Anatomy, Function, and Diseases of the Oral Cavity

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The oral cavity is the beginning of the human digestive tract. Its anatomy ranging from the lips to the pharynx; the salivary glands and their function; and the Waldeyer’s tonsillar ring are all popular topics in examinations. The articulation of sounds and food comminution are two of the main functions of the oral cavity. Pathological changes in the oral cavity can be indications for certain clinical pictures. In this article, you will get a compact overview of all there is to know about the oral cavity.

Topography of the Oral Cavity

The oral cavity is an anatomic space that forms the outer limit of the alimentary canal. It is made up of the lips anteriorly, the oral vestibule, the palate, and the teeth. The distal end is made up of the pharynx.

The oral fissure (rima oris) is the beginning of the oral cavity. The isthmus of the fauces (isthmus faucium) is the posterior edge and is formed by an anterior and a posterior pharyngeal arch (palatoglossal arch and palatopharyngeal arch).

The area between the cheeks and the teeth is referred to as the oral vestibule or vestibulum oris. Behind the rows of teeth, the oral cavity proper begins, which is the main
cavity.

The hard palate and soft palate form the roof. On the sides, the cheeks for the lateral walls of the cavity. The orbicularis oris muscle runs around the mouth like a ring and forms, together with the buccinator muscle (a chewing muscle), the cheek and mouth musculature.

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**Lips**

The lips are the soft and movable parts of the oral cavity that serve various functions such as:

- Occlusion of the oral cavity
- They are also a sensory organ that can be used for tactile responses such as in kissing

The pars cutanea is the part that can be seen from the outside. It is covered with hair, there are sebaceous and respiratory glands, and the skin is pigmented and made up of the stratified squamous epithelium.

The red area of the lips, referred to as pars intermedia, is the transition to the interior side of the lips. The tissue appears red since there are a lot of blood vessels present.
Note: Cyanosis is the bluish coloration of lips, nails, and mucous membranes, which appears in the event of oxygen deficiency.

The inside of the lips is referred to as pars mucosa. This is where the oral mucosa begins. It consists of the non-keratinized stratified squamous epithelium. The lips are attached to the gums by the upper and lower labial frenula, also called frenulum labii superioris and frenulum labii inferioris. The lip musculature consists of the orbicularis oris muscle, the depressor labii inferioris muscle, and the levator labii muscle.

The nerve supply of the lips is mainly derived from the trigeminal nerve. The superior lip derives its supply from the infraorbital nerve which is a branch of maxillary while the lower lip derives its nerve supply from the mental nerve which is a branch of the mandibular nerve.

Palate

The palate is the structure that forms the roof of the mouth and floor of the nasal cavity. It is divided into:

- The anterior hard palate (palatum durum) that is formed by the two-palatine process of the maxilla and the palatine bones. It contains five foramina i.e. the incisive fossa, a pair of greater palatine and a pair of lesser palatine fossae.
- The soft palate attaches behind it (palatum molle). It is soft and movable and contains the muscle tensor veli palatini posteriorly.

The two upper jaw bones and the horizontal plate of the palatine bone (lamina horizontalis) form the hard palate, which results in two sutures: the median palatine suture in the sagittal orientation and the transverse palatine suture in the transverse orientation. The palatum molle consists of rough connective tissue and ends in the uvula.
Tongue

The human tongue (lingua) is anatomically divided into three parts: the root of the tongue (radix linguae), the body of the tongue (corpus linguae), and the tip of the tongue (apex linguae).

It carries the gustatory organ (organum gustus) and takes part in a lot of processes like chewing, speaking, and swallowing. Therefore, the tongue consists of skeletal muscles which allow large flexibility. Most of the tongue muscles are attached to the connective
tissue under the tongue. This plate is referred to as the lingual aponeurosis. There is a distinction made between inner and outer tongue muscles. The outer muscles connect the tongue to the surrounding structures and consist of the genioglossus muscle, the hyoglossus muscle, the styloglossus muscle, and the palatoglossus muscle.

