23.3: The Mouth, Pharynx, and Esophagus

Skills to Develop

- Describe the structures of the mouth, including its three accessory digestive organs
- Group the 32 adult teeth according to name, location, and function
- Describe the process of swallowing, including the roles of the tongue, upper esophageal sphincter, and epiglottis
- Trace the pathway food follows from ingestion into the mouth through release into the stomach

In this section, you will examine the anatomy and functions of the three main organs of the upper alimentary canal—the mouth, pharynx, and esophagus—as well as three associated accessory organs—the tongue, salivary glands, and teeth.

The Mouth

The cheeks, tongue, and palate frame the mouth, which is also called the oral cavity (or buccal cavity). The structures of the mouth are illustrated in Figure 23.3.1.

At the entrance to the mouth are the lips, or labia (singular = labium). Their outer covering is skin, which transitions to a mucous membrane in the mouth proper. Lips are very vascular with a thin layer of keratin; hence, the reason they are "red." They have a huge representation on the cerebral cortex, which probably explains the human fascination with kissing! The lips cover the orbicularis oris muscle, which regulates what comes in and goes out of the mouth. The labial frenulum is a midline fold of mucous membrane that attaches the inner surface of each lip to the gum. The cheeks make up the oral cavity’s sidewalls. While their outer covering is skin, their inner covering is mucous membrane. This membrane is made up of non-keratinized, stratified squamous epithelium. Between the skin and mucous membranes are connective tissue and buccinator muscles. The next time you eat some food, notice how the buccinator muscles in

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your cheeks and the orbicularis oris muscle in your lips contract, helping you keep the food from falling out of your mouth. Additionally, notice how these muscles work when you are speaking.

The pocket-like part of the mouth that is framed on the inside by the gums and teeth, and on the outside by the cheeks and lips is called the **oral vestibule**. Moving farther into the mouth, the opening between the oral cavity and throat (oropharynx) is called the **fauces** (like the kitchen "faucet"). The main open area of the mouth, or oral cavity proper, runs from the gums and teeth to the fauces.

When you are chewing, you do not find it difficult to breathe simultaneously. The next time you have food in your mouth, notice how the arched shape of the roof of your mouth allows you to handle both digestion and respiration at the same time. This arch is called the palate. The anterior region of the palate serves as a wall (or septum) between the oral and nasal cavities as well as a rigid shelf against which the tongue can push food. It is created by the maxillary and palatine bones of the skull and, given its bony structure, is known as the hard palate. If you run your tongue along the roof of your mouth, you'll notice that the hard palate ends in the posterior oral cavity, and the tissue becomes flesher. This part of the palate, known as the **soft palate**, is composed mainly of skeletal muscle. You can therefore manipulate, subconsciously, the soft palate—for instance, to yawn, swallow, or sing (see Figure 23.3.1).

![Figure 23.3.1: Mouth](https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Book%3A_Anatomy_and_Physiology_(OpenStax)/Unit_5%…)

A fleshy bead of tissue called the uvula drops down from the center of the posterior edge of the soft palate. Although some have suggested that the uvula is a vestigial organ, it serves an important purpose. When you swallow, the soft palate and uvula move upward, helping to keep foods and liquid from entering the nasal cavity. Unfortunately, it can also contribute to the sound produced by snoring. Two muscular folds extend downward from the soft palate, on either side of the uvula. Toward the front, the **palatoglossal arch** lies next to the base of the tongue; behind it, the **palatopharyngeal arch** forms the superior and lateral margins of the fauces. Between these two arches are the palatine tonsils, clusters of lymphoid tissue that protect the pharynx. The lingual tonsils are located at the base of the tongue.
The Tongue

Perhaps you have heard it said that the tongue is the strongest muscle in the body. Those who stake this claim cite its strength proportionate to its size. Although it is difficult to quantify the relative strength of different muscles, it remains indisputable that the tongue is a workhorse, facilitating ingestion, mechanical digestion, chemical digestion (lingual lipase), sensation (of taste, texture, and temperature of food), swallowing, and vocalization.

