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## Review Article

# Systemic diseases and oral health

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### ARTICLE INFO

#### Article history:

Received 31 July 2013

Accepted 1 June 2014

#### Keywords:

Bacteremia

Coronary disease

Dental caries

Diabetes mellitus

Periodontal diseases

### ABSTRACT

Oral health is an important and often overlooked component of a person's general health and well-being. Systemic conditions noted to occur with oral manifestations include diabetes, cutaneous diseases, hereditary disease, joint disease, immunocompromised states like HIV, AIDS, etc. Several studies have linked poor oral health with cardiovascular disease, poor glycemic control in diabetics, low birth-weight pre-term babies, and a number of other conditions, including rheumatoid arthritis and osteoporosis, respiratory diseases, etc. This review is to stress on the importance of considering both systemic and oral health when treating an individual.

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## 1. Introduction

The effect of oral health on the rest of the body was stated by the Assyrians as early as the seventh century B.C.<sup>1</sup> There is much more than beautiful teeth aligned perfectly in the oral cavity when it comes to oral health. Oral health, in essence, refers to the freedom from chronic oral-facial pain, orofacial lesions, birth defects such as cleft lip and palate, and other diseases and disorders that affect the craniofacial complex.<sup>2</sup> Socio-economic considerations often serve as barriers to obtain dental care in a private practice dental delivery system, and it has been noticed that, this population experiences greater levels of both dental and systemic disease.<sup>3</sup>

The most prevalent and non-transmissible infectious disease experienced by most of the people all over the world is dental caries which is nothing but the bacterial infection and degradation of the tooth structure.<sup>4</sup> Colonization of the oropharyngeal region is always linked with several systemic diseases<sup>5</sup> such as cardiovascular disease,<sup>6</sup> chronic obstructive

pulmonary disease,<sup>7</sup> endocarditis<sup>8</sup> and bacteremia.<sup>9</sup> Considerable controversy surrounds the focal infection theory, which says that the mouth is a bacterial reservoir from where infection can spread through blood to cause infections at distant sites, besides, it can stimulate the immune response and the circulating inflammatory mediators will cause damage throughout the body.<sup>10</sup> This review discusses the influence that oral health has on systemic diseases and vice-versa. The role of salivary biomarkers has also been presented.

## 2. The relationship between oral health and systemic diseases

Various diseases or problems like stroke, infective endocarditis, bacterial pneumonia, low birth weight, myocardial infarction, congestive heart failure etc., are caused mainly by oral infections or oral health.<sup>11</sup>

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<http://dx.doi.org/10.1016/j.injms.2015.02.003>

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### 2.1. Stroke

Stroke is a cerebrovascular disease that affects blood vessels supplying blood to the brain. It occurs when a blood vessel bringing oxygen and nutrients to the brain bursts or is clogged by local thrombus formation or by aggregates of bacteria and fibrin from other sources such as the heart. Studies on the pathology of stroke indicate that 80–85% of these lesions are due to cerebral infarction; 15–20% are caused by hemorrhage.

The periodontium when inflamed releases bacterial by-products, inflammatory cytokines, lipopolysaccharides (LPS) and bacteria into the circulation. It advances atherosclerosis and it may affect the coagulation of blood, the normal platelet functions and prostaglandin synthesis, thus abetting the onset of stroke. A case control study demonstrated poor oral health in patients with cerebral infarction as compared to the control group.<sup>12</sup> This could further set up a vicious cycle because of periodontal inflammation.

### 2.2. Infective endocarditis

Bacterial infection of the heart valves or the endothelium of the heart is called as infective endocarditis. It is caused due to bacteria gaining entry in to the bloodstream and getting lodged on abnormal heart valves or damaged heart tissue.<sup>13</sup> It is a fatal systemic disease, when untreated and has always been connected with dental diseases and their treatment, during which the bacteria enter the blood stream and there are more chances of them getting lodged in the heart. Recently there were three controlled studies conducted and all showed a link between dental procedures and bacterial endocarditis.<sup>14–16</sup> The commonly implicated dental procedures are oral prophylaxis (scaling and root planning) and extractions. Endodontic treatment is considered to be safe in these patients.

