

PERIODONTAL INFECTIONS AS A RISK FACTOR FOR VARIOUS SYSTEMIC DISEASES

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Abstract

A healthy periodontium is needed for the general well being of an individual. However, periodontal diseases are common and periodontal infections are increasingly associated with systemic diseases. The literature is focused on the association between periodontal infections and systemic diseases. The individuals with periodontal disease may be at higher risk for adverse medical outcomes including cardiovascular diseases, respiratory infections, adverse pregnancy outcomes, rheumatoid arthritis and diabetes mellitus. Many cohorts, *in vitro* and animal studies suggest that systemic inflammation due to pathogens associated with periodontal disease may play a role in the initiation and progression of some systemic diseases. Periodontal infections should therefore be considered as a risk factor for various systemic diseases.

Keywords periodontium; Systemic Diseases; inflammation

1. Introduction:

The oral cavity is a mirror of the body and reflects the general health and well being of an individual. Humans have been afflicted by major oral diseases such as dental caries and periodontal diseases since time immemorial. Periodontal infections have many causes, often modified by underlying systemic conditions. In recent years, there has been a shift in interest from understanding periodontal manifestations of systemic diseases to linking the role of periodontal infections with various systemic diseases¹⁻⁵.

Associations have been reported between periodontal disease and cardiovascular disease, strokes, diabetes, preterm low birth-weight babies, respiratory infections and rheumatoid arthritis. Periodontal disease is the result of host inflammatory reaction to bacterial infection. The focus of infection in the oral cavity can lead to systemic inflammation resulting in adverse medical outcomes. There is a need to educate both dentists as well as general healthcare practitioners about this important aspect of oral health. It is also necessary to coordinate with medical institutions where the results of emerging research are translated into practice guidelines⁶⁻¹⁰.

As the prevalence of CVD, cerebro-vascular accidents, respiratory infections and diabetes is increasing globally, identifying risk factors other than the traditionally recognized ones may help in effectively preventing and managing these diseases. We have summarized the available evidence on the possible mechanisms by which periodontal infections may be responsible for the

initiation and progression of systemic diseases^{11,12}.

2. Periodontal Diseases¹³⁻¹⁶:

Periodontal diseases are a group of diseases that cause inflammation and destruction of the investing and supporting structures of the teeth (such as the gingiva, periodontal ligament, alveolar bone and cementum of the tooth), as well as the periodontal tissues. This leads to apical migration of the junctional epithelium, resulting in the formation of periodontal pockets. Periodontal diseases occur due to a complex interplay of bacterial infection and host response, often modified by behavioral factors and various systemic conditions such as metabolic disorders (diabetes mellitus, female hormonal imbalance), drug-induced disorders, hematological disorders such as leukaemia, and immune system disorders. These systemic disorders have been shown to affect the periodontium and/or influence the treatment of periodontal disease. Periodontal disease is caused by bacteria found in dental plaque, and about 10 species have been identified as putative pathogens in periodontal disease. Pathogens frequently associated with periodontal disease include *Aggregatibacter actinomycetemcomitans* (previously *Actinobacillus actinomycetemcomitans*), *Campylobacter rectus*, *Fusobacterium nucleatum*, *Porphyromonas gingivalis*, *Prevotella intermedia*, *Tannerella forsythia* and *Treponema denticola*.

2.1 Periodontal Infections and Cardiovascular Diseases¹⁷⁻²²: Periodontal infections are associated with systemic inflammation characterized by an increased burden of

periodontal pathogens, antigens, endotoxins and liberation of pro-inflammatory cytokines, which may contribute to atherogenesis and thrombo-embolic events culminating in ischaemic stroke. Both periodontal diseases and CVD are chronic, whose causes are multi-factorial. Risk factors common to both include older age, male gender and smoking, and psychosocial factors such as stress. A number of epidemiological studies in the 1990s suggested a relationship between CVD and periodontal diseases. However, these observational studies did not provide a rationale for periodontal infections leading to systemic complications. There is now epidemiological evidence to support the concept that poor oral health, especially extensive and severe periodontal disease, may put patients at risk for a variety of systemic conditions such as CVD. This association highlights the importance of good oral health. Poor dental health has been associated with an increased risk of fatal coronary heart disease (CHD). Thus, maintenance of good oral hygiene is important. A study by de Oliveira showed that infrequent brushing of the teeth was associated with increased concentrations of C-reactive protein (CRP) and fibrinogen; both are associated with coronary arterial plaque formation.

2.2 Periodontal Infections and Low Birth-Weight and Preterm Babies^{23 - 26}: Many prospective cohort studies, case-control studies and crosssectional observational studies have correlated poor maternal periodontal health with low birth-weight (LBW) and preterm babies.

The severity of periodontitis may adversely affect pregnancy outcomes in a dose-dependent manner. One report suggested that the average PPD and average CAL were significantly higher among women who gave birth to preterm LBW babies. The extent and severity of periodontal diseases appeared to be associated with increased odds of preterm LBW delivery. Larger studies are needed before one can be sure that periodontal infection is a true risk factor for preterm LBW.

2.3 Periodontal Infections and Respiratory Diseases^{27 - 31}: Dental plaque may promote oral and oropharyngeal colonization by respiratory pathogens. Bacteria from oral biofilms may be aspirated into the respiratory tract to initiate and cause progression of conditions such as aspiration pneumonia, chronic obstructive pulmonary disease (COPD) and lower respiratory tract infections. Reports suggest that patients on ventilators are at higher risk for acquiring fatal pneumonia due to periodontal infections, and

poor periodontal health in the elderly may be associated with increased mortality from pneumonia.

It has been reported that dental plaque may act as a reservoir for respiratory pathogens such as *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *P. gingivalis*, *A. actinomycetemcomitans* and enteric species, and thus be an important risk factor for various respiratory infections. Enzymes released from oral bacteria may act on the respiratory mucosal surface promoting adhesion and colonization of respiratory pathogens. In addition, oral bacterial products in oropharyngeal aspirates may stimulate cytokine production from the respiratory epithelial cells, resulting in recruitment of inflammatory cells. The resulting inflamed epithelium may be more susceptible to respiratory infection. The findings of many studies underline the necessity of improving oral hygiene among patients who are at risk for lifethreatening respiratory infections, such as those living in long term care institutions.

2.4 Periodontal Infections and Diabetes Mellitus^{32, 33}:

The association of periodontal infections and diabetes mellitus is bidirectional. Various oral conditions are associated with diabetes such as dry mouth, candidal infections, delayed wound healing and periodontal disease. Periodontitis has been described as the sixth complication of diabetes, together with retinopathy, nephropathy, neuropathy, macrovascular disease and altered wound healing. Poorly controlled diabetes is also associated with periodontal diseases. Severe periodontitis in people with diabetes increases the risk of poor glycaemic control due to release of pro-inflammatory cytokines such as TNF- α , which are known to play a role in inducing insulin resistance in a manner similar to that of obesity. Based on their systematic review, Taylor and Borgnakke concluded that periodontitis poses an increased risk for worsening glycaemic control. The risk of developing ketoacidosis, retinopathy and neuropathy is also higher among people who have diabetes and periodontitis.

Chronic periodontitis may have an effect on insulin resistance, since increased levels of TNF- α are seen in patients with severe periodontitis. In chronic periodontitis, there is persistent release of lipopolysachharides (LPS) from *P. gingivalis* and prolonged upregulation of TNF- α , which may increase the severity of diabetes. A chronic increase in serum TNF- α due to periodontal infection may actually cause type 2 diabetes as

insulin resistance increases, and the patient can no longer metabolize glucose appropriately. Taylor found that patients with severe periodontitis had an increased risk of developing poor glycaemic control over time.

2.5 Periodontal Infections and Rheumatoid Arthritis³⁴: There is evidence to suggest a relationship between the extent and severity of periodontal disease and RA. Many studies suggest that periodontitis could indeed be a causal factor in the initiation and maintenance of the autoimmune inflammatory response that occurs in RA. Studies also support the fact that both conditions manifest as a result of an imbalance between pro- and anti-inflammatory cytokines. As a result, new treatment strategies are expected to emerge for both diseases that may target the inhibition of pro-inflammatory cytokines and destructive proteases. Findings that support the hypothesis that oral infections play a role in the pathogenesis of RA are the impact of periodontal pathogens such as *P. gingivalis* on citrullination, and the association of periodontitis in RA patients with seropositivity for rheumatoid factor and the anti-cyclic citrullinated peptide antibody. The findings of a case-control study suggest that antibodies to *P. gingivalis* are more common in patients with RA than in healthy controls. An association of *P. gingivalis* titres with RA-related autoantibody and CRP levels suggests that infection with this organism may play a role in the risk for and progression of RA. Patients with RA should be carefully screened and their periodontal condition treated appropriately.

3. Effect of Periodontal Treatment³⁵:

Periodontal treatment, a relatively simple and cost-effective intervention, has many benefits. Many studies report a decrease in plasma levels of pro-inflammatory cytokines, CRP and other markers of systemic inflammation. Periodontal management markedly reduces systemic inflammatory markers after 1 year but not in the short term, and also improves endothelial function. It decreases insulin resistance in patients with diabetes, improves periodontal health and reduces the severity of RA if anti-TNF- α therapy is used along with standard periodontal therapy. Use of chlorhexidine (0.12%) mouth rinse also decreases the risk of ventilator-associated pneumonia (VAP). Timely dental treatment can not only halt progression of the disease but possibly also reduce the risk of developing various systemic conditions.

Conclusion:

Periodontal disease is possibly an important risk factor for various systemic diseases. Maintenance of good oral health should be given priority. People should be educated on the importance of good oral health and the risks associated with poor oral health. Dentists and medical practitioners should work together to provide comprehensive healthcare, thereby reducing the morbidity and mortality associated with periodontal infections.

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