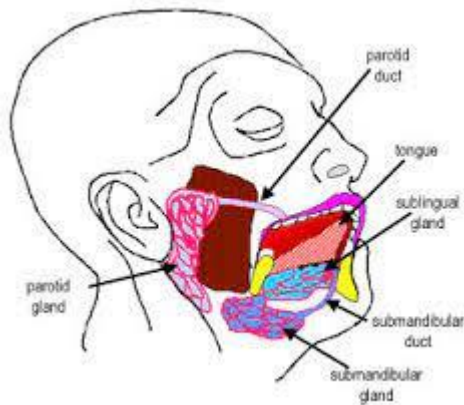


Saliva and dental caries



Dr. Dhuha M. Hasan

---Pure saliva secreted by the oral glands is sterile until it is discharged onto the mouth.

major salivary glands, parotid glands are the largest; the submandibular gland is smaller than the parotid glands. The sublingual gland is composed of several smaller glands.

The minor glands situated on the tongue, palate and buccal and labial mucosa. These glands produce 10% of the total volume of saliva.

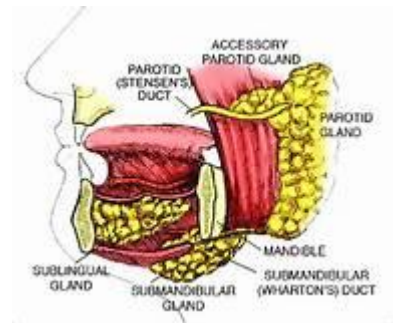
The function of the minor salivary glands is also important since about 70 % of the total volume of salivary proteins is secreted by them. They also contribute fluoride that bathes the teeth and enhances caries resistance.

The parotid glands are serous glands with high content of enzymes like amylase and lipase,

sublingual glands are predominantly mucous, mucin-rich fluids, as same as of minor salivary glands.

submandibular glands are a mixture of mucous and serous fluids.

The word saliva is synonymous with spittle, whole saliva, mixed saliva and oral fluid



Oral fluid which include all the fluid present in the mouth and it is made by

1- secretion of salivary glands

2- gingival crevicular fluid

3- food debris

4- microorganisms

5- human cells

6- desquamated oral epithelia

7- transudate of the mucous membrane and mucous from nasal cavity and pharynx,

8- sometimes it may include acid from the stomach in cases of gastric reflux.

Function of saliva:

- **Lubrication**

- **Digestion**

- **Ion reservoir**

Taste

- **Clearance**

- **Maintenance** of healthy oral tissues.

- **Buffer.**

- **Route of excretion**

- **Antimicrobial actions** by specific and nonspecific immune components).

- **Agglutination**

- **Water balance.**

Oral clearance

An important function of saliva is therefore to dilute and eliminate substances. This is a physiological process usually referred to as salivary clearance.

.

The saliva film is moving slowly towards the throat with a speed varying from about 1 to 8 mm/min

Composition of saliva

The composition of saliva varies, depending on whether it is stimulated or unstimulated (resting). The submandibular gland secretes the greatest proportion of the unstimulated saliva (69%) followed by the parotid, sublingual and minor glands.

Saliva is composed of about 99.5% water and 0.5% solid of which about half is inorganic and about half is organic

The most important ions for maintaining the ionic strength of saliva are sodium, potassium and chloride.

Factors influencing salivary composition

1- **Flow rate**: flow rate increases, the pH and other constituents like protein, sodium, calcium, chloride and bicarbonate rise. While other constituents fall (magnesium, potassium and phosphate).

2- **Glandular source**: The parotid glands normally contribute 20% of the total volume of unstimulated saliva, while at high flow rate the parotid glands contribute 50% of the whole saliva.

3- **Duration of stimulation**: Bicarbonate, protein and calcium concentration increases with duration of stimulation whereas decreased chloride.

4- **Nature of stimulus**: The taste of salts stimulated much the higher protein content. Acid is the most potent stimulus for salivary secretion and leads to production of an alkaline saliva. The pH of saliva is dependent mainly on the flow rate and is independent of the nature of the stimulus.

