Al Rasheed College of Dentistry
Oral Histology
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Lecture 18

Salivary Glands (S.G.)

The oral cavity is kept moist by a film of fluid called saliva that coat the teeth and the mucous membrane. Saliva is a complex fluid, produced by salivary glands, the most important function of which is to maintain the well-being of the mouth. The total volume of saliva secreted per day is about 1-1.5 liter in humans.

S.G. are exocrine, merocrine, compound, acinar, either serous or mucous or mixed glands whose secretions flow into the oral cavity. S.G. are classified as either major or minor depending on their size and the amount of their secretions. Major S.G. are three pairs of large glands the parotid, submandibular, and sub lingual glands, which located extra orally and carry their secretion some distance to the oral cavity by means of a main ducts. While the minor S.G. are numerous small glands widely distributed in the submucosa of oral cavity such as labial lingual, palatal, buccal, glossopalatal and retromolar glands and these glands empty their products directly into the mouth by means of short ducts.

Oral fluid which is referred to as mixed or whole saliva includes the secretion of major and minor S.G., desquamated oral epith. cells, microorganism and their product, food debris and serum component and inflammatory cells that gain access in the gingival sulcus.

Composition of saliva: Saliva consists of 99% or more of water.

Organic constituents of saliva are as follows:

a. Enzymes: amylase, ribonuclease, kallikreins, esterase, hystatin, cystatin, peroxidase. lysozymes lactoferrin, acid phosphatase.
b. Immunoglobulins: IgG and IgM.
c. Other factors like blood clotting factors, amino acids, urea, uric acid, glucose are also present.

Development of S.G.:

S.G. are a major division of epithelial tissue. Consequently, glands derive from either the ectoderm or the endoderm layers. Glands can be classified in a variety of ways based on different criteria, but all glands arise in a similar fashion.

a. The epithelium invaginates into the underlying connective tissue, bringing the epithelial basal lamina with it.
b. The invagination develops a lumen that communicates to the original surface.
c. The invagination differentiates into a secretory unit at its furthest part and a duct.

Histology of S.G. :

Both major and minor S.G. composed of parenchyma elements are derived from oral epith. and consists of terminal secretary units either serous or mucous or a combination of the two called serous demilunes and these secretary into ducts that open into oral cavity. The C.T. forms a capsule around the gland and extends into it, dividing groups of secretary units and ducts into lobes and lobules, the blood and lymph vessels and nerves that supply the gland are contained within C.T.

S.G. acini:

The functional unit of the S.G. tissue is the secretary end piece or acinus, is a cluster of pyramid-shaped cells, either mucous, serous, or a combination of the two which is serous demilune. The secretions of these units are collected by ducts.

- Serous Cells: Usually arranged as acinar secretory 'units. The cells are pyramidal shaped and arranged in a spherical unit with the apices of the cells meeting to form a small lumen. Eosinophilic zymogen granules fill the cell apex. The nuclei are spherical and located toward the base of the cells, the function of secretory serous cells are: 1. Protein synthesis., 2. Glycosylation, which is the formation of linkages with glycosyl groups. In this, there is addition of a carbohydrate side to the amino acid side chain. 3.Production of salivary amylase enzyme in zymogen granules.
- Mucous Cells: Usually arranged as acinar or tubular secretory units. They have cuboidal cells arranged around a large lumen. The cuboidal cells have a thin rim of lightly stained cytoplasm rich in rough endoplasmic reticulum at their base, and flattened dark-stained nuclei also at the base.

  The apex is filled with large mucinogen droplets or granules, whose proteins have high sugar content. The secretory product of these granules is called

mucin or mucus, the lumen is larger than in a serous acinus. Mucous acini also drained by intercalated ducts same as serous acini. The secretory products of most mucous cells differ from those of serous cells in important respects: 1-They have little or no enzymatic activity, 2-Serve mainly for lubrication and protection of the oral tissue .3-The ratio of carbohydrate to protein is greater than serous secretion. 4- Mucous secreation contain-large amount of-sialic-acid.

Mixed Acini: Some acinar units are made up of a mixture of mucous and serous cells. These may be in one acinus, where groups of mucous and serous cells form the acinar unit. Most often, mixed acini are composed of a mucous acinus which is capped by a serous demilune, that is, a cap of serous cells sitting on a mucous acinus and the secretions enter a common duct, which may be intercalated.

S.G. Ducts:

All of the larger glands are compound glands with an extensive duct system. Duct systems share common features, and three divisions are recognized: 1) Intercalated; 2) Striated; and 3) Excretory ducts. These follow one another in sequence and appear in various planes of section interspersed with the acini of the gland. They can be recognized on the basis of their structure.

Intercalated Ducts: These are the smallest ducts, being much smaller than the diameter of the acini. They are lined by low cuboid cells and have a very small lumen. These are difficult to see and are only slightly bigger than capillaries, but they are very regular structures, with distinctive features.

Striated Ducts: These have about the same diameter as acini. They are the main ductal component located within the lobules of the gland, that is intralobular. They are regular and round in cross section, but the lateral borders of their columnar or high cuboidal cells are indistinct because of cell interdigitation. The nuclei are round and near the base. The cytoplasm is deeply eosinophilic and striated due to extensive basal membrane infolding and elongated mitochondria. The lumen of the striated duct is larger than those of the secretary acini and intercalated ducts. An important function of

striated duct cells is modification of the primary saliva by resorption and secretion of electrolytes.

Excretory ducts: The excretory ducts are located in the C.T. septa between the lobules of the gland, that is, in an interlobular location. They are larger in diameter than striated ducts and have pseudo stratified epith. with columnar cells extending from basal lamina to the ductal lumen and small basal cells that sit on the basal lamina but do not reach the lumen. The function of the excretory ducts are also electrolyte reabsorption and secretion such as the striated ducts.

Myoepithelial cells: They are contractile cells (contain the contractile filaments actin and myosin) associated with secretary acini and intercalated ducts of S.G. They have many similarities to smooth muscle but are derived from epith. These cells are present around the secretary acini and have stellate shape, numerous branching prosses extend from the cell body to surround and embrace the acinar. These cells are difficult to identify in routine histologic preparation, but their typical stellate shape can be observed in special histochemical technique. Their appearance is resembling the basket cradling the secretary units. Contraction of these cells is thought to provide support for the acini and intercalated ducts during active secretion of saliva.

Minor Salivary Glands: Minor S.G. are found through the oral cavity except in the anterior part of the hard palate and gingiva. They consist of several small groups of secretory opening via short ducts directly into the mouth. They lack capsule, instead mixing with the C.T. of the submucosa or between muscle fibers of the tongue.

The secretary acini of most minor S.G. are mucous or have small serous demilune. Lingual serous glands (Von Ebner glands) in the tongue below the circumvallates papillae are pure serous. Minor glands saliva is rich in mucins, various antibacterial proteins and secretary immunoglobulin. Minor S.G. secret continuously about 5% of total saliva.

Major Salivary Glands: There are three pairs:

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1. **Parotid Gland**: The largest salivary gland, weights 20-30gm and produce about 30% of total saliva. Its enclosed within a well-formed C.T. capsule, with its superficial portion lying in front of the external ear and its deeper part filling the retromandibular fossa. It`s a **pure serous** gland, but there is much fat tissue between the serous acini. These deposits of unilocular adiposities are scattered throughout the acinar tissue. The compound duct system shows intercalated, striated and excretory ducts. The intercalated ducts are long and branching, and a pale staining striated ducts are numerous. The main duct opens on the inside of the cheek, just opposite to the upper 2nd molar tooth. The duct is called **Stenson' s duct**
2. **Submandibular Gland**: Greatest output of salivary glands. Its weight 12-15gm and produce about 60% of total saliva. Also, well encapsulated. This gland consists of 90% serous acini and 10% mucous acini. The mucous acini occur in small patches distributed throughout the gland. Some mucous acini may be mixed, or show serous demilunes. The presence of light stained mucous acini may resemble the fat deposits in the parotid. The intercalated ducts tend to be somewhat shorter than those of the parotid, whereas the striated ducts are usually longer.
   The duct opens under the tongue and is called **Wharton's duct.**
3. **Sublingual Gland**: It's the smallest gland and it lies between the floor of the mouth and the mylohyoid muscle, its composed of main gland and several smaller glands. The main duct **(Bartholin's duct)** opens with or near the submandibular duct and several smaller ducts (2-20) open along the sublingual fold. It is poorly encapsulated and has **mixed acini**, mainly mucous with serous demilunes.

Functions of the saliva:

1. It keeps the oral tissue moist and facilities swallowing by moistening and lubrication the bolus and it facilitate speech.
2. It forms a protective coat minimizing the risk of abrasion of mucosa and it produce a fluid seal necessary for sucking.
3. It helps in digestion of food through the action of digestive enzymes mainly lipase, amylase and water.
4. It contains antimicrobial agent (lysosomes, peroxidase and immunoglobulin mainly IgA and small amount of IgM and IgG, which protect the oral tissue

by variety of mechanisms such as prevention of bacterial adhesion, agglutination of microorganisms and inhibition of its multiplication and metabolism.

5. It helps in protection of teeth from dental caries by means of both cleansing and buffering action due to bicarbonate which resist the fall in pH when acid is produce (pH of saliva varies from 6.7-7.4).

Salivary gland dysfunction So-called "dry mouth" (xerostomia, lack of saliva) can occur for many reasons. Decreased saliva can lead to difficulties in swallowing, tasting and speaking, can increase the chance of dental decay and other infections of the mouth, and can be caused by certain medications and medical treatments. More than 400 medicines can cause dry mouth, particularly those used for high blood pressure and depression treatments. Radiation therapy, chemotherapy and nerve damage can also lead to dry mouth. Diseases that affect the salivary glands include Sjogren's Syndrome,