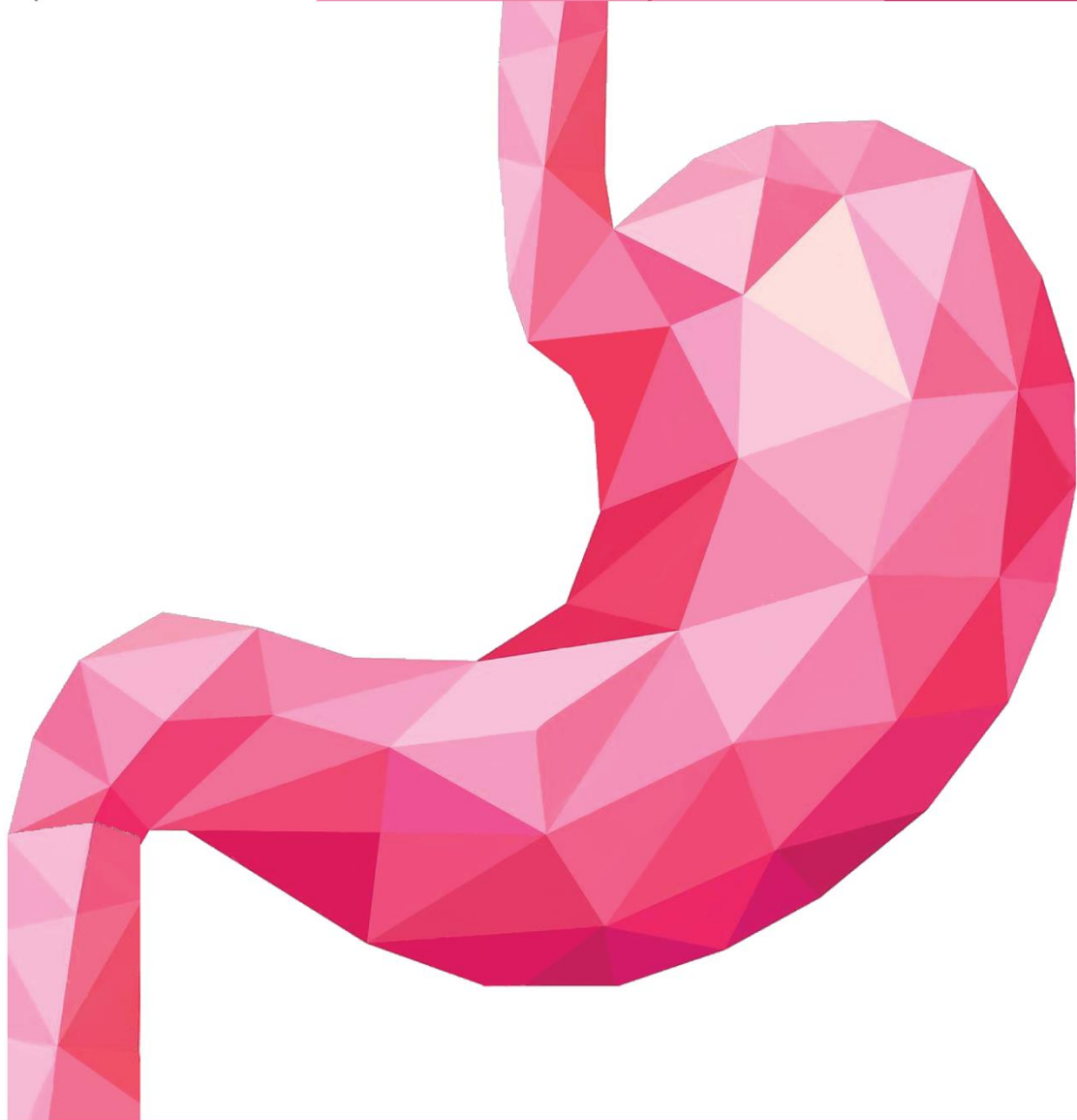




GIS

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ANATOMY



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Scientific Correction: Obada Froukh

Gramatical Correction: Obada Froukh

Doctor: Mohammad Al-muhtaseb

➔ **Note!** Additional pictures were added for clarification from doctor 2017 sheet.
Underlined sentences are from the slides but were not mentioned by the doctor during the lecture.

➤ Introduction into the Gastrointestinal System

▪ The Gastrointestinal System is an organ system; it is divided into:

A. The Alimentary canal (also known as the digestive tract): a tube that begins by the mouth and ends in the anal canal. It includes the **oral cavity** which transforms food into a bolus which will be swallowed into the **pharynx** then into the **esophagus**, the **stomach**, the **small intestines** then into the **large intestines**, **rectum** and the finally into the **anal canal (orifice)**.

-The small intestine has three parts: the duodenum, jejunum, and ileum.

-The large intestine is divided into 4 parts: the ascending colon which begins with the cecum, the transverse colon, the descending colon and the sigmoid colon.

B. Accessory (association) digestive organs:

- The tongue and the teeth.
- The salivary glands (the parotid, submandibular and sublingual glands in addition to minor glands such as labial, palatal and lingual glands. These glands empty their secretions into the oral cavity where digestion begins).
- The liver and gallbladder (they have a duct connecting them with the duodenum).
- The pancreas (has a pancreatic duct that also opens into the duodenum).

