

Review Article

A Stitch in Time Saves Nine!

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Abstract

Periodontitis is a chronic inflammatory disease affecting the tooth supporting structures which leads to mobility and eventual tooth loss. Periodontitis acts as a foci of infection or gate way for many systemic infections due to the dissemination of microbial products in distant body parts. Oral health and general health are not separate entities. Prevention of periodontal inflammation is of utmost importance for the over all general health. The aim of this review is to bring to light the systemic problems for which periodontitis act as a risk factor.

Key Words: Periodontitis, foci of infection, myocardial infarction, stroke, preterm low birth weight, cardiovascular disease, diabetes mellitus, cognitive impairment, rheumatoid arthritis, respiratory disease.

Chettinad Health City Medical Journal 2014; 3(3): 129 - 132

Introduction

Periodontitis is a chronic inflammatory disease affecting the tooth supporting structures which leads to mobility and eventual tooth loss. Dental Plaque and calculus leads to inflammation of the gingiva which if left untreated progresses to the bone resulting in periodontitis. The mouth of the human body contains more number of microbes (10^{14}) than the somatic cells (10^{13}). Oral cavity forms an ideal niche for colonization of pathogenic micro organisms¹. Foci of infection is the dissemination of the microbes and microbial products to distant body parts.

A stitch in time saves nine! Prevention of periodontal inflammation at the earliest is of utmost importance to prevent the systemic problems elsewhere in the body. Periodontitis being a gram negative bacterial infection acts as a foci of infection or gateway causing many systemic problems as shown in figure 1. The aim of this review is to bring to light the systemic problems for which periodontitis act as a risk factor.

History

In 1891 Miller in his article on, 'The human mouth as a focus of infection', stated that micro-organisms and their waste products may enter various parts of the body adjacent to or remote from the mouth. The oral bacteria was found to cause diseases like osteitis, osteomyelitis, septicemia, pyemia, meningitis, disturbance of alimentary tract, pneumonia, gangrene of the lungs, diseases of the maxillary sinus, actinomycosis, noma, diphtheria, tuberculosis, syphilis and thrush².

In 1900, William Hunter, a British Physician developed

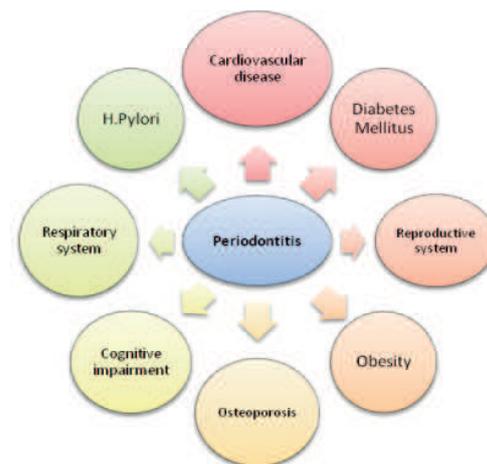


Figure 1: Periodontitis as a risk factor for systemic diseases

the idea that the oral micro organisms are responsible for wide range of systemic conditions which he stated in his paper on, "Oral sepsis as a cause of disease"³. In 1911 Frank Billings, Professor of Medicine and head of the focal infection research team at Rush Medical College and Presbyterian Hospital in Chicago, replaced the term oral sepsis with "focal infection". There was a widespread practice of so called "preventive" or "therapeutic edentulation," including extraction of otherwise healthy teeth, in attempts to treat or prevent various systemic diseases^{4,5}.

The concept of focal infection, while shifting in and out of favor as a pathogenic mechanism, has always been recognized as being potentially causal in bacterial

endocarditis. The evolution of evidence based dentistry provides an excellent association of oral and systemic problems. Mattila and coworkers reintroduced the association between oral infection and systemic disease using sound, scientific methods⁶. Later studies by Offenbacher et al provided exciting support that periodontitis may confer independent risks for systemic conditions, in particular cardiovascular disease and preterm low birth weight. At the 1996 World Workshop in Periodontics, Offenbacher introduced the term, "periodontal medicine," as a discipline of periodontology focusing on the new data establishing a strong relationship between periodontal health or disease and systemic health or disease⁷.

Oral bacteria can cause systemic diseases by remote infections caused by translocation of bacteria, metastasis of bacterial toxins which spread by blood flow and bacterial induced immune changes in remote inflammations by circulating specific antibodies from blood, forming macromolecular complexes⁸.

Apparently, an old concept is seeing new light as growing number of studies and research unfolds the concept of two way association of periodontal infections and systemic problems.

Pathogenesis

Periodontitis though a chronic and low grade bacterial infection may have an acute exacerbation of the disease during the course. The disease induces the host immune inflammatory response and the release of cytokines and acute phase markers like C - reactive protein, haptoglobin, α - 1 anti trypsin and fibrinogen. This chronic inflammation, along with acute phase markers and pro inflammatory cytokines induces the systemic response.

Periodontitis and cardiovascular disease

A number of studies have shown an association between periodontitis and cardiovascular disease (Figure 2). Mattila and co workers in 1989, indicated that poor dental health and myocardial infarction were associated with an odds ratio (OR) of 1.3 i.e., subjects with poor dental health were 1.3 times more likely to experience myocardial infarction as compared to individuals with good dental health which was independent of known risk factors like age, total cholesterol, triglycerides, hypertension, smoking and the presence of diabetes⁶.

Patients with periodontitis have shown higher risk of coronary heart disease. The amount of bone loss was found to be associated with coronary artery disease⁹⁻¹². The increase in the severity of bone loss was found to correlate with the increase in the risk of myocardial infarction¹³.

In addition, Zambon et al.¹⁴ isolated DNA sequences specific for periodontal pathogens like *Porphyromonas gingivalis* and *Actinobacillus actinomycetemcomitans* from human atheroma specimens using polymerase chain reaction (PCR) techniques. Similarly periodontal

pathogens like *Actinobacillus actinomycetemcomitans* and *Prevotella intermedia* were isolated from major arteries affected by atherosclerosis¹⁵. Atheroma formation is induced by dental plaque bacteria through various mechanisms; either by activation of innate immunity, as a result of dental treatment or direct involvement of mediators activated by dental plaque antigens in atheroma processes. Dental plaque induces production of cytokines and heat shock proteins and certain common predisposing factors^{16,17}.

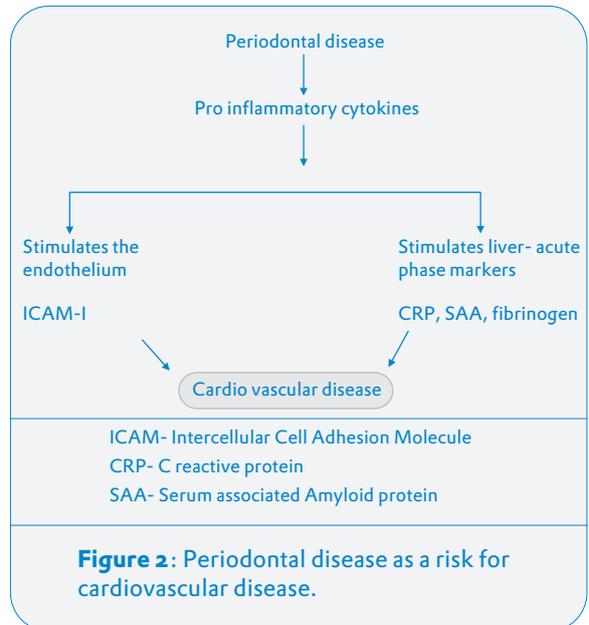


Figure 2: Periodontal disease as a risk for cardiovascular disease.

Periodontitis and Preterm low birth weight infants

Premature low birth weight (PLBW) is defined as an adverse pregnancy outcome where the infant weighs less than 2,500 g. Infection is now considered one of the major causes of premature low birth weight deliveries, responsible for ~30-50% of all cases¹⁸. Chronic bacterial challenge of the periodontium can increase the release of pro inflammatory cytokines, Lipopolysaccharide, Tumor Necrosis Factor- α , Prostaglandin E₂ which in turn cause premature contraction of uterine smooth muscles or premature rupture of membranes (Figure 3). Increased severity of periodontal disease was found to be associated with increased risk of preterm birth^{19,20}. Ig M specific antibodies against the periodontal pathogens like *Porphyromonas gingivalis* and *Bacteroides forsythus* were detected in placental blood of these patients²¹.

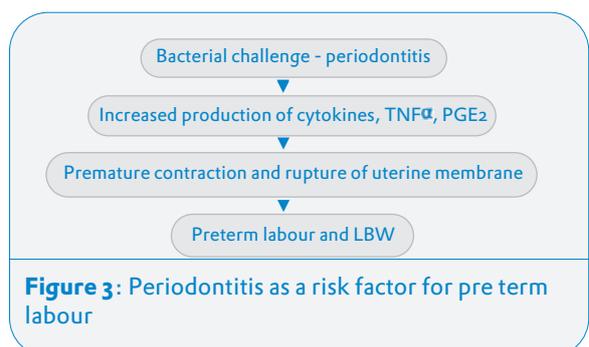


Figure 3: Periodontitis as a risk factor for pre term labour

Periodontitis and Diabetes Mellitus

Though periodontitis is considered as a sixth complication of diabetes²², it certainly has negative impact on glycemic control due to increased production of pro inflammatory cytokines . Various studies have shown the two way relationship of diabetes and periodontitis²³. Diabetes and its complications like retinopathy, neuropathy, end stage renal disease and cardiovascular complications are strongly associated with severity of periodontitis²⁴⁻²⁷.

Periodontitis and cognitive impairment

Periodontitis is associated with impaired or delayed memory and calculation²⁸. Tooth loss affects the ability to consume recommended levels of many foods and nutrients and vitamins. Pro-inflammatory factors derived from the body's response to a chronic periodontal infection may enter the brain through systemic circulation leading to cognitive function²⁹.

Periodontitis and rheumatoid arthritis

The prevalence of rheumatoid arthritis is higher in periodontal patients compared to individuals without periodontal disease. Higher serum levels of antibodies against disease-causing periodontal bacteria were observed in Rheumatoid arthritis(RA) patients compared to a control group in a case-control. Moreover the concentrations of autoantibodies that are related to RA and C-reactive protein are also higher in people with *P. gingivalis* infections. Gram negative bacilli infections can cause systemic infections anywhere in the body. Periodontal pathogens were found to induce rheumatoid arthritis in genetically susceptible host^{30,31}.

Periodontitis and *H. pylori*

Deeper periodontal pockets are most likely to colonize *H.pylori* compared to patients with normal gingiva. Subgingival plaque in individuals with periodontitis act as *H. pylori*. (Riggio Lennon 1999, Bruce et al 2002)^{32,33}

Periodontitis and respiratory diseases

Periodontitis may influence the initiation of pneumonia and chronic obstructive lung disease. Periodontal pathogens and the enzymes released by them can modify the respiratory mucosa by colonizing the respiratory pathogens; the increased production of cytokines by periodontitis promote the colonization and infection by respiratory pathogens^{34, 35}.

Conclusion

A spark of fire can light the whole forest. Hence the prime focus of this article is to enlighten the medical practitioners the role of periodontal disease in causing systemic problems. Periodontal disease does not just affect the dental health of the patient, but affects the systemic health. Hence the oral health care is of utmost importance in the overall health care of the patient. Diagnosis and prevention of the periodontal disease at the earliest should be encouraged as a part of general health care management.

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