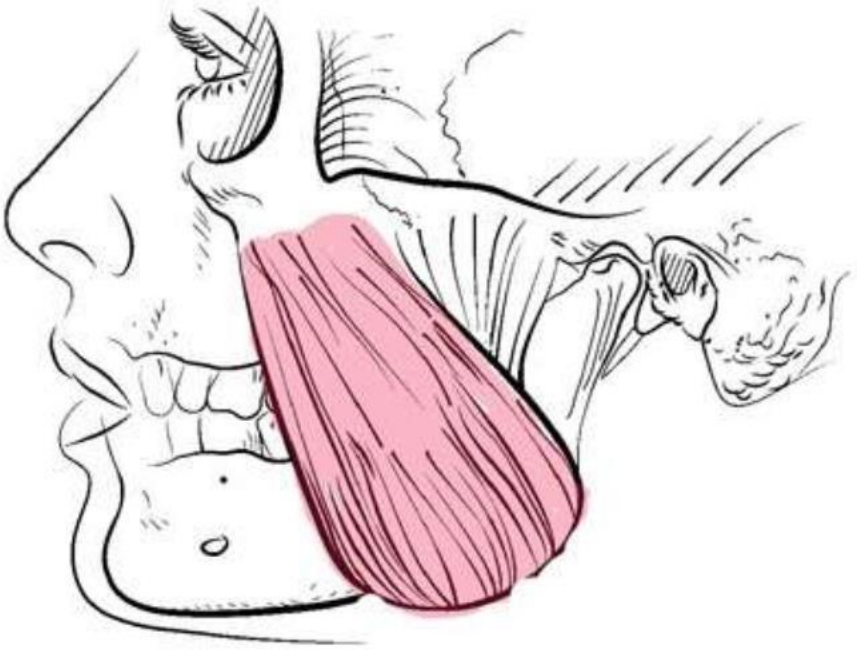
From the medial aspect of the anterior two-thirds of the zygomatic arch

The lower border of the posterior third of this arch

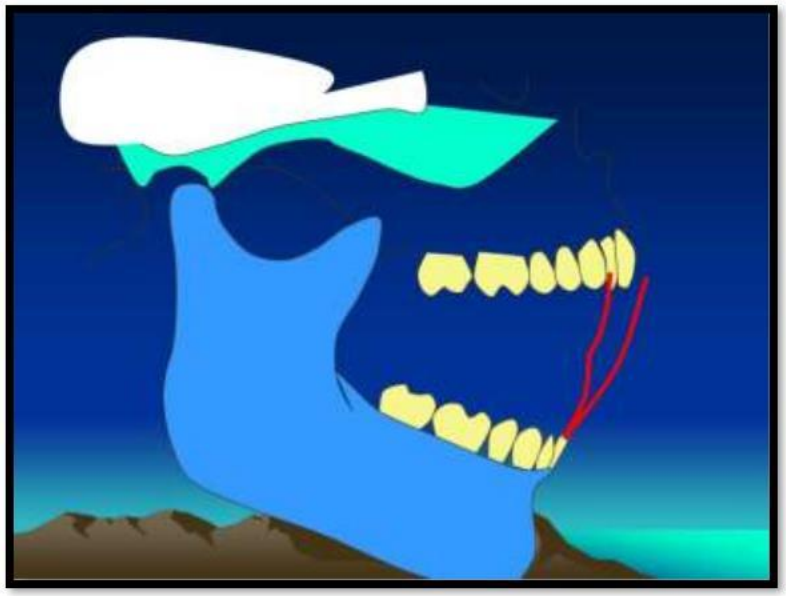
The deep layer arises from the deep surface of the zygomatic arch

INSERTION

Insert into the angle and lower posterior half of the lateral surface of the mandibular ramus



FUNCTION OF MASSETER MUSCLE



Contraction elevates the mandible and brings teeth in contact

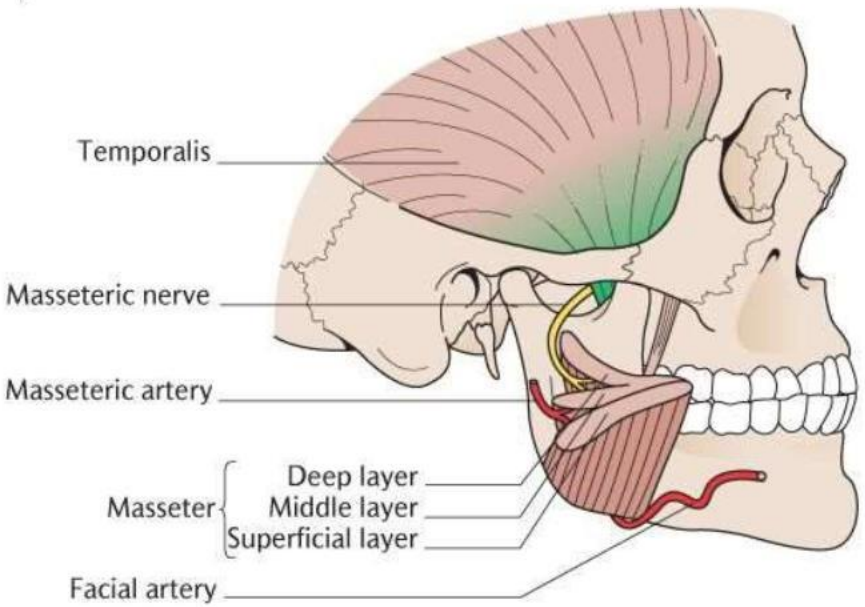
Provides the force required to chew efficiently

Superficial part also helps in protruding

Biting foce applied in protruded position ,condyles are stablized against articular eminence by deep fibres

VASCULAR SUPPLY

- By the masseteric branch of the maxillary artery,
- the facial artery and
- the transverse facial branch of the superficial temporal A



INNERVATION

By the masseteric branch of the anterior trunk of the mandibular nerve.

TEMPORALIS

- FAN SHAPED
- BIPENNATE
- VOLUNTARY

ORIGIN

Arises from the whole of the temporal fossa up to the inferior temporal line and from the deep surface of the temporal fascia.

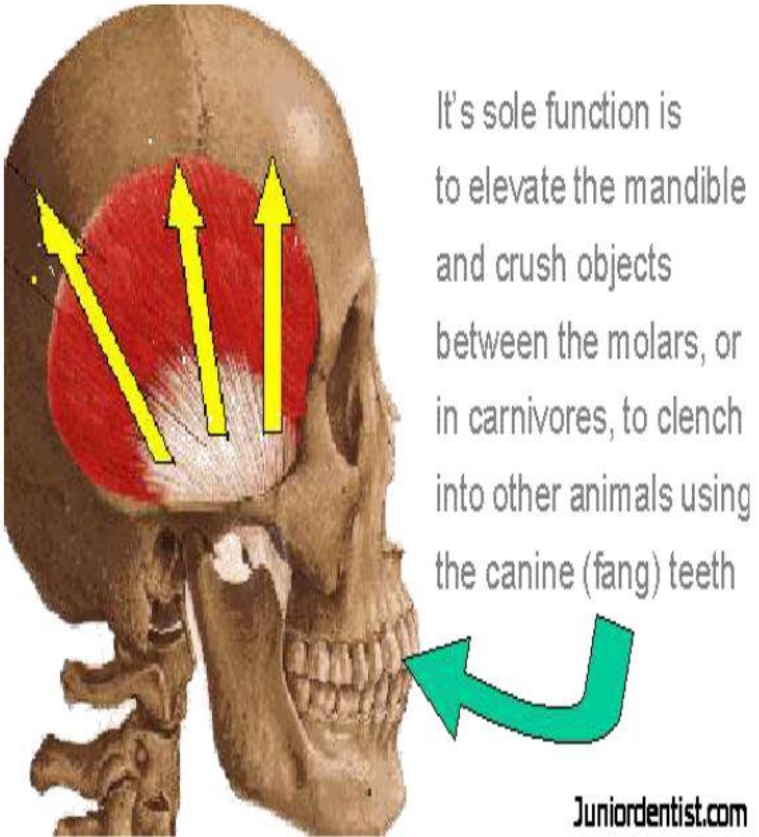
INSERTION

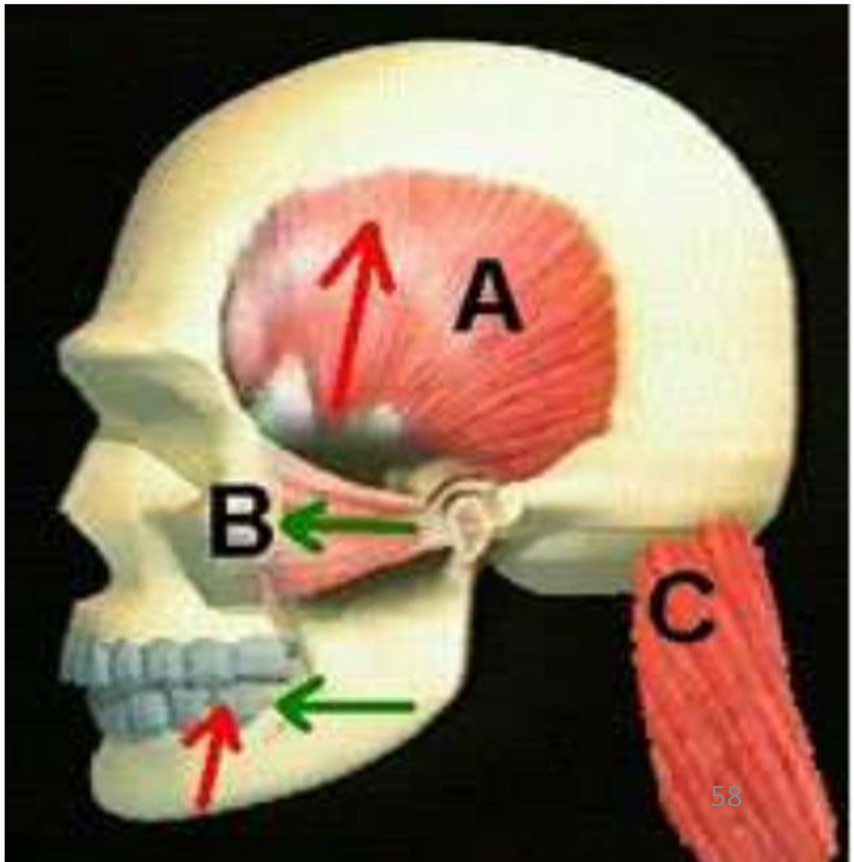
Temporalis is attached to the coronoid process and to the anterior border of the mandibular ramus

FUNCTIONS OF TEMPORALIS MUSCLE

Anterior fibers ELEVATION

Posterior fibers RETRUSION





VASCULAR SUPPLY

The deep temporal branches from the second part of the maxillary artery.

