Saliva

Introduction

Saliva is like a bloodstream to the mouth. As does blood, saliva helps build and maintain the health of the soft and hard tissues. Saliva removes waste products and provides disease-fighting substances throughout the mouth, offering first line protection against microbial invasion or overgrowth that might lead to disease. The chemical nature of saliva has evolved in humans along with the oral flora and the teeth. Saliva is derived from blood and, as such, can be used diagnostically to detect

Salivary Flow

Chewing is the most efficient way to stimulate salivary flow by causing muscles to compress the salivary glands and release saliva. Through internal feedback mechanisms the taste and consistency of food also affect the quantity of saliva produced. It is difficult to exhaust the salivary glands, so chewing throughout the day to maintain stimulated salivary flow is possible.

When salivary flow is reduced oral health deteriorates. Patients with dry mouths (xerostomia) experience difficulty chewing, speaking and swallowing. There are more than 400 commonly used Rx drugs that lead to mouth dryness. Common examples are analgesics, antihistamines, anti-hypertensives, anti-depressants, anti-anxiety agents, diuretics and appetite suppressants. Radiation, chemotherapy and autoimmune diseases also reduce salivary flow.

Saliva stimulated by chewing has a greater buffering capacity, providing more relief for gastric reflux. Saliva plays a significant role in maintaining oral health.

Saliva and the Plaque Biofilm

Plaque grows naturally on the teeth in the form of a microbial community called a biofilm. Saliva plays an important role in the development of the acquired pellicle, a protein film that forms quickly on a clean enamel surface. Microbes form their initial attachment to the tooth using the salivary pellicle film. Once attached the microbes then begin a new biofilm community.

Microbes live and thrive in the biofilm. Salivary flow brings biofilms nutrition, removes their waste and guards against metabolic changes that could disrupt oral homeostasis and manifest as disease. Since salivary flow throughout the mouth is innately uneven biofilms tend to become more disruptive in locations where salivary flow is slow.

The Minerals in Saliva

Saliva contains the minerals that maintain the integrity of the enamel surface and thus is the major caries preventive agent. Saliva enhances enamel protection by providing high levels of calcium and phosphate ions at the tooth surface. The initial film layer of plaque, the pellicle laid down by saliva, also acts as a selective membrane that controls mineral transfer between saliva and the enamel surface.

As enamel ages it becomes harder. On the enamel surface there is a constant cycle of mineral change. The longer enamel is exposed to this saliva-mediated natural process, the more resistant it becomes to decay. After 20 years the enamel has been remineralized and the organic material it initially contained is lost. This may explain why the majority of new carious lesions occur in children and adolescents.

The Salivary Immune System

Saliva contains an array of passive and active immunoproteins that have evolved to protect the mouth's resident organisms. Passive immunoproteins include mucins, lysozyme, and lactoferrin. They work to inhibit microbial overgrowth by interfering with nutrition, weakening cell walls (apotosis) and causing bacteria to clump together and be washed away (aggregation). Active immunoproteins, such as s-IgA, are produced in the salivary glands of the soft palate. IgG, the most powerful active immunoprotein, enters the mouth through gingivo-crevicular fluid. The IgG works to inhibit the organisms that cause gingivitis. Inflammation causes swelling, which permits the gingivo-crevicular fluid to enter the mouth. IgG within the gingivo-crevicular fluid suppresses the changes in the biofilm that lead to the gingivitis.

Alterations in Salivary Flow

Soft and hard tissues are healthiest where saliva flows freely. When we eat bread or other starchy foods the carbohydrates they contain do not easily dissolve in the saliva and block natural salivary flow. To ensure its free flow to all parts of the mouth, saliva contains amylase, an enzyme that breaks down starch into sugars that clear the mouth and re-establish a path for salivary flow.

Xerostomia

Dry mouth, or xerostomia, is a chronic reduction in salivary flow. It can lead to altered taste, difficulty in chewing/swallowing and rampant tooth decay. Without saliva flowing the tissues in the mouth suffer, much in the same way body tissues suffer if blood circulation is disrupted.

Treating Dry Mouth

In addition to chewing sugar free gum, commercial products such as artificial saliva and tissue lubricants are also used to relieve dry mouth symptoms. If dry mouth symptoms persist, see your physician to rule out a possible underlying medical condition.

Causes of Decreased Salivary Flow

Prescription and non-prescription drugs often cause reduction in salivary flow. Almost eighty percent of the most commonly prescribed medications lead to a dry mouth. Following radiation and chemotherapy the function of the salivary glands is often lost. Some systemic conditions, such as Sjogren's syndrome, also compromise salivary flow.

Saliva is a Diagnostic Fluid

Since saliva is so similar to blood, it is increasingly being used in the evaluation of systemic health. The U.S. National Institutes of Health have targeted salivary diagnostics as an important area of development and are researching its many potential uses. The advantages of saliva as a diagnostic fluid, relative to blood, include simplicity in collection, its noninfectious nature and the cost-effectiveness of the testing.

Salivary Diagnostic Tests

A common use of salivary diagnostics is for detection of viral infections, in particular HIV. Researchers also report promising results in the use of saliva for the diagnosis of breast cancer, oral cancers and viral hepatitis.

Saliva is an efficient indicator of recent drug usage. Portable salivary testing for detection of therapeutic and abused drugs is available. Saliva also has been used with some success in monitoring responses to the treatment of anxiety and depression.

Saliva acts as the bloodstream of the mouth, providing nutrients, removing waste, protecting against foreign bacteria and constantly remineralizing tooth enamel. When saliva flow is reduced health problems such as tooth decay and gum disease occur. Health professionals are using saliva for the early diagnosis of many systemic and metabolic conditions.