The tongue is attached to the mandible, the styloid processes of the temporal bones, and the hyoid bone. The hyoid is unique in that it only distantly/indirectly articulates with other bones. The tongue is positioned over the floor of the oral cavity. A medial septum extends the entire length of the tongue, dividing it into symmetrical halves.

Beneath its mucous membrane covering, each half of the tongue is composed of the same number and type of intrinsic and extrinsic skeletal muscles. The intrinsic muscles (those within the tongue) are the longitudinalis inferior, longitudinalis superior, transversus linguae, and verticalis linguae muscles. These allow you to change the size and shape of your tongue, as well as to stick it out, if you wish. Having such a flexible tongue facilitates both swallowing and speech.

As you learned in your study of the muscular system, the extrinsic muscles of the tongue are the mylohyoid, hyoglossus, styloglossus, and genioglossus muscles. These muscles originate outside the tongue and insert into connective tissues within the tongue. The mylohyoid is responsible for raising the tongue, the hyoglossus pulls it down and back, the styloglossus pulls it up and back, and the genioglossus pulls it forward. Working in concert, these muscles perform three important digestive functions in the mouth: (1) position food for optimal chewing, (2) gather food into a bolus (rounded mass), and (3) position food so it can be swallowed.

The top and sides of the tongue are studded with papillae, extensions of lamina propria of the mucosa, which are covered in stratified squamous epithelium (Figure 23.3.2). Fungiform papillae, which are mushroom shaped, cover a large area of the tongue; they tend to be larger toward the rear of the tongue and smaller on the tip and sides. In contrast, filiform papillae are long and thin. Fungiform papillae contain taste buds, and filiform papillae have touch receptors that help the tongue move food around in the mouth. The filiform papillae create an abrasive surface that performs mechanistically, much like a cat’s rough tongue that is used for grooming. Lingual glands in the lamina propria of the tongue secrete mucus and a watery serous fluid that contains the enzyme lingual lipase, which plays a minor role in breaking down triglycerides but does not begin working until it is activated in the stomach. A fold of mucous membrane on the underside of the tongue, the lingual frenulum, tethers the tongue to the floor of the mouth. People with the congenital anomaly ankyloglossia, also known by the non-medical term “tongue tie,” have a lingual frenulum that is too short or otherwise malformed. Severe ankyloglossia can impair speech and must be corrected with surgery.
The Salivary Glands

Many small **salivary glands** are housed within the mucous membranes of the mouth and tongue. These minor exocrine glands are constantly secreting saliva, either directly into the oral cavity or indirectly through ducts, even while you sleep. In fact, an average of 1 to 1.5 liters of saliva is secreted each day. Usually just enough saliva is present to moisten the mouth and teeth. Secretion increases when you eat, because saliva is essential to moisten food and initiate the chemical breakdown of carbohydrates. Small amounts of saliva are also secreted by the labial glands in the lips. In addition, the buccal glands in the cheeks, palatal glands in the palate, and lingual glands in the tongue help ensure that all areas of the mouth are supplied with adequate saliva.

The Major Salivary Glands

Outside the oral mucosa are three pairs of major salivary glands, which secrete the majority of saliva into ducts that open into the mouth:

- The **submandibular glands**, which are in the floor of the mouth, secrete saliva into the mouth through the submandibular ducts.
- The **sublingual glands**, which lie below the tongue, use the lesser sublingual ducts to secrete saliva into the oral cavity.
- The **parotid glands** lie between the skin and the masseter muscle, near the ears. They secrete saliva into the mouth through the parotid duct, which is located near the second upper molar tooth (Figure 23.3.3).

Saliva

**Saliva** is essentially (95.5 percent) water. The remaining 4.5 percent is a complex mixture of ions, glycoproteins, enzymes, growth factors, and waste products. Perhaps the most important ingredient in saliva from the perspective of...
digestion is the enzyme salivary amylase, which initiates the breakdown of carbohydrates. Food does not spend enough time in the mouth to allow all the carbohydrates to break down, but salivary amylase continues acting until it is inactivated by stomach acids. Bicarbonate and phosphate ions function as chemical buffers, maintaining saliva at a pH between 6.35 and 6.85. Salivary mucus helps lubricate food, facilitating movement in the mouth, bolus formation, and swallowing. Saliva contains immunoglobulin A, which prevents microbes from penetrating the epithelium, and lysozyme, which makes saliva antimicrobial. Saliva also contains epidermal growth factor, which might have given rise to the adage "a mother's kiss can heal a wound."

Each of the major salivary glands secretes a unique formulation of saliva according to its cellular makeup. For example, the parotid glands secrete a watery solution that contains salivary amylase. The submandibular glands have cells similar to those of the parotid glands, as well as mucus-secreting cells. Therefore, saliva secreted by the submandibular glands also contains amylase but in a liquid thickened with mucus. The sublingual glands contain mostly mucous cells, and they secrete the thickest saliva with the least amount of salivary amylase.

Figure 23.3.3: Salivary glands. The major salivary glands are located outside the oral mucosa and deliver saliva into the mouth through ducts.

HOMEOSTATIC IMBALANCES

The Parotid Glands: Mumps

Infections of the nasal passages and pharynx can attack any salivary gland. The parotid glands are the usual site of infection with the virus that causes mumps (paramyxovirus). Mumps manifests by enlargement and inflammation of the parotid glands, causing a characteristic swelling between the ears and the jaw. Symptoms include fever and throat pain, which can be severe when swallowing acidic substances such as orange juice.

In about one-third of men who are past puberty, mumps also causes testicular inflammation, typically affecting only one testis and rarely resulting in sterility. With the increasing use and effectiveness of mumps vaccines, the incidence of mumps has decreased dramatically. According to the U.S. Centers for Disease Control and Prevention (CDC), the number of mumps cases dropped from more than 150,000 in 1968 to fewer than 1700 in 1993 to only 11 reported cases in 2011.
Regulation of Salivation

The autonomic nervous system regulates salivation (the secretion of saliva). In the absence of food, parasympathetic stimulation keeps saliva flowing at just the right level for comfort as you speak, swallow, sleep, and generally go about life. Over-salivation can occur, for example, if you are stimulated by the smell of food, but that food is not available for you to eat. Drooling is an extreme instance of the overproduction of saliva. During times of stress, such as before speaking in public, sympathetic stimulation takes over, reducing salivation and producing the symptom of dry mouth often associated with anxiety. When you are dehydrated, salivation is reduced, causing the mouth to feel dry and prompting you to take action to quench your thirst.

Salivation can be stimulated by the sight, smell, and taste of food. It can even be stimulated by thinking about food. You might notice whether reading about food and salivation right now has had any effect on your production of saliva.

How does the salivation process work while you are eating? Food contains chemicals that stimulate taste receptors on the tongue, which send impulses to the superior and inferior salivatory nuclei in the brain stem. These two nuclei then send back parasympathetic impulses through fibers in the glossopharyngeal and facial nerves, which stimulate salivation. Even after you swallow food, salivation is increased to cleanse the mouth and to water down and neutralize any irritating chemical remnants, such as that hot sauce in your burrito. Most saliva is swallowed along with food and is reabsorbed, so that fluid is not lost.

The Teeth

The teeth, or dentes (singular = dens), are organs similar to bones that you use to tear, grind, and otherwise mechanically break down food.

Types of Teeth

During the course of your lifetime, you have two sets of teeth (one set of teeth is a dentition). Your 20 deciduous teeth, or baby teeth, first begin to appear at about 6 months of age. Between approximately age 6 and 12, these teeth are replaced by 32 permanent teeth. Moving from the center of the mouth toward the side, these are as follows (Figure 23.3.4):

- The eight incisors, four top and four bottom, are the sharp front teeth you use for biting into food.
- The four cuspids (or canines) flank the incisors and have a pointed edge (cusp) to tear up food. These fang-like teeth are superb for piercing tough or fleshy foods.
- Posterior to the cuspids are the eight premolars (or bicuspids), which have an overall flatter shape with two rounded cusps useful for mashing foods.
- The most posterior and largest are the 12 molars, which have several pointed cusps used to crush food so it is ready for swallowing. The third members of each set of three molars, top and bottom, are commonly referred to as the wisdom teeth, because their eruption is commonly delayed until early adulthood. It is not uncommon for wisdom teeth to fail to erupt; that is, they remain impacted. In these cases, the teeth are typically removed by orthodontic surgery.
Figure 23.3.4: Permanent and Deciduous Teeth. This figure of two human dentitions shows the arrangement of teeth in the maxilla and mandible, and the relationship between the deciduous and permanent teeth.

Anatomy of a Tooth

The teeth are secured in the alveolar processes (sockets) of the maxilla and the mandible. Gingivae (commonly called the gums) are soft tissues that line the alveolar processes and surround the necks of the teeth. Teeth are also held in their sockets by a connective tissue called the periodontal ligament.

The two main parts of a tooth are the crown, which is the portion projecting above the gum line, and the root, which is embedded within the maxilla and mandible. Both parts contain an inner pulp cavity, containing loose connective tissue through which run nerves and blood vessels. The region of the pulp cavity that runs through the root of the tooth is called the root canal. Surrounding the pulp cavity is dentin, a bone-like tissue. In the root of each tooth, the dentin is covered by an even harder bone-like layer called cementum. In the crown of each tooth, the dentin is covered by an outer layer of enamel, the hardest substance in the body (Figure 23.3.5).
Although enamel protects the underlying dentin and pulp cavity, it is still nonetheless susceptible to mechanical and chemical erosion, or what is known as tooth decay. The most common form, dental caries (cavities) develops when colonies of bacteria feeding on sugars in the mouth release acids that cause soft tissue inflammation and degradation of the calcium crystals of the enamel. The digestive functions of the mouth are summarized in Table 23.3.1.

![Figure 23.3.5: The Structure of the Tooth. This longitudinal section through a molar in its alveolar socket shows the relationships between enamel, dentin, and pulp.](https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Book%3A_Anatomy_and_Physiology_(OpenStax)/Unit_5%…)

**Table 23.3.1 Digestive Functions of the Mouth**

<table>
<thead>
<tr>
<th>Structure</th>
<th>Action</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lips and cheeks</td>
<td>Confine food between teeth</td>
<td>• Food is chewed evenly during mastication</td>
</tr>
<tr>
<td>Salivary glands</td>
<td>Secrete saliva</td>
<td>• Moisten and lubricate the lining of the mouth and pharynx</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Moisten, soften, and dissolve food</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Clean the mouth and teeth</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Salivary amylase breaks down starch</td>
</tr>
<tr>
<td>Tongue’s extrinsic</td>
<td>Move tongue sideways, and in and out</td>
<td>• Manipulate food for chewing</td>
</tr>
<tr>
<td>muscles</td>
<td></td>
<td>• Shape food into a bolus</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Manipulate food for swallowing</td>
</tr>
<tr>
<td>Tongue’s intrinsic</td>
<td>Change tongue shape</td>
<td>• Manipulate food for swallowing</td>
</tr>
<tr>
<td>muscles</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Digestive Functions of the Mouth

<table>
<thead>
<tr>
<th>Structure</th>
<th>Action</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Taste buds</td>
<td>Sense food in mouth and sense taste</td>
<td>• Nerve impulses from taste buds are conducted to salivary nuclei in the brain stem and then to salivary glands, stimulating saliva secretion</td>
</tr>
<tr>
<td>Lingual glands</td>
<td>Secrete lingual lipase</td>
<td>• Activated in the stomach</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Break down triglycerides into fatty acids and diglycerides</td>
</tr>
<tr>
<td>Teeth</td>
<td>Shred and crush food</td>
<td>• Break down solid food into smaller particles for deglutition</td>
</tr>
</tbody>
</table>

### The Pharynx

The **pharynx** (throat) is involved in both digestion and respiration. It receives food and air from the mouth, and air from the nasal cavities. When food enters the pharynx, involuntary muscle contractions close off the air passageways.

