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# TONGUE ANATOMY AND ORAL FUNCTIONALITY

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TONGUE ANATOMY AND ORAL FUNCTIONALITY (Abstract): Abnormal functions, such as mouth breathing, swallowing, and unilateral chewing, and aberrant postures of the oral circumferential muscles, such as forwards tongue thrust, tongue biting, and low tongue at rest, can also contribute to the development of malocclusion. Even the most conservative of orthodontists would admit that aberrant tongue movement is a common contributor to misaligned teeth. This research was conducted with the intention of shedding light on the tongue's structure and development, as well as its functions and orthodontic consequences. **Key words**: TONGUE ANATOMY, ORAL MUSCLE, ORAL FUNCTION, ORTHODONTIC TREATMENT

## INTRODUCTION

The tongue is a special muscle that helps us communicate, eat, and keep our airways clear. Although its importance to human physiology, the tongue's complex layered arrangement of muscle and connective tissue makes learning and appreciating its intricate anatomy challenging (1).

As compared to the rest of the skeletal system, where muscles have distinct bony origins and insertions, the muscles of the tongue are unusual in that they widely interdigitate and often attach on soft tissue rather than bone (2-6).

Orthodontists believe that improper tongue movement is a common cause of many different types of malocclusions. In an effort to ascertain whether or not the tongue is a significant component in malocclusion, a great deal of research has been conducted on the topic (1,2).

Abnormal functions, such as mouth breathing, tongue push, swallowing, and unilateral chewing, as well as aberrant postures of the oral circumferential muscles, such as forward tongue thrust, tongue biting, and low tongue at rest, can also contribute to malocclusion. Jaw deformity and malocclusion can develop when the bony structures are consistently subjected to forces from inadvertent and habitual activities operating on the maxillofacial and alveolar areas (3-5).

The muscle fiber orientation vectors in the tongue's various muscle groups also vary, rather than being uniformly parallel like in other skeletal muscles (7). Lastly, tongue surgery is an integral part of treating a wide variety of medical issues, from squamous cell carcinoma (10) to obstructive sleep apnea (8). A patient's quality of life can be severely impacted by damage to the neurovascular systems beneath their tongue, which can lead to difficulties with speech, swallowing, and even death (11,12).

These factors combine to make it difficult to examine the tongue's musculature using standard approaches like cadaver dissection, twodimensional (2D) textbooks, and radiologic imaging.

## ANATOMY OF TONGUE

The intrinsic muscles, the extrinsic muscles, and the connective tissue framework that make up the tongue are all variously described in the existing literature. It is up to the reader to extrapolate the tongue's 3D structure from these explanations and the associated 2D visual aids (13, 15). As an added complication, descriptions of tongue anatomy come from a broad variety of models, such as animals, (16) human fetal dissections, (17-19) and human studies with small sample sizes.

Several studies have shown different arrangements of tongue muscles, (6,20) leading to conflicting findings (13). In addition, cadaveric dissections typically necessitate disruption of surface muscle linkages to access deeper tissues, leading to unsettling figures and images, and 2D models do not allow the student to perceive all the intrinsic and extrinsic tongue musculature in a single place. Given these knowledge gaps and the limited nature of existing teaching tools, it is imperative that we have a model that is both accurate and favorable to studying tongue anatomy in its natural 3D environment.

There is a direct correlation between a healthy jaw relationship and proper dental function and the appropriate growth, development, and function of the tongue and all other connected oral and dental structures. There are three hypotheses on what contributes to natural growth rates. The following is a brief overview of these : occlusal force during mastication is mostly responsible for the growth of the jaws, second, the teeth play a key role in how the jaws grow, three, muscular activity plays a crucial role in jaw growth (18,19).

## FUNCTIONS OF TONGUE

The highest variation in muscle activity was seen during lateral tongue movement compared to action potential in the resting position (mouth closed).

Like breathing and heartbeat, swallowing is a vital function. This process, which begins in utero, involves a series of coordinated muscle and joint movements that ultimately result in the "bolus" (containing saliva) moving from the mouth cavity into the digestive system.

*Mastication*

Solid items should be crushed between the tongue and hard palate if they are soft, or between the upper and lower teeth if they are hard, stiff, or rough, as is often recognized in the HL model. Liquids and raw oysters are consumed without chewing.

Mastication is aided by the tongue, which is a well-known fact. With the help of the buccinator, it manipulates where food is located between the teeth, and it also twists and combines food with saliva. Masticatory effectiveness, on the other hand, has been shown to be heavily influenced by the tongue. When the mouth is closed, the tongue's motion resembles that seen during mastication more so than when the mouth is open (23).

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Gray-Stuart, Jones, and Bronlund conceptualize the mouth as an engineering system consisting of occlusion by jaw-teeth and circulation by tongue to analyze the oral process of mastication, despite the fact that the functions of both the jaw and teeth to comminute a solid food and the tongue to move and position the fragmented food are interrelated (27).

Mastication has three stages : oral, pharyngeal, and esophageal. Oral phase of swallowing implements not only the lingual and masticatory muscles as well as the facial muscles and the infra-hyoid muscles and sub-hyoid. Beginning at birth, the infant's ability to swallow serves a vital nutritional purpose. At this phase of swallowing, the tongue is lowered and positioned between the arches (28,29).

There is a direct anatomical association between the maximal occlusion and articular swallowing position because of the high frequency (between 1000 and 3000 times per day) and persistent functional stimulation it generates, even at the TMJ level, which is established gradually during development. While swallowing normally, the tongue plays an important function and is placed in a certain posture.

Misaligned or unusual lingual postures in children with deciduous or mixed dentition are strongly linked to facial abnormalities. Facial development and the placement of the teeth in occlusion and along occlusal curves are both directly impacted by lingual position and volume dyskinesia (Wilson and Spee).

*Speech*

Only humans use language to communicate with one another and other animals. A great deal of research has been done on how human speech evolved over time, yet the origin of speech is still mostly mysterious. A number of sounds (including s, z, t, d, sh, e, g, and is) require the assistance of the tongue. as a result, it enhances the quality of one's voice (30,31).

According to MacNeilage's "frame/content hypothesis of the development of speech production" study from 1998, "articulatory cyclicity of speech emerges from ingestive cyclicities." Speech, he says, is made up of open-close mandibular alternations that begin with babbling and whose cyclicity may have originated from jaw cyclicity in eating. This idea, however, has been contested, and other explanations for the jaw's cyclicity in articulation have been presented. These explanations include call vocalization and the modulation of acoustic characteristics (32).

It has been suggested by Hiiemae et al. and Hiiemae and Palmer that the tongue movements used in speech may be "derived from the wide variety of tongue movements found in suckling and feeding," building on MacNeilage's theory and highlighting the fact that feeding is a more fundamental activity than speech (33-35).

They generalize this idea in their study, where they propose that speaking motions might be a subset of those utilized in feeding.

*Breathing*

The proper development of the orofacial muscles depends on the ability to breathe primarily through the nose. Effective nasal breathing need a climatic setting that permits air to enter and exit the nose. When nose breathing is impeded, whether through an obstruction or from habit, oral breathing becomes the norm. Nasal breathing occurs when the tongue is relaxed. Forced mouth breathing, however, is always the result of some sort of habit or compulsion.

*Swallowing*

Transferring airway to the digestive tube in less than a second is a feat of complicated coordination between sophisticated volitional and reflexive movements (36). Tongue movement aids in bolus preparation during the voluntary oral preparatory phase (37,38), with the genioglossus muscles (the biggest and strongest extrinsic tongue muscles) contracting and relaxing alternately to ensure optimal bolus preparation. As soon as the bolus is ready, it is pushed backwards. There are pressure receptors in the pharynx, and this activates them. These receptors are mostly found at the base of the tongue and in the pharyngeal arches. The involuntary pharyngeal phase of swallowing starts when this nerve ending is stimulated (39).

Hyolaryngeal elevation (HLE) is a telltale sign that you're about to begin swallowing through your pharynx (40). The hyoid bone and larynx shift forward and forward during HLE, causing the base of the epiglottis to thicken and causing it to slant downward, therefore closing the laryngeal entry. The pharynx's anterior wall is also strained, which relaxes the upper esophageal sphincter and makes it easier to push the bolus down the pharynx and into the esophagus (41,42). The importance of biofeedback processes is comparable to that of the use of muscular power. If even a little component of the swallowing motion is missing, it might affect the rest of the process.

Upon activation of the pharyngeal swallowing phase, the base of the tongue takes on a ramp form, guiding the bolus into the pharynx (41). Tongue base retraction (TBR) begins when the bolus's tail reaches the level of the base of the tongue.

Two more extrinsic tongue muscles (hyoglossus and styloglossus) contract to help bring about this change in shape and posterior migration of the base of the tongue (37,38,43).

Maintaining enough pressure on the bolus tail necessitates that the base of the tongue advance towards the posterior pharyngeal wall and achieve full contact. The bolus propulsion is then taken up by esophageal peristalsis, which begins at the upper esophageal sphincter and travels gradually down the throat.

*Role in malocclusion*

Malocclusions such proclination, open bite, deep bite, and others can be the result of the genioglossus reflex, which is triggered by a big tongue. Graber said that the dental arch and bone production were affected by factors like the size of the jaw, the size of the tongue, and the location of the tongue.

Naosuke Doto used this body of research to propose that tongue pressure and lip closure force play crucial roles in avoiding malocclusion and ensuring long-term stability following orthodontic treatment. Regression of the incisor relation following therapy is possible if the lower lip and tongue have aberrant morphology, which may be primary or subsequent to the malocclusion. Several muscle forces, both internal and external, were proposed by Lambrechts to play pivotal roles in directing eruption, shaping the occlusal complex, and supporting the dental arch.

The location of the teeth is mostly determined by the perioral musculature and the tongue, as stated in the Theory of Tomes (44). Many writers have pointed to the importance of muscular function, duration, speech, and swallow in the development and maintenance of malocclusions. EMG, cineradiography, palatography, sensors, balloon-filled pressure tips, and other methods can all be used to quantify the force exerted by the tongue on the teeth.

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