INNERVATION

The deep temporal branches from the anterior trunk of mandibular nerve

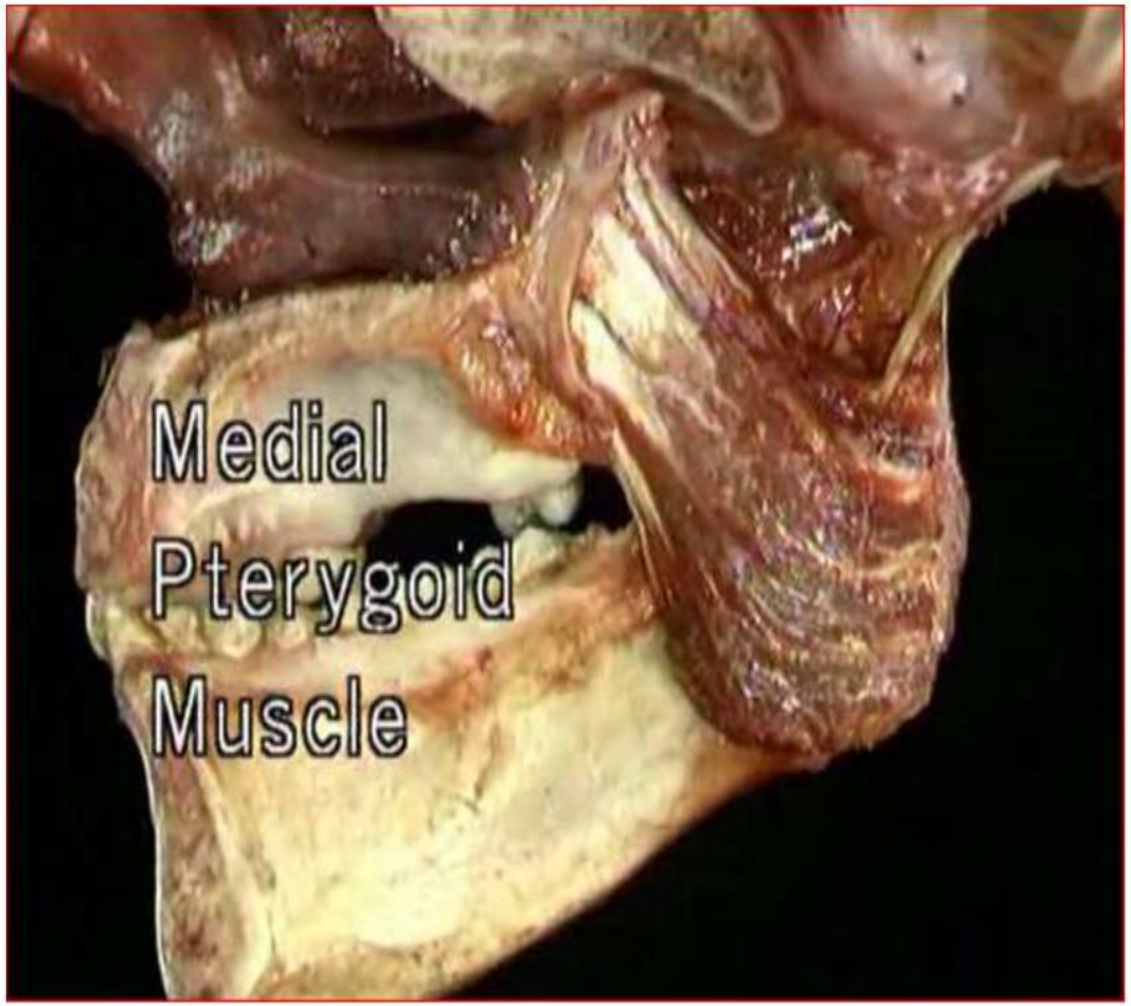
MEDIAL PTERYGOID or INTERNAL PTERYGOID

Consists 2 heads

Deep Head

Superficial Head

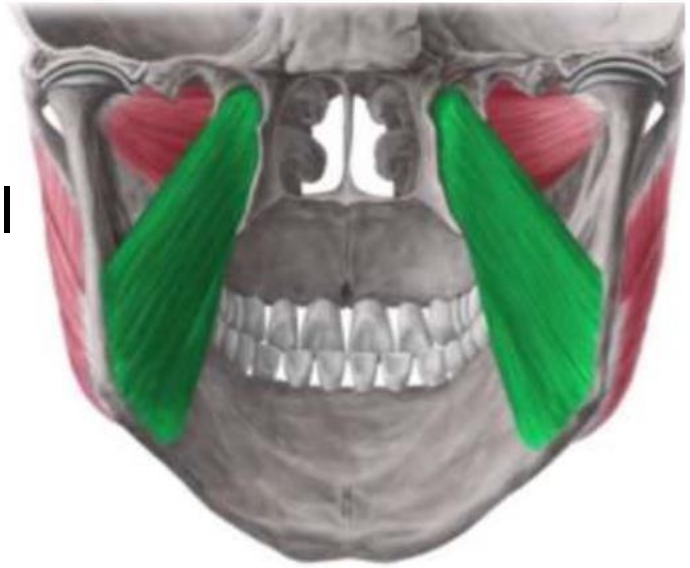
- Thick muscle
- Quadrilateral
- Multipennate
- Voluntary



ORIGIN

The large deep head arises from the medial surface of the lateral pterygoid plate of the sphenoid bone

The small, superficial head :
Maxillary tuberosity and the pyramidal process of the palatine bone



INSERTION

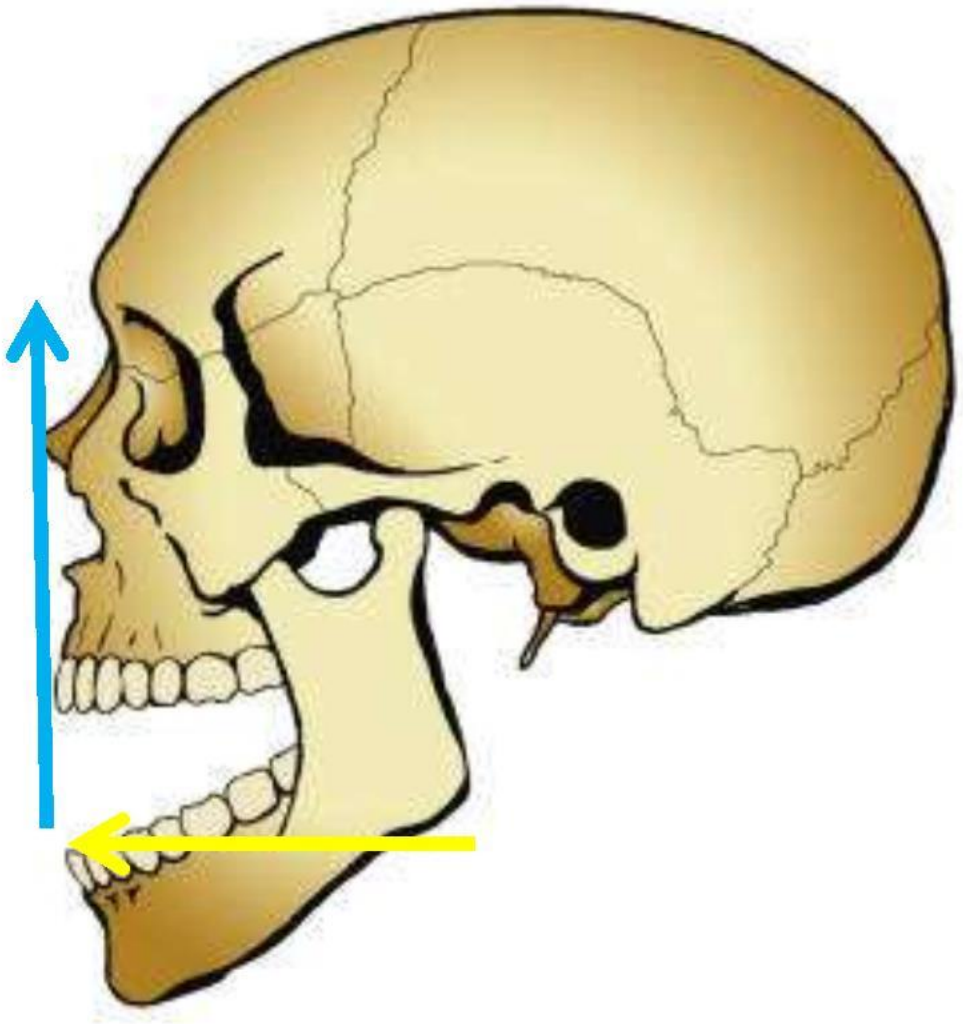
Postero-inferior part of the medial surface of the ramus and angle of the mandible

FUNCTION:

- Contraction - mandible is ELEVATED and the teeth are brought into contact

- It is also active in PROTRUDING the mandible

- Unilateral contraction - mediotrusive movement of the MANDIBLE



VASCULAR SUPPLY

Pterygoid branches of the maxillary artery.

INNERVATION

Medial pterygoid branch of the mandibular nerve

LATERAL PTERYGOID

It consists 2 heads or bellies with different function

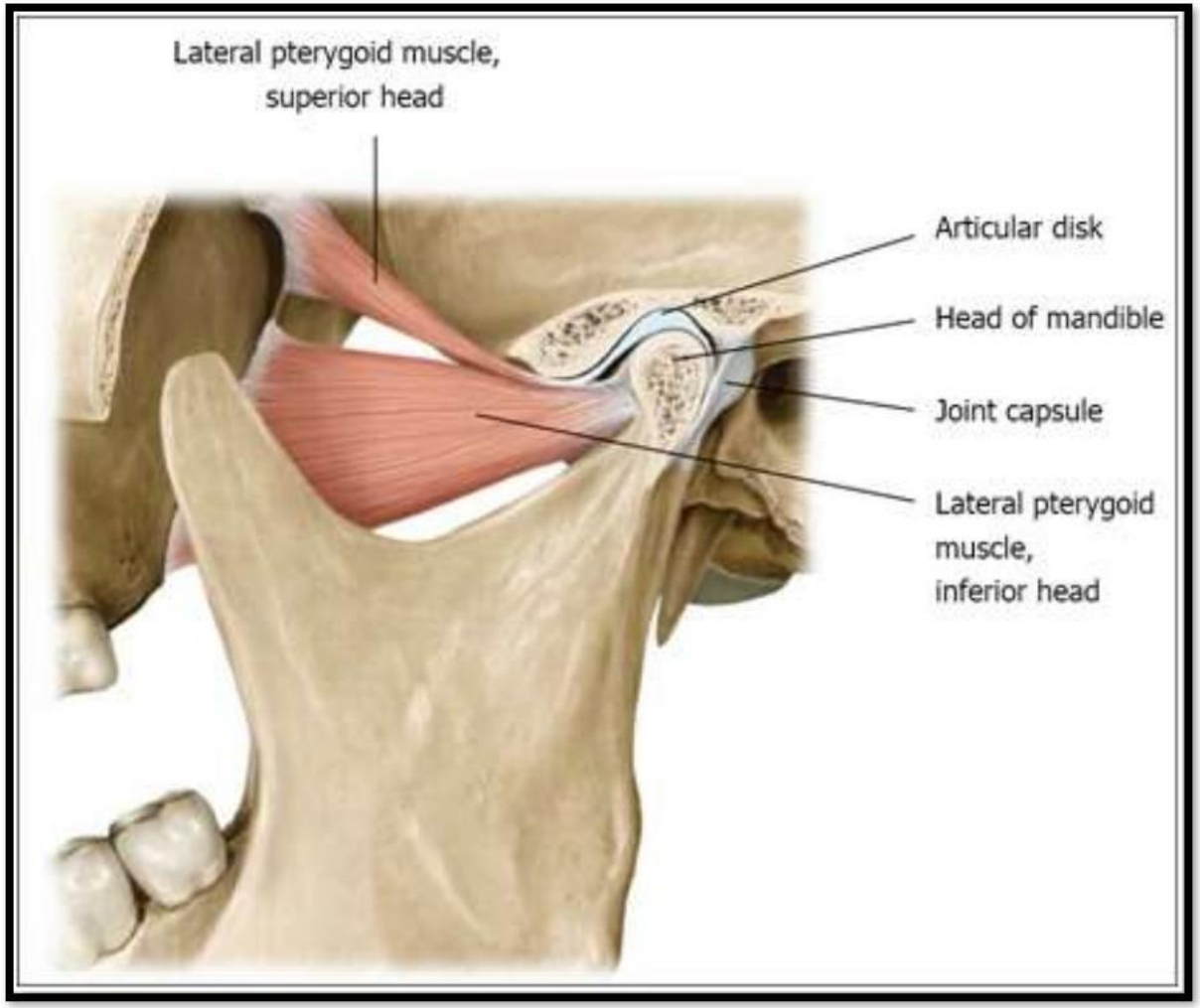
Superior head

Inferior head

Thick

Short

Non-pennate



ORIGIN.

The Superior head :Infratemporal surface and
:crest of the greater wing of the
sphenoid bone.

The Inferior head : the lateral surface of lateral
pterygoid plate.

