PennWell Continuing Education Course:
The Critical Role of the Oral-Systemic Link in Clinical Practice
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THE CRITICAL ROLE OF THE ORAL-SYSTEMIC LINK IN CLINICAL PRACTICE

Abstract

It is now widely accepted that there is an integral association between oral disease and systemic disease, and the term "the oral-systemic link" refers to the connections between the two. Inflammation has been implicated as a contributing factor in a multitude of systemic diseases and conditions, such as cardiovascular disease, diabetes, respiratory disease, kidney disease, rheumatoid arthritis, pregnancy complications and a variety of cancers. Periodontal disease, an inflammatory disease process resulting from the interaction of a bacterial attack and host inflammatory response, has been shown to result in inflammation in parts of the body beyond the oral cavity.

Some systemic diseases, such as diabetes, have a bi-directional relationship with periodontal disease. Inflammation appears to be the common denominator, although a variety of other pathways have been studied and found to be significant. Research continues to focus on the impact of periodontal disease on systemic health and on the mechanisms by which periodontal disease affects the body.

Educational Objectives

Recognize the role of dental practitioners in the diagnosis and treatment of periodontal disease

Identify the ways in which periodontal disease can be related to systemic diseases

Recognize the barriers that keep medical practitioners from recognizing periodontal disease

Identify systemic diseases that are related to periodontal disease

Introduction

As the oral-systemic link is becoming more widely accepted by mainstream dentistry, practicing dentists and dental hygienists must be aware of the connections between oral and systemic health and must learn to integrate this knowledge into clinical practice. It is imperative that dental practitioners recognize their critical role in performing periodontal disease risk assessment and interventions to potentially prevent negative systemic outcomes and improve the overall health of their patients. Approximately 70% of the population visits a dental office at least once a year according to data from the Centers for Disease Control and Prevention (CDCP). [1] This is much more often than people visit a physician; therefore the responsibility lies with dental professionals to protect not only the oral health of their patients but their systemic health, as well. For the 30% of the population who do not see a dental practitioner at least annually, a certain number may visit a physician. Therefore, education regarding periodontal disease and its

systemic implications is imperative for medical professionals. And ideally, medical and dental practitioners will collaborate to insure the best possible heath outcomes for their mutual patients.

The most common dental disease that has a connection to systemic disease is periodontal disease, which encompasses the spectrum from gingivitis to periodontitis. According to the American Dental Association (ADA), over 47% of the U.S adult population over 30 has mild to severe periodontal disease.[2] And according to the CDCP, approximately 64% of adults in the U.S. over age 65 have moderate to severe forms of periodontal disease.[3] Periodontal disease is a destructive inflammatory disease of the supporting tissues of the teeth caused by specific pathogenic bacterial microorganisms that results in a destruction of the periodontal ligament and alveolar bone. The progression of this infection and resulting inflammatory response can have a vast variety of effects on multiple different organ systems in the body.

Manifestations of periodontal disease in the oral cavity may be indicative of systemic disease[4]; therefore, it is crucial that the dental team work with the patient's physician to recognize, diagnose, treat and prevent a multitude of systemic diseases and conditions. Overall health may be dramatically improved by expanding the focus from the oral cavity to the entire body.

As early as 2000, the U.S. Surgeon General's report *Oral Health in America* highlighted numerous ways in which oral health and general health are linked. Oral examination can reveal signs and symptoms in over 90% of systemic diseases including immunologic diseases, endocrine disorders, hematologic conditions, systemic infections, and nutritional disorders. Identifying these early signs and symptoms may allow for early diagnosis and treatment, and possibly substantially more positive outcomes for the patient. [5]

Shifting Focus

In the past, the oral cavity was not a significant focus of medical school training, and the total body was not a significant focus of dental school training. Dentistry and medicine were separate and unconnected fields, pertaining to separate and unrelated entities. [6]

As a result, periodontal disease had been seen for decades as only an oral condition, separate from systemic disease. Dr. Ray Williams, chairperson of the department of periodontology at the University of North Carolina School of Dentistry stated, “Over recent years, we have increasingly begun to focus on inflammation of the oral cavity, not only as important for disease of the periodontal tissues, but also as a risk factor for systemic diseases. It is evident that we can no longer view gingivitis simply as a precursor of periodontitis, but we should treat it as oral inflammation that needs to be controlled and eliminated for the overall wellbeing of the individual. Any new treatment strategy that can help in controlling gingivitis should have a beneficial effect both on oral and systemic health.”[7]

Some practitioners are proponents of a redesign of dental and medical school programs entirely, to include a multi-disciplinary approach to learn to provide collaborative care. David A. Nash, DMD, MS, EdD, professor at University of Kentucky College of Dentistry, wrote a June 2006 Journal of Dental Education opinion piece titled “Why Dentists Should Become Oral Physicians” which argued that dentistry should merge completely with medicine. “The stomatognathic system is part of the human body. There is no reason to believe that the first twenty centimeters of the alimentary canal is or should be treated conceptually or practically as different from the

rest of the body."[8] Inter-professional education may take years to achieve. In the interim, continuing education courses can serve to educate and inspire practitioners to expand the scope of their knowledge and practice to be able to provide more comprehensive, oral and systemic care.

Medical Practitioners Lack Oral Education

In a study published in the journal Pediatrics[9], 90% of pediatricians reported that they had an important role in identifying dental problems in their patients and educating families about dental care. However, half of the physicians reported that they had no oral health training in medical school or in their residency programs. Another study showed similar findings in surveys of certified diabetes educators. They felt oral health was important for patient care and education, but they also felt that they lacked sufficient knowledge themselves to provide that oral health education for their diabetes patients.[10]

Even obstetricians, nurse practitioners, nurse midwives and physicians assistants who perform pre-natal exams report a lack of education and low rates of oral exam performance unless a patient reports an oral problem. In this instance again, the practitioners did not feel competent to provide the education or oral examinations that their patients required.[11]

This self-reported lack of education and knowledge of oral health on the part of medical practitioners highlights the critical need for dental providers to take responsibility for being aware of oral-systemic connections and to perform a risk assessment on every patient in whom periodontal inflammation is detected. The outcome of the pregnancy, or the diabetes treatment,

or the cardiac care, or whatever treatment the patient is receiving, could be dramatically improved with professional dental intervention.

Routine collaboration between dental health care providers and physicians to detect and treat systemic conditions relating to periodontal disease is an idea that is gaining momentum. Charles Whitney, MD, wrote in an article for the Journal of Cosmetic Dentistry, "I am a physician, not a dentist. However, I work closely with dentists and their teams to bridge the oral-systemic gap and to provide my patients with an optimal level of care. Do not ever underestimate the critical role you and your team play in the overall health of your patients, even in saving their lives."[12]

The Science Behind the Oral-Systemic Link

The inflammatory process significantly affects the periodontium. Plaque biofilm releases a variety of biologically active products such as gram-positive and gram-negative bacteria to colonize the tooth surface around the gingival margin and interproximal surfaces. Among the products are endotoxins, cytokines and protein toxins. These molecules penetrate the gingival epithelium and initiate a host response that results in gingivitis. Untreated chronic gingivitis poses a significant risk to systemic health, although many clinicians seem to be less concerned about treatment of gingivitis than periodontitis. Periodontitis occurs when the inflammatory process continues. The collagen of the periodontal ligament breaks down and alveolar bone resorption occurs. Increased levels of pro-inflammatory mediators are present, including C-reactive protein, fibrinogen and Interleukin-1 and interlukin-6.

In recent years there has been a new renaissance in dental practice philosophy among leading edge professionals as relationships between dental disease and systemic health have been proven and the role of inflammation in both dental and systemic disease has been shown to be of critical importance.

We now know that widespread systemic health effects may be caused by or exacerbated by periodontal disease. Scientific findings have pointed to a causal or bi-directional relationship

between periodontal disease and other systemic diseases or conditions. The recurring inflammation of an infected periodontium may serve as a reservoir of bacterial products and a source of infective organisms such as bacterial antigens, gram-negative bacteria, cytokines and other pro-inflammatory mediators that can interact with other organ systems and contribute to disease conditions in many other areas of the body. [13]

Patients diagnosed with periodontal disease may also be at higher risk for systemic conditions due to a compromised immune system. Infectious and opportunistic microbes responsible for periodontal infection may bring this bio-burden to the rest of the body. In addition, these microbes can release products that elicit an inflammatory response. [14]

Periodontal infections may increase blood viscosity while increasing its coagulation ability. Elevated numbers of leukocytes and higher levels of fibrinogen are found in plaque and gingival inflammation. Many strains of gram-negative periodontal pathogens bind to blood platelets, resulting in more aggregation on heart valves. A systemic immunological challenge is produced by periodontal pathogens that release bacterial endotoxins. Periodontal infection and the resulting inflammation, therefore, create multi-faceted challenges to the host body.[15]

The list of systemic conditions and diseases linked to periodontal disease seems to be ever increasing. The following have all been linked in some way to periodontal inflammation.[16]

- **Diabetes and Diabetic complications** The relationship between diabetes and periodontal disease is considered to be bi-directional. Periodontal disease results in difficulty controlling glucose levels in the blood. Poor blood sugar control results in a

greater prevalence and severity of periodontal disease. It has been suggested that the presence of periodontal disease may create a state of chronic systemic inflammation as demonstrated by increased levels of C-reactive protein, interleukin-6 (IL-6) and fibrinogen levels found in those with periodontitis. Periodontal infection may exacerbate insulin resistance. * http://www.scielo.br/scielo.php?pid=S1806-83242008000500006&script=sci_arttext

- **Cardiovascular Disease** (congestive heart failure, cardiac arrhythmias, coronary artery disease, atherosclerosis, myocardial infarction, valvular heart disease, stroke) Periodontal pathogens have been discovered in the atherosclerotic plaques on the innermost walls of diseased arteries. Several mechanisms have been investigated to explain the association between periodontal disease and cardiovascular disease. The host response to the presence of periodontal bacteria may trigger the production of inflammatory mediator (C-reactive protein, TNF-a, PGE_2, IL-1B, and IL-6)which can accelerate the production of atherosclerotic plaques. Studies have demonstrated the ability of periodontal pathogens to increase blood viscosity while increasing its coagulation ability as well as inducing platelet aggregation and the formation of atheromas. * http://www.scielo.br/scielo.php?pid=S1806-83242008000500006&script=sci_arttext

- **Cerebrovascular accidents (stroke)** Periodontitis is associated with cerebral ischemia caused by atherosclerosis. Active periodontal inflammation may contribute to risk for strokes due to recurrent bacteremia, platelet activation and elevated closing factors. * http://stroke.ahajournals.org/content/35/2/496.full

- **Pulmonary Disease (bronchitis, pneumonia, emphysema, chronic obstructive pulmonary disease, pulmonary abscess)** Increasing evidence points to poor oral health as a risk factor for respiratory disease, especially in high-risk patients (patients requiring ventilation in hospital situations, nursing home residents and the elderly). The oral cavity serves as a reservoir for respiratory pathogens, is contiguous with the respiratory tract, and may be a pathway for pathogens that may be aspirated into the lungs. * http://www.scielo.br/scielo.php?pid=S1806-83242008000500006&script=sci_arttext

- **Rheumatoid Arthritis** Levels of pro-inflammatory proteins (IL-1, IL-6, tumor necrosis factor) are similar in Rheumatoid Arthritis and periodontal disease. Periodontal pathogens may cause or exacerbate Rheumatoid Arthritis by inducting citrullination, a process by which a protein undergoes a molecular change in structure. The immune system reacts to the protein as a foreign body, mounting an attack against it by creating antibodies against it. *http://www.arthritistoday.org/about-arthritis/types-of-arthritis/rheumatoid-arthritis/what-to-expect/effects-on-body-and-health/ra-and-gum-disease-3.php

- **Alzheimer's Disease ***

- **Prosthetic Joint Infections ***

- **Infertility ***

- **Adverse pregnancy outcomes (preeclampsia, pre-term, low birth weight babies)** The etiology of preterm birth is multifactorial, but inflammation is the common

mechanism that leads to uterine contractions and cervical changes. The presence of pro-inflammatory cytokines and prostaglandins is also a significant factor. The maternal and fetal immune response to oral pathogens is also theorized to contribute to the association between periodontitis and preterm birth, as is the potential of bacteremia from oral infection. * http://www.scielo.br/scielo.php?pid=S1806-83242008000500006&script=sci_arttext

- **Osteoporosis ***
- **Brain Abscesses ***
- **Cancers of the colon, lungs, kidneys, prostate, pancreas, breast, Hodgkin's Lymphoma and Multiple Myeloma ***
- **Complications of Human Immunodeficiency Virus/Aids, cancer treatment, organ transplants, bone marrow transplants and stem cell transplants. ***

At its worst, periodontal disease can lead to life threatening illness. Reducing and eliminating inflammation are key goals in the treatment of periodontal disease. Preventing the passage of bacteria into the bloodstream could significantly reduce the risk of heart attack, stroke, and a multitude of other diseases.

Turning Awareness into Action

In the conclusion of a study focused on the link between periodontal disease and cardiovascular disease published in 2010, it was written, "It seems from the scientific evidence gathered so far

that interventional periodontal care remains invaluable not only for oral health but for general health as well."[17]

Despite the fact that many respected dental and medical opinion leaders encourage dental practitioners to treat periodontal disease with an increasing focus on total body wellness, this philosophy has not yet been incorporated into the majority of dental practices. Studies show that dentists and dental hygienists are more likely to assess and *discuss* potential links between a patients' periodontal health status and his glycemic control, for example, than to actually perform a finger stick blood test with a glucometer to evaluate the blood sugar level. Typically, according to this study, dental practitioners are less likely to manage their patients' systemic conditions than they are to assess or discuss them.[13]

Dental health care providers pointed to a variety of barriers to implementing research evidence into practice. [14]

Some of the barriers found by the study published by Bell, et al, are as follows:

- Lack of awareness of available research literature
- Time constraints
- Insufficient authority to change practice protocols
- Inadequate skills in critical appraisal
- Lack of support
- Patient's objection to fees

- Lack of reimbursement from third party providers
- Concern over legal risk
- Concern about perception by the dental board as the unauthorized practice of medicine.

Another factor that influences dental hygiene care according to this study is the hygienist's philosophy of practice, their own expectations of professionalism, and the expectations of their employers and their patients.[15]

Physician Charles Whitney recently wrote, "Periodontal inflammation and infection is a medical disease of the mouth that physicians can not treat." [16] Dental professionals, with our expertise in oral health care, are the leaders in treating this "medical disease of the mouth." In order to do so, dentists and dental hygienists must expand their practice to include protocols beyond the traditional treatment for periodontal disease. Dental hygienists, who regularly assess the periodontal health status of their patients, in particular, have been pointed to as front line critical health care providers for assessing oral-systemic risks and managing those risks, according to Bell, et al.[17]

In light of growing evidence regarding the connection between oral and systemic health, and the fact that people visit dental health care providers far more regularly than they see medical health providers, it is apparent that dentists and dental hygienists must elevate their roles as health care providers to include a comprehensive approach to total body wellness through the treatment of periodontal disease. As evidence emerges about the oral systemic link, expectations will change and patients will expect more comprehensive care from dental professionals.

The American Academy for Oral and Systemic Health (AAOSH) recommends an all-encompassing periodontal treatment protocol to address the affects of periodontal inflammation and its effects on total body wellness.

“The focus on treating the body as a whole, signals that we are in a new age of healthcare,” according to Dr. Lisa Marie Samaha, one of the founding members of AAOSH. “The dental profession is transitioning into a profession which requires consideration of systemic issues in every patient interaction. Without a focus on total body health, we can not achieve long-term periodontal and systemic health.”[18]

In order to achieve more systemic health benefits and longer-term oral health, dentists devoted to comprehensive, whole body health utilize a variety of tests and treatments.[19]

Leading edge dentists are incorporating many of the following as part of their comprehensive care for periodontal disease. Dental practitioners are advised to share test results with the patients’ physician and consult with the physician on the best course of treatment for the individual patient.

Conclusion

There are many dental and medical professionals, as well as professional organizations, that support the need for treatment of the total health of the patient by healthcare practitioners. Education is necessary for both dental and medical practitioners to prepare them to recognize the links between oral and systemic health, and to help them integrate treatment protocols into their

regular general practices. It is imperative that dental and medial practitioners work together for the benefit of their mutual patients. Patients are becoming better educated about the connections between oral and overall health, and will expect their healthcare providers to be even more knowledgeable and to provide recommendations and treatment that address both oral and overall health. The identity of the dentist and dental hygienist will be elevated to that of "oral medicine practitioner" as this knowledge and these protocols are integrated into practice.

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