

Gum Disease In-Depth Report

Background

Periodontal disease refers to a group of problems that arise in the sulcus, the gap between the gum and the tooth.

WHAT IS THE PERIODONTIUM?

The part of the mouth that consists of the gum and supporting structures is called the periodontium. It is made up of the following parts:

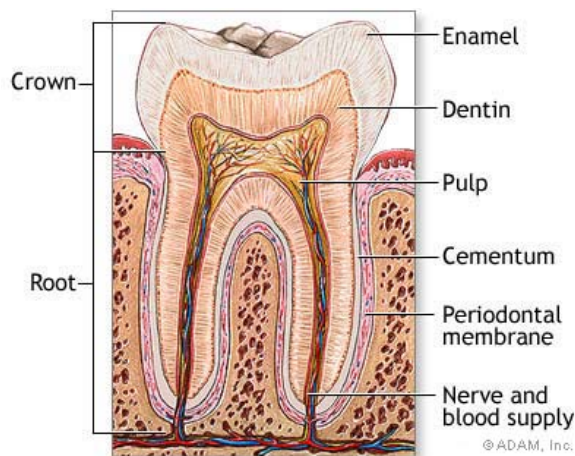
Gum (*gingiva*). When healthy, the gingiva is pale pink, firm, and does not move. It has a smooth or speckled texture. The gingival tissue between teeth is shaped like a wedge.

The space between the gum and tooth, called the *sulcus*

Root surface (the *cementum*)

Connective tissue

Bone. The crest of the supporting bone, which can be viewed on x-rays, is normally 2 mm below the point where the crown of the tooth meets the root (the cemento-enamel junction).



The structure of the tooth includes dentin, pulp and other tissues, blood vessels, and nerves imbedded in the bony jaw. Above the gum line, the tooth is protected by the hard enamel covering.

PERIODONTAL DISEASE

Periodontal diseases are generally divided into two groups:

Gingivitis, which causes lesions (wounds) that affect the gums

Periodontitis, which damages the bone and connective tissue that supports the teeth

The process starts with bacteria. Even in healthy mouths, the sulcus is teeming with bacteria, but they tend to be harmless varieties. Periodontal disease develops usually because of two events in the oral cavity: an increase in bacteria quantity and a change in balance of bacterial types from harmless to disease-causing bacteria. These harmful bacteria increase in mass and thickness until they form a film known as *plaque*.

In healthy mouths, plaque itself actually provides some barrier against outside bacterial invasion. When it accumulates to excessive levels, however, plaque sticks to the surfaces of the teeth and adjacent gums and causes cellular injury, with subsequent swelling, redness, and heat.

When plaque is allowed to remain in the periodontal area, it transforms into *calculus* (commonly known as *tartar*). This material has a rock-like consistency and grabs onto the tooth surface. It is much more difficult to remove than plaque, which is a soft mass.

The most important component leading to the disease process, however, is the body's persistent immune response to the bacterial plaque. Specific immune factors are released that cause inflammation and damage that eventually destroys the support structures and bone and can lead to tooth loss.

GINGIVITIS

Gingivitis is an inflammation of the gingiva, or gums. Is nearly always chronic, but an acute form infrequently occurs.

Chronic Gingivitis. Ordinary chronic gingivitis affects over 90% of the population. It is characterized by tender, red, swollen gums that bleed easily and may be responsible for bad breath (*halitosis*) in some cases. Treatment is very effective if initiated early in the course of gingivitis. Without good management, however, the problem can progress.

PERIODONTITIS

Periodontitis is characterized by the following:

Gum inflammation, with redness and bleeding.

Deep pockets (greater than 3 mm in depth) form between the gum and the tooth.

Loose teeth, caused by loss of connective tissue structures and bone.

Gingivitis precedes periodontitis, although it doesn't always lead to this more severe condition. In fact, some experts believe it is an entirely different disease. There

are different categories of periodontal disease, including:

Chronic Periodontitis. Chronic periodontitis (also referred to as adult periodontitis) may begin in adolescence as a slowly progressing disease that becomes clinically significant in the mid-30s and continues throughout life. Some experts question whether it is a chronic, unrelenting condition and instead suggest that it waxes and wanes depending on the response of the immune system.

Aggressive Periodontitis. Aggressive periodontitis (also referred to as early onset periodontitis) often occurs in young people. It is subdivided according to whether it begins before or after puberty. Immune deficiencies and a genetic link have been shown to be possible factors for all types of aggressive periodontitis. If the condition is localized and treated, the outlook is positive. People with severe and widespread aggressive periodontitis are at high risk for tooth loss. According to a 2001 study, impaired infection-fighting white blood cells, together with bacterial presence, can lead to aggressive periodontitis.

Periodontitis that occurs before puberty is very rare. It begins with the eruption of primary teeth in the first year and causes severe inflammation and bone and tooth loss.

Juvenile periodontitis begins at puberty and is defined by severe bone loss around the first molars and incisors. It is more common in girls than in boys. The clinical signs such as inflammation, bleeding, and heavy plaque accumulation are not present in this relatively rare disease. The treatment is the same as in chronic periodontitis.

Rapidly progressive periodontitis occurs in the early 20s to mid-30s. Severe inflammation and rapid bone and connective tissue loss occur, and tooth loss is possible within a year of onset.

Disease-Related Periodontitis. Periodontitis can also be associated with a number of systemic diseases, including type 1 diabetes, Down syndrome, AIDS, and several rare disorders of white blood cells.

Acute Necrotizing Periodontal Disease. Acute necrotizing periodontal disease is an acute infection in the gums. It is characterized by:

- Black, dead tissue (necrosis)
- Spontaneous bleeding
- Rapid onset of pain
- Bad odor
- Blunted gum tissue (tissue is normally cone-shaped)

Stress, poor diet, smoking, and viral infections are predisposing factors for this acute necrotizing periodontal disease.

Symptoms

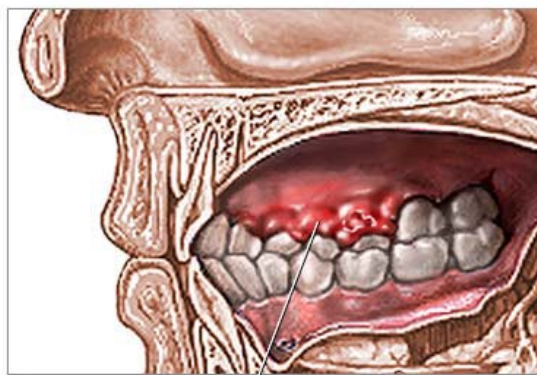
In general, symptoms progress over time and include:

Red and Swollen Gums

Gum Bleeding. Bleeding of the gums, even during brushing, is a sign of inflammation and the major marker of periodontal disease. One exception is juvenile periodontitis, in which symptoms are mild or even absent. It should be noted that the gums of smokers with periodontal disease tend to bleed less than nonsmokers.

Bad Breath. Debris and bacteria can cause a bad taste in the mouth and persistent bad breath.

Gum Recession and Loose Teeth. As the disease advances the gums recede, and supporting structure of bone is lost. Teeth loosen, sometimes causing a change in the way the upper and lower teeth fit together when biting down or a change in the fit of partial dentures.



Swollen gums partially obscuring teeth

© ADAM, Inc.

Abnormally bulging, protruding, or swollen gums are a possible sign of disease.

Abscesses. Deepening periodontal pockets between the gums and bone can become blocked by tartar or food particles. Infection-fighting white blood cells become trapped and die. Pus forms and an abscess develops. Abscesses can destroy both gum and tooth tissue, cause nearby teeth to become loose and painful, and may cause fever and swollen lymph nodes.

Pain is usually not a symptom, which partly explains why the disease may become advanced before treatment is sought and why some patients avoid treatment even after periodontitis is diagnosed.