INSERTION

Pterygoid fovea
A part of the superior head attached to the capsular ligament and to the anterior and medial borders of articular disc.

FUNCTION :

When left and right muscles contract together –protrusive movement

If only one lateral pterygoid contracts, the jaw rotates around a vertical axis passing through the opposite condyle and is pulled medially toward the opposite side.

During powerful clenching of teeth ,temporalis muscle pulls the condyle backwards which is limited by superior head of lateral pterygoid muscle

Vascular supply

Pterygoid branches from the MAXILLARY ARTERY

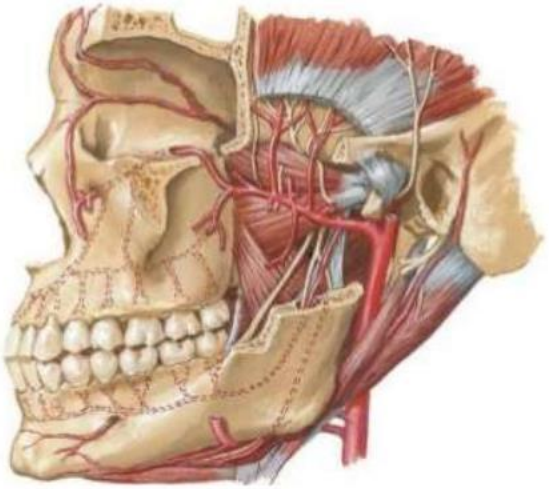
Ascending Palatine branch of FACIAL ARTERY

Innervation

The superior head & the lateral part of the inferior head: a branch from BUCCAL NERVE.

The medial part of the lower head : a branch arising directly from the anterior trunk of MANDIBULAR NERVE..

BLOOD SUPPLY OF TMJ



- **ARTERIES:**

Anteriorly: Masseteric A

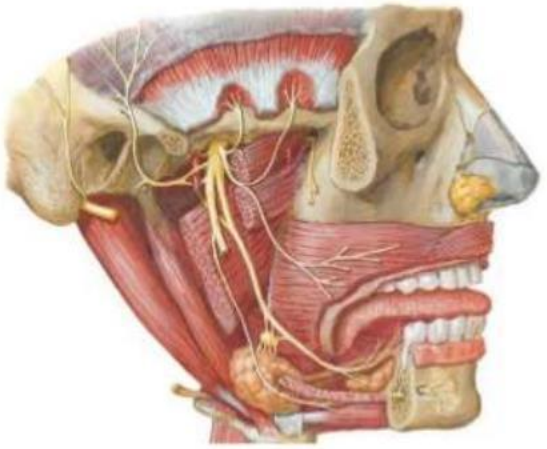
Posteriorly Branches from Maxillary A

Superficial temporal A

VEINS:

Maxillary vein and pterygoid venous plexes

INNERVATION

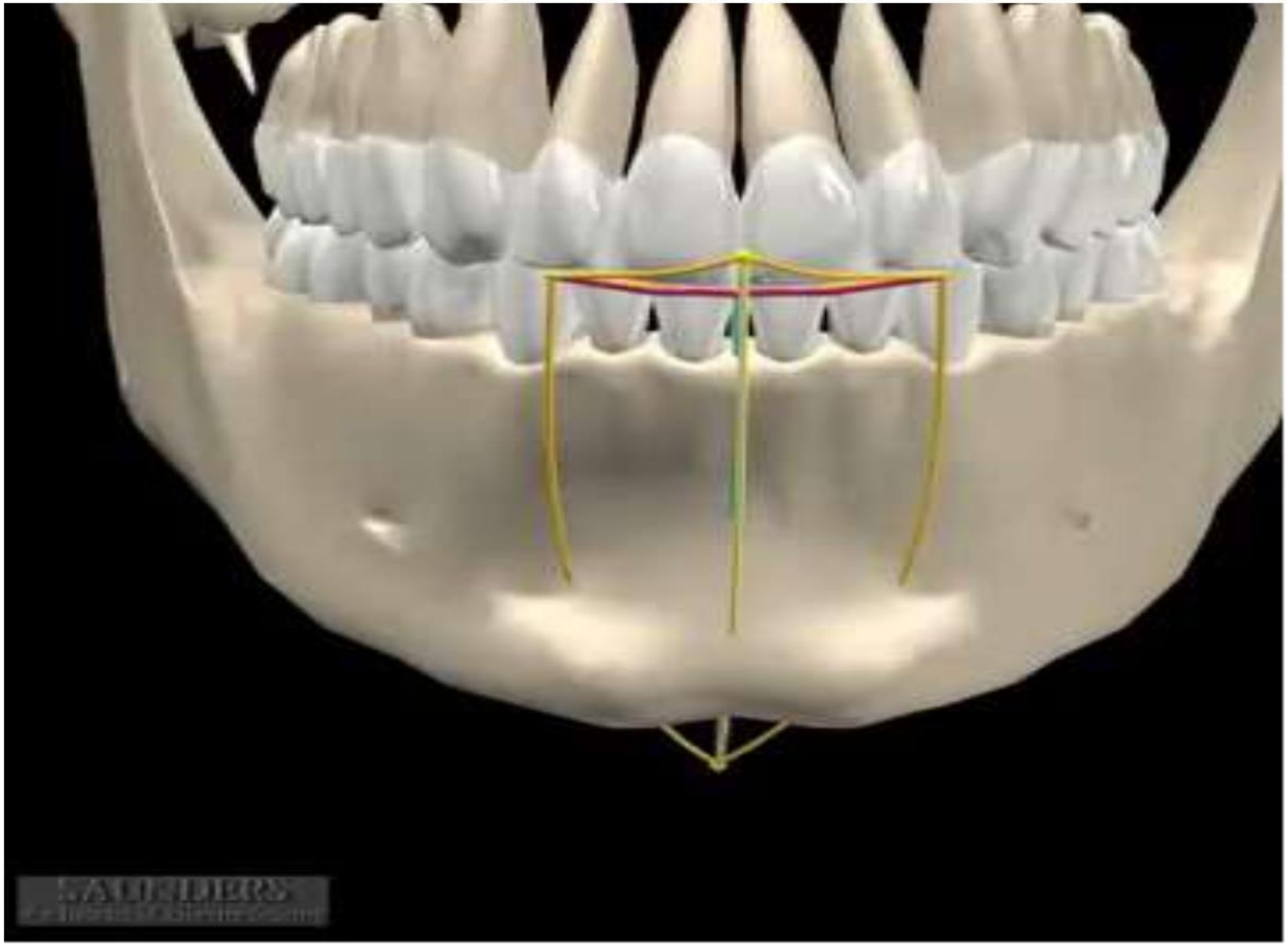


- Movements of synovial joint are initiated & effected by muscle coordination.

- Achieved in part through sensory innervation

- Branches of the mandibular division of the fifth cranial nerve supply the TMJ
- Anterioly by Auriculotemporal and Masseteric Nerve
- Posteriolrly by Deep temporal Nerve

MOVEMENTS



CLASSIFICATION

HABITUAL

- Speech
- Mastication

} LEARNED

- Deglutition
- Breathing

} INNATE

- Sucking,whistling etc

- **BASED ON AXIS OF ROTATION**
  - Transverse
  - Sagital
  - Vertical

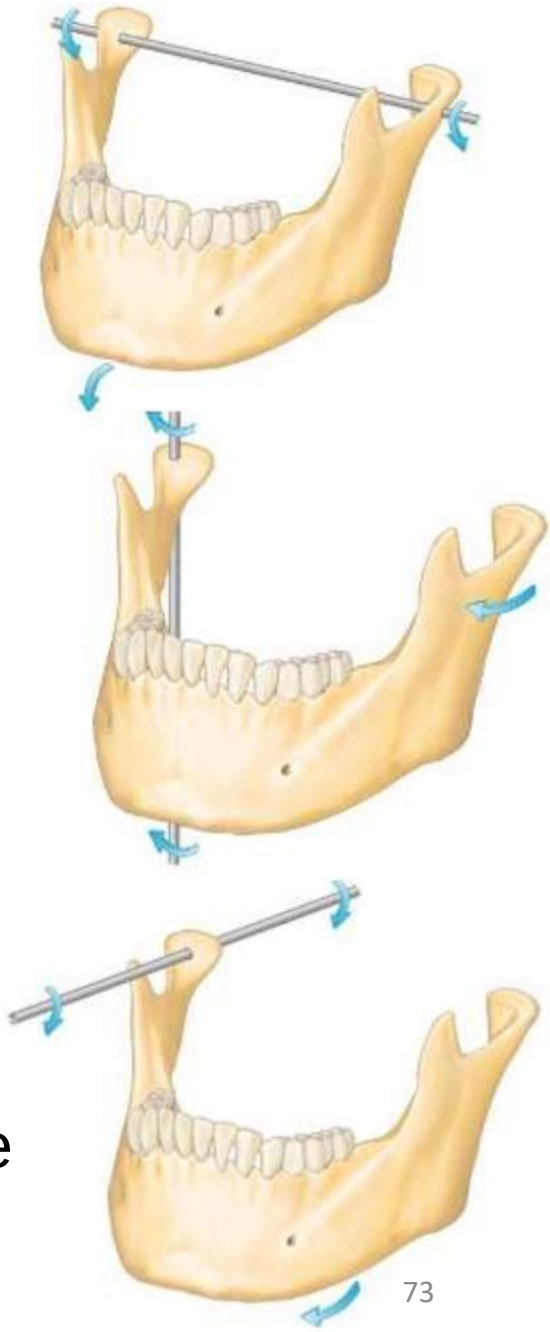
- **BASED ON EXTENT OF MOVEMENT**
  - Border movements
    - Extreme movements in all planes
    - Envelope motion
  - Intra border
    - Functional
    - Parafunctional
- **BASED ON TYPE OF MOVEMENT**
  - Hinge
  - Protrusive
  - Retrusive
  - Lateral

