TEMPOROMANDIBULAR JOINT ANATOMY

The temporomandibular joint (TMJ) is actually two separate (right and left) but similar joints and is a freely mobile articulation. The TMJ consists of the condyle of the mandible and the squamous portion of the temporal bone of the skull (1). Both mandible condyles project vertically for articulation with the temporal bone and assist in creating congruency between the two structures.

The Articular Disc

The articular disc of the TMJ separates the joint into an upper and lower compartment, and during nonpathologic circumstances, the upper and lower compartments do not communicate (1). The disc is biconcave and is made of flexible, dense, collagenous connective tissue. Both the anterior and posterior aspects of the disc are innervated—the posterior more extensively (2). The posterior aspect is thicker than the anterior, and the central aspect is thinner than both peripheral regions. The disc is attached to the lateral and medial poles of the mandibular condyle, which allows movements in an anterior and posterior direction. During aging, the disc is less flexible and thickens throughout the structure. The disc is responsible for reoccurring clicking and popping sounds, specifically during improper movement or during instability (3).
Intra-articular Region

The **intra-articular region** that lies posterior to the articular disc is commonly referred to as the **retrodiscal area** (4). This highly innervated region contains synovial fluid, a synovial membrane, blood vessels, nerves, loose connective tissue, fat, and ligaments (5). The retrodiscal region demonstrates poor tolerance to constant load or tensile stresses (4) that occur during overstretching. Overstretching generally occurs during excessive mouth opening or compression and potentially as a consequence of trauma. Trauma or overstretching may lead to inflammation of the retrodiscal region and is frequently a cause of persistent temporomandibular disorder (TMD) symptoms (4). Nonetheless, this region does require frequent loading and unloading for nutrition, a requirement that is generally fulfilled during chewing movements and daily mandible motion.

![Figure 6.2: The TMJ Joint Capsule, Disc, and Ligaments](image)

Ligaments

Several ligaments serve to reduce movement of the TMJ. The TMJ ligament extends from the lateral joint capsule as a thickening of the capsule, the sphenomandibular ligament extends from the greater wing of the sphenoid to the mandible, and the stylomandibular ligament extends from the styloid process to the mandible (1).
Muscles

Three muscles are responsible for jaw closing—the temporalis, the powerful masseter, and the medial pterygoid. Several smaller muscles contribute to jaw opening including the lateral pterygoid, the geniohyoid, the genioglossus, the anterior bellies of the digastric, and the mylohyoid muscles (1). Protrusion is accomplished through contraction of the lateral and medial pterygoids and retraction is a function of temporalis (posterior fiber) contraction (4). Lateral movements are a consequence of alternative contraction of the medial and lateral pterygoids.

Table 6.1. Major Muscles and Responsibilities of the Face and Skull.

<table>
<thead>
<tr>
<th>Muscle (s)</th>
<th>Responsibilities</th>
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<tbody>
<tr>
<td>Temporalis</td>
<td>Sole function is to close the jaw</td>
</tr>
<tr>
<td>Masseter</td>
<td>Sole function is to close the jaw</td>
</tr>
<tr>
<td>Upper trapezius</td>
<td>The upper trapezius extends the neck when contracting bilaterally and extends, laterally flexes, and rotates the head to the opposite side when contracting unilaterally</td>
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<tr>
<td>Orbicularis oris</td>
<td>The orbicularis oris is a spincter muscle that encompasses the mouth. The muscle closes and protrudes the lips as when whistling</td>
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<tr>
<td>Orbicularis oculi</td>
<td>The orbicularis oculi can gently or firmly compress the eyelid and surrounding structures around the eye</td>
</tr>
<tr>
<td>Occipitofrontalis</td>
<td>The occipitofrontalis draws the scalp back, which raises the eyebrows and wrinkles the forehead</td>
</tr>
</tbody>
</table>

Summary

- The TMJ is created by the bony articulation of the mandibular condyle and the squamous portion of the temporal bone.
- A mobile, biconcave disc separates the TMJ into an upper and lower compartment.
- Several ligaments contribute to movement control. These ligaments are sometimes injured during compressive and tension-related dysfunction.
- The primary muscles associated with closure of the jaw include the masseter and the medial pterygoid.
- The primary muscles associated with opening of the jaw include the lateral pterygoid, the geniohyoid, the genioglossus, and the anterior bellies of the digastric and mylohyoid muscles.
TEMPOROMANDIBULAR JOINT BIOMECHANICS

During normal opening kinematics of the TMJ, the condyle of the mandible that normally is suspended from the concave articular fossa by joint capsule and ligaments rolls posteriorly on the articular disc then glides forward (with the disc) within the articular fossa (1). Subsequently, the condyle rolls and slides up to 6–9 mm in opposite directions while concurrently providing a stretch on the posterior-superior anchoring structures (4). The disc has free motion in anterior and posterior directions but moves very little in the directions of medial to lateral.

For achievement of maximal mouth opening, angular rotation must be greater than angular swing (6). If condylar movement occurred without subsequent roll, the condyle would move posteriorly and impinge structures. The passive restraint associated with the sphenomandibular ligament provides the necessary mechanism for stability of the jaw (6).

Figure 6.3: The Normal Kinematics of TMJ Movement

The loose- and close-packed positions of the TMJ are currently debated. Rocabado (7) suggested that the close-packed position of the jaw is during full mouth opening while others suggest variations of mouth opening. The loose-packed position is generally suspected to consist of slight retraction of the jaw with tongue placement near the roofline of the mouth.
The normal range of mouth opening is both age and gender dependent. Gallagher et al. (8) reported that men range from 41 to 44 mm of mouth opening (ages 16 to 65+), whereas women range from 39 to 43 mm (ages 15 to 65+). Mouth opening declines steadily with age and is less in individuals who report TMD (8).

Pathological movement may cause excessive loading or tension to the retrodiscal structures. Damage may exacerbate the potential of anterior disc displacement, which is the most problematic intra-articular dysfunction (4). When the disc fails to reduce accordingly during condylar motion, the condyle pushes the disc anteriorly down the temporal articular surface during the process of mouth opening (4). This action further stretches the retrodiscal tissue until the disc pops loose of the condyle, causing an audible click.

**Figure 6.4: Pathological Movement of the TMJ**

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<td>• During normal kinematics of the TMJ, the condyle of the mandible that normally is suspended from the concave articular fossa by joint capsule and ligaments rolls posteriorly on the articular disc then glides forward (with the disc) within the articular fossa.</td>
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<td>• Pathological kinematics involves the failure of the disc to reduce accordingly during condylar motion. In essence, the condyle pushes the disc anteriorly down the temporal articular surface during the process of mouth opening and the condyle moves posterior to compress the retrodiscal structures.</td>
</tr>
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ONLINE REFERENCES