

## **The tongue, mandible, hyoid system**

Giuseppe Messina (1,2)

(1) *Science & Posture, Laboratory of Biomechanics, University of Palermo;* (2) *Postura Lab Research Institute, Palermo, Italy*

This article is distributed under the terms of the Creative Commons Attribution Noncommercial License (CC BY-NC 4.0) which permits any noncommercial use, distribution, and reproduction in any medium, provided the original author(s) and source are credited.

### **Abstract**

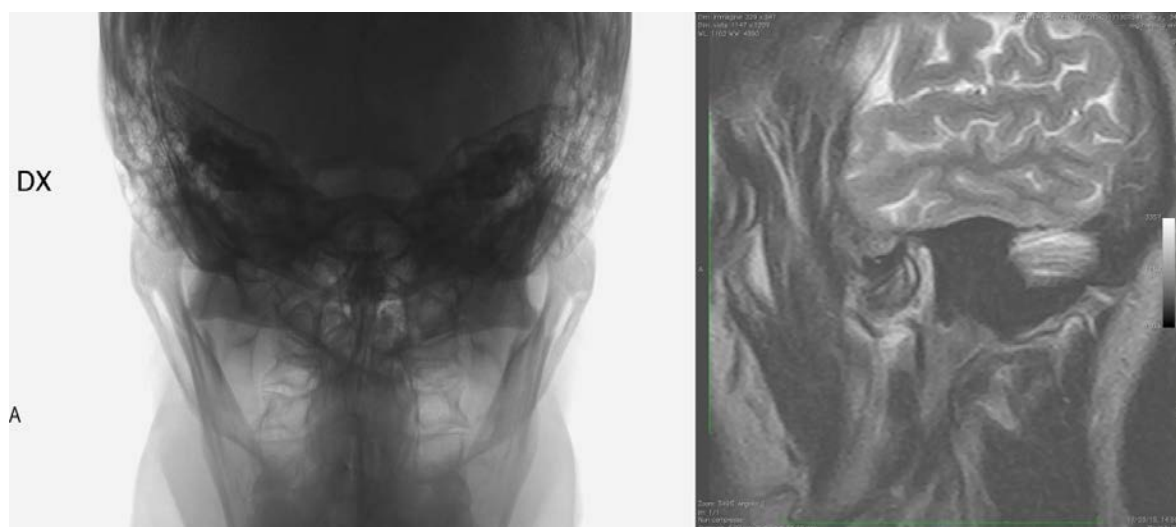
The craniocervical-mandibular system works in harmony and allows different functional tasks as the postural control of the cervical region. This system is formed by the temporomandibular joint, the masticatory muscles and ligaments connecting the temporomandibular joint and the cervical region. It has been seen to affect human posture, and many disorders of the temporomandibular joints may affect this functional arrangement. Notwithstanding this system considered as a functional arrangement, may offer various clinical explanations, it does not hold anatomical connections with the posterior region of the cranium, thus it should not be referred to as a craniocervical arrangement. For this reason a new interpretation of such system as the tongue, mandible, hyoid system should be considered. Such functional reinterpretation between these three anatomical structures allows further comprehension of specific clinical conditions connected to deglutition aspects or the temporomandibular joint, for such needs to be taken into account during clinical diagnosis and treatment.

**Key Words:** Mandible, hyoid, tongue, functional system.

*Eur J Transl Myol 2017;27(1):74-76*

To the editor, for many years the stomatognathic system, also defined as craniocervical-mandibular system, has been considered as a functionally based system with the role to keep the skull in position. The craniocervical-mandibular system works in harmony and allows different functional tasks as the postural control of the cervical region. This functional system has been considered as formed by the temporomandibular joint, the masticatory muscles and ligaments connecting the temporomandibular joint and the cervical region. The system has been seen to affect human posture, and many disorders of the temporomandibular joints may affect this functional arrangement<sup>1</sup>. However, this system as described may not be complete. Notwithstanding the concept of a craniocervical-mandibular system may have implications during postural control, the lack of direct muscular anatomical connections between the mandible and the posterior cervical region of the cranium should not allow the description of such system as craniocervical-mandibular as a functionally linked. For such, the concept of a tongue, mandible, hyoid system may be a more efficient way to describe the stomatognathic system from a functional point of view. The tongue, mandible, hyoid system is functionally composed by two bony components, the hyoid and the mandible and one muscle component, the tongue. The

