

The Digestive System in the Head and Neck

The Mouth

The Lips

The lips are two fleshy folds that surround the oral orifice. They are covered on the outside by skin and are lined on the inside by mucous membrane. The substance of the lips is made up by the orbicularis oris muscle and the muscles that radiate from the lips into the face. Also included are the labial blood vessels and nerves, connective tissue, and many small salivary glands. The philtrum is the shallow vertical groove seen in the midline on the outer surface of the upper lip. Median folds of mucous membrane "the labial frenulae" connect the inner surface of the lips to the gums.

The Mouth Cavity

The mouth extends from the lips to the pharynx. The entrance into the pharynx, the oropharyngeal isthmus, is formed on each side by the palatoglossal fold. The mouth is divided into the vestibule and the mouth cavity proper.

Vestibule

The vestibule lies between the lips and the cheeks externally and the gums and the teeth internally. This slitlike space communicates with the exterior through the oral fissure between the lips. When the jaws are closed, it communicates with the mouth proper behind the third molar tooth on each side. The vestibule is limited above and below by the reflection of the mucous membrane from the lips and cheeks to the gums.

The lateral wall of the vestibule is formed by the cheek, which is made up by the buccinator muscle and is lined with mucous membrane. 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. The duct of the parotid salivary gland opens on a small papilla into the vestibule opposite the upper second molar tooth.

Mouth Proper

The mouth proper has a roof and a floor.

Roof of Mouth

The roof of the mouth is formed by the hard palate in front and the soft palate behind.

Floor of Mouth

The floor is formed largely by the anterior two thirds of the tongue and by the reflection of the mucous membrane from the sides of the tongue to the gum of the mandible. A 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. Lateral to the frenulum, the mucous membrane forms a fringed fold, the plica fimbriata.

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 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.

Mucous Membrane of the Mouth

In the vestibule the mucous membrane is tethered to the buccinator muscle by elastic fibers in the submucosa that prevent redundant folds of mucous membrane from being bitten between the teeth when the jaws are closed. The mucous membrane of the gingiva, or gum, is strongly attached to the alveolar periosteum.

Sensory Innervation of the Mouth

- Roof: The greater palatine and nasopalatine nerves from the maxillary division of the trigeminal nerve
- Floor: The lingual nerve (common sensation), a branch of the mandibular division of the trigeminal nerve. The taste fibers travel in the chorda tympani nerve, a branch of the facial nerve.
- Cheek: The buccal nerve, a branch of the mandibular division of the trigeminal nerve (the buccinator muscle is innervated by the buccal branch of the facial nerve)

The Teeth

Deciduous Teeth

There are 20 deciduous teeth: 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.

Permanent Teeth

There are 32 permanent teeth: four incisors, two canines, four premolars, and six molars in each jaw. They begin to erupt at 6 years of age. The last tooth to erupt is the third molar, which may happen between the ages of 17 and 30. 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. The 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.

Mucous Membrane of the Tongue

The mucous membrane of the upper surface of the tongue can be divided into anterior and posterior parts 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 sulcus serves to divide the tongue into the anterior two thirds, or oral part, and the posterior third, or pharyngeal part. The foramen cecum is an embryologic remnant and marks the site of the upper end of the thyroglossal duct.

Three types of papillae are present on the upper surface of the anterior two thirds of the tongue: the filiform papillae, the fungiform papillae, and the vallate 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.

Muscles 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
- Action: Alter the shape of the tongue

Extrinsic Muscles

These muscles are attached to bones and the soft palate. They are the genioglossus, the hyoglossus, the styloglossus, and the palatoglossus.

- Nerve supply: Hypoglossal nerve

Blood Supply

The lingual artery, the tonsillar branch of the facial artery, and the ascending pharyngeal artery supply the tongue. The veins drain into the internal jugular vein.

Lymph Drainage

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

Sensory Innervation

- Anterior two thirds: Lingual nerve branch of mandibular division of trigeminal nerve (general sensation) and chorda tympani branch of the facial nerve (taste)
- Posterior third: Glossopharyngeal nerve (general sensation and taste)

Movements of the Tongue

- **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

Muscles of Tongue

Muscle	Origin	Insertion	Nerve Supply	Action
Intrinsic Muscles				
Longitudinal	Median septum and submucosa	Mucous membrane	Hypoglossal nerve	Alters shape of tongue
Transverse				
Vertical				
Extrinsic Muscles				
Genioglossus	Superior spine of mandible	genialBlends of other muscles of tongue	withHypoglossal nerve	Protrudes apex of tongue through mouth
Hyoglossus	Body and cornu of hyoid bone	greaterBlends of other muscles of tongue	withHypoglossal nerve	Depresses tongue
Styloglossus	Styloid process of temporal bone	Blends of other muscles of tongue	withHypoglossal nerve	Draws tongue upward and backward
Palatoglossus	Palatine aponeurosis	Side of tongue	Pharyngeal plexus	Pulls roots of tongue upward and backward, narrows oropharyngeal isthmus

The Palate

The palate forms the roof of the mouth and the floor of the nasal cavity. It is divided into two parts: the hard palate in front and the soft palate behind.