Causes

Periodontal disease is marked by bacterial overgrowth. However, a persistent immune response to chronic infections in the mouth is believed to play a major role in gum destruction.

BACTERIAL CULPRITS

In the healthy mouth, more than 350 species of microorganisms have been found. Periodontal infections are linked to fewer than 5% of these species. Healthy and disease-causing bacteria can generally be grouped into two categories:

The harmless or helpful bacteria are usually known as *gram positive aerobic bacteria*.

In periodontal disease, the bacterial balance shifts over to *gram negative anaerobic bacteria*. Inflammatory disease and injury cannot develop without these bacteria.

Following are some of the bacteria most implicated in periodontal disease and bone loss:

Actinobacillus actinomycetemcomitans and *Porphyromonas gingivalis*. These two bacteria appear to be particularly likely to cause aggressive periodontal disease. In one study, both *P. gingivalis* and *A. actinomycetemcomitans*, along with multiple deep pockets in the gum, were associated with resistance to standard treatments for gum disease. In another study, *P. gingivalis* doubled the risk for serious gum disease. Particularly virulent strains of this bacterium may be responsible for periodontal disease. A 2001 study suggests that the *P. gingivalis* produces enzymes, such as one called arginine-specific cysteine proteinase, which may be the specific destructive factors that disrupt the immune system and lead to subsequent periodontal connective tissue destruction.

Bacteroides forsythus is also strongly linked to periodontal disease.

Other bacteria associated with periodontal disease are *Treponema denticola*, *T. socranskii*, and *P. intermedia*. These bacteria, together with *P. gingivalis*, are frequently present at the same sites, and are associated with deep periodontal pockets.

Some bacteria are related to gingivitis, but not plaque development. They include various streptococcal species.

THE AUTOIMMUNE AND INFLAMMATORY RESPONSE

Evidence now suggests that periodontal disease is an *autoimmune disorder*, in which immune factors in the body attack the person's own cells and tissue -- in this case, those in the gum. It appears to work as follows:

The bacteria that form plaque and tartar release toxins that stimulate the immune system to overproduce powerful infection-fighting factors called *cytokines*.

Ordinarily, cytokines are important for healing. In excess, however, they can cause inflammation and severe damage. Cytokines of particular importance in periodontal disease are known as tumor necrosis factor-alpha (TNF-alpha) and interleukin-1beta, which are very active in the mouth, and are important in causing destructive inflammation.

In addition, white blood cells produced by the immune response to bacteria also release a family of enzymes called matrix metalloproteinases (MMPs), which break down connective tissue.

Studies suggest that this inflammatory response may have damaging effects not only in the gums but also in organs throughout the body, including the heart.

VIRAL CAUSES

Certain herpes viruses (herpes simplex and varicella-zoster virus, the cause of chickenpox and shingles) are known causes of gingivitis. A 2000 study found that other herpes viruses (cytomegalovirus and Epstein-Barr) may play a role in the onset or progression of some types of periodontal disease, including aggressive and severe chronic periodontal disease. All herpes viruses go through an active phase followed by a latent phase and possibly reactivation.

Some experts theorize that these viruses may cause periodontal disease in different ways, including release of tissue-destructive cytokines, overgrowth of periodontal bacteria, suppressing immune factors, and initiation of other disease processes that lead to cell death.

Risk Factors

More than 75% of American adults have some form of gum disease, but according to a major survey, only 60% have any significant knowledge about the problem. Gum inflammation and ulcers are common and not all people with these problems develop periodontal disease. Still, about 30% of people are genetically susceptible to periodontal disease. Other factors also put individuals at higher risk.

ORAL ENVIRONMENT

Lack of Oral Hygiene. Lack of oral hygiene encourages bacterial buildup and plaque formation.

Sugar and Acid. The bacteria that cause periodontal disease thrive in acidic environments. Therefore, eating sugars and other foods that increase the acidity in the mouth increase bacterial counts.

Poorly Contoured Restorations. Poorly contoured restorations (fillings or crowns) that provide traps for debris and plaque can also contribute to its formation.

Anatomical Tooth Abnormalities. Abnormal tooth structure can increase the risk.

Wisdom teeth. Wisdom teeth, also called third molars, can be a major breeding ground for the bacteria that cause periodontal disease. In fact, for patients in their 20s, periodontal disease is most likely to occur around the wisdom teeth. Research suggests that periodontitis can occur in wisdom teeth that have broken through the gum as well as teeth that are impacted (buried). Periodontal disease can also be present even in patients with wisdom teeth who do not have any symptoms. Experts recommend that adolescents and young adults with wisdom teeth should have a dentist check for signs of periodontal disease

AGE

Children and Adolescents. Gingivitis, in varying degrees, is nearly a universal finding in children and adolescents. In rare genetic cases, children and adolescents are subject to destructive forms of the disease. Researchers have also observed some of the organisms seen in periodontal disease in young children without signs of gum problems. Healthy children, however, do not generally harbor two primary periodontal bacteria, *P. gingivalis* and *T. denticola*. The disease is also uncommon in teenagers.

Adults. One survey reported that 3.6% of adults between the ages of 18 - 34 had periodontal disease. As people age, the risk for periodontal disease increases. Over half of American adults have gingivitis surrounding 3 - 4 teeth and 30% have significant periodontal disease surrounding 3 - 4 teeth. In a study of people over 70 years old, 86% had at least moderate periodontitis and over a quarter of them had lost their teeth.

FEMALE HORMONES

About three-quarters of periodontal office visits are made by women, even though women tend to take better care of their teeth than men. Female hormones affect the gums, and women are particularly susceptible to periodontal problems. Hormone-influenced gingivitis appears in some adolescents, in some pregnant women, and is occasionally a side effect of birth control medication.

Before Menstruation. Gingivitis may flare up in some women a few days before they menstruate when progesterone levels are high. Gum inflammation may also occur during ovulation. Progesterone dilates blood vessels causing inflammation, and blocks the repair of collagen, the structural protein that supports the gums.

Pregnancy. Hormonal changes during pregnancy can aggravate existing gingivitis, which typically worsens around the second month and reaches a peak in the eighth month. Pregnancy does not cause gum disease, and simple preventive oral hygiene can help maintain healthy gums. Any pregnancy-related gingivitis usually resolves within a few months of delivery. Because periodontal disease can increase the risk for low-weight infants and cause other complications, it is important for

pregnant women to see a dentist.

Oral Contraceptives. Some studies report that oral contraceptives containing the synthetic progesterone desogestrel (but not dienogest, another common progesterone) increase the risk for periodontal disease.

Menopause. Estrogen deficiency after menopause reduces bone mineral density, which can lead to bone loss. Bone loss is associated both with periodontal disease and osteoporosis. A 2005 study found that bone loss in the alveolar bone (which holds the tooth in place) was a major predictor of tooth loss in postmenopausal women. Periodontal disease is the main cause of alveolar bone loss. During menopause, some women may also develop a rare condition called menopausal gingivostomatitis, in which the gums are dry, shiny, and bleed easily. Women may also experience abnormal tastes and sensations (such as salty, spicy, acidic, burning) in the mouth.

FAMILY FACTORS

Periodontal disease often occurs in members of the same family. Genetics, intimacy, hygiene, or a mixture of factors may be responsible. Studies have found that children of parents with periodontitis are 12 times more likely to have the bacteria thought to be responsible for causing plaque and, eventually, periodontal disease.

Genetic Factors. According to a 2000 study, genetic factors may play the critical role in half the cases of periodontal disease. Up to 30% of the population may have some genetic susceptibility to periodontal disease. For example, some people with severe periodontal disease have genetic factors that affect the immune factor interleukin-1 (IL-1), a cytokine involved in the inflammatory response. Such individuals are up to 20 times more likely to develop advanced periodontitis than those without these genetic factors. Early onset and rapidly progressive periodontal disease also have strong genetic components.