A short tube of skeletal muscle lined with a mucous membrane, the pharynx runs from the posterior oral and nasal cavities to the opening of the esophagus and larynx. It has three subdivisions. The most superior, the nasopharynx, is involved only in breathing and speech. The other two subdivisions, the **oropharynx** and the **laryngopharynx**, are used for both breathing and digestion. The oropharynx begins inferior to the nasopharynx and is continuous below with the laryngopharynx (Figure 23.3.6). The inferior border of the laryngopharynx connects to the esophagus, whereas the anterior portion connects to the larynx, allowing air to flow into the bronchial tree.
Histologically, the wall of the oropharynx is similar to that of the oral cavity. The mucosa includes a stratified squamous epithelium that is endowed with mucus-producing glands. During swallowing, the elevator skeletal muscles of the pharynx contract, raising and expanding the pharynx to receive the bolus of food. Once received, these muscles relax and the constrictor muscles of the pharynx contract, forcing the bolus into the esophagus and initiating peristalsis.

Usually during swallowing, the soft palate and uvula rise reflexively to close off the entrance to the nasopharynx. At the same time, the larynx is pulled superiorly and the cartilaginous epiglottis, its most superior structure, folds inferiorly, covering the glottis (the opening to the larynx); this process effectively blocks access to the trachea and bronchi. When the food “goes down the wrong way,” it goes into the trachea. When food enters the trachea, the reaction is to cough, which usually forces the food up and out of the trachea, and back into the pharynx.

The Esophagus

The esophagus is a muscular tube that connects the pharynx to the stomach. It is approximately 25.4 cm (10 in) in length, located posterior to the trachea, and remains in a collapsed form when not engaged in swallowing. As you can see in Figure 23.3.7, the esophagus runs a mainly straight route through the mediastinum of the thorax. To enter the abdomen, the esophagus penetrates the diaphragm through an opening called the esophageal hiatus.

Passage of Food through the Esophagus

The upper esophageal sphincter, which is continuous with the inferior pharyngeal constrictor, controls the movement
of food from the pharynx into the esophagus. The upper two-thirds of the esophagus consists of both smooth and skeletal muscle fibers, with the latter fading out in the bottom third of the esophagus. Rhythmic waves of peristalsis, which begin in the upper esophagus, propel the bolus of food toward the stomach. Meanwhile, secretions from the esophageal mucosa lubricate the esophagus and food. Food passes from the esophagus into the stomach at the **lower esophageal sphincter** (also called the gastroesophageal or cardiac sphincter). Recall that sphincters are muscles that surround tubes and serve as valves, closing the tube when the sphincters contract and opening it when they relax. The lower esophageal sphincter relaxes to let food pass into the stomach, and then contracts to prevent stomach acids from backing up into the esophagus. Surrounding this sphincter is the muscular diaphragm, which helps close off the sphincter when no food is being swallowed. When the lower esophageal sphincter does not completely close, the stomach’s contents can reflux (that is, back up into the esophagus), causing heartburn or gastroesophageal reflux disease (GERD).

Figure 23.3.7: Esophagus. The upper esophageal sphincter controls the movement of food from the pharynx to the esophagus. The lower esophageal sphincter controls the movement of food from the esophagus to the stomach.

**Histology of the Esophagus**

The mucosa of the esophagus is made up of an epithelial lining that contains non-keratinized, stratified squamous epithelium, with a layer of basal and parabasal cells. This epithelium protects against erosion from food particles. The mucosa’s lamina propria contains mucus-secreting glands. The muscularis layer changes according to location: In the upper third of the esophagus, the muscularis is skeletal muscle. In the middle third, it is both skeletal and smooth muscle. In the lower third, it is smooth muscle. As mentioned previously, the most superficial layer of the esophagus is...
called the adventitia, not the serosa. In contrast to the stomach and intestines, the loose connective tissue of the
adventitia is not covered by a fold of visceral peritoneum. The digestive functions of the esophagus are identified in
Table 23.3.2.

