Micronutritional approaches to periodontal therapy. 
Van der Velden U, Kuzmanova D, Chapple IL. 

Periodontitis is associated with low serum/plasma micronutrient levels which may result from dietary and/or lifestyle factors as well as nutrigenetic characteristics. Early evidence suggest beneficial outcomes from nutritional interventions; supporting the contention that daily intake of certain nutrients should be at the higher end of recommended daily allowances. For prevention of periodontitis daily nutrition should include sufficient antioxidants, vitamin D, and calcium. Inadequate antioxidant levels may be managed by higher intake of vegetables, berries and fruits or by phytonutrient supplementation.

Effects of a nutritional supplement on periodontal status.

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 nutriceutical appeared to offer patients a noninvasive, systemic, adjunctive protocol to potentiate in-office therapies.

Inflammatory mechanisms and redox status in periodontal and cardiometabolic diseases: effects of adjunctive nutritional antioxidants and statins.

Periodontal pathogens in plaque biofilm initiate periodontitis, which is influenced by genetic and environmental factors. The resultant pro-oxidant status imposed on the periodontium, exacerbated by episodic hyperinflammatory damage contributes to progression of periodontitis and tooth loss in susceptible subjects. Applications for the role of nutritional and therapeutic antioxidants as adjuncts in diseases with a distinctly pro-oxidant profile are discussed.
Role of Antioxidants as an adjunct in periodontal therapy  
RG Shiva manjunath  
Journal of Academy of Advanced Dental Research, Vol 2; Issue: May 2011

Systemic factors such as a balanced nutrition or nutritional supplementation have not been thoroughly evaluated in periodontal research, although reports of the possible effects of nutrient deficiency and supplementation have appeared early in the periodontal literature. There are many studies linking free radical damage at the cellular level not only to premature aging, but also to virtually everything that ails us including periodontal disease. It therefore seems prudent to address host resistance specifically with regard to antioxidant status along with our periodontal protocols. Nutritional counselling and supplementation may very well reduce inflammation and thereby enhance outcomes of conventional periodontal therapy. The purpose of this review is to summarise available research in the role of antioxidants as an adjunct to periodontal therapy.

The prevalence of inflammatory periodontitis is negatively associated with serum antioxidant concentrations.  

Oxidative stress is reported in periodontitis both locally and peripherally (serum), providing potential mechanistic links between periodontitis and systemic inflammatory diseases. It is therefore important to examine serum antioxidant concentrations in periodontal health/disease, both at an individual species and total antioxidant (TAOC) level. Higher serum antioxidant concentrations were associated with lower odds ratios for severe periodontitis. Increased serum antioxidant concentrations are associated with a reduced relative risk of periodontitis.

Use of Antioxidants in Oral Healthcare
Symone M. San Miguel, DMD, PhD;* Lynne A. Opperman, PhD;† Edward P. Allen, DDS, PhD;‡ and Kathy K.H. Svoboda, PhD†  
Compendium: March 2011, Volume 32, Issue 2

There is increasing attention to the potential benefit from the use of antioxidants in the field of dental medicine. In general, antioxidants may be available through oral ingestion, diet or vitamin supplements, and in nutraceuticals. This review focuses on relationships between antioxidants and free-radical/reactive-oxygen species in the oral environment.

Relationship between intake of green tea and periodontal disease.  

Green tea is very popular beverage and in vitro studies have shown that green tea polyphenols inhibit the growth and cellular adherences of periodontal pathogens and the production of virulence factors. The
relationship between the intake of green tea and periodontal disease was investigated. Conclusion: There was a modest inverse relationship between the intake of green tea and periodontal disease.

**Omega 3 fatty acid regulates inflammatory cytokine/mediator messenger RNA expression in Porphyromonas gingivalis-induced experimental periodontal disease.**


Porphyromonas gingivalis is strongly implicated in the etiology of adult periodontitis by inducing inflammatory cytokines, resulting in gingival and periodontal tissue inflammation and alveolar bone resorption. This study tested the hypothesis that supplementing the diet with omega-3 fatty acid (omega-3 FA; i.e. fish oil) would exert anti-inflammatory effects in gingival tissues. These findings suggest that diets enriched for omega-3 FA modulate the local gingival inflammatory milieu of the host following oral P. gingivalis infection, which impacts on alveolar bone resorption.