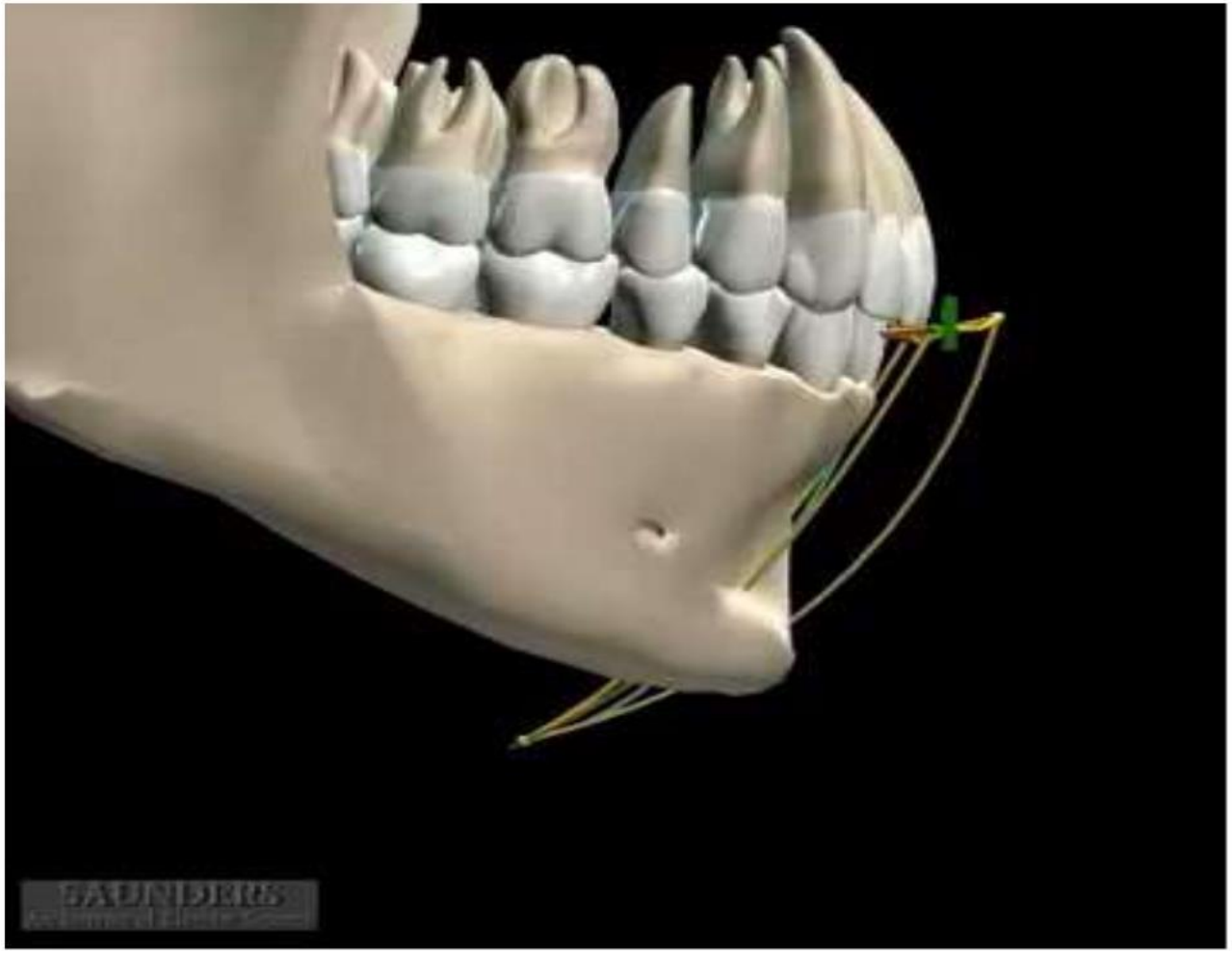
AXIS OF MOVEMENTS

Transverse or hinge axis:
Opening and closing movements
takes place in sagital plane

Vertical axis: lateral movements takes place through this axis which condyle twists laterally and backward in horizontal plane

Antero-posterior or Sagital axis:
lateral movements
takes place through this axis at which condyle twists while rotating in frontal plane



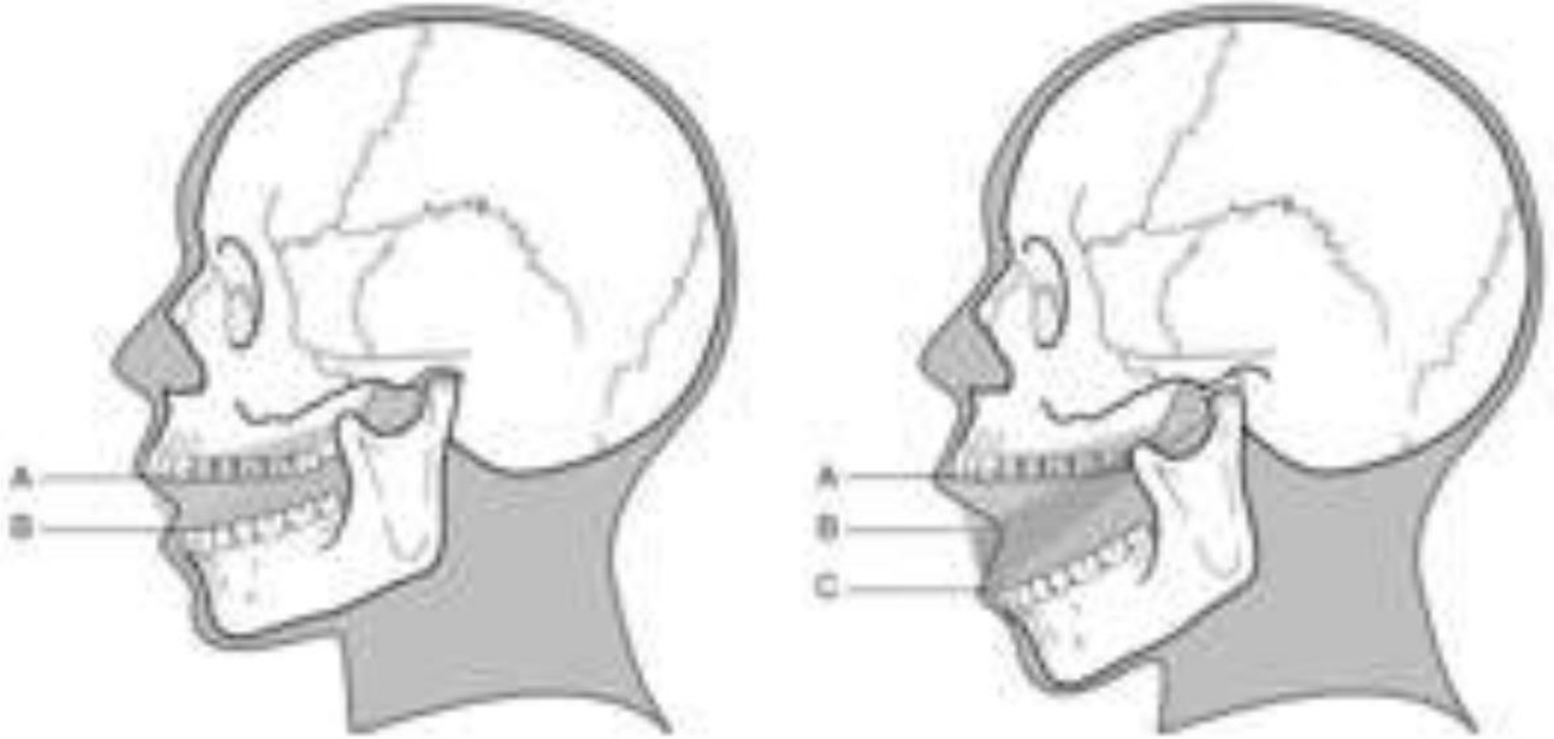


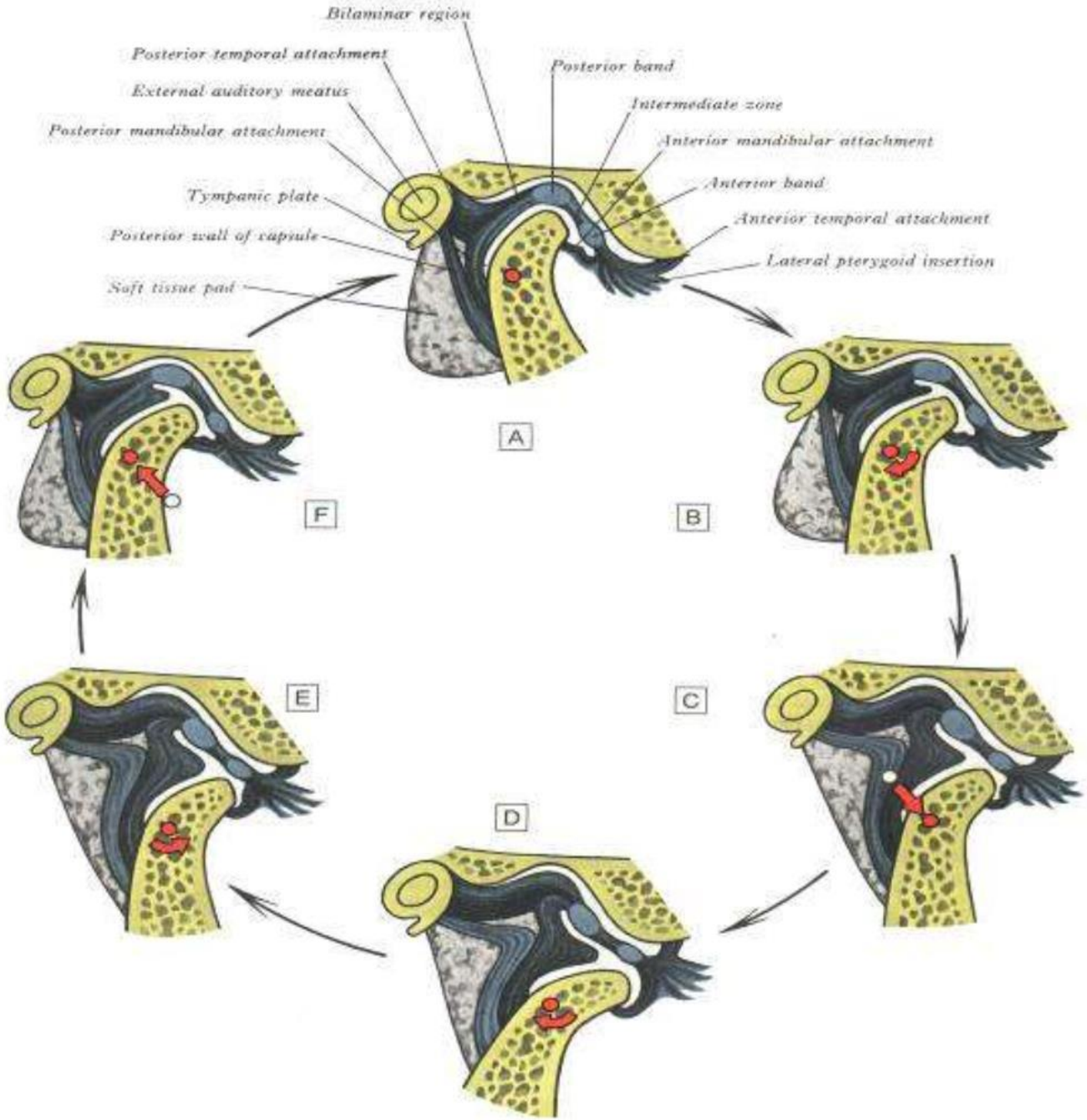
All the three axis of mandibular movemnets are inter-related to each other and simultaneous movements occurs around all axis during chewing cycle

MOVEMENTS

- Rotational / hinge movement in first 20-25mm of mouth opening

- Translational movement after that when the mouth is excessively opened.




Bilaminar region
Posterior temporal attachment
External auditory meatus
Posterior mandibular attachment
Tympanic plate
Posterior wall of capsule
Soft tissue pad
Posterior band
Intermediate zone
Anterior mandibular attachment
Anterior band
Anterior temporal attachment
Lateral pterygoid insertion
A
B
C
D
E
F

