

# Obstructive Sleep Apnea and Genioglossus

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## **ABSTRACT**

**The human upper airway is important in many voluntary and involuntary tasks such as swallowing, speech and breathing. The nasal, pharyngeal and laryngeal region forms upper airway. It is a complicated structure that plays a key role in breathing, vocalization and swallowing. The upper airway is a highly flexible structure that lack rigid bony support. It is vulnerable by pressures that are generated during inspiration and by the surrounding soft tissues. The focus in this article was on the genioglossus muscle and its role in maintaining upper airway.**

## **1. INTRODUCTION**

The muscles that are responsible for maintaining upper airway patency by opposing collapsing forces are termed as dilator muscles. They either make the upper airway walls rigid or enlarge the lumen. Various dilator muscles encircle the upper airway which is broadly grouped according to their influence on key structures within the upper airway. The muscles that control tongue protrusion, retraction, elevation and depression are genioglossus [GG], geniohyoid, styloglossus and hyoglossus. The muscles that retract elevate and depress the soft palate are levator veli palatini, palatoglossus, palatopharyngeus, tensor veli palatini and musculus uvulae. The mylohyoid, geniohyoid, digastric, stylohyoid, omohyoid, sternohyoid and thyrohyoid are the muscles that connect to the hyoid bone to alter the position of both the tongue and the anterior pharyngeal wall. The superior, middle and inferior pharyngeal constrictors are the muscles that close and stiffen the pharynx. Genioglossus is the largest upper airway dilator.

Genioglossus muscle is a paired fan shaped bulk of the fibers inserting into the body of the tongue. It brings about the forward traction of the tongue to protrude its apex from the mouth. This muscle has a protrusive action that helps the tongue to maintain an open-air passage in the oropharyngeal region. Dysfunctioning of the genioglossus muscle causes repetitive upper airway closure during sleep which is called Obstructive Sleep Apnea. Obstructive sleep apnea is a type of sleep apnea and a common sleep disorder which affects approximately 2-4% of adult

## 2. ANATOMY

The Genioglossus is a flat triangular muscle. It is close to and parallel with the median plane. Its apex is origin from the mandible, its base inserted into the tongue and hyoid bone<sup>1</sup>. It arises by a short tendon from the superior mental spine on the inner surface of the symphysis menti, immediately above the Geniohyoid. The muscle spreads out in a fan-like form.

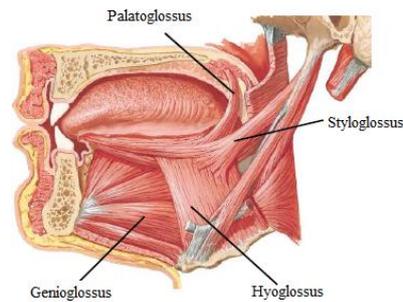


Fig.1 Genioglossus muscle.

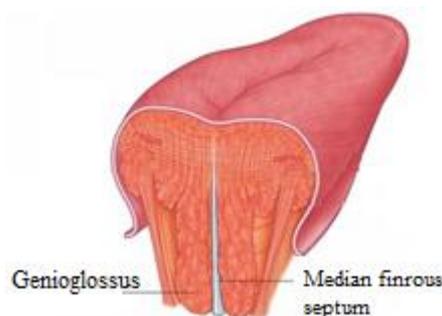


Fig.2 Genioglossus inserted into medium septum

The genioglossus muscle divides into four main parts (fig 1): Anterior, Posterior, Middle, Inferior<sup>2</sup>. The inferior fibers extend downward and attached by a thin aponeurosis to the upper part of the body of the hyoid bone. The middle fibers pass backward, and the superior ones upward and forward, to enter the whole length of the under surface of the tongue, from the root to the apex. The muscles of opposite sides are separated at their insertions by the median fibrous septum of the tongue (fig.2). They are more or less decussate in the median plane. The hypoglossal nerve (Cranial Nerve XII) innervates the muscle and sublingual branch of lingual artery, a branch of the external carotid artery supplies it. Acting bilaterally, the two muscles depress the central part of the tongue, making it concave from side. Acting unilaterally, the tongue diverges to the opposite side.

### CLINICAL IMPORTANCE

The genioglossus is a muscle responsible for airway dilation. The Genioglossus muscle has a protrusive action that helps the tongue to maintain an open-air passage in the oropharyngeal region<sup>2</sup>. The decreased function of the muscle can lead to airway obstruction. Airway collapse during sleep can lead to hypoxemia which further leads to increased risk of strokes and sudden cardiac death<sup>3</sup>.

Genioglossus muscle is used for testing the integrity of the hypoglossal nerve. We can do this by asking the patient to protrude the tongue. If hypoglossal nerve of the right side is paralyzed, the normal left genioglossus will pull the base towards the left side, pushing the apex towards the right side.

