Salivary Glands: A Brief View on Types, Anatomy & Histological Features

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Abstract

Salivary glands are crucial organs playing a vital role in the secretion of saliva in the oral cavity. During its morphogenesis a sequel of coordinated movements that are developmental processes occurred and the interaction of mesenchyme and epithelium generating the ductal system and secretory units. Salivary glands consist of major and minor glands that play different roles in saliva secretion. The maximum cell types of salivary glands are innervated by parasympathetic and sympathetic nerves. Histologically serous acini and mucous acini cell types can be seen with a network of the ductal system which includes striated, excretory and intercalated ducts, the external carotid artery maintain the blood supply of major salivary glands and the role of vasculature supply remaining unclear regarding the maintenance of saliva secretion which needs further investigation. The article throws light on its different types, its histological features, and its ductal system.

Keywords: *Salivary glands, serous acini, mucous acini, Ducts.*

Introduction

The human salivary glands are the major ones for maintaining the homeostasis of the oral cavity. They secrete saliva which is a multi-functional fluid that gives salivary electrolytes providing antibacterial property and help in mucosal lubrication which in return protecting the oral mucosa and teeth surface. Various types of enzymes are also secreted by salivary glands. The saliva secretion is very crucial in maintaining the oral hygiene and keeps the oral cavity moist. Reduction in the saliva may occur due to different reasons which involve loss of gland or degeneration and SG includes three pairs of glands i.e. parotid, submandibular and sublingual glands.

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These are considered major salivary glands and they are responsible for 90% of saliva secretion and rest are secreted by minor salivary glands. Minor salivary gland comprises of 600-1000 glands distributing through the whole oral –cavity. As these minor salivary glands, only less than 10% of saliva but they provide an important role in the main lubricant of saliva because of its mucous and protective components. The adult salivary glands include specialized cells which are acinar cells and myoepithelial cells that contribute to the secretion of saliva into the ducts.[1] Intercalated ducts are first structures that receive the initial secretion which is then conveyed to striated ducts, where changes occurred in several electrolytic between the extracellular matrix and the fluid salivary through the plasma membrane.

Classification of Salivary Glands:

- Based on its location and size – A. Major salivary glands B. Minor salivary glands

The major salivary glands are further classified into– parotid gland, submandibular gland, sublingual gland.

These all are located outside the oral cavity and the secretion reaches the mouth by the ductal system.

- Based on the types of secretion- A. Serous secreting glands-example such as parotid glands, von Ebner's gland.

B. Mucus secreting glands- examples such as glands of Blandin and Nuhn, glosso palatine glands.

C. Mixed glands- Such as submandibular gland & sublingual gland.[2]

Major Salivary Glands:

- Parotid Gland - The word originates from Para which means around and otic means ear. It is the largest salivary gland among all. It is characterized by serous cells as it is purely serious. It weighs about 15 grams.

Anatomy- The superficial part of this gland is present in front of the ear and the deepest portion lies or filling the retromolar fossa. The artery supply includes the external carotid artery, maxillary artery, and superficial temporal and posterior auricular artery. Facial nerves supply this gland with the union of the superficial temporal and maxillary vein.

Duct- Parotid duct which is also known as **Stenson's duct** crosses the masseter and then pierces the buccinators and then opens into papilla at buccal mucosa which is present opposite to the maxillary second molar. The duct sizes 4-6mm in length and 5 mm in the diameter. The blood supply is provided by ECE and veins drain into the external jugular vein. The lymph first drains into parotid notes and then t upper deep cervical lymph nodes. The parasympathetic fibers, sympathetic nerves, and sensory nerves are associated with the parotid gland. [3]

- Sub-mandibular Gland- This is the second-largest gland and is also known as the submaxillary gland. It is a mixed type of gland which includes both serious and mucous acini but the serous units are found to be dominating as compared to mucous units.

Anatomy - The superficial part of the gland lies in the digastric triangle and the deepest part is associated with or deep to mylohyoid and superficial to styloglossus and hyoglossus. They are supplied by the facial artery and the veins drain into a common lingual or facial vein. The lymphatic drains into the deep cervical and jugular group of nodes.

