Introduction

Saliva serves multiple and important functions. Three major, paired salivary glands produce the majority of saliva: the parotid, the submandibular, and the sublingual glands. In addition, 600-1,000 minor salivary glands line the oral cavity and oropharynx, contributing a small portion of total salivary production.

Embryology

The major salivary glands develop from the 6th-8th weeks of gestation as outpouchings of oral ectoderm into the surrounding mesenchyme. The parotid enlarge develops first, growing in a posterior direction as the facial nerve advances anteriorly; eventually, the fully developed parotid surrounds CN VII. However, the Parotid gland is the last to become encapsulated, after the lymphatics develop, resulting in its unique anatomy with entrapment of lymphatics in the parenchyma of the gland. Furthermore, salivary epithelial cells are often included within these lymph nodes. This is felt to play a role in the development of Warthin’s tumors and Lymphoepithelial cysts within the Parotid gland. The other major salivary glands do NOT have intraparenchymal lymph nodes.

The minor salivary glands arise from oral ectoderm and nasopharyngeal endoderm. They develop after the major salivary glands.

During development of the glands, autonomic nervous system involvement is crucial; sympathetic nerve stimulation leads to acinar differentiation while parasympathetic stimulation is needed for overall glandular growth. (9)
Anatomy

**Parotid Gland**

The parotid gland represents the largest salivary gland, averaging 5.8 cm in the craniocaudal dimension, and 3.4 cm in the ventral-dorsal dimension. The average weight of a Parotid gland is 14.28 g. It is irregular, wedge shaped, and unilobular. The Parotid has been described as having 5 processes (3 superficial and 2 deep), thus making it very difficult to surgically removal all parotid tissue. It lies in the parotid compartment, a triangular space which also contains CN VII and its branches, sensory and autonomic nerves, the External Carotid artery and its branches, the Retromandibular (Posterior Facial) vein, and Parotid lymphatics. The following lists the boundaries of the parotid compartment:

- Superior border – Zygoma
- Posterior border – External Auditory Canal
- Inferior border – Styloid Process, Styloid Process musculature, Internal Carotid Artery, Jugular Veins
- Anterior border – a diagonal line drawn from the Zygomatic root to the EAC

80% of the gland overlies the Masseter and mandible. The remaining 20% of the gland (the retromandibular portion) extends medially through the stylomandibular tunnel formed by the posterior edge of the mandibular ramus (ventral), SCM and posterior belly of the Digastric (dorsal), and the stylomandibular ligament (deep and dorsal). In addition, the Stylomandibular ligament separates the Parotid from the Submandibular gland. This portion of the gland lies in the Prestyloid Compartment of the Parapharyngeal space. Thus, a deep parotid tumor can push the tonsillar fossa and soft palate anteromedially. The isthmus of the Parotid gland runs between the mandibular ramus and the posterior belly of the Digastric to connect the retromandibular portion to the remainder of the gland.

The Parapharyngeal space is an inverted pyramid with its base at the skull base and its apex at the Greater Cornu of the Hyoid bone, bounded medially by the pharyngeal wall and laterally by the mandibular ramus and Medial Pterygoid muscle. This space is divided into pre- and post- styloid compartments by a line connecting the Styloid process and Medial Pterygoid plate. Deep lobe parotid tumors occupy the Prestyloid Compartment and tend to push the Carotid sheath laterally. Paragangliomas and nerve sheath tumors usually occupy the Poststyloid Compartment and tend to push the Carotid sheath medially. Parotid tumors that involve the Parapharyngeal space are referred to as dumbbell tumors.

The tail of the parotid overlies the upper ¼th of the Sternocleidomastoid muscle and extends toward the mastoid process. Patients with parotitis frequently have pain with mastication because the gland becomes trapped between the mandible and mastoid process upon opening of the mouth.

Stensen’s duct (parotid duct) arises from the anterior border of the Parotid and parallels the Zygomatic arch, 1.5 cm (approximately 1 finger breadth) inferior to the
inferior margin of the arch. Stensen’s duct runs superficial to the masseter muscle, then
turns medially 90 degrees to pierce the Buccinator muscle at the level of the second
maxillary molar where it opens onto the oral cavity. Using surface landmarks, Stensen’s
duct lies midway between the Zygomatic arch and corner of the mouth along a line
between the upper lip philtrum and the tragus. The buccal branch of CN VII runs with
the parotid duct. The duct measures 4-6 cm in length and 5 mm in diameter.

