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REPORT

How Poor Oral Health Promotes Systemic Diseases

By Nelson Wood, DMD, DSc, MS

Although oral health is often considered a distinct specialty that is separate from the body as a whole, the health of the oral cavity can have wide-reaching effects on overall health. Poor oral health may occur concomitantly with a more serious underlying disease process or may predispose an individual to other health conditions. This article examines the relationship between poor oral health and increased risk for several systemic diseases, underscoring that the oral cavity and its tissues are an integral part of the human body.

The mouth is colonized by hundreds of different bacterial species that inhabit dental plaque. These species form firm clusters adhering in layers to oral surfaces that are not easily eliminated by the body's natural immune responses, and must be mechanically removed. Bacteria beneath the gums, or gingiva, have been reported to be involved in numerous systemic diseases. Dental plaque becomes more difficult to remove as it matures, forming a harder substance called calculus, which must be removed professionally by a dentist.



A clean mouth contains several hundred billion bacteria, and this number increases tenfold when the mouth is not sufficiently cleaned. Using saliva and gingival fluid as their main nutrients, bacteria inhabit tooth surfaces, gingival crevices, saliva, the tongue, and the oral mucosa, threatening oral and systemic health. Oral health care, primarily mouth cleaning, is an important component of a healthy lifestyle.



Dental decay occurs when the plaque bacteria on the tooth surface produce acid following the consumption of carbohydrates. These acids cause demineralization of the tooth. Between meals, saliva normally replenishes the tooth minerals. When fermentable carbohydrate foods are eaten frequently, acidic saliva is sustained for a period of time, resulting in a net loss of mineral from the tooth and possible cavity formation.

Gingival disease, or gingivitis, occurs when bacteria and dental plaque cause an inflammatory reaction in the gums that cannot be defended by the body's immune response. Clinical signs of gingivitis include local redness, swelling, bleeding, and visible pus. Gingivitis can be divided into two categories: 1) that affected by local factors such as plaque; and 2) that affected by local factors and modified by systemic inflammatory factors found in the host. If left untreated, gingivitis can progress to periodontal disease, or periodontitis.

Periodontal infections most often involve anaerobic bacteria that discharge various compounds such as hydrogen sulfide, ammonia, amines, and toxins that elicit an inflammatory response. Periodontal disease can cause loss of periodontal tissue, pocket formation, and loosening and loss of teeth.

This condition may be painless until its later stages, when abscesses, bleeding gums, and bad breath may occur. Your susceptibility to periodontal disease is affected by numerous factors, including genetics, immune health, and inflammatory status.

Periodontitis can cause tooth loss and may thus compromise your health by making eating difficult. Individuals who cannot chew or bite comfortably are less likely to consume high-fiber and nutrient-rich foods such as fruits and vegetables, thereby reducing their intake of essential nutrients. Thus, periodontitis may affect nutritional status and food selection, which can have very harmful effects on the body's general health.



Perils of Periodontitis

Periodontitis is a chronic inflammatory oral disease that affects approximately 75% of US adults.¹

It is known to have harmful effects on overall health, due to the accumulation of oral gram-negative bacteria and resultant inflammatory mediators that enter the bloodstream.^{2,3} Periodontitis has been shown to predispose people to diabetes, insulin resistance, respiratory diseases,⁴ rheumatoid arthritis,⁵ obesity,⁶ osteoporosis,^{7,8} complications of pregnancy,^{9,10} and cardiovascular diseases such as atherosclerosis, heart attack,

congestive heart failure, and coronary artery disease.^{2,3,11,12} Some of these conditions may in turn increase the incidence and severity of periodontal disease by modifying the body's immune response to periodontal bacteria and their byproducts.¹¹⁻¹³ Thus, an increasing body of evidence suggests a bi-directional relationship between periodontitis and systemic diseases.¹¹

People with periodontitis have increased levels of inflammatory markers in their blood. These occur when pathogenic bacteria, their byproducts, and cytokines enter the circulation from the periodontal lesion, stimulating the liver and white blood cells to increase their production of inflammatory proteins such as C-reactive protein, inflammatory cytokines (IL-1 beta, tumor necrosis factor-alpha, and IL-6), blood coagulation and adhesion factors, and increased blood lipid levels.^{2,3} These blood markers are associated with an increased risk of developing cardiovascular and other diseases.¹⁴

Periodontal pathogenic bacteria have been recovered from athero-sclerotic plaques¹⁵ and major arteries,¹⁶ and may directly affect blood platelet activation and aggregation, causing the initiation and progression of atherosclerosis. A direct relationship between periodontitis and thickening of the carotid artery has also been reported.¹²