tongue, mandible, hyoid system is functionally arranged as follows: From the *apophysis geni superior* there is the origin of the *genioglossus*, from the inferior the *geniohyoid* muscle, the first an intrinsic tongue muscle the latter that inserts distally on the hyoid bone. We also have the insertions of the mylohyoid and pharyngeal constrictor muscles and the pterygo-mandibular ligament in the inner part of the mandible whereas on the inferior part of the mandible the palatine muscles. On the external face of the mandibular rami there are the masseter muscles and the sfeno-mandibular ligament, and the medial pterygoid muscle on the internal face of the mandibular rami. In addition, there also is the insertion of the stilo mandibular ligament on the posterior margin of the rami. On the superior margin of the mandibular rami, on the coronoid process, there is the origin of the temporal muscle and from the condyloid process of the mandible the lateral and medial collateral ligaments. On the mandible we have 13 muscles and 5 ligaments. The motor control of these muscles is carried out by the V, VII, IX and XII cranial nerves. On the body of the hyoid we can find insertions of several muscles that originate either from the tongue and the mandible such as the geniohyoid and the mylohyoid, and also the sternohyoid, sternothyroid, thyrohyoid and omohyoid muscles. On the horns of the hyoid there is the insertion the hyoglossus, the



**Fig 1.** A: Frontal view of a male patient suffering with Eagle syndrome with calcification of the left stylohyoid ligament; B: Sagittal view of left TMJ in a male patient T.C. with Costen syndrome. Figures are relative to the same patient.

pharyngeal constrictor muscles, the stylohyoid and the tendinous pulley of the digastric muscle. On the distal part of the horns there is also the insertion of the longitudinal superior muscle and the longitudinal inferior muscle and the stylohyoid ligament. The two longitudinal muscles are both intrinsic tongue muscles<sup>2</sup>. On the hyoid there are 10 muscles, 1 ligament on each side and the motor control of these muscles is carried out by the V, IX, X and XII cranial nerve and the nervous root emerging from C2. There also are, 8 couple of muscles and 1 single muscle that form the tongue, all innervated by the hypoglossal nerve (XII). An example of the direct relation between these three structures may be represented by the connections between the mandible and the tongue through the genioglossus and the pharyngeal constrictor muscles, between the mandible and the hyoid through the geniohyoid and the mylohyoid and between the tongue and the hyoid through the two longitudinal muscles. A functional classification of this system may allow a better comprehension of clinical conditions such as the Eagle syndrome or the Coston Syndrome (Figure 1A and 1B of the same patient, respectively)<sup>3-5</sup>. The first is a painful cranio-facial disorder associated to an asymmetry between the two styloid processes of the hyoid bone with or without the calcification of the stylohyoid ligament. The Eagle syndrome is characterized by neck pain, otalgia, dysphagia and a dysfunctional deglutition. The Costen syndrome is characterized by otalgia, tinnitus, dizziness, headache, and burning sensation of the throat, tongue, and side of the nose and had been originally attributed to a temporomandibular joint dysfunction resulting from occlusal disharmony. The tongue, mandible and hyoid system is a complex biomechanical system. The

comprehension of a functional connection between these three anatomical structures needs to be taken into account during clinical diagnosis and treatment.

### Author's contributions

The Author has conceived, written and revised the present manuscript.

### Acknowledgments

I would like to thank Professor Antonio Palma and Professor Angelo Iovane for their invaluable help for the interpretation of the radiological images and Dr. Ewan Thomas for suggestions regarding the drafting of this manuscript in English. The author declares no external funding.

### Conflict of Interest

The author declares no conflict of interest in regard to the present manuscript.

### Corresponding Author

Giuseppe Messina, MD, Postura Lab Research Institute, University of Palermo, Via Giovanni Pascoli 6 - 90144, Palermo, Italy  
Email: giuseppe.messina17@unipa.it

### References

1. Cuccia A, Caradonna C. The relationship between the stomatognathic system and body posture. *Clinics (Sao Paulo)*. 2009;64:61-6.
2. Standring S, Borley NR. *Gray's Anatomy: The Anatomical basis of clinical practice*. Churchill Livingstone/Elsevier; 2008.
3. Bakshi SS. An Unusually long process: Eagle syndrome. *Am J Med* 2016;129(11):1166-1167. doi: 10.1016/j.amjmed.2016.05.047.

## **The tongue, mandible, hyoid system**

Eur J Transl Myol 2017; 27 (1): 74-76

4. Parry LG. Costen's syndrome; a report of two cases. J Am Dent Assoc 1947;35:831-3.
5. Edmunds KJ, Gíslason MK, Arnadóttir ID, et al. Quantitative computed tomography and image analysis for advanced muscle assessment. Eur J Transl Myol 2016 26:6015
6. Schultheiss C, Schauer T, Nahrstaedt H et al. Efficacy of EMG/Bioimpedance-Triggered Functional Electrical Stimulation on Swallowing Performance. Eur J Transl Myol 2016;26:283-286.
7. Riebold B, Nahrstaedt H, Schultheiss C, et al. Multisensor Classification System for Triggering FES in Order to Support Voluntary Swallowing. Eur J Transl Myol 2016;26:287-291.