Duct- The important excretory duct includes the **Wharton's duct** that runs forward above the mylohyoid muscle which lies just below the mucosa and floor of mouth. It opens on the carnucula sublingual and lateral to the lingual frenum. The secretomotor pathway playing a crucial role in its nerve supply. [4]

- Sublingual Gland –This is the smallest salivary gland and weighs about 2gram. It contributes to the 2.5% secretion of total saliva.

Anatomy- It lies at the anterior part of the floor of mouth, which is just between the mylohyoid muscle and mucosa. It opens in the oral cavity by a series of small ducts i.e. duct of rivinus and opening along sublingually fold which opens through a large duct known as **Bartholin's duct.**

The blood supply is provided by sublingual and submental arteries and its lymphatic drains into the submental lymph nodes. The nerve supply including parasympathetic supply consisting of the facial nerve reaching the gland by the submandibular ganglion and lingual nerve and in sympathetic supply includes postganglionic fibers coming through the plexus on the facial artery.[5]

Minor Salivary Gland: The minor salivary gland ranges between 600-1000 in number and playing a crucial role in protecting and moistening the oral mucosa. It is present in the submucosa throughout the oral cavity. This gland is rich in anti-bacterial protein and rich in mucin and consists of secretory immunoglobulin.

Von Ebner's lingual Serous Gland- It is present in a tongue that opens in the circumvallate papillae on the dorsum of the tongue and also in the foliate papillae on another side of tongue. This gland secretes digestive enzymes and also proteins which play an important role in the taste process. [6]

Development of Salivary gland:

It includes different stages in the development of salivary glands, as follow:

- Stage 1 (Bud formation) – This stage starts with the proliferation of oral epithelium into the ectomesenchyme that is underlined and a thin basal lamina that separates the bud from the underlined mesenchyme and the epithelium interaction with condensing mesenchyme is responsible for gland formation.
- Stage 2 – This stage includes the formation and growth of epithelial chord. As the proliferation of epithelial buds in the underlined mesenchyme gives

the formation of epithelial cords and the MES also starts proliferating this is around the glandular epithelium. Basal lamina is found to be playing a vital role in influencing the differentiation and morphogenesis of the salivary glands.[7]

- Stage 3 - It includes the initiation of branching in the terminal part of the epithelial chord. The epithelial chord proliferating and ending with branch into bulbs.
- Stage 4- In this stage the cleft formation occurs and the ECM deposits within the clefts and the connective tissue component which is present below the epithelial chord forming capsule and surrounding the entire gland. The hypothesis including the interaction of epithelial-mesenchymal. Growth factor b which is transformed by fibroblasts growth factor family and their receptors. The stage notices the contraction of actin filament at the apical and basal ends.
- Stage 5- (Canalization):- In this stage the formation of lumen takes place at the distal ends of the chord and then it takes place in the proximal end and the central part in the last. The lumen develops in the terminal buds before that they form within the ducts. In this respective stage the apoptosis occurs of centrally placed cells and the proliferation of inner and outer layers of the epithelial chord occurs with the fluid secretion by ductal cells that increase the hydrostatic.
- Stage 6- (Cytodifferentiation)- In this stage which follows the formation of the lumen within terminal buds in which the epithelium including the two layers – the inner cells differentiate into the mucous or serous cell and the outer cells differentiate to myoepithelial cells which are present in and around the secretory and intercalated ducts. The result gives the main excretory duct which formed by epithelial bud portion that is close to the oral cavity as well as the secretory end piece forms by the distal portion.

Histology of Salivary Gland: The histology includes the acinar units, ductal system & connective tissue.

