Temporomandibular Joint

Most human bones are joined with one another. These connections of bones to each other are termed articulations or joints. Some joints are immovable as in the articulations of the bones of the skull. This type of joint is known as a suture. In movable joints, the surfaces of the bones are slightly separated. The articulating surfaces are covered by cartilage, and the entire joint is enveloped by a fibrous tissue capsule. The lining cells of the interior of the capsule form a synovial membrane which secretes an intracapsular fluid. This fluid acts as a lubricant for the joint. The bones forming the joint are supported, strengthened, and connected by fibrous bands called ligaments.

Ligaments are strong bands of fibrous tissue. They appear white and silvery and are somewhat pliant and flexible. Thus, they allow freedom of movement, but still protect the joint against overexcursion. They normally lie outside the capsule and are attached to the involved bones. Sometimes one end of the ligament is attached to a more distant bone. The sphenomandibular ligament is an example. Often the ligaments are incorporated in and fused to the capsule.

Classification of Joints

There are three main classes of joints: synarthrosis, amphiarthrosis, and diarthrosis.

Synarthrosis. Synarthrosis designates an immovable joint such as the sutures of the bones of the skull.

Amphiarthrosis. Joins that are only slightly movable fall into this category. The articulations between the vertebrae are a good example for this class.

Diarthrosis. Joints that are freely movable are members of this group. The joints of the arms, legs, and fingers are diarthroidal joints. Also, the temporomandibular joint is diarthroidal.

Diarthroidal joints may be subclassified according to the various types of movements of which they may be capable. The two important divisions relative to the study of head anatomy are the ginglymus (hinge) and the arthrodia (gliding) types.

In a diarthrosis, the articulating surfaces are covered by cartilage. Also, the joint is divided into an upper and a lower compartment by an interposed piece of cartilage known as the meniscus or articular disk. The edges of the disk blend with the capsule, and the surfaces of the disk are covered with the synovial membrane.

Structure of the Temporomandibular Joint (TMJ)

The temporomandibular joint is the articulation between the mandible and the cranium. It is a diarthrosis, but is unique in several aspects from other diarthroidal joints. First of all,
both the articulating complexes of this joint house teeth. The shapes and positions of these teeth influence the function of the temporomandibular joint. Secondly, the articulating surfaces are covered with a nonvascular fibrous tissue that contains some cartilage cells and is designated as a fibrocartilage. Thirdly, the right and left articulations are functionally intercoupled and have a restricting influence on each other.

The condylar head of the mandible conforms to the anterior slope of the glenoid fossa of the temporal bone. Anteroposteriorly, the condyle is convex. Mediolaterally, it is also convex but is wider than the anteroposterior dimensions. Below the head of the condyle is the neck which is quite thin. The neck is a frequent area of fracture when a strong force is abruptly applied to the lower jaw.

The glenoid fossa of the temporal bone is a smooth concavity covered with a fibrocartilage. Anteriorly, a transverse bony ridge, the articular eminence or tubercle forms the boundary. The thin bone of the fossa separates it from the cranial cavity. It is interesting that this thin bone is rarely fractured or perforated. The reason is twofold. The articular disk protects the fossa from any trauma the condyle might exert. Also, the head of the condyle is angled forward on the neck of the ramus. Posteriorly, the glenoid fossa is bounded by a bony ridge, the postglenoid process.

Between the glenoid fossa and the head of the mandibular condyle lies a fibrous oval disk, the meniscus. It is thinner in the central part than at the periphery. Posterior to the disk is a thick layer of loose, vascular connective tissue which fuses with the capsule of the temporomandibular joint.

The capsule encloses the joint. Superiorly, it encircles the glenoid fossa. Below, it attaches to the circumference of the neck of the condyle just beneath the head of the condyle.

The disk is fused to the capsule anteriorly. Some fibers of the external pterygoid muscle attach to the disk here. Laterally and medially, the disk is attached to the medial and lateral poles of the condylar neck. The capsule is too, but somewhat lower than the attachments of the disk.

Laterally, the capsule is thickened, reinforced, and strengthened by the temporomandibular (lateral) ligament. The sphenomandibular ligament is a band of fibrous tissue arising from the angular spine of the sphenoid bone and attaching at the lingula of the mandibular foramen. It is located on the medial aspect. The stylomandibular ligament is another fibrous band. It extends from the styloid process of the temporal bone to the mandibular angle. Only the temporomandibular ligament limits the joint. Neither the stylomandibular ligament nor the sphenomandibular ligament has any influence upon the movement of the lower jaw.

The inner surface of the temporomandibular capsule is lined by a synovial membrane which reflects onto the superior and inferior surfaces of the meniscus. Synovial fluid lubricates the joint.
The temporomandibular joint is divided into two compartments, an upper and a lower, by the articular disk. In theory, these two compartments may move in conjunction with one another or independently. The upper compartment is a sliding joint and the lower compartment is a hinge joint. Because of this dual action the temporomandibular joint is classified as a ginglymoarthroidal joint.

**Movements of the Temporomandibular Joint**

Under normal circumstances, mandibular movement is a result of upper and lower compartments of the temporomandibular joint acting together. In addition, the condyle, disk, and fossa are in contact at rest and in all movements. Moreover, the head of the condyle, being angled slightly forward, actively holds the disk against the posterior slope of the articular eminence, *not in the depths* of the fossa.

In general, the movement of the temporomandibular joint include opening, closing, protrusion, and lateral displacement. The disk slides on the articular tubercle, and the condyle rotates on the disk when the jaw is opened and closed. In protruding the mandible, both disks glide forward; rotation of the condyles is prevented by contraction of the elevating muscles of the mandible. When the mandible goes into lateral positions, one disk glides forward while the other remains stable in position. In chewing, first there is lateral movement; then the mandible is returned to position by the closing muscles.

Opening is accomplished by contraction of the external pterygoid, digastric, mylohyoideus, and geniohyoideus muscles. Elevation is produced by the masseter, temporalis, and internal pterygoid muscles.

The mandible is protruded by simultaneous action of both external pterygoids and the closing muscles. It is retracted by the posterior fibers of the temporalis muscle. Lateral movement is accomplished by contractions of the pterygoid muscles. When the left pterygoid muscles are contracted, the left condyle glides forward, the right condyle stays in position, and the mandible shifts to the right.

**Mandibular Positions**

There are much research and controversy regarding positions of the mandible, definitions of terms, and relative functions of the positions. However, a general discussion of the subject is necessary to acquaint the student with a basic knowledge of maxillomandibular relations.

*Rest position* is herein defined as that position of the mandible when the muscles of mastication are in repose. The individual is sitting or standing, looking straight ahead. The teeth are not in contact. In rest position, approximately 3 millimeters of space are between the upper and lower bicuspids.

When the lower teeth and upper teeth are occluded with the most complete and comfortable intercuspation, the position is termed *centric occlusion.*
Centric relation may be defined as the teeth positioned in occlusion with the condyles in the most posterior location possible.

It is from these various neutral positions that the mandibular excursions take place.

Clinical Notes

The temporomandibular joint, because of its anatomy and unique features, presents several interesting clinical problems. There are proprioceptive fibers in the temporomandibular joint, the periodontal membranes of the teeth, and muscles of mastication. Those in the periodontal membranes are more sensitive and exacting. Patients without their natural dentition, therefore, often have difficulty positioning their jaws in the neutral positions which are based on occlusion.

Pain

Pain in the temporomandibular joint may be a result of a pathologic condition in the joint or of a pathologic condition elsewhere that is radiating pain to the joint. Infection in the joint is rare. Degenerative disease of the various structures of the joint, unfortunately, is not so rare. Arthritis is inflammation of a joint. The temporomandibular joint may become inflamed either as an extension of generalized arthritis of all joints or as a result of malfunction of the masticatory machine. Malocclusion can result in undue stress and abnormal pressures on the protective fibrocartilages. The cushion effect of the cartilages is reduced and inflammation results. Tumors of the condyle or other associated parts may cause painful pressure on nerves.

The patient with an infection or a pathologic condition of the ear, may complain of temporomandibular joint pain. Pain in the teeth or jaws, primarily in the lower molars or mandible, often radiates to the temporomandibular joint. The sensory nerve supply to the temporomandibular joint and ear is via the auriculotemporal nerve. Pain in the jaws, radiating to the ear and the temporomandibular joint is thought to be based on central nervous system synapses and connections of the various branches of the fifth nerve. Thus, pain stimuli to the inferior alveolar nerve from a lower molar may be interpreted as ear or joint pain via the auriculotemporal nerve. A similar situation occasionally occurs with pain from the upper teeth radiating to the lower teeth or ear.

Clicking

Many patients hear or feel clicking in the temporomandibular joint during various excursions of the jaw. If the meniscus becomes more mobile than normal, clicking or crepitus is often the result. Hypermobility of the meniscus may result from degeneration and reduction in thickness of the disk. It may also result from a "sloppy" joint caused by overstretching and loss of resiliency of the temporomandibular ligament and capsule. Stretching of the fibrous attachments of the meniscus to the condyle may also cause hypermobility of the meniscus and result in crepitus.
Dislocation

When the condyle comes to rest in front of the anterior articular eminence, it is dislocated. The patient is unable to close his mouth. Normally, this situation is painful. Even under normal conditions, when the jaw is opened wide, the condyle and disk pass beyond the summit of the anterior articular eminence. The closing movement begins with retraction of the mandible, bringing the condyle into position behind the height of the eminence. Then the elevators replace the condyle and meniscus into the fossa. This movement must be made with extreme precision and coordination. If, however, this coordinated motion is disturbed and the elevators contract before the retractors, the condyle may be moved superiorly before it is moved posteriorly. Dislocation will occur. Overexcursion upon opening may stretch the capsule or muscles, causing spasm of the muscles, loss of coordination, and dislocation. This painful malposition anterior to the eminence is then maintained by the continued spasm of the elevators.

Reduction of the dislocation is aimed at overcoming the muscle spasm. This may be accomplished by general anesthesia, which is usually not necessary. The dislocation can often be reduced by pressing downward on the lower molars. Since the muscle spasm may be a result of increased reflex stimuli to the muscles from capsule damage, injection of a local anesthetic directly into the capsule sometimes reduces the dislocation by interrupting these reflex stimuli.

If a patient is able to reduce the dislocation for himself, it is termed subluxation. If help from another person is required, the term is luxation. Patients who have frequent luxation of the temporomandibular joint may be treated by surgically reducing the height of the articular eminence (eminectomy). Also, surgical tightening of the temporomandibular ligament may reduce joint mobility and prevent dislocation from overexcursion.