

SALIVARY GLANDS - AN OVERVIEW

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E-mail of Corresponding Author: dr_gauravsolanki@yahoo.com**Abstract**

The glands are divided into major and minor salivary gland categories. The major salivary glands are parotid, submandibular and sublingual glands. The minor glands are dispersed throughout the upper aero-digestive submucosa. Saliva is the watery substance produced in the mouths of humans and other animals. Saliva is a component of oral fluid. Human saliva is composed of 98% water, while the other 2% consists of other compounds such as electrolytes, mucus, antibacterial compounds and various enzymes. A review of some patents on salivary glands is also provided that summarizes the recent technical advancements taken place in this area.

Keywords: Salivary gland, benign tumors, malignant tumors, signs and symptoms, treatment

1. Introduction:

The glands are divided into major and minor salivary gland categories. The major salivary glands are the parotid, the submandibular, and the sublingual glands. The minor glands are dispersed throughout the upper aero-digestive sub-mucosa (i.e. palate, lip, pharynx, nasopharynx, larynx, para-pharyngeal space) ¹⁻³ which are buccal, labial, lingual, palatine, etc. Saliva is the watery substance produced in the mouths of humans and most other animals. Saliva is a component of oral fluid. Human saliva is composed of 98% water, while the other 2% consists of other compounds such as electrolytes, mucus, antibacterial compounds, and various enzymes. As part of the initial process of food digestion, the enzymes in the saliva break down some of the starch and fat in the food at the molecular level. Saliva also breaks down food caught in the teeth, protecting them from bacteria that cause decay. Furthermore, saliva lubricates and protects the teeth, the tongue, and the tender tissues inside the mouth. Saliva also plays an important role in tasting food, by trapping thiols produced from odorless food compounds by anaerobic bacteria living in the mouth ⁴⁻⁶.

2. Classification ⁷⁻¹⁰:**2.1 Major Salivary Glands:**

- Parotid Gland
- Submandibular Gland
- Sublingual Gland

2.2 Minor Salivary Glands:

- Lingual glands
- Labial glands
- Buccal glands
- Palatine glands

3. Stimulation ¹¹⁻¹⁵: The production of saliva is stimulated both by the sympathetic nervous system and the parasympathetic. The saliva stimulated by sympathetic innervations is thicker, and saliva stimulated Parasympathetically is more watery. Sympathetic stimulation of saliva is to facilitate respiration, whereas parasympathetic stimulation is to facilitate digestion. Parasympathetic stimulation leads to acetylcholine (ACh) release onto the salivary acinar cells. ACh binds to muscarinic receptors and causes an increased intracellular calcium ion concentration. Increased calcium causes the vesicles within the cells to fuse with the apical cell membrane leading to secretion formation. Both parasympathetic and sympathetic nervous stimulation can lead to myoepithelium contraction which causes the expulsion of secretions from the secretory acinus into the ducts and eventually to the oral cavity. Saliva production may also be pharmacologically stimulated by sialagogues. It can also be suppressed by antisialagogues.

4. Composition ¹⁶⁻²⁰: It is a fluid containing:

- Water
- Electrolytes:
 - 2-21 mmol/L sodium (lower than blood plasma)
 - 10-36 mmol/L potassium (higher than plasma)
 - 1.2-2.8 mmol/L calcium (similar to plasma)
 - 0.08-0.5 mmol/L magnesium
 - 5-40 mmol/L chloride (lower than plasma)
 - 25 mmol/L bicarbonate (higher than plasma)
 - 1.4-39 mmol/L phosphate

- Iodine (mmol/L usually higher than plasma, but dependent variable according to dietary iodine intake)
- Mucus
- Antibacterial compounds
- Epidermal growth factor.
- Various enzymes
- Various human and bacterial cells
- Opiorphin, a newly researched pain-killing substance found in human saliva.

5. Function²¹⁻²⁶:

- Providing a medium for dissolved and suspended food materials that chemically stimulate taste buds
- Buffering of the contents of the oral cavity through its high concentration of bicarbonate ion
- Digestion of carbohydrates by the digestive enzyme alpha-amylase
- Controlling the bacterial flora because of the presence of the antibacterial enzyme lysozyme.
- Source of calcium and phosphate ions essential for normal tooth maintenance
- Moistening dry foods to aid swallowing
- The complex mix of salivary constituents provides an effective set of systems for lubricating and protecting the soft and hard tissues.
- Saliva can encourage soft tissue repair by reducing clotting time and accelerating wound contraction.
- Maintenance of the ecological balance in the oral cavity via: debridement/lavage; aggregation and reduced adherence by both immunological and non-immunological means; and direct antibacterial activity.
- Saliva also possesses anti-fungal and anti-viral systems. Saliva is effective in maintaining pH in the oral cavity, contributes to the regulation of plaque pH, and helps neutralize reflux acids in the esophagus.

