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## **Nutritional Supplementation and Periodontal Disease: A Review of the Literature**

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The aim of this article is to provide an overview of the scientific research related to the relationship of nutrition, inflammation, and periodontal disease. Among the recommendations for the maintenance of healthy periodontal tissues, few have focused on the value diet and nutritional supplementation. A summary of the literature available and the correlation between specific nutrients and their effect on periodontal disease will be discussed. Introduction of a risk assessment tool to measure nutritional status is also summarized.

### **Introduction**

Typical nonsurgical periodontal therapy involves a combination of in-office treatments targeted at removing toxins and irritants from the gingival environment, as well as home-care instructions to minimize the proliferation of bacteria in the gingival sulcus. Antibiotic therapies using both systemic and local delivery have shown promise initially, but often fail to convert the chronic periodontal patient to long-term health. Dietary recommendations may be discussed by the clinician, usually regarding the detrimental effect of sugar and refined carbohydrates on the dentition. All of the above mentioned therapies focus on the signs and symptoms of the disease rather than the source of the disease. Although bacteria are often cited as the causative agents for disease, many scientists believe that systemic host response and the immune system are actually the determinants of disease. (1,2,5) Manifestations of inflammation in the oral cavity can, in many instances, be indicative of systemic disease. Dr. David Tecosky, DMD, MAGD, states, "More than 90% of systemic diseases reveal signs and symptoms in the mouth. Most patients see their dentist on a regular basis more frequently than they do their physician. We are in a unique position to help our patients."

### **Discussion**

Periodontal disease is the result of an inflammatory response resulting from the interaction between pathogenic bacteria and the host's immune response. (3,4) As a result of stimulation by bacterial antigens, polymorph nuclear leukocytes (PMN) produce reactive oxygen species (ROS) during phagocytosis as part of the host response to infection. Patients with periodontal disease display increased PMN number and activity. It has been suggested that this proliferation results in a high degree of ROS release, culminating in heightened oxidative damage to gingival tissue, periodontal ligaments, and alveolar bone. (4,5,6) These ROS contribute to tissue destruction by damaging DNA, causing lipid peroxidation, and stimulating proinflammatory cytokines release. These reactive oxygen species are strong free radicals that can be defined as any species capable of independent existence that contains one or more unpaired electrons. It has been postulated in the literature that the damage from ROS can be modulated by the presence of antioxidants, through the mechanism of electron transfer, thereby neutralizing the ROS. (5) Antioxidants are defined as molecules capable of slowing or preventing the oxidation of other molecules. (6) Oxidation is a chemical reaction that transfers electrons from a substance to an oxidizing agent. (7) Oxidation reactions can produce free radicals, which start chain reactions that damage cells. Data from research collected suggests that there are mechanisms in which nutrition, particularly antioxidants, can influence periodontal disease onset, progression, and wound healing. (5) "The body contains a number of protective antioxidant mechanisms, whose specific role is to remove harmful oxidants as they form, or to repair damage caused by ROS in vivo. Antioxidants may be regarded as those substances which will significantly delay or inhibit oxidation of that substrate." (8) There has also been much discussion in the literature as to the method of delivery and what combinations of antioxidants are the most

efficacious. The following review of the literature summarizes several clinical studies citing the promising benefits of nutritional supplements in periodontally compromised patients delivered both locally and systemically. Common nutrients reviewed include several proprietary combinations of antioxidants, Glutathione (an intrinsically produced antioxidant), multiple vitamins including vitamin A, C, E, the B-complex vitamins, and Green Tea Catechins. Finally, the deployment of a risk assessment device called the Biophotonic Scanner (Pharmanex) that measures systemic antioxidant status is reviewed for validity and relevance in the treatment of periodontal disease.

## Review of the literature

Munoz C, Kiger R, Stephens J, Kim J, Wilson A. Effects of a nutritional supplement on periodontal status. *Compendium*, May 2001; 425-438.