Intimacy. Intimate partners and spouses of people with periodontal disease may also be at risk. Researchers have found that the bacteria *P. gingivalis* may be contagious after exposure to an infected person over a long period of time. There is no risk from short exposure such as after a fast kiss or when sharing an eating utensil.

SMOKING AND NICOTINE

Smoking is the single major preventable risk factor for periodontal disease. The habit can cause bone loss and gum recession even in the absence of periodontal disease. A number of studies indicate that smoking and nicotine increase inflammation by reducing oxygen in gum tissue and triggering an over-production of immune factors called cytokines (specifically ones called interleukins), which in excess are harmful to cells and tissue.

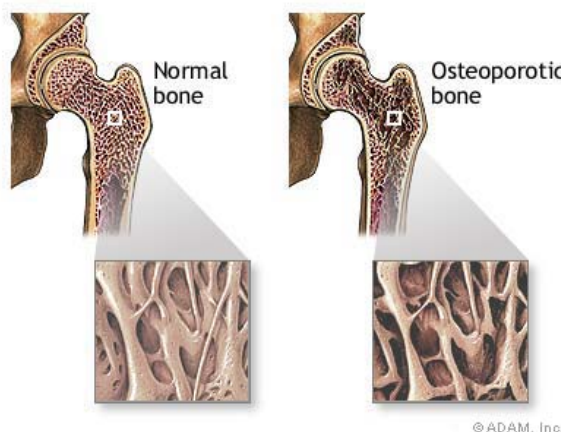
Furthermore, when nicotine combines with oral bacteria, such as *P. gingivalis*, the effect produces even greater levels of cytokines and eventually leads to periodontal connective tissue breakdown. Studies suggest that smokers are 11 times more likely than nonsmokers to harbor the bacteria that cause periodontal disease and four times more likely to have advanced periodontal disease. In one study more than 40% of smokers lost their teeth by the end of their lives.

The risk of periodontal disease increases with the number of cigarettes smoked per day. Smoking cigars and pipes carries the same risks as smoking cigarettes. Exposure to secondhand smoke is also associated with a 50 - 60% increased risk for developing periodontal disease, according to a 2001 study. Fortunately, when smokers quit, their periodontal health gradually recovers to a state comparable to that of nonsmokers.

DISEASES ASSOCIATED WITH PERIODONTAL DISEASE

Diabetes. Much evidence exists on the link between type 1 and 2 diabetes and periodontal disease. Diabetes causes abnormalities in blood vessels, and high levels of specific inflammatory chemicals such as interleukins, that significantly increase the chances of periodontal disease. High levels of triglycerides (which are common in type 2 diabetes) also appear to impair periodontal health. A high blood sugar level, which is the hallmark of diabetes, has even been associated with severe periodontal disease in people without diabetes, according to a 2000 study. Obesity, which is common in type 2 diabetes, may also predispose a person to gum disease. Controlling both type 1 and 2 diabetes may help reduce periodontal problems. For children with diabetes, good oral hygiene should begin at a young age. A 2006 study suggested that gum problems can start as early as 6 years of age in children with diabetes.

Osteoporosis. Osteoporosis (loss of bone density) has been associated with periodontal disease in postmenopausal women. There have also been a few reports of osteonecrosis (bone decay) of the jaw in patients who take oral bisphosphonate drugs such as alendronate (Fosamax). Osteonecrosis of the jaw is a rare, but serious, condition. As a precaution, the American Dental Association (ADA) recommends that patients who are prescribed bisphosphonate drugs get a thorough dental exam before beginning drug therapy, or as soon as possible after beginning therapy. The ADA also recommends that patients who take oral bisphosphonate drugs should discuss with their dentists any potential risks from dental procedures (such as extractions and implants) that involve the jawbone. In any case, be sure to inform your dentist if you are taking a bisphosphonate drug.



© ADAM, Inc.

Osteoporosis is a condition marked by progressive loss of bone density, thinning of bone tissue, and increased risk of fractures. Osteoporosis may result from disease, dietary or hormonal deficiency, or advanced age. Regular exercise and vitamin and mineral supplements can reduce and may even reverse loss of bone density.

Cancer. Patients who are treated for bone cancer, or cancers that have spread to the bone, sometimes receive intravenous bisphosphonate drugs to help strengthen bone. These drugs can increase the risk of developing osteonecrosis (bone decay) of the jaw. Symptoms of osteonecrosis of the jaw include loose teeth, exposed jawbone, pain or swelling in the jaw, gum infections, and poor healing of the gums. About 1 - 10% of patients treated with intravenous bisphosphonates develop this condition. Patients who take oral bisphosphonate drugs also have a slight risk, but 94% of osteonecrosis of the jaw cases involve patients who received bisphosphonates intravenously. If possible, see a dentist for a complete oral exam before beginning bisphosphonate therapy. In any case, be sure to inform your dentist if you are receiving intravenous bisphosphonates. Your dentist or oral surgeon may need to take special precautions when performing dental surgery.

Herpes-Related Gingivitis. Herpes virus is a common cause of gingivitis in children and has become increasingly common in adults. It typically starts out with a purplish color and "boggy" sensation in the gums. Multiple blisters may form across the mucus membranes in the mouth and gums, followed by ulcers. They usually resolve in 7 - 14 days.

HIV-Associated Gingivitis. HIV-associated gingivitis has been reported in 15 - 50% of patients with HIV or AIDS. HIV-positive individuals harbor larger numbers of periodontal bacteria (*Candida albicans*, *P. gingivalis*, black-pigmented anaerobic rods, and *A. actinomycetemcomitans*) than people without HIV. Severe pain is characteristic, along with odor, spontaneous bleeding, ulcers, and swollen, bright red gums. The inflammation never recedes, but halitosis and acute episodes can be managed by conventional cleaning treatments. Its severest form, known as necrotizing stomatitis, can be diagnostic for AIDS. In addition to bleeding, the gums in the front of the mouth are a yellowish-gray color, and bone thrusts out.

Autoimmune Diseases. Autoimmune conditions (Crohn's disease, multiple sclerosis, rheumatoid arthritis, lupus erythematosus, CREST syndrome) have been associated with a higher incidence of periodontal disease. Some research suggests that periodontal disease may even play some causal role. For example, one 2002 study suggested that *P. gingivalis*, one of the major bacteria in periodontal disease, was associated with destructive processes in the brain leading to multiple sclerosis. Still, more research is needed to determine a definitive association between these diseases.

Other Diseases. People with tuberculosis, syphilis, Wegener's granulomatosis, amyloidosis, and many genetic disorders are also at higher risk for periodontitis.

VITAMIN C DEFICIENCIES

Vitamin C helps the body repair and maintain connective tissue, and its antioxidant effects are important in the presence of tissue-destroying oxidants in periodontal disease. A large 2000 study found that people who consumed less than the recommended daily allowance of vitamin C, 60 mg (about one orange) were 1.5 times more likely to develop severe gingivitis than those who consumed more than 180 mg each day. (It should be noted that smoking also depletes vitamin C supplies.)

ETHNIC, SOCIOECONOMIC, AND GEOGRAPHIC FACTORS

Dental disease is most likely to affect the poor. Children and the elderly suffer the worst oral care, and ethnic minorities follow. A 2002 study reported that the amount of oral bacteria was greater in people who visited their dentist the least and when educational levels were low. Ethnicity played no role. It is distressing enough that 44 million Americans lack medical insurance, but almost 2.5 times that number lack dental insurance. In a survey of residents of five states (Arizona, California, Hawaii, Oregon, and Wisconsin), the rate of total tooth loss was less than 20%. In three states (Kentucky, Louisiana, and West Virginia) it was greater than 40%.

DRUG-INDUCED GINGIVITIS

Gingival overgrowth can be a side effect of nearly 20 different drugs, most commonly phenytoin (Dilantin), cyclosporine (Sandimmune), and a short-acting form of the calcium channel blocker nifedipine (Procardia).

OTHER CAUSES OF GUM INFLAMMATION

Several other conditions can also cause gum inflammation, and some have been associated with periodontal disease. They include:

Mouth breathing

Psychologic stress. Stress can affect the immune system. Some studies suggest that stress can influence the development of chronic inflammatory diseases, like periodontitis.

Alcohol abuse. One study reported a higher incidence of periodontal disease, tooth decay, and possibly precancerous areas in patients who abuse alcohol.

Canker sores (aphthous ulcers)

Self-injury in psychologically disturbed patients

Hereditary gingival fibromatosis. A rare genetic disease associated with both gum overgrowth and hairiness. It is often associated with gingivitis and periodontal disease.

Desquamative gingivitis. With this condition the outer layer of the gum tissue desquamates (peels away), exposing an acutely red surface. It usually occurs as a result of an allergic reaction or of skin diseases such as lichen planus, benign mucous membrane pemphigoid, bullous pemphigoid, and pemphigus vulgaris. (Bacteria may also play a role in this gum disease.) This condition generally resolves when the underlying problem is treated. It is fairly common in middle-aged women.

Complications

The ultimate outcome of uncontrolled periodontal disease is tooth loss. As the destructive factors cause the breakdown of bone and connective tissue, there remains no anchor for the teeth.

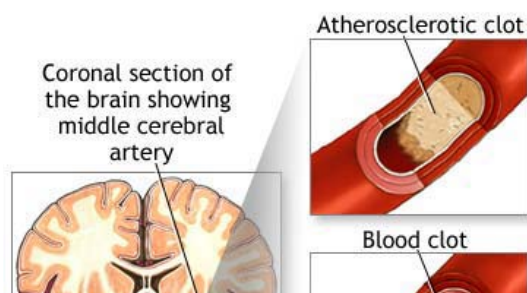
BAD BREATH

A much less severe but nevertheless distressing problem caused by periodontal disease is bad breath, although coatings on the tongue may contribute more to bad breath than periodontal disease.

HEART DISEASE AND STROKE

Studies have reported that people who have heart disease have a 1.5 - 4 times increased risk for periodontal disease. (The risk is highest for patients with extensive gum disease, bleeding from every tooth.) Acute coronary syndrome, high blood pressure (hypertension), and high cholesterol have also been associated with periodontal disease.

Periodontal disease has also been linked to stroke and to coronary artery disease (CAD). The more severe the periodontitis, the greater the risk for heart problems. Many experts, however, are still not sure whether periodontal disease is a risk factor for stroke or a marker that reflects various risk factors common to both conditions.





© ADAM, Inc.

A stroke is caused by a loss of blood circulation to areas of the brain. The blockage usually occurs when a clot or piece of atherosclerotic plaque breaks away from another area of the body and lodges within the blood vessels of the brain.

Recent evidence suggests that the inflammatory response may be the common element. This is an over-reaction of the immune system that causes injury to tissues in the body. A common link between patients with both heart conditions and periodontal disease may be elevated levels of C-reactive protein (CRP), a marker for the inflammatory response. Some experts believe that immune factors causing this response are released into the bloodstream during periodontal disease and cause injury in the arteries supplying blood to the heart.

Other evidence suggests that the periodontal disease bacteria itself -- particularly *P. gingivalis*, *T. denticola*, *T. forsythia*, and *streptococci spp* -- may be the main culprit. In 2005, results from the NIH-sponsored Oral Infections and Vascular Disease Epidemiology Study (INVEST) determined an association between cardiovascular disease and the bacteria that cause periodontal disease. In this study, higher levels of periodontal bacteria were associated with thicker carotid arteries (a predictor of heart attack and stroke), regardless of C-reactive protein levels. While this study's findings are an important advance in understanding the relationship between periodontal and heart disease, it is still not clear if periodontal disease actually causes heart disease. Researchers hope that future results from INVEST will clarify this issue.

Experts are still not sure if treating gum disease can reduce the risks of heart disease. Studies have been mixed.

EFFECT ON DIABETES

Diabetes is not only a risk factor for periodontal disease -- periodontal disease itself can worsen diabetes. Some evidence suggests that the bacteria that causes periodontal disease may enter the bloodstream and activate cytokines, (damaging immune system factors), which then destroy cells in the pancreas where insulin is produced. Some studies indicate that treating periodontal disease can reduce the need for insulin and improve blood sugar control in some people with diabetes.

EFFECT ON RESPIRATORY DISEASE

Bacteria that reproduce in the mouth can also be carried into the airways in the throat and lungs, increasing the risks for respiratory diseases and worsening chronic lung conditions such as emphysema.

EFFECT ON PREGNANCY

Many studies strongly indicate that bacterial infections that cause moderate-to-severe periodontal disease in pregnant women increase the risk of premature delivery and low birth weight infants. The more severe the infection, the greater the risk to the baby. Research indicates that the bacteria from gum disease, and from tooth decay, may trigger the same factors in the immune system as genital and urinary tract infections. These biologic substances, called prostaglandins and tumor necrosis factor, produce inflammation in the cervix and uterus that can cause premature dilation and contractions. Research also suggests that periodontal disease increases the risk for preeclampsia, a life-threatening disorder that occurs in mid- to late pregnancy and is characterized by high blood pressure.

Experts recommend that women have a periodontal examination before becoming pregnant or as soon as possible thereafter. Because women with diabetes are at higher risk for periodontal disease, it is especially important that they see a dentist early in pregnancy. Experts are still not sure if treating periodontal disease can improve birth outcomes. A 2006 study in the *New England Journal of Medicine* indicated that the treatment does not affect pre-term birth or birth weight. However, the researchers reported that periodontal treatment is definitely safe for pregnant women.

Prevention

Healthy habits and good oral hygiene are critical in preventing gum disease. Regular and effective tooth brushing and mouth washing, however, are effective only above and slightly below the gum line. Once periodontal disease develops, more intensive treatments are needed.

DIETARY CHANGES

It is important to reduce both the quantity and, in particular, the *frequency* of sugar intake. Snacks and drinks should be free of sugars (other than natural sugars found in fruits and vegetables). Sugar-containing foods should be consumed with meals, ideally followed by brushing. Since fruit juices can also cause tooth erosion in children, milk and water use should be emphasized.

QUITTING SMOKING

Smoking may play a significant role in over half the cases of chronic periodontal disease, according to research published in 2000. For smokers, quitting is one of the most important steps toward regaining periodontal health.

FLUORIDE TREATMENTS

Fluoride treatment in children has helped to account for the decline in periodontal disease in adults. Because fluoride prevents decay, back molars, which keep the teeth in place, are spared, and are thus less vulnerable to bacteria. Even before teeth first erupt, babies' gums should be wiped clean with a bit of gauze bearing a dab of fluoride toothpaste. Supplementation with fluoride tablets or drops may be recommended for children 6 months or older who drink unfluoridated water or who are at risk for dental problems. A prescription from the child's pediatrician or dentist is required.

Some dentists recommend a fluoride gel for adult patients who are still at risk for tooth decay or sensitivity, but extra fluoride is generally not necessary for adults who use fluoride toothpaste.

DENTAL EXAMINATIONS

Periodontitis is a silent disease. People with the disease rarely experience pain and may not be aware of the problem. A periodontal examination by a general dentist once or twice a year should reveal any incipient or progressive problems. A full mouth series of x-rays is advised every 2 - 3 years. This will alert the dentist to early bone loss and other disorders of the oral cavity.

Dentists now often perform Periodontal Screening and Recording (PSR) using a probe to measure gum pockets. This procedure used to be performed only by periodontists but is now encouraged as part of a regular dental examination. The dentist will identify any areas where deep pocketing has occurred, where the health of the gingiva appears compromised, and where there is undue mobility of teeth. It is the general dentist's responsibility to identify periodontal disease and inform the patient. If the condition is severe, the dentist may want to refer the patient to a periodontist.

DAILY DENTAL CARE

Correct tooth brushing, mouth cleansing, and flossing should be everyone's defense against periodontal disease. (However, good hygiene is probably not sufficient to

prevent periodontal disease in many people. Regular visits to a dentist are extremely important, especially for high-risk individuals.)

Brushing Guidelines. The following are some recommendations for brushing:

Use a dry brush. One study reported that when people brushed their teeth without toothpaste first, using a soft dry brush, their plaque deposits were reduced by 67%, and gum bleeding dropped by 50%.

No brush of any size, shape, or gimmick is effective if it is incorrectly positioned in the mouth. Place the brush where the gum meets the tooth, with bristles resting along each tooth at a 45-degree angle.

Begin by dry brushing the inside the bottom row of teeth, then the inner top teeth, and last the outer surfaces.

Wiggle the brush back and forth so the bristles extend under the gum line.

Scrub the broad, biting surfaces of the back teeth.

Dry brushing should take about a minute and a half.

A paste is then applied, and the teeth should again be brushed in the same way.

The tongue should be scrubbed for a total of about 30 seconds. A tongue scraper used with an anti-bacterial mouthwash (such as Listerine) is more effective than a toothbrush in removing bacteria.

Rinse the toothbrush thoroughly and then tap it on the edge of the sink at least five times to get rid of debris.

Flossing should finish the process. A mouthwash may also be used.

If brushing after each meal is not possible, rinsing the mouth with water after eating can reduce bacteria by 30%.

Toothbrushes. A vast assortment of brushes of varying sizes and shapes are available, and each manufacturer makes its claim for the benefits of a particular brush. Look for the American Dental Association (ADA) seal on both electric and regular brushes.

In spite of the wide variety of nonelectric toothbrushes, both in shape and bristle design, a study of eight brands found no significant differences in effectiveness among them.

Electric toothbrushes, particularly those with a stationary grip and revolving tufts of bristles, can be advantageous for some people with physical disabilities. Electric toothbrushes with heads that move back and forth up to 4,200 times a minute remove significantly more plaque than ordinary brushes. Even more high-tech brushes are now available that use sound waves to remove plaque.

In general, studies have reported no differences between electric and manual toothbrushes in their ability to remove plaque. (One study showed considerable improvement in groups using sonic toothbrushes, particularly in those with moderate periodontal disease.) Experts recommend, however, that if a regular toothbrush works, then it isn't necessary to buy an expensive electric one.

For individuals with average dexterity, a four- or five-rowed, soft, nylon-bristled toothbrush is sufficient. The most important factor in buying any toothbrush, electric or manual, is to choose one with a soft head. Soft bristles get into crevices easier and do not irritate the gums. One study found that those who used a soft toothbrush had 4.7% of exposed tooth below the gum line compared to 9.4% with hard brush users.

Experts generally recommend replacing toothbrushes every 1 - 3 months. Not only do they become breeding grounds for bacteria, but the worn bristles are less effective at removing plaque.

Toothpaste. The object of a good toothpaste is to reduce the development of plaque and eliminate periodontal causing microorganisms without destroying the organisms that are important for a healthy mouth. All brands should show ADA approval. Even a good toothpaste, however, cannot be delivered past 3 mm below the gum line, where periodontitis develops.

Toothpastes are a combination of abrasives, binders, colors, detergents, flavors, fluoride, humectants, preservatives, and artificial sweeteners. Highly abrasive toothpastes should not be used, especially by individuals whose gums have receded.

Ingredients contained in toothpastes may include:

Fluoride. Most commercial toothpastes contain fluoride, which both strengthens tooth enamel against decay and enhances remineralization of the enamel. Fluoride also inhibits acid-loving bacteria, especially after eating, when the mouth is more acidic. This antibacterial activity may help control plaque.

Triclosan. Colgate's Total toothpastes contain a fluoride and triclosan, an extremely potent anti-bacterial substance. The toothpaste also contains a substance that keeps triclosan active in the mouth for 12 hours. Total was the first FDA approved toothpaste for the prevention of tooth decay, gingivitis, and plaque. Still the benefits of this toothpaste are limited and are most pronounced in people with severe gingivitis. Of some concern are studies reporting development of bacteria resistant to triclosan. Anyone with periodontal disease should not rely on this product alone.

Metal salts. Metal salts such as stannous and zinc serve mostly as anti-bacterial substances in toothpastes. Stannous fluoride gel toothpastes do not reduce plaque, however, even though they have some effect against the bacteria that cause it, but slightly reduce gingivitis. Such toothpastes can cause staining that requires professional cleaning. Crest Plus Gum Care contains a stabilized form of stannous fluoride. Studies conducted by the manufacturer suggest that it has antibacterial activity and that it might be more effective than Colgate's Total in reducing gingivitis and bleeding.

Enzymes called glucanases

Plant extracts (such as sanguinarine). Viadent toothpaste and mouthwash contain an anti-bacterial herbal extract called sanguinarine. The two products provide minimal results when used individually, but if the mouthwash and toothpaste are used together they have produced plaque reductions of 17 - 42% and reductions of gingivitis of 18 - 57% during a 6-month period. However, some questions have been raised about the safety of prolonged use of sanguinarine.

Peroxide and baking soda. Toothpastes with these ingredients appear to offer no benefits against gum disease. In fact, tooth whiteners are usually made with carbamide peroxide, which breaks down into hydrogen peroxide, and brushing with hydrogen peroxide is not recommended. Studies indicate that overuse of this solution may actually damage cells and soften tooth surfaces. People who smoke or drink alcohol, however, might avoid products with hydrogen peroxide in them.

Antibacterial sugar substitutes (xylitol), and detergents (delmopinol)

Mouthwashes. The value of many mouthwashes is highly controversial. Many have only temporary antibacterial value. Some can even harm the mucus membrane, and they can be dangerous to children who drink them. Those that are considered plaque fighters are chlorhexidine (prescription) and Listerine, which is available over the counter.

Chlorhexidine (Peridex or PerioGard) is available by prescription only. It reduces plaque by 55% and gingivitis by 30 - 45%. Patients should rinse for 1 minute twice daily. They should wait at least 30 minutes between brushing and rinsing since chlorhexidine can be inactivated by certain compounds in toothpastes. It has a bitter taste. It also binds to tannins, which are in tea, coffee, and red wine, so it has tendency to stain teeth in people who drink these beverages.

Listerine is composed of essential oils and is available over the counter. It reduces plaque and gingivitis, when used for 30 seconds twice a day. It leaves a burning sensation in the mouth that most people better tolerate after a few days of use. Some people might object to or have concerns about the high alcohol content in the standard version. Other forms of Listerine that have a different taste and lower alcohol content retain the same active ingredients and appear to be as effective. The usual regimen is to rinse twice a day. Generic equivalents are available. (Listerine PocketPaks, which are strips that dissolve on the tongue, have no proven effects on plaque and gingivitis.)

Mouthwashes containing cetylpyridinium (Scope, Cepacol) have moderate effect on plaque, but only if they are used an hour after brushing. None are as effective as Listerine or chlorhexidine, but they may still have some value for people who cannot tolerate the other mouthwashes.

Mouthwashes containing stannous fluoride and amine fluoride (Meridol) are moderately effective, but are also not as effective as Listerine or chlorhexidine.

Fluoride mouthwashes (Act) are helpful in preventing cavities.

Plax offers only modest protection against plaque and gingivitis. Even Advanced Formula Plax, which may show a minor reduction in plaque levels, does not seem to provide any protection against periodontal disease.

Flossing. The use of dental floss, either waxed or unwaxed, is critical in cleaning between the teeth where the toothbrush bristles cannot reach. In spite of this, nearly two-thirds of people do not floss.

