**NAME: TOLUSE JOYCE AYOMIDE**

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**COURSE: GROSS ANATOMY OF HEAD AND NECK**

**ASSIGNMENT: ANATOMY OF THE TONGUE AND AIR SINUSES**

**ANATOMY OF THE TONGUE**

  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.  Parts and Surfaces of the Tongue The tongue have a root, a body, an apex, a curved dorsum, and an inferior surface. The root of the tongue is the part of the tongue that rests on the floor of the mouth.  It is usually defined as the posterior third of the tongue.  The body of the tongue is the anterior two thirds of the tongue. The apex (tip) of the tongue is theanterior end of the body, which rests against the incisor teeth. The body and apex of the tongue are extremely mobile.  The dorsum (dorsal surface) of the tongue is the posterosuperior surface, which is located partly in the oral cavity and partly in the oropharynx. It is characterized by a V-shaped groove, the terminal sulcus or groove, the angle of which points posteriorly to the foramen cecum. This small pit, frequently absent, is the non-functional remnant of the proximal part of the embryonic thyroglossal duct from which the thyroid gland developed. The  terminal  sulcus divides the dorsum of the tongue into the anterior (oral) part in the oral cavity  proper  and  the  posterior  (pharyngeal)  part  in  the  oropharynx.  The margin of the tongue is related on each side to the lingual gingivae and lateral teeth. The mucous membrane on the anterior part of the tongue is rough because of the presence of numerous small lingual papillae:

* **Vallate  papillae:** Large  and  flat  topped,  they  lie  directly  anterior  to  the  terminal sulcus and are arranged in a V‐shaped row. They are surrounded by deep moat‐like trenches, the walls of which are studded with taste buds. The ducts of the serous glands of the tongue open into the trenches. Innervation is by the glossopharyngeal nerve (CN IX).
* **Foliate papillae**:  Small lateral folds of the lingual mucosa.  They are poorly developed in humans.
* **Filiform papillae:** Long and numerous, they contain afferent nerve endings that are sensitive to touch. These scaly, conical projections are pinkish gray and are arranged in V‐shaped rows that are parallel to the terminal sulcus, except at the apex, where they tend to be arranged transversely.
* **Fungiform  papillae**:  Mushroom  shaped  pink  or  red  spots,  they  are  scattered  among the filiform papillae but are most numerous at the apex and margins of  the tongue.

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

**Taste Functions**

 Chemicals that interact with the taste buds in the tongue are referred to as "tastants." Taste buds themselves are found within the various papillae of the tongue. Tastants interact with gustatory cell receptors in the taste buds, resulting in transduction of a taste sensation. The five broad categories of taste receptors are (1) sweet, (2) salty, (3) sour, (4) bitter, and (5) umami. The lingual papillae are divided into the Vallate (or circumvallate), fungiform, filiform, and foliate papillae. More than half of the taste buds are located on the Vallate papillae at the junction of the oral and oropharyngeal tongue or tongue base.

**Speech Functions**

Speech is produced in part by manipulation of the tongue in the mouth against the teeth and palate within the oral cavity. The intrinsic muscles of the tongue are involved primarily in shaping the tongue for speech.

**Food Manipulation Functions**

The tongue moves food around the mouth within the oral cavity by pressing it against the hard palate and out to the sides to enable mastication. It enables the formation of the food bolus in the oral preparatory phase of swallowing. It also takes part in the oral phase of swallowing by elevating and sweeping posteriorly to propel the food bolus past the anterior tonsillar pillar, triggering the swallowing reflex.

 **Muscles of the Tongue**

The  tongue  is  essentially  a  mass  of  muscles  that  is  mostly  covered  by  mucous  membrane.  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, however, 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**

 The extrinsic muscles (genioglossus, hyoglossus, styloglossus, and palatoglossus) originate outside the tongue and attach to it. They mainly move the tongue but they can alter its shape as well.