6. Spitting of Saliva²⁷⁻³⁰: Spitting or expectoration is the act of forcibly ejecting saliva or other substances from the mouth. It is currently considered rude and a social taboo in many parts of the world including the West, while in some other parts of the world it is considered more acceptable. It is possible to transmit infectious diseases in this way.

7. Tumors of salivary glands³¹⁻³⁵: Tumors arising from the salivary gland may arise from the salivary epithelium (the parenchyma) or the supportive stroma (mesenchymal).

Salivary gland tumors may also arise from any cellular component including the basal cells ductal, striated intercalated ducts, acini and the myoepithelial cells. Salivary glands tumors can be broadly subdivided into two main types based on biological behavior - benign and malignant neoplasms.

7.1 Benign Tumors: Benign parenchymal tumors are known as Adenomas. These tumors are well circumscribed and generally not associated with pain of any kind. Such tumor cells do not metastasize and do resemble parenchymal cells in some manners. E.g. Pleomorphic Adenoma, Monomorphic Adenoma, etc.

7.2 Malignant Tumors: Malignant tumors are known as adenocarcinomas. These tumors are not well circumscribed and generally associated with pain. Such tumor cells do metastasize and don't resemble parenchymal cells in any manner. E.g. Adenoid Cystic Carcinoma, Mucoepidermoid carcinoma, etc. these can be subdivided into low and high grade tumors.

8. Some patents on Saliva:

8.1 Saliva-monitoring biosensor electrical toothbrush³⁶: A biosensor electrical toothbrush having a brush head with a test channel and a renewable biosensor system within the test channel for performing routine saliva tests. The brush head stimulates saliva production and collection in the test channel where measurement signals are produced by sensors. The signals are transmitted for storage and analysis to a microprocessor that provides readable data signals reflective of the presence or quantitative level of a specific component of saliva. The brush handle contains the microprocessor, a display means, a battery, a motor and a reservoir for storing a reagent which is supplied in controlled quantities to the channel during saliva testing. The toothbrush is used to detect fertility periods, pregnancy, labor onset, alcohol concentration, blood glucose concentration and indicators that signal a need for comprehensive HIV testing. A test head without bristles may be used in place of a brush head to provide a saliva-monitoring oral device.

8.2 Method and apparatus for preserving human saliva for testing³⁷: A method and apparatus for the preservation of a saliva sample for use in subsequent quantitative chemical assays. The method involves collecting a saliva sample at a location,

directly into a specimen cup. The specimen cup contains a predetermined volume of aqueous solution of pH buffered saline and enzymatic inhibitor and is optionally adapted with a constituent compound specific, qualitative test unit.

8.3 Method and apparatus for collecting saliva³⁸: A method and apparatus for collecting saliva from a test subject comprises providing a flavored absorbent mass, such as a sponge, for mastication and charging with saliva and then expressing the saliva from the mass. Apparatus for this method comprises a barrel-piston arrangement in association with a specimen vial for storage until diagnostic testing.

8.4 Method of extracting human saliva³⁹: In a method of extracting human saliva a resilient absorbent inert body is chewed by a person and is subsequently introduced into a centrifuge tubule provided with an apertured floor. The centrifuge tubule is introduced into a centrifuge and subjected to a spinning process, whereupon the saliva is pressed out of the resilient body and passes through the floor into the lower part of the centrifuge tubule.

8.5 Saliva collector with an aspirating pipette⁴⁰: Saliva samples are collected for body fluid constituent analysis by placing a sponge member into a patient's oral cavity. The sponge member is formed similarly to a pacifier nipple. Saliva is absorbed. The saliva is then expelled from the sponge member into a pipette. A filter may be placed between the sponge member and the pipette, through which the saliva is cleaned and molecular weight-selectively prepared by letting only substances through with a molecular weight below a cut-off weight. The integral unit is dismembered after the saliva has been transferred into the collection pipette, and the latter is tightly closed off for further handling.

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