Temporomandibular joint (TMJ)

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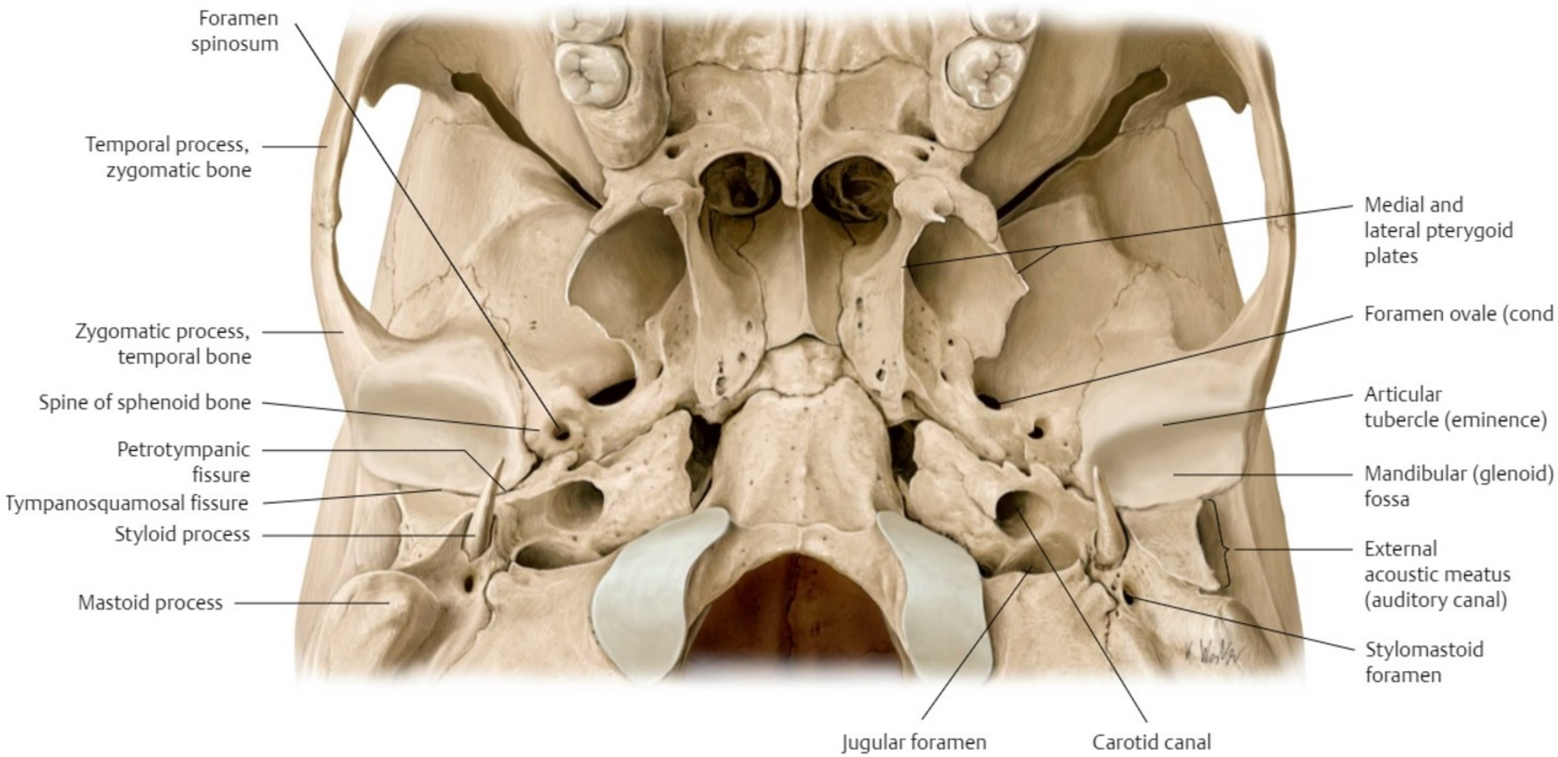
Articular surfaces

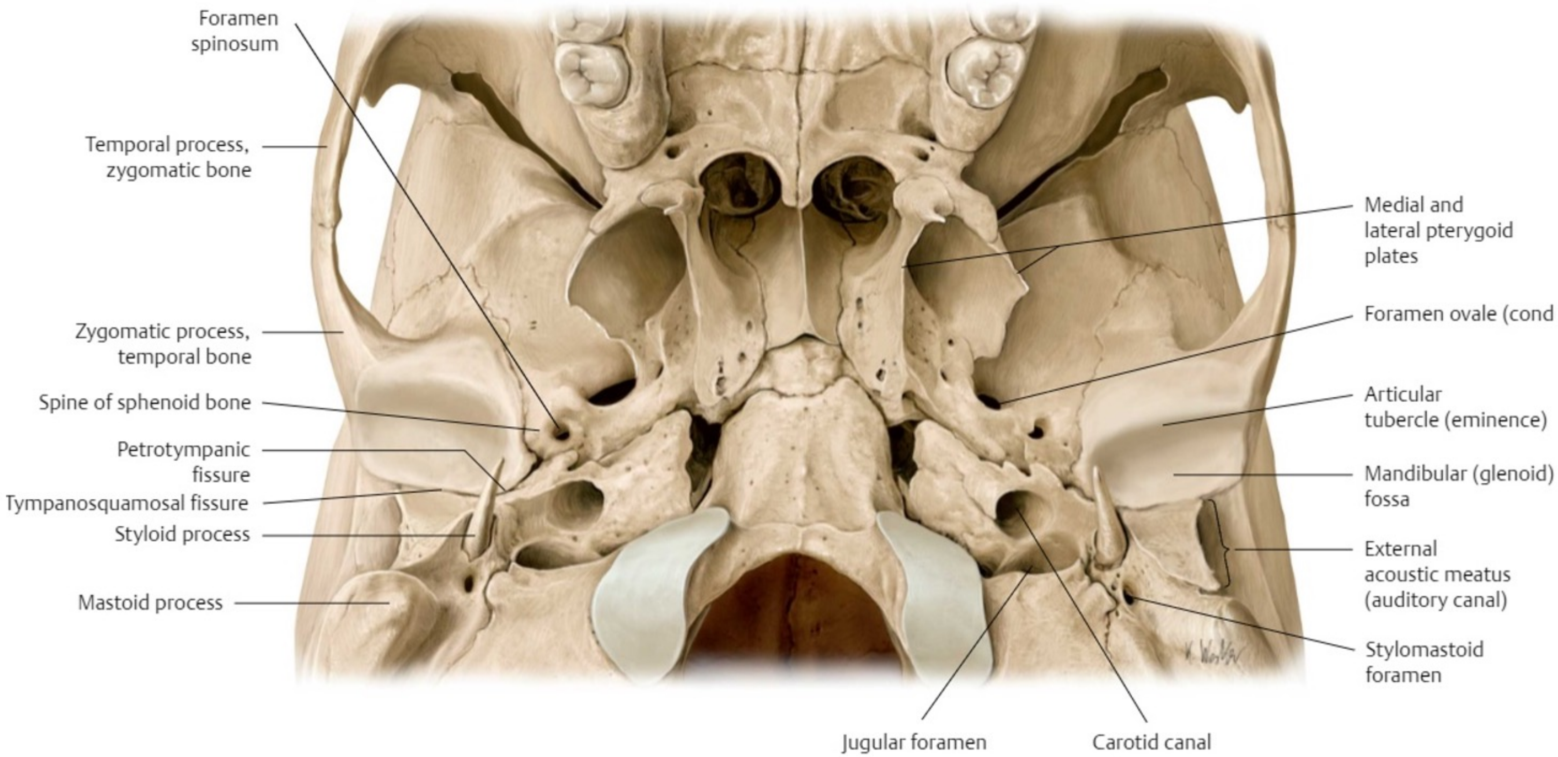
- **Upper articular surface is formed by the mandibular fossa and the articular tubercle of the squamous part of the temporal bone. Squamotympanic fissure Separating the mandibular fossa from the tympanic plate posteriorly.**

- **Lower articular surface is formed by the head (condyloid process) of the mandible.**

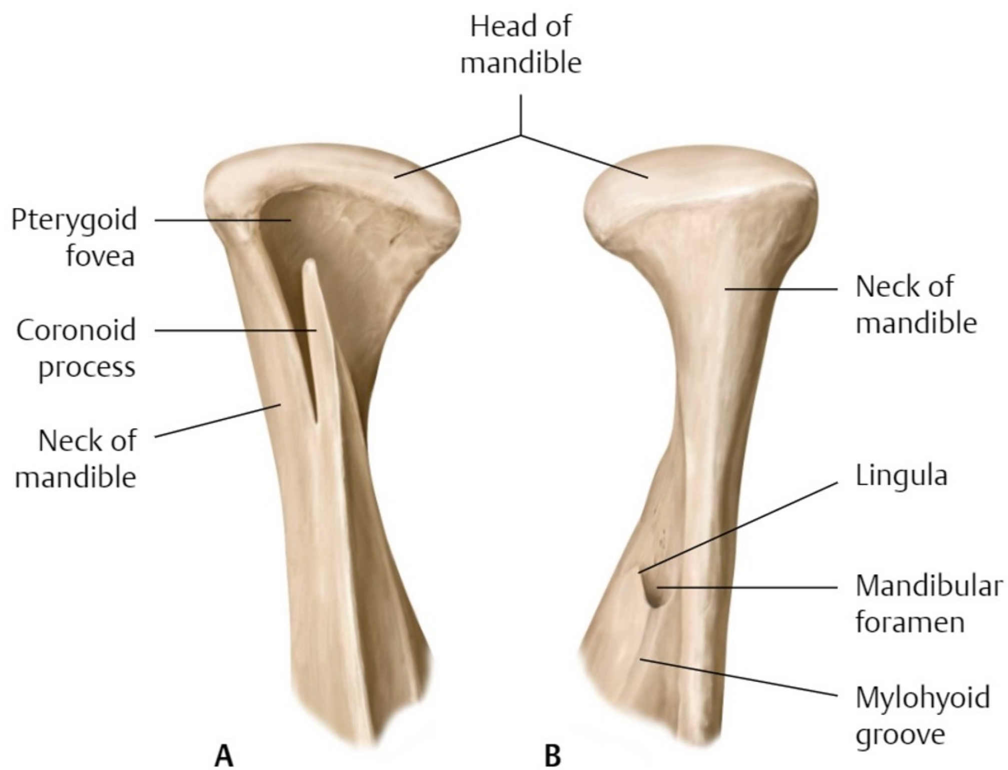
The mandibular fossa is a depression in the squamous part of the temporal bone.
The articular tubercle is located on the anterior side of the mandibular fossa.
The head of the mandible is markedly smaller than the mandibular fossa, allowing it to have an adequate range of movement.
The external auditory canal lies just posterior to the mandibular fossa. Trauma to the mandible may damage the auditory canal.

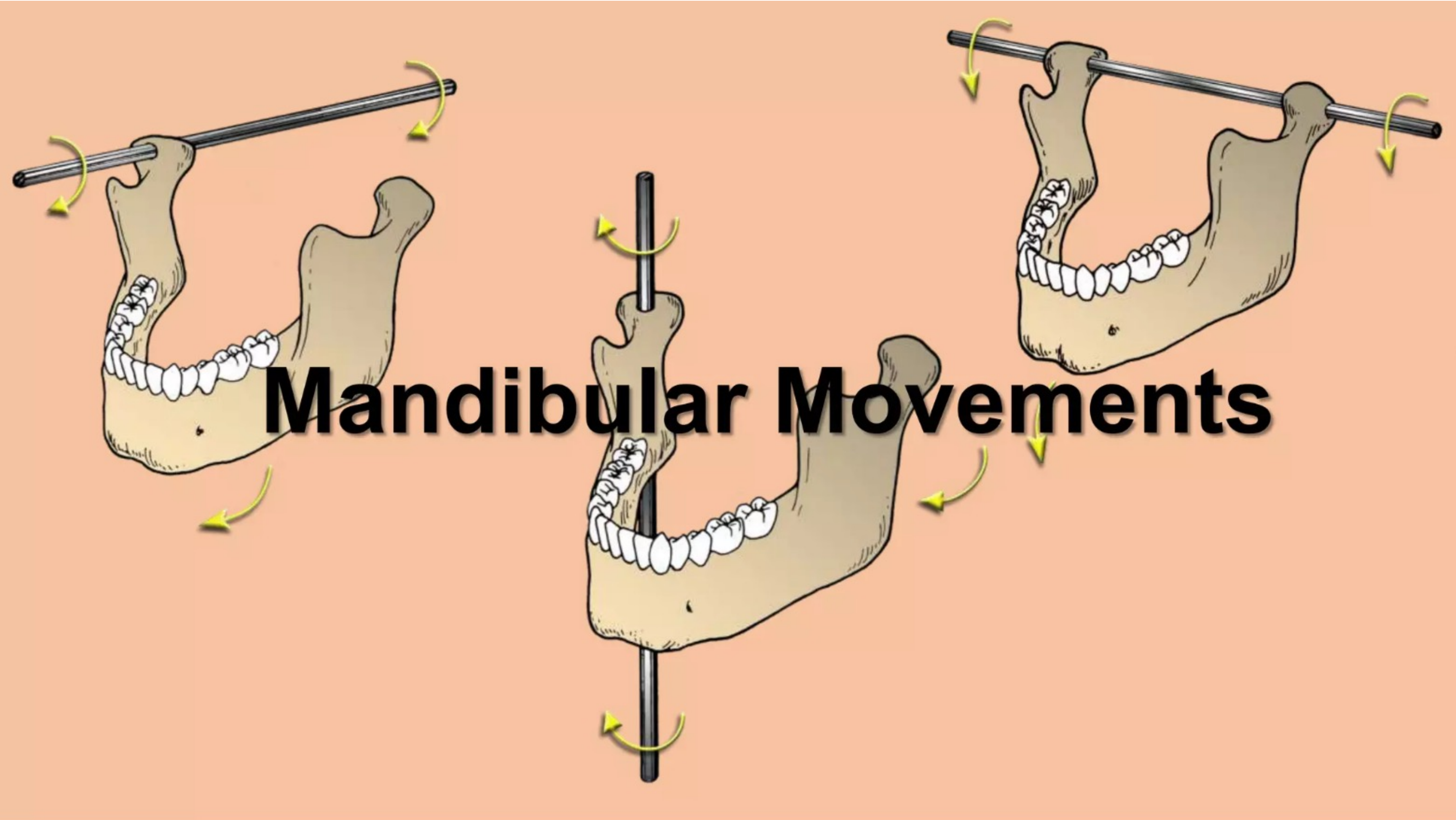


The mandibular fossa is divided into two compartments (anterior and posterior), separated by the tympanosquamosal and petrotympanic fissures.
The posterior compartment is nonarticulatory, and the chorda tympani nerve and anterior tympanic artery are able to pass through this space without being compressed.
The glenoid lobe of the parotid gland may also project into the posterior compartment.



The head of the mandible not only is markedly smaller than the articular fossa but also has a cylindrical shape. This shape increases the mobility of the mandibular head, as it allows rotational movements about a vertical axis (condular–hinge axis).