To floss correctly, the following steps may be helpful:

Break off about 18 inches of floss and wind most of it around the middle finger of one hand and the rest around the other middle finger.

Hold the floss between the thumbs and forefingers and gently guide and rub it back and forth between the teeth.

When it reaches the gum line, the floss should be curved around each tooth and slid gently back and forth against the gum.

Finally, rub gently up and down against the tooth. Repeat with each tooth, including the outside of the back teeth.

If, on repeated flossing attempts, the floss becomes shredded or cannot be removed easily from between the teeth, a rough crown or overhanging filling may be the cause. In such cases, the restoration should be redone. Such areas create spaces for the collection of food debris, plaque, and calculus.

Here are some tips in choosing the right floss or flossing device:

Use a floss that does not shred or break.

Avoid a very thin floss, which can cut the gum if brought down with too much force or not guided along the side of the tooth.

People who have very tight spaces between their teeth should consider flosses that are made of Gore-Tex. This floss slips easily between tight teeth and will not tear on sharp edges. It does cost slightly more, however.

A floss threader is an invaluable aid for the person who has bridgework. Made of plastic, it looks like a needle with a huge eye, or loop. A piece of floss is threaded into the loop, which can then be inserted between the bridge and the gum. The floss that is carried through with it can then be used to clean underneath the false tooth or teeth and along the sides of the abutting teeth.

Another handy device for cleaning under bridges is a Proxabrush. This is a tiny narrow brush that can be worked in between the natural teeth and around the attached false tooth or teeth.

The Floss Plus easy flosser device is also effective and may make it easier for some people to floss.

Special toothpicks such as Stim-U-Dent may be effective for wide spaces between teeth but should never replace flossing. Standard toothpicks should never be used for regular hygiene.

Electronic products such as Oral B Innerclean and the Water Pik Flosser are as effective as manual flossing. These devices are expensive but may improve compliance.

Producing Saliva and Drinking Water. Saliva is important for diluting the toxins created by plaque. Drinking at least 7 glasses of water a day helps reduce inflammation in the mouth by producing more saliva. Increasing water intake is particularly important as one ages, when less saliva is produced.

Diagnosis

The dental practitioner typically performs a number of procedures to determine a diagnosis of periodontal disease.

MEDICAL HISTORY

The dentist will first take a medical history to reveal any past or present periodontal problems, any underlying diseases that might be contributing to the problem, and any medications the patient is taking. After noting the general state of oral hygiene, the dentist may ask about the quality of home dental care.

PHYSICAL EXAMINATION

Inspection of the Gum Area. The dentist inspects the color and shape of gingival tissue on the cheek (buccal) side and the tongue (lingual) side of every tooth and compares these qualities to the healthy ideal. Redness, puffiness, and bleeding upon probing indicate inflammation. If the gum formation between teeth is blunt and not pointed, acute necrotizing periodontal disease may be indicated.

Periodontal Screening and Recording (PSR). PSR is a painless procedure used to measure and determine the severity of periodontal disease:

The dentist uses a mirror and a periodontal probe, a fine instrument calibrated in millimeters (mm), which is used to measure pocket depth. (A new automatic probing device may prove to be even more sensitive and accurate than the standard manual probe that most dentists use.)

The probe is held along the length of the tooth with the tip placed in the pocket. The tip of the probe will then touch the point where the connective tissue attaches to the tooth.

The dentist will "walk" the probe to six specified points on each tooth, three on the buccal (cheek) and three on the lingual (tongue) sides. The dentist measures the depth of the probe at each point.

Pocket depths greater than 3 mm indicate disease.

These measurements help determine the condition of the connective tissue and amount of gingival overgrowth or recession. PSR appears to be even more reliable than x-rays in diagnosing gum disease.

Testing Tooth Movement. Tooth mobility is determined by pushing each tooth between two instrument handles and observing any movement. Mobility is a strong indicator of bone support loss.

X-rays. X-rays are taken to show any loss of bone structure supporting the teeth. Eighteen x-rays make up the full mouth series necessary for diagnosis.

Treatment

Studies support the effectiveness of active treatment combined with a strict maintenance program for patients with periodontal disease. In one 2002 study, for example, people with periodontal disease who were inconsistent in caring for their gums after treatment had 5.6 times the risk for tooth loss as those who were very vigilant.

Some dentists have reported a success rate of 85% when professional treatment and good home maintenance are combined. Treatment helps nonsmokers more than smokers, particularly when pockets are deep and persistent. Some studies suggest that periodontal treatment in people with type 2 diabetes helps improve blood

sugar levels. Whether treatment will help reduce other health risks, including heart attack and stroke, is unknown.

Treatment Goals. Once periodontal disease has been identified, the goals of treatment are:

- To arrest and control the progress of the disease
- To leave the periodontal tissues in an easily maintainable state
- If possible, to restore the supporting structures, which include bone, gum tissue, and ligaments

Treatment Phases. To achieve these goals, there are various approaches:

- Initial cleaning, scaling, and curettage
- Surgery -- if needed for reducing deep pockets that remain underneath the gum after extensive cleaning sessions
- Low-dose oral or topical antibiotics
- Maintenance

After the active treatment is completed and the mouth is in a relative state of health, the patient should have regular cleanings lasting 45 minutes to 1 hour, approximately every 3 months. These may be done by the dental hygienist, the periodontist, or the general dentist. The patient may alternate between them. Home care, of course, must be continued.

Antibiotics Before Treatment. In cases where the individual has a mitral valve prolapse or history of rheumatic heart disease, pretreatment with an appropriate antibiotic is required before any dental work, including cleaning. This is necessary to prevent the possibility of bacterial endocarditis, which can be life threatening.

DEEP CLEANING: SCALING AND ROOT PLANING

Scaling, polishing, and sometimes curettage are used to manage periodontal disease. They are usually accomplished in a series of three to four visits spaced about a week apart. (Patients might ask their dentist about the gas nitrous oxide, which is helpful for many patients and may reduce the visits to a single one.) The dental hygienist or practitioner generally uses both ultrasonic and manual instruments to remove calculus.

- Calculus above the gum is easily seen. The dental professional usually detects calculus below the gum by careful probing with an instrument.
- The hygienist or dentist may use an ultrasonic instrument for removal of the more accessible calculus. This probe-like device vibrates at a frequency range higher than is audible to the human ear. Some people with low tolerance for the ultrasonic probe may wish to request nitrous oxide.
- A spray of water is used with ultrasound to prevent overheating and to flush out the debris that is dislodged.
- The dental professional will scrape the plaque from above and below the gum line (called scaling). When the probe contacts the rock-like calculus, deposits fracture off the tooth fairly efficiently.
- The hygienist or dentist will then smooth the rough spots on the tooth. Smoothing the surface helps remove bacteria that collect there (root planing) and also helps the gums reattach.
- Polishing is the finishing procedure. It uses a rubber cup with an abrasive paste to remove plaque and stains on the crown portion of the tooth. It produces a smooth surface, making it temporarily harder for plaque to adhere.

After the cleaning procedure, the dentist will check the pocket depths around the teeth after the cleaning process has been completed. Further treatment needs are determined by the results of these initial sessions:

- If the cleaning processes have reduced inflammation, observation only is needed.
- If an abscess is present, surgery may be required.

Finally, the dental hygienist or practitioner should offer thorough instructions on home care to insure the removal of bacteria on a daily basis. This includes proper use of the toothbrush, paste, mouth rinses, floss, floss threaders, and proxabrushes. Home care can effectively eliminate the plaque above the gums and down to 2 mm below the gums.

GINGIVAL CURETTAGE

Gingival curettage removes the soft tissue lining of the periodontal pockets in order to completely eliminate bacteria and diseased tissue. It may be used along with scaling and root planing, but achieves a deeper and more complete cleaning. Evidence indicates, however, that it does not contribute any additional benefits beyond simple scaling and planing.