5- Others like **medications** (Antidepressants, diuretics, antihistamines and narcotics), various diseases (Autoimmune diseases, diabetes mellitus, salivary glands stones, malnutrition) and exercises.

Salivary flow rate

important clinical parameter of saliva affecting dental caries susceptibility.

A reduced salivary flow rate results in reduced defense capacity and increased susceptibility to oral diseases.

A low flow rate can affect oral sugar clearance negatively, reducing salivary pH, and influencing the concentrations of various salivary components in particular the antimicrobial factors. A total volume of about 0.5 - 1 liters of saliva is secreted daily.

Hyposalivation

is not the same thing as xerostomia.

Hyposalivation describing a condition where the flow rates of saliva are abnormally low. unstimulated whole saliva flow rate is 0.1 ml/min and that of paraffin-chewing stimulated whole saliva is 0.5–0.7 ml/min (for women and men, respectively).

Xerostomia may be symptomless, although xerostomia most often is associated with low saliva flow rates. In general, healthy individuals with a normal salivary flow rate can experience xerostomia, like those breathing through the mouth. 25 % of general population complain of xerostomia

Factors influencing salivary flow rate

- 1- **Age:** The flow rate increases gradually with age.
- 2- **Gland size:** Flow rate is less in females than for males due to a larger size of glands among males.
- 3- **Nature of stimulus:** Mechanical stimulation leads to increase salivation.
- 4- **Medications** like antidepressants, antihypertensive reduce salivary flow rate.
- 5- Other factors like **circadian** (Sodium and chloride levels peak in the early morning while the peak protein is in the late afternoon) and **circannual** rhythms (flow is lower in warm weather and higher in cold), **body position**; a person when standing will have a higher flow rate than sitting and when a person is lying down. it's almost zero during sleep.

Influence of saliva on dental caries

. **The static effects** exerted continuously, throughout the day and include effects on bacterial composition of plaque through antibacterial or metabolic factors, protective effects of pellicle formation, and effects of salivary ions in maintaining a supersaturated environment for the tooth mineral.

Dynamic effects, mobilized over the time-course of the Stephan curve. These include the clearance of the carbohydrate challenge and of the acid products of plaque metabolism, and the alkalinity and buffering power to restore plaque pH towards neutrality. These dynamic effects are **related to the level of salivary stimulation**, and are thus activated during eating or drinking, i.e., approximately when their action is required.

- ❑ the clearance of cariogenic microorganisms**
- ❑ Saliva may remineralize early carious lesion**
- ❑ Inorganic components of saliva (calcium, phosphate, fluoride) increase the resistance of hydroxyapatite**
- ❑ Salivary buffering effect (bicarbonate, phosphate and some protein systems**

Bicarbonate may buffer against pH fall

bicarbonate found in saliva is present as a result of carbohydrate metabolism, through anaerobic glycolysis and the citric acid cycle.

When an acid is added bicarbonate release a weak carbonic acid, which rapidly decompose to water and carbon dioxide that leave the solution. The increase in the carbonic acid concentration lead to more carbon dioxide escape from saliva making it possible for more bicarbonate to bind to hydrogen ions (H⁺), which will end in the removal of the acid.



The phosphate buffer

When the pH falls below the critical level (5.5) the HA begins to dissolve, freeing phosphates that attempt to restore the pH balance.

Certain proteins, such as histatins or sialin, as well as certain alkaline products generated by the metabolic activity of bacteria on amino acids, peptides, proteins and urea, are also important for controlling the pH of the saliva

**(mechanical plaque
control)**

In periodontal therapy, plaque control serves two purposes:

1-To minimize gingival inflammation.

2. To prevent recurrence or progression of periodontal disease in treated mouth.

Toothbrushes: They were first introduced in China as early as 1600 B.C. Through the years toothbrushes have undergone changes in many ways as possible. By early nineteenth century the handles were constructed from gold, Ivory or ebony in which replaceable brush heads could be fitted. Nylon bristles came into use in 1938 to replace the natural bristles. Nylon bristles flex as many as 10 times more often than natural bristles before breaking; they do not split or abrade and are easier to clean. The shape and stiffness of nylon bristles can be standardized. Natural bristle diameters vary greatly in each filament.

