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 **DISCUSS THE ANATOMY OF THE TONGUE AND COMMENT ON ITS APPLIED ANATOMY.**

The tongue is a muscular structure that forms part of the floor of the oral cavity and part of the anterior wall of the oropharynx. It is the primary organ of taste (gustation). It has an **oral part** that lies in the mouth and a **pharyngeal part** that lies in the oropharynx.

The oral and pharyngeal parts are separated by a **V-shaped** sulcus called the sulcus terminalis.

**FUNCTIONS**

1. Speech
2. Taste
3. Mastication
4. Deglutition (swallowing)

**PARTS AND FUNCTIONS OF THE TONGUE:**

The tongue has a fixed root and a mobile body and tip that can take on a variety of shapes and positions.

1. **The Tip:** The tip is the anterior end of the body and it rests on the upper incisors
2. **The Body:** The body is the anterior 2/3rd of the tongue and it has an upper and lower surface.
3. **The Root:** The root is attached to the styloid process, soft palate above and to the mandible and hyoid bone below.

**EXTERNAL SURFACE OF THE TONGUE:**

The tongue has a dorsal surface and a ventral surface.

1. **Ventral:** the sublingual surface of the tongue is covered with thin, transparent mucosa which shows a median fold called the frenulum linguae. On either side of the frenulum there is a prominence produced by deep lingual veins. More laterally, there is a fold called the plica fimbricata.
2. **Dorsal surface:** it is convex in all directions. It has two parts;
* The oral part(anterior 2/3rd)
* The pharyngeal part(posterior 1/3rd)

**Dorsal surface anterior 2/3rd**

The dorsal mucosa is covered by filiform, fungiform, foliate and circumvallate papillae.

1. **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.
2. **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.
3. **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.
4. **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.**

**Taste Buds**

Taste buds are cluster of bulbous nerve endings on the tongue and in the lining of the mouth which provides the sense of taste.

Taste buds are present in relation to circumvallate, fungiform and foliate papilla. They are located in the walls and grooves of papillae. It opens on the surface as taste pores.

The taste buds contains the taste receptors cells which are known as gustatory cells. On average, the human tongue has 2,000-8,000 taste buds.

**Taste sensation**

Gustatory receptors detect the following types of taste sensation:

1. Sweet: tip
2. Umami: middle
3. Bitter: base
4. Sour: lateral margin
5. Salty: anterolateral

**Dorsal surface posterior 1/3rd**

The mucosa of the posterior third of the tongue is devoid of small papillae. It’s surface is irregular and has many large nodules composed of lymphoid tissue. Collectively, the lymphoid nodules are called **the lingual tonsil** which gives it the cobblestone appearance. The anterior walk of the oropharynx is formed by the upper part of the posterior one-third or pharyngeal part of the tongue.

**MUSCLES OF THE TONGUE**

There are 4 intrinsic and 4 extrinsic muscles.

**Intrinsic muscles**

The intrinsic muscles of the tongue originate and insert within the substance of the tongue. They alter the shape of the tongue by lengthening and shortening it, curling and uncurling its apex and edges, and flattening band rounding its surface.

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 hypoglossus. 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 and vertical 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.

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.

**Extrinsic muscles**

These muscles attach to the soft palate and styloid process above and to the mandible and hyoid bone below.

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 fiber retracts the tip, the middle fibers depress the tongue, the lower fibers pull the posterior part forward.

1. **Hypoglossus muscle:** These are thin Quadrangular muscles lateral to the genioglossus muscles. It originates from the grater 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 the tongue and elevates and retracts 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.

**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 juguloomohyoid nodes.

**Applied Anatomy**

1. Geographic tongue: this is the appearance of serpiginous white lines surrounding areas of smooth depapillated mucosa.
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

**WRITE AN ESSAY ON AIR SINUSES**

The para nasal sinuses are air filled sacs found in the skull bone. These sacs surround the nasal cavity. They are also paired and are four in number. They include:

1. Frontal sinuses
2. Maxillary sinuses
3. Ethmoidal sinuses
4. Sphenoidal sinuses

Ethmoidal sinuses can be divided into anterior, middle and posterior groups.

**Functions**

1. The presence of these sinuses lightens the skull.
2. They add resonance to speech.
3. They play a vital role in conditioning the inspired air.

**MAXILLARY SINUS**

It is also known as Antrum of Highmore.

It is the largest of all Paranasal sinuses.

It lies just under the cheek area.

It is shaped like a pyramid.

It’s 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 caldwelllucsurgery(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 caldwellluc 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 lie 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 SINUS**

This sinus shows the maximum variation, it is shaped more or less like L.

Its posterior wall is related to the anterior cranial fossa.

Its floor is formed by the upper part of the orbit.

It drains into the anterior part of the middle meatus via the frontonasal duct.

It develops very late in life as It is only fully developed at age 9

**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 aggernasi. Larger aggernasi 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.