➤ The Digestive Tract in the Head and Neck

• The Oral Cavity

▪ The oral cavity has two openings:

- ✓ An anterior opening (the space between the upper and the lower lips).
- ✓ A posterior opening called oropharyngeal isthmus (opens into the pharynx).

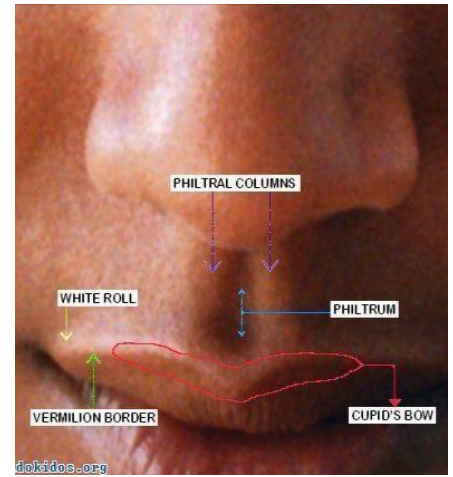
A. The anterior opening (the mouth):

- It lies between the upper and the lower lip and is surrounded by the lips.
- The lips are the two fleshy folds that surround the oral orifice. They are muscular organs; their core is formed by a striated muscle called the orbicularis oris muscle.

➔ Histology of the Lips:

- The lip is covered by three different zones: the skin from the outside, the transitional zone and the mucosa from the inside.
- The skin of the lip consists of stratified squamous keratinized epithelium. It has hair follicles (thick in men; mustache), sebaceous and sweat glands.
- The transitional zone (Vermilion zone): it is the reddish part of the lip which consists of a **modified squamous epithelium**. It contains a large number of vessels and nerve terminals that make it red and very sensitive. It is called transitional zone because it's different from the skin and the mucosa as it has no hair follicles, sebaceous glands or sweat glands.
- The mucosa (from inside) consists of stratified squamous non-keratinized epithelium. It has labial glands.

- The philtrum is the shallow vertical groove seen in the midline on the outer surface of the upper lip only. It is formed in the embryo by the left and right maxillary prominence growth (where the maxillary prominence meets with the nasomedial prominence → the nasomedial prominence wasn't mentioned by the doctor but we took it in MSS embryology).
- [Median folds of mucous membrane "the labial frenulum" connects the inner surface of the lips to the gums].



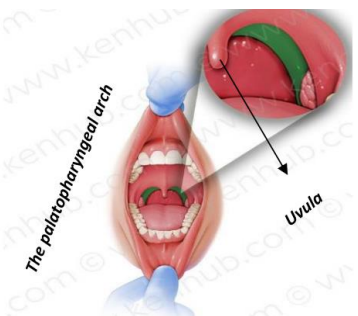
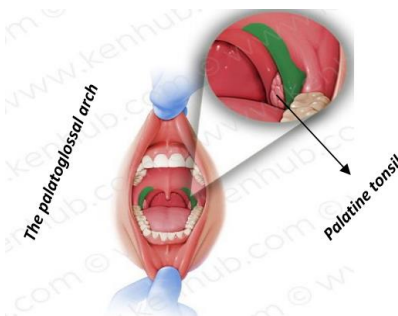
▪ Orbicularis Oris Muscle

- ✓ A striated muscle (voluntary).
 - ✓ It is supplied by the facial nerve.
 - ✓ It has circular fibers that is why it functions as a sphincter to close the lips and it is important in whistling. This muscle is also responsible for pronunciation.
 - ✓ The inability to whistle and the drooping of saliva on one side is a sign of facial nerve paralysis on that side.
- The anterior opening also includes labial blood vessels, nerves, connective tissues and many minor salivary glands that secrete mucous.



B. The posterior opening (Oropharyngeal Isthmus or Isthmus of the Fauces)

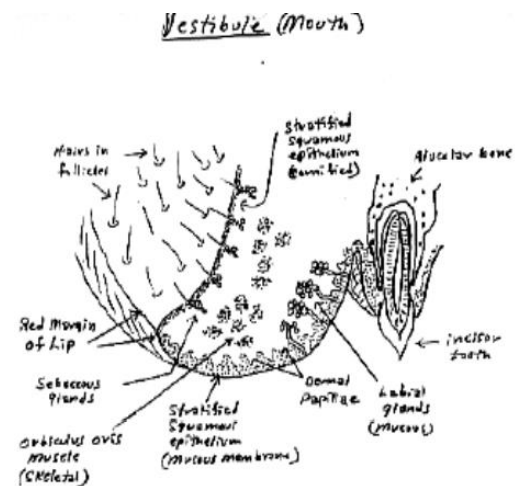
- It is the posterior orifice and the entrance into the pharynx.
- The roof: the uvula which is an extension of the soft palate.
- The floor: posterior third of the tongue.
- There are two folds at the two sides of the Oropharyngeal Isthmus: an anterior one called the palatoglossal fold and a posterior one called the palatopharyngeal fold.
- ✓ The palatoglossal fold extends from the palate (palate) to the tongue (glossal).
- ✓ The palatopharyngeal fold extends from the palate (palate) to the pharynx (pharyngeal).
- Inside these two folds there are two muscles, the palatoglossal muscle and the palatopharyngeal muscle. Between these two muscles, there are palatine tonsils (at the two sides of the oropharyngeal isthmus).
- The palatine tonsils (especially in children) aid in filtration of bacteria and viruses. Infection of the palatine tonsil is called tonsillitis (will be explained in more details in future lectures).



