

## **TEMPOROMANDIBULAR JOINT (T.M.J)**

### **JOINT:**

Point of contact between-

- Bones
- Cartilage and bone(s)
- Teeth and bone

**Arthrology:** Scientific study of Joints.

### **Structural Classification of Joints:**

- Fibrous : No joint cavity, bones held by Fibrous tissue.
- Cartilagenous : No joint cavity, bones held by Cartilage
- Synovial : Joint cavity and bone forming joint are united by a surrounding articular capsule and supported by accessory ligaments.

### **Functional Classification of Joints:**

- Synarthrosis (Immovable)  
Sutures, Synchondrosis & Gomphoses
- Amphiarthrosis (Slightly-movable)  
Syndesmosis & Symphysis
- Diarthrosis (Movable)  
Plane, Saddle, Pivot, Hinge, Ball-Socket & Elipsoid

## **TEMPOROMANDIBULAR JOINT (TMJ)**

The articulation of lower jaw ( Mandible ) with the cranium (or temporal).

- Synovial joint of condylar variety
- Hinge or Ginglymus
- Gliding or arthroidal

*Ginglymo-arthroidal joint*

### **Bones of the TMJ**

- Glenoid fossa (undersurface of the squamous part of temporal bone) & Condyle (condylar process of mandible).

- Articular surfaces are covered by a fibrous tissue. This fibrous tissue covers the condylar cartilage.

Condylar cartilage is a form of disorganized white fibrocartilage. It is also seen covering the slopes of the articular eminence.

### **Capsule of the TMJ**

- Capsule of synovial joint:
- Fibrous, non-elastic membrane surrounding the joint.
- Provides passive stability.

Attachments:

- Posteriorly - Squamotympanic fissure.
- Laterally - Margins of glenoid fossa,
- Anteriorly - Articular eminence
- Inferiorly - Neck of condyle.

### **Ligaments of TMJ**

#### **(a) Temporomandibular Ligament**

- Runs obliquely backward and downward from the lateral aspect of the articular eminence to the posterior aspect of the condylar neck.
- Ligament consists of two parts:
  - Outer oblique part – arises from outer surface of the articular eminence and extending backward and downward to insert into outer surface of the condylar neck.
  - Inner horizontal part – same origin and inserting into lateral pole of condyle.

#### **(b) Sphenomandibular Ligament**

- Runs from lingula of mandible to spine of sphenoid bone.

#### **(c) Stylomandibular Ligament**

- Runs from styloid process to angle of mandible.

Functions:

1. Restrict and limit movements of joint.
2. Restricts displacement of mandible.

## Articular Disc / Meniscus

- The Meniscus/Articular disc is a fibrous, saddle shaped structure that separates the condyle and the temporal bone.
- The meniscus varies in thickness: the *thinner*, central intermediate zone separates *thicker* portions called ***the anterior band and the posterior band***.
- Posteriorly, the meniscus is contiguous with the posterior attachment tissues called the ***bilaminar zone***. The bilaminar zone is vascular, innervated tissue that plays an important role in allowing the condyle to move forward.
- The disc is well supplied with vascular and neural elements at its periphery but is avascular and non-innervated in its central region.
- The meniscus and its attachments divide the joint into superior and inferior spaces. The superior joint space is bounded above by the articular fossa and the articular eminence. The inferior joint space is bounded below by the condyle. Both joint spaces have small capacities, generally 1cc or less

## Synovial Membrane

- The capsule is lined on its inner surface by a synovial membrane.
- Lines the entire capsule with folds or villi of membrane protruding into the joint cavity.
- It does not cover the articular surfaces of joint or disk.
- Consists of 2 layers – ***a cellular intima*** resting upon a ***vascular subintima*** which in turn blends with fibrous tissue of capsule.
  - Intima varies in structure, having one to four layers of synovial cells embedded in an amorphous, fiber-free intercellular matrix.
  - Subintima is a loose connective tissue containing vascular elements together with fibroblasts, macrophages, mast cells, fat cells, and some elastic fibers.

## Synovial Fluid

The chemical composition of synovial fluid indicates that it is a dialysate of plasma with some added protein and mucin. It is characterized by well defined physical properties of viscosity, elasticity and plasticity.

### Functions of Synovial Fluid

- It provides a liquid environment for the joint surfaces.

- Metabolic exchange- since the articular surfaces of the joint are non vascular, the synovial fluid acts as a medium for providing metabolic requirements to these tissues. Free or rapid exchange exists between the vessels of the capsule, the synovial fluid and the articular tissues.
- Synovial fluid also has phagocytic function.
- It serves as a lubricant between articular surfaces to increase efficiency and minimize the friction.

### **Histology of Articular Surfaces**

The Articular surface of the condyle and mandibular fossa are composed of four distinct layers

- Articular zone
- Proliferative zone
- Fibrocartilaginous zone
- Calcified cartilaginous zone

#### *Articular Zone*

- It is the most superficial layer. It is adjacent to the joint cavity and forms the outermost functional surface.
- This layer is made up of dense fibrous connective tissue rather than hyaline cartilage.
- It is less susceptible than hyaline cartilage to the effects of ageing and therefore is less likely to break down over time. It also has better ability to repair than hyaline cartilage.

#### *Proliferative Zone*

- It is mainly cellular. Undifferentiated mesenchymal tissue is found in this area.

#### *Fibrocartilaginous Zone*

- Collagen fibrils are arranged in bundles in a crossing pattern.

#### *Calcified Zone*

- It is the deepest zone made up of chondrocytes and chondroblast distributed throughout the articular cartilage.

### **Nerve supply and Blood supply of TMJ**

- Nerve supply: Auriculotemporal , deep temporal and massetric nerve.

- Blood supply:
  1. Branches of superficial temporal artery.
  2. Deep auricular and anterior tympanic branches of first part of maxillary artery.
 Ascending pharyngeal arteries.

## **MUSCLES OF MASTICATION**

The main muscles helping in mastication are:

- Masseter
- Medial pterygoid (Inferior pterygoid)
- Lateral pterygoid (Superior pterygoid)
- Temporalis

Other muscle groups involved are:

- Infrahyoid group (which stabilizes the hyoid bone)
- Mylohyoid muscle,
- Anterior belly of Digastric.

### **Masseter**

*Origin:*

Superficial layer – anterior 2/3rds of lower border of zygomatic arch and zygomatic process of maxilla.

Middle layer – anterior 2/3rds of deep surface and posterior 1/3 of lower border of zygomatic arch.

Deep layer – deep surface of zygomatic arch.

*Insertion:*

- Superficial fibers pass downwards and backwards at angle of 45 degrees and are inserted into lower part of lateral surface of ramus of mandible.
- Middle and deep fibers pass vertically downwards and are inserted into middle part of ramus and upper part as well as coronoid processes.

*Nerve supply:* Masseteric Nerve, branch of anterior division of mandibular nerve.

*Action:* Elevates the mandible and closes the mouth.

## **Temporalis :**

### *Origin:*

- Deep surface of Temporal fascia
- Temporal fossa- from the inferior temporal line to the infratemporal crest.

### *Insertion:*

- Margins and deep surface of coronoid process.
- Anterior border of ramus of mandible upto the last molar.

*Nerve supply:* Deep temporal branches from anterior division of mandibular nerve.

### *Action:*

- Elevates mandible
- Posterior fibers retract the protruded mandible.

## **Lateral Pterygoid**

### *Origin:*

- Upper head: Infratemporal surface and crest of greater wing of sphenoid bone.
- Lower head: lateral surface of lateral pterygoid plate

### *Insertion:*

- Pterygoid fovea on anterior surface of neck of mandible.
- Anterior margin of articular disc and capsule of TMJ.

*Nerve supply:* Branch of anterior division of mandibular nerve.

### *Action:*

- Depresses mandible and opens mouth
- Acting together protrude mandible.
- Help in side-wise movements of mandible.

## **Medial Pterygoid**

### *Origin:*

- Superficial head: Tuberosity of maxilla.
- Lower head: Medial surface of lateral pterygoid plate

### *Insertion:*

- Medial surface of the angle of mandible and adjoining parts of ramus of mandible.

*Nerve supply:* Nerve to Medial Pterygoid, branch of main trunk of mandibular nerve.

*Action:* Elevates mandible

Helps protrude mandible.

Pterygoids on both sides acting together help in side-wise movements of mandible.

### **Movements at TMJ and Muscles Involved**

#### **Closing the Jaw**

- Masseter,
- Medial pterygoid
- Anterior part of temporalis
- Upper head of lateral pterygoid.

#### **Opening the jaw**

- Inferior head of lateral pterygoid
- Anterior belly of digastric
- Mylohyoid

#### **Protrusive movement**

- Inferior head of lateral pterygoid
- Elevator group

#### **Retrusive movement**

- Posterior fibers of temporalis
- Elevator group.
- Lateral movement
- Combined action of elevator muscles posterior part of temporalis and lateral pterygoid.

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*Note:* Draw well labeled diagrams wherever necessary as shown in the lecture class.