

Preventive Dentistry
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Lec. 18: Saliva and Dental Caries

By Professor Dr. Sulafa El Samarrai

Saliva is a unique complex and important body fluid and contain a number of systems to protect oral mucosa and the whole body from oral infections. It is the pure secretion from salivary gland that tend to be sterile until entrance to the oral cavity. Saliva in daily use is synonymous with spittle, whole saliva, mixed saliva and oral fluid.

Oral fluid: represent all the fluid present at any time in the oral cavity. It is made of secretions of:

- Major salivary glands are: Parotid, sub mandibular, sublingual.
- Minor salivary gland: 200 – 400 glands
- Gingival exudates (; gingival crevicular fluid)
- Food debris
- Desquamated epithelial cells in addition to microorganisms
- others (transudate of oral mucous membrane, mucous secretion from nose and pharynx, gastric acid).

General functions of saliva:

- 1- Physiological functions (lubrication, digestion, oral clearance, speech, taste, swallowing)
- 2- Maintenance of health of oral tissues.
- 3- Buffer capacity
- 4- Reservoir for ions facilitating re- mineralization of teeth
- 5- Antimicrobial prosperities
- 6- Others (water balance, agglutination, route of excretion of substance that reabsorbed by GIT)

Composition of saliva: it is mainly composed of **water** (99.4 – 99.5%), organic (protein, carbohydrates and lipids), and inorganic (electrolytes, as Ca, PO₄, Mg, K, CL, and others). Many factors may affects salivary constituents these are:

- 1- **Salivary flow rate:** The type and concentrations of organic and inorganic constituents of saliva differ between stimulated and un stimulated (; resting) saliva. For example the level of bicarbonate increases from 1 mmol/L in un stimulated saliva to 60 mmol/L in stimulated. Also the level of Ca, Na, and CL increase by stimulation at the time other minerals fall in concentration in stimulated saliva as Mg, K, phosphate.
Note: 50% of stimulated saliva is secreted from parotid gland, while for un stimulated saliva 69% secreted from the submandibular gland followed by the parotid and other glands.
- 2- **Nature of stimulation:** Salivary glands are innervated by parasympathetic and sympathetic. Parasympathetic stimulation increases in water and electrolyte levels. While sympathetic stimuli increases mucous secretions.
There are three types of stimulations; chemical, mechanical and psychological stimuli. Each may affect composition of saliva for example taste of salt stimulates protein secretions.
Note: Acids is a potent stimuli for secretion and leads to production of alkaline saliva.
- 3- **Duration of stimulations:** Increase time of the stimuli cause an increase in water, bicarbonate and protein but decrease chloride.
- 4- **Ages:** With age there is an increase in Ca and phosphate concentrations.
- 5- **Others:** as medications , diseases (as diabetes) and exercises, genetics.

Salivary flow rate: In healthy adult about 0.5 – 1 ml of saliva is present at any time in the mouth. A total volume of 1 – 1.5 L of saliva is secreted daily. The normal salivary flow rate for un stimulated (resting) saliva is 0.3 ml/ min while for stimulated saliva is 2 ml/min. However there is a wide individual variation. Many factors affect salivary flow rate these are:

- 1- **Nature of stimulations:** Mechanical stimulations cause more watery saliva.
- 2- **Gland size:** Salivary flow rate is more in males compared to females due to larger gland size.

- 3- **Age:** Flow rate increases with age.
- 4- **Drugs:** Anti-depressants and analgesics reduce flow rate.
- 5- **Others:** Body posture (saliva is more in standing than seated, the least in lying), time of the day (; circadian rhythms: saliva peak in afternoon) and season (; circannual rhythms: saliva more in winter than summer).

Saliva and Dental Caries:

Animal studies showed that de-salivated experimental animals fed cariogenic diet develop rampant caries. Observational human studies also showed an increase in caries severity with reduced salivary flow rate.

There are many reasons explain the increase in incidence and severity of dental caries associated with the reduction of saliva:

1- ***Reduction in the quantity of saliva***; thus its protective constituents in addition to the reduction the in important physiological function that is the oral clearance. Salivary constituents involves calcium and phosphate the important elements in re-mineralization of teeth. In addition to elements as fluoride, zinc, strontium which may present in saliva and aid in re-mineralization of the outer enamel surfaces. An important function of saliva is to dilute substances introduced in the oral cavity. This is through salivary oral clearance.

Saliva enhances the eliminations of food debris, carbohydrates and acid produced by cariogenic bacteria.

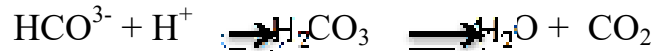
2- ***Reduction in the buffer system***; Acid produced by bacterial plaque leads to fall in the pH to even less than 5.5. This pH is known as the **critical pH of saliva** (at which there will be dissolution of enamel surface). By the buffer action of saliva the pH increases to normal which is around 7 pH.

3- ***Alteration in amount and bacteriological composition***; the reduction in saliva leads to the reduction in the oral immune system. The reduction in the buffer capacity leads to acidic medium in the mouth favoring the growth of bacteria especially cariogenic bacteria as *mutans* streptococci.

Buffer System of Saliva:

Buffer means a solution that tends to maintain constant pH. The salivary buffer system composed of bicarbonate/carbonic acid and phosphate. In addition to urea and protein. Buffers differ between stimulated and unstimulated saliva. In stimulated saliva the main buffer is the bicarbonate.

When acid is formed it will react with carbonate forming a carbonic acid that decompose rapidly to water and carbon dioxide. This CO₂ escape the solution leads to increase in concentration of carbonic acid, causing more reaction between acid and bicarbonate till the removal of all acid.



In un stimulated saliva the main buffer is phosphate. When the pH decrease below 5.5, dissolution of apatite crystal take place freeing phosphate. Phosphate attempts to restore the pH balance, increasing pH level and allowing for the re – mineralization of enamel.

Other buffers are present as urea, proteins and peptides, all play a role in buffering saliva.

Note: pH is the negative logarithm of the hydrogen ion concentration. The pH of saliva ranges 6.7- 7.4 with great individual variation.

Hypo Salivation and Xerostomia:

The reduction in the salivary flow rate is known as hypo salivations in severe cases it is known as Xerostomia. This may lead to increase severity of dental caries and even some times rampant caries.

Management:

- 1- Oral hygiene measures and dietary restrictions.
- 2- Avoid drugs lead to Xerostomia as anti -depressant, anti-hypertensive (consult a physician).
- 3- Use fluoridated products (self- applied as dentifrices and mouth rinses) and professional applied topical agents.
- 4- Use of artificial saliva.