ACTION OF MASTICATORY MUSCLES ON MANDIBULAR MOVEMENTS

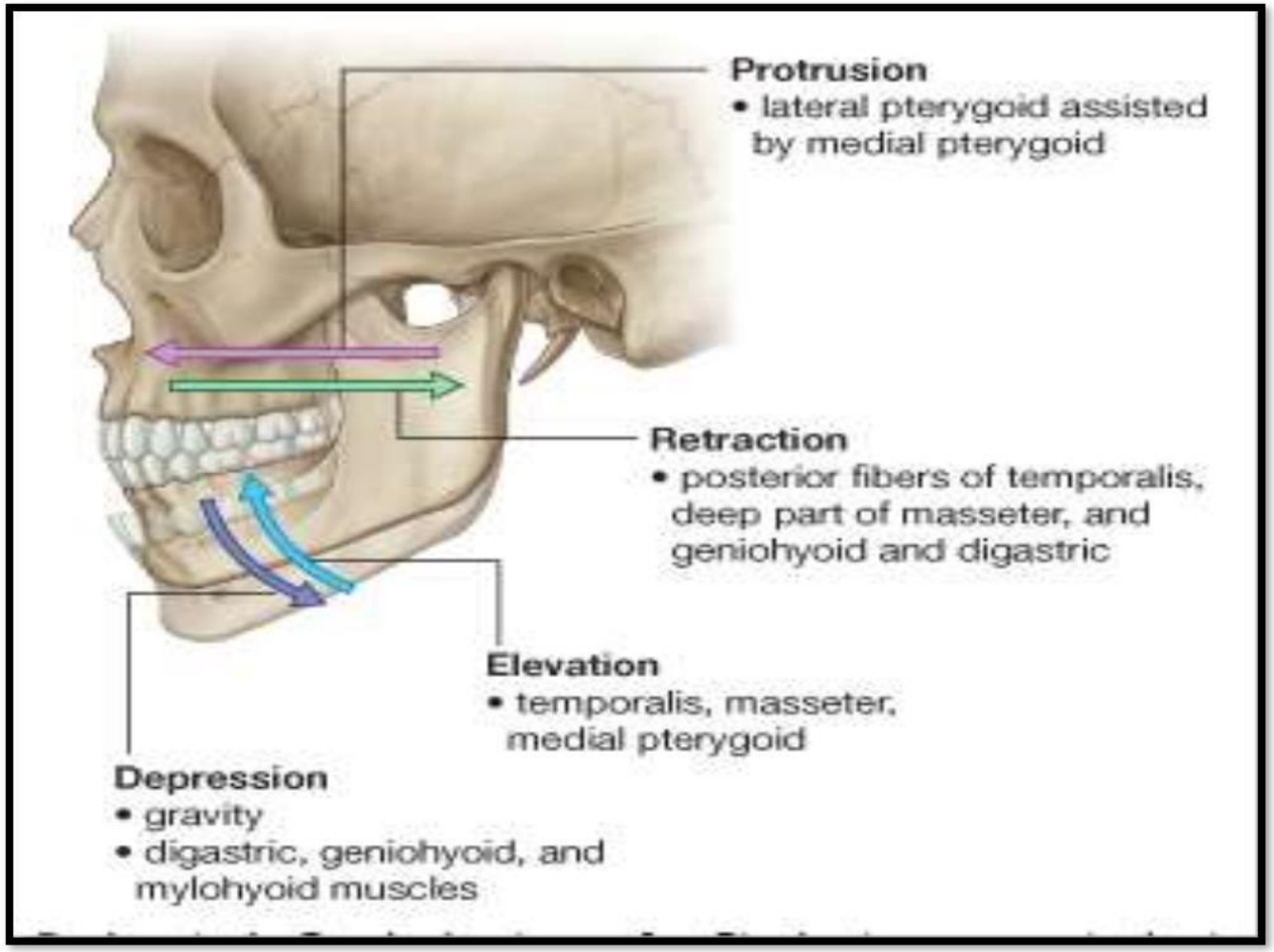
DEPRESSION OF MANDIBLE

Digrastric

Mylohyoid

Geniohyoid

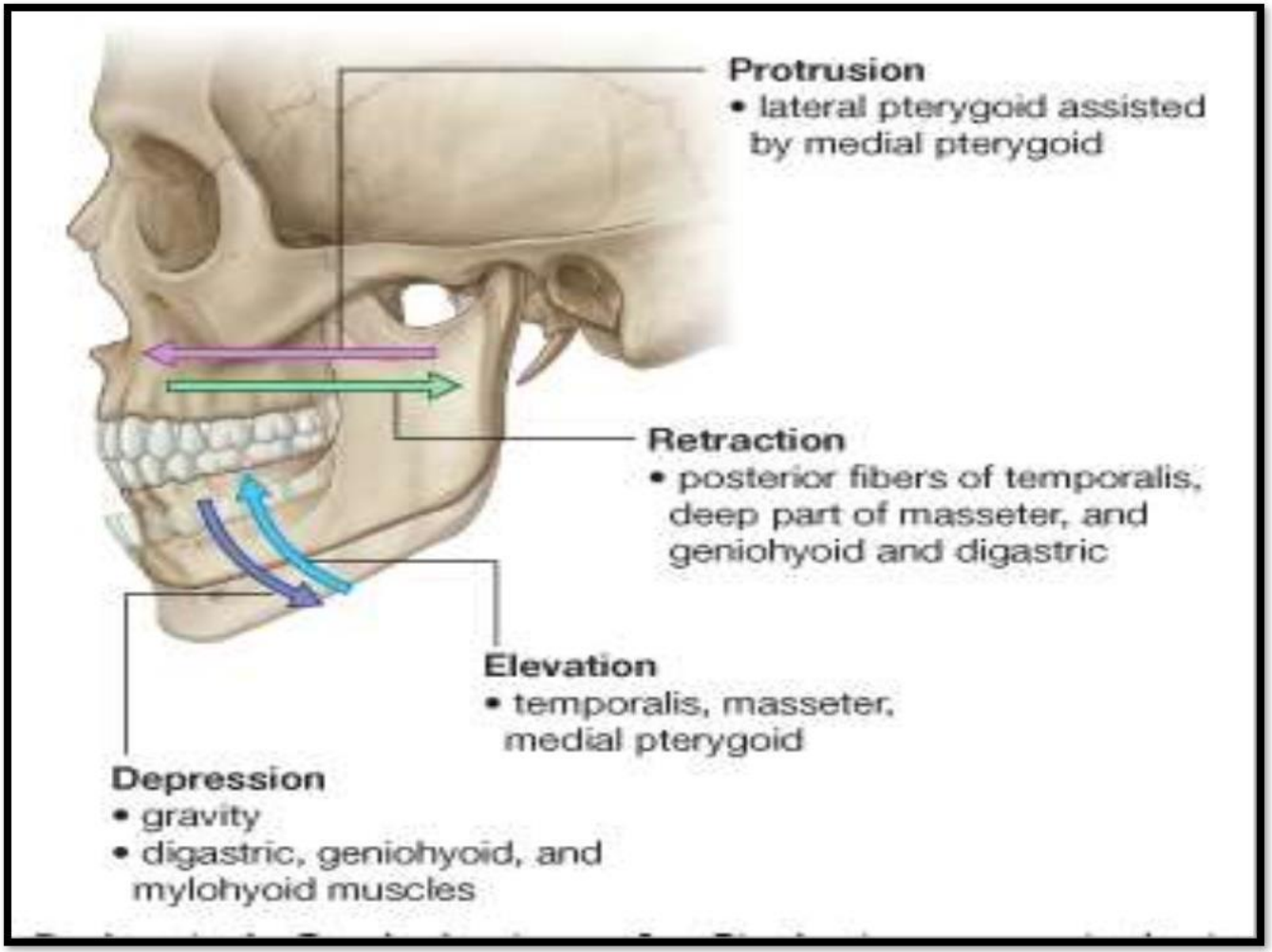
Lateral Pterygoid



ELEVATION OF MANDIBLE

Temporalis Medial Pterygoid

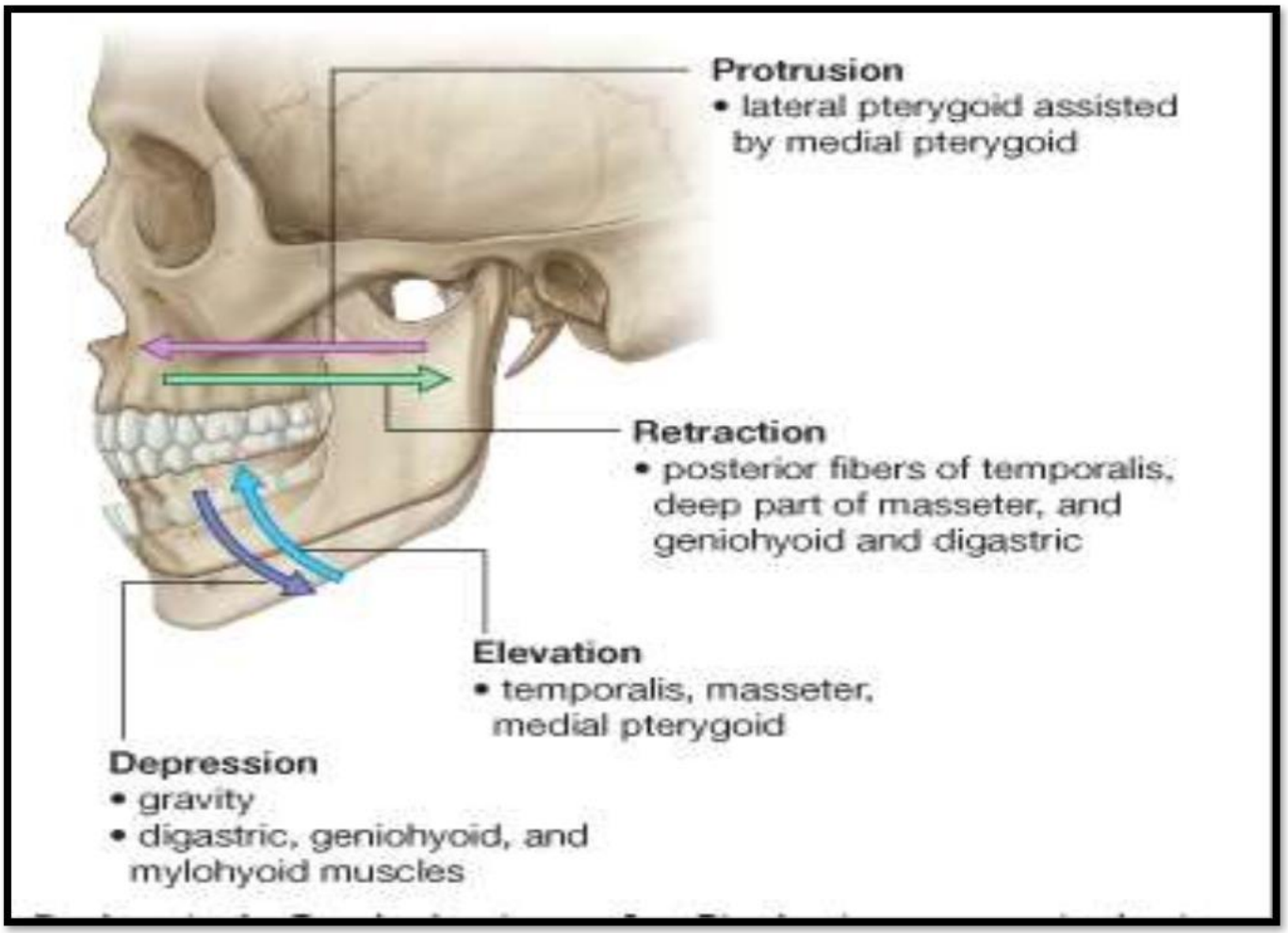
Masseter



PROTRUSION OF MANDIBLE

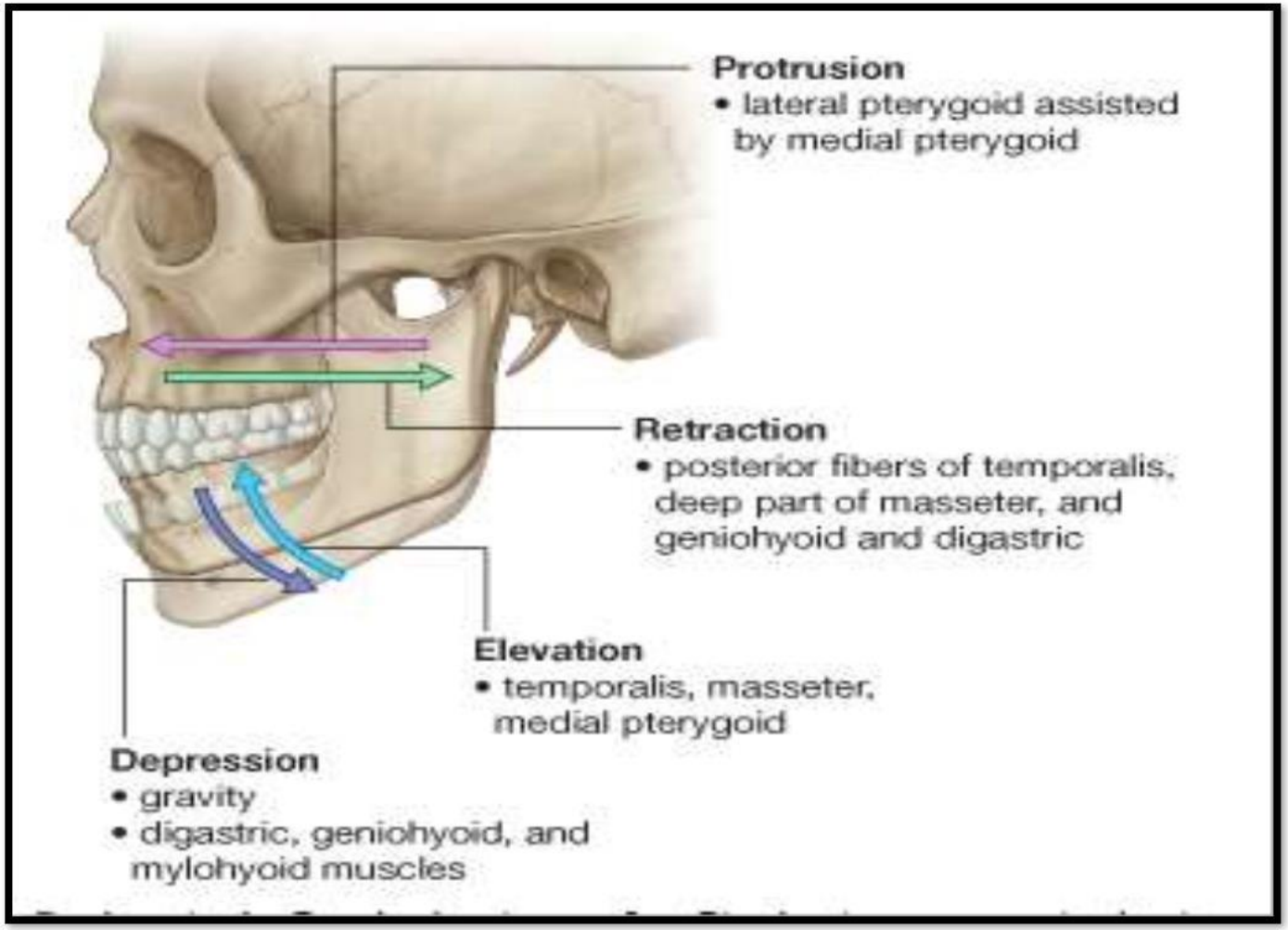
Lateral Pterygoids

Medial Pterygoids



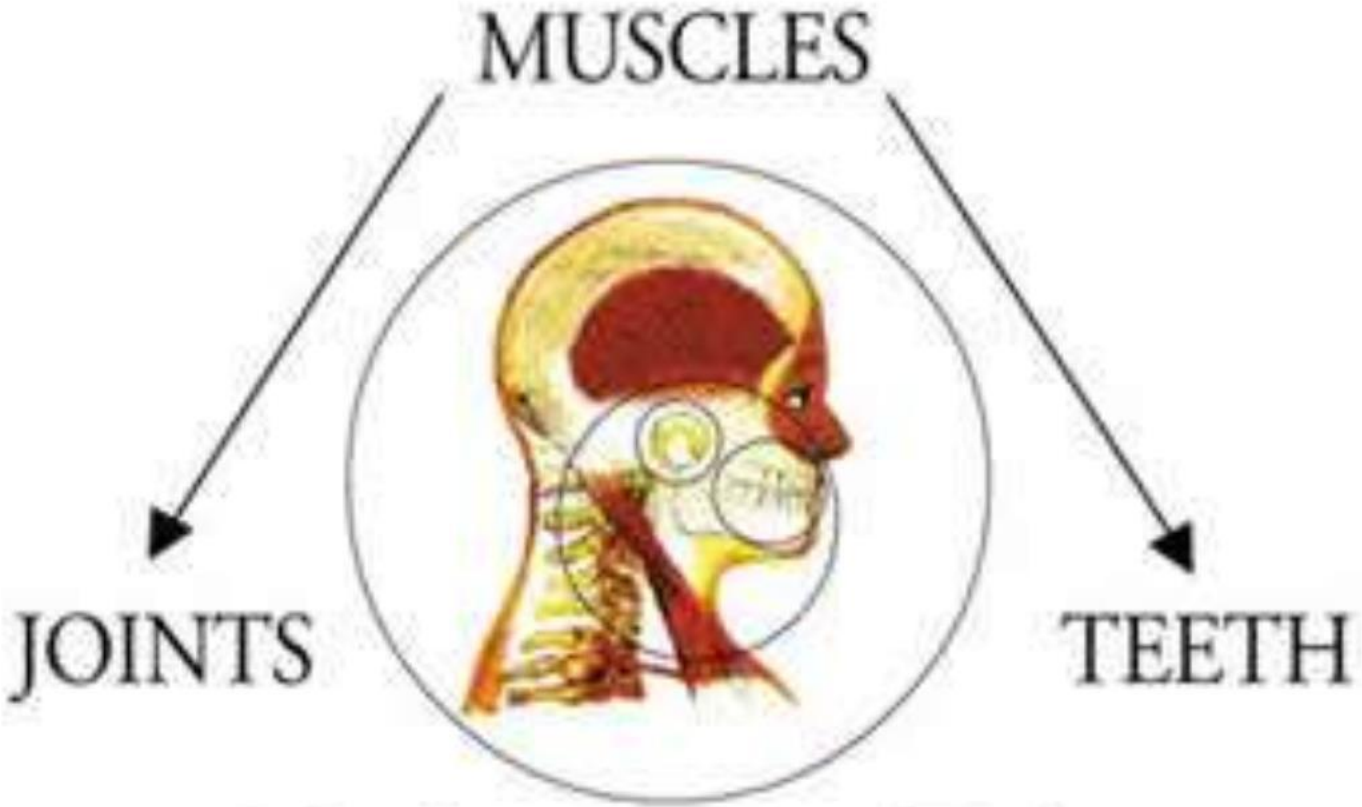