- The mouth cavity is divided into the vestibule & the mouth proper.

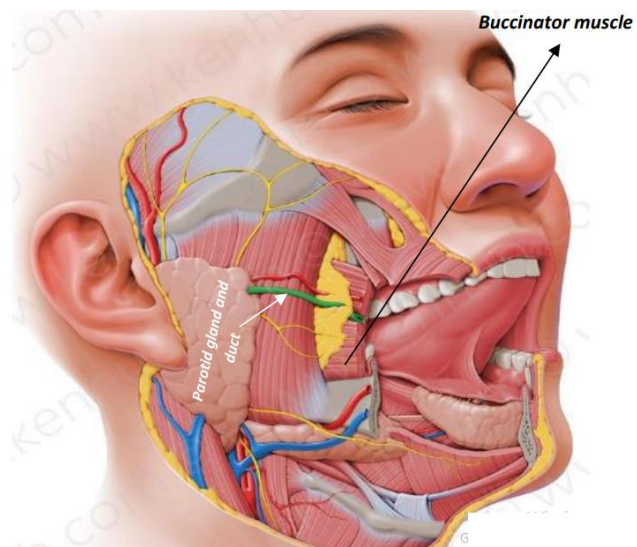
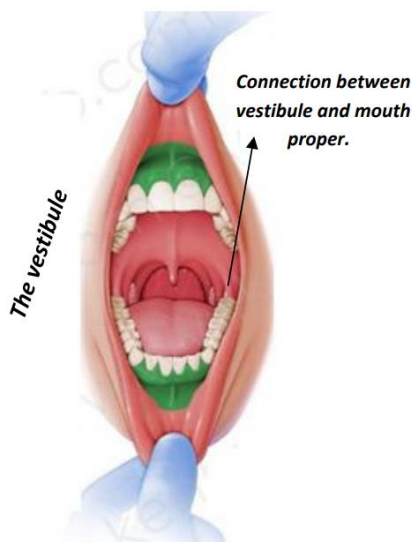
A) The Vestibule:

- The vestibule is the cavity outside the closed teeth.
- It lies between:
 - ∞ Externally: the lips anteriorly and the cheeks on the lateral sides.
 - ∞ Internally: the (closed) teeth and gum.
- This slit-like space communicates with the exterior through the oral fissure between the lips.
- It is where you move the tooth brush to brush your teeth when the upper and the lower jaw are closed.
- It communicates with the mouth proper behind the third (last) molar tooth on each side when the jaws are closed.
- The lateral wall of the vestibule is formed by the cheek, which is made up by the buccinator muscle.
- The vestibule helps in mastication and it receives the ducts of salivary glands such as the parotid gland. The duct of the parotid salivary gland which is found over the ramus of the mandible opens on a small papilla into the vestibule opposite to the upper second molar tooth, it also contains minor glands.
- [The vestibule is limited above and below by the reflection of the mucous membrane from the lips and cheeks to the gums].



• The Buccinator Muscle:

- The cheeks (buccinator muscle) is lined from the outside by skin (keratinized stratified squamous epithelium) and from the inside by mucous membrane (Non-keratinized stratified squamous epithelium).
- The buccinator muscle is used for blowing and is supplied by the motor facial nerve.
- [The tone of the buccinator muscle and that of the muscles of the lips keeps the walls of the vestibule in contact with one another].



B) The Mouth Proper:

- The mouth proper is the cavity found inside the closed teeth.
- Boundaries of the mouth proper:
 - ∞ Roof: the hard palate in front and the soft palate in the back which ends with the uvula.
 - ∞ Floor: formed largely by the anterior two thirds of the tongue (dorsum aspect) and by the reflection of the mucous membrane from the sides of the tongue to the gum of the mandible.
 - ∞ Sides: the teeth and cheeks (buccinator muscle lined by mucous membrane).
 - ∞ Posteriorly: Oropharyngeal isthmus with its folds and tonsils.



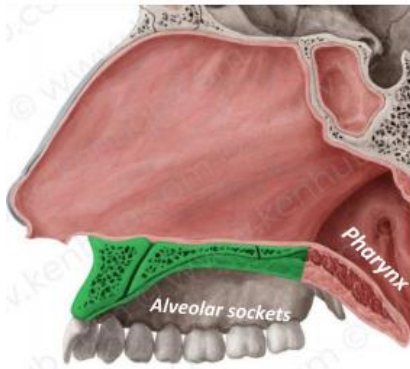
• Mucous Membrane of the Mouth

- It is composed of stratified squamous non-keratinized epithelium.
- Rich in minor salivary glands.
- The mucous membrane is hard (tough) over the gingiva (the gum) & the hard palate and it is strongly attached to the alveolar periosteum (found on the border of the alveolar socket).
- The mucosa of the soft palate and the floor of the mouth is soft.
- Both types of **mucosa** (hard & soft) have the same structure.
- The mucosa has many folds inside the mouth proper:
 - ∞ Fold of mucous membrane called the frenulum of the tongue connects the undersurface of the tongue in the midline to the floor of the mouth.
 - ∞ Also, there are the Superior labial frenulum which connects the inner surface of upper lip to the mouth. And the Inferior labial frenulum which connects the inner surface of lower lip to the mouth.
 - ∞ The sublingual gland projects up into the mouth, producing a low fold of mucous membrane, the sublingual fold (numerous ducts of the gland open on the summit of the fold).
- The submandibular duct of the submandibular gland opens onto the floor of the mouth on the summit of a small papilla on either side of the frenulum of the tongue. The ducts of the sublingual gland open into the same fold.
- [In the vestibule the mucous membrane is tethered to the buccinator muscle by elastic fibers in the submucosa and this prevents redundant folds of mucous membrane from being bitten between the teeth when the jaws are closed].