Types of toothbrushes:

- ☐ Manual toothbrush.
- ☐ Powered toothbrush.
 - ☐ Sonic and ultrasonic toothbrush.
- ☐ Ionic toothbrush.

☐ Manual toothbrush: It should be easily and effectively manipulated, inexpensive.

Parts of toothbrush:

- 1-Handle: The part grasped in the hand during tooth brushing.
2. Head: The working end of a toothbrush that holds the bristles.
3. Tufts: Clusters of bristles secured into head.
4. Shank: The section that connects head and handle.

Toothbrush bristles

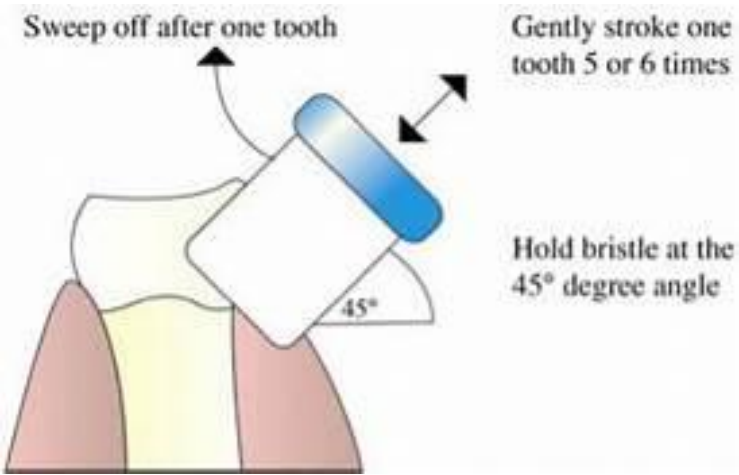
either natural from hair of hogs or synthetic from nylon (not larger than 0.23 mm in diameter) which are uniform in size and elasticity, resistant to fracture. Rounded bristles ends cause fewer scratches on the gingiva. The type of brush is a matter of individual preference. A toothbrush should be able to reach and clean most areas of teeth. For maintenance of toothbrush; most brushes wear out in three months and should be replaced, it should be stored in dry areas and cleaned in antiseptic mouthwashes.

Tooth brushing methods:

❑ **Bass method**: It is the most widely accepted and most effective method for dental plaque removal, adjacent and directly beneath the gingival margin. The technique is place the bristles at 45° angle to the gingiva and move in in back and forth motions. Strokes are repeated around 20 times.

Advantages: Effective method for removing plaque from the cervical area beneath the height of contour of enamel, easy to learn, provides good gingival stimulation and recommended for patient with or without periodontitis.



