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**ANATOMY OF THE TONGUE**

**General description**: The tongue is a mobile muscular organ covered with a mucous membrane, it can assume a variety of shapes as positions, it is partly in the oral cavity and also in the oropharynx, the tongue is involved in various activities such as:

1. Articulation
2. Swallowing
3. Mastication
4. Taste
5. Oral cleansing

**PARTS AND SURFACES OF THE TONGUE**

The tongue is divided into three parts;

1. The root, which is the attached posterior portion extending between the mandible, hyoid and the posterior surface of the tongue
2. The body of the tongue is the anterior, approximately two thirds of the tongue between the root and the apex.
3. The apex is the anterior end of the body, resting against the incisor teeth, the body and the apex are both very mobile.

**SURFACES OF THE TONGUE**

1. **DORSUM**: this is the more extensive superior and posterior surface it is convex in all directions. It has two parts distinct from a division by the terminal sulcus;

* The oral part (anterior 2/3rd)
* The pharyngeal part (posterior 1/3rd)

A midline groove separates the anterior part of the tongue into left and right parts.

**ANTERIOR/ORAL PART**

The anterior part of the dorsal mucosa is covered by circumvallate papillae, foliate, filiform and fungiform.

* **Circumvallate papilla:** they are large and flat topped. They are large in size 1-2mm in diameter 8-12mm. They lie anterior to the terminal sulcus and the walls are studded with **taste buds**. Each papilla is a cylindrical projection surrounded by a circular sulcus; the ducts of serous glands drain into this pit.
* **Foliate papillae:** they are bilaterally at the sides of the tongue near the sulcus terminalis. They are bounded by narrow fold of mucous membrane. They have numerous **taste buds.**
* **Filiform papilla:** it is the most numerous and it covers most of the presulcal area of the dorsum tongue. The pinpoint cone-shaped projections of the mucosa ends in one or more points. It gives a velvety appearance of the tongue. They are the smallest papillae and are covered in keratin. It increases friction between the tongue and food. It contains afferent nerve endings that are sensitive to touch
* **Fungiform papilla:** these are mushroom shaped and are more numerous near the tip and margins of the tongue but some of them are scattered over the dorsum tongue.

The vallate, foliate, and most of the fungiform papillae contain taste receptors in the taste buds.

**POSTERIOR/PHARYNGEAL PART**

The mucosa of the posterior part of the tongue is thick and freely movable, it has no lingual papillae, but the underlying lymphoid nodules gives it an irregular cobblestone appearance, collectively the lymphoid nodules are called **lingual tonsil**. The pharyngeal part of the tongue constitutes the anterior wall of the oropharynx

1. **VENTRAL SURFACE**: the inferior surface of the tongue or its underside rests against the floor of the mouth, the margin of the tongue separating the two surfaces is related on each side to the lingual gingiva and the lateral teeth. It is covered with a thin transparent mucous membrane; this surface is connected to the floor of the mouth by a midline fold called the **frenulum.** The frenulum allows the anterior part of the tongue to move freely, a deep lingual vein is visible on each side of the frenulum through the thin mucous membrane. A lingual caruncle is present on each side of the base of the frenulum that includes the opening of the submandibular duct from the submandibular salivary gland.

**MUSCLES OF THE TONGUE**

The tongue is essentially a mass of muscles that is mostly covered by mucosa. The muscles of the tongue do not act in isolation, and some muscles perform multiple actions Parts of a single muscle are capable of acting independently, producing different, even antagonistic actions. In general, extrinsic muscles alter the position of the tongue, and 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 MSUCLES OF TONGUE**

1. Genioglossus
2. Hyoglossus
3. Styloglossus
4. Palatoglossus

These muscles originate outside the tongue and attach to it, they move the tongue but can also alter its shape

1. **Genioglossus muscle:** the thick fan-shaped genioglossus muscle makes a contribution to the structure of the tongue. It originates from the superior genial tubercle and inserts in the tip of the tongue (upper fibers), the dorsum (middle fibers), and the hyoid bone (lower fibers).

