Periodontitis - A Hidden Danger: Causes, Symptoms and Prevention

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Abstract: This article provides detailed information about periodontitis, its causes, symptoms and complications. Also, special attention is paid to early detection of the disease, methods of treatment and preventive measures. The article covers recommendations of dentists and important aspects of maintaining oral hygiene. The effect of periodontitis on general health is also considered, and useful tips for patients are given. This article may be useful for medical professionals, dentists and the general public.
Keywords: Periodontitis, dental diseases, gingivitis, gum disease, tooth damage, oral hygiene, dentistry, periodontitis symptoms, periodontitis causes, periodontitis treatment, dental care, bleeding gums, oral health, tooth brushing, dental advice.

Periodontal disease, also known as **gum disease**, is a set of inflammatory conditions affecting the tissues surrounding the teeth. In its early stage, called gingivitis, the gums become swollen and red and may bleed. It is considered the main cause of tooth loss for adults worldwide. In its more serious form, called **periodontitis**, the gums can pull away from the tooth, bone can be lost, and the teeth may loosen or fall out. Halitosis (bad breath) may also occur.

Periodontal disease typically arises from the development of plaque biofilm, which harbors harmful bacteria such as *Porphyromonas gingivalis* and *Treponema denticola*. These bacteria infect the gum tissue surrounding the teeth, leading to inflammation and, if left untreated, progressive damage to the teeth and gum tissue. Recent meta-analysis have shown that the composition of the oral microbiota and its response to periodontal disease differ between men and women. These differences are particularly notable in the advanced stages of periodontitis, suggesting that sex-specific factors may influence susceptibility and progression. Factors that increase the risk of disease include smoking, diabetes, HIV/AIDS, family history, high levels of homocysteine in the blood and certain medications. Diagnosis is by inspecting the gum tissue around the teeth both visually and with a probe and X-rays looking for bone loss around the teeth.

Treatment involves good oral hygiene and regular professional teeth cleaning. Recommended oral hygiene include daily brushing and flossing. In certain cases antibiotics or dental surgery may be recommended. Clinical investigations demonstrate that quitting smoking and making dietary changes enhance periodontal health. Globally, 538 million people were estimated to be affected in 2015 and has been known to affect 10–15% of the population generally. In the United States, nearly half of those over the age of 30 are affected to some degree and about 70% of those over 65 have the condition. Males are affected more often than females.

Systemic implications

Periodontal disease (PD) can be described as an inflammatory condition affecting the supporting structures of the teeth. Studies have shown that PD is associated with higher levels of systemic inflammatory markers such as Interleukin-6 (IL-6), C-Reactive Protein (CRP) and Tumor Necrosis Factor (TNF). To compare, elevated levels of these inflammatory markers are also associated with cardiovascular disease and cerebrovascular events such as ischemic strokes.

The presence of a wide spectrum inflammatory oral diseases can increase the risk of an episode of stroke in an acute or chronic phase. Inflammatory markers, CRP, IL-6 are known risk factors of stroke. Both inflammatory markers are also biomarkers of PD and found to be an increased level after daily activities, such as mastication or toothbrushing, are performed. Bacteria from the periodontal pockets will enter the bloodstream during these activities and the current literature suggests that this may be a possible triggering of the aggravation of the stroke process.

Other mechanisms have been suggested, PD is a known chronic infection. It can aid in the promotion of atherosclerosis by the deposition of cholesterol, cholesterol esters and calcium within the subendothelial layer of vessel walls. Atherosclerotic plaque that is unstable may rupture and release debris and thrombi that may travel to different parts of the circulatory system causing embolization and therefore, an ischemic stroke. Therefore, PD has been suggested as an independent risk factor for stroke.

A variety of cardiovascular diseases can also be associated with periodontal disease. Patients with higher levels of inflammatory markers such as TNF, IL-1, IL-6 and IL-8 can lead to progression of atherosclerosis and the development and perpetuation of atrial fibrillation, as it is associated with platelet and coagulation cascade activations, leading to thrombosis and thrombotic complications.

Experimental animal studies have shown a link between periodontal disease, oxidative stress and cardiac stress. Oxidative stress favours the development and progression of heart failure as it causes cellular dysfunction, oxidation of proteins and lipids, and

damage to the deoxyribonucleic acid (DNA), stimulating fibroblast proliferation and metalloproteinases activation favouring cardiac remodelling.