An accessory Parotid gland and duct are noted in 20% of people. The accessory
gland is typically found overlying the masseter, and the accessory duct typically lies
cranial to Stensen’s duct.

The Parotid is invested in its own fascia (capsule), which is continuous with the
superficial layer of deep cervical fascia. The Parotid fascia consists of
1) Superficial layer – extends from the masseter and SCM to the Zygoma, and
2) Deep layer – extends from the fascia of the posterior belly of the Digastric muscle,
and forms the Stylomandibular membrane separating the Parotid and Submandibular
glands.

The Parotid fascia sends septa into the glandular tissue, which prevents the possibility of
separating the glandular tissue from its investing fascia. The attachments of the Parotid
fascia include
1) Anterior – Mandible
2) Inferior – Stylomandibular ligament
3) Posterior – Styloid process

Of note, parotid tissue can herniate through the Stylomandibular membrane. Thus, deep
parotid tumors can present as parapharyngeal masses.

As mentioned previously, Cranial Nerve VII is intimately associated with the
parotid gland, dividing it into 2 surgical zones (the superficial and deep lobes). CN VII
exits the skull base via the stylomastoid foramen (styloid process-medial, mastoid
process-lateral). It immediately gives off three motor branches upon exiting the foramen:
1) To Stylohyoid muscle
2) To Postauricular muscle
3) To posterior belly of Digastric

After exiting the foramen, CN VII turns laterally to enter the Parotid gland at its
posterior margin. The nerve then branches at the Pes Anserinus (goose’s foot)
approximately 1.3 cm from the stylomastoid foramen. The nerve then gives rise to 2
divisions:
1) Temperofacial (upper)
2) Cervicofacial (lower)

Followed by 5 terminal branches:
1) Temporal
2) Zygomatic
3) Buccal
4) Marginal Mandibular
5) Cervical

Small communications are often present between the Temporal, Zygomatic, and Buccal branches. Four types of CN VII branching patterns have been described in the transition from divisions to terminal branches, and no one pattern predominates. Of note, branches of CN VII are more superficial at the anterior border of the Parotid gland, and are therefore more prone to injury there.

Localization of CN VII is critical intraoperatively. The following is a list of important surgical landmarks:
1) Tragal pointer – points to the main trunk of CN VII proximal to the Pes and 1-1.5 cm deep and inferior to the pointer
2) Tympanomastoid suture – traced medially, the main trunk of VII is encountered 6-8 mm deep to the suture line
3) Posterior belly of Digastric muscle – is a guide to the Stylomastoid foramen; the trunk of VII is just superior and posterior to the cephalic margin of the muscle
4) Styloid process – sits 5-8 mm deep to the Tympanomastoid suture; the trunk of VII lies on the posterolateral aspect of the Styloid near its base

Furthermore, retrograde dissection may be employed to trace one of the terminal branches proximally:
1) Buccal branch – runs with the parotid duct either superiorly or inferiorly
2) Temporal branch – crosses the zygomatic arch parallel with the superficial temporal artery and vein
3) Marginal Mandibular branch – runs along the inferior border of the parotid superficial to the retromandibular vein.

As a last resort, one can perform a mastoidectomy to identify the nerve at the stylomastoid foramen or to identify the intratemporal mastoid course of VII. The Stylomastoid foramen is the single most constant landmark.

The Great Auricular nerve passes from deep to superficial around the posterior border of the SCM, then travels superiorly, posterior to the External Jugular vein. This nerve, which arises from the cervical plexus, provides sensation to the posterior pinna and lobule. It is the first nerve encountered in surgery, lateral to the Parotid fascia and deep to the Platysma. The nerve is routinely divided during parotidectomy, and no benefit has been proven from preserving the posterior branch of the nerve (10).

The Auriculotemporal nerve, a branch of V-3, runs anterior to the EAM, paralleling the superficial temporal artery and vein. This nerve carries Parasympathetic postganglionic fibers from the otic ganglion to the Parotid gland. Thus, when this nerve is injured intraoperatively, aberrant parasympathetic innervation to the skin results in Frey’s Syndrome (i.e., gustatory sweating). This nerve may be resected intentionally to avoid Frey’s Syndrome. In addition, the Auriculotemporal nerve provides sensory
innervation to the parotid capsule, and the skin of the auricle and temporal region. As a result, referred pain from parotitis can involve the auricle, EAM, TMJ, and temples.

The most superficial portion of the Parotid makes up the neural compartment, containing CN VII, the Auriculotemporal nerve, and the Great Auricular nerve.