Gingivitis, periodontitis, and an increase in decayed, filled, and missing teeth have all been associated with excess body weight and obesity.⁶ Conditions associated with obesity, including syndrome X, insulin resistance, hypertension, and type II diabetes, may also worsen periodontitis.¹¹ Moreover, research has established links between periodontitis and increased fat levels in the blood, which have serious negative impacts on overall health.¹⁷

Periodontitis has been called "the sixth complication of diabetes mellitus," as it is twice as prevalent in diabetic individuals as in non-diabetics. Experimentally produced periodontitis has been shown to increase blood glucose levels in uncontrolled diabetic animals, and it may increase insulin resistance in diabetic patients.¹¹ One study demonstrated that the treatment of periodontitis using systemic antibiotics in addition to mechanical cleaning improved levels of glycated hemoglobin, a measure of long-term blood-glucose control.¹³



Periodontitis is characterized by the loss of oral bone and soft tissue attachments to the tooth. Studies have reported significant relationships between periodontitis and systemic bone metabolism, and investigators have suggested different theories.^{7,8,18} Some believe that poor bone metabolism may predispose the host to periodontitis or modify its progress. Others believe that poor systemic bone metabolism may initiate periodontitis. Both theories suggest that nutrition is an important modifiable factor in bone mass development and maintenance, osteoporosis prevention and treatment, and periodontal disease prevention. Dietary calcium may affect oral health, with some studies reporting that calcium supplements improve periodontal conditions.⁷

Researchers have found that pregnant women with periodontitis were 7.5 times more likely to have a preterm low-birth-weight infant than were unaffected pregnant women. Other researchers report that the risk of preterm birth is directly related to the severity of periodontitis.¹⁰ It has also been suggested that periodontal pathogens may disseminate systemically and gain access to the fetal environment.¹⁹ Early-intervention studies of patients at risk for periodontitis and adverse pregnancy outcomes, including low-birth-weight infants, are ongoing in several cities. Early data indicate that periodontal therapy administered to pregnant mothers with periodontitis can reduce the incidence of preterm low-birth-weight deliveries.²⁰ Thus, oral health care is a crucial component of comprehensive prenatal health care.

Oral Health Linked to Other Conditions

Female hormone levels play a role in determining periodontal health. Estrogen deficiency is a risk factor for periodontal disease, and also plays a role in the increased risk of osteopenia and osteoporosis in women.²¹ Krall and others reported that estrogen users had more teeth remaining than nonusers. Women using hormone replacement demonstrated decreased indicators of gingivitis and periodontitis severity compared to estrogen-deficient females.⁸ Oral and eating changes during pregnancy have been documented for many years, and gingivitis and pyogenic granulomas (small, reddish bumps on the skin that bleed easily due to an abnormally high concentration of blood vessels) often accompany pregnancy. Oral contraceptives have also been shown to cause periodontal destruction.

Studies have suggested a relationship between poor oral health and respiratory infections and compromised lung function. The increased presence of decayed, missing, and filled teeth has been found to increase pulmonary impairment. One study found a nearly fivefold increase in chronic respiratory disease in subjects that had poor oral hygiene when compared to those with good oral hygiene.⁴ Periodontal bacteria have also been cultured from infected lung fluids and lung tissues.¹⁶



Oral health may likewise be related to joint health. People with moderate to severe periodontitis have been found to be at increased risk of suffering from rheumatoid arthritis.²² The relationship between periodontitis and rheumatoid arthritis may be due to common underlying systemic dysregulation of the inflammatory response.⁵

Lifestyle factors may play a role in promoting oral health. Physical activity in the form of walking has been shown to benefit periodontal health.²³ Smoking, stress, depression,²⁴ and alcohol consumption²⁵ are risk factors for periodontitis. Smoking, stress, and a sedentary lifestyle increase risk for periodontal disease as well as for heart disease and diabetes.^{11,23,24}

The scientific community has shown renewed interest in the relationship between nutrition and oral infectious diseases. Nutrition significantly influences the immune response and the integrity of the oral cavity's hard and soft tissues. Nutritional deficiencies may play a role in the incidence and severity of periodontal disease. Conversely, nutritional supplementation may improve treatment outcomes in periodontal disease, and may also be beneficial in addressing associated systemic diseases.²⁶

Treatment of gingivitis and periodontal disease includes: 1) removal of bacteria by mechanical cleaning; 2) training patients to maintain optimal oral hygiene; 3) dietary evaluation, nutritional counseling, and/or supplementation; 4) immune system support; and 5) using the best available oral health care products. This comprehensive approach will help to prevent oral disease and related systemic illnesses.