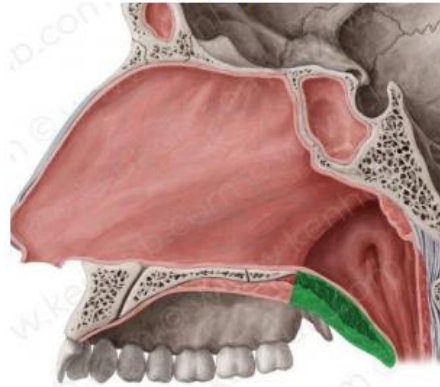
• Salivary Glands:

- Three major glands: the parotid gland, the submandibular and the sublingual gland.
- Minor glands such as palatal, labial and lingual glands which secrete mucous.
- They are important because the oral cavity must be moist → the dryness of the oral cavity permits the bacteria to grow and cause infection.

Hard palate



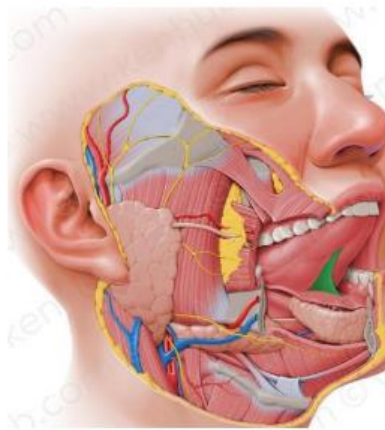
Soft palate



inferior labial frenulum



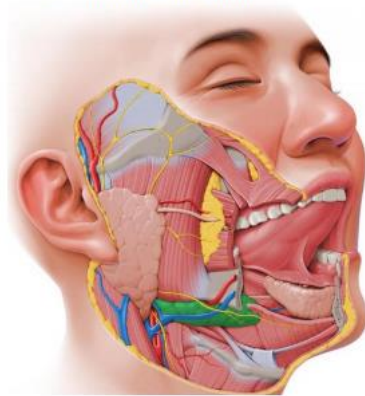
Frenulum of the tongue



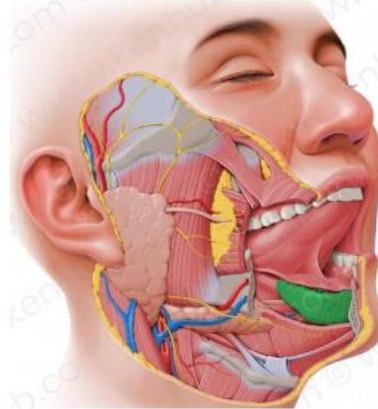
Superior labial frenulum



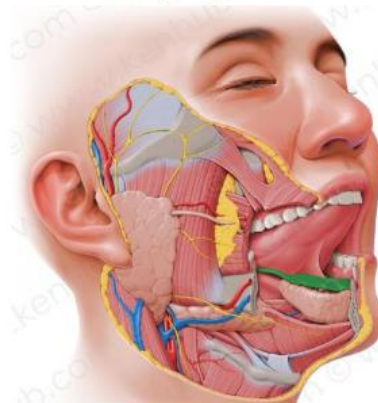
Submandibular gland



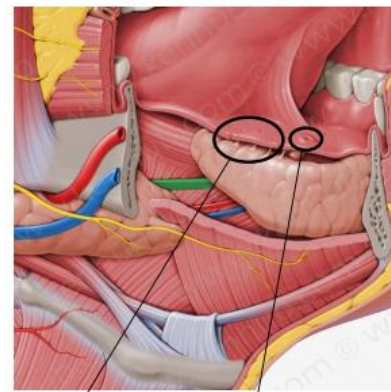
Sublingual gland



Sublingual fold



Submandibular duct



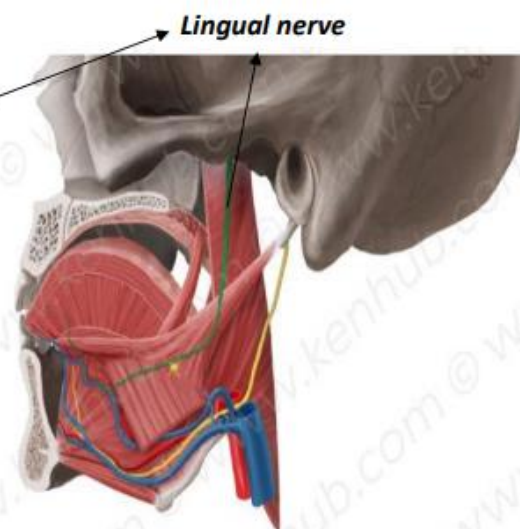
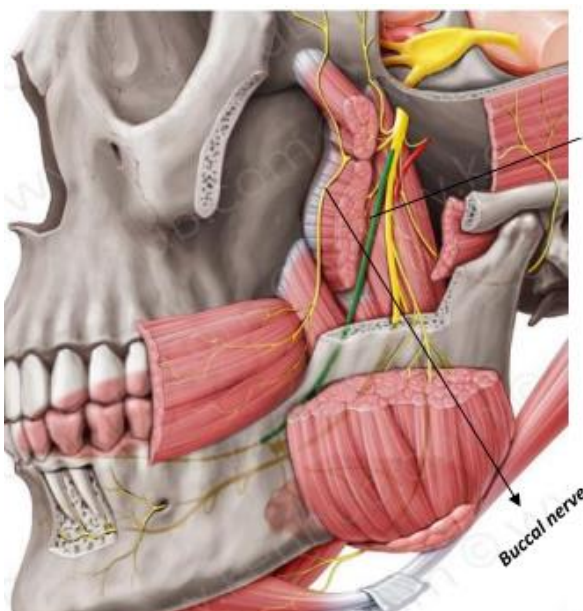
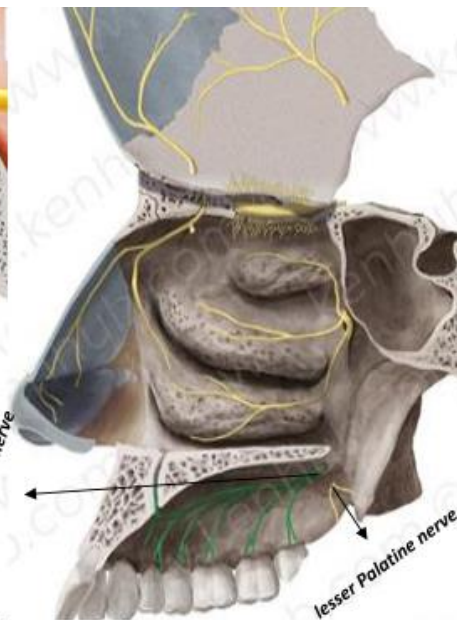