RETRACTION OF MANDIBLE

Posterior fibres of Temporalis



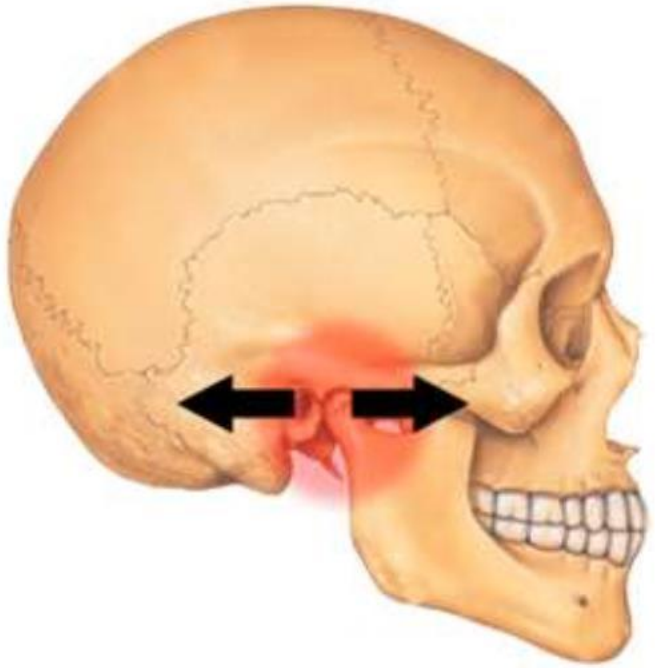
PROSTHODONTIC IMPLICATIONS OF TEMPROMANDIBULAR JOINT

Why TMJ imp for Prosthodontist



Teeth must fit into harmony of jaw relationship-not vice -versa

- The changes in mandible and maxilla occurs slowly over a period of time

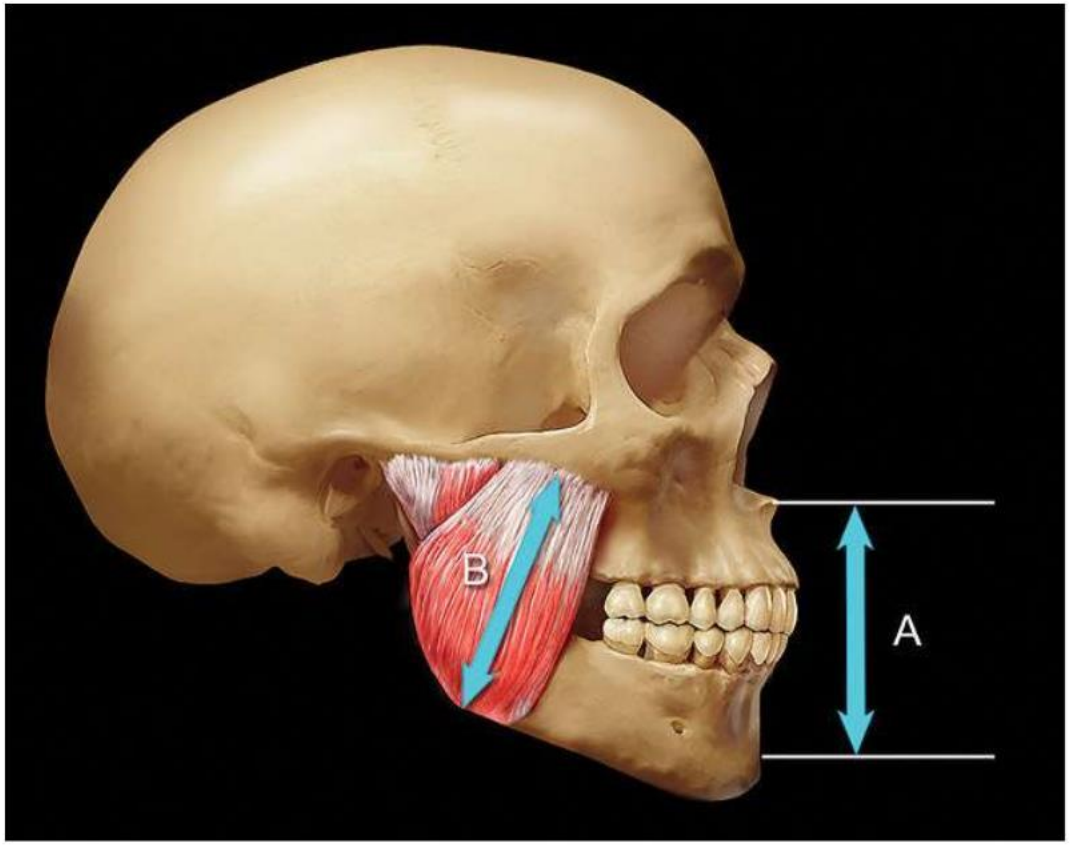


- Articular surfaces of TMJ undergo slow but continuous remodelling throughout life