**Effects of specific nutrients on periodontal disease onset, progression and treatment.**


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."

**Local and systemic total antioxidant capacity in periodontitis and health.**


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."


Antioxidant supplementation is an excellent way of improving free radical protection. The aim of this study was to provide cytotoxicity, proliferation and migration data on the in vitro effects of bioactive AO mixtures on human oral fibroblasts. High and low concentration of these antioxidants have beneficial effects on functional mechanisms regulating fibroblast migration and proliferation during gingival health or periodontal repair.


Periodontal pathogens can induce ROS overproduction and thus may cause collagen and periodontal cell breakdown. When ROS are scavenged by antioxidants, there can be a reduction of collagen degradation. Ubiquinol (reduced form coenzyme Q(10)) serves as an endogenous antioxidant which increases the concentration of CoQ(10) in the diseased gingiva and effectively suppresses advanced periodontal inflammation.


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."

Recent years have shown the presence of free radicals in causation and progression of various dental diseases and antioxidant usage in dental therapeutics. Antioxidant micronutrients are important not only for limiting oxidative and tissue damage, but also in preventing increased cytokine production, which is a result of prolonged activation of the immune response. This article highlights the clinical significance of antioxidant therapy in dental practice and the table below lists some of the most studied nutrients and their effect on dental tissues.

<table>
<thead>
<tr>
<th>Antioxidant</th>
<th>Source</th>
<th>Mechanism</th>
<th>Clinical significance (location)</th>
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</thead>
<tbody>
<tr>
<td>Beta carotene</td>
<td>Dark green, orange or yellow vegetables and fruits (spinach, carrots, orange, squash, papaya, mangos and cantaloupe)</td>
<td>Scavenging effect (traps peroxyl free radicals in tissue at low partial pressure of oxygen)</td>
<td>Deficiency can lead to periodontal destruction (Plasma)</td>
</tr>
<tr>
<td>Alpha tocopherol</td>
<td>Plant oil, margarine, wheat germ and green, leafy vegetables</td>
<td>Scavenging effect (breaks free radical chain reaction)</td>
<td>Prostaglandin inhibitory effect can contribute in reducing periodontal inflammation. (Plasma, saliva, GCF)</td>
</tr>
<tr>
<td>Ascorbic acid</td>
<td>Citrus fruits, cruciferous vegetables</td>
<td>Scavenging and preventive (binds metal ion) effect. Act by decreasing nitration and also affects the activity of leukocytes and macrophages</td>
<td>Gingival bleeding is a common result of ascorbate depletion. (Plasma, saliva, GCF, synovial fluid)</td>
</tr>
<tr>
<td>Minerals (zinc, copper, manganese, selenium)</td>
<td>Legumes, nuts, whole grains, green vegetables</td>
<td>Enzyme activators and subunits of antioxidant defense mechanism</td>
<td>Cytotoxic in action</td>
</tr>
<tr>
<td>Curcuminoinds</td>
<td>Turmeric</td>
<td>Inhibits the generation of potent free radicals like superoxide and hydroxyl radicals</td>
<td>Antibacterial, fungicidal, wound healing, cytotoxic</td>
</tr>
<tr>
<td>Epigallocatechin-3-gallate</td>
<td>Green Tea</td>
<td>Scavenging effect</td>
<td>Reduce the risk of dental caries and plaque formation. Effective in oral leukoplasia</td>
</tr>
<tr>
<td>Spirulina</td>
<td>Blue green micro algae</td>
<td>Potent quencher of highly reactive singlet oxygen</td>
<td>Effective in buccal squamous cell carcinoma</td>
</tr>
<tr>
<td>Eugenol</td>
<td>Clove</td>
<td>Scavenging and Preventive effect. Enzyme activator for antioxidant action</td>
<td>Effective in toothache</td>
</tr>
</tbody>
</table>

**Final comment:** After reviewing the literature it appears prudent to consider the inclusion of antioxidant rich comprehensive nutritional supplementation MINIMALLY to home care regimens for patients with periodontal disease. As oral physicians we have a responsibility to our patients to elevate the standard of care in our offices and educate our patients about the irrefutable benefits of diet, nutrition and supplementation as it influences oral health. Combing natural alternatives with traditional therapies appears to show promise in modifying systemic risk factors and providing safe methods to potentiate the clinical response during periodontal therapy.