During SARS Covid 19 pandemic, Periodontitis was significantly associated with a higher risk of complications from COVID-19, including ICU admission, need for assisted ventilation and death and increased blood levels of markers such as D-dimer, WBC and CRP which are linked with worse disease outcome.

Causes

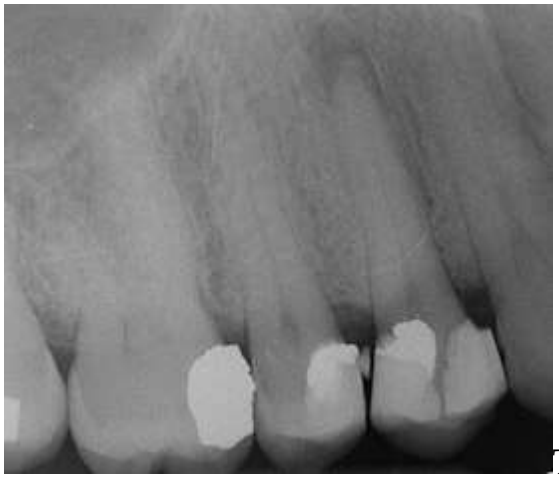
Periodontitis is an inflammation of the periodontium, i.e., the tissues that support the teeth. The periodontium consists of four tissues:

- gingiva, or gum tissue,
- cementum, or outer layer of the roots of teeth,
- alveolar bone, or the bony sockets into which the teeth are anchored, and
- periodontal ligaments (PDLs), which are the connective tissue fibers that run between the cementum and the alveolar bone.

This X-ray film displays two lone-standing mandibular teeth, the lower left first premolar and canine, exhibiting severe bone loss of 30–50%. Widening of the periodontal ligament surrounding the premolar is due to secondary occlusal trauma.

The primary cause of gingivitis is poor or ineffective oral hygiene, which leads to the accumulation of a mycotic and bacterial matrix at the gum line, called dental plaque. Other contributors are poor nutrition and underlying medical issues such as diabetes. Diabetics must be meticulous with their homecare to control periodontal disease. New finger prick tests have been approved by the Food and Drug Administration in the US, and are being used in dental offices to identify and screen people for possible contributory causes of gum disease, such as diabetes.

In some people, gingivitis progresses to periodontitis — with the destruction of the gingival fibers, the gum tissues separate from the tooth and deepened sulcus, called a periodontal pocket. Subgingival microorganisms (those that exist under the gum line) colonize the periodontal pockets and cause further inflammation in the gum tissues and progressive bone loss. Examples of secondary causes are those things that, by definition, cause microbic plaque accumulation, such as restoration overhangs and root proximity.

 The excess restorative material that exceeds the natural contours of restored teeth, such as these, are termed "overhangs", and serve to trap microbic plaque, potentially leading to localized periodontitis.

Smoking is another factor that increases the occurrence of periodontitis, directly or indirectly, and may interfere with or adversely affect its treatment. It is arguably the most important environmental risk factor for periodontitis. Research has shown that smokers have more bone loss, attachment loss and tooth loss compared to non-smokers. This is likely due to several effects of smoking on the immune response including decreased wound healing, suppression of antibody production, and the reduction of phagocytosis by neutrophils

Ehlers–Danlos syndrome and Papillon–Lefèvre syndrome (also known as palmoplantar keratoderma) are also risk factors for periodontitis.

If left undisturbed, microbial plaque calcifies to form calculus, which is commonly called tartar. Calculus above and below the gum line must be removed completely by the dental hygienist or dentist to treat gingivitis and periodontitis. Although the primary cause of both gingivitis and periodontitis is the microbial plaque that adheres to the tooth surfaces, there are many other modifying factors. A very strong risk factor is one's genetic susceptibility. Several conditions and diseases, including Down syndrome, diabetes, and other diseases that affect one's resistance to infection, also increase susceptibility to periodontitis.

Periodontitis may be associated with higher stress. Periodontitis occurs more often in people in the lower classes than people in the upper classes.

Genetics appear to play a role in determining the risk for periodontitis. It is believed genetics could explain why some people with good plaque control have advanced periodontitis, whilst some others with poor oral hygiene are free from the disease. Genetic factors which could modify the risk of a person developing periodontitis include:

- Defects of phagocytosis: person may have hypo-responsive phagocytes.
- Hyper-production of interleukins, prostaglandins and cytokines, resulting in an exaggerated immune response.
- Interleukin 1 (IL-1) gene polymorphism: people with this polymorphism produce more IL-1, and subsequently are more at risk of developing chronic periodontitis.