Researchers at Loma Linda University studied the impact of an antioxidant-rich oral supplement on 63 patients ranging in age from 20 to 70 years and diagnosed with gingivitis and Type II periodontal disease for a 60-day double-blind clinical trial. The proprietary blend of nutrients contained folate, which is reported to reduce gingival inflammation by binding to the endotoxins from bacterial plaque preventing irritation of the gingival architecture, (9) vitamin B12, vitamin C, an aqueous antioxidant which works synergistically with vitamin E to prevent oxidation of cells, Echinacea, Coenzyme Q10, and Piper Nigrum Extract. The participants were randomly assigned to two groups — the experimental group, which took two tablets each day of the proprietary blend of antioxidants, and the control group, which took a similar-looking placebo. Results of that study showed significant improvement in the clinical parameters and measurements of gingival inflammation; bleeding on probing, pocket depth, and attachment levels. "At the 60-day evaluation point, all subjects receiving the experimental treatment had significant reduction in the gingival index, pocket depth, and bleeding index," Treatment with this proprietary nutraceutical appeared to offer patients a noninvasive, systemic, adjunctive protocol to potentiate in-office therapies.

Chapple I, Brock G, Eftimiadi C, Matthews JB. Glutathione in gingival crevicular fluid and its relation to local antioxidant capacity and periodontal health and disease. *Journal of Clinical Pathology*, May 2002; 55:367-373.

The aim of this study was to determine possible changes in gingival crevicular fluid (GCF) antioxidant defense in chronic adult periodontal disease and to investigate the nature of the local radical scavenging mechanisms, with particular reference to glutathione, an intrinsically produced antioxidant. The double-blind placebo study compared 10 patients with clinically advanced stages of periodontal disease with age and sex matched periodontally healthy control subjects. Plasma and GCF samples were collected and treated with high-performance liquid chromatography analysis for both groups. The results from the cross-sectional study indicated: "local, GCF antioxidant capacity is significantly decreased in patients with periodontal disease compared to periodontally healthy controls. Furthermore, this local decrease was reflected systemically by lower mean antioxidant capacity in plasma from patients with periodontitis." Data from the high-performance liquid chromatography analyses "indicate that reduced glutathione is the local component within gingival crevicular fluid responsible for the stepped antioxidant response." These results indicate that the gingival crevice is normally bathed in fluid containing high concentrations of GSH, which is known to have powerful anti-inflammatory and antioxidant activity. The authors suggested additional investigation of therapeutic strategies for periodontal disease involving nutrients, particularly antioxidants both locally applied and systemically derived.

Neiva RF, Steigenga J, Al-Shammari K, Wang H-L. Effects of specific nutrients on periodontal disease onset, progression. and treatment. *Journal of Clinical Periodontology*, 2003; 30:579-588.

The authors studied nutritional elements (e.g., vitamin B-complex, vitamin C, and dietary calcium) that have been strongly associated with the wound healing, periodontal disease status, and response to treatment. Vitamin B-complex deficiency has been shown to decrease resistance to infection secondary to antibody formation and some WBC functions may be impaired in their absence. Vitamin C, an important aqueous antioxidant, is essential for collagen formation and healing of wounds, and is shown to improve resistance to infection. Vitamin C deficiency also makes capillaries fragile and susceptible to rupture. Bleeding and swelling of

the gingiva is the chief symptom of scurvy, which is readily reversed by administration of vitamin C. Calcium, the most abundant mineral in the body, plays a structural role and is present 99% in bones and teeth. The other 1% is present in body fluids, and is essential for cell metabolism, muscle contraction, and nerve impulse transmission. Many clinical trials were referenced and reviewed by the authors, and they concluded, "Several studies reported various degrees of association between nutritional elements/supplement and periodontal status, and others have reported possible positive influences of nutritional supplementation on periodontal therapeutic outcomes." They further recommended, "Considering that nutrient supplementation shows minimal or no side effects, controlled clinical trials are able to demonstrate that it could be used to enhance response to therapy and may prove valuable in producing more predictable treatment outcomes."

Hirasawa M, Takada K, Makimura M, Otake S. Improvement of periodontal status with green tea catechin using a local delivery system: A clinical pilot study. *Journal of Periodontal Research*, 2002; 37:433-438.

The purpose of this study was to determine the usefulness of localized green tea catechin, an active ingredient in green tea, for the improvement of periodontal disease. According to the authors, green tea catechin has been reported to be therapeutic for prevention of periodontal disease for its inhibitory effect on collagenase activity. (10) They studied the effect of locally delivered slow-release green tea catechin on black-pigmented, Gram-negative anaerobic rods (BPR), which have been associated with various forms of destructive periodontal disease. Resting bacterial cells from *P. gingivalis*, *P. intermedia*, and *P. nigrescens* were killed by green tea catechin within 120 minutes. "The antibacterial effects of green tea catechin on BPR showed bactericidal action in this study." It was also pointed out in the article that green tea catechin treatment inhibited collagenase activity in the gingival crevicular fluid in vitro, and may be a useful and practical method for prevention and treatment of periodontal disease. They summarized their results, "The slow release and local delivery system described here using strips containing green tea catechin is an effective method for improvement of periodontitis."

Brock GR, Butterworth CJ, Matthews JB, Chapple ILC. Local and systemic total antioxidant capacity in periodontitis and health. *Journal of Clinical Periodontology*, 2004; 31:515-521.

The authors' aim in this cross-sectional study was to determine both local (saliva and gingival crevicular fluid) and peripheral (plasma and serum) antioxidant capacity in periodontal health and disease. The data showed that in health, antioxidant concentrations in GCF are significantly greater than those of serum and plasma, indicating a local synthesis or storage within the periodontium. Interestingly, both serum and plasma total antioxidant capacity (TAOC) were reduced in periodontal subjects relative to controls. They commented, "Given the established role for reactive oxygen species in cardiovascular pathology and the established links between periodontal disease and cardiovascular disease, the reduced plasma TAOC in periodontitis subjects warrants further investigation. One may speculate that reduced plasma antioxidant defenses are a common risk factor for both diseases."

## Summary

It is evident after reviewing the literature that periodontal disease is regarded as "an inflammatory lesion mediated by host-parasite interactions." (3) Mediation of the inflammatory response has been successful in several peer-reviewed clinical trials with a variety of naturally occurring, safe nutritional supplements that neutralize the reactive oxygen species produced in the presence of periodontal pathogens. Whether locally applied or systemically supported, antioxidant status appears to have a strong correlation with incidence of disease. Most medical practitioners were and still are unaware of the connection between disease and antioxidant status, although it has been rigorously studied and documented in the literature for the past 40 years by scientists such as Dr Lester Packer. (11) However, it is this author's hope that in light of current corroborative evidence, all health-care practitioners will take a more common sense approach to wellness and therapeutic options when it comes to treatment of inflammatory disease. Until recently, only blood tests were available to detect antioxidant status in the body, and often they were too volatile to be accurate indicators of overall antioxidant status. With the arrival of the BioPhotonic Scanner by Pharmanex in the United States in 2003, a new standard is now available that will noninvasively measure antioxidant status in live tissue in 90 seconds. The BioPhotonic Scanner, at this point in time, is the only noninvasive method to obtain any reasonable

approximation of total body antioxidant status reporting a "skin carotenoid score." A review of the original patent for the BioPhotonic Scanner is instructive. Below are relevant excerpts from the United States Patent Application 6,205,354 — granted March 20, 2001, and awarded to Werner Gellermann and colleagues at the University of Utah. All quotes are directly excerpted from the patent. It should be noted that the patent was granted as specified, meaning that the U.S. Patent Office was satisfied with the claims and the supporting documentation.

### **From the abstract**

"A method and apparatus are provided for the determination of levels of carotenoids and similar chemical compounds in biological tissue such as living skin. The method and apparatus provide a noninvasive, rapid, accurate, and safe determination of carotenoid levels, which in turn can provide diagnostic information regarding cancer risk, or can be a marker for conditions where carotenoids or other antioxidant compounds may provide diagnostic information. Such early diagnostic information allows for the possibility of preventative intervention."

The scanner uses Raman Spectroscopy discovered by C. V. Raman who was awarded the 1930 Nobel Prize in Physics for his work on the scattering of light and for the discovery of the Raman effect. Raman spectroscopy is based on this phenomenon to measure the vibration of all of the double bonds of all carotenoids present in the skin, and through an array detector, correlate that energy into a skin carotenoid score (SCS). In an abstract submitted to the IADR/AADR in March 2007, researchers at the University of Pacific in a double-blind study determined the effect of a proprietary nutritional supplement on gingival index score and antioxidant status using the Biophotonic Scanner. The supplement contained basic the multi-vitamins, A, C, E, B6, B12, folate, zinc, selenium, and copper and several other botanically derived ingredients known to exert anti-inflammatory and antioxidant effects including green tea extract. Reported results showed that the supplement significantly decreased the gingival index score and a decrease in bleeding score compared to the placebo. The supplement also significantly increased skin carotenoid level. The researchers concluded that the supplement may be beneficial as an adjunct to therapy in the management of periodontal disease. (12)

Dr Ross Lambert, in an article he wrote for *Dentistry Today* states, "A better understanding of how antioxidants function in the pathogenesis of periodontitis, and the effects of diet and nutritional supplementation on antioxidant status, may lead to new strategies on the treatment of the disease. An accurate and low-cost noninvasive test to measure a patient's antioxidant levels is commercially available and will become part of the prevention and treatment modules (Biophotonic Scanner, Pharmanex). It is well-accepted that antioxidants play a major role in the immune system, fighting cancer and aging. Studies have shown that antioxidant levels play a role in periodontal disease and that periodontal disease significantly improves when these levels are restored to accepted levels. High-quality pharmaceutical-grade nutritional supplements are now proven to make a difference, elevate antioxidants and beta carotenoids, and become part of every module in the model. The test for antioxidants provides a method to measure these levels on an ongoing basis and to confirm the effectiveness of a supplement." (13)

With a risk assessment tool that is as innocuous and convenient to use as a blood pressure monitor, we can now confidently educate and monitor our patient's oral and systemic risk factors for disease. Not only can we begin to prevent the onset of periodontal disease by recognizing these risk factors, but we can intervene earlier with enhanced treatment outcomes. Historically, dentist's leadership role in prevention of disease has been a pioneering force in the medical community. Dr David A. Garber, partner of Dr Ron Goldstein from "Team Atlanta" states, "The biophotonic scanner can now evaluate the level of systemic antioxidants. Dentistry can then evolve to be more than a restorative modality and move into the realm of a more holistic domain, which is so important with the oral systemic link now definitively acknowledged and related to a person's overall well being." (14)

After reviewing the literature, it appears prudent to consider the inclusion of specifically targeted nutritional supplements to the home-care regimen for patients with periodontal symptoms. Combining natural alternatives with traditional therapies appears to show promise in modifying systemic risk factors and providing safe methods to potentiate the clinical response during treatment. Lastly, the recent introduction of the Biophotonic Scanner (Pharmanex), which objectively measures patient antioxidant status noninvasively, provides the

practitioner with a provocative risk-monitoring device. This technology appears to provide the dentist with information relevant to early diagnosis and intervention of periodontal disease, which could lead to more predictable treatment outcomes.



Jacqueline Russo, RN, DDS, graduated from the Indiana University School of Nursing in 1978 and the Baylor College of Dentistry in 1985. She practiced general dentistry with an emphasis on cosmetic dentistry from 1985 to 1999. After working with THE Design to build her own office, she later became a dental consultant with the company in 2000. Dr. Russo has worked with dentists to increase practice profitability so they could afford a healthy, efficient, and ergonomic facility in which to practice. In 2007, when THE Design closed its doors, she started EnviroMed Design Group, a dental and medical office design company. She now works with a team of architects, interior designers, and technology system engineers helping dentists achieve their dreams of healthy, esthetic, ergonomic offices. Dr. Russo is an enthusiastic student of optimal oral and total body health. Her passion is for prevention of disease and teaching others not to succumb to the disease management model of medicine. You may contact Dr. Russo by e-mail at [jacque@enviromedgroup.com](mailto:jacque@enviromedgroup.com).

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