![Deglutition](Image: Deglutition by Phil Schatz. Lizenz: CC-BY 4.0)

The inner tongue muscles have blind endings and beginnings: this means they neither have a real origin nor insertion. They consist of the verticalis linguae muscle, the superior longitudinal muscle, the inferior longitudinal muscle, and the transverse lingual muscle.

**Note:** All tongue muscles are innervated by the hypoglossal nerve (cranial nerve XII) except for the palatoglossus muscle! The vagus nerve innervates this muscle.

The tongue papillae (papillae lingualis) are located on the tongue mucosa and either has a mechanical or gustatory function.

<table>
<thead>
<tr>
<th>Tongue Papillae at a Glance</th>
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</thead>
<tbody>
<tr>
<td>Filiform papillae (thread-like)</td>
</tr>
<tr>
<td>Tactile; cover the surface of the tongue</td>
</tr>
<tr>
<td>Conic papillae (cone-shaped)</td>
</tr>
<tr>
<td>Similar to the filiform papillae</td>
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<tr>
<td>Fungiform papillae (mushroom-shaped)</td>
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<tr>
<td>Gustatory papillae; on the anterior part of the tongue</td>
</tr>
<tr>
<td>Foliate papillae (leaf-shaped)</td>
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<tr>
<td>Gustatory papillae; on the posterior part of the tongue</td>
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<tr>
<td>Vallate papillae (dome-shaped)</td>
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<tr>
<td>Gustatory papillae; there are only 7-12 of them.</td>
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</tbody>
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**Teeth**

Normally, an adult has 32 teeth, 16 per jaw. They are divided into four quadrants with 8 teeth each. 2 incisors (dentes incisivi), 1 canine (dens caninus), 2 premolars (dentes premolares), and 3 molars (dentes molares) make up one quadrant.
A tooth is located in an alveolar process and is held in position by the periodontal ligament. The teeth consist of enamel (enamelum), dentine (dentinum), and dental cement (cementum).

**Note:** Dental enamel is the hardest substance in the human body.

### Salivary Glands

**There are three major paired salivary glands, the sublingual gland, the submandibular gland, and the parotid gland.**

The parotid gland is the largest of the salivary glands. It is situated on the masseter muscle in the retromandibular fossa. Cranially, there is the zygomatic arch and caudally, the angle of the mandible. The course of the excretory duct, the parotid duct, is a popular subject in exams. It runs above the masseter, pierces the buccinator muscle, and opens into the area of the second molar tooth. The end of the parotid duct can be seen in the oral vestibule as the papilla of the molar tooth. The parotid gland receives parasympathetic innervation originating from the inferior salivatory nucleus, passing the otic ganglion, and finally reaching the parotid gland via the auriculotemporal nerve.

**Note:** Mumps (parotitis epidemica) affects the parotid gland and is a common childhood disease.
The sublingual gland is the smallest salivary gland and is located under the tongue on the diaphragm of the mouth. The major sublingual duct ends in the sublingual caruncle and originates from the anterior part of the gland. The shorter minor sublingual ducts lead to the floor of the oral cavity. The facial nerve, which innervates the sublingual and the submandibular glands, arises from the superior salivatory nucleus.

The submandibular gland is situated between the digastric muscle and the mandible in the submandibular triangle. The submandibular duct ends in the sublingual caruncle.

Physiology of the Salivary Glands

The salivary glands produce 0.5—1.5 liters of saliva every day. The saliva contains certain enzymes that play a crucial part in the digestion process. Also, it is important for the rinsing of the oral cavity and it makes food components easier to swallow.

A frequent exam subject is the saliva’s composition. There is an important distinction between serous and mucous salivary glands. Serous saliva is a thin fluid and contains a lot of digestive enzymes. The parotid gland is an exclusively serous gland. Mucous glands secrete a slimy fluid with a high degree of viscosity. The mucous secrete is rich in mucous glycoproteins. In the sublingual and submandibular glands, there are both serous and mucous gland cells present.