Hard Palate

The hard palate is formed by the palatine processes of the maxillae and the horizontal plates of the palatine bones. It is continuous behind with the soft palate.

Soft Palate

The soft palate is a mobile fold attached to the posterior border of the hard palate. Its free posterior border presents in the midline a conical projection called the uvula. The soft palate is continuous at the sides with the lateral wall of the pharynx.

The soft palate is composed of mucous membrane, palatine aponeurosis, and muscles.

Mucous Membrane

The mucous membrane covers the upper and lower surfaces of the soft palate.

Palatine Aponeurosis

The palatine aponeurosis is a fibrous sheet attached to the posterior border of the hard palate. It is the expanded tendon of the tensor veli palatini muscle.

Muscles of the Soft Palate

The muscles of the soft palate are the tensor veli palatini, the levator veli palatini, the palatoglossus, the palatopharyngeus, and the musculus uvulae.

The muscle fibers of the tensor veli palatini converge as they descend from their origin to form a narrow tendon, which turns medially around the pterygoid hamulus. The tendon, together with the tendon of the opposite side, expands to form the palatine aponeurosis. When the muscles of the two sides contract, the soft palate is tightened so that the soft palate may be moved upward or downward as a tense sheet.

Nerve Supply of the Palate

The greater and lesser palatine nerves from the maxillary division of the trigeminal nerve enter the palate through the greater and lesser palatine foramina. The nasopalatine nerve, also a branch of the maxillary nerve, enters the front of the hard palate through the incisive foramen. The glossopharyngeal nerve also supplies the soft palate.

Blood Supply of the Palate

The greater palatine branch of the maxillary artery, the ascending palatine branch of the facial artery, and the ascending pharyngeal artery

Lymph Drainage of the Palate

Deep Cervical Lymph Nodes

Palatoglossal Arch

The palatoglossal arch is a fold of mucous membrane containing the palatoglossus muscle, which extends from the soft palate to the side of the tongue. The palatoglossal arch marks where the mouth becomes the pharynx.

Palatopharyngeal Arch

The palatopharyngeal arch is a fold of mucous membrane behind the palatoglossal arch that runs downward and laterally to join the pharyngeal wall. The muscle contained within the fold is the palatopharyngeus muscle. The palatine tonsils, which are masses of lymphoid tissue, are located between the palatoglossal and palatopharyngeal arches.

Muscles of the Soft Palate

Muscle	Origin	Insertion	Nerve Supply	Action
Tensor palatini	veliSpine sphenoid, auditory tube	ofWith muscle other forms aponeurosis	ofNerve side,medial palatinepterygoid from mandibular nerve	toTenses soft palate
Levator palatini	veliPetrus part of auditory tube	Palatine bone,aponeurosis	Pharyngeal plexus	Raises soft palate
Palatoglossus	Palatine aponeurosis	Side of tongue	Pharyngeal plexus	Pulls root of tongue upward and backward, narrows oropharyngeal isthmus
Palatopharyngeus	Palatine aponeurosis	Posterior border of thyroid cartilage	Pharyngeal plexus	Elevates wall of pharynx, pulls palatopharyngeal folds medially
Musculus uvulae	Posterior	Mucous	Pharyngeal	Elevates uvula

border of hardmembrane ofplexus
palate uvula

Movements of the Soft Palate

The pharyngeal isthmus (the communicating channel between the nasal and oral parts of the pharynx) is closed by raising the soft palate. Closure occurs during the production of explosive consonants in speech.

The soft palate is raised by the contraction of the levator veli palatini on each side. At the same time, the upper fibers of the superior constrictor muscle contract and pull the posterior pharyngeal wall forward. The palatopharyngeus muscles on both sides also contract so that the palatopharyngeal arches are pulled medially, like side curtains. By this means the nasal part of the pharynx is closed off from the oral part.

The Pharynx

The pharynx is situated behind the nasal cavities, the mouth, and the larynx and may be divided into nasal, oral, and laryngeal parts. The pharynx is funnel shaped, its upper, wider end lying under the skull and its lower, narrow end becoming continuous with the esophagus opposite the sixth cervical vertebra. The pharynx has a musculomembranous wall, which is deficient anteriorly. Here, it is replaced by the posterior openings into the nose (choanae), the opening into the mouth, and the inlet of the larynx. By means of the auditory tube, the mucous membrane is also continuous with that of the tympanic cavity.

