Muscles of mastication [part 1]

In this lecture we'll have the muscles of mastication, neuromuscular function, and its relationship to the occlusion morphology.

The fourth determinant of occlusion is the neuromuscular function; understanding of the anatomic relationships of the TMJ ligaments and muscles of mastication (Function, innervation, and vascularization).

The muscles that are related to the oral cavity are numerous, some of them are even considered neck muscles.

As we already know that we have four main muscles of mastication; lateral pterygoid, medial pterygoid, masseter, and temporalis. However the suprahyoids, infrahyoids, and the sternocleidomastoids are also related to the TMJ and the occlusion.

It is not possible to provide distinct complete relation of the various masticatory muscles for each movement of the mandible because of the very complex interplay (movement and interaction) of a large number of muscles that are directly or indirectly related to the masticatory system. For instance, we can never say that we can open our mouths using one muscle, and sometimes in the very same muscles the anterior fibers may play a role whereas the posterior fibers are excluded in that more and so on.

Now if you realize in the following definition; “the muscles directly responsible for the movements and positions of the mandible plus the mastication and talking are called muscles of mastication or jaw muscles” that these muscles are called muscles of mastication but are not only related to mastication → responsible for every movement you do with your jaws.

Roughly, they are sub-divided into muscles of propulsion, retrusion, lateral movements and muscles of closure and opening.

The masticatory functions, speaking, yawning and swallowing involve reflex contraction and relaxation of the muscles of mastication whose activity is initiated voluntary; in other words these are voluntary movement that we make in which some muscles will contract and others will relax in order to get the desired position of the jaw.
Temporomandibular Joint and Ligaments

- Mandibular fossa
- Condylar process
- Coronoid process
- Mandibular notch
- Ramus
- Articular disc
- External auditory meatus
- Styloid process
What determines the movement and position of the mandible?
Many determinants and one of them is the TMJ including the bone and the ligaments, plus the muscles and the neurofunction.

Concerning the TMJ; **The capsule is connected to the articular disc at its entire circumference, forming the two separate compartments → superior and inferior compartments.**

Borders of the capsule:
Anteriorly: anterior margin of the articular eminence. Medially: sphenosquamous suture, Posteriorly: it follows the deep part of the mandibular fossa in front of the petrotympanic fissure. Laterally: It extends along the outer edge of the mandibular fossa. The capsule is inserted into the condyle at some distance from its articular surface.

Ligaments of the TMJ:
- the most important, most related to the movements, the strongest, and the largest → the tempromandibular ligament laterally.
Extension: lower margin of the zygomatic process of the temporal bone and follows an oblique course inferioposteriorly. The superficial strongest fibres are inserted into the posteriolateral part of the neck of the mandible. **It has an important part to play in the caudal limitation and control of the terminal hinge movement when arriving the terminal position.**
So patients with hypermobility of the mandible or exaggerated movements of the mandible have these ligaments involved; may have them teared or diseased.
  - Sphenomandibular ligament
  - Stylomandibular ligament

The above suspensory ligaments (also the bone) are fixed and influence the parameters of the envelope of motion and the extreme borders of movement within which the mandible moves. In other words they explain why does this patient have the ability to open their mouth to a certain extent and that patient doesn’t.
**Muscles of mastication**

1. **Temporalis:**
   - Biggest muscle, fan shaped
   - Three independent functional components; anterior, middle, and posterior fibers. Anterior and middle are associated together in the function while the posterior work alone.
   - Inserts on the anterior and mesial surface of the coronoid process and along the anterior border of the ascending ramus of the mandible down distally till the last molar tooth along with the Articular Disc.
   - Origin: temporal fossa and fascia.
   - *Note: the muscle that is related directly to the articular disc is the later pterygoid.

   **Fxn:** the principle positioner of the mandible during elevation, elevates jaw, retracts and positions the mandible, and clenches the teeth.
   - *On closing the contraction of the temporalis muscle holds the articular disc in place to allow the condyle to return on the disc. Due to its fibers direction and position it stabilizes the disc in its position so that the condyle returns on the disc.

   * When we say TMJ dysfunction we mean that any dysfunction in any component affects the TMJ as well; the muscles, ligaments, inflammation in the capsule or the synovial fluid...

2. **Masseter:**
   - It goes from its origin downward backward to insert in the coronoid process to the lateral surface of the ramus along with the angle of the mandible.

   **Fxn:** jaw elevation and clenching of the teeth.
   - The principal function: mandibular elevation it is active during forceful jaw closure although may assist in protrusion and extreme lateral movements of the mandible.

   *Some muscles have principle functions and other functions that they participate in along with other muscles once the jaw enters an extreme movement.*
3. Lateral pterygoid:

*add to the insertion the articular disc.
Fxn (in bilateral contraction) : protrusion of mandible (opening of the mouth), pulls the articular disc forward, and assists in rotary movements (which are concerned in opening of the mandible) of the mandible.

And the superior head is drawing the head along side.
The principle function: protraction the condyle while drawing the disc forward
*Thus the lateral pterygoid muscle is concerned in all degrees of protraction and rotary movements of the mandible.

