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## **Full Length Review Article**

### **DIET – A POINTER TO DENTAL AND ORAL HEALTH**

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#### **ABSTRACT**

Nutrition is expanding to reach all components of health care including dentistry. Diet can affect oral health via numerous mechanisms. The health of oral tissues can be affected by nutrition, diet and oral habits. The documented associations between oral health and systemic health demonstrates the need for dentists to become more knowledgeable about systemic nutrition which affects the normal growth, development and maintenance of the dental structures, promotes the immunity necessary for wound healing and affects resistance to oral infections. Certain foods have both beneficial and disease causing capacity, potentially affecting the teeth and other oral structures. This article discusses the impact of dietary variables on multiple aspects of oral health.

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#### **INTRODUCTION**

##### ***Dental diseases: A marker of an unhealthy diet or a local dietary side effect?***

*Eliminating symptoms is like responding to a car's oil light by clipping the wires rather than addressing the underlying causes...* (Nesse 2007)

Nutrients can be divided into six major classes -fats, carbohydrates, minerals, proteins, vitamins and water. These can be further subdivided into two broad categories; macronutrients (fats, carbohydrates and proteins) which are required in larger quantities in the diet and micronutrients (minerals, vitamins, trace elements and amino acids) which are required in small quantities in the diet and which are essential for a range of biological processes important in supporting optimal health. As dental professionals become increasingly aware of the association between systemic and oral health, the importance of addressing systemic nutrition takes on a new urgency.

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Dental diseases impair quality of life and have a negative impact on self-esteem, and health, causing pain, anxiety and impaired social functioning. (Kelly *et al.*, 1998) Tooth loss reduces the ability to eat a nutritious diet, the enjoyment of food and confidence to socialize. (Joshi *et al.*, 1966) There is a wealth of evidence to show the role of dietary sugars in the etiology of dental caries.

In recent years, much attention has been focused on research and education related to the identification of food components and development of food products with disease preventing and health promoting benefits of functional foods. Numerous naturally occurring components in foods and vegetables have been shown to promote health and reduce risks for many diseases. Despite these advances, the general public seems less aware of foods that promote oral health.

##### **Developmental defects of the enamel**

Nutritional status affects the teeth pre-eruptively. This influence is much less important than the post eruptive local effect of diet. (Rugg-Gunn, 1993) Deficiencies of Vitamin A and D and protein –energy malnutrition are associated with

enamel hypoplasia. Excessive fluoride ingestion while enamel is forming may cause dental fluorosis. (Chen *et al.*, 1997)

### Dental erosion

Of late, dental erosion is perceived to be increasing. Evidence suggests that soft drinks, a major source of acid in the diet is a significant causative factor of dental erosion. Dietary acids include citric, phosphoric, ascorbic, malic, tartaric, oxalic and carbonic acids. Observational studies in humans have shown an association between dental erosion and the consumption of a number of acidic foods and drinks including consumption of fruit juice, soft drinks, vinegar, citrus fruits and berries. (Jarvinen *et al.*, 1991; Coombs, 2005) Age related increase in dental erosion have been shown to be greater than in those with the highest intake of soft drinks.

### Dental caries

A wealth of evidence from many different types of investigation, including human studies, animal experiments and experimental studies has consistently shown that sugars are the most important factor in caries development. The term *free sugars* is used to refer to all monosaccharides and disaccharides added to foods by the manufacturer, cook / consumer plus those naturally present in honey, fruit juices and syrup (Diet, nutrition and the prevention of chronic diseases 2003). The term free sugars excludes sugars naturally present in whole fruits, vegetable and milk.

Epidemiological evidence suggests that starch rich staple foods pose low risk to dental health. (Rugg-Gunn, 1993) People who consume high starch low sugar diet generally have low levels of caries. Whereas people who consume low starch / high sugar diets have high levels of caries. (Fisher, 1968; Harris, 1963) The intake of fruits is not significant in the development of dental caries. (Clancy *et al.*, 1977) Specific dietary elements and related factors that have demonstrated significant potential for causing caries include the following (Tanaka *et al.*, 2010; Touger Decker *et al.*, 2003).

- Number of fruit based sugary soft drinks imbibed
- Frequency of fruit based sugary drink intake
- Length of time taken to consume acidic drinks
- Eating processed starch as starches
- The co-presence of buffers such as calcium taken with fermentable carbohydrates.
- Intake of long lasting sources of sugars such as hard candies, mints etc

### Dietary factors that protect against dental caries

Food and dietary habits that should be recommended because of their minimal risk of caries potential or their caries risk reduction include the following (Gazzani *et al.*, 2011; Ferrazzano *et al.*, 2011).

- Eating fruits such as apples, oranges, pears and bananas
- Eating vegetables such as carrots, celery, tomatoes, lettuce, cucumber
- Eating aged cheese
- Eating eggs and yogurt
- Eating of sugar containing foods with meals rather than between meals

- Drinking versus sipping sugary drinks
- Rinsing with water after eating sugary snacks eating fruits instead of juices

Cow's milk contains Ca, P and casein all of which inhibit caries. Recent studies have indicated a positive<sup>15</sup> or neutral effect<sup>16</sup> of consumption of cow's milk on caries. Foods that stimulate salivary flow including whole grain foods, peanuts, hard cheeses and chewing gums protect against dental decay.

### Diseases of the oral mucosa

The pathogenesis of several oral conditions including aphthous stomatitis, leukoplakia, plasma cell gingivitis and allergy has been associated with foods and food products. Aphthous stomatitis has been linked to foods / food products such as chocolate, cheese, nuts, pine apple, citrus fruits, coffee, potatoes, figs and gluten containing products. Vitamin deficiencies in iron, folate and vitamin B-12 may play a role in the etiology of aphthous ulceration (Petersen and Baughman, 1996). Cinnamon flavoring agents have also been associated with oral mucosal changes including erythematous patches, leukoplakia/keratosis and ulceration. (Carrozzo, 2009) Most commonly cinnamon flavoured chewing gum is the cause of lesions which are confined to the buccal mucosa and lateral borders of the tongue. Plasma cell gingivitis has been linked to the chewing of khat, use of herbal toothpastes, mint, red chillies, black pepper and cardamom. (Marker and Krodhagi, 2002)

### Oral allergy syndrome (<http://webmd.com/allergies/features/oral-allergy-syndrome-foods>)

Oral allergy syndrome is used to characterize the oral symptom of intraoral itching reported in individuals with pollen allergies when they eat certain foods. According to the American Academy of Allergy, Asthma and Immunology, ragweed pollen allergy reacts with bananas, avocados, kiwi, chestnut and papaya. In patients who report oral allergy not associated with obvious pathology, it might be worthwhile to enquire about the possibility of allergy and to refer the patient for allergy testing in such cases.

### Oral conditions and true dietary deficiency

#### Vitamin deficiency can alter the oral mucosa in distinctive ways:

**Vitamin B12 Deficiency-** Glossitis, glossodynia and glossopyrosis, Hunter's glossitis (raw red beefy tongue)

**Vitamin B1 deficiency** – satiny appearance of oral mucosa, hyperesthesia.

**Vitamin B-2 deficiency** – Angular cheilitis, tongue swelling, atrophy and redness of the tongue, swelling and erythema of oral mucosa, purplish majenta colour of marginal gingiva and oral mucosa, itching and burning of oral mucosa.

**Vitamin B-3 deficiency** – Pellagra: stomatitis and glossitis, bald tongue of Sand with, early pellagra with increased salivary flow with salivary flow decreasing later, burning mouth

**Vitamin B6 deficiency** - Cheilitis and glossitis

**Vitamin A deficiency** – Mucosal dryness, atrophy, hyperplasia and keratinisation of mucous membrane, angular cheilitis,

**Vitamin C deficiency scurvy** : Atrophic glossitis, fiery red, glazed and swollen gingiva with loss of stippling, widened periodontal ligament, hemorrhagic tendencies, impaired wound healing, osteoporosis and xerostomia.

**Zinc deficiency** – Lip crusting, oral ulcