Kinesiology of Mastication and Ventilation

Eating & breathing are essential to life!
Temporomandibular Joint (TMJ)

One of the most frequently used joints in the body
1) Sagittal view of normal temporo-mandibular joint. Sliding joint type used in:

- Chewing
- Swallowing
- Talking

2) Inflammation of the TMJ can cause:

- Headache pain
- Ear pain and pressure
- Ringing in the ears
- TMJ catching or locking
- Change in bite
- Neck, shoulder and upper back pain
TMJ Functions

Chewing
Swallowing
Yawning
Talking
Anything involving the jaw!
Temporomandibular Joint

The TMJ is where the lower jaw meets the skull.

Jaw muscles open and close the jaw when you chew and talk.

The socket

The condyle is the round end of the lower jaw.

A proper bite allows smooth and effective chewing.

Closed jaw

The disk fits in the socket when the jaw is closed.

Ligament

The condyle fits in the socket when the jaw is closed.
Joint Structure & Motions

Made up of:
- 2 bones,
- a disc that divides the joint into 2 joint spaces,
- a joint capsule,
- 4 ligaments,
- 4 main muscles that create 5 motions
Bones that make up the TMJ
Osteology and Related Structures

Bones: Mandible, Temporal, Maxillae, Zygomatic, Sphenoid and Hyoid
The Mandible

One bone, rests dependent upon muscle relaxation and forms 2 identical joints with a temporal bone on either side of the face

Makes up the inferior part of the face

The “jaw”

Bony landmarks
Mandible

The largest of the facial bones and highly mobile
Suspended by muscles, ligaments and the TMJ capsule bilaterally
The Mandible
Motions of the TMJ

Mandibular depression
Mandibular elevation
Mandibular lateral deviation (L & R)
Motions of the TMJ

Mandibular retrusion or retraction

Mandibular protrusion
Resting position of the mandible:

The condyle of the mandible is seated in the mandibular fossa of the temporal bone. The lips would be closed and teeth would be several millimeters apart.
Resting position of the mandible:

This would be maintained by low levels of activity of the temporalis muscles.

You should be able to open your mouth enough to fit 2-3 finger widths between the front upper and lower teeth.

Normal opening

Excessive Opening!
Ligaments & Other Structures

Numerous ligaments suspend and/or limit excessive motion of the mandible.
TMJ & The Articular Disc

The articular disc divides the joint space into upper and lower spaces. The movement of the disc is often the source of “clicking” that can be heard or felt by patients. It may or may not be a sign of pathology.
During opening of the mouth, the condyles of the mandible move forward along the articular disc. This is a smooth movement unless the opening is excessive. Repeated excessive opening can cause trauma to the area and potential disc injury.
Muscles of the TMJ

Masseter
Temporalis
Medial & Lateral Pterygoids

Muscle Names, Locations, Actions & Innervations are the goal!
Please identify the following muscle:

<table>
<thead>
<tr>
<th><strong>Masseter</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
</tr>
<tr>
<td><strong>Action</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
</tr>
</tbody>
</table>

Palpate it on yourself!
Please identify the following muscle: **Temporalis**

<table>
<thead>
<tr>
<th>Location</th>
<th>Within the temporal fossa</th>
</tr>
</thead>
</table>
| Action         | Bilateral: elevation of the mandible (closing the mouth), retrusion of the mandible  
                 Unilateral: lateral excursion (to the ipsilateral side) |
| Innervation    | Cranial n. V              |
Please identify the following muscles:

<table>
<thead>
<tr>
<th>Medial Pterygoids</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
</tr>
<tr>
<td><strong>Action</strong></td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
</tr>
</tbody>
</table>

![Diagram of Medial Pterygoids](image)
Please identify the following muscles:

<table>
<thead>
<tr>
<th>Lateral Pterygoids</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Location</strong></td>
</tr>
<tr>
<td><strong>Action</strong></td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
</tr>
</tbody>
</table>

![Diagram of Lateral Pterygoids](image-url)
What do I need to know?

You should be able to palpate the masseter and the temporalis on a classmate.
What do I need to know?

You should also be able to determine whether or not there is any asymmetry in the TMJ upon opening or closing when observing a classmate.
What do I need to know?

You also need to be able to locate all of the muscles and bony landmarks identified, including the external auditory meatus.
Ventilation

The mechanical process by which air is inhaled and exhaled through the lungs.

The interaction between the muscles and joints of the axial skeleton.
Ventilation

Allows:
exchange of oxygen & carbon dioxide between the lungs and blood

Drives:
the physiology of activated muscles that move and stabilize the joints of the body
Ventilation

Inspiration = breathing in
Expiration = breathing out

- Inspiration: The diaphragm contracts, causing the chest to expand and the ribs to rise.
- Expiration: The diaphragm relaxes, allowing the lung to deflate and the ribs to move inward.
Ventilation

Muscles of Inspiration:
- Diaphragm
- Scalenes
- Intercostals
### Ventilation

#### Diaphragm

| **Origin** | **Costal part:** inner surfaces of the cartilages and adjacent bony regions of ribs 6-12  
**Sternal part:** posterior side of the xiphoid process  
**Lumbar part:** bodies of L1-L3 through 2 distinct tendinous attachments called the L & R crus |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Insertion</strong></td>
<td>Central tendon near the dome of the diaphragm</td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
<td>Phrenic n.</td>
</tr>
<tr>
<td><strong>Action</strong></td>
<td>inspiration</td>
</tr>
</tbody>
</table>
## Ventilation

<table>
<thead>
<tr>
<th>External Intercostals</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Origin</strong></td>
</tr>
<tr>
<td><strong>Insertion</strong></td>
</tr>
<tr>
<td><strong>Innervation</strong></td>
</tr>
<tr>
<td><strong>Action</strong></td>
</tr>
</tbody>
</table>
### Ventilation

#### Internal Intercostals

<table>
<thead>
<tr>
<th>Origin</th>
<th>11 per side, each muscle arises from the upper border of a rib</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insertion</td>
<td>On the lower border of the rib above, deep to the external intercostals with the fibers perpendicular to the external intercostals</td>
</tr>
<tr>
<td>Innervation</td>
<td>Intercostal n. T2-12</td>
</tr>
<tr>
<td>Action</td>
<td>Assist with forceful expiration by depressing the ribs</td>
</tr>
</tbody>
</table>
## Ventilation

### Scalenes

| Origin | Ant. Scalene: transverse processes of C3-C7  
|        | Middle Scalene: transverse processes of C2-C7  
|        | Posterior Scalene: transverse processes of C5-C7 |
| Insertion | Ant. Scalene: 1<sup>st</sup> rib  
|          | Middle Scalene: 1<sup>st</sup> rib  
|          | Posterior Scalene: external surface of the 2<sup>nd</sup> rib |
| Innervation | Ventral rami (C3-C7) |
| Action | Bilateral: flexion of the neck, assist with inspiration by elevating ribs 1&2  
|        | Unilateral: lateral flexion |
Ventilation: Accessory Muscles

What does it really mean to take a deep breath?
Ventilation

**Inhalation**
Air drawn into lungs

- Trachea
- Pectoralis minor muscles contract
- Lungs expand
- Diaphragm contracts and flattens
- Intercostal muscles contract

**Exhalation**
Air forced out of lungs

- Trachea
- Pectoralis minor muscles relax
- Lungs contract
- Diaphragm relaxes and moves up
- Intercostal muscles relax
What do you think you need to know?