**Action:** the upper fibre retracts the tip, the middle fibres depress the tongue, the lower fibres pull the posterior part forward.

1. **Hyoglossus muscle:** These are thin Quadrangular muscles lateral to the genioglossus muscles. It originates from the greater cornu and the adjacent part of the body of the hyoid bone. It inserts into the side of the tongue.

**Action:** depresses the tongue.

1. **Styloglossus muscle:** this muscle originates from the styloid process near its apex. It inserts into the lateral surface of the tongue.

**Action:** it draws retrudes the tongue, elevates and curls the sides of the tongue

1. **Palatoglossus muscle:** originates from the palatine aponeurosis of soft palate and inside into the side of the tongue.

**Action:** elevates the posterior part of the tongue and depresses the soft palate.

**INTRINSIC MUSCLES OF TONGUE**

1. Superior longitudinal muscle
2. Inferior longitudinal muscle
3. Transverse muscle
4. Vertical muscle

They have their attachments entirely confined in the tongue. The s**uperior and inferior longitudinal muscles** act together to make the tongue thick and short, also to retract the protruded tongue. The transverse and vertical muscles act simultaneously to make the tongue long and narrow.

1. **Superior longitudinal muscle:** this muscle lies beneath the mucosa of the dorsum of the tongue. Some fibers are inserted into the mucous membrane.

**Action:** it shortens the tongue, makes dorsum concave.

1. **Inferior longitudinal muscle:** lies close to the inferior lingual surface between genioglossus and hyoglossus. It extends from the root of the tongue to the apex. Some of its posterior fibers are connected to the body of the hyoid bone. Anteriorly, it bends with styloglossus.

**Action:** it shortens the tongue and makes dorsum concave

1. **Transverse muscle:**

The transverse muscles pass laterally from the median fibrous septum to the submucous fibrous tissue at the lingual margin

**Action:** makes the tongue narrow and elongated.

1. **Vertical muscle:**

The vertical muscles extend from the dorsal to the ventral aspects of the tongue in the anterior borders.

**Action:** makes the tongue broad and flattened.

**ARTERIAL SUPPLY**

**Lingual artery:** arterial supply is mainly by lingual artery which is a branch of external carotid artery. It is divided into:

1. Dorsal lingual arteries: supply posterior part
2. Deep lingual artery: supply anterior part

The root of the tongue is supplied by the **tonsillar and ascending pharyngeal arteries.**

**Venous Drainage**

1. Dorsal lingual veins: drains the dorsum sides of the tongue
2. Deep lingual veins: drains the tip of the tongue

All these veins terminate directly or indirectly into the **internal jugular veins.**

**Innervation**

**Sensory**

1. Anterior 2/3rd(oral): lingual nerve (general sensation), chorda tympani (special sensation, taste)
2. Posterior 1/3rd(pharyngeal): glossopharyngeal nerve (general and special sensation)

**Motor**

1. All intrinsic muscle except palatoglossus muscles are supplied by the hypoglossal nerve.
2. The palatoglossus muscle is supplied by the pharyngeal plexus via the vagus nerve.

**Lymphatic Drainage**

1. Tip drains bilaterally to submental nodes.
2. Right and left anterior 2/3rd of the tongue drains unilaterally to submandibular nodes.
3. Posterior most part and posterior 1/3rd of the tongue drains bilaterally into jugulodiagastric nodes.
4. The Whole lymph finally drains into the jugulo-omohyoid nodes.

**APPLIED ANATOMY:**

1. Lingual Frenectomy: This is the surgical removal of the frenulum especially in cases where the frenulum extends farther anteriorly towards the apex thus causing speech impediments
2. Median rhomboid glossitis: this is the central papillary atrophy of the tongue anterior to circumvallate.
3. Hairy tongue: this is the hypertrophy of filiform papillae due to lack of mechanical debridement

**ESSAY ON AIR SINUSES**

The paranasal sinuses 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.**

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.

Sinuses are formed in childhood by the nasal cavity **eroding** into surrounding bone. As they are outgrowths of the nasal cavity, they all drain back into it. **Openings** to the paranasal sinuses are found on the **roof** and **lateral** walls of the nasal cavity. The inner surface is lined by a respiratory mucosa.

