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Anatomical Study of an Adult Human Temporomandibular Joint in Iraq

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Abstract

Temporomandibular articulation is the highest feature that outlines the class of the mammalian and divorces mammals from further vertebra, it allows normal parting and departing of the jawbone and is needed for purposes such as mastication and speaking. Components of this synovial joint between the condyle process of mandible and glenoid cavity of the temporal bone has been studied anatomically and histologically in 25 autopsies of adult males and female were examined at different Iraqi cities. Descriptions of TMJ related structures skin, parotid gland with its traversed facial nerve, all are related laterally the capsule of the joint, the fibrous connective tissue sac and lines with synovial membrane, containing synovial fluid, capsule is supported anteriorly by the fibers of the sphenomandibular ligaments and to the facial fibers of the masseter muscle .Also present study describe rectangular masseter muscle with its dimensions (70±12mm) x (50 ±14) mm; contemporary no readings were recorded. In addition dimensions of the ovoid condyle process were 15 to 20 mm from side to side and 8to 10 mm from front to back Current study mentioned dimensions of the mandibular fossa which has been delimited by the attachment of joint capsule antereoposterior dimension was range from 24 – 38 mm and its lateral dimension from side to side was ranging from 19- 33mm, these differences between the condyle process and glenoid fossa inform us the free movement of the small condyle process within the fossa were it glide anteriorly furing protraction of the mandible and then its retraction. Measurements of different bones at different sex depict that the thickest trabeculae by its mean & standard deviation is founded in male in condyle process, 13.03±1.54, though the thinnest trabeculae is founded in female within the mandibular fossa of the temporal bone, 11.23 ±0.90. Despite the fact for recorded algebraic data of the gaps, spaces were occupied by the trabeculae displays that the widest gaps in dimension were seen in female mandibular fossa, 36.20 ±0.71. While the narrowest spaces were seen between the trabeculae of condyle process bone of the mandible in male, 23.25±0.93. From current study anatomical features are grossly in agree with other anatomist descriptions, but dimensions of fossa and condyle are greater than other studies.

Anatomical Study, Temporomandibular Joint

The Temporomandibular joint (TMJ) is the only valid oromaxillofacial joint. This is a synovial joint. It is also known as the mandibular or craniomandibular joint. The TMJ is unusual for revolving (ginglymoid) and translational (armorial) gestures, including the opening and closing of the mouth, mastication, and speaking during jaw operation. The right and left articulations cannot shift separately because they are joined by the mandible that creates a bicondylar joint [(1)]. The TMJ is differentiated by an articular disk into a bottom and an upper segment. The TMJ mechanism plays an important role and makes difficult jaw motions. A capsule and numerous ligaments envelop the TMJ. Mandibular movements can be constant or periodic and allow the TMJ to be loaded statically and/or dynamically. In general, there are three types of loading: stress, strain, and shear [(2)]. A gymnastic joint formation from the glenoid fossa (GF), articular tuber, joint plate, condyle, retro-discal muscle, capsule joints, and synovial membrane (TMJ) is an arthrodial ginglymus join [(3)]. The commonest joint in the human body is capable of rotating the lower jaw on a bilateral basis [(4,5)]. This study was designed in order to investigate about the different joint structures achieved to depict different parameters of articulation beside the accessory ligaments & muscles site attachments, diameters, and its relations to other structures beside different anatomical relations.

Materials and Methods

1-The collection of samples:

From different Iraqi governorates at dissimilar forensic medicines centers rules as of Tikrit citiy, twenty five autopsy samples of males and females cadavers (19 males and 6 females) were collected and studied according to families permission and helps of forensic staff, in addition two human dried heads (male, average age 40 years) and dried bones from varied academic centers, with assessment of different scientific references in libraries of various colleges.

2-Anatomical procedure:

The TMJs were observed from 25 cadavers aged between 30 and 75 years. The sex ratio was 19 men to 6 women. The harvesting was done through a lateral approach as in Fig. (1). Through different incisions by a pre-tragal incision as in Fig. (2). extended at its superior extremity by a horizontal incision over the zygomatic arch or by incise the skin as well as to the fascia, lifting them start from the inferior border of mandible ramus to study the topography of varied structures in the region. Sagittal and coronal sections were made in order to analyze the relationship of the superior, posterior and superoposterior surfaces.

Results

1-Anatomical study

After removing the skin and subcutaneous tissues which cover the superficial region, extending just posterior to the ramus of mandible and anterior to the tragus near the TMJ, the articular capsule on its front edge has direct contact with the masseter muscle and its perimysium. Its origin is from the zygomatic arch with many muscular sheets and inter on the lateral surface branch of the mandible and to the base of the lateral aspect coronoid process was noticed, anterior to the TMJ, attached the lower margine of the zygomatic arch, Existent training display dimension of the rectangular masseter muscle was ranging from (70±12mm) x (50 ±14 mm), the upper portion of the parotid gland appeared, it was surrounded by its capsule sending its parotid duct and traversed by the facial nerve.

After elating integument and parotid gland, externally and lateral to TMJ capsule, the temporomandibular ligament seems attached to the lateral surface of the zygomatic arch from above and to the articular tubercle on its lower border; below, its fibers are running obliquely downward and backward to the lateral surface and posterior border of the neck of the condyle process, it is thiner below than above.

The sphenomandibular ligament is a flat, thin band that attaches superiorly to the

spine of the sphenoid bone and descends, becoming wider as it descends and fixed to the lingula of the mandibular foramen. When the temporomandibular joint (TMJ) is locked, it is slack. It is taut because the mandibular condyle is in front of the temporomandibular ligament.
Also laterally, portion of the zygomatic arch extends anteriorly, giving attachments to different muscles; mainly to the masseter muscle and just in the lateral aspect we find the facial nerve branches emerge from anterior border of the parotid gland which is surrounded by its capsule as in F**ig. (3).**

2-Exploration of the joint displays its contents; the condylar process appeared as an ovoid process seated atop a narrow mandibular neck. It is 15 to 20 mm from side to side and 7 to 10 mm from front to back. The lateral pole of the condyle is rough, bluntly pointed, and projects only moderately from the plane of ramus, while the medial pole extends sharply inward from this plane Fig. (4).

Discussion:

Tissues and structures that are related laterally to the temporomandibular joint as appeared in present study displays location of the masseter muscle was noticed, anterior to the TMJ, attached the lower border of the zygomatic arch and during it descend, it is attached to the anterior part of TMJ capsule, this description was in agree with [6].

Whilst present description was in disagreement with description of [7], who describe attachment of the master muscle to the coronoid process and its attachment to articular disc. This variance in attachment of the muscle to the disc directly crossing the capsule may they study extension of the muscle fiber across the capsule, while present study describes attachment of the muscle to the capsule.

Existent training display dimension of the rectangular masseter muscle was ranging from 70x50 ±14 mm; contemporary no reading was recorded.

Another muscle located medial to the TMJ is the medial pterygoid muscle, which has two heads. The majority of the muscle emerges as a deep head from the medial surface of the lateral pterygoid plate. The superficial head of the muscle is formed by the maxillary tuberosity and the pyramidal process of the palatine bone. Both muscle fibers migrate downward, lateral, and posteriorly and are inserted into the lower and back portion of the medial surface of the ramus and angle of the mandible by a tight tendinous lamina. Same description of both medial and lateral pterygoid muscles by Illustrated Anatomy of the Head and Neck [8]

But he labels insertion of medial pterygoid joins the masseter muscle to form a common tendinous sling which permits the medial pterygoid and masseter to be powerful elevators of the jaw. This tendon in existing study couldn't be discriminated in autopsy.

In extant schoolwork the Joint is explored and its capsule and the articular disc and their depiction give the dint similar to that written by [10,11,7], except that they describe the disc keeping the same thickness of its center and at periphery, through its span.

The condyle is the part of the mandible that mates to the undersurface of the disc, and the articular fossa, glenoid fossa, or mandibular fossa is the part of the temporal bone that mates to the upper surface of the disc.

Current study demonstrates dimention of the condyle process as follow; Exploration of the joint displays its contents; the condylar process appeared as an ovoid process seated atop a narrow mandibular neck. It is 15 to 20 mm from side to side and 8 to 10 mm from front to back. The lateral pole of the condyle is rough, bluntly pointed, and projects only moderately from the plane of ramus, while the medial pole extends sharply inward from this plane which were in agree with that recorded by [12,13], but in disagreement with [14,15], who documented and verified less diameter of the head of the mandible grossly and collectively give diameter range from 11 to 17 mm from side to side

and 7 to 10 mm from front to back in addition they describe the lateral pole of the condyle is lumpy pointed, while the medial pole extends cuttingly inward from this plane.

Analysis for these differences are related to the family history which is affected by gene inheritance and type of food and style of chawing and the traditional and culture of society in feeding. Current study mentioned dimensions of the mandibular fossa which has been delimited by the attachment of joint capsule anteroposterior dimension was range from 24 – 38 mm and its lateral dimension from side to side was ranging from 19- 33mm, these results are coincident with that recorded by [16,17].

But they disagree about the dimensions they recorded diameters of the anteroposterior was 20-35 mm and transverse diameters was15-29. Exploration for these dissimilarities in measurements may be related chromosomal variances and environmental in addition to the feeding attitude according to the opinions of [12,18 ,19]

Studying the morphometry of the trabeculae and the distances distancing them in mandibular fossa of the temporal bone and in the condylar process in both male and female by obtaining the mean and standard deviation of widest spaces and large thickness of trabeculae in different region bones and in male and female, we gain different measurements scored by microns, findings of present study are in agree with results describing features and dimensions of these trabeculae which are listed by [20,10, 21].
But their findings about dimensions were less than our listed diameters and the cause for that is their training and experts in addition to the facilities in using computed tomography.

Fig. (1): (A) Lateral view of human head.
(1) Skin (withdrawn), (2) Subcutaneous tissue.
escape

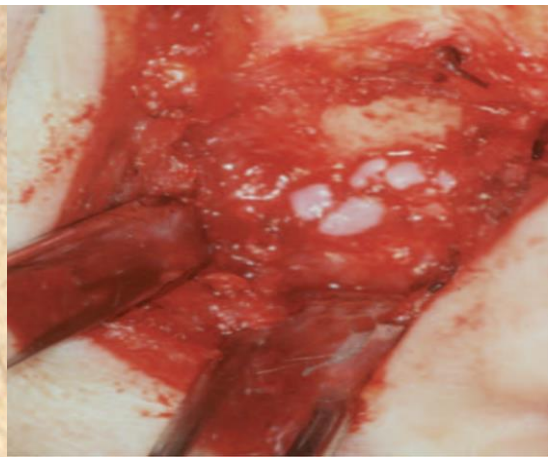
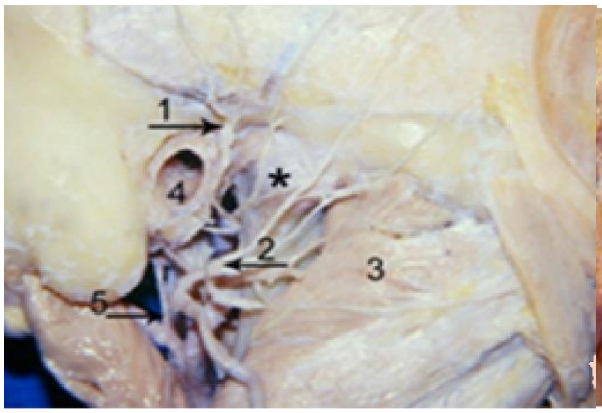


Fig. (2): The left TMJ of humen is exposed via a preauricular approach. Loose bodies from the upper compartment after incision of the capsule



Fig(3): Lateral view of human head. * TMJ. (1) Auriculotemporal Nerve, (2) Facial Nerve, (3) Masseter Muscle, (4) External Acoustic Porion, (5) Deep Auricular Artery.

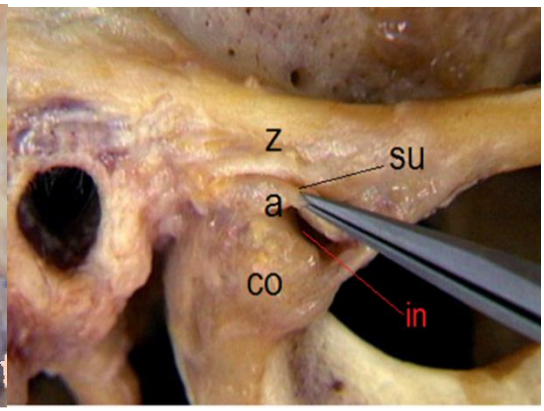


Fig. (4): Freeing TMJ from surrounding tissues inter articular disk is labeled by the mosquito, (z) zygomatic arch, (co) condyle process, (su) superior compartment of joint cavity, (in) inferior compartment of the joint cavity.

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