Oral Infections – A Risk Factor for Systemic Diseases

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Abstract

The oral cavity may act as a site of origin for dissemination of pathogenic organisms to distant body sites, especially in immunocompromised hosts such as patients suffering from malignancies, diabetes, rheumatoid arthritis or having corticosteroids or other immunosuppressive treatments. Many epidemiological studies have suggested that oral infections especially periodontitis may be a risk factor for systemic diseases. These infections are predominantly anaerobic with gram negative rods being the most common isolates. The anatomic closeness of these micro floras to the blood stream can facilitate bacteraemia & systemic spread of bacterial products, components & immunocomplexes. Various systemic diseases that are associated with oral infections are cardiovascular diseases, stroke, bacterial pneumonia, diabetes mellitus etc. At this moment it seems justified to state that good oral health is important not only to prevent oral disease but also to maintain good general health.


Key words: Systemic diseases, Periodontitis, Oral Infections, Foci of infection

Introduction

Focal infection is a localized or general infection caused by the dissemination of microorganisms or toxic products from a focus of infection.¹ It has been observed since 19th and early 20th centuries, that “foci” of sepsis were responsible for the initiation and progression of a variety of systemic diseases.²³ Certain microorganisms are normally present in the oral cavity which have led to a more accurate assessment of the importance of oral focal infection.²

Oral cavity may be sources of infection and set up distant metastases through infected periapical lesions (periapical granuloma, periapical cysts, periapical abscess), teeth with infected root canals and periodontal diseases with special reference to tooth extraction and manipulation.¹
A number of epidemiological studies have shown that oral infection, especially marginal and apical periodontitis may be a risk factor for systemic diseases as they are the most common oral infections.

Periodontal diseases are a group of bacterial infections and inflammatory diseases that result in the destruction of tooth-supporting tissue, including the gingiva, alveolar bone and the teeth themselves, which may eventually cause tooth loss. It is most commonly associated with Actinobacillus actinomycetemcomitans, Porphyromonas gingivalis, and Bacteroides forsythus. Periodontitis may affect the host’s susceptibility by three ways that are by shared risk factors, by subgingival biofilms which acts as reservoirs of gram-negative bacteria, and lastly by acting as a reservoir of inflammatory mediators.

Systemic Diseases associated with Oral Infection
Various systemic diseases that are associated with oral infections are cardiovascular diseases, stroke, bacterial pneumonia, diabetes mellitus etc.

Cardiovascular Diseases
Coronary heart disease such as ischaemic heart disease and Valvular heart disease such as infective endocarditis are more likely to be related to periodontal diseases than other types of cardiovascular disorders.

Long-term systemic exposure to periodontal pathogens may play a central role. Periodontitis release bacteria and lipopolysaccharide (LPS) which when invades the coronary endothelial cells can induce an acute coronary syndrome or ischaemic stroke.

They may also cause vascular athheroma thereby leading to progression of atherosclerotic plaque leading to infective endocarditis.

Bacteria also induces inflammatory response which thereby trigger several pro-inflammatory cytokines and tissue-destructive mediators, such as C-reactive protein (CRP), TNF-a, PGE2, IL-1b and IL-6. These cytokines lead to additional monocytes and T-lymphocytes to the lesion sites.

The host inflammatory responses have both local and systemic manifestations. They lead to vascular endothelial injury, platelet aggregation, migration of monocyte, proliferation of smooth muscles and deposition of lipids thus causing a atherosclerotic lesion.

Diabetes Mellitus
Diabetes mellitus is a clinically and genetically heterogenous metabolic disease characterized by abnormally elevated blood glucose levels (hyperglycaemia) and desregulation of carbohydrate, proteins, and lipid metabolism. It is classified into four categories as follows: Type I (formerly juvenile diabetes, insulin dependent diabetes) Type II (formerly adult onset diabetes, non insulin dependent diabetes), other specific types and gestational diabetes.

Periodontal infection may induce insulin resistance, resulting in hyperglycaemia and formation of AGE. A pro-inflammatory states occur when AGEs bind to AGE receptors on target cell surfaces which include interleukin-1-b (IL-1b), tumour necrosis factor-a (TNF-a) and prostaglandin E2 (PGE2).

Formation of AGEs affect migration and phagocytic activity which triggers an ‘infection-mediated’ pathway of cytokine upregulation, resulting in destruction of connective tissue.

Porphyromonas gingivalis is thought to play an important role in periodontal diseases as it producesa lipopolysaccharide (LPS) which is a potent inducer of IL-1b, TNF-a and PGE2 thus impairing insulin action.

Also, bacterial infections can decrease insulin mediated glucose uptake by skeletal muscle and produce whole-body insulin resistance.

Respiratory Infection
Respiratory diseases cause significant morbidity and mortality in the population, especially in the hospital environment. Respiratory infections can be divided into two...
major categories: community-acquired and hospital acquired types of bacterial pneumonia.4

Teeth and periodontium may act as a reservoir for respiratory infection. Dental plaque could be a source of these anaerobic bacteria that cause pneumonia or other types of respiratory infection.21

Once bound to the host surface, the bacteria multiply and colonize the upper respiratory airway. These bacteria can be aspirated into the lower airway to cause subsequent lower respiratory infection and can get adhered in to the lungs. They may colonize there thus diminishing the nonspecific host defence against respiratory pathogens.

Cytokines (such as IL-1, IL-6, IL-8 and TNF-a) released from periodontal tissues may also alter respiratory epithelium and increase its susceptibility to colonization by respiratory pathogens. Subsequent inflammatory responses also contribute to break down the pulmonary tissues.4, 22, 23

Osteoporosis

Osteoporosis has been described as ‘thin bones’ or ‘brittle bones’. Periodontal pathogens releases endotoxins and proinflammatory cytokines, IL-1 and IL-6 which results in uncoupling of normal bone homeostasis leading to increased osteoclastic activity and decreased bone density thereby causing osteoporosis.4, 24, 25

Stroke

Periodontitis is associated with elevated markers of inflammation that are themselves indicators of stroke risk. Bacteria, cytokines, LPS from periodontal pockets can enter the systemic circulation during activities such as chewing or tooth brushing. They promote atherosclerosis and affects blood coagulation, functions of platelets and prostaglandin synthesis thereby leading to stoke.26, 27

Conclusion

Thus we see that oral infection, especially periodontitis, are a potential contributing factor to a variety of clinically important systemic diseases. However, further understanding and studies related to it should be done to know the association between periodontal diseases and systemic diseases so that it can raise society’s awareness that good oral health is important not only to prevent oral disease but also to maintain good general health.

References


