Anatomy and physiology of Temporomandibular Joint

**Temporal mandibular joint (TMJ):** It is the articulation of the condyle of the mandible, and the inter-articular disc; with the mandibular fossa (glenoid fossa) of the temporal bone. The joint has a capsule and an articulating disc. It is considered as a compound joint (a compound joint is one with more than two bones articulating); in TMJ, the articular disc acts like the third bone.

**TMJ CONSISTS OF THE FOLLOWING PARTS**
1. The mandibular fossa (glenoid fossa) of temporal bone.
2. The condyle or head of the mandible.
3. Synovial cavity.
4. The articular disc or (meniscus).

Meniscus is found between the condyle and the glenoid fossa. It divides the synovial joint or TMJ into upper and lower (superior and inferior) compartments. Each compartment acts as a separate joint during function. The presence of the meniscus also distinguishes the TMJ from most other joints in the body, making it a bone-to-tissue (*mandible to disc*) and tissue-to-bone (*disc to skull*) articulation.
The muscles that control the movement of the mandible

There are three groups of muscles:

1. Closing muscles.
2. Gliding muscles.
3. Opening muscles.

**CLOSING MUSCLES**

The temporalis, masseter and medial pterygoid muscles supply the power for pulling the mandible against the maxilla (elevating and closing the mandible).
GLIDING MUSCLES

The lateral pterygoid muscle connects the mandible to the lateral pterygoid plate in such a way as to act as the steering mechanism for the mandible and act to protrude the jaw or to move it laterally.

Figure (5-4): Closing muscles.

Figure (5-5): Gliding muscle.
**OPENING MUSCLE**

The muscles that depress (open) mandible consist of three groups, suprahyoid muscles, infrahyoid muscles, and platysma.

**Figure (5-6): Opening muscles.**

**Ligaments affect the movement of mandible consist of**

1. Temporomandibular and capsular ligaments.
2. Sphenomandibular ligament.

**Figure (5-3): TMJ ligaments.**
Good prosthodontic treatment bears a direct relation to the structures of the temporomandibular articulation, since occlusion is one of the most important parts of treatment of the patients with complete dentures. The temporomandibular joints affect the dentures and likewise the dentures affect health and function of the joints.

The mandibular bone has specific relationships to the bones of the cranium. The mandible is connected to the cranium at the two temporomandibular joint by the temporomandibular and capsular ligaments. The sphenomandibular and stylomandibular ligaments also connect the bones in such a way as to limit some motions of the mandible.

**MANDIBULAR AXES & MANDIBULAR MOVEMENTS**

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**MANDIBULAR AXES**

There are three axes around which the mandibular movements take place, the mandibular movements are related to three planes of skull (sagittal, transverse (horizontal), and coronal (frontal)), figure (5-8).

These axes include the followings:

1. **Hinge axis or transverse axis**
   It is an imaginary line around which the mandible may rotate within the sagittal plane (during opening and closing movement).

2. **Sagittal axis of the mandible**
   It is an imaginary anteroposterior line around which the mandible may rotate within the frontal plane.

3. **Vertical axis of the mandible**
   It is an imaginary line around which the mandible may rotate through the horizontal plane.
MANDIBULAR MOVEMENTS

The mandibular movements can be classified as following

Based on the dimension involved in the movement

1- Rotational
   a- Rotation around the transverse or hinge axis.
   b- Rotation around the anteroposterior or sagittal axis.
   c- Rotation around the vertical axis.

2- Translational or gliding
They are considered as basic movements of the mandible.
The upper compartment shows anteroposterior gliding movement, when this movement takes place, the condyle and the disc move as a single unit against the glenoid fossa.

The lower compartment shows hinge movement, during hinge movement the condyle moves against the articular disc and the glenoid fossa, which together act as a single unit. True condylar rotation is 12° with the maximum incisal separation of 22 mm. See figure (5-14).

Based on the type of movement
1- Hinge movement.
2- Protrusive movement.
3- Retrusive movement.
4- Lateral movement.
   a- Lateral rotation or (laterotrusion).
      - Right.
      - Left.
   b- Lateral translation or (Bennett movement).
      - Immediate side shift.
      - Progressive side shift.
      - Precurrent side shift.

Figure (5-10): 1- Closed mouth. 2- Hinge movement. 3- Protrusion. 4- Retrusion.
**IMMEDIATE SIDE SHIFT**
**PROGRESSIVE SIDE SHIFT**

75% of the shift takes place during the first 3 mm of anterior movement of the condyle.

**PRECURRENT SIDE SHIFT**

The angle formed between the sagittal plane and the average path of the advancing condyle as viewed in the horizontal plane during lateral mandibular movements.

*Figure (5-13): Bennett angle: the angle formed between the progressive lateral path and the sagittal plane (Note there is immediate side shift ISS followed by progressive side shift PSS).*
1- Border movement
   a- Extreme movement in the sagittal plane.
   b- Extreme movement in the horizontal plane.
   c- Extreme movement in the frontal plane.
   d- Envelope of motion.

2- Intra-border movement
   a- Functional movement.
      - Chewing cycle.
      - Swallowing.
      - Yawing.
      - Speech.
   b- Para-functional movement.
      - Clenching.
      - Bruxism.
      - Other habitual movements.

Figure (5-14): Extreme movement in the sagittal plane.
**Figure (5-15): Beak tracing**

Borders movements recorded in the sagittal plane.

**Figure (5-16): Shield tracing**

Border movements recorded in the coronal plane.

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<thead>
<tr>
<th>CO</th>
<th>Centric occlusion.</th>
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<tbody>
<tr>
<td>RD</td>
<td>Right disocclusion.</td>
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<tr>
<td>MRL</td>
<td>Maximum right lateral position.</td>
</tr>
<tr>
<td>MMO</td>
<td>Maximum mouth opening.</td>
</tr>
<tr>
<td>MLL</td>
<td>Maximum left lateral position.</td>
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<tr>
<td>LD</td>
<td>Left disocclusion.</td>
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When we combine the border movements of all the three planes, we get a three dimensional space within which mandibular movements is possible, this three dimensional limiting space is called the (envelope of motion).