Mandibular Movements

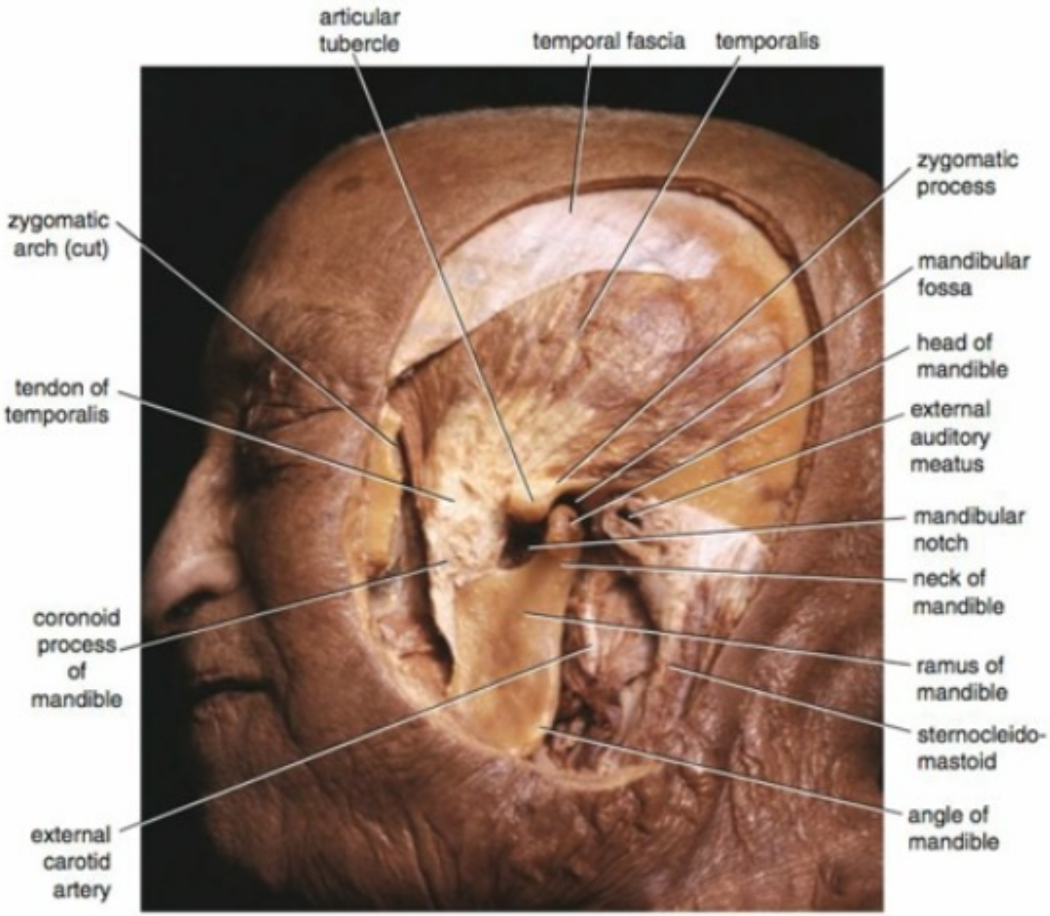


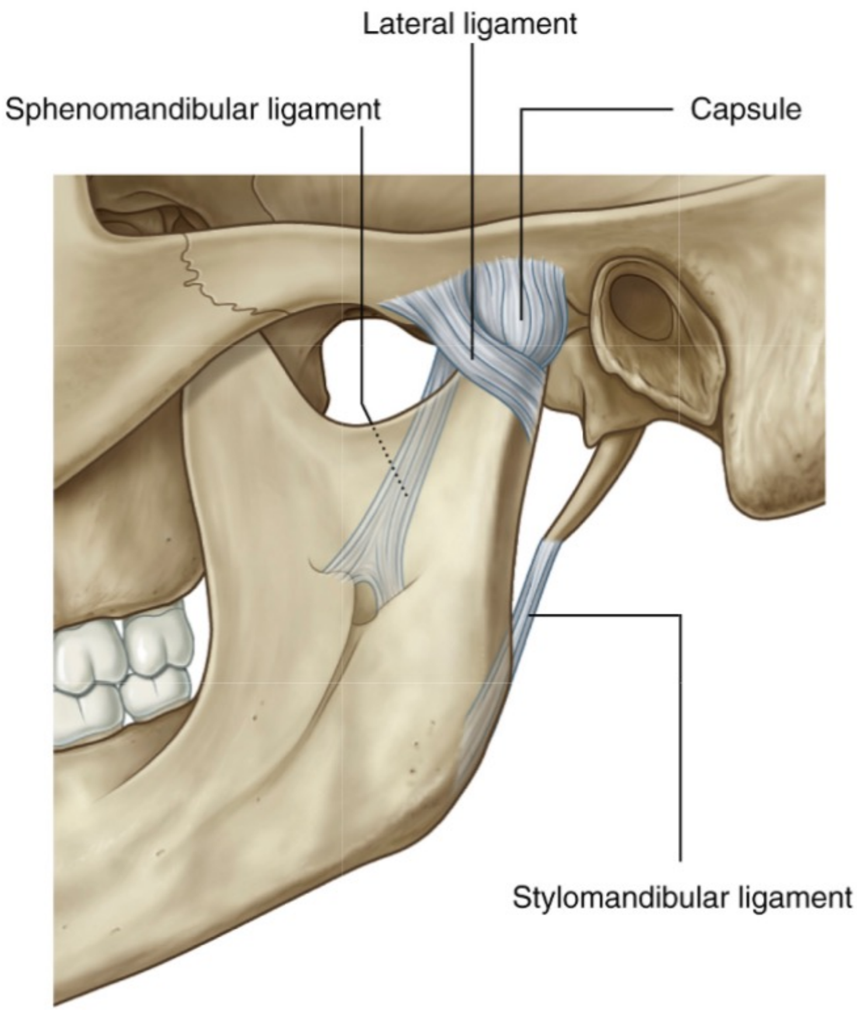
FIGURE 11.34 A dissection of the left temporomandibular joint. The capsule and lateral temporomandibular ligament have been removed to reveal the interior of the joint. Note the articular tubercle and mandibular fossa of the temporal bone and the head of the mandible. The articular disc is present within the joint cavity on the upper surface of the head of the mandible.

Type of joint

- **Is a compound joint – presence of articular disc**
- **Is a synovial joint. Unlike most other synovial joints where the articular surfaces of the bones are covered by a layer of hyaline cartilage, those of the temporomandibular joint, the articular surfaces are covered by fibrocartilage.**
- **Fibrocartilage has many collagen fibers embedded in a small amount of matrix and is found in the discs within joints (e.g., the temporomandibular joint, sternoclavicular joint, and knee joint) and on the articular surfaces of the clavicle and mandible.**
- **Fibrocartilage, if damaged, repairs itself slowly in a manner similar to fibrous tissue elsewhere. Joint discs have a poor blood supply and therefore do not repair themselves when damaged.**

Articular capsule

- **The TMJ is surrounded by a relatively lax capsule, which permits physiological dislocation during jaw opening.**
- **The synovial membrane of the joint capsule lines all nonarticular surfaces of the upper and lower compartments of the joint and is attached to the margins of the articular disc.**
- **The fibrous membrane of the joint capsule encloses the temporomandibular joint complex and is attached:**
  - **above and ventrally along the anterior margin of the articular tubercle,**
  - **laterally and medially along the margins of the articular fossa,**
  - **posteriorly to the region of the tympanosquamous suture, and petrotympanic fissure**
  - **below around the upper part of the neck of the mandible.**


Lateral ligament
Sphenomandibular ligament
Capsule
Stylomandibular ligament

Articular disc

It is an oval plate of fibrocartilage that is attached to the joint capsule on all sides.

It is also attached in front to the tendon of the lateral pterygoid muscle and by fibrous bands to the head of the mandible. These bands ensure that the disc moves forward and backward with the head of the mandible during protraction and retraction of the mandible.

The upper surface of the disc is concavoconvex to fit the shape of the articular tubercle and the mandibular fossa;

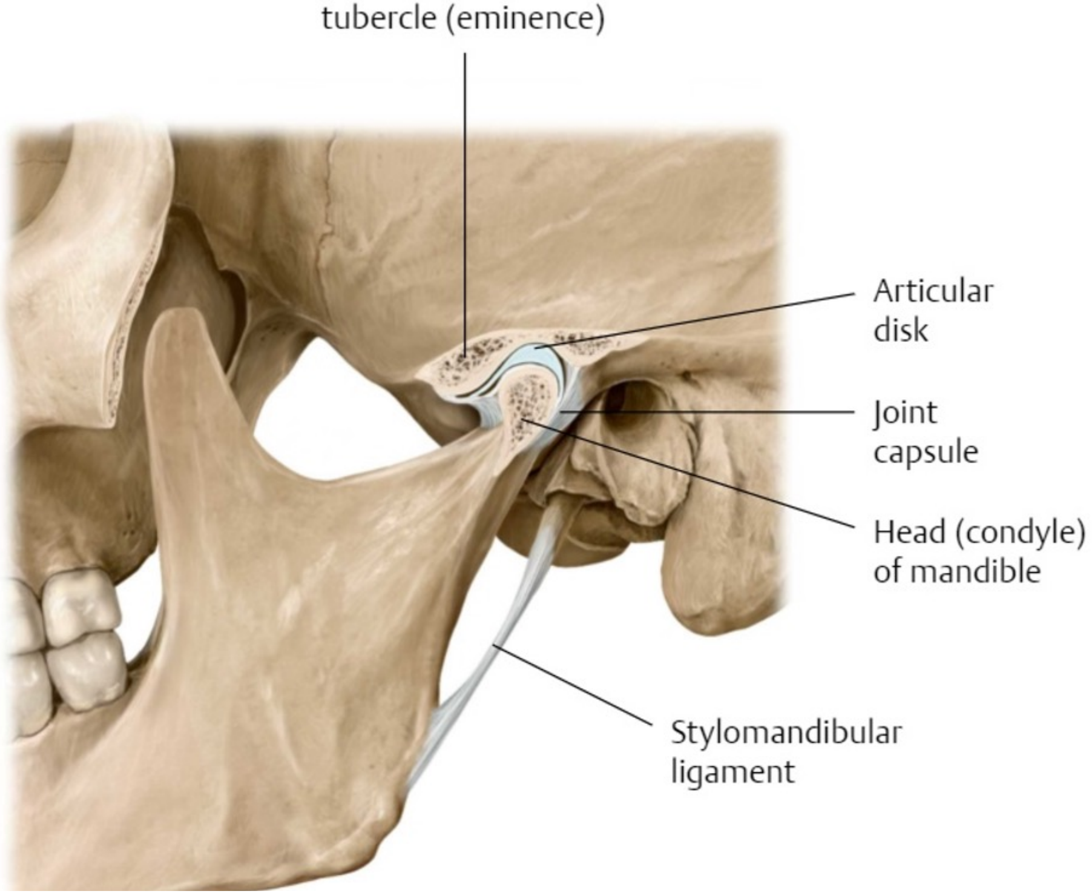
The lower surface is concave to fit the head of the mandible.

The central part it the thinnest .