Muscles of the Pharynx

The muscles in the wall of the pharynx consist of the superior, middle, and inferior constrictor muscles, whose fibers run in a somewhat circular direction, and the stylopharyngeus and salpingopharyngeus muscles, whose fibers run in a somewhat longitudinal direction.

The three constrictor muscles extend around the pharyngeal wall to be inserted into a fibrous band or raphe that extends from the pharyngeal tubercle on the basilar part of the occipital bone of the skull down to the esophagus. The three constrictor muscles overlap each other so that the middle constrictor lies on the outside of the lower part of the superior constrictor and the inferior constrictor lies outside the lower part of the middle constrictor.

The lower part of the inferior constrictor, which arises from the cricoid cartilage, is called the cricopharyngeus muscle. The fibers of the cricopharyngeus pass horizontally around the lowest and narrowest part of the pharynx and act as a sphincter.

Interior of the Pharynx

The pharynx is divided into three parts: the nasal pharynx, the oral pharynx, and the laryngeal pharynx.

Nasal Pharynx

This lies above the soft palate and behind the nasal cavities. In the submucosa of the roof is a collection of lymphoid tissue called the pharyngeal tonsil. The pharyngeal isthmus is the opening in the floor between the soft palate and the posterior pharyngeal wall. On the lateral wall is the opening of the auditory tube, the elevated ridge of which is called the tubal elevation. The pharyngeal recess is a depression in the pharyngeal wall behind the tubal elevation. The salpingopharyngeal fold is a vertical fold of mucous membrane covering the salpingopharyngeus muscle.

Oral Pharynx

This lies behind the oral cavity. The floor is formed by the posterior one third of the tongue and the interval between the tongue and epiglottis. In the midline is the median glossoepiglottic fold, and on each side the lateral glossoepiglottic fold. The depression on each side of the median glossoepiglottic fold is called the vallecula.

On the lateral wall on each side are the palatoglossal and the palatopharyngeal arches or folds and the palatine tonsils between them. The palatoglossal arch is a fold of mucous membrane covering the palatoglossus muscle. The interval between the two palatoglossal arches is called the oropharyngeal isthmus and marks the boundary between the mouth and pharynx. The palatopharyngeal arch is a fold of mucous membrane covering the palatopharyngeus muscle. The recess between the palatoglossal and palatopharyngeal arches is occupied by the palatine tonsil.

Muscles of the Pharynx

Muscle	Origin	Insertion	Nerve Supply	Action
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Superior constrictor	Medial pterygoid plate, pterygoid hamulus, pterygomandibular ligament, mylohyoid line of mandible	Pharyngeal tubercle of raphe in midline posteriorly	Pharyngeal plexus	Aids soft palate in closing off nasal pharynx, propels bolus downward
Middle constrictor	Lower part of stylohyoid ligament, lesser and greater cornu of hyoid bone	Pharyngeal raphe	Pharyngeal plexus	Propels bolus downward
Inferior constrictor	Lamina of thyroid cartilage, cricoid cartilage	Pharyngeal raphe	Pharyngeal plexus	Propels bolus downward
Cricopharyngeus	Lowest fibers of inferior constrictor muscle			Sphincter at lower end of pharynx
Stylopharyngeus	Styloid process of temporal bone	Posterior border of thyroid cartilage	Glossopharyngeal nerve	Elevates larynx during swallowing
Salpingopharyngeus	Auditory tube	Blends with palatopharyngeus	Pharyngeal plexus	Elevates pharynx
Palatopharyngeus	Palatine aponeurosis	Posterior border of thyroid cartilage	Pharyngeal plexus	Elevates wall of pharynx, pulls palatopharyngeal arch medially

Tonsils and Tonsillitis

The palatine tonsils reach their maximum normal size in early childhood. After puberty, together with other lymphoid tissues in the body, they gradually atrophy. The palatine tonsils are a common site of infection, producing the characteristic sore throat and

pyrexia. The deep cervical lymph node situated below and behind the angle of the mandible, which drains lymph from this organ, is usually enlarged and tender.

Laryngeal Pharynx

This lies behind the opening into the larynx . The lateral wall is formed by the thyroid cartilage and the thyrohyoid membrane. The piriform fossa is a depression in the mucous membrane on each side of the laryngeal inlet.