The arterial compartment sits in the deep portion of the gland containing the External Carotid, Internal Maxillary, and Superficial Temporal arteries. An effort should be made to spare the Superficial Temporal which supplies the temperoparietal fascial flap. This flap can be used to recontour defects left in the Parotid bed. Arterial supply is provided by the Transverse Facial artery from the Superficial Temporal artery, providing blood to the Parotid gland, Stensen’s duct, and the Masseter muscle. This artery runs between the zygomatic arch and Stensen’s duct.

The venous compartment sits in the middle of the Parotid, deep to CN VII. Venous drainage is provided by the Retromandibular vein, which lies deep to the Facial nerve. This vein runs lateral to the Carotid artery, and emerges at the inferior pole of the Parotid gland. The Retromandibular vein joins
1) The Postauricular vein to form the External Jugular
2) The Anterior Facial vein to form the Common Facial vein, which empties into the Internal Jugular.

Lymphatic drainage is unique in the Parotid with Paraparotid and Intraparotid nodes. The Paraparotid nodes are more numerous and drain the temporal region, scalp, and auricle. The Intraparotid nodes drain the posterior nasopharynx, soft palate, and ear. The Parotid lymphatics drain into the superficial and deep cervical lymph nodes.

**Submandibular Gland**

The Submandibular gland weighs ½ the weight of the Parotid. It is often referred to as the Submaxillary gland because of the tendency of British anatomists to refer to the mandible as the ‘submaxilla’. This gland lies in the submandibular triangle formed by the anterior and posterior bellies of the Digastric muscle and the inferior margin of the mandible. The gland is positioned medial and inferior to the mandibular ramus partly superior and partly inferior to the base of the posterior half of the mandible. The gland forms a ‘C’ around the anterior margin of the Mylohyoid muscle, which divides the Submandibular gland into a superficial and deep lobe. The deep lobe comprises the majority of the gland. The Marginal Mandibular branch of CN VII courses superficial to the Submandibular gland and deep to the Platysma.

As is the case with the Parotid gland, the Submandibular gland is invested in its own capsule, which is also continuous with the superficial layer of deep cervical fascia.

The Submandibular duct (Wharton’s duct) exits the medial surface of the gland and runs between the Mylohyoid (lateral) and Hyoglossus muscles and on to the Genioglossus muscle. Wharton’s duct empties into the intraoral cavity lateral to the
lingual frenulum on the anterior floor of mouth. The length of the duct averages 5 cm. The Lingual nerve wraps around Wharton’s duct, starting lateral and ending medial to the duct, while CN XII parallels the Submandibular duct, running just inferior to it. The identification of CN XII, the Lingual nerve, and Wharton’s duct is absolutely essential prior to resection of the gland.

Innervation to the Submandibular gland derives from 2 important sources:
1) Sympathetic innervation from the Superior Cervical ganglion via the Lingual artery, and
2) Parasympathetic innervation from the Submandibular ganglion, which is fed by the Lingual nerve

Arterial supply to the Submandibular gland comes from the Submental branch of the Facial artery (off of the External Carotid artery). The Facial artery forms a groove in the deep part of the gland, then curves up around the inferior margin of the mandible to supply the face. The Facial artery and vein are the first blood vessels encountered when resecting the Submandibular glands as they cross superficially over the inferior border of the mandible. The Facial vein courses over the lateral surface of the Submandibular gland. One method of preserving the Marginal Mandibular nerve is to identify and ligate the Facial vein 2-3 cm inferior to the mandible and elevate the vein and all superior tissue superiorly.

Venous drainage is provided by the Anterior Facial vein, which lies deep to the Marginal Mandibular branch of CN VII.

Lymphatic drainage goes to the deep cervical and jugular chains of nodes. Perivascular lymph nodes near the Facial artery are often involved with cancer originating in the Submandibular gland, and these nodes should be removed with Submandibular resection.

Sublingual Gland

This is the smallest of the major salivary glands. The almond shaped gland lies just deep to the floor of mouth mucosa between the mandible and Genioglossus muscle. It is bounded inferiorly by the Mylohyoid muscle. Wharton’s duct and the Lingual nerve pass between the Sublingual gland and Genioglossus muscle.

Unlike the Parotid and Submandibular glands, the Sublingual gland has no true fascial capsule.