The posterior part of disc has 2 lamellae called **BILAMELAR ZONE:**

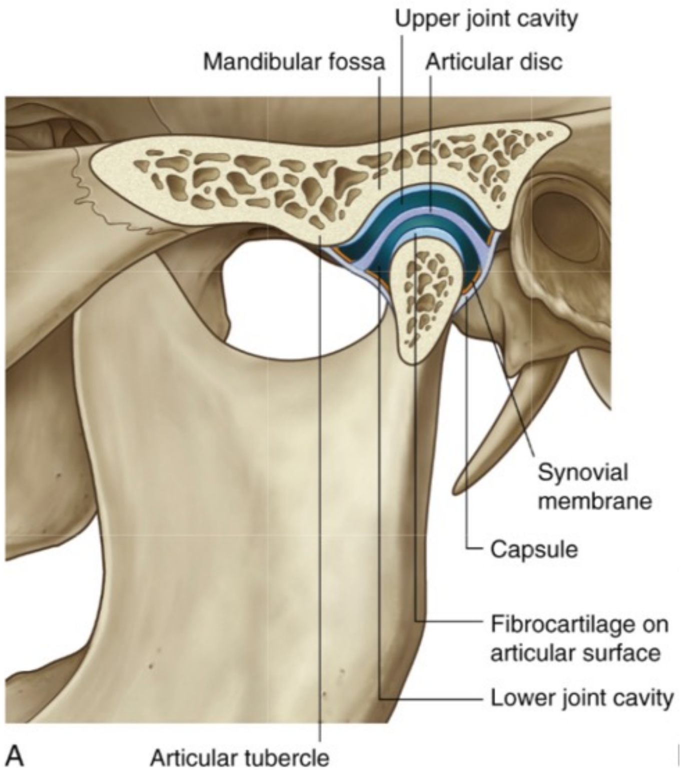
Upper: Elastic – attached to the post. Part of **mandibular fossa**

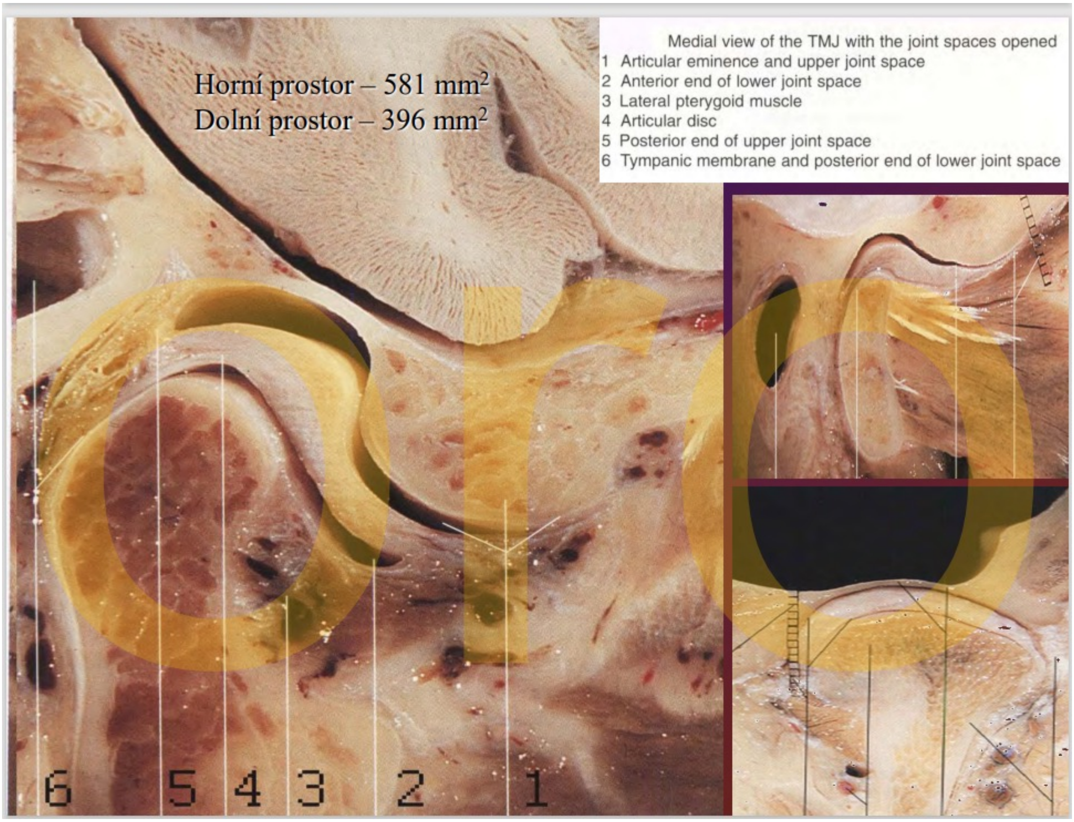
Lower: Non elastic (Fibrous) – attached to the posterior part of haed of mandible



The articular disc divides the joint into upper and lower cavities (compartments):
The lower part of the joint (discocondylar) allows mainly the hinge-like depression and elevation of the mandible - hinge (rotational) movement - this is the initial movement of the jaw when the mouth opens untill about 2 cm.

The upper part of the joint (discotemporal) allows the head of the mandible to translocate forward (protrusion) onto the articular tubercle and backward (retraction) into the mandibular fossa - Gliding (translational) movement - this is the secondary gliding motion of the jaw as it is opened widely. (open mouth more than about 2 cm to max.)



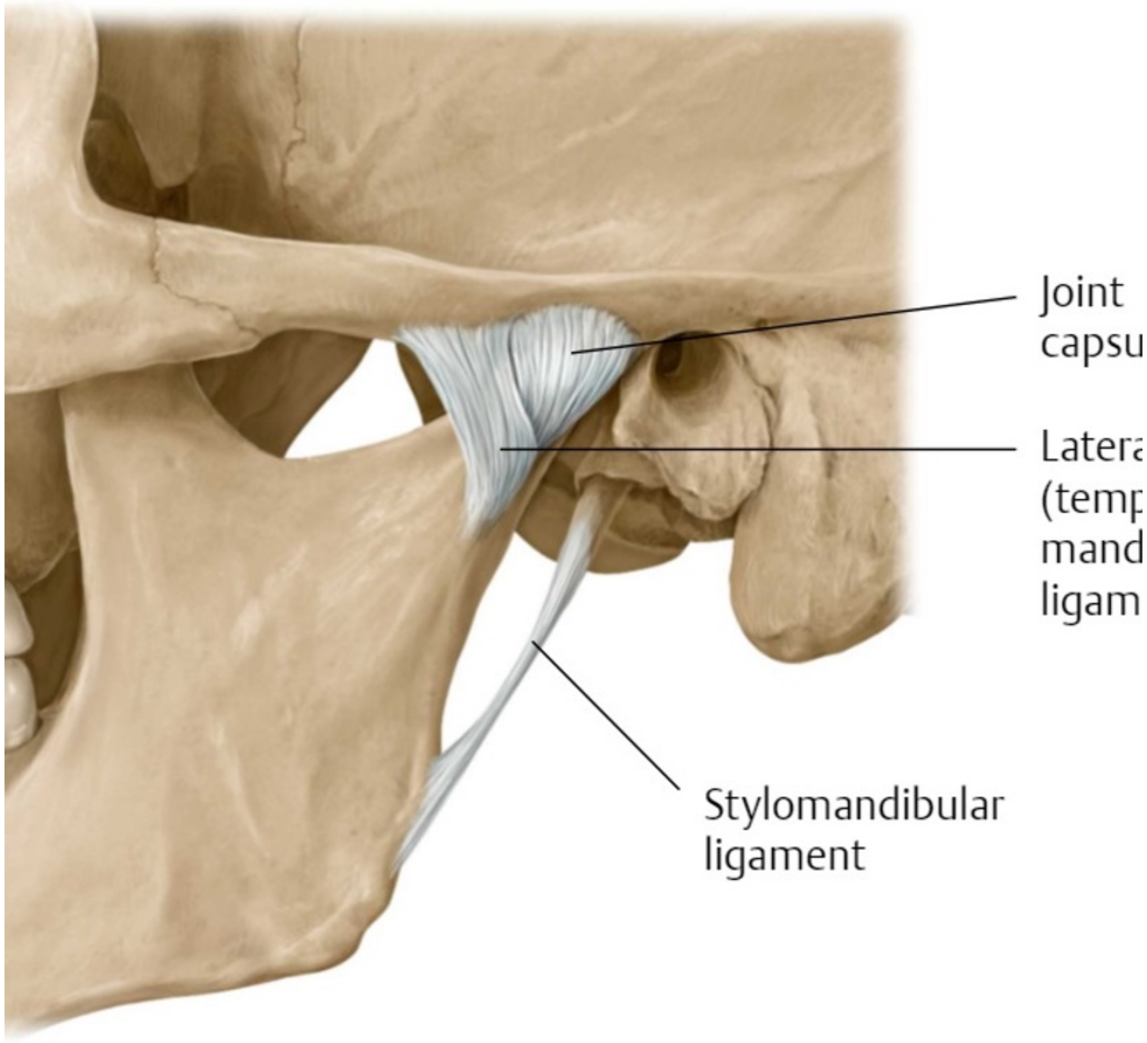


The joint is stabilized by three ligaments:

lateral (temporomandibular), stylomandibular, and sphenomandibular.

This lateral view demonstrates the strongest of these ligaments, the lateral ligament, which stretches over the capsule and is blended with it.

The **lateral ligament** is closest to the joint, just lateral to the capsule, and runs diagonally backward from the margin of the articular tubercle to the neck of the mandible.