### Table 23.3.2

**Digestive Functions of the Esophagus**

<table>
<thead>
<tr>
<th>Action</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper esophageal sphincter</td>
<td>Allows the bolus to move from the laryngopharynx to the esophagus</td>
</tr>
<tr>
<td>relaxation</td>
<td></td>
</tr>
<tr>
<td>Peristalsis</td>
<td>Propels the bolus through the esophagus</td>
</tr>
<tr>
<td>Lower esophageal sphincter</td>
<td>Allows the bolus to move from the esophagus into the stomach and prevents chime from entering the esophagus</td>
</tr>
<tr>
<td>relaxation</td>
<td></td>
</tr>
<tr>
<td>Mucus secretion</td>
<td>Lubricates the esophagus, allowing easy passage of the bolus</td>
</tr>
</tbody>
</table>

**Deglutition**

**Deglutition** is another word for swallowing—the movement of food from the mouth to the stomach. The entire process takes about 4 to 8 seconds for solid or semisolid food, and about 1 second for very soft food and liquids. Although this sounds quick and effortless, deglutition is, in fact, a complex process that involves both the skeletal muscle of the tongue and the muscles of the pharynx and esophagus. It is aided by the presence of mucus and saliva. There are three stages in deglutition: the voluntary phase, the pharyngeal phase, and the esophageal phase (Figure 23.3.8). The autonomic nervous system controls the latter two phases.

![Figure 23.3.8: Deglutition. Deglutition includes the voluntary phase and two involuntary phases: the pharyngeal phase and the esophageal phase.](https://med.libretexts.org/Bookshelves/Anatomy_and_Physiology/Book%3A_Anatomy_and_Physiology_(OpenStax)/Unit_5%…)

**The Voluntary Phase**

The **voluntary phase** of deglutition (also known as the oral or buccal phase) is so called because you can control when you swallow food. In this phase, chewing has been completed and swallowing is set in motion. The tongue moves
upward and backward against the palate, pushing the bolus to the back of the oral cavity and into the oropharynx. Other muscles keep the mouth closed and prevent food from falling out. At this point, the two involuntary phases of swallowing begin.

### The Pharyngeal Phase

In the pharyngeal phase, stimulation of receptors in the oropharynx sends impulses to the deglutition center (a collection of neurons that controls swallowing) in the medulla oblongata. Impulses are then sent back to the uvula and soft palate, causing them to move upward and close off the nasopharynx. The laryngeal muscles also constrict to prevent aspiration of food into the trachea. At this point, deglutition apnea takes place, which means that breathing ceases for a very brief time. Contractions of the pharyngeal constrictor muscles move the bolus through the oropharynx and laryngopharynx. Relaxation of the upper esophageal sphincter then allows food to enter the esophagus.

### The Esophageal Phase

The entry of food into the esophagus marks the beginning of the esophageal phase of deglutition and the initiation of peristalsis. As in the previous phase, the complex neuromuscular actions are controlled by the medulla oblongata. Peristalsis propels the bolus through the esophagus and toward the stomach. The circular muscle layer of the muscularis contracts, pinching the esophageal wall and forcing the bolus forward. At the same time, the longitudinal muscle layer of the muscularis also contracts, shortening this area and pushing out its walls to receive the bolus. In this way, a series of contractions keeps moving food toward the stomach. When the bolus nears the stomach, distention of the esophagus initiates a short reflex relaxation of the lower esophageal sphincter that allows the bolus to pass into the stomach. During the esophageal phase, esophageal glands secrete mucus that lubricates the bolus and minimizes friction.