SURGERY (OPEN FLAP CURETTAGE)

Surgery allows access for deep cleaning of the root surface, removal of diseased tissue, and repositioning and shaping of the bones, gum, and tissues supporting the teeth. Surgical procedures vary depending on the individual diagnosis and needs of the patient. The basic procedure is known as open flap curettage. It involves:

- The periodontal surgeon lifts, or flaps, the gums away from the tooth and surrounding bone.
- The diseased root surfaces are cleaned and curetted (scraped) to remove deposits.
- Gum tissue is replaced into positions to minimize pocket depth.
- The periodontist may also contour the remaining bone and attempt to regenerate lost bone and gingival attachment through bone grafts and guided tissue regeneration or the use of enamel matrix protein derivatives.

There is some debate about whether this procedure is any more effective in preventing disease progression than non-surgical therapies, such as low-dose doxycycline, short-term antibiotics, or antibiotic gels. Some studies have reported that although surgical treatment reduced pocket depth more than non-surgical therapies for at least a year after the procedure, benefits from surgery do not persist beyond 5 years, except in very deep pockets.

Postsurgery Pain and Discomfort. Post-surgery discomfort is usually managed easily with over-the-counter medications such as ibuprofen. If discomfort is severe, stronger analgesics may be prescribed. Some patients experience sensitivity to hot or cold temperatures from exposed roots. These problems can be managed with topical fluoride treatments or, in severe cases, with dental restoration.

TECHNIQUES AND MATERIALS FOR RESTORING GUM TISSUE AND BONE

Guided Tissue Regeneration. A more advanced technique, called guided tissue regeneration, is used to stimulate bone and gum tissue growth:

- First, the root surfaces and diseased bone are meticulously cleaned out. Preventing bacterial contamination is very important. The more residual bacteria, the greater the chance that the treatment will fail.
- A specialized piece of fabric is sewn around the tooth to cover the crater in the bone left after the cleaning. It is either absorbable or nonabsorbable. (Some studies report highly beneficial results with new absorbable materials, including those coated with the antibiotic doxycycline.)
- The gum is then sewn over the fabric. The fabric prevents the gum tissue from growing down into the bone defect and allows the bone and the attachment to the

root to regenerate.

After 4 - 6 weeks, the nonabsorbable fabric must be removed using a minor surgical procedure. The absorbable membrane may be left in. In general, there is little difference in outcome between absorbable and nonabsorbable procedures. The absorbable fabric may not be as effective as standard grafts if gum tissue is thin, although newer materials may prove to produce better results.

Bone Grafting. In some cases of severe bone loss, the surgeon may attempt to encourage regrowth and restoration of bone tissue that has been lost through the disease process. This involves bone grafting:

The surgeon places bone graft material into the defect.

The material may be either bone from the same patient or a substance called decalcified freeze-dried bone allografts (DFDBA) which is obtained from a donor.

This material then stimulates new bone growth in the area.

Enamel Matrix Protein Derivative. Amelogenin is a derivative of a major protein in the structure (the matrix) of enamel that helps stimulate gum tissue growth. A gel containing amelogenin (Emdogain) is applied during surgery and forms a coat over the roots of the teeth. The gel itself dissolves after 2 days, leaving the active substance behind. Studies report that it is safe and may significantly reduce the effects of periodontal disease. A 2001 study suggested that the benefits, as indicated by bone attachment, can persist for at least 4 years. (Results were similar to guided tissue regeneration.)

COSMETIC AND GUM GRAFTING TREATMENTS

Gum grafting techniques can also be very useful for improving the looks of the gum as well as adding support to the teeth. During this procedure, the periodontist takes gum tissue from the palate or another donor source to cover the exposed root in order to even the gum line and reduce sensitivity. Other procedures are available to improve the look of the gums and teeth. The gum line can be sculpted to improve uneven or excess gums and to cover exposed roots as gums recede.

IMPLANTS

Periodontists report that they are achieving great success with tooth implants in patients who have lost teeth due to periodontal disease. The average cost for a single implant is high, however, and one implant requires 5 - 7 months for completion.

Medications

Antibiotics are often used in combination with surgery, curettage, or alone to eliminate or prevent disease-causing bacteria after periodontal procedures. They are being investigated in oral forms as well as in topical forms that are applied directly to the gum. Increasingly, dental professionals are finding that local application of antibiotics is more effective than periodontal surgery alone. They may even prove to be an alternative to surgery.

Some experts are concerned, however, that long-term use of antibiotics increases the risk of bacterial resistance to these drugs, which is a growing health problem in general. Of some encouragement was a 2000 review, which indicated that low-dose antibiotics do not increase the risk of bacterial resistance. However, long-term studies are still needed.

ORAL ANTIBIOTICS AT STANDARD DOSES

Antibiotics given orally and at standard doses have some limited applications for periodontal disease. They are typically given for an acute infection. Long-term use of antibiotics is advised for the control of juvenile periodontitis, refractory periodontitis, rapidly progressing periodontitis, and prepubertal periodontitis. Specific antibiotics used in periodontal disease include:

Tetracycline antibiotics -- which include tetracycline hydrochloride, doxycycline, and minocycline -- are the primary drugs used. They not only have anti-bacterial actions but also reduce inflammation and help block collagenase, the protein that destroys connective tissue and bone, even in low doses. In fact, these two actions seem to contribute most to periodontal protection, rather than their antibacterial properties. Short-term use of standard-dose doxycycline (a 10-day treatment) is used for treating acute periodontal infections and for eliminating inflammation. Topical application and long-term use of these antibiotics are showing particular promise.

Some macrolide antibiotics (roxithromycin) may have actions against inflammation and growth involved in periodontal disease.

Some quinolone antibiotics (moxifloxacin, ciprofloxacin) may specifically target *A. actinomycetemcomitans*, an important bacteria in periodontal disease.

Metronidazole (Flagyl) in combination with tetracycline or amoxicillin (a penicillin) may be used for severe and chronic periodontal disease.

There is growing bacterial resistance to many of these antibiotics, such as roxithromycin and metronidazole, therefore limiting their use in periodontal disease. One study indicated, however, that 3 months after antibiotic administration, the percentage of bacteria that could be eliminated with standard antibiotics returned to normal.

DIRECT DELIVERY OF ANTIBIOTICS TO THE GUMS

Topical application of antibiotics to the gum surface does not affect the entire body like oral antibiotics do, and they are preferred whenever possible. Studies suggest that in combination with scaling and planing any of these approaches are very effective for periodontal health.

Several different topical applications are showing promise, including:

Atridox is a doxycycline gel that conforms to the gum surface and then solidifies. Over the next few days, it releases the antibiotics.

Elyzol is a gel or strip applied to the gum that is composed of metronidazole. It has unique actions that are effective against parasites as well as bacteria. Studies suggest that Atridox, which contains doxycycline, may be more effective than Elyzol. (In one study, however, the doxycycline gel worked faster but metronidazole achieved a greater bacterial reduction.)

PerioChip is a chip that is placed into the gum pocket after scaling. Over time, it slowly releases chlorhexidine, a powerful bacteria-killing antiseptic. Early studies report benefits in reducing pocket depths, but it is still not known whether these improvements are sustained.

Minocycline microspheres (Arestin) contain antibiotics in tiny capsules, which are applied to the gums after scaling and planing. Studies report that they are more effective in reducing pocket depth and bone loss than standard periodontal maintenance. Patients obtain these benefits regardless of their smoking status, age, gender, or extent of the periodontal disease.

Actisite is a thin strip similar to dental floss, which is treated with tetracycline hydrochloride. The treated thread is temporarily inserted between the tooth and gum. (Using multiple strips may be more beneficial than using a single strip.) This was one of the first topical applications of antibiotics. Other topical approaches are being increasingly used.