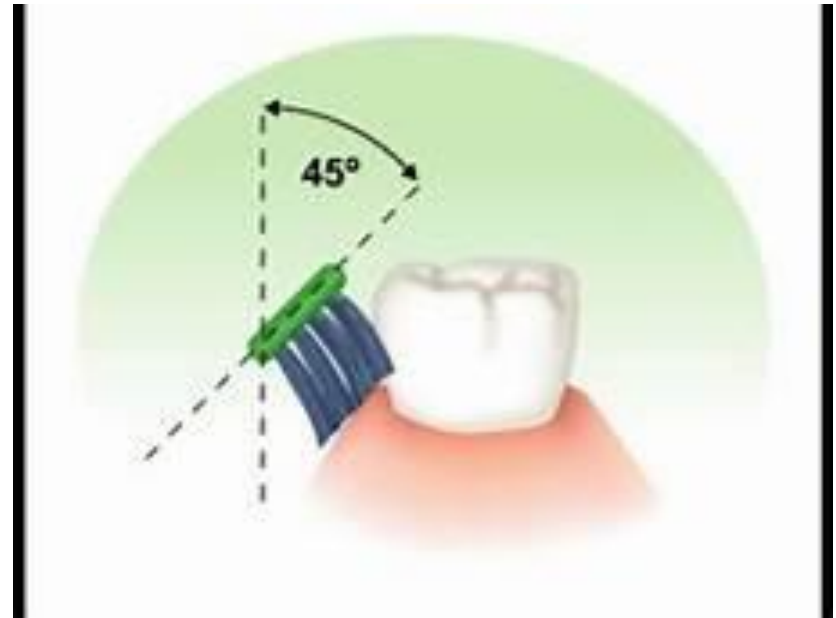


Modified Bass technique: This technique combines the circular motions of Bass technique with the sweeping motion of the Roll technique. It has sweeping motion from cervical to incisal or occlusal surface. The bristles are gently vibrated by moving the brush handle in a back and forth motion.

Advantages: Good interproximal, gingival and sulcus cleaning as well as good gingival stimulation

Stillman's method: The bristles are positioned apically along the long axis of the tooth. The edge of the brush head should be touching the facial or lingual aspect of the tooth. The brush is slightly rotated at a 45-degree angle and vibrated over the crown.

Advantages: It is used for massage and stimulation of gingiva and for cleaning the cervical area of the teeth.





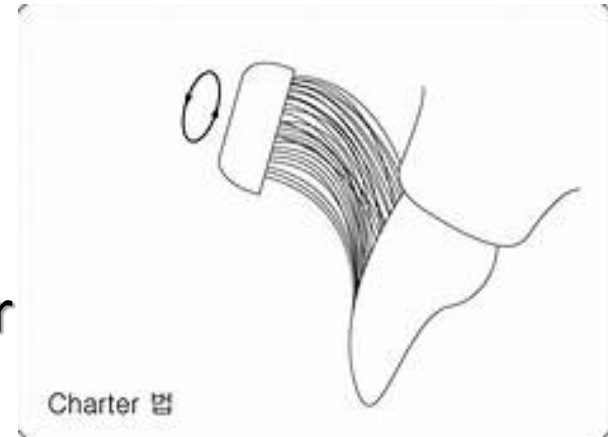
Modified Stillman's method:

The bristles are positioned partly on the cervical portion of teeth and partly on the adjacent gingiva in an apical direction with an oblique angle to the long axis of the tooth. Roll the brush down to the crown of the tooth.

Advantages: It is recommended for cleaning in areas with progressing gingival recession and root exposure to prevent abrasive tissue destruction

Charters method: The bristles are placed at a 45-degree angle toward the occlusal or incisal surface of the tooth. The bristles should touch at the junction of the free gingival margin and tooth. A circular vibratory motion is then activated.

Advantages: It is recommended for temporary cleaning in areas of healing wounds after periodontal surgery and effective for cleaning around devices used to correct improper contact of opposing teeth and plaque under abutment teeth.





Scrub brush method: The teeth are placed edge to edge while the brush maintains a **90-degree angle to the long axis of the tooth**. The brush is then moved in a horizontal stroke. This technique is known to cause excessive toothbrush abrasion.

Roll technique or sweep

method: The bristles are placed at 45° angle and lightly rolled across the tooth surface toward the occlusal surface.

It is indicated for children and for individuals with limited dexterity.

Advantages: It works fairly well for patients with anatomically normal gingival tissues.



Fones method or circular scrub method: The teeth are clenched, and the brush is placed inside the cheeks. The brush is moved in a circular motion over both maxillary and mandibular teeth. In the anterior region, the teeth are placed in an edge-to-edge position and the circular motion is continued.

. Advantages: It is recommended for children and physically or emotionally handicapped individuals.



LEONARD'S METHOD



Vertical method or Leonard's method:

The bristles of toothbrush are placed at 90° angle to the facial surface of the teeth. The teeth are held in an edge-to-edge position. Next the toothbrush is moved in a vertical, vigorous motion up and down the teeth. The maxillary and mandibular teeth are brushed separately.

Advantages: Most convenient and effective for small children.