*Watch this animation to see how swallowing is a complex process that involves the nervous system to coordinate the actions of upper respiratory and digestive activities. During which stage of swallowing is there a risk of food entering respiratory pathways and how is this risk blocked?*
Chapter Review

In the mouth, the tongue and the teeth begin mechanical digestion, and saliva begins chemical digestion. The pharynx, which plays roles in breathing and vocalization as well as digestion, runs from the nasal and oral cavities superiorly to the esophagus inferiorly (for digestion) and to the larynx anteriorly (for respiration). During deglutition (swallowing), the soft palate rises to close off the nasopharynx, the larynx elevates, and the epiglottis folds over the glottis. The esophagus includes an upper esophageal sphincter made of skeletal muscle, which regulates the movement of food from the pharynx to the esophagus. It also has a lower esophageal sphincter, made of smooth muscle, which controls the passage of food from the esophagus to the stomach. Cells in the esophageal wall secrete mucus that eases the passage of the food bolus.

Interactive Link Questions

Watch this animation to see how swallowing is a complex process that involves the nervous system to coordinate the actions of upper respiratory and digestive activities. During which stage of swallowing is there a risk of food entering respiratory pathways and how is this risk blocked?
Answer: Answers may vary.

Review Questions

Q. Which of these ingredients in saliva is responsible for activating salivary amylase?

A. mucus

B. phosphate ions

C. chloride ions

D. urea

Answer: C

Q. Which of these statements about the pharynx is true?

A. It extends from the nasal and oral cavities superiorly to the esophagus anteriorly.

B. The oropharynx is continuous superiorly with the nasopharynx.

C. The nasopharynx is involved in digestion.

D. The laryngopharynx is composed partially of cartilage.

Answer: B

Q. Which structure is located where the esophagus penetrates the diaphragm?
A. esophageal hiatus
B. cardiac orifice
C. upper esophageal sphincter
D. lower esophageal sphincter
Answer: A

Q. Which phase of deglutition involves contraction of the longitudinal muscle layer of the muscularis?
A. voluntary phase
B. buccal phase
C. pharyngeal phase
D. esophageal phase
Answer: D

Critical Thinking Questions

Q. The composition of saliva varies from gland to gland. Discuss how saliva produced by the parotid gland differs in action from saliva produced by the sublingual gland.

A. Parotid gland saliva is watery with little mucus but a lot of amylase, which allows it to mix freely with food during mastication and begin the digestion of carbohydrates. In contrast, sublingual gland saliva has a lot of mucus with the least amount of amylase of all the salivary glands. The high mucus content serves to lubricate the food for swallowing.

Q. During a hockey game, the puck hits a player in the mouth, knocking out all eight of his most anterior teeth. Which teeth did the player lose and how does this loss affect food ingestion?
A. The incisors. Since these teeth are used for tearing off pieces of food during ingestion, the player will need to ingest foods that have already been cut into bite-sized pieces until the broken teeth are replaced.

Q. What prevents swallowed food from entering the airways?
A. Usually when food is swallowed, involuntary muscle contractions cause the soft palate to rise and close off the nasopharynx. The larynx also is pulled up, and the epiglottis folds over the glottis. These actions block off the air passages.

Q. Explain the mechanism responsible for gastroesophageal reflux.
A. If the lower esophageal sphincter does not close completely, the stomach’s acidic contents can back up into the
esophagus, a phenomenon known as GERD.

Q. Describe the three processes involved in the esophageal phase of deglutition.

A. Peristalsis moves the bolus down the esophagus and toward the stomach. Esophageal glands secrete mucus that lubricates the bolus and reduces friction. When the bolus nears the stomach, the lower esophageal sphincter relaxes, allowing the bolus to pass into the stomach.

