

NAME : IKINI FAVOUR CATHERINE ONYINYE

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ASSIGNMENT:

1. Discuss the anatomy of the tongue and comment on its applied anatomy.
2. Write an essay on the air sinuses.

ANSWERS:

A. Discuss the anatomy of the tongue and comment on its applied anatomy

The tongue is a mobile muscular organ that can assume a variety of shapes and positions. It is partly in the **oral cavity** and partly in the **oropharynx**. The tongue is involved with mastication, taste, deglutition (swallowing), articulation, and oral cleansing; however, its **main functions** are forming words during speaking and squeezing food into the oropharynx when swallowing. Under normal circumstances, the tongue is a pink, muscular organ located within the oral cavity proper. The tongue is covered with moist, pink tissue called mucosa. Tiny bumps called papillae give the tongue its rough texture. Thousands of taste buds cover the surfaces of the papillae. Taste buds are collections of nerve-like cells that connect to nerves running into the brain.

It is kept moist by the products of the major and minor salivary glands, which aids the organ as it facilitates deglutition, speech, and gustatory perception. While there is significant variability in the length of the tongue among individuals, on average, the organ is roughly 10 cm long. It has three main parts:

The tip or apex of the tongue is the most anterior, and most mobile aspect of the organ.

The tip is followed by the body of the tongue. It has a rough dorsal (superior) surface that abuts the palate and is populated with taste buds and lingual papillae, and a smooth ventral (inferior) surface that is attached to the floor of the oral cavity by the lingual frenulum.

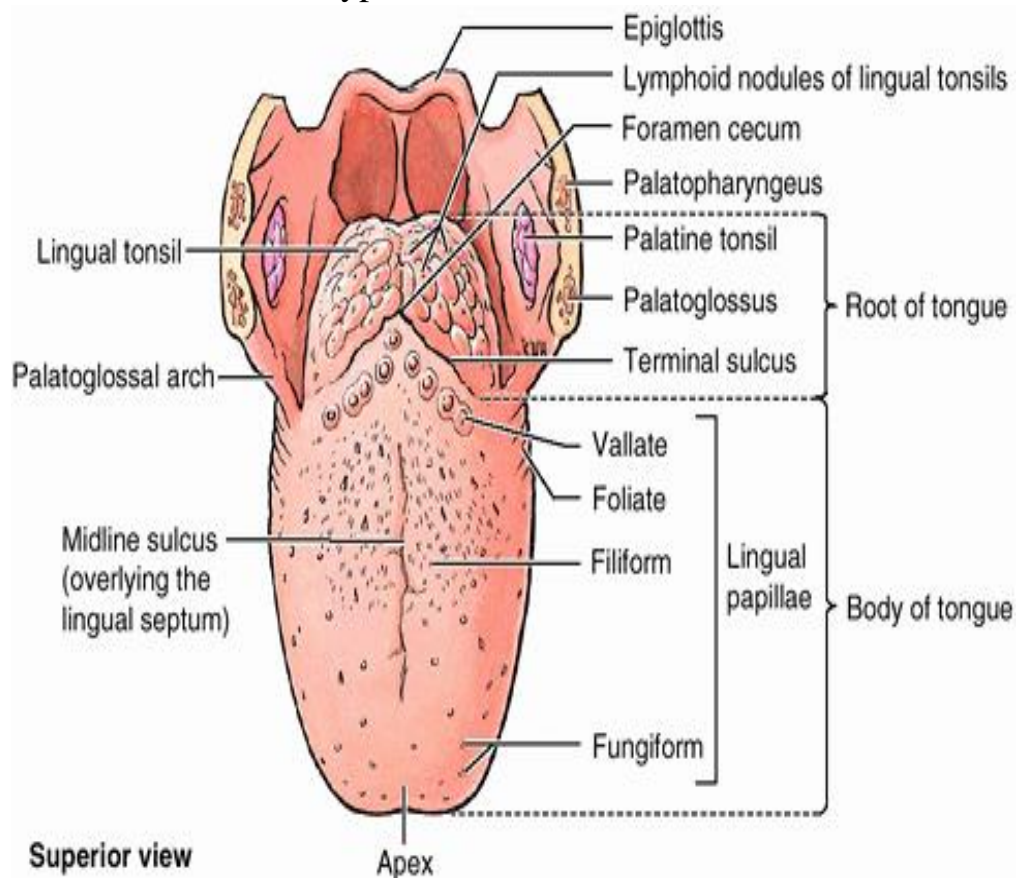
The base of the tongue is the most posterior part of the organ. It is populated by numerous lymphoid aggregates known as the lingual tonsils along with foliate papillae along the posterolateral surface.