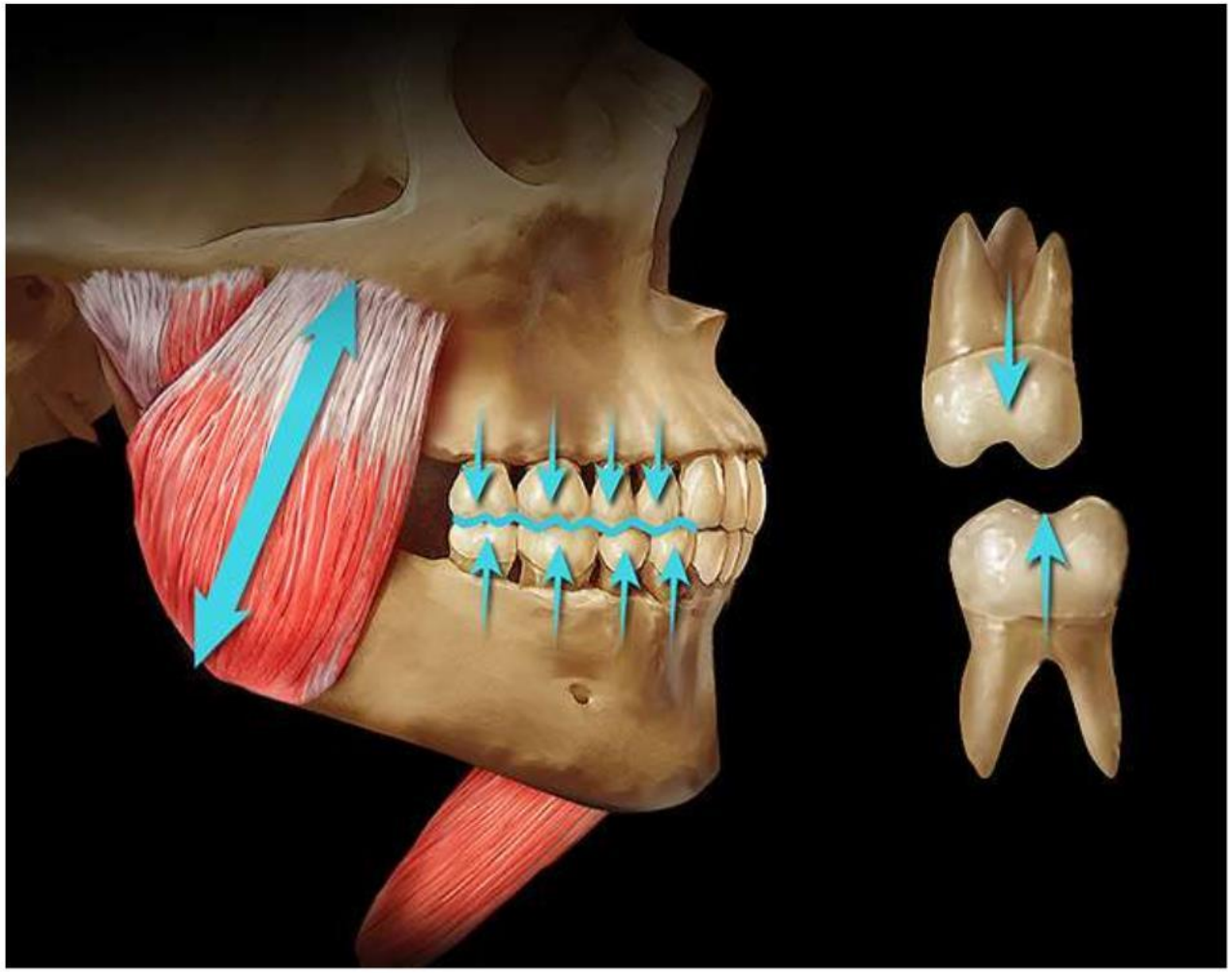
VERTICAL DIMENSION

Vertical position of mandible in relation to maxilla when teeth are intercuspated at most closed position

- Dictated by repetitious position of contracted length of elevators



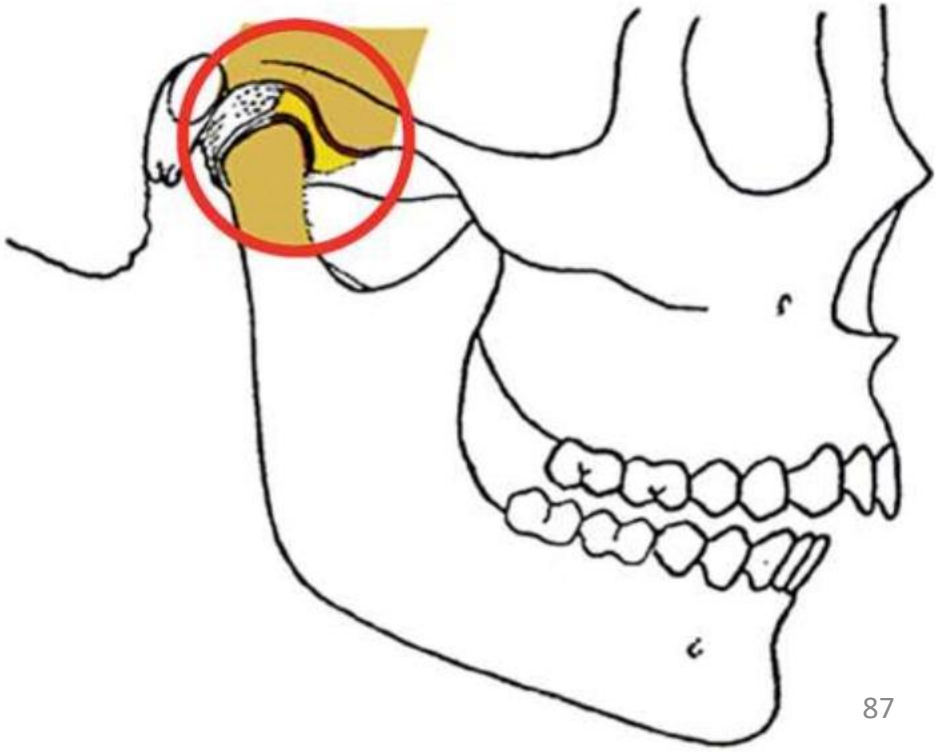
- The vertical dimension determined by contracted length of elevators, sets the limit of jaw separation to which teeth erupts



CENTRIC RELATION

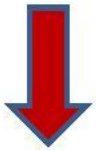
Centric relation is the relationship of the mandible to the maxilla when the properly aligned condyle-disk assemblies are in the most superior position against the eminentiae irrespective of vertical dimension or tooth position

GPT 8

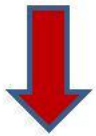


HOW MANDIBLE GOES INTO CENTRIC RELATION

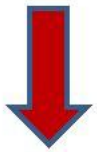
Triad of strong elevator muscles moves the condyle-disk assembly up on posterior slopes of the articular tubercle



The LATERAL PTERYGOID relaxes and stays relaxed during complete closure



Complete seating of the condyles in superior most position

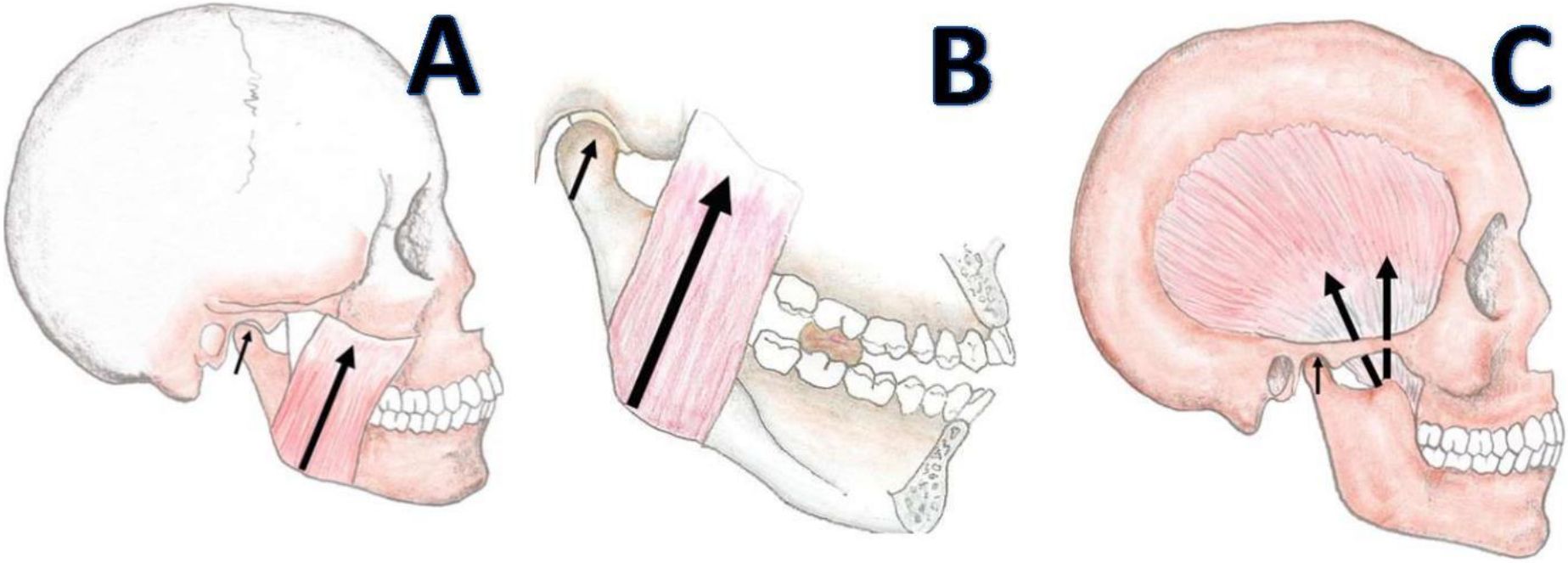


CENTRIC RELATION

A:SUPERFICIAL MASSETER moves the condyle UP against the posterior slope

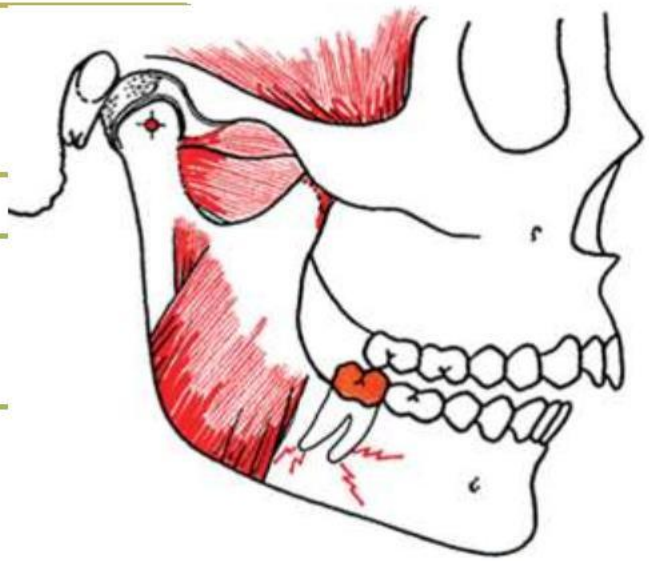
B: The MEDIAL PTERYGOID moves THE CONDYLES UP from the lingual side of the mandible

C:The TEMPORALIS attach to the coronoid process between the teeth and the TMJs and moves THE CONDYLE UP……



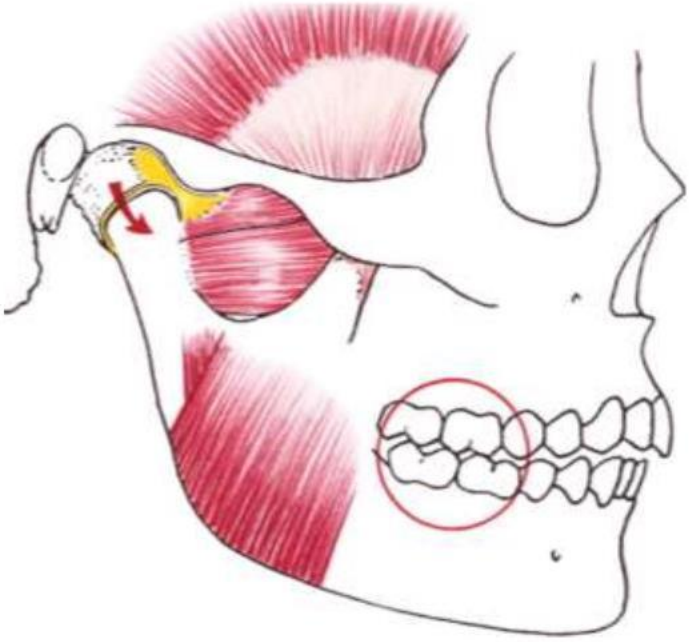
OCCLUSO MUSCLE PAIN

- OCCLUSAL INTERFERENCES Cause
- DISPLACEMENT OF TMJ (to achieve max.intercuspation)
- Cause INCORDINATION OF MASTICATORY MUSCULATURE
- Muscle hyperactivity & **PAIN**



MOST COMMON CONDITIONS AFFECTING TMJ IN A PROSTHETIC SET UP

- Occlusal discrepencies
- Dysharmony between centric relation & occlusion
- Bruxism
- Emotional stress (mostly in edentulous patients)

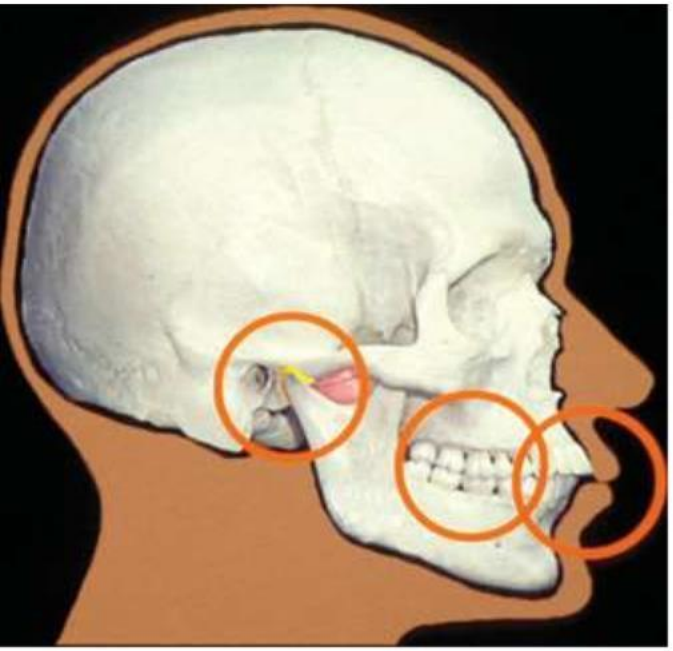


OTHER FACTORS AFFECTING TMJ

- Trauma
- Mal-alignment of the occlusal surfaces of the teeth due to defective crowns or other restorative procedures.