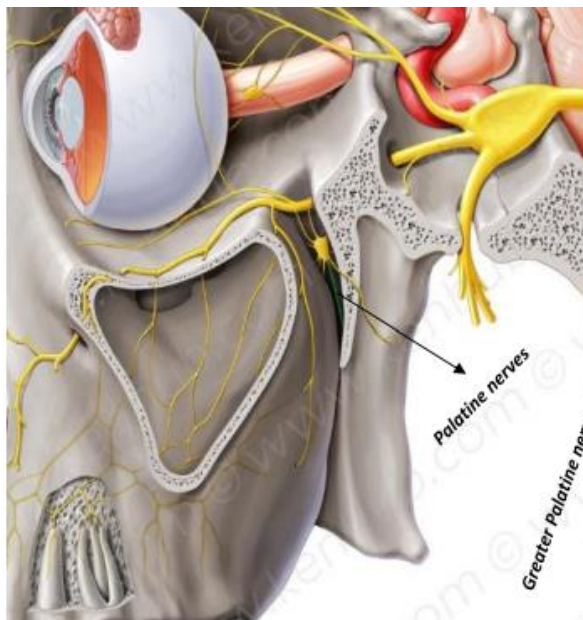
Sublingual ducts

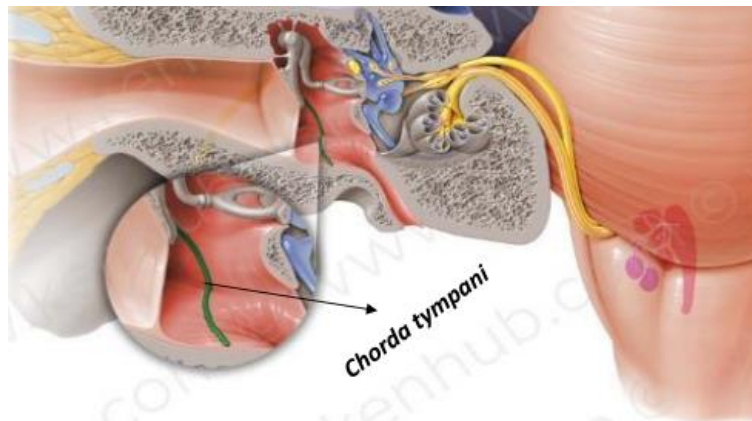
Opening of submandibular duct

- **Sensory Innervation of the Mouth:**

- ✓ Roof (hard & soft palates): the greater palatine and nasopalatine nerves from the maxillary division of the trigeminal nerve.
- ✓ Floor: the lingual nerve. The lingual nerve is also responsible for general (common) sensation → touch, pain and temperature. It is a branch of the mandibular division of the trigeminal nerve.
- ✓ Taste buds (special sensation): fibers travel in the chorda tympani nerve, a branch of the facial nerve. It innervates the anterior two thirds only as the posterior third lack taste buds.
- ✓ Cheeks : the buccal nerve (sensory), a branch of the mandibular division of the trigeminal nerve (remember that the buccinator muscle's motor supply is a branch from the facial nerve (motor buccal nerve)).