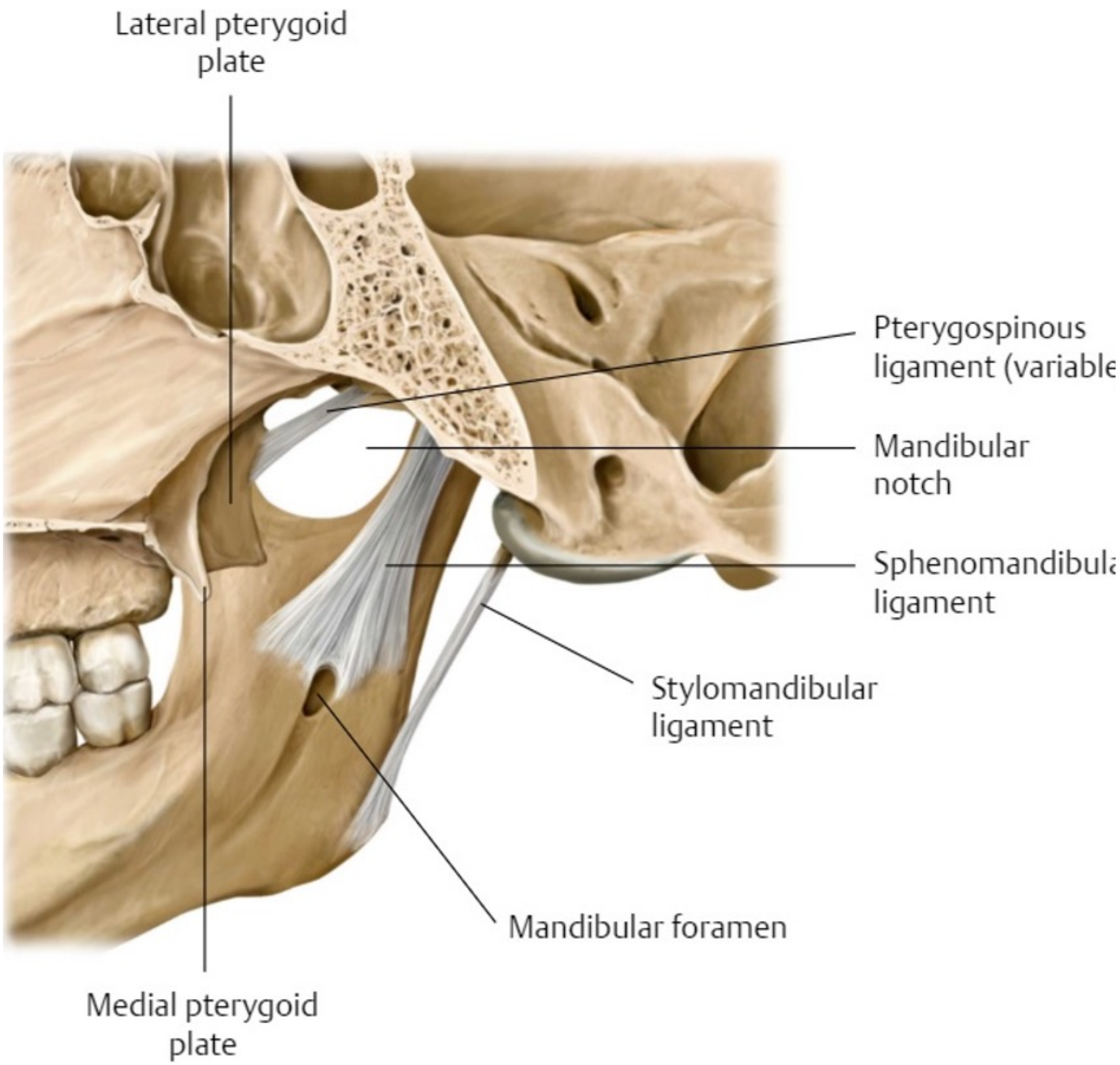
The **sphenomandibular ligament** is medial to the temporomandibular joint, runs from the spine of the sphenoid bone (angular spine) at the base of the skull to the lingula on the medial side of the ramus of the mandible.

The **stylomandibular ligament** passes from the styloid process of the temporal bone to the posterior margin and angle of the mandible.

Some literature also states:

Medial ligament – reinforces the articular capsul on the media side

Pterygomandibulare lig - Raphe pterygomandibular raphe / Buccopharyngial raphe - origio: hamulus pterygoideus , insertio: retromolar trigon (limits the range of jaw opening)



Movements

- A chewing or grinding motion occurs when the movements at the temporomandibular joint on one side are coordinated with a reciprocal set of movements at the joint on the other side.
- The mandible can be **depressed or elevated, protruded or retracted**. **Rotation** can also occur, as in chewing.
- In the position of rest, the teeth of the upper and lower jaws are slightly apart (about 2mm). On closure of the jaws, the teeth come into contact.

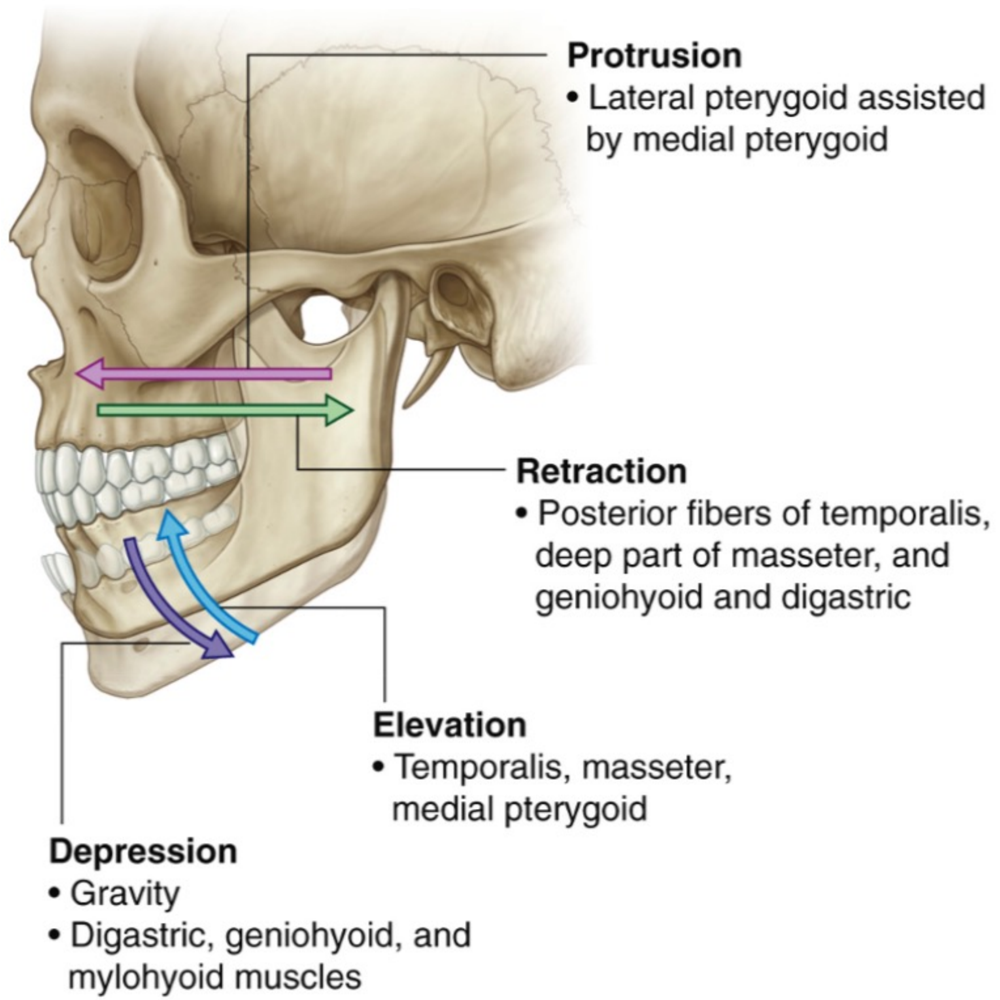
Movements

- **Depression** is generated by the **digastric, geniohyoid, and mylohyoid muscles** on both sides, is normally assisted by gravity. As the mouth is opened, the head of the mandible rotates on the undersurface of the articular disc around a horizontal axis. and, because it involves forward movement of the head of the mandible onto the articular tubercle, the **lateral pterygoid muscles** are also involved.

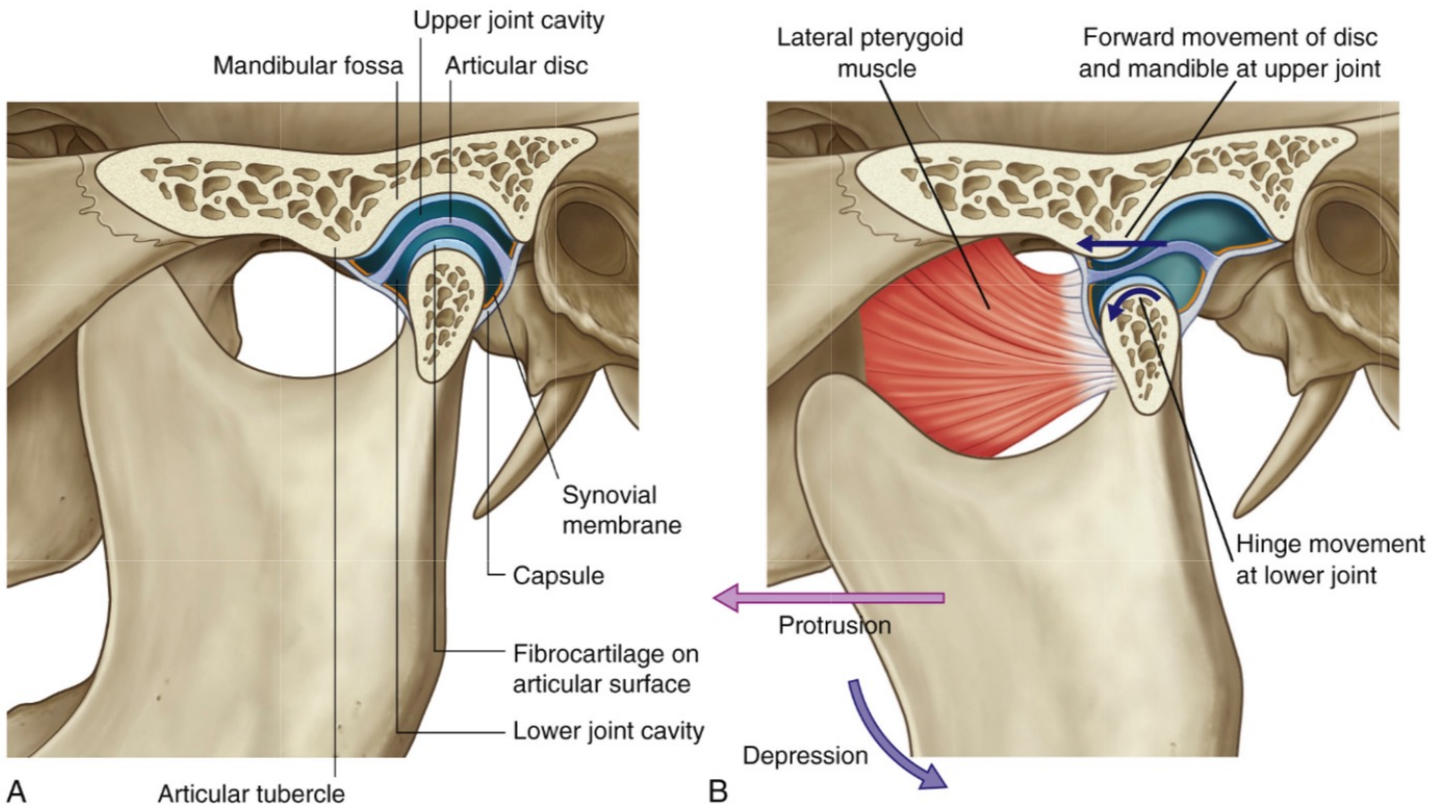
- **Elevation** is a very powerful movement generated by the **temporalis, masseter, and medial pterygoid muscles** and also involves movement of the head of the mandible into the mandibular fossa. The movements in depression of the mandible are reversed. First, the head of the mandible and the disc move backward, and then the head rotates on the lower surface of the disc.

- **Protraction** is mainly achieved by **the lateral pterygoid muscle**, with some assistance by the medial pterygoid.**(anterior part of the temporal m. and superficial part of masseter m).** The articular disc is pulled forward onto the anterior tubercle, carrying the head of the mandible with it. All movement thus takes place in the upper cavity of the joint. In protrusion, the lower teeth are drawn forward over the upper teeth.

- **Retraction** is carried out by **posterior part of the temporal m. and deep part of masseter m) +** the geniohyoid and digastric muscles, and by the posterior and deep fibers of the temporalis and masseter muscles, respectively. The articular disc and the head of the mandible are pulled backward into the mandibular fossa.



Opening the mouth involves both depression and protrusion



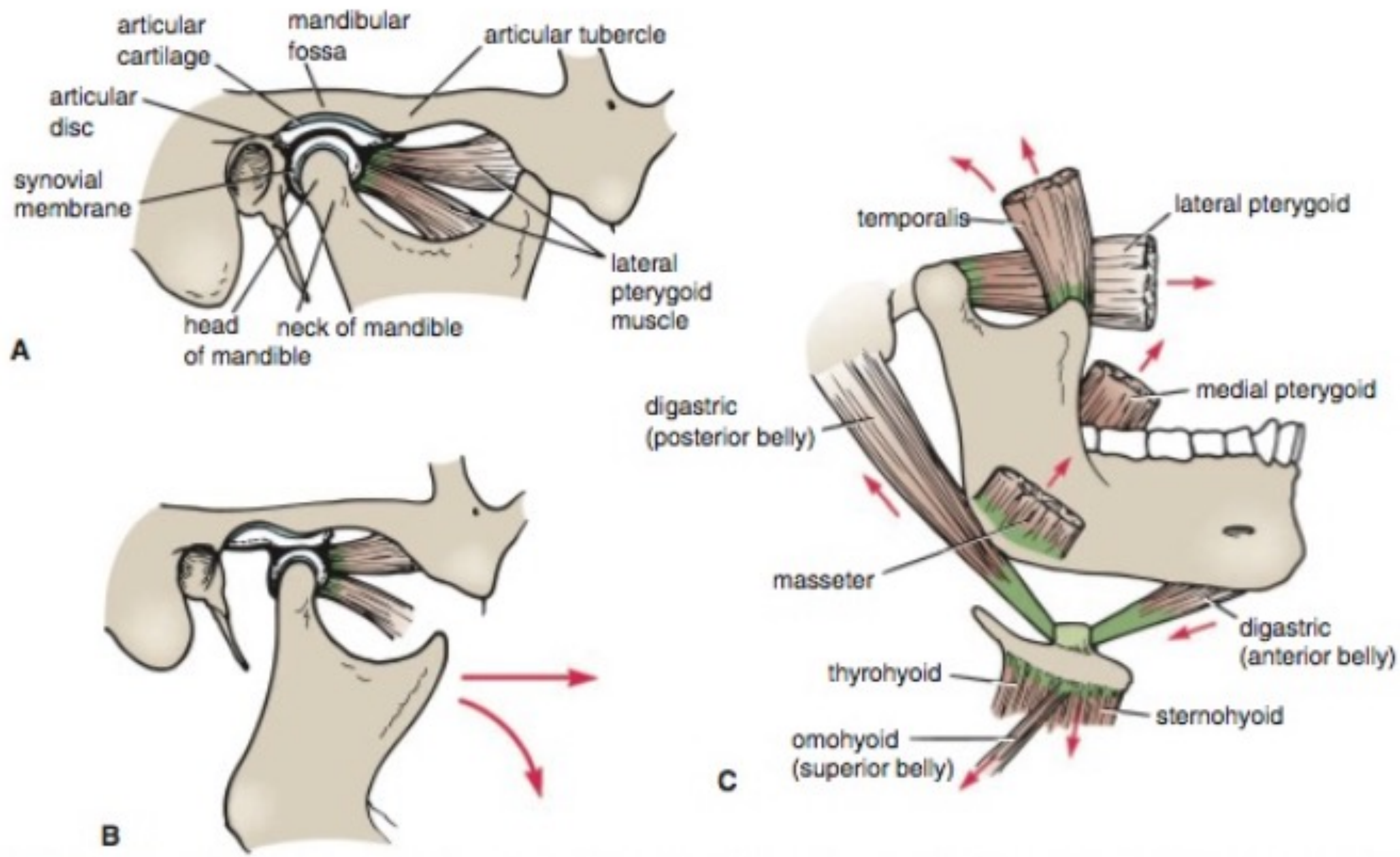
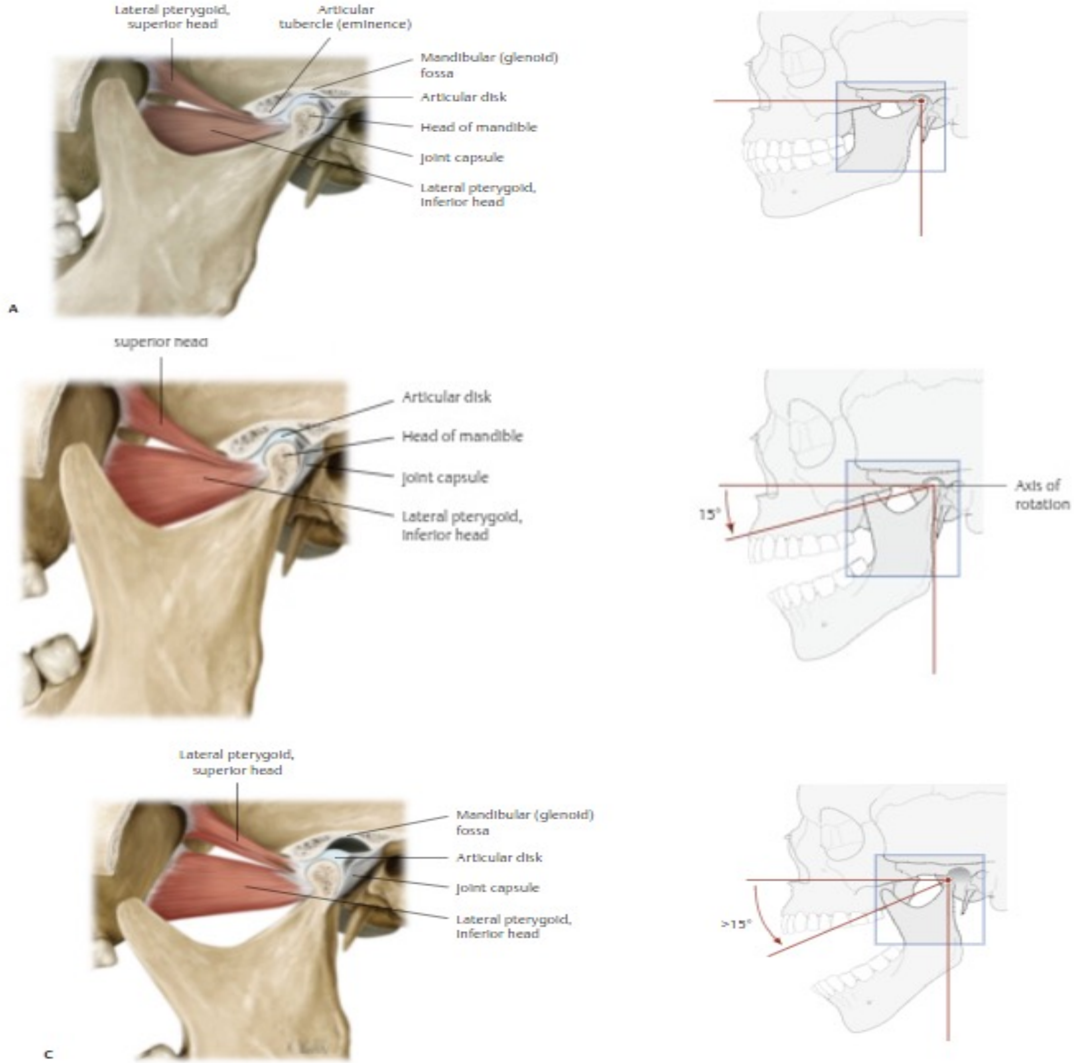


FIGURE 11.35 Temporomandibular joint with mouth closed **(A)** and with the mouth open **(B)**. Note the position of the head of the mandible and articular disc in relation to the articular tubercle in each case. **C.** The attachment of the muscles of mastication to the mandible. The *arrows* indicate the direction of their actions.

A) Mouth closed, teeth in occlusion. When the mouth is in the closed position with teeth in occlusion, the head (condyle) of the mandible maintains its contact with the articular disk, and the space of the upper compartment is maintained between the articular disk and the mandibular (glenoid) fossa of the temporal bone.

B) Mouth opened to 15 degrees. Up to 15 degrees of abduction, the head of the mandible remains in the mandibular fossa.

C) Mouth opened past 15 degrees. At this point the head of the mandible glides (translates) forward onto the articular tubercle (eminence). The joint axis that runs transversely through the mandibular head is shifted forward. The articular disk is pulled forward by the superior part of the lateral pterygoid muscle, and the head (condyle) of the mandible is drawn forward by the inferior part of that muscle.



Lateral Chewing Movements - lateropulsion

- These are accomplished by alternately protruding and retracting the mandible on each side. For this to take place, a certain amount of rotation occurs, and the muscles responsible on both sides work alternately and not in union.
- **LATEROPULSION -** PUSH JAW SIDEWARD – kombination of **Rotation in one side & Propulsion of opposite side**
- (for example pushing jaw to the righ side: head of mandible at the right side stay in the mandibular fossa and rotates lateraly – and head of mandible at the left side gliding anteriorly and inferiorly

- Except for the **geniohyoid muscle**, which is innervated by the C1 spinal nerve, all muscles that move the temporomandibular joints are innervated by the **mandibular nerve [V_3]** by branches that originate in the infratemporal fossa.

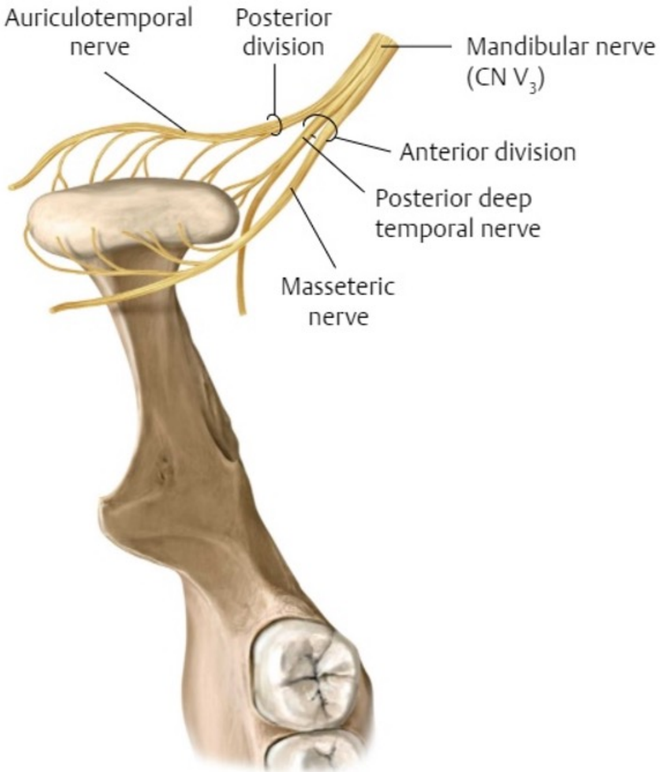
Sensory innervation of the TMJ capsule (after Schmidt) Superior view. The TMJ capsule is supplied by articular branches arising from three branches of the mandibular division of the trigeminal nerve (CN V_3):

Auriculotemporal nerve (posterior division of CN V_3)

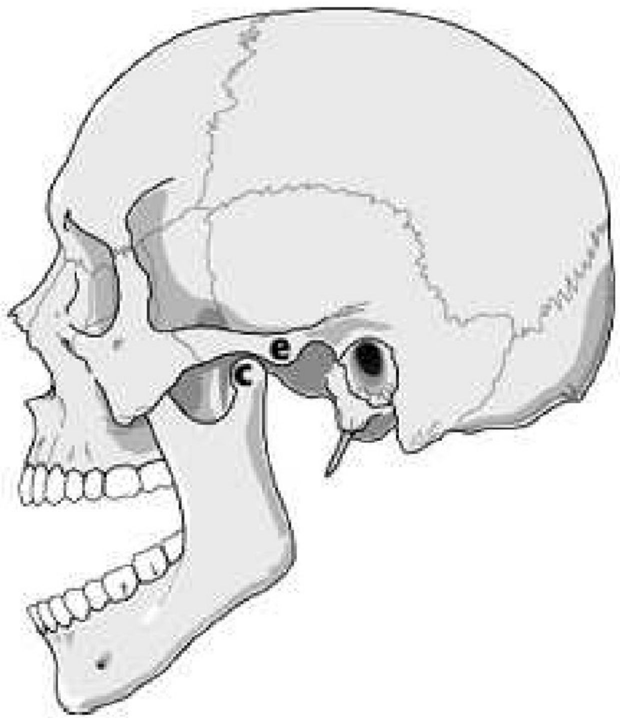
Posterior deep temporal nerve (anterior division of CN V_3)

Masseteric nerve (anterior division of CN V_3)

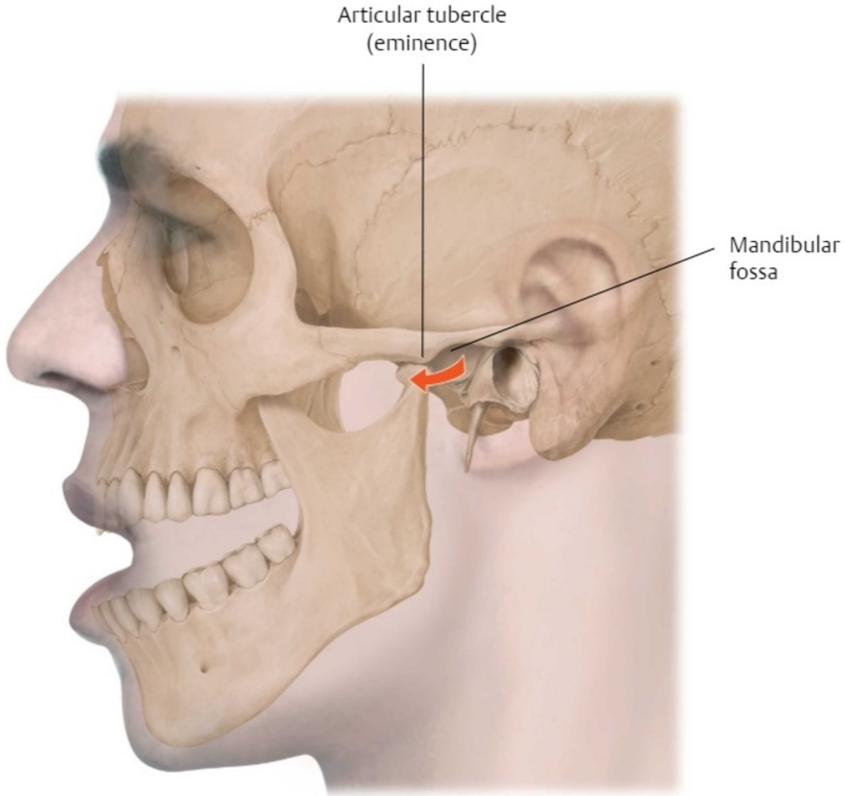
Note: While the masseteric and posterior deep temporal nerves are generally considered to be motor nerves, they also innervate the TMJ.