Also unlike the Parotid and Submandibular glands, the Sublingual gland lacks a single dominant duct. Instead, it is drained by approximately 10 small ducts (the Ducts of Rivinus), which exit the superior aspect of the gland and open along the Sublingual fold on the floor of mouth. Occasionally, several of the more anterior ducts may join to form a common duct (Bartholin’s duct), which typically empties into Wharton’s duct. Of
note, the ducts of the sublingual glands are too small for the injection of contrast, making a sialogram of this gland impossible.

Innervation to the Sublingual gland derives from 2 important sources:
1) Sympathetic innervation from the cervical chain ganglia via the Facial artery
2) Parasympathetic innervation, like the Submandibular gland, is derived from the Submandibular ganglion

Arterial supply to this gland is two-fold:
1) The Sublingual branch of the Lingual artery, and
2) The Submental branch of the Facial artery

Venous drainage reflects the arterial supply.
Lymphatic drainage goes to the Submandibular nodes.

**Minor Salivary Glands**

Unlike the major salivary glands, the minor salivary glands lack a branching network of draining ducts. Instead, each salivary unit has its own simple duct. The minor salivary glands are concentrated in the Buccal, Labial, Palatal, and Lingual regions. In addition, minor salivary glands may be found at the superior pole of the tonsils (Weber’s glands), the tonsillar pillars, the base of tongue (von Ebner’s glands), paranasal sinuses, larynx, trachea, and bronchi.

The most common tumor sites derived from the minor salivary glands are the palate, upper lip, and cheek.

Most of the minor glands receive parasympathetic innervation from the Lingual nerve, except for the minor glands of the palate, which receive their parasympathetic fibers from the Palatine nerves, fed by the Sphenopalatine ganglion.

**Imaging of the Salivary Glands**

CT, MR, and ultrasound are the imaging modalities of choice with respect to the salivary glands. As a general rule, most radiologists recommend CT for inflammatory diseases and MR for the evaluation of tumors. In children, radiologists recommend ultrasound and MR: ultrasound for inflammatory or superficial disease, and MR for deeper masses. (9)

Contrast generally is NOT useful in the evaluation of the salivary glands. MR with contrast may help distinguish a solid tumor from a cystic mass. In addition, contrast is useful when evaluating for perineural spread.

Sialograms used to be the mainstay of major salivary gland imaging, and they remain the most detailed way to image the ductal system. In addition, a sialogram is the only imaging modality that can diagnose early Sjogren’s Disease. However, sialograms
are contraindicated in active infection and in patients allergic to contrast. Thus, there is rarely a need to perform sialography.

Characteristically, the healthy parotid gland is fatty with numerous thin strand-like structures interlacing through it. In children and some adults, a clinically normal parotid can have less fat content, making it difficult to distinguish a healthy from a diseased parotid in those individuals. Normally, the facial nerve is NOT imaged.

The submandibular glands are less fatty than the parotid glands. As a result, the submandibular glands are more homogenous and cellular on imaging; furthermore, the gland’s thicker mucoid secretions can normally be identified in the major collecting ducts. After the administration of contrast, both submandibular glands should enhance to the same degree, otherwise one gland is functioning abnormally.

**Microanatomy of the Salivary Glands**

The secretory unit (salivary unit) consists of the acinus, myoepithelial cells, the intercalated duct, the striated duct, and the excretory duct. All salivary acinar cells contain secretory granules; in serous glands, these granules contain amylase, and in mucous glands, these granules contain mucin. Acini, responsible for producing the primary secretion, are divided into 3 types:

1) Serous (protein-secreting)=spherical cells rich in zymogen granules
2) Mucous (mucin-secreting)=more tubular shaped cells; mucinogen granules are washed out on H&E preparations giving an empty cell appearance
3) Mixed=serous demilunes, or predominantly mucous acinar cells capped by a few serous acinar cells

Myoepithelial cells send numerous processes around the acini and proximal ductal system (intercalated duct), moving secretions toward the excretory duct.

The lumen of the acinus is continuous with the ductal system, made up of (from proximal to distal) the intercalated duct, the striated duct, and the excretory duct. The intercalated duct is lined by low cuboidal epithelial cells rich in carbonic anhydrase. These cells secrete bicarbonate into the ductal lumen and absorb chloride from the lumen.

The striated duct is lined by simple cuboidal epithelial cells proximally with infoldings of the basal and basolateral plasma membrane and associated mitochondria (producing “striations”). These cells absorb Na from the lumen, secrete K into the lumen, and produce an increasingly hypotonic fluid. The faster the salivary flow rate, the less time allowed for these cells to act, resulting in a less hypotonic product.