*Fxn in unilateral contraction along with the adjacent medial pterygoid: the is going forward downward and the is going medially → resulting in a lateral movement (the movement of the condyle on the nonworking side)
Thus the movement of the lateral pterygoid on one side will draw the mandible to the other side.

*The superior head is active during various jaw closing movements only presumably stabilizes the condylar head and disc against the articular eminence during mandibular closing.
The inferior head is active during jaw opening movements and protrusion only
4. Medial pterygoid:

In a sagittal section like the one above it looks like the masseter, however the masseter lies above it.

*fxn summarized in one word; closure.
Please refer to the slides starting from the suprathyoids and till the end of all slides for all the origins, insertions, functions, and basic information to be memorized, ill be adding notes only.

Slide 20: why are the suprathyoids concerned with the oral cavity? Because they cause opening of the jaw and depressing of the mandible when the hyoid bone is fixed. They participate in the maximum opening only because when we normally open our mouth the muscles of mastication will do the job.
When is the hyoid bone fixed? When the infrahyoids are in contraction.
Slide 22: the fan shaped mylohyoid makes the floor of the mouth.

Slide 26: for the infrahyoids they are summarized in slide 26 only and that’s only what we need to know about them.

Slide 28: buccinators is the muscle that underlies the mucosa of the cheek. It compresses cheeks to return food in between the molars and that’s how it aids in mastication.
The raphe:

Slide 32: third branch of the mandibular nerve which is the trigeminal.
Slide 33: maxillary artery and facial artery are branches of the external carotid artery.
Now this part of the lecture is on the interferences. Part 2. Slide 39
Slide 40: by the end of the normal closure temporalis posterior and medial fibers retract mandible. Lateral pterygoids relax allowing articular disc to glide back into fossa.

Slide 41: there are two types of closure interferences that cause a shift to the mandible during closure either anteriorly or laterally or both depending on the location of the premature contact. Interferences that will occur on one side and will cause the mandible to displace either to the same side or the opposite side to reach the maximum intercuspation.

The first case is when the patient is closing there will be a premature touch that happens between a lower tooth and an upper tooth that prohibits the final closure. This affects some of the mastication muscles and then the mandible slides in order to close in its fitted position. This may happen in most populations without any problem when closing their mouth to the centric relation. So these are premature contact occurring mainly on the posterior teeth mainly between the mesial slope of the upper and the distal slope of the lower no matter which cusps (they may be one or two contacts) and causing a displacement or shift to the mandible during closure either anteriorly/forward.
Note that there is no way for the displacement to go posteriorly because the centric relation is the most posterior position.
This displacement is explained through the fact that when you first get your mandible to its centric relation one premature contact occurs with no maximum intercuspation and for the muscles to come into a comfortable position the mandible will shift a little to reach the maximum intercuspation.
However, why don’t we feel this displacement? Because this became a habit and is memorized and that’s why we close to the maximum intercuspation directly without feeling the sliding and displacement. But if your dentist tried to close your mandible to the centric relation you will feel this premature contact.
And this shift differs from patient to patient and ranges from less than 0.5 mm to 1 or 2 mm. The more the shift the worse the problem and pain in the TMJ and muscles.

Slide 42: influenced muscles and those which will suffer from hyperactivity are:
1-the posterior fibers of temporalis because they are responsible for retraction and thus cannot completely retrude the mandible
However, all of this isn’t considered a pathological case or TMJ dysfunction, we all have it and we all have the adaptive capacity of the TMJ muscles and neurons for this to happen without suffering.
2-Lateral pterygoids get in function during closure – unusually - only to relieve the closure interference.

Slide 43 & 44: The second case is a lateral displacement to the opposite side. This type of interference occurs either between the inner incline of maxillary buccal cusp and outer incline of mandibular buccal cusp or between the outer incline of the maxillary lingual cusp and the inner incline of the mandibular lingual cusp. This displacement also occur to relieve the muscles and reach the maximum intercuspation state because the interference prevented the tips of cusps to slide into the fossae.

Slide 45: this lateral displacement resembles the normal lateral movement that we know but occurs to a lesser extent ( less in the amount of displacement) As we know The Lateral movement begins forward downward medial but in this case we are not doing a typical lateral movement and thus in this shift the condyle of the opposite side deviates laterally and the condyle of the same (the nonworking) side moves anteriorly.

To the same side: Slide 47: closure interference that will cause a lateral displacement to the same side of the interference. Occurs between the inner inclines on the functional cusps; maxillary lingual and mandibular buccal.

Conclusion: a simple premature contact may involve all muscles of mastication.

Muscle examination: Slide 51: how do I know that a muscle is tender or hyperactive? By palpation of asymmetrical movements. When you ask your patient to open his mouth maximally, he may open in a straight line or may deviate afterward a little bit. This is called deviation during opening and closing. Now for hypertrophy (due to hyperactivity for a long time) examination is done by palpating both sides together and when the patient says this side is more painful that the other it means we have tenderness there. Slide 52: it is more difficult to palpate the inner muscles; medial and lateral pterygoids because palpation that is done extraorally is easier than of that intraorally especially that it may cause a gag reflex. Nevertheless, note that the mouth must not open maximally because the condyle will interfere with the palpation.