### 2.3. Low birth weight

Pregnancy gingivitis is a condition which is due to the changes in the hormone levels during pregnancy resulting in inflammation of gingiva.<sup>17</sup> It has been elucidated that gram negative periodontal infections can have an influence on the outcome of pregnancy. Considering local factors like plaque in such a case during the second trimester of pregnancy, these gram negative anaerobic bacteria produce several bioactive molecules that have a direct negative impact on the host. For example, the lipopolysaccharide component of the cell wall of gram negative bacteria activate macrophages and help in the production of several cytokines like interleukins 1 and 6, tumor necrosis factor (TNF), and prostaglandin E2 (PGE2), in addition to matrix metalloproteinases. These molecules have the ability to cross the placental barrier, augment the levels of PGE2 and TNF in the amniotic fluid and induce premature labor. Low birth weight infants are more likely to die during the neonatal period when compared to normal birth weight infants<sup>18</sup> and even if they survive they will face neurodevelopmental disturbances,<sup>19</sup> problems with respiration<sup>20</sup> and congenital anomalies.<sup>21</sup>

### 2.4. Diabetes mellitus

Periodontal disease often occurs in co-existence with diabetes mellitus. Recent research focusses on the possibility that periodontal disease can either predispose or exacerbate diabetes. This is based on findings that when mechanical periodontal treatment [scaling, root planing and curettage] alone is provided, regardless of the severity of periodontal disease or degree of diabetes control, the treatment outcome is improvement in periodontal status only i.e., it is a localized effect. However, when systemic antibiotics are included in addition to the mechanical therapy, an improvement in diabetes control is achieved which is evident by a reduction in glycosylated hemoglobin or a reduction in insulin requirements.<sup>22</sup>

Diabetics are more likely to develop severe periodontal disease than non-diabetics and it is a well realized point.<sup>22</sup> There is an increased risk of poor glycemic control in diabetic patients with periodontitis when compared to the diabetics without periodontitis.<sup>23</sup> Dental check up should be made periodic for diabetic patients to check their periodontal health status.<sup>24</sup>

### 2.5. Bacterial pneumonia

Potential pathogens can be cultured from the oral cavity in critically ill patients in the intensive care units, and these microorganisms in the mouth can move along the respiratory tract and colonize the lung resulting in ventilator-associated pneumonia.<sup>25</sup> This incidence can be reduced by removing the dental plaque.

### 2.6. Patients in the critical care unit

Unlike the healthy persons, dental plaque in patients in the Intensive Care Unit may serve as a reservoir for the pathogens and can be easily colonized by respiratory pathogens like methicillin-resistant *Staphylococcus aureus* and *Pseudomonas aeruginosa*.<sup>26,27</sup> Bacteria gain easy entry from the oropharynx through an open glottis to the lower part of the respiratory tract along the endotracheal tubes. These tubes also help in colonization, by interfering with the cough reflex. Decreasing the number of microorganisms in the mouth will help in reducing the organisms which are available for the passage to and colonization of the lung. Commonly used material by the nurse to provide mouth care to patients who cannot provide their own care are the foam swabs,<sup>28</sup> which are not effective in plaque control but still they provide stimulation of mucosa.<sup>29</sup>

### 2.7. Cancer

Pancreatic carcinogenesis is influenced by periodontal diseases which increase the generation of carcinogens like nitrosamines.<sup>30</sup> There is evidence of elevated levels of oral bacteria and levels of nitrosamine in the oral cavity of the patients with periodontal disease.<sup>31</sup> Smoking leads to oxidative stress and triggers a series of events that could contribute to cell transformation.<sup>32</sup>

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