**Maxillary Sinus**

It is also known as Antrum of Highmore.

It is the largest of all Paranasal sinuses.

It rests just under the cheek area.

It is shaped like a pyramid.

Its capacity is roughly one fluid once(30ml).

**Boundaries**

1. Medial wall: this is the base of the pyramidal shaped maxillary sinus. This corresponds to the lateral wall of the nasal cavity. This wall has its convexity towards the maxillary sinus. The central portion of this wall is very thin and could even be membranous in places. The natural ostium is present in this wall, closer to the roof of the sinus.
2. Anterior wall: the anterior wall corresponds to the cheek area of the face. This portion also constitutes the lateral wall of the maxilla. Hence it would be appropriate to call it an antero-lateral wall. The most important feature of this wall is the **canine fossa.**
3. Roof: this forms the floor of the orbit. This wall is thin and it’s though this wall that the infraorbital vessels and nerves traverses.
4. Floor: the floor is formed by the alveolar process of the maxilla and the hard palate. The roots of the firsts and second molars may reach up to the floor of the sinus.

**Canine fossa**

This is the thinnest portion of the anterior wall of the maxillary sinus.

It is bounded;

Inferiorly: by alveolar ridge

Laterally: by canine eminence

Superiorly: infraorbital foramen

Medially: pyriform aperture

The caldwell luc surgery (removal of irreversible damaged mucosa of the maxillary sinus) is performed through this area.

**Applied Anatomy**

1. Canine fossa is about 2mm thick and it is the entry point for the caldwell luc surgery.
2. The roof of the maxillary sinus is weakened by the presence of infraorbital canal and infraorbital foramen.
3. In children, the floor of the maxillary sinus lies at the same level as that of the nasal cavity while in adults, it lies about 5-10mm below the level of the nasal cavity.

Dental infections involving the first and second molars may involve the maxillary sinus because the bone is thin in this area.

**Frontal Sinuses**: These are the most superior in location, found under the forehead. The frontal sinuses are variable in size, but always triangular-shaped. They drain into the nasal cavity via the **frontonasal duct**, which opens out at the hiatus semilunaris on the lateral wall

**Ethmoidal Sinus**

It is situated close to the anterior skull base.

It is composed of complex bony labyrinth with thin walls.

There may be 6-10 ethmoid cells present in adults.

Common sinus infection in children involves ethmoidal sinuses.

It is anatomically divided into anterior, middle and posterior groups according to their drainage pattern. Anterior and middle group drains into the middle meatus while posterior group drain into the superior meatus.

**Boundaries**

1. Lateral wall: it is formed by the orbital plate of ethmoid. It is paper thin and is also known as lamina papyracea. It separates the ethmoid air cells from the orbit. Infections involving the ethmoidal air cells may spread to the orbit via this thin plate bone.
2. Roof: it is formed by the frontal bone anteriorly, by the face of the sphenoid and orbital process of palatine bone posteriorly.

**Applied Anatomy**

1. Anterior most ethmoidal air cell is known as agger nasi. Larger agger nasi air cell can impede frontal sinus drainage due to its close proximity to the frontal sinus drainage pathway.
2. Holler cells belong to the anterior ethmoidal group of air cells. These cells are also known as infraorbital cells. Enlargement of these cells may block the drainage of the maxillary sinus.
3. Pneumatized middle turbinate is known as concha bullosa. Inflamed concha bullosa of middle turbinate may block middle meatus drainage channels.

**Sphenoid Sinus**

This sinus is located in the skull base at the junction of anterior and middle cranial fossa.

Pneumatization of this sinus begins during the fourth year of childhood and gets completed by the seventeenth year of life.

It varies in size and maybe asymmetric.

It drains into the superior meatus.

**Relations**

Superiorly- pituitary gland

Lateral wall- optic nerve and internal carotid artery

Floor- nerve of pterygoid canal

Infections of sphenoid sinus may involve optic never if the never is dehiscent.