Remember! The trigeminal nerve is the 5th cranial nerve which gives 3 divisions: The ophthalmic (sensory to the eye), the maxillary (supplies the maxilla and the upper teeth) and the mandibular (supplies the mandible and the lower teeth)



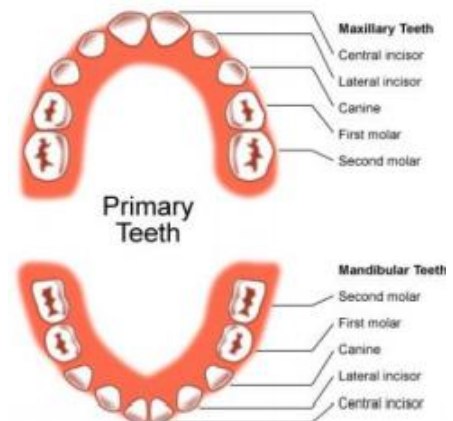


• The Teeth:

- Found within the alveolar sockets of the upper and lower jaw (maxilla and mandible).
- The gingivae (gums) are specialized regions of the oral mucosa that surround the teeth and cover adjacent regions of the alveolar bone.
- There are two types of teeth: deciduous and permanent.

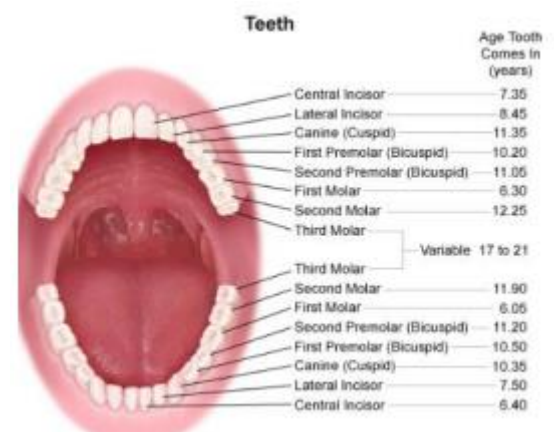
A. Deciduous Teeth (Milk teeth):

- ✓ There are 20 deciduous teeth (10 in each jaw): four incisors, two canines, and four molars in each jaw.
- ✓ They begin to erupt about 6 months after birth and have all erupted by the end of 2 years.
- ✓ The teeth of the lower jaw usually appear before those of the upper jaw (specifically the incisors).



B. Permanent Teeth:

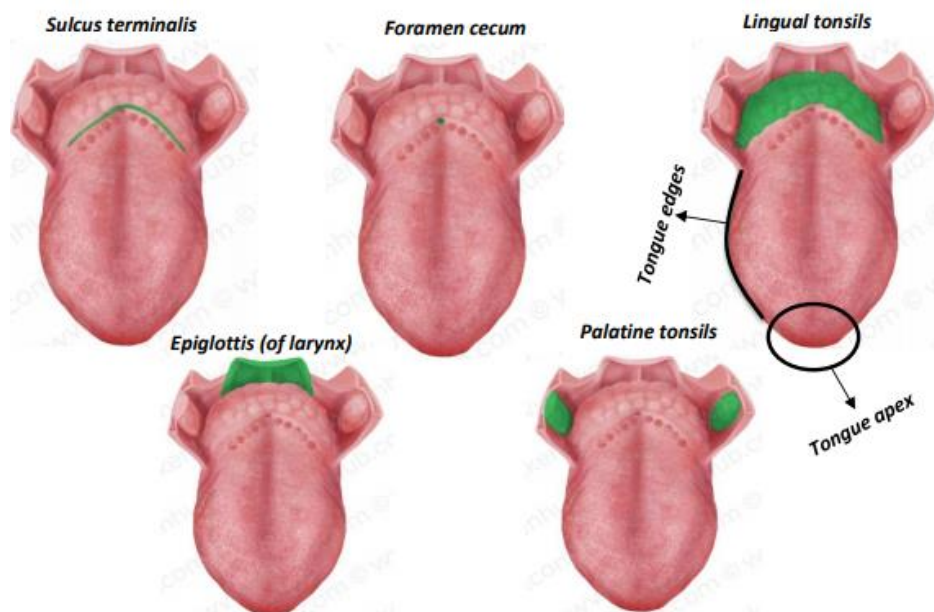
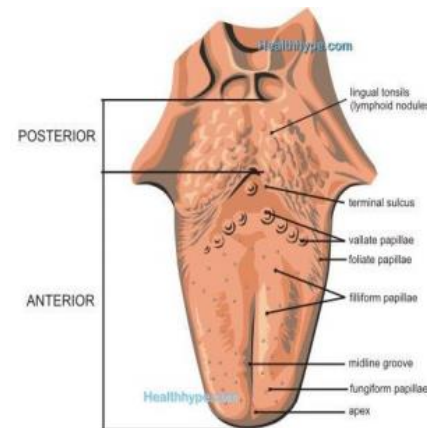
- ✓ There are 32 permanent teeth (16 at each jaw): four incisors, two canines, four premolars, and six molars (including wisdom teeth) in each jaw.
- ✓ They begin to erupt at 6 years of age and have all erupted by the age of 12. Except for the third molar (wisdom teeth) which may happen between the ages of 17 and 30 (they may erupt normally but, some cause an infection, or they do not erupt at all).
- ✓ The teeth of the lower jaw appear before those of the upper jaw.