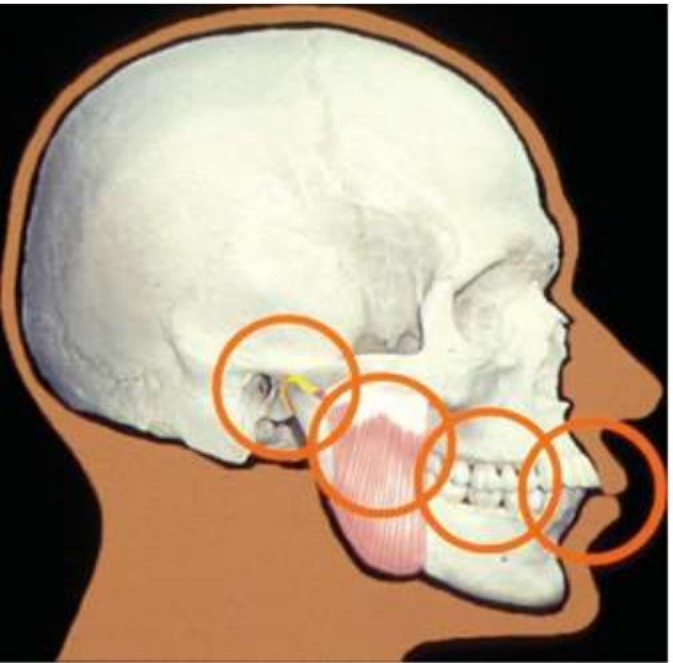
.

- Excessive gum chewing or nail biting.
- Degenerative joint disease, such as osteoarthritis



PRIMARY REQUIREMENTS FOR SUCCESSFUL OCCLUSAL THERAPY

- Stable TMJ
- Non interfering post.teeth
- Anterior teeth in harmony with envelope of function



MASTICATORY MUSCLE FUNCTION IS AFFECTED BY THE OTHER 3 STRUCTURES.

TREATMENT

1. Restoration of the occlusal surfaces of the teeth
   a) Selective reshaping of teeth
   b) Crown & bridges , Implants
2. Occlusal Splint (also called night guards or mouth guards)
3. Orthodontic treatment **&** Orthognathic Surgery

A BRIEF ABOUT OCCLUSAL SPLINTS

OCCLUSAL SPLINTS

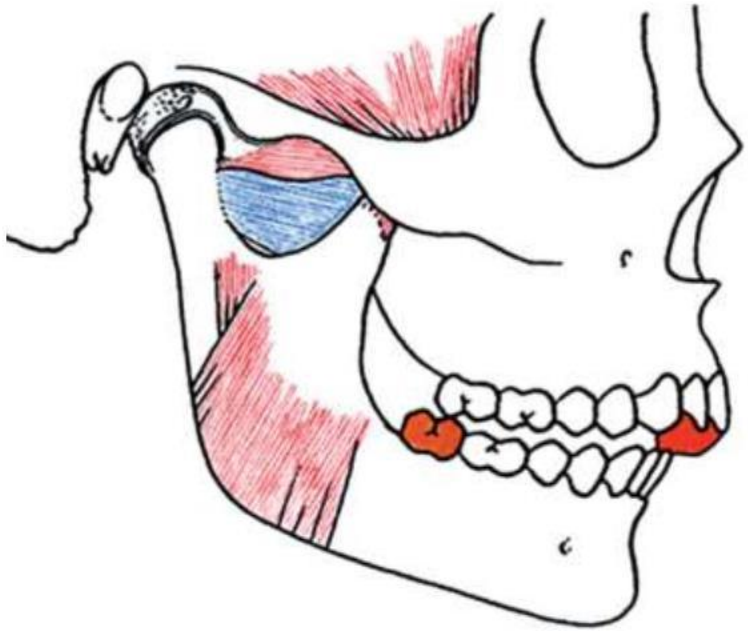
- An occlusal splint is a removable device made of hard acrylic resin creating precise occlusal contact with the teeth of the opposing arch.

PRIMARY FUNCTIONS OF OCCLUSAL SPLINTS

- Temporarily provide an orthopedically musculoskeletal stable joint position.

- Introduces an optimum occlusal condition that prevents the muscular hyperactivity.

- Used to protect teeth from excessive tooth wear.



SECONDARY FUNCTION OF OCCLUSAL SPLINTS

- Stablization of week teeth
- Distribution of occlusal forces
- Stablization of unopposed teeth

TYPES OF OCCLUSAL APPLIANCES

- THE TWO MOST COMMONLY USED ARE:

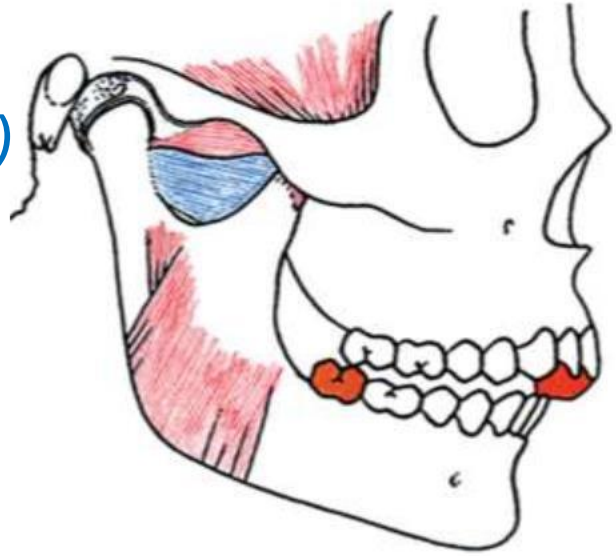
1. The Permissive Split
2. The Directive Splint

INDICATIONS

PERMISSIVE SPLINT

Stabilizing appliance are generally used to treat muscle pain disorders.

(*also called as Muscle De-programmer)*



DIRECTIVE SPLINT

- Anterior positioning appliance are used to position or align the condyle disk assembly

INSTRUCTIONS

- The patient is instructed how to properly seat the appliance and the final seating is done by biting.

- Patients are instructed to wear it in night for bruxism and in day time for disc problems.

IMPORTANT POINTS IN SPLINT MANAGEMENT

- A splint should be checked at least once during the 1st week after delivery and adjustments are done if required

- Patients with occlusal splint should preferably be recalled after 3 months months

CONCLUSION

Dentist must assess the oral function of patients prior to any treatment, since mastication is the most important oral function and it is closely associated with TEMPOROMANDIBULAR JOINT. Therefore, examination of TMJ & thorough knowledge of its anatomy and functioning are the keys for successful PROSTHODONTIC treatment

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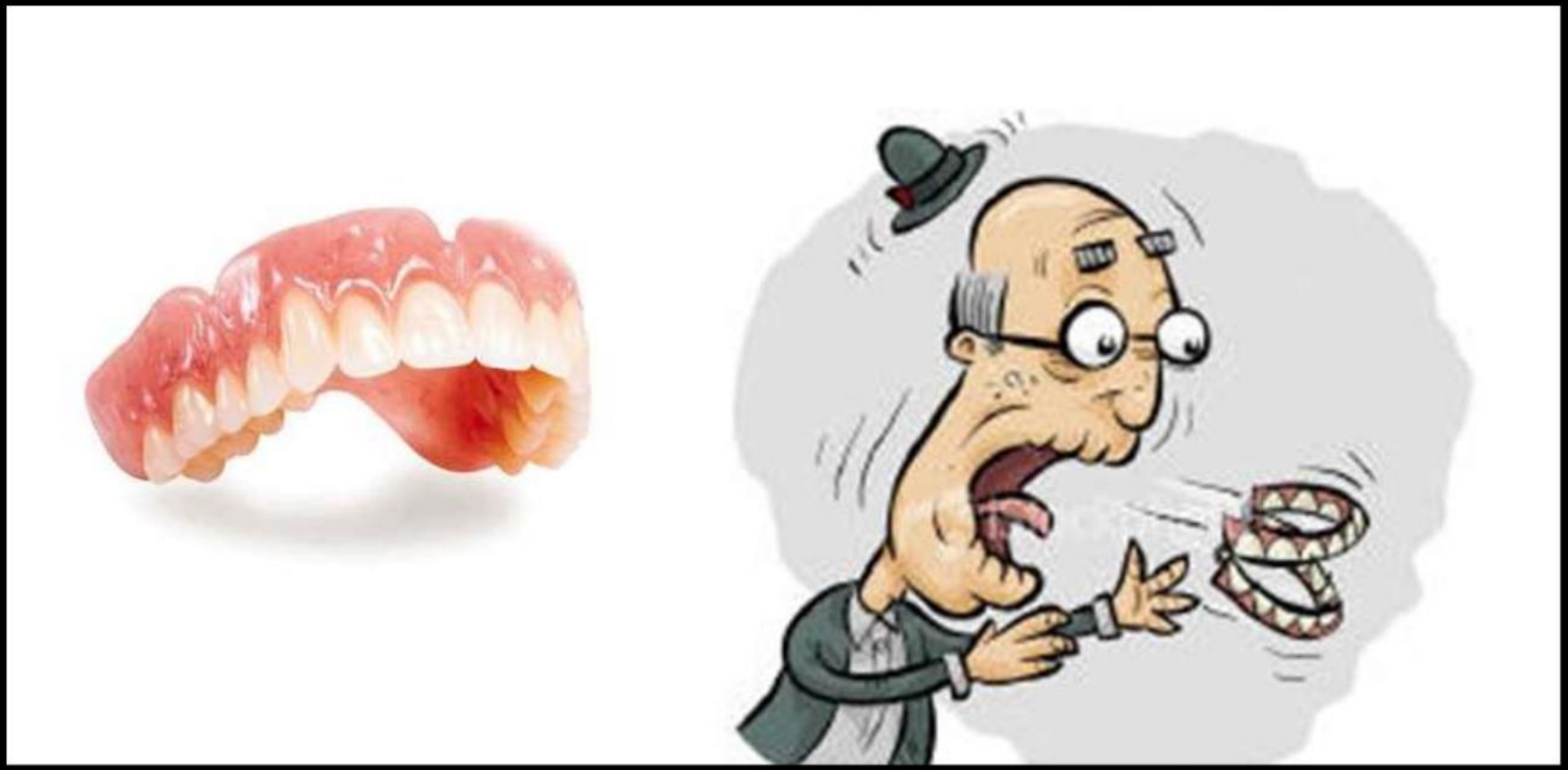

THANK YOU