❓ Powered toothbrush: These were introduced in 1960's. Powered toothbrushes are not superior to manual. Most powered toothbrush manufacturers do not recommend a specific brushing method. However, some guidelines for using a powered brush are available. It is recommended that the brush be positioned slightly differently for each surface of the tooth. Each tooth and corresponding gingival areas should be brushed separately, always with light, steady pressure. Pressure should never be exerted on the bristles of a powered toothbrush because this could damage the tissues.

The indications for uses are:

- Young children.
- Disabled patients.
- Individuals lacking manual dexterity.
- Patients with prosthodontics, or orthodontic treatment as well as implants.
- Patients on supportive periodontal treatment.
- Institutionalized elderly peoples.

☐ Sonic and ultrasonic toothbrush: These types produce high frequency vibrations (200-400 HZ for sonic and 1.6 MHZ for ultrasonic), which lead to the phenomenon of disruption of bacterial cell wall (bactericidal) and aids in stain removal.

☐ Ionic toothbrush: This type changes the surface charge of a tooth by influx of positively charged ions. The plaque with similar charge is repelled from the tooth surface and is attracted by the negatively charged bristles of the toothbrush. It indicates a brush that aims to impart an electrical charge to the tooth surface with the intent of disrupting the attachment of dental plaque

Objectives of toothbrushing:

- 1-To clean teeth and interdental spaces.
2. To prevent plaque formation.
3. To disturb and remove plaque.
4. To stimulate and massage gingival tissues.
5. To clean the tongue.

Effects of improper tooth brushing:

1. Gingival alterations include: ☐ Acute lacerations. ☐ Chronic alterations. ☐ Recession. ☐ Change in gingival contour.

Corrective measures: Use of soft toothbrush and change of brushing method.

2. Abrasion of the teeth: It means the loss of tooth substance produced by mechanical wear other than by mastication. The contributing factors are: hard toothbrush, horizontal brushing, abrasive agents in dentifrice, excessive pressure during brushing and prominence of the tooth surface labially or buccally. The abraded areas are on the cervical areas of exposed root but may occur on enamel.

Interdental Cleaning aids: The toothbrush does not completely remove interdental plaque either in healthy or periodontal involved patients. Interdental cleaning is crucial to augment the effect of tooth brushing.

Factors affecting the selection of interdental cleaning aids:

- ☐ Type of gingival embrasures.
- ☐ Alignment of teeth.
- ☐ Fixed prosthesis or orthodontic appliances.
- ☐ Open furcation areas.
- ☐ Contact areas.

Dental floss: It is used to remove plaque from interproximal surfaces in which the embrasure is completely occupied by healthy interdental papilla. There are many types either waxed, unwaxed, flavored or tape.

Function of dental floss:

1. Remove of adherent plaque and food debris to teeth and others.
2. Reducing gingival bleeding.
3. Improving oral hygiene.
4. Massaging the interdental papillae.
5. Helping in locating calculus, overhanging restorations and proximal carious lesion.
6. Polishing of tooth surfaces during plaque removal.

Wooden tips: They are placed in the interdental space in such a way that the base of triangle toward the gingiva and the sides are in contact with the proximal surfaces.

Interdental brushes: These brushes are suitable for cleaning large, irregular tooth surfaces adjacent to wide interdental spaces and may also be used to clean furcation areas.

Miswak (Siwak): It provides both mechanical (bristles) and chemical (antimicrobial agents) measures for plaque control

Oral irrigation devices

These are beneficial in the removal of unattached plaque and debris. They may also be used to deliver antimicrobial agents such as chlorhexidine.

Gingival massage:

Massaging the gingiva with toothbrush produce epithelial thickening and increased keratinization.

Tongue brushing:

The tongue is anatomically perfect for harboring bacteria. The tongue can transmit organisms during toothbrushing and infection or reinfection of a periodontal pocket. For these reasons, the tongue, especially those with fissuring or prominent papilla, should be regularly cleaned. Commercial tongue cleaners, made of plastic or a flexible metal, are also available. They are curved so they can be placed over the tongue without touching the teeth. These instruments are swept over the dorsum of the tongue to remove bacterial plaque and debris.