Excretory ducts are lined by simple cuboidal epithelium proximally and stratified cuboidal or pseudostratified columnar epithelium distally. These cells do NOT perform any modification of the saliva.
Of note the intercalated duct is short and poorly developed in mucous glands, while the striated duct is nonexistent in mucous glands. However, both of these ducts are well developed in serous glands, where the secretion is heavily modified. Mucous glands, in contrast, do not significantly modify the primary secretion.

The basal cells of the intercalated duct and the excretory duct are capable of giving rise to all fully differentiated ductal epithelial cells. This is a significant feature with respect to the Bicellular Theory of tumorogenesis, which states that all tumors of the salivary glands arise from either the Intercalated duct stem cells (Pleomorphic adenoma, Warthin’s, Oncocytoma, Acinic Cell, Adenoid Cystic, Oncocytic CA) or the Excretory duct stem cells (Squamous cell, Mucopepidermoid). The state of differentiation of the stem cell determines whether a tumor is benign or malignant. The Bicellular Theory, however, has been more or less abandoned in favor of the Multicellular Theory of tumorogenesis, which states that salivary gland tumors arise from the differentiated cells of the salivary gland unit (i.e., acinar cells, striated duct epithelium, excretory duct epithelium, intercalated duct epithelium, and myoepithelial cells).

The Parotid gland is a purely serous salivary gland. Of note, the Parotid gland is unique in that it contains many fat cells; in fact, the adipocyte to acinar cell ratio in the Parotid is 1:1.

The Submandibular gland is mixed, but predominantly serous. Approximately 10% of its acini are mucinous.

The Sublingual gland is mixed, but predominantly mucous. Of the major salivary glands, the Sublingual gland utilizes a simple system of transport, whereas the Parotid and Submandibular glands involve elaborate networks.

Salivary gland stroma is rich in lymphocytes and plasma cells, which are responsible for the production of IgA. IgA fuses with the secretory piece on the basal membrane, is then transported across the epithelial cell, and released into the ductal lumen as secretory IgA.

**Function of Saliva**

At least 8 major functions of saliva have been identified (8):

1) Moistens oral mucosa. In fact, the mucin layer on the oral mucosa is thought to be the most important nonimmune defense mechanism in the oral cavity.

2) Moistens dry food and cools hot food.

3) Provides a medium for dissolved foods to stimulate the taste buds.

4) Buffers oral cavity contents. Saliva has a high concentration of bicarbonate ions.

5) Digestion. Alpha-amylase, contained in saliva, breaks 1-4 glycoside bonds, while lingual lipase helps break down fats.

6) Controls bacterial flora of the oral cavity.

7) Mineralization of new teeth and repair of precarious enamel lesions. Saliva is high in calcium and phosphate.
8) Protects the teeth by forming a “Protective Pellicle”. This signifies a saliva protein coat on the teeth which contains antibacterial compounds. Thus, problems with the salivary glands generally result in rampant dental caries.

Lysozyme, Secretory IgA, and Salivary Peroxidase play important roles in saliva’s antibacterial actions. Lysozyme agglutinates bacteria and activates autolysins. IgA interferes with the adherence of microorganisms to host tissue. Peroxidase breaks down salivary thiocyanate which, in turn, oxidizes the enzymes involved in bacterial glycolysis. However, salivary flow rate may play a more important role in oral hygiene than any of these factors.

The intraoral complications of salivary hypofunction include (4)
1) Candidiasis
2) Oral Lichen Planus (usually painful)
3) Burning Mouth Syndrome (normal appearing oral mucosa with a subjective sensation of burning)
4) Recurrent aphthous ulcers
5) Dental caries

The best way to evaluate salivary function is to measure the salivary flow rate in stimulated (e.g., by using a parasympathomimetic such as pilocarpine) and unstimulated states. Xerostomia is NOT a reliable indicator of salivary hypofunction.

The Cephalic Phase response refers to the effects that the sensory stimuli have on the physiologic response to food. This is neuronally mediated via the parasympathetic nervous system. There is a hierarchy of sensory stimuli such that swallow>mastication>taste>smell>sight>thought. Stimulation results in an increase in total salivary flow from 0.3 cc/min to >1 cc/min. In addition, the magnitude of salivary response is directly related to a subject’s state of hunger (6).

Production of Saliva
The production of saliva is an active process occurring in 2 phases:
1) Primary secretion – occurs in the acinar cells. This results in a product similar in composition and osmolality to plasma.
2) Ductal secretion – results in a hypotonic salivary fluid. It also results in decreased sodium and increased potassium in the end product.