Sensory Nerve Supply of the Pharyngeal Mucous Membrane

- Nasal pharynx: The maxillary nerve (V2)
- Oral pharynx: The glossopharyngeal nerve
- Laryngeal pharynx (around the entrance into the larynx): The internal laryngeal branch of the vagus nerve

Blood Supply of the Pharynx

Ascending pharyngeal, tonsillar branches of facial arteries, and branches of maxillary and lingual arteries

Lymph Drainage of the Pharynx

Directly into the deep cervical lymph nodes or indirectly via the retropharyngeal or paratracheal nodes into the deep cervical nodes

The Process of Swallowing (Deglutition)

Masticated food is formed into a ball or bolus on the dorsum of the tongue and voluntarily pushed upward and backward against the undersurface of the hard palate. This is brought about by the contraction of the styloglossus muscles on both sides, which pull the root of the tongue upward and backward. The palatoglossus muscles then squeeze the bolus backward into the pharynx. From this point onward the process of swallowing becomes an involuntary act.

The nasal part of the pharynx is now shut off from the oral part of the pharynx by the elevation of the soft palate, the pulling forward of the posterior wall of the pharynx by the upper fibers of the superior constrictor muscle, and the contraction of the palatopharyngeus muscles. This prevents the passage of food and drink into the nasal cavities.

The larynx and the laryngeal part of the pharynx are pulled upward by the contraction of the stylopharyngeus, salpingopharyngeus, thyrohyoid, and palatopharyngeus muscles. The main part of the larynx is thus elevated to the posterior surface of the epiglottis, and the entrance into the larynx is closed. The laryngeal entrance is made smaller by the approximation of the aryepiglottic folds, and the arytenoid cartilages are pulled forward by the contraction of the aryepiglottic, oblique arytenoid, and thyroarytenoid muscles.

The bolus moves downward over the epiglottis, the closed entrance into the larynx, and reaches the lower part of the pharynx as the result of the successive contraction of the superior, middle, and inferior constrictor muscles. Some of the food slides down the groove on either side of the entrance into the larynx, that is, down through the piriform fossae. Finally, the lower part of the pharyngeal wall (the cricopharyngeus muscle) relaxes and the bolus enters the esophagus.

Palatine Tonsils

The palatine tonsils are two masses of lymphoid tissue, each located in the depression on the lateral wall of the oral part of the pharynx between the palatoglossal and palatopharyngeal arches. Each tonsil is covered by mucous membrane, and its free medial surface projects into the pharynx. The surface is pitted by numerous small openings that lead into the tonsillar crypts.

The tonsil is covered on its lateral surface by a fibrous capsule. The capsule is separated from the superior constrictor muscle by loose areolar tissue and the external palatine vein descends from the soft palate in this tissue to join the pharyngeal venous plexus. Lateral to the superior constrictor muscle lie the styloglossus muscle, the loop of the facial artery, and the internal carotid artery.

The tonsil reaches its maximum size during early childhood, but after puberty it diminishes considerably in size.

Blood Supply

The tonsillar branch of the facial artery. The veins pierce the superior constrictor muscle and join the external palatine, the pharyngeal, or the facial veins.

Lymph Drainage of the Tonsil

The upper deep cervical lymph nodes, just below and behind the angle of the mandible

Waldeyer's Ring of Lymphoid Tissue

The lymphoid tissue that surrounds the opening into the respiratory and digestive systems forms a ring. The lateral part of the ring is formed by the palatine tonsils and tubal tonsils (lymphoid tissue around the opening of the auditory tube in the lateral wall of the nasopharynx). The pharyngeal tonsil in the roof of the nasopharynx forms the upper part, and the lingual tonsil on the posterior third of the tongue forms the lower part.

The Esophagus

The esophagus is a muscular tube about (25 cm) long, extending from the pharynx to the stomach. It begins at the level of the cricoid cartilage, opposite the body of the sixth cervical vertebra. It commences in the midline, but as it descends through the neck, it inclines to the left side. Its further course is described in the thorax.

Relations in the Neck

- **Anteriorly:** The trachea; the recurrent laryngeal nerves ascend one on each side, in the groove between the trachea and the esophagus.
- **Posteriorly:** The prevertebral layer of deep cervical fascia, the longus colli, and the vertebral column
- **Laterally:** On each side lie the lobe of the thyroid gland and the carotid sheath

Blood Supply in the Neck

The arteries of the esophagus in the neck are derived from the inferior thyroid arteries. The veins drain into the inferior thyroid veins.

Lymph Drainage in the Neck

The lymph vessels drain into the deep cervical lymph nodes.

Nerve Supply in the Neck

The nerves are derived from the recurrent laryngeal nerves and from the sympathetic trunks.