References


Glossary

bolus
mass of chewed food

cementum
bone-like tissue covering the root of a tooth

crown
portion of tooth visible superior to the gum line

cuspid
(also, canine) pointed tooth used for tearing and shredding food

deciduous tooth
one of 20 “baby teeth”

deglutition
three-stage process of swallowing

dens
tooth

dentin
bone-like tissue immediately deep to the enamel of the crown or cementum of the root of a tooth

dentition
set of teeth

enamel
covering of the dentin of the crown of a tooth

esophagus
muscular tube that runs from the pharynx to the stomach

fauces
opening between the oral cavity and the oropharynx
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>gingiva</td>
<td>gum</td>
</tr>
<tr>
<td>incisor</td>
<td>midline, chisel-shaped tooth used for cutting into food</td>
</tr>
<tr>
<td>labium</td>
<td>lip</td>
</tr>
<tr>
<td>labial frenulum</td>
<td>midline mucous membrane fold that attaches the inner surface of the lips to</td>
</tr>
<tr>
<td></td>
<td>the gums</td>
</tr>
<tr>
<td>laryngopharynx</td>
<td>part of the pharynx that functions in respiration and digestion</td>
</tr>
<tr>
<td>lingual frenulum</td>
<td>mucous membrane fold that attaches the bottom of the tongue to the floor of</td>
</tr>
<tr>
<td></td>
<td>the mouth</td>
</tr>
<tr>
<td>lingual lipase</td>
<td>digestive enzyme from glands in the tongue that acts on triglycerides</td>
</tr>
<tr>
<td>lower esophageal sphincter</td>
<td>smooth muscle sphincter that regulates food movement from the esophagus to</td>
</tr>
<tr>
<td></td>
<td>the stomach</td>
</tr>
<tr>
<td>molar</td>
<td>tooth used for crushing and grinding food</td>
</tr>
<tr>
<td>oral cavity</td>
<td>(also, buccal cavity) mouth</td>
</tr>
<tr>
<td>oral vestibule</td>
<td>part of the mouth bounded externally by the cheeks and lips, and internally</td>
</tr>
<tr>
<td></td>
<td>by the gums and teeth</td>
</tr>
<tr>
<td>oropharynx</td>
<td>part of the pharynx continuous with the oral cavity that functions in</td>
</tr>
<tr>
<td></td>
<td>respiration and digestion</td>
</tr>
<tr>
<td>palatoglossal arch</td>
<td>muscular fold that extends from the lateral side of the soft palate to the</td>
</tr>
<tr>
<td></td>
<td>base of the tongue</td>
</tr>
<tr>
<td>palatopharyngeal arch</td>
<td>muscular fold that extends from the lateral side of the soft palate to the</td>
</tr>
<tr>
<td></td>
<td>side of the pharynx</td>
</tr>
<tr>
<td>parotid gland</td>
<td>one of a pair of major salivary glands located inferior and anterior to the</td>
</tr>
<tr>
<td></td>
<td>ears</td>
</tr>
<tr>
<td>permanent tooth</td>
<td>one of 32 adult teeth</td>
</tr>
<tr>
<td>pharynx</td>
<td>throat</td>
</tr>
<tr>
<td>premolar</td>
<td>(also, bicuspid) transitional tooth used for mastication, crushing, and</td>
</tr>
<tr>
<td></td>
<td>grinding food</td>
</tr>
</tbody>
</table>
pulp cavity
deepest portion of a tooth, containing nerve endings and blood vessels

root
portion of a tooth embedded in the alveolar processes beneath the gum line

saliva
aqueous solution of proteins and ions secreted into the mouth by the salivary glands

salivary amylase
digestive enzyme in saliva that acts on starch

salivary gland
an exocrine gland that secretes a digestive fluid called saliva

salivation
secretion of saliva

soft palate
posterior region of the bottom portion of the nasal cavity that consists of skeletal muscle

sublingual gland
one of a pair of major salivary glands located beneath the tongue

submandibular gland
one of a pair of major salivary glands located in the floor of the mouth

tongue
accessory digestive organ of the mouth, the bulk of which is composed of skeletal muscle

upper esophageal sphincter
skeletal muscle sphincter that regulates food movement from the pharynx to the esophagus

voluntary phase
initial phase of deglutition, in which the bolus moves from the mouth to the oropharynx

Contributors