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Nutrients to Improve Oral Health

Nutritional and botanical therapies have demonstrated positive effects for people with gingivitis, gingival bleeding, periodontal pocketing, and periodontal attachment and bone loss. Topical and systemic nutritional supplementation may be a beneficial adjunct to gingivitis and periodontitis therapy.



The benefits of the nutrients in the Life Extension™ toothpaste formulation have been scientifically researched in both the dental and medical literature. Its unique formulation includes coenzyme Q10, tea tree oil, xylitol, hydrogen peroxide, folic acid, lactoferrin, and squalene.^{27,28}

Topical application of CoQ10 to periodontal pockets has been associated with significant improvements in gingivitis and bleeding of the gums.²⁹ In one clinical study, topical application of CoQ10 was so effective in promoting healing and reducing periodontal pocket depth that after five to seven days of treatment, the diseased gingival sites were difficult to locate.³⁰

Patients with periodontitis frequently have significant gingival and white-blood-cell CoQ10 deficiencies, indicating both a local and a systemic nutritional imbalance. A local deficiency of CoQ10 could predispose the gingiva to periodontitis, and periodontitis could even exacerbate systemic CoQ10 deficiency.³¹ Topical application of CoQ10 improves adult periodontitis not only as an individual treatment, but also in combination with traditional non-surgical periodontal therapy.²⁹ CoQ10 is also known for its cardioprotective properties.³²

Tea tree oil (*melaleuca alternifolia*) is known for its antiseptic, fungicidal, and bactericidal effects.³³ It has been found to be effective in reducing oral bacteria.³³ Topically applied tea tree oil gel was found to significantly reduce gingivitis and bleeding of the gums in people with severe gingivitis.³⁴

Xylitol, a naturally occurring sweetener that is not fermentable by cavity-inducing oral bacteria, demonstrates numerous benefits in promoting oral health. When tested as a dietary supplement, xylitol was associated with impressive reductions in cavity incidence. Xylitol may decrease the production of acids that demineralize the teeth.³⁵ It may also stimulate the production of saliva, a helpful effect for individuals taking medications that produce mouth dryness. The use of xylitol is compatible and complementary with all current oral hygiene recommendations. Its pleasant taste facilitates a wide array of applications to promote oral health.³⁶



Hydrogen peroxide, long used for its antiseptic properties, has been shown to inhibit plaque formation and to reduce gingivitis.³⁷ Its bubbling action exposes oral bacteria that are difficult to reach with ordinary brushing and flossing, promoting a more thorough cleansing of the teeth and gums.

Folic acid is required by the body on a daily basis to build new cells, and is essential for the integrity of the gingival tissues. Topical folic acid in the form of mouthwash has been shown to be effective in the treatment of gingivitis and its accompanying inflammation. Folic acid significantly reduces gingival redness and bleeding of the gums in people with gum disease.³⁸ This effect is thought to be the result of topical application of folic acid and not of its systemic influences. Denture wearers and individuals with impaired dentition have significantly lower blood and dietary levels of folate.^{39,40} Dietary folic acid supplementation may also increase the resistance of the gingiva to local irritants.⁴¹

Lactoferrin has been shown to reduce the adhesion of several bacteria found in the oral cavity,^{42,43} to stop the growth of periodontitis-causing bacteria,⁴³ and to kill cavity-causing bacteria.⁴³ In a study of cats, lactoferrin powder appeared to offer benefits in resolving oral lesions when applied locally.⁴⁴

Squalene, a nutrient with a chemical makeup similar to vitamin A, is easily emulsified and spreads easily. Squalene has been shown to be effective in inducing bone formation⁴⁵ and improving immune health. The squalene in the Life Extension™ toothpaste formula is derived from shark liver oil.



Conclusion

Good oral health is an important component of overall health and well-being. When oral health is compromised, as in conditions such as periodontitis, consequences may reach far beyond the oral cavity. Periodontitis is associated with an increased risk of illnesses that affect the entire body. These include rheumatoid arthritis, diabetes, heart disease, obesity, osteoporosis, and complications of pregnancy. Protecting oral health is therefore critical to maintaining overall health.

Conventional treatment for periodontitis may not always be enough to maintain optimal oral health. Nutritional therapeutics may be useful adjuncts in improving healing, reducing inflammation, and

strengthening the body's immune system. These nutritional approaches include coenzyme Q10, folic acid, xylitol, lactoferrin, and squalene. These nutrients may be useful when used internally as well as when applied topically to the oral tissues. Optimizing oral health is an important step in preventing disease and promoting a long and healthy life.

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