* **Intrinsic Muscles of the Tongue**

The superior and inferior longitudinal, transverse, and vertical muscles are confined to the tongue. They have their attachments entirely within the tongue and are not attached to bone. The superior and inferior longitudinal muscles act together to make the tongue short and thick and to retract the protruded tongue. The transverse and vertical muscles act simultaneously to make the tongue  long and narrow, which may push the tongue against the incisor teeth or protrude  the tongue from the open mouth (especially when acting with the posterior inferior  part of the genioglossus).

**Blood Supply and Lymphatics**

Blood supply to the tongue is predominantly from the lingual artery, a branch of the external carotid artery between the superior thyroid artery and the facial artery, which departs at the level of the greater horn of the hyoid bone within the carotid triangle. After branching from the external carotid artery, the lingual artery passes deep to the hyoglossus muscle and superficial to the middle pharyngeal constrictor muscle. It then gives rise to the following four arteries:

* The suprahyoid artery supplies the omohyoid, sternothyroid, and thyrohyoid muscles. They anastomose with the corresponding vessels from the opposite side.
* The dorsal lingual arteries arise beneath the hyoglossus muscle and pass to the posterior part of the dorsum of the tongue. They supply the mucous membrane of this region as well as the glossopalatine arch, lingual tonsils, soft palate, and epiglottis. They anastomose with their corresponding vessels on the opposite side.
* The sublingual artery branches at the anterior border of the hyoglossus muscle before passing between the genioglossus muscle and mylohyoid muscle to the sublingual gland. It supplies the sublingual gland before giving branches to the mylohyoid muscle. One branch from the sublingual artery passes posterior to the alveolar process of the mandible and anastomoses with the corresponding artery from the other side. A second branch of the sublingual artery pierces the mylohyoid muscle and anastomoses with the submental branch of the facial artery.
* The deep lingual artery, which is the termination of the lingual artery, passes between the genioglossus muscle and inferior longitudinal muscle.

**Nerves**

The hypoglossal nerve (CN XII) provides motor innervation to all of the intrinsic and extrinsic muscles of the tongue except for the palatoglossus muscle, which is innervated by the vagus nerve (CN X). It runs superficial to the hyoglossus muscle. Lesions of the hypoglossal nerve cause deviation of the tongue to the ipsilateral (i.e., damaged) side.

Taste to the anterior two-thirds of the tongue is achieved through innervation from the chorda tympani nerve, a branch of the facial nerve (CN VII). General sensation to the anterior two-thirds of the tongue is by innervation from the lingual nerve, a branch of the mandibular branch of the trigeminal nerve (CN V3). The lingual nerve is located deep and medial to the hyoglossus muscle and is associated with the submandibular ganglion.

 On the other hand, taste to the posterior one-third of the tongue is accomplished through innervation from the glossopharyngeal nerve (CN IX), which also provides general sensation to the posterior one-third of the tongue. Taste perception also is performed by both the epiglottis and the epiglottic region of the tongue, which receives taste and general sensation from innervation by the internal laryngeal branch of the vagus nerve (CN X). Damage to the vagus nerve (CN X) causes contralateral deviation (i.e., away from the injured side) of the uvula.

 **CLINICAL CORRELATE**

1. Ankyloglossia ("tongue-tie") occurs due to an abnormal length of the frenulum linguae which causes limited manipulation of the tongue during speech and results in a speech impediment. In the most common form of ankyloglossia, the frenulum extends to the tip of the tongue. Ankyloglossia can be corrected by surgically severing the lingual frenulum.
2. Fissured tongue ("scrotal tongue," "plicated tongue") occurs when several small furrows present on the dorsal surface of the tongue. It can be an oral manifestation of psoriasis. It is generally painless and benign, and is often associated with other syndromes (e.g., Down syndrome).
3. The tongue tends to fall posteriorly, thus obstructing the airway. Paralysis or total relaxation of the genioglossus muscle presents a risk of suffocation, which can occur during general anaesthesia. An artificial airway is made using intubation, which prevents the tongue from falling backward and blocking the airway.
4. Dysgeusia, or a pure taste disorder, is rare and is usually associated with olfactory disorders.