• The Tongue:

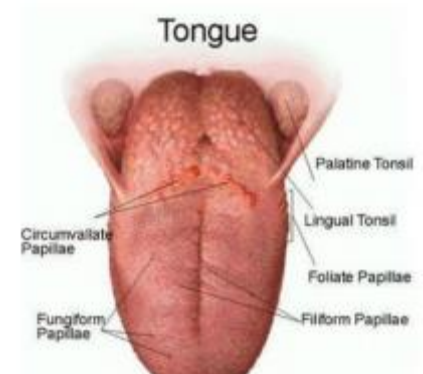
- The tongue is a mass of striated muscle covered with mucous membrane (has no bones).
- The dorsum (anterior) surface of the tongue is covered by taste buds (lingual papillae).

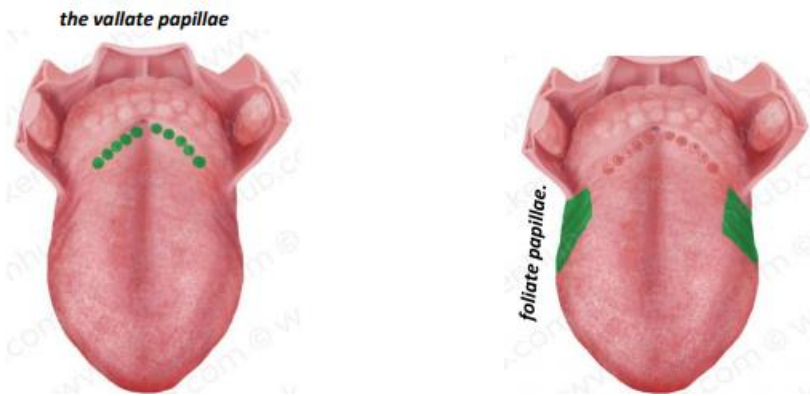
- The epithelium type of the dorsum surface is stratified squamous para-keratinized (it was keratinized but certain injuries induces changes).
- The lower surface consists of stratified squamous non keratinized epithelium (like the floor of the mouth).
- Muscles attach the tongue to the styloid process and the soft palate above and to the mandible and the hyoid bone below.
- The tongue is divided into right and left halves by a median fibrous septum.
- The mucous membrane of the upper surface of the tongue can be divided into anterior 2/3 (apparent part) and posterior 1/3 (pharyngeal part) by a V-shaped sulcus, the sulcus terminalis.
- The apex of the sulcus projects backward and is marked by a small pit, the foramen cecum.
- The foramen cecum is an embryologic remnant and marks the site of the upper end of the thyroglossal duct. It is a landmark for where the thyroid gland is first formed before descending into the neck around the larynx.
- The posterior third lacks taste buds. It contains the lingual tonsils (lymphatic nodules).



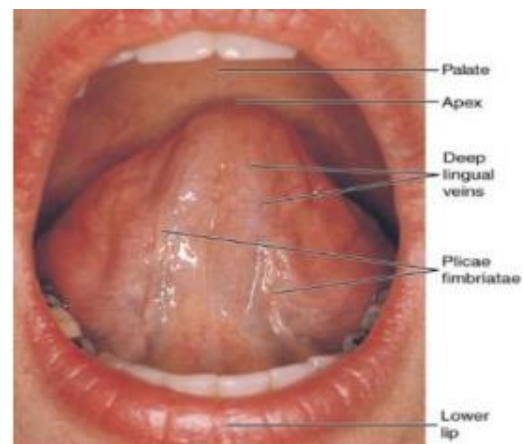
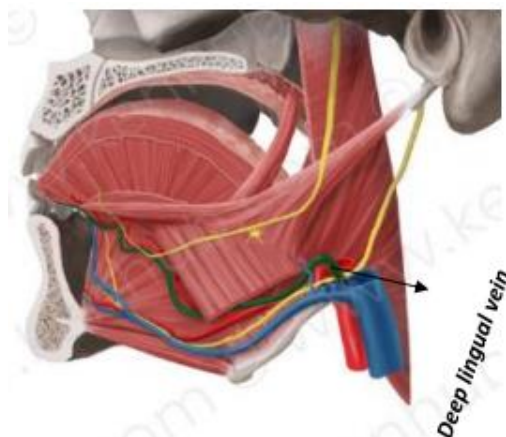
• Taste Buds (Papillae):

- Four types of papillae are present on the upper surface of the anterior two thirds of the tongue:
 - ✓ The filiform papillae: **most abundant**
 - ✓ The fungiform papillae: mushroom shape, contains taste buds
 - ✓ The vallate papillae: 12 -18 Circumvallate papillae in front of the sulcus terminalis. It contains bitter taste buds
 - ✓ The foliate papillae



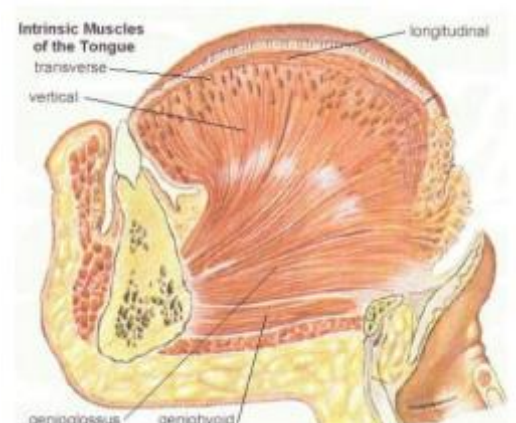


- The mucous membrane covering the posterior third of the tongue is devoid of papillae but has an irregular surface caused by the presence of underlying lymph nodules, the lingual tonsil.
- The mucous membrane on the inferior surface of the tongue is reflected from the tongue to the floor of the mouth.
- [In the midline anteriorly, the undersurface of the tongue is connected to the floor of the mouth by a fold of mucous membrane, the frenulum of the tongue].
- [On the lateral side of the frenulum, the deep lingual vein can be seen through the mucous membrane. Lateral to the lingual vein, the mucous membrane forms a fringed fold called the plica fimbriata].