LOW-DOSE AND CHEMICALLY MODIFIED TETRACYCLINES

Subantimicrobial Dose Doxycycline (Periostat). Subantimicrobial dose doxycycline (SDD) is a term used for a treatment that uses very low doses (20 mg) of doxycycline (Periostat). Although doxycycline is a tetracycline antibiotic, the doses used are too low to affect bacteria. However, at these dose levels, the drug blocks matrix metalloproteinases (MMPs) -- enzymes that destroy the connective tissues holding the teeth. Periostat is taken twice a day for months. There is some concern that such long-term use may pose a risk for the development of antibiotic-resistant bacteria or other, still unknown, adverse effects. The doses used in this treatment, however, are too low to have any effect on bacteria, so some experts believe this risk is very low. In fact, several 12-month studies report significant improvements in tooth attachment and pocket depth with no increased incidence of side effects. [Taking a common nonsteroidal anti-inflammatory drug, such as aspirin or ibuprofen

(Advil) along with doxycycline, may enhance the effectiveness of this treatment.]

Chemically Modified Tetracyclines. Other tetracyclines are being developed that inhibit MMPs but have no antibiotic properties, which would, theoretically, avoid possible long-term problems with antibiotic resistance.

Other Treatments

Nonsteroidal Anti-inflammatory Drugs (NSAIDs). NSAIDs are drugs that block factors that cause inflammation and pain.

Over-the-counter NSAIDs include aspirin, ibuprofen (Motrin IB, Advil, Nuprin, Rufen), naproxen (Aleve), ketoprofen (Actron, Orudis KT). Prescription NSAIDs include naproxen (Naprosyn, Anaprox), diclofenac (Voltaren), tolmetin (Tolectin), ketoprofen (Orudis, Oruvail), indomethacin (Indocin).

These drugs are used not only for relieving pain in periodontal disease but also for slowing the disease process. NSAIDs block inflammatory enzymes triggered by cytokines, which are important immune factors in periodontal disease. A number of NSAIDs have been investigated and have been shown to reduce gingivitis and slow progression of periodontal disease.

In one study, long-term use of oral flurbiprofen (Ansaid) resulted in significantly lower bone loss, although disease progression returned when the drug was stopped.

Investigators are also studying rinses, creams, and other topical forms of NSAIDs. For example, a cream containing ketoprofen appears to reduce bone loss. (Ketoprofen is of particular interest because it blocks not only COX-2 but also another pathway involved in the disease process.)

Warning about NSAIDs: Although NSAIDs work well, long-term use can cause stomach problems, such as ulcers and bleeding, and possible heart problems. In April 2005, the FDA asked drug manufacturers of NSAIDs to include a warning label on their product that alerts users of an increased risk for cardiovascular events and gastrointestinal bleeding.

GROWTH FACTORS

Gels containing growth factors -- including substances called recombinant human (rh), platelet-derived growth factor-BB (PDGF-BB), and (rh) insulin-like growth factor-I (IGF-I) -- are showing promise for restoring bone.

VACCINES

Research is underway to find a vaccine against periodontal disease. To date, animal studies show promise, but an effective vaccine for people is years away.

PHOTODYNAMIC THERAPY

Researchers are investigating the use of photodynamic therapy (PDT) as an alternative to antibiotic drugs. PDT destroys periodontal bacteria by applying photosensitive drugs to oral regions and exposing the drug-treated area to a light or laser. Research appears promising but is still in its preliminary stages.

References

- American Dental Association Council on Scientific Affairs. Dental management of patients receiving oral bisphosphonate therapy. Expert panel recommendations. *J Am Dent Assoc.* 2006 Aug;137(8): 1144-1150.
- Contreras A, Herrera JA, Soto JE, Arce RM, Jaramillo A, Botero JE. Periodontitis is associated with preeclampsia in pregnant women. *J Periodontol.* 2006 Feb;77(2):182-8.
- Faria-Almeida R, Navarro A, Bascones A. Clinical and metabolic changes after conventional treatment of type 2 diabetic patients with chronic periodontitis. *J Periodontol.* 2006 Apr;77(4):591-8.
- Geismar K, Stoltze K, Sigurd B, Gyntelberg F, Holmstrup P. Periodontal disease and coronary heart disease. *J Periodontol.* 2006 Sep;77(9):1547-54.
- Goldenberg RL and Culhane JF. Preterm birth and periodontal disease. *N Engl J Med.* 2006 Nov 2;355(18):1925-1927.
- Lalla E, Cheng B, Lal S, Tucker S, Greenberg E, Goland R, et al. Periodontal changes in children and adolescents with diabetes: a case-control study. *Diabetes Care.* 2006 Feb;29(2):295-9.
- Lee HJ, Garcia RI, Janket SJ, Jones JA, Mascarenhas AK, Scott TE, et al. The association between cumulative periodontal disease and stroke history in older adults. *J Periodontol.* 2006 Oct;77(10):1744-1754.
- Lopez NJ, Da Silva I, Ipinza J, Gutierrez J. Periodontal therapy reduces the rate of preterm low birth weight in women with pregnancy-associated gingivitis. *J Periodontol.* 2005 Nov;76(11 Suppl):2144-53.
- Melo MD, Obeid G. Osteonecrosis of the jaws in patients with a history of receiving bisphosphonate therapy: strategies for prevention and early recognition. *J Am Dent Assoc.* 2005 Dec;136(12):1675-81.
- Michalowicz BS, Hodges JS, DiAngelis AJ, Lupo VR, Novak MJ, Ferguson JE, et al. Treatment of periodontal disease and the risk of preterm birth. *N Engl J Med.* 2006 Nov 2;355(18):1885-94.
- Nase JB and Suzuki JB. Osteonecrosis of the jaw and oral bisphosphonate treatment. *J Am Dent Assoc.* 2006 Aug;137(8):1115-1119.
- Offenbacher S, Boggess KA, Murtha AP, Jared HL, Lief S, McKaig RG, et al. Progressive periodontal disease and risk of very preterm delivery. *Obstet Gynecol.* 2006 Jan;107(1):29-36.
- Renvert S, Pettersson T, Ohlsson O, Persson GR. Bacterial profile and burden of periodontal infection in subjects with a diagnosis of acute coronary syndrome. *J Periodontol.* 2006 Jul;77(7):1110-9.
- Taylor BA, Tofler GH, Carey HM, Morel-Kopp MC, Philcox S, Carter TR, et al. Full-mouth tooth extraction lowers systemic inflammatory and thrombotic markers of cardiovascular risk. *J Dent Res.* 2006 Jan;85(1):74-8.
- Van Poznak C, Estilo C. Osteonecrosis of the jaw in cancer patients receiving IV bisphosphonates. *Oncology.* 2006 Aug;20(9):1053-62.

Woo SB, Hellstein JW, Kalmar JR. Narrative [corrected] review: bisphosphonates and osteonecrosis of the jaws. *Ann Intern Med.* 2006 May 16;144(10):753-61.

A.D.A.M., Inc. is accredited by URAC, also known as the American Accreditation HealthCare Commission (www.urac.org). URAC's accreditation program is an independent audit to verify that A.D.A.M. follows rigorous standards of quality and accountability. A.D.A.M. is among the first to achieve this important distinction for online health information and services. Learn more about A.D.A.M.'s editorial policy, editorial process and privacy policy. A.D.A.M. is also a founding member of Hi-Ethics and subscribes to the principles of the Health on the Net Foundation (www.hon.ch).

A.D.A.M. Copyright

The information provided herein should not be used during any medical emergency or for the diagnosis or treatment of any medical condition. A licensed medical professional should be consulted for diagnosis and treatment of any and all medical conditions. Call 911 for all medical emergencies. Links to other sites are provided for information only -- they do not constitute endorsements of those other sites. © 1997- 2008 A.D.A.M., Inc. Any duplication or distribution of the information contained herein is strictly prohibited.