There are numerous important structures surrounding the tongue. It is limited anteriorly and laterally by the upper and lower rows of teeth. Superiorly, it is bordered by the hard (anterior part) and soft (posterior part) palates. Inferiorly, the root of the tongue is continuous with the mucosa of the floor of the oral cavity;

with the sublingual salivary glands and vascular bundles being located below the mucosa of the floor of the oral cavity.

The palatoglossal and palatopharyngeal arches (along with the palatine tonsils) have lateral relations to the posterior third of the tongue. Posterior to the base of the tongue is the dorsal surface of the epiglottis and laryngeal inlet, and the posterior wall of the oropharynx.

The tongue has a presulcal and postsulcal part, the presulcal and postsulcal parts of the tongue differ not only by anatomical location, but also based on embryological origin, innervation, and the type of mucosa found on its surface.



Anterior two-thirds:

The presulcal tongue includes the apex and body of the organ. It terminates at the sulcus terminalis; which can be seen extending laterally in an oblique direction from the foramen cecum towards the palatoglossal arch. The mucosa of the dorsal surface of the oral tongue is made up of circumvallate, filiform, and fungiform papillae. There is also a longitudinal midline groove running in an anteroposterior direction from the tip of the tongue to the foramen cecum. This marks the embryological point of fusion of the lateral lingual swellings that formed

the oral tongue. It also represents the location of the median lingual (fibrous) septum of the tongue that inserts in the body of the hyoid bone.

On the lateral surface of the oral tongue are foliate papillae arranged as a series of vertical folds. The ventral mucosa of the oral tongue is comparatively unremarkable. It is smooth and continuous with the mucosa of the floor of the mouth and the inferior gingiva. The lingual veins are relatively superficial and can be appreciated on either side of the lingual frenulum. Lateral to the lingual veins are pleated folds of mucosa known as the plica fimbriata. They are angled anteromedially toward the apex of the tongue.

Posterior third:

The remainder of the tongue that lies posterior to the sulcus terminalis is made up by the base of the organ. It lies behind the palatoglossal folds and functions as the anterior wall of the oropharynx. Unlike the oral tongue, the pharyngeal tongue does not have any lingual papillae. Instead, its mucosa is populated by aggregates of lymphatic tissue known as the lingual tonsils. The mucosa is also continuous with the mucosa of the laterally located palatine tonsils, the lateral oropharyngeal walls, and the posterior epiglottis and glossoepiglottic folds.

- There are four basic taste sensations: sweet, salty, sour, and bitter
 - **Sweetness** is detected at the apex
 - **saltiness** at the anterolateral margins
 - **sourness** at the posterolateral margins
 - **bitterness** at the posterior part of the

tongue



Muscles of the Tongue

The muscles of the tongue are divided into extrinsic and intrinsic muscles. Extrinsic muscles alter the position of the tongue while intrinsic muscles alter its shape. The four intrinsic and four extrinsic muscles in each half of the tongue are separated by a **median fibrous lingual septum**, which merges posteriorly with the lingual aponeurosis

Extrinsic Muscles of the Tongue:

These include:

- genioglossus
- Hyoglossus
- styloglossus
- palatoglossus

They originate outside the tongue and attach to it and mainly move the tongue but they can alter its shape as well

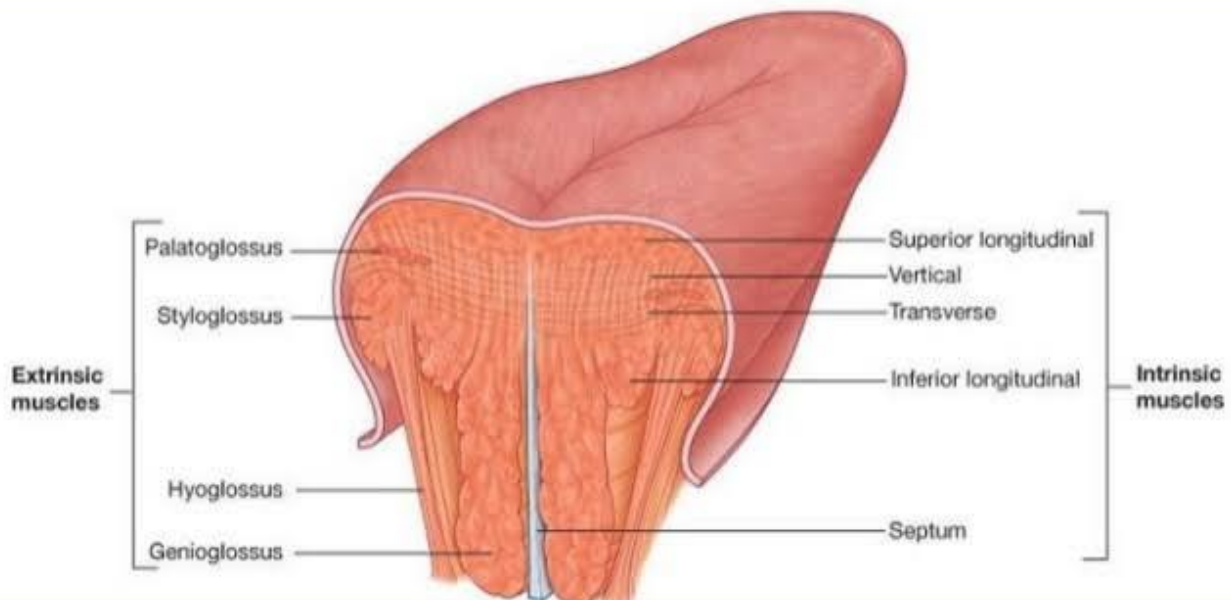
Intrinsic Muscles of the Tongue:

They include:

- superior longitudinal muscle
- inferior longitudinal muscle

- transverse muscle
- vertical muscles
 - They have their attachments entirely within the tongue and are not attached to bone

Muscles of Tongue



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Vasculature of the Tongue

Arterial supply

- The arteries of the tongue are derived from the **lingual artery**, which arises from the **external carotid artery**

On entering the tongue, the lingual artery passes deep to the hyoglossus muscle and give rise to the:

- The dorsal lingual arteries which supply the posterior part (root); are prevented from communicating by the lingual septum
- the deep lingual arteries supply the anterior part which communicate with each other near the apex of the tongue.

Venous drainage

- The veins of the tongue are the **dorsal lingual veins**, which accompany the **lingual artery**;
- the deep lingual veins, which begin at the apex of the tongue, run posteriorly beside the **lingual frenulum** to join the **sublingual vein**
- The sublingual veins in elderly people are often varicose (enlarged and tortuous)
- All these lingual veins terminate, directly or indirectly, in the IJV

Innervation of the Tongue

Motor innervation

- All muscles of the tongue, except the palatoglossus (actually a palatine muscle supplied by the **vagus nerve(X)** of the pharyngeal plexus), receive **motor innervation from the hypoglossal nerve (CN XII)**

Sensory innervation

The anterior two thirds of the tongue are supplied by:

- the lingual nerve (CN V₃) for general sensation
- the chorda tympani, a branch of the facial nerve (CN VII) transferring nerve fibers to the lingual nerve, for taste

The posterior third of the tongue and the vallate papillae are supplied by:

- the lingual branch of the glossopharyngeal nerve (CN IX) for both general sensation and taste

Another contribution is made by the internal laryngeal branch of the vagus (CN X) for general sensation and taste

- Hence CN VII, CN IX, and CN X provide nerve fibers for taste; those from CN VII are ultimately conveyed by CN V₃

Clinical Anatomy

- I. Thrush (candidiasis): *Candida albicans* (a yeast) grows over the surface of the mouth and tongue. Thrush can occur in almost anyone, but it occurs more often in people taking steroids or with suppressed immune systems, the very young, and the elderly.
- II. Oral cancer: A growth or ulcer appears on the tongue and grows steadily. Oral cancer is more common in people who smoke and/or drink alcohol heavily.
- III. Macroglossia (big tongue): This can be broken down into various categories based on the cause. These include congenital, inflammatory, traumatic, cancerous, and metabolic causes. Thyroid disease, lymphangiomas, and

congenital abnormalities are among some of the causes of an enlarged tongue.

- IV. Canker sores (aphthous ulcers): Small, painful ulcers appear periodically on the tongue or mouth. A relatively common condition, the cause of canker sores is unknown; they are unrelated to the cold sores caused by herpes viruses. Canker sores are not contagious.
- V. Oral leukoplakia: White patches appear on the tongue that can't be scraped off. Leukoplakia may be benign, or it can progress to oral cancer. Biopsy: A small sample of tissue is taken from a suspicious-looking area on the tongue. This is most often done to check for oral cancer.
- Tongue surgery: Surgery may be required to remove oral cancer or leukoplakia.

VI. Lingual Carcinoma

A lingual carcinoma in the posterior part of the tongue metastasizes to the superior deep cervical lymph nodes on both sides, whereas a tumor in the anterior part usually does not metastasize to the inferior deep cervical lymph nodes until late in the disease.

Because these nodes are closely related to the IJV, metastases from the tongue may be widely distributed through the submental and submandibular regions and along the IJVs in the neck.

VII. Frenectomy

An overly large lingual frenulum (tongue-tie) interferes with tongue movements and may affect speech. In unusual cases, a frenectomy (cutting the frenulum) in infants may be necessary to free the tongue for normal movement and speech

VIII. Thyroglossal Duct Cyst

A cystic remnant of the thyroglossal duct, associated with development of the thyroid gland, may be found in the root of the tongue and be connected to a sinus that opens at the foramen cecum

- Surgical excision of the cyst may be necessary
- Most thyroglossal duct cysts are in the neck, close or just inferior to the body of the hyoid bone

B. Write on air sinuses

The air sinuses are also referred to as **paranasal sinuses**; which are air-filled extensions of the respiratory part of the nasal cavity. There are four paired sinuses

named according to the bone in which they are located; maxillary, frontal, sphenoid and ethmoid.

FUNCTION

The function of the sinuses is not clear. It is thought that they may contribute to the **humidifying** of the inspired air. They also reduce the weight of the skull.

Four sets of paired sinuses are recognized: maxillary, frontal, sphenoid, and ethmoid sinuses.

Maxillary sinuses:

The maxillary sinuses are the largest of all the paranasal sinuses. They have thin walls which are often penetrated by the long roots of the posterior maxillary teeth. The superior border of this sinus is the bony orbit, the inferior is the maxillary alveolar bone and corresponding tooth roots, the medial border is made up of the nasal cavity and the lateral and anterior border are limited by the cheekbones.

Posteriorly, two anatomical spaces known as the pterygopalatine fossa and the infratemporal fossa exist.

The submandibular lymph nodes are the main destination during lymphatic drainage. The blood supply includes a contribution from the:
anterior superior alveolar artery, middle superior artery, posterior superior alveolar artery

Innervation occurs through nerves of the same names as the arteries.

Frontal Sinuses:

Anteriorly, the frontal sinuses are contained by the forehead and the superciliary arches, superiorly and posteriorly by the anterior cranial fossa and inferiorly by the bony orbit, the anterior ethmoidal sinuses and the nasal cavity. Medially the sinuses face one another, separated by the midline.

This pair of sinuses are irregular in shape when compared to one another and is underdeveloped at birth. They reach their full size and shape around seven to eight years of age. They drain primarily into the ethmoidal infundibulum and the corresponding lymph drainage occurs via the submandibular lymph nodes. It is innervated by the ophthalmic nerve, including the supraorbital and supratrochlear branches.

The frontal sinuses are supplied by the:
anterior ethmoidal artery, supraorbital artery, supratrochlear artery

Sphenoidal sinuses:

The most posterior of all the sinuses in the head, the sphenoidal sinuses are large and irregular, just like their septum, which is made by the sphenoid bone. Laterally, a cavernous sinus exists which is part of the middle cranial fossa and also the carotid artery and cranial nerves III, IV, V/I, V/II and VI can be found. The anterior wall separates this pair of sinuses from the nasal cavity, as does the hypophyseal fossa, the pituitary gland and the optic chiasm superiorly and the nasopharynx and pterygoid canal inferiorly.

The lymphatic drainage occurs in the same way as the posterior ethmoid sinus. The posterior ethmoidal artery and the posterior lateral nasal branches supply the sphenoidal sinuses.

The posterior ethmoidal nerve and the orbital branch of the pterygopalatine ganglion innervate them.

Ethmoidal sinuses:

Superior to the ethmoidal sinus is the anterior cranial fossa and the frontal bone, laterally the orbit can be found, while the nasal cavity is situated medially. The ethmoid sinuses are unique because they are the only paranasal sinuses that are more complex than just a single cavity.

On each side of the midline, anywhere from three to eighteen ethmoidal air cells may be grouped together. These air cells are smaller individual sinuses grouped together to form one large one which encompass the anterior, middle and posterior nasal meatuses.

The anterior and middle ethmoid sinuses send their lymphatic drainage to the submandibular lymph nodes while the posterior ethmoid sinus sends its own to the retropharyngeal lymph nodes.

The anterior and posterior ethmoidal arteries, as well as the posterior lateral nasal branches provide an ample blood supply to this region. Meanwhile the anterior and posterior ethmoidal nerves and the posterior lateral superior and inferior nasal nerves help innervate it.

CLINICAL RELEVANCE

1. **SINUSITIS:** As the paranasal sinuses are continuous with the nasal cavity, an upper respiratory tract infection can spread to the sinuses. And infection of the sinuses causes inflammation of the mucosa causing SINUSITIS.

NOTE: CN V₂ supplies both the maxillary sinus and maxillary teeth, and so inflammation of the sinus can cause **toothache**.