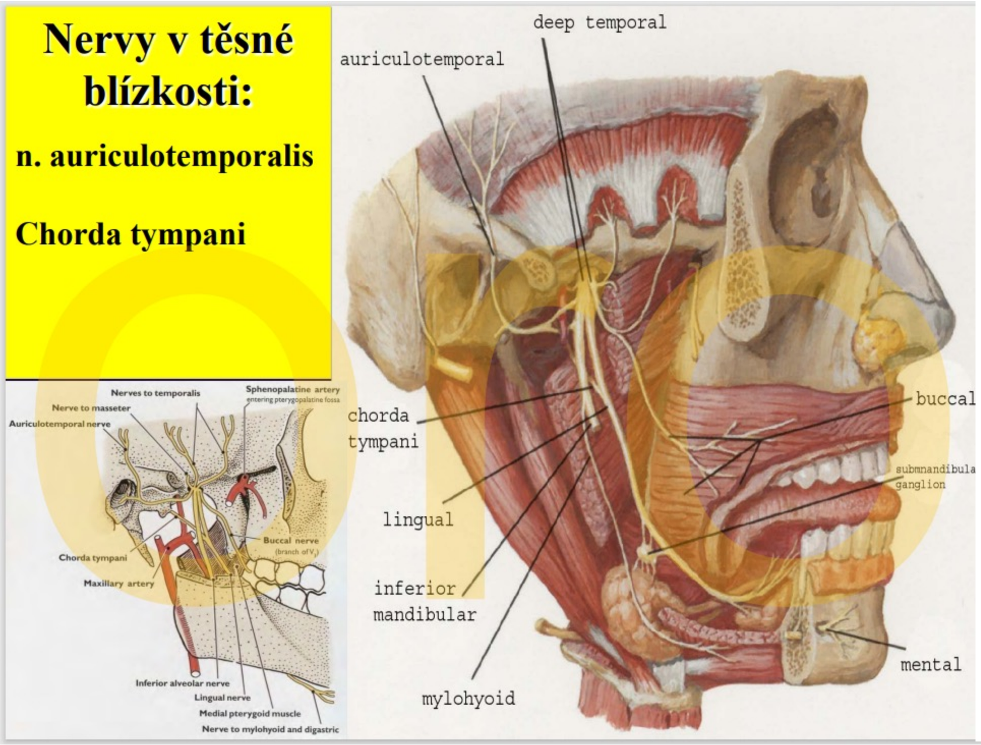
When examining a patient, the clinician should assess the normal range of movement of all joints. When the bones of a joint are no longer in their normal anatomic relationship with one another, then the joint is said to be **dislocated**. Some joints are particularly susceptible to dislocation because of lack of support by ligaments, the poor shape of the articular surfaces, or the absence of adequate muscular support. The shoulder joint, temporomandibular joint, and acromioclavicular joints are good examples.

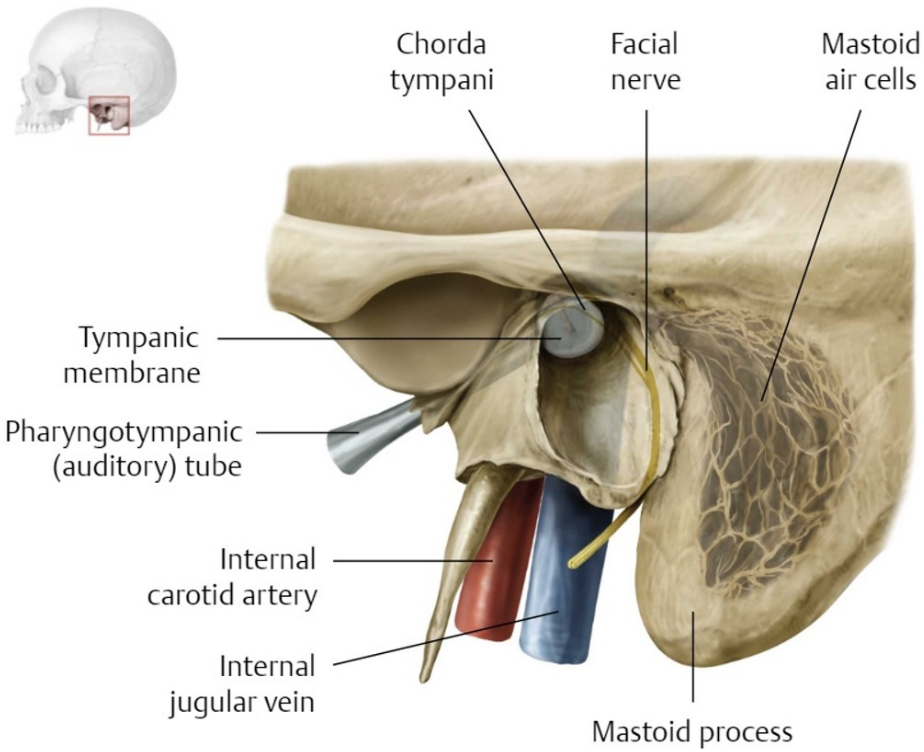


The head of the mandible may slide past the articular tubercle when the mouth is opened, **dislocating the TMJ**. This may result from heavy yawning or a blow to the opened mandible. When the joint dislocates, the mandible becomes locked in a protruded position and can no longer be closed. This condition is easily diagnosed clinically and is reduced by pressing on the mandibular row of teeth- **(Hippocratic maneuver)**

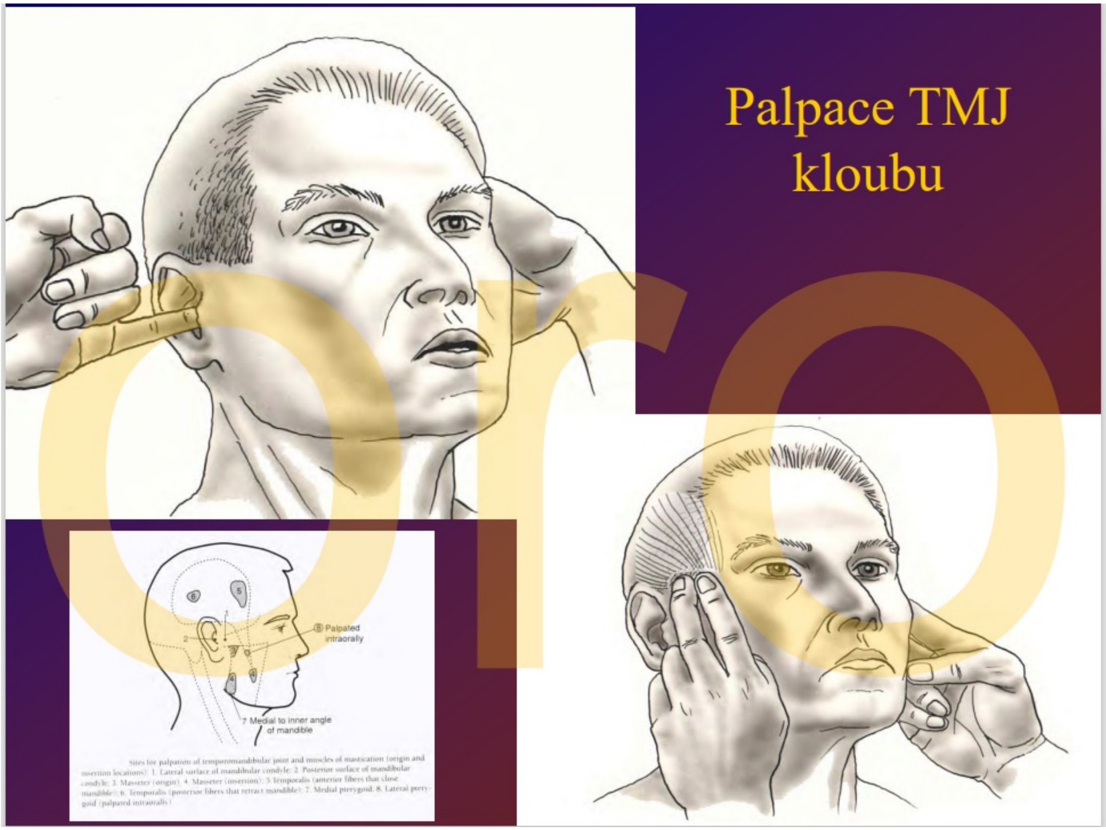


A fine nerve, the chorda tympani, passes through the tympanic cavity and lies medial to the tympanic membrane. The chorda tympani arises from the facial nerve, which is susceptible to injury during surgical procedures.





The temporomandibular joint can be easily palpated in front of the auricle. Note that as the mouth is opened, the head of the mandible rotates and moves forward below the tubercle of the zygomatic arch



Mini invasive treatment of TMJ disorders

- **Intra articular application**:

Mini invasive treatment of TMJ disorders

- **Arthrocentesis**:

Arthroscopy: