FUNCTIONAL ANATOMY OF THE TEMPOROMANDIBULAR JOINT (I).

Anca Sava¹, Mihaela Monica Scutariu²

University of Medicine and Pharmacy „Grigore T. Popa” - Iasi
School of Dental Medicine
1. Discipline of Anatomy and Embryology
2. Discipline of Oral Diagnosis

FUNCTIONAL ANATOMY OF THE TEMPOROMANDIBULAR JOINT (I). (Abstract): Jaw movement is analyzed as the action between two rigid components jointed together in a particular way, the movable mandible against the stabilized cranium. Jaw articulation distinguishes form most other synovial joints of the body by the coincidence of certain characteristic features. Its articular surfaces are not covered by hyaline cartilage as elsewhere. The two jointed components carry teeth the shape, position and occlusion of which having a unique influence on specific positions and movements within the joint. A fibrocartilaginous disc is interposed between upper and lower articular surfaces; this disc compensates for the incongruities in opposing parts and allows sliding, pivoting, and rotating movements between the bony components. These are the reasons for our review of the functional anatomy of the temporomandibular joint.

Key words: TEMPOROMANDIBULAR JOINT, JAW MUSCLES, MANDIBLE POSTURES AND MOVEMENTS

The craniomandibular articulation is a peculiar, bilateral, roving fulcrum around which moments of force turn into a complex jaw-lever system.

Each joint involves the articular fossa above and the mandibular condyle below (1). The articular eminence, a transversely elliptical region sinuously curved in the sagittal plane and tilted forward at 25° to the occlusal plane, forms most of the articular surface of the articular fossa. Its steepness is variable and becomes flatter in the edentulous. Its anterior limit is the summit of the articular eminence, a transverse ridge that extends laterally out to the zygomatic arch as far as the articular tubercle. Articular tissue extends anteriorly beyond the articular summit and on to the preglenoid plane. Posteriorly it extends behind the depth of the fossa as far as the squamotympanic fissure. A postglenoid tubercle (at the root of the zygomatic arch, just anterior to the fissure) is usually poorly developed in human skulls (2).

The articular surface of the mandibular condyle is slightly curved and tilted forward at about 25° to the occlusal plane. In coronal plane its shape varies from that of a gable to roughly horizontal in the edentulous.

Fibrous capsule
The lower part of the joint is surrounded by tight fibers which attach the condyle of the mandible to the disc. The upper part of the joint is surrounded by loose fibers which attach the disc to the temporal bone. Thus, the articular disc is attached separately to
the temporal bone and to the mandibular condyle forming what could be considered two joint capsules. Longer fibers joining the condyle directly to the temporal bone may be regarded as reinforcement.

**Ligaments**

Sphenomandibular ligament is medial to, and normally separate from the capsule. It is a flat, thin band that descends from the spine of the sphenoid and widens as it reaches the lingual of the mandibular foramen. With the jaw closed, there is about 5 mm slack within the ligament, but it becomes taut when the jaw is about half open. Lateral pterygoid and auriculotemporal nerve are lateral relations: chorda tympani nerve lies near its upper end and medial pterygoid is an infero-medial relation.

Stylomandibular ligament is a thickened band of deep cervical fascia that stretches from the apex and adjacent anterior aspect of the styloid process to the angle and posterior border of the mandible. Its position and orientation indicate that it cannot mechanically constrain any normal movements of the mandible and does not seem to warrant the status of a ligament of the joint.

Temporomandibular (lateral) ligament is attached above to the articular tubercle on the root of the zygomatic process of the temporal bone. It extends downwards and backwards at an angle of 25° to the horizontal, to attach to the lateral surface and posterior border of the neck of the condyle, deep to the parotid gland. It appears to be poorly developed in the edentulous.

Synovial membrane lines the inside of the capsule of the joint but does not extend to cover the disc or the articular surfaces.

**Articular disc**

The transversal oval articular disc is composed predominantly of dense fibrous connective tissue (3). It has a thick margin which forms a peripheral annulus and a central depression in is lower surface that accommodates the articular surface of the mandibular condyle. The depression probably develops as a mechanical response to pressure from the condyle as it rotates inside the annulus.

The functions of the articular disc remain controversial. It is generally believed that the disc helps to stabilize the temporomandibular joint. The articulating surfaces of the mandibular condyle and the articular fossa fit together poorly and are therefore separated by an irregular space. Muscle forces control the position of the mandible, and therefore of the condyle, in relation to the articular eminence, and these in turn set the shape and thickness of the irregular space (4).

**Postures**

The term posture is preferable, since it emphasizes the disposition of the parts of the body with reference to each other, which is precisely the feature to be analyzed. The most commonly discussed of these postures are usually labeled rest position and hinge position, along with centric and other occlusal position (5). Unfortunately, the terminology of some of these positions is confusing and controversial in the current literature. Here only the simplest and least equivocal terms will be used.

**Resting posture (rest position).** The resting posture of the mandible is the position the lower jaw assumes when the mandibular muscles are at „rest”, provided that the individual stands or sits at ease in the upright posture and holds the head so that the gaze is toward the horizon. This provi-
so is essential because it specifies that the entire head and neck should also be in normal rest position. If the head is flexed forward, the bunched-up soft structures between chin and chest tend to shove the mandible forward from its rest position. If the head is extended backward, the opposite displacement occurs. Then such structures as skin, fascia, and facial muscles (for example, platysma) are stretched and pull the mandible down and back form the rest position.