**AIR SINUSES**

 The paranasal sinuses are air‐filled extensions of the respiratory part of the nasal  cavity into the following cranial bones: frontal, ethmoid, sphenoid, and maxilla. They  are named according to the bones in which they are located. The sinuses continue to  invade the surrounding bone, and marked extensions are common in the crania of  older individuals. 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. The paranasal air sinuses are lined with respiratory epithelium (ciliated pseudostratified columnar epithelium).

**Frontal Sinuses**  The frontal sinuses are between the outer and the inner tables of the frontal bone,  posterior to the superciliary arches and the root of the nose.  Frontal  sinuses  are  usually  detectable  in  children  by  7  years  of  age.  Each  sinus  drains  through  a  frontonasal  duct  into  the  ethmoidal  infundibulum,  which  opens into the semilunar hiatus of the middle nasal meatus. The frontal sinuses are  innervated by branches of the supraorbital nerves (CN V1).

**Sphenoidal Sinuses**  The sphenoidal sinuses are located in the body of the sphenoid and may extend into  the  wings  of  this  bone.  They  are  unevenly  divided  and  separated by a bony septum. Because of this extensive pneumatization (formation of  air cells  or  sinuses),  the  body  of  the  sphenoid  is  fragile. Only  thin plates  of  bone  separate the sinuses from several important structures: the optic nerves and optic  chiasm, the pituitary gland, the internal carotid arteries, and the cavernous sinuses.  The  sphenoidal  sinuses  are  derived  from  a  posterior  ethmoidal  cell  that  begins  to  invade  the  sphenoid  at  approximately  2  years  of  age.  In  some  people,  several  posterior  ethmoidal  cells  invade  the  sphenoid,  giving  rise  to  multiple  sphenoidal  sinuses  that  open  separately  into  the  sphenoethmoidal  recess.  The  posterior  ethmoidal arteries and posterior ethmoidal nerve supply the sphenoidal sinuses.

**Maxillary Sinuses**  The  maxillary  sinuses  are  the  largest  of  the  paranasal  sinuses.  They  occupy  the  bodies of the maxillae and communicate with the middle nasal meatus.

* The apex of the maxillary sinus extends toward and often into the zygomatic  bone.
* The base of the maxillary sinus forms the inferior part of the lateral wall of the  nasal cavity.
* The roof of the maxillary sinus is formed by the floor of the orbit.
* The floor of the maxillary sinus is formed by the alveolar part of the maxilla. The  roots  of  the  maxillary  teeth,  particularly  the  first  two  molars,  often  produce conical elevations in the floor of the sinus.

Each maxillary sinus drains by one or more openings, the maxillary ostium (ostia),  into the middle nasal meatus of the nasal cavity by way of the semilunar hiatus.  The arterial supply of the maxillary sinus is mainly from superior alveolar branches  of  the  maxillary  artery ;  however,  branches  of  the  descending  and  greater  palatine  arteries  supply  the  floor  of  the  sinus.  Innervation  of  the  maxillary  sinus  is  from  the  anterior,  middle,  and  posterior  superior alveolar nerves, which are branches of the maxillary nerve.

**CLINICAL CORRELATE**

 **Sinusitis:** The paranasal sinuses are joined to the nasal cavity via small orifices called ostia. These become blocked easily by allergic inflammation, or by swelling in the nasal lining that occurs with a cold. If this happens, normal drainage of mucus within the sinuses is disrupted, and sinusitis may occur. Because the maxillary posterior teeth are close to the maxillary sinus, this can also cause clinical problems if any disease processes are present, such as an infection in any of these teeth. These clinical problems can include secondary sinusitis, the inflammation of the sinuses from another source such as an infection of the adjacent teeth

These conditions may be treated with drugs such as decongestants, which cause vasoconstriction in the sinuses; reducing inflammation; by traditional techniques of nasal irrigation; or by corticosteroid.

**Cancer**

Malignancies of the paranasal sinuses comprise approximately 0.2% of all malignancies. About 80% of these malignancies arise in the maxillary sinus. Men are much more often affected than women. They most often occur in the age group between 40 and 70 years. Carcinomas are more frequent than sarcomas. Metastases are rare. Tumours of the sphenoid and frontal sinuses are extremely rare.