Diabetes appears to exacerbate the onset, progression, and severity of periodontitis. Although the majority of research has focused on type 2 diabetes, type 1 diabetes appears to have an identical effect on the risk for periodontitis. The extent of the increased risk of periodontitis is dependent on the level of glycaemic control. Therefore, in well managed diabetes there seems to be a small effect of diabetes on the risk for periodontitis. However, the risk increases exponentially as glycaemic control worsens. Overall, the increased risk of periodontitis in diabetics is estimated to be between two and three times higher. So far, the mechanisms underlying the link are not fully understood, but it is known to involve aspects of inflammation, immune functioning, neutrophil activity, and cytokine biology.

Hormonal fluctuations can also play a significant role in the development and progression of gingivitis and periodontitis. Changes in hormone levels, particularly during puberty, menstruation, pregnancy, and menopause, can lead to increased sensitivity and inflammatory responses in the gums. For example, elevated oestrogen and progesterone during pregnancy can heighten the inflammatory response to dental plaque, making pregnant individuals more susceptible to gingival disease.

Prevention

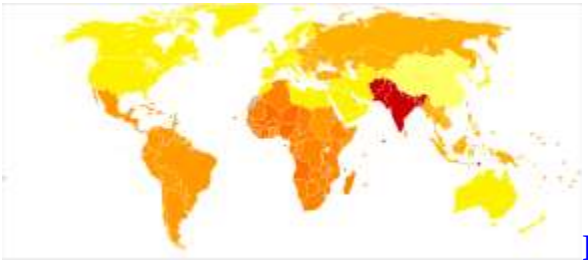
Daily oral hygiene measures to prevent periodontal disease include:

- Brushing properly on a regular basis (at least twice daily), with the person attempting to direct the toothbrush bristles underneath the gumline, helps disrupt the bacterial-mycotic growth and formation of subgingival plaque.
- Flossing daily and using interdental brushes (if the space between teeth is large enough), as well as cleaning behind the last tooth, the third molar, in each quarter.

- Using an antiseptic mouthwash: Chlorhexidine gluconate-based mouthwash in combination with careful oral hygiene may cure gingivitis, although they cannot reverse any attachment loss due to periodontitis.
- Regular dental check-ups and professional teeth cleaning as required: Dental check-ups serve to monitor the person's oral hygiene methods and levels of attachment around teeth, identify any early signs of periodontitis, and monitor response to treatment.

Typically, dental hygienists (or dentists) use special instruments to clean (debride) teeth below the gumline and disrupt any plaque growing below the gumline. This is a standard treatment to prevent any further progress of established periodontitis. Studies show that after such a professional cleaning (periodontal debridement), microbial plaque tends to grow back to precleaning levels after about three to four months. Nonetheless, the continued stabilization of a person's periodontal state depends largely, if not primarily, on the person's oral hygiene at home, as well as on the go. Without daily oral hygiene, periodontal disease will not be overcome, especially if the person has a history of extensive periodontal disease.

Epidemiology



Disability-adjusted life year for periodontal disease per 100,000 inhabitants in 2004:

no data	6–6.5
<3.5	6.5–7
3.5–4	7–7.5
4–4.5	7.5–8
4.5–5	8–8.5
5–5.5	>8.5
5.5–6	

Periodontitis is very common, and is widely regarded as the second most common dental disease worldwide, after dental decay, and in the United States has a prevalence of 30–50% of the population, but only about 10% have severe forms.

Chronic periodontitis affects about 750 million people or about 10.8% of the world population as of 2010.

Like other conditions intimately related to access to hygiene and basic medical monitoring and care, periodontitis tends to be more common in economically disadvantaged populations or regions. Its occurrence decreases with a higher standard of living. In Israeli populations, individuals of Yemenite, North-African, South Asian, or Mediterranean origin have higher prevalence of periodontal disease than individuals from European descent. Periodontitis is frequently reported to be socially patterned, i.e. people from the lower end of the socioeconomic scale are affected more often than people from the upper end of the socioeconomic scale.

Summary: Periodontitis is a serious oral health problem that can lead to tooth loss if left untreated. This article details the causes, symptoms and treatment of periodontitis. To prevent the disease, it is important to observe regular oral hygiene, regular visits to the dentist and follow a healthy lifestyle. If periodontitis is detected in time and treated correctly, it is possible to preserve the health of teeth and gums. Therefore, everyone should pay attention to oral care.