In the saliva, the digestive enzyme alpha-amylase can be found. It hydrolyzes 1,4-glycosidic bonds, which are present in starch. The enzyme is most active at a pH of 6.9.
However, it is inactive in the stomach due to its extremely acidic pH-level. Also, the saliva contains immunoglobulins, especially IgA, as well as electrolytes like sodium, potassium, chloride, and others.

Lymphatic System of the Oral Cavity

The processes of breathing and eating constantly transport bacteria into the body. The pharynx is one of the entrances to the body. Around this entrance, lymphatic tissue is located in a circular manner—these are the tonsils of the so-called Waldeyer's tonsillar ring. Their role is to detect potentially harmful organisms.

Waldeyer's tonsillar ring consists of:

- Palatine tonsils between the palatal arches
- Lingual tonsil at the root of the tongue
- Tubal tonsils around the orifice of the Eustachian tube
- Pharyngeal tonsil in the throat area

Pharynx (Throat)

The pharynx is roughly 5 inches (12cm) long and extends from the nasal cavity to the esophagus or the larynx.

Anatomically, the pharynx is divided into:

- Nasopharynx (pars nasalis pharyngis) or epipharynx is the upper portion of the pharynx. Cranially, there is the roof of the pharynx (fornix pharyngis), which is where the pharyngeal tonsil is situated.
- Oropharynx (pars oralis pharyngis) or mesopharynx begins at the isthmus faucium (see above).
- Laryngopharynx (pars laryngea pharyngis) or hypopharynx is the posterior lower part of the pharynx and connects to the esophagus.
Swallowing is the coordinated action of several muscle groups. A special kind of musculature is needed in the pharynx. A distinction is made between pharyngeal muscles that constrict (superior, middle, and inferior constrictor muscle) and pharyngeal muscles that shorten and widen the pharynx (palatopharyngeus, stylopharyngeus, salpingopharyngeus, and stylohyoid muscle).

The topography of the pharynx is a popular subject in examinations. Laimer’s triangle and Killian’s dehiscence are a part of it. They are anatomic weak spots in the posterior wall of the laryngopharynx. Killian’s dehiscence is located between the inferior pharyngeal constrictor muscle and the cricopharyngeus muscle. Laimer’s triangle is located under the pars fundiformis, where muscle fibers scatter in a V-shape. A so-called Zenker’s diverticulum, which is bagging in the posterior pharyngeal wall, can form in this area.

**Clinic:** Severe bad breath (foetor ex ore) can occur due to dental decay. An acidic smell points to hyperacidity of the stomach. In diabetic persons, a characteristic smell of acetone might be noticed.
Diseases of the Oral Cavity

Tonsillitis

The common inflammation of the palatine tonsil is referred to as tonsillitis. In most cases, this inflammation is caused by group A, C, or G beta-hemolytic streptococci. Tonsillitis and pharyngitis are one of the most common reasons for consulting a physician. Besides typical symptoms like fever and fatigue, difficulty swallowing and lymphadenopathy in the mandible can occur.

Candida mycosis

Fungal infections of the oral cavity are most frequently caused by Candida albicans. The infection normally only occurs at immunosuppression or after therapy with antibiotics. Also, diabetic patients are more susceptible to fungal infections. A typical symptom is a white coating on the tongue.

Oral Cancer

Malignant tumors in the oral cavity are mostly squamous cell carcinomas. Risk factors are smoking, chewing tobacco, and regular alcohol consumption. Men are roughly eight times more frequently affected than women. The oral cavity is easily accessible in terms of an examination and squamous cell carcinomas are very apparent. Often, they can be found on the tongue, the gum of the mandible, the lower lip, or on the floor of the mouth. Symptoms arise early.

Pleomorphic Adenoma

The most common tumor of the salivary glands is the pleomorphic adenoma. Mostly, the parotid gland is affected. The pleomorphic adenoma is a benign tumor and appears individually. A capsule surrounds it. Excision can be difficult due to the anatomic location of the salivary gland. Thus, recurrences occur occasionally.

References


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