Bacterial Plaque and Its Relation to Dental Diseases

As a hygienist it is important to stress the importance of good oral hygiene and adequate plaque removal to our patients. Bacterial Plaque is the cause of several dental diseases including caries, gingivitis, and periodontal disease. It is also responsible for the formation of supragingival and subgingival calculus.

Plaque is a biofilm made of a very organized, complex bacterial system in an intermicrobial matrix held together by glucan. It is created after bacteria attaches to tooth pellicle. Bacteria attached to the pellicle multiply and colonize which causes the biofilm to grow and form a matrix. Many different types of bacteria increase throughout the production of plaque. During the first two days, gram-positive streptococci form including streptococcus sanguis and streptococcus mutans. Days two through four of plaque production include an increase of gram-positive filamentous forms and slender rods. During days four through seven a greater variety of bacteria appear. After the first week of plaque production, vibrios and spirochetes appear which causes white blood cells to increase and inflammation to occur. After two weeks, bacteria become densely packed and clinical gingivitis will occur. It is important to know that bacteria in plaque are resistant to many anti-infectives and the best way to remove plaque is by mechanical means. A good brushing and flossing routine is essential to the successful removal of plaque. If plaque is not removed successfully, plaque may mineralize and turn into
calculus or the bacteria in plaque may cause oral diseases like caries, gingivitis, and periodontal disease.

Calculus is defined as a deposit of calcium and organic matter that accumulates on the teeth or on a dental prosthesis. Calculus is formed when plaque isn’t removed for a period of time and mineralizes. Minerals in calculus include mostly calcium and phosphate, however magnesium, sodium, potassium, fluoride, and zinc are also found in calculus. Calculus may be supragingival, which means it is found on the clinical crowns on teeth. Supragingival calculus is most commonly found on teeth near salivary glands. Subgingival calculus, or calculus formed under the gingival margin, is mostly found interproximally. Subgingival calculus may be black or dark green. Once calculus is formed a dentist or a hygienist must remove it. Calculus itself does not cause periodontal problems, however, plaque is often found with calculus, which does cause gingivitis, periodontal disease, and caries.

The Center for Disease Control estimates that ninety percent of adults over the age of twenty have some form of decay and caries is the most common chronic disease of children and adolescence. Caries is a tooth disease caused by the complex reaction of food with the bacteria that form dental plaque. The three things needed for someone to have caries are a tooth, bacteria, and a cariogenic food. Streptococcus mutans is the infectious, transmissible, bacterium that causes caries. Caries begins when someone eats a cariogenic food. The food is taken into the biofilm on teeth and the pH in the biofilm drops. This drop in pH creates an acid that is exposed to a tooth. If a tooth is continually exposed to this acid, the tooth will demineralize. Caries is initiated after demineralization, and white spot lesions will occur on the teeth. These lesions may get
worse as the disease continues. Cavities may be simple, involving one tooth surface, compound, involving two tooth surfaces, or complex, involving more than two tooth surfaces. Cavities may be found on the pits, fissures, smooth surfaces, or roots of teeth. Foods that are sticky, very soft or very hard, or retentive may stick to teeth and are more likely to cause caries. Consuming a lot of sugar and carbs will also increases someone’s risk of caries. A longer exposure time to cariogenic foods will cause the pH in someone’s biofilm to remain acidic for a longer period of time, which will also cause caries. It is important to consume cariogenic foods in a timely fashion. Incorporating fluoridated toothpaste and fluoridated mouth rinse may decrease the likelihood and/or severity of caries.

Gingivitis is the inflammation of the gingiva. Gingivitis is usually the result of poor oral hygiene and is directly associated with bacterial plaque on teeth. Gingivitis is the most common human disease, but it is also the easiest disease to treat. Gingivitis begins when white blood cells rush to the gingival sulcus in response to the bacteria in plaque. The collagen in the gums begins to break down and sulcus fluid fills the tissue. Symptoms of gingivitis include redness, swollen gums, bleeding, and drainage from gums. As gingivitis continues to get worse, destruction of tissues continues and periodontitis occurs.

A report from the Center for Disease Control states that forty seven percent of the adults in the United States over the age of thirty have some form of periodontal disease. Periodontitis is caused when subgingival plaque is not removed from the gingival sulcus and the bacteria in plaque releases toxins and enzymes. The body reacts by causing an inflammatory response that destroys the periodontium and causes irreversible bone loss.
Clinical characteristics of periodontitis include swelling, enlarged tissue, deep sulci, bleeding, bluish-red tissue, and mobility. Some people with a higher risk of developing periodontitis include those who use tobacco products, those who live in poverty, those with less than a high school education, patients with diabetes, osteoporosis, immune diseases, nutritional deficiencies, poor oral hygiene, heredity, xerostomia, hormonal changes, defective fillings, and stress.

In order to prevent the formation of calculus, and the development of caries, gingivitis, and periodontal disease, a proper oral health care routine is essential to remove harmful plaque. Currently, it is recommended that a person brush their teeth at least two times a day for two minutes a day. Using the modified bass technique when brushing will ensure optimal results. In order to use modified bass technique, the toothbrush must be angled at a forty-five degree angle towards the gum line. The toothbrush must be moved in a circular motion concentrating on two teeth at a time. A soft bristled toothbrush is best. Flossing is also essential to good oral hygiene and it is recommended to floss at least one a day to effectively remove plaque. In order to floss properly a patient must wrap the floss around their teeth in a “C” shape when patients insert it between their teeth so they do not damage their gum tissue. A gentle see-sawing motion in between their teeth will help remove plaque. Using a fluoridated toothpaste and fluoridated mouth rinse is beneficial to patients suffering from caries because the fluoride may help remineralize their teeth. A proper diet that limits the amounts of sugars and carbohydrates a person consumes will be beneficial to their oral health. If a patient chooses to continue eating and drinking carbohydrates, a hygienist should tell them to limit their exposure time to these cariogenic substances. Drinking a can of soda in five
minutes does less damage to the oral cavity than sipping on a soda for an hour. Regular cleanings by a hygienist can help restore a patient’s oral health.

Plaque is the cause of several dental diseases and successful removal of plaque is essential to avoiding these diseases that can negatively impact a patient’s life. Motivating a patient to complete at-home care is the best thing a hygienist can do to help prevent disease.
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