### OBSTRUCTIVE SLEEP APNEA

Obstructive sleep apnea is a type of sleep apnea and a common sleep disorder which affects approximately 2-4% of adults<sup>4</sup>. Obstructive sleep apnea is associated with automobile accidents, decreased quality of life and cardiac and cerebrovascular events. The genioglossus muscle is one of the major oropharyngeal dilators. Histological changes in the genioglossus of Obstructive sleep apnea patients causes neuromuscular impairment of this muscle and acts as a possible consequence of OSA<sup>5</sup>(fig.3). Dysfunctioning of the genioglossus muscle causes repetitive upper airway closure during sleep characterized by a number of symptoms in which the most common are loud snoring along with unrefreshing sleep and daytime somnolence<sup>4</sup>

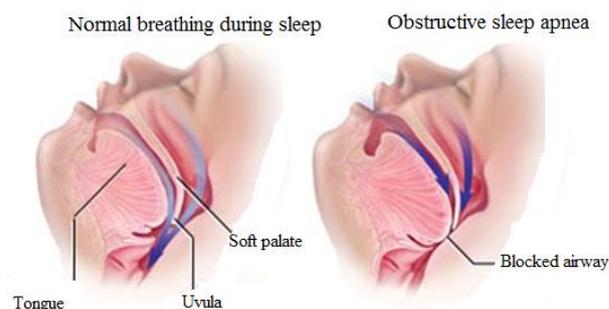


Fig. 3 In normal breathing the airway is opened and air moves through. In obstructive sleep apnea the airway is blocked and air does not move through.

### 3. TREATMENT

**Continuous Positive Airway pressure (CPAP)** - Patients suffering from obstructive sleep apnea can be treated with Continuous Positive Airway pressure (CPAP) via a comfortable mask through the nares which fits over the nose and continues to blow air gently into the airway to help keep it open during sleep<sup>3,6</sup>(fig.4)



Fig.4 Continuous Positive Airway pressure device

**Oral Appliances-** Oral Appliances can also be used for the treatment of Obstructive Sleep Apnea. These appliances fit in the mouth like sports mouth guard (fig.5). These devices, which must be fitted by a dentist or orthodontist, and worn in the mouth at night. It supports the jaw in the forward position to maintain an open upper airway. Oral Appliance therapy is an easy and non-invasive treatment that fits easily into the patient's lifestyle<sup>6</sup>

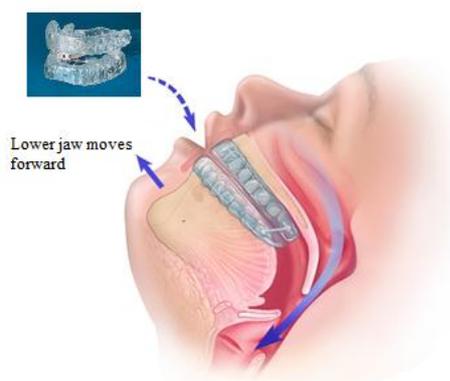
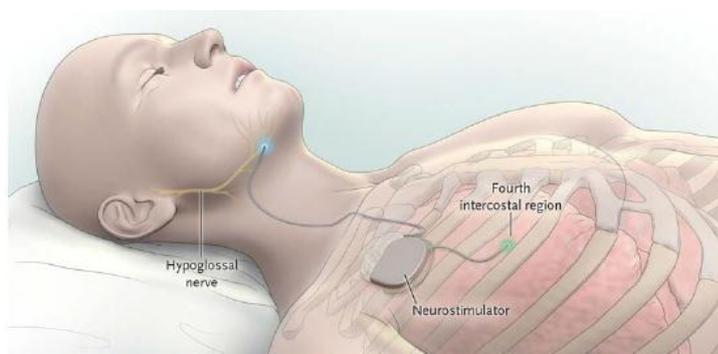


Fig. 5. Oral device is fitted in the mouth to maintain an open upper airway.



**Hypoglossal-nerve stimulation-** Hypoglossal nerve stimulation (HGNS) is a relatively new

treatment. It's also known as upper airway stimulation or a "pace maker for the tongue." The treatment works by stimulating the hypoglossal nerve to restore the tone to (or stiffen) the key tongue muscles that when relaxed, can block the airway causing an obstruction that reduces or stops breathing during the night. The stimulating device, battery and breathing sensor are implanted in the chest and connected to a stimulation lead that touches the hypoglossal nerve. It's turned on when you go to sleep and off when you wake up by a small hand-held remote. The pulse generator is placed over the pectoralis major muscle, and a sensing lead is placed between the internal and external intercostal muscles in a lower intercostal space (fig.6). Hypoglossal-nerve stimulation may be an effective therapy for patients who have obstructive sleep apnea possibly related to ineffectiveness in the Genioglossus muscles<sup>6</sup>.

**Fig.6** The device is placed over the pectoralis major muscle, and a sensing lead is placed between the internal and external intercostal muscles in a lower intercostal space

#### **4. Conclusion**

Obstructive sleep apnea (OSA) is a common disturbance with many effects on sleep and daytime functioning. It is linked to many important adverse daytime consequences such as poor performance, accidents, hypertension, heart disease, stroke, and insulin resistance. The close association with obesity and the current epidemic of obesity mean that in the future, these disorders will become more prevalent, and thus clinicians need to remain alert to them and to be proactive in their evaluation of sleep. OSA is a condition with multifactorial pathophysiology. The disease can be controlled by these therapeutic techniques. Continuous positive airway pressure therapy is a gold standard therapy for OSA treatment. Early diagnosis and treatment of OSA may contribute to improved quality of life for the patient. New management strategies need to be added for a better control of the disease.

## 5. REFERENCE

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