• Muscle of The Tongue

- The muscles of the tongue are divided into two types: intrinsic and extrinsic.
- Intrinsic Muscles:
 - ✓ These muscles are confined to the tongue and are not attached to bone.
 - ✓ They consist of longitudinal, transverse, and vertical fibers.
 - ✓ Nerve supply: Hypoglossal nerve (motor).
 - ✓ Action: Alter the shape of the tongue.



- Extrinsic Muscles:

- ✓ These muscles are attached to bones and the soft palate and they end by attaching to the tongue.
- ✓ Extrinsic muscles form the bulk of the tongue. They are striated (voluntary) muscles.

Muscle	Origin	Insertion	Function	Nerve Supply
Palatoglossus	Palatine aponeurosis	Blends with each other, the palatoglossus inserts at sides of the tongue	[Pulls roots of tongue upward and backward, narrows oropharyngeal isthmus]	Pharyngeal plexus through the vagus nerve (Cranial accessory nerve)
Styloglossus	Styloid process of temporal bone		[Draws tongue upward and backward]	Hypoglossal nerve
Hyoglossus	Body and greater cornu (horn) of hyoid bone		[Depresses tongue]	Hypoglossal nerve
Genioglossus	Superior genial spine of mandible		Protrudes apex of tongue through mouth	Hypoglossal nerve

- ✓ The genioglossus is the most important muscle. In order to diagnose an injury to the hypoglossal nerve, the patient should be asked to bring out his tongue. Normally, the tongue is straight but if the nerve was injured on one side, the tongue will be deviated towards the same paralyzed site.

- Summary of muscle movements:

- ∞ Protrusion: the genioglossus muscles on both sides acting together.
- ∞ Retraction: Styloglossus and [hyoglossus] muscles on both sides acting together.
- ∞ Depression: Hyoglossus muscles on both sides acting together.
- ∞ [Retraction and elevation of the posterior third: Styloglossus and palatoglossus muscles on both sides acting together].
- ∞ Shape changes: Intrinsic muscles.

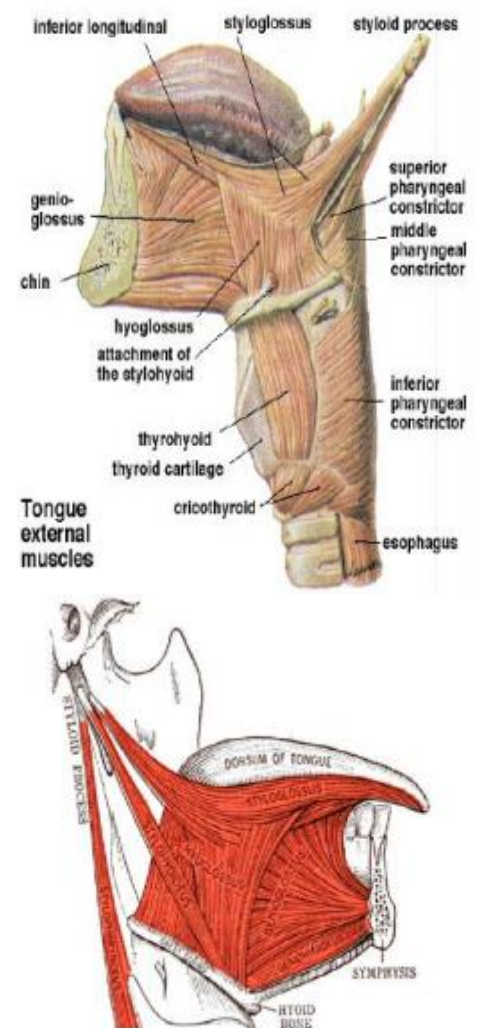


FIG. 89. SOME OF THE MUSCLES OF THE TONGUE. Viewed from the right side.

- **Innervation, blood supply and lymphatic drainage of the tongue:**

- Sensory and taste innervation:

- ✓ Posterior 1/3: Glossopharyngeal for both.
 - ✓ Anterior 2/3: sensory (lingual nerve), taste (chorda tympani).

- Blood Supply (three arteries):

- ✓ The lingual artery.
 - ✓ The tonsillar branch of the facial artery
 - ✓ The ascending pharyngeal artery supply the tongue (all branches from external carotid artery).

- Venous drainage (lingual veins):

- ✓ The veins drain into the internal jugular vein.

- Lymph Drainage:

- ✓ Tip of the tongue: Submental lymph nodes.
 - ✓ Sides of the anterior two thirds: Submandibular and deep cervical lymph nodes.
 - ✓ Posterior third: Deep cervical lymph nodes.

