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## Dental Infection and Diabetes: The Cycle

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### Introduction

The relation between dental infection and diabetes is like a cycle, in term of; diabetes can lead to dental infection due to alteration of the host immune responses, resulting in increase the predisposition to infectious processes. Once that infection is established, the oral infection exacerbates the progression of systemic disease. Consequent control of the blood sugar level will be difficult with subsequent exacerbation of the infection and so on. Furthermore; the link between periodontal diseases and diabetes is well documented, in terms of; periodontal diseases can lead to diabetes. When diabetes start, the periodontal diseases getting worse. So, it's important to know how to break this cycle to get the control of the disease process.

### Diabetes - Dental Infection Cycle

The negative effects of diabetes mellitus on the immune system have been extensively investigated. These effects impact greatly on the host's ability to prevent the establishment of, and bring resolution to a variety of head and neck infections. The main etiologic factor in diabetes mellitus that leads to dysfunction in the immune system is hyperglycemia. All the major cell types involved in the immune defense are affected. Cellular elements of the innate immune system, including neutrophils and monocytes/macrophages, have altered function. In the neutrophils, functions such as adherence, chemotaxis, and phagocytosis may be down-regulated. This results in a less effective defense against a microbial challenge. The neutrophils from diabetic patients also produce less free oxygen radicals, which reduce their ability to make toxic metabolites for release against microbes. Monocytes and macrophages may have up-regulated catabolism of pro-inflammatory cytokines as well as increased production of matrix metalloproteases, such as collagenase. This creates an imbalance that is detrimental to the containment of head and neck infections. The hyperglycemic state may also lead to a decrease in fibroblast proliferation and synthesis of collagen, impairing tissue turnover and wound repair. It has been proposed that the formation of advanced glycation end-products (AGEPs), which form as a result of glucose irreversibly binding to proteins and lipids in the face of prolonged hyperglycemia, is a key event in the generation of the defects seen in diabetes. Glycation end products can bind to receptors on various cells, such as leukocytes, and affect their function. The up regulation of tissue destructive cytokines produced by the monocytes and macrophages may be a result of AGEP binding. AGEPs also alter the solubility of collagen and may play a role in the changes seen in small and large blood vessels. This collagen interaction may result in the accumulation of AGEPs on the basement membrane, affecting the exchange of nutrition, neutrophil migration, and the diffusion of antibodies and oxygen. As a group, these effects should have a detrimental effect on the wound healing apparatus and can lead to serious and life-threatening infections in patients with DM. Prompt

recognition of infection and treatment with appropriate empirical broad-spectrum antimicrobial agents, in conjunction with surgical intervention, is often necessary to eradicate such infections.

The fundamental flaw of a shallow oxygen gradient in the diabetic tissue is shared by the radiated tissue, which is another tissue fraught with wound healing complications and tissue non viability. In each of these tissues the shallow oxygen gradient (less than 20 mmHg) fails to generate macrophage chemotaxis and fail to stimulate macrophage secretion of angiogenic factors and fibroblast growth factors. Shallow oxygen gradient predisposes wounds to infection, because the neutrophil-mediated killing of bacteria by free radicals is decreased.

When infection starting, pain and stress lead to stress response in the body by increasing the amount of certain hormones such as cortisol and adrenaline. These hormones work against the action of insulin and, as a result, the body's production of glucose increases, which results in high blood sugar levels. The high blood sugar level lead to progression of the infection with subsequent more pain and stress and the situation can go out of control.

### How to break the diabetic-dental infection cycle

Prompt recognition of infection and aggressive treatment of the infection with effective antibiotic agents (combination of amoxicillin-clavulanic acid & metronidazole), in conjunction with surgical intervention, is often necessary to eradicate such infections. The control of the blood sugar level is the key of success of the treatment of the infection. The use of hyperbaric oxygen (HBO) will be of great help in case of massive and sever infection. HBO develop oxygen gradient range from 50-250 mmHg which restores the defense against infection by neutrophil-mediated free radicals, increases the rate of killing of some common bacteria by phagocytes and increase the macrophage chemotaxis and secretion of angiogenic and fibroblast growth factors. In addition, hyperbaric oxygen alone is bactericidal for certain anaerobes. HBO Improves leukocyte function and bacterial killing, Antibiotic potentiation, Enhances collagen synthesis and cross linking, Improves cellular metabolism and host immune response, Direct toxic affect to anaerobic bacteria, Inactivates clostridium toxin, The neutrophils-mediated killing of bacteria by free radicals, Stimulate macrophage secretion of angiogenic factors and fibroblast growth factors, Increase the macrophage chemotaxis and Adequate tissue oxygen tension also facilitates fibroblast proliferation and new capillary formation. Adequate tissue oxygen tension also facilitates fibroblast proliferation, new capillary formation.

### Dental infection-diabetes cycle

Periodontal disease may be the most prevalent chronic disease affecting children, adolescents, adults, and the elderly. Untreated periodontal disease has been linked to an increased risk for developing

certain systemic conditions as well as difficulties in managing certain systemic conditions. The link between periodontal and systemic health is a two-way street, particularly when it comes to periodontitis and diabetes mellitus. The American Diabetes Association (ADA) acknowledges the link between periodontal disease and diabetes in their 2003 Report on the Diagnosis and Classification of Diabetes Mellitus: "periodontitis is often found in people with diabetes [1]. In 2000, the American Academy of Periodontology (AAP) took a strong public stand on this issue in their 1999 position paper that acknowledges a bi-directional relationship between periodontal disease and diabetes. [2] The Proposed biological mechanisms (association between periodontal disease and diabetes) as following: Inflammatory mediators (prostaglandins), Bacterial products (lipopolysaccharides) and Bacteria. All of these pass to the Bloodstream reaching Liver and pancreas (Insulin resistance and glucose intolerance) and lead to Diabetes. Once the diabetes starting, the periodontal infection and the periodontal status of the diabetic patient will get worse and the cycle will start.

### **How to break the dental infection -diabetes cycle**

Periodontal treatment and metabolic control of diabetes is the foundation of success of treatment. Long-term successes depend on

optimal oral hygiene and regular maintenance visits for monitoring the status of periodontium and reinforcement of daily plaque removal by the patient. Treatment of the periodontal disease requires special skills and knowledge of the disease background which maybe cannot be achieved by the general scope dentist. The most frequently used antibiotics are metronidazole, the Tetracyclines, Clindamycin, ciprofloxacin and amoxicillin. While the selection of specific antibiotic is the periodontist decision. Monitoring the blood sugar level for the patients with chronic periodontal diseases shouldn't be missed.

I would like to thank the editors of Journal of Oral Hygiene & Health for inviting me to present this editorial.

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