The acini is the basic functional unit of the salivary gland and the secretory unit is formed by serous cells, mucous cells, and myoepithelial cells. The cells in acini rest on a basement membrane and the central lumen which is star-shaped due to extension of the lumen between the cells resulting in intercellular canaliculi. The mucous acini have larger lumen as compared to serous acini and the continuing central lumen forming the excretory duct i.e. ductal system.[8]

Serous Cells- Morphologically it is pyramidal in shape with a broad base in the basement membrane and apex focusing toward the lumen. Finger-like extensions are noticed between the adjacent cells which are known as intercellular canaliculi which increase the size of cells of the luminal surface. The apical cytoplasm showing the secretory granules that are 1mm in diameter. The secretory granules including the zymogen granules and the glycolate proteins are stored in a vacuole. The desmosomes and adhering junction holds the adjacent cell and thus helps in cell signaling. The gap junction allowing the passage of ion and small molecule in between the cells.

Mucous Cells- the structure showing the apex of cells appears to be empty except for the thin strands of cytoplasm resulting in a trabecular network. Compressed nucleus and the rims of cytoplasm present against the base of the cell. Oval or flattered in shape nucleus can be observed which is located just above the basal plasma membrane. Large amount of secretory product is accumulated by mucous cells in the apical cytoplasm.[9]

The mucous secretion differs from serous secretion by two ways, which includes:

1. As they have less or no enzymatic activity and crucially serving the lubrication and protection action of oral tissues.
2. The ratio of carbohydrate to the protein is higher and a greater amount of sialic acid and often sulfated sugars is present.

Myoepithelial cells: These are the contractile cells attached with secretory end pieces and intercalated ducts of the salivary gland. These cells are similar to smooth cells but are derived from epithelium. They are located between the basal lamina and the ductal cells. Desmosomes connect the myoepithelial cells plasma membrane to the basal membrane of parenchymal cells. They are spider-like cells having nucleus flattened with flat perinuclear cytoplasm and secretory and duct cells are embraced by long branching process. Their appearance gives basket cells as basket cradling the secretory unit. The immunofluorescence studies indicating the presence of actin and myosin. A regular pulsatile movement of the entire unit occurs. These cells containcytokeratin

filament and actin filaments. This helps it to identified immunohistochemically. The function of these cells includes the acceleration of the initial outflow of saliva and contributing to secretary pressure in the duct. It also reduces the back permeation of fluids and supports the underlined parenchyma. Recent research has shown that myoepithelial cells playing a role in the signal to the secretory cells and protecting the salivary gland tissue. These cells also produce several proteins that have a tumor suppressor activity like as angiogenic factors that provide a barrier in fighting against the epithelial neoplasms. [10]

Ducts: The different ducts involved as- Intercalated ducts which are the smallest – striated ducts i.e. intralobular – excretory ducts (interlobular). The ducts play a main role in modifying saliva by the secretory and resorptive process. The intercalated ducts replace the damaged cells in the striated ducts. The striated ducts which are lined by tall columnar epithelial cells and the nucleus is placed centrally. Eosinophilic cytoplasm shows prominent striations at the basal end of cells, helping in the absorption of sodium, and excretion of bicarbonate and potassium. The excretory duct includes two layers which are mucosa and connective tissue adventitia. The transformation of stratified squamous epithelium from cuboidal occurs by ductal epithelium slowly.[11]

Connective tissue elements: These cells include macrophages, mast cells, fibroblasts, plasma cells, and fat cells. These cells are embedded in ground substance consisting of proteoglycans and glycoprotein. These elements tissue forming the capsule for gland and dividing the gland into lobules.[12]

Conclusion: Salivary gland which secretes saliva contains digestive enzymes like lingual lipase and amylase, these enzymes start breaking the food in the oral cavity or mouth and the chewing process the food mixes with saliva, thus starting the mechanical process of digestion and in return produces a bolus that can be swallowed down the esophagus entering into the stomach, wherein the stomach the gastric phase of digestion takes place. Thus saliva helps in food digestion and maintains oral hygiene by keeping the oral cavity moist and reducing it to dry to prevent the infection in the mouth. There are different disorders relating tothe salivary gland that includes sialolithiasis, sialadenitis, and many more. A disease known as Sjogren's syndrome results in the dry mouth, which is a disorder of salivary gland, that often occurs with lupus and rheumatoid arthritis.

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