The salivary ducts rely heavily on the Na/K/2Cl cotransporter. The duct cells maintain a negative resting membrane potential, and these cells hyperpolarize secondary to the efflux of potassium and influx of chloride with autonomic nervous stimulation. This is unusual, and is referred to as the “secretory potential”, because most excitable cells depolarize (rather than hyperpolarize) with stimulation.

The degree of modification of saliva in the ducts turns heavily on salivary flow rate. Fast rates result in a salivary product more like the primary secretion (but it should
be noted that saliva is ALWAYS hypotonic to plasma). Slow rates result in an increasingly hypotonic and potassium rich saliva.

In general, saliva is composed of 99.5% water in addition to proteins, glycoproteins, and electrolytes. Saliva is high in potassium (7x plasma), bicarbonate (3x plasma), calcium, phosphorous, chloride, thiocyanate, and urea. Saliva is low in sodium (1/10 x plasma). The normal pH of saliva is 5.6-7.

**Autonomic Innervation**

The parasympathetic nervous system is the primary instigator of salivary secretion. Interruption of parasympathetic innervation to the salivary glands results in atrophy, while interruption of sympathetic innervation results in no significant change in the glands. It was once thought that the sympathetic nervous system antagonizes the parasympathetic nervous system with respect to salivary output, but this is now known not to be true.

Stimulation by the parasympathetic nervous system results in an abundant, watery saliva with a decrease in [amylase] in saliva and an increase in [amylase] in the serum. Acetylcholine is the active neurotransmitter, binding at muscarinic receptors in the salivary glands. In the case of the parotid, parasympathetic fibers originate from CN IX, travel via the Lesser Superficial Petrosal nerve to synapse in the Otic ganglion, then to the Auriculotemporal nerve and finally the salivary gland. In the case of the Submandibular and Sublingual glands, the parasympathetic fibers originate in CN VII, travel via the Chorda Tympani to the Submandibular ganglion, then release acetylcholine in close proximity to the glands with no true postganglionic synapses.

Stimulation by the sympathetic nervous system results in a scant, viscous saliva rich in organic and inorganic solutes with an increase in [amylase] in the saliva and no change in [amylase] in the serum. For all of the salivary glands, these fibers originate in the Superior Cervical ganglion then travel with arteries to reach the glands:
1) External Carotid artery in the case of the Parotid
2) Lingual artery in the case of the Submandibular, and
3) Facial artery in the case of the Sublingual.

**Salivary Flow**

The average volume of saliva secreted in a 24 hour period is 1-1.5 liters (approximately 1 cc/minute), most of which is secreted during meals. The basal salivary flow rate=0.001-0.2 ml/minute/gland. With stimulation, salivary flow rate=0.18-1.7 ml/min/gland. Salivary flow rate from the minor salivary glands is independent of stimulation, constituting 7-8% of total salivary output.

In the UNSTIMULATED state the relative contribution of the major salivary glands is as follows:
1) Submandibular gland=69%
2) Parotid gland=26%
3) Sublingual gland=5%

In the STIMULATED state the relative contribution of the major salivary glands is as follows:
1) Parotid gland=69%
2) Submandibular gland=26%
3) Sublingual gland=5%

Though the Sublingual glands and minor salivary glands contribute only about 10% of all saliva, together they produce the majority of mucous and are critical in maintaining the mucin layer over the oral mucosa.

Ptyalism, or drooling, may be secondary to salivary hypersecretion. This is caused either by excessive salivary flow, or a salivary flow rate which surpasses the ability to swallow the saliva. Possible surgical treatments for Ptyalism are tympanic neurectomies (eliminating parasympathetic innervation to the Parotid gland) or Parotid duct rerouting.

80-90% of salivary gland stones occur in the Submandibular gland, and of those, 85% occur in Wharton’s duct. Complete ductal obstruction generally results in atrophy of the gland, while partial obstruction usually results in glandular mucocele.

Effects of Aging

Acinar cells do degenerate with age. However, total salivary flow rates have been found to be independent of age. Xerostomia, or the subjective complaint of dry mouth, must be distinguished from the objective finding of decreased salivary flow. Xerostomia in the elderly is generally either secondary to medications or to systemic disease.

The Submandibular glands are more sensitive to metabolic and physiologic changes. Thus, it is salivary flow in the unstimulated state which is more greatly affected by such changes.

References