Protecting the Teeth

The Fluoride Reservoir

Only micro-quantities of fluoride are needed to have an impact on the re- and demineralization process occurring at the enamel surface. Immediately after brushing with a fluoride toothpaste, the fluoride level in saliva increases. Fluoride ions bond easily with calcium ions always present on tooth surfaces and in saliva. Following a topical fluoride application, a "reservoir" of calcium/fluoride-like precipitates forms throughout the mouth. These precipitates are stored in the plaque and on the enamel surface. The sum of the precipitates is viewed as the "fluoride reservoir." When plaque acid occurs, the calcium/fluoride-like

material in the reservoir dissolves before the enamel, releasing fluoride exactly when and precisely where it is needed.

Saliva

Saliva is the mouth's primary defense against tooth decay. Research has proven that fluoride works to prevent tooth decay by boosting the ability of saliva to return lost minerals to tooth enamel before cavities can develop. Saliva enhances protection of enamel by providing high levels of calcium and phosphate ions at the tooth surface. The presence of those ions slows demineralization and encourages an ongoing remineralization of tooth enamel. The best explanation of how fluoride works is that it enhances the natural remineralizing properties of saliva.

Saliva, Fluoride and Diet

Fermentable carbohydrates (cooked starches and sugars) present in the wide range of foods we eat also provide food for the bacteria that live in the plaque. Organic acid produced by the plaque biofilm as a by-product of its metabolism causes surface enamel to dissolve. Most times we eat there is a resulting acid attack on the enamel surface. Interestingly, more sugar contained in a food does not generate more bacterial acid. Since even small amounts of sugars or starches will lead to similar acid conditions, making lists of foods that are "good" or "bad" for teeth is difficult. Today most advice is focused on trying to moderate the frequency of eating between meals while maintaining daily levels of fluoride.

Brushing twice daily with a fluoride toothpaste can help neutralize the effects of too frequent snacking by enhancing saliva's ability to prevent or repair early tooth decay. Excessive snacking between meals leads to tooth decay. By snacking in moderation (three to four times daily), one limits the frequency of acid attacks and enables saliva enhanced by fluoride to sustain enamel integrity.

Chewing gum after a snack or meal stimulates salivary flow, clearing food from the mouth and neutralizing plaque acid. Gum chewing stimulates saliva production by up to 10 times the normal rate. Stimulating salivary flow changes the chemistry of the saliva. Stimulated saliva contains higher concentrations of bicarbonate, helping it to buffer plaque acid and fight tooth decay.

Reduced Salivary Flow

The importance of saliva is truly appreciated when salivary flow is reduced. Wherever salivary flow diminishes tooth decay and erosion are likely to occur. About 20 percent of adults occasionally experience reductions in salivary flow. Common symptoms include persistent dry mouth, pain, difficulty in chewing, tasting, speaking and swallowing. Problems with dentures increase when the mouth is constantly dry. Daily chewing programs can maintain salivary output throughout the day..

Saliva Doesn't Mix Well

Saliva is produced by major salivary glands and also within tissue covering the inner lip and soft palate. Surprisingly, saliva from different glands does not mix well in the mouth. Saliva secreted in the back of the mouth does not reach the front and there is little movement of saliva from side to side. Since saliva does not mix well and its mineral content and buffering ability differs from gland to gland, certain tooth sites are

therefore more susceptible to tooth decay. Secretions from minor mucous glands in the upper lip, for example, lack the ability to buffer acid and have very low mineral content that might aid remineralization. This is one reason why the maxillary anterior teeth are so susceptible to enamel demineralization. Muscular movements associated with chewing action help change the direction of salivary flow and mix saliva from different glands.

Salivary Film Velocity

When salivary flow rate increases, salivary film velocity increases. This enhances cavity prevention by more rapidly clearing food particles containing carbohydrates. Individuals with unstimulated, low velocity saliva swallow less efficiently and clear sugars from the mouth much more slowly. Such individuals are more susceptible to erosion and decay.

Saliva is the primary protection against the loss of tooth surfaces and its calcium and phosphorous minerals maintain the integrity of the enamel surface. Reductions in salivary flow lead to acid conditions and subsequent enamel demineralization. Small quantities of fluoride at the saliva-enamel boundary boost the maintenance of enamel structure. Fluoride is stored in a “reservoir” on the teeth and in the plaque in the form of calcium/fluoride-like precipitates. During an acid attack the calcium/fluoride-like material dissolves easily, releasing fluoride when and where it is needed. Since most foods contain sugars or starches they may lead to plaque acid when eaten. Chewing after a snack or meal stimulates salivary flow, increasing its cavity preventing properties.

Influence of Saliva

Saliva plays an important role in the development and maintenance of a healthy plaque biofilm. Proteins from saliva enable the biofilm to attach to the tooth’s surface. After a tooth is cleaned, its enamel surfaces quickly become coated with a salivary protein film, the pellicle. The pellicle supports the attachment of free-floating bacteria (planktonic) that are the first settlers of a new biofilm. As bacteria begin to attach to one another, they pave the way for attachment by other bacteria in a very specific order and pattern. Over the course of about three days, as plaque biofilm grows to maturity, it depends mainly on saliva for nutrition and the removal of waste. As the biofilm approaches maturity, it releases planktonic bacteria back into the saliva. Saliva then transports these free-floating bacteria to sites where a new biofilm will form.

Passive and active immune proteins within saliva regulate the growth and movement of the plaque biofilm. There is strong evidence today that the microbes and immune system have evolved together and they work as a team to prevent visiting microorganisms from residing in the mouth. The mature plaque biofilm also is dependent on salivary flow. When flow is reduced the various organisms and structures within the biofilm undergo changes that often lead to inflammatory changes in the supporting tissues.