Therefore it must be clearly understood that the term „resting posture” does not imply a fixed or static position (6). The position varies continuously depending on numerous factors, including momentary bodily postures, immediately preceding activities, fatigue, and perhaps even the time of the day. That any such position is precisely reproducible with any degree of confidence is wholly an illusion.

In the resting posture the teeth are clearly not in contact. The space between upper and lower teeth is called the free-way space, or interocclusal clearance. This normally measures from 2 to 5 mm between incisors. In this position the lips touch lightly. Thus, it is also clear that rest position is entirely independent of the number, form, position, or even the presence or absence of teeth. Instead, rest position is entirely dependent on the resting tonus of the mandibular musculature and gravity. No muscle is ever totally atonal (except perhaps under the influence of certain drugs, deep anesthesia, or unconsciousness). The residual tension of a muscle „at rest” is termed resting tonus, but this too must be defined with care.

Resting tonus is due both to the innate turgor and elasticity of muscular and fibrous tissue and to the discontinuous contractions of muscle bundles in response to an alert nervous system. But in addition, in antigravity muscles, such as those of the jaw, intermittent reflex contraction of a number of muscle fibers is always present (5). Thus, as some fibers become fatigued, others take up the tension so that a given percentage of the fibers maintains, at all time, firm contact between articulating joint surfaces and thus ensures the integrity of the articulation. This mechanism becomes especially critical in all highly movable joints where the stability of the articulation cannot be greatly dependent on other features of joint structure (for example, the shoulder joint). Thus, in normal rest position of the jaw, the antero-superior articular surfaces of the mandibular condyles are pulled toward the posterior slopes of the articular eminences of the temporal bone. As shown, these surfaces are protected by articular coverings. The thinnest parts of the articular discs intervene between these surfaces, and all are held in these relations by the conditions of resting tonus mentioned above.

This is simply one instance of the general physiologic principle in which the proper relations of all body parts are maintained by muscle tone. Though considerably lower during sleep, tonus is even then not entirely lost. Obviously, as muscle tonus is constant under constant conditions, so are the rest positions of the mandible. In aberrant conditions, such as disease, exhaustion, or nervous tension, these relationships may change. Certainly, it is well understood that „constancy” in a living organism means simply that the range of variation is small but constant.

Clinically, the range of the resting posture is of great significance because it specifies the crucial limits to any „bite-
raising” prosthetic procedures. If the bite is „opened” (raised) as far as the rest position (meaning that the teeth touch in this position), the mandibular musculature is severely stressed. Constant contact of the teeth, however light, causes the neural end organs in the periodontium to signal this contact to the motor nucleus of the fifth nerve in the brainstem. This disrupts the normal, long established firing pattern. The disrupted pattern then deprives the muscle fibers of their normal resting sequences. Trauma to teeth, supporting structures, and joint structures, as well as muscle spasm and pain, are the obvious consequences.

**Hinge posture** of the jaw joint is one that can be located with some accuracy. It is the posture in which the condyles rest at the most retruded limit, against the thick back rims of the discs below the front of the fossa when the cusps of the teeth are just cleared of contact. It is from this position that a practically „pure” hinge raising and lowering of the jaw can be made. The simple hinge swinging of the mandible describes a small arc and is accomplished only when the mandible is forcefully retruded. The posterior most retrusion that the condyle can reach is determined by the length of the tensed inner horizontal band of the craniomandibular ligament. Since the length of this band is constant, the clinical registration of this position can be repeated accurately. The hinge movement rotates around a common horizontal axis, which runs approximately through the centers of both condyles. Because of the appreciable asymmetries between both sides of the skull, it is highly unlikely that the axis will ever run exactly through a juncture of horizontal and frontal planes. The location of this position is said to be useful in some clinical procedures. One feature of this is obviously significant; it specifies that the normal rest position of the condyle must be some short distance anterior to the hinge position.

**Centric occlusal posture** signifies some sort of contact between upper and lower teeth. Centric occlusion denotes a concept of normal mandibular posture in which the dentition is occluded with all teeth fully interdigitated at the same time that all other kinetic components of the oral apparatus are in „harmonious balance”. The condyles are slightly rotated backward and are at or slightly retruded from the level of their position at rest. Ideally, that is the position the jaw should reach if snapped shut from the open position when the head and neck are in the upright posture. This is the most likely to occur in healthy young adults with a full complement of teeth and what is classically considered a normal occlusion. It has been shown that, in the overwhelming majority of cases, the mandible can be retruded from this position some 0.5 to 1 mm, if the teeth are barely freed. As noted above, it is obvious that the normal centric occlusal posture must be slightly forward of the position that the masticatory musculature can actually achieve. Thus, the ability to move the mandible slightly backward from the centric occlusal relation is at least one distinct sign of a well-balanced oral apparatus. The hinge position is an extreme position, and it is entirely contrary to well-known principles of biologic constructs that any normal joint be habitually postured in such a strained position.

**Protrusive occlusal relation** is the po-
sition of occlusion in which the incisal edges of the four lower incisors contact the incisal edges of the upper centrals and sometimes the laterals. Normally, all the other teeth are not in occlusion. The condyles are slightly forwardly rotated and moved downward and forward to a level at or near the peak of the articular eminence.

**Lateral occlusal relation** is the position when the upper and lower posteriors of the ipsilateral side contact along the line of the crests of the buccal and lingual cusps. In unworn teeth the cusps bulge in curves so that the contacts are at spots where opposing contours meet. In worn teeth the contours are flattened, and contact lines may be almost continuous. In the natural dentition, the teeth of the controlateral side are not in occlusion.

**REFERENCES**