

Oral infections and systemic disease—an emerging problem in medicine

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ABSTRACT

The relationship between oral and general health has been increasingly recognised during the past two decades. Several epidemiological studies have linked poor oral health with cardiovascular disease, poor glycaemic control in diabetics, low birth-weight pre-term babies, and a number of other conditions, including rheumatoid arthritis and osteoporosis. Oral infections are also recognised as a problem for individuals suffering from a range of chronic conditions, including cancer and infection with human immunodeficiency virus, as well as patients with ventilator-associated pneumonia. This review considers the systemic consequences of odontogenic infections and the possible mechanisms by which oral infection and inflammation can contribute to cardiovascular disease, as well as the oral conditions associated with medically compromised patients. A large number of clinical studies have established the clinical efficacy of topical antimicrobial agents, e.g., chlorhexidine and triclosan, in the prevention and control of oral disease, especially gingivitis and dental plaque. The possible risks of antimicrobial resistance are a concern, and the benefits of long-term use of triclosan require further evaluation. Oral infections have become an increasingly common risk-factor for systemic disease, which clinicians should take into account. Clinicians should increase their knowledge of oral diseases, and dentists must strengthen their understanding of general medicine, in order to avoid unnecessary risks for infection that originate in the mouth.

Keywords Bacteraemia, odontogenic infections, oral disease, prevention, review, triclosan

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INTRODUCTION

Advances in the understanding, prevention and treatment of oral diseases during the past 50 years have led to a significant increase in the number of individuals retaining more of their natural teeth for longer periods of time. However, many of these teeth have been heavily restored and are prone to further breakdown, and this increasingly dentate population is at risk for periodontal disease. The goal of modern dental care is oral health, but this cannot always

be achieved or maintained. Often, only an arrest of disease progression can be attained, and chronic asymptomatic infections may persist. In addition, chronic or malignant diseases of the mucosa are increasingly common. The mouth has thus become a significant potential source of both infection and inflammation that contributes to the total burden of disease and to overall health and well-being.

The oral microbiota is both rich and unique. A similar microbiota does not exist elsewhere. In healthy individuals, viridans group streptococci constitute the majority of the indigenous oral flora. However, the most common bacteria isolated from pus samples from odontogenic infections are facultative anaerobic streptococci and anaerobic Gram-negative bacilli, e.g., *Prevotella* and *Fusobacterium* spp. [1,2]. Currently, a

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significant proportion of Prevotellae isolates worldwide are β -lactamase producers, and β -lactam antibiotics alone are thus ineffective against these organisms. For this reason, metronidazole has been used in combination with penicillin in order to achieve improved efficacy against anaerobes.

Actinobacillus (now *Aggregatibacter*) *actinomycetemcomitans* and *Porphyromonas gingivalis* are also key oral pathogens and have frequently been associated with periodontal diseases. It is also interesting to note that both of these organisms can invade oral epithelial cells, which contributes to their immune evasion and resistance to antibiotic treatment [3,4]. *Actinomyces* spp. are part of the normal oral microbiota and constitute the bulk of the structural elements of the dental plaque biofilm. These organisms are also found in cases of peri-implantitis, which is an infection of dental implant supporting tissues, and which may result in loss of the implant [5]. In addition, they can cause actinomycosis of jaws. *Candida albicans* is the most common yeast found in the oral cavity, although the proportion of non-*albicans* *Candida* isolates has increased in recent years, especially in patients with fragile health.

ODONTOGENIC INFECTIONS

The spread of oral infections is generally confined by anatomical barriers or tissue planes, e.g., muscle and bone. However, spread of infection back and down to the larynx and the mediastinum can occur [1]. A central principle is that oral infections cannot be resolved merely by use of antibiotics, and successful treatment is always based on properly conducted dental procedures. Nevertheless, antibiotic treatment is important and, as stated above, a combination of penicillin and metronidazole should be considered. An odontogenic infection can spread very rapidly, and the airway may become obstructed within a few hours. If this occurs, rapid intubation or tracheostomy and intensive care may be required. An example of a life-threatening infection originating in the mouth is Lemierre's syndrome, which is a rare septic condition that usually requires intensive care. Isolation of *Fusobacterium necrophorum* is common, and a suppurative thrombophlebitis in the vena jugularis interna and metastatic abscesses in the lungs or the brain can develop [1].

The mouth clearly represents an important reservoir of microorganisms and any infection caused by these organisms should alert the clinician to the possibility of an oral source [6–8]. While there have been a number of reports of brain abscess being caused by oral microorganisms [9], the classical example is endocarditis caused by viridans group streptococci. According to the infectious diseases register of the Finnish National Public Health Institute (<http://www.ktl-fin/tartuntatautirekisteri>), the number of adult septicaemias caused by viridans streptococci has almost doubled in the past 10 years, which is directly proportional to the number of individuals remaining dentate throughout their lives. Viridans group streptococci are currently the fifth most common cause of septicaemia among adults in Finland.

In this context, it is therefore important for infectious disease physicians to give increasing attention to oral health. The possibility of an oral source should be considered for any infection of unknown origin. Oral infections often remain asymptomatic, and may still result in bacteraemia despite an absence of overt symptoms. Minor oral procedures, including brushing of teeth, as well as invasive dental procedures, e.g., removal of dental calculus, root treatment and surgery, may all result in bacteraemia, even in an otherwise healthy individual [10,11]. Furthermore, an oral infection may provide the physician with clues for diagnosis of a systemic disease. For example, oral candidosis, in the absence of any other explanation, could suggest infection with human immunodeficiency virus at a stage when the CD4⁺ cell count is still high and the disease is still otherwise asymptomatic.

THE MEDICALLY COMPROMISED PATIENT

An increasing number of systemic diseases, e.g., gastroenterological and rheumatological, are treated with moderate-to-severe immunosuppressive agents. Malignancies, with their associated therapies, also affect an increasingly large proportion of the population. The oral health of medically and immunologically compromised patients is fundamental to the overall care of these patients. Oral infections are typically chronic and often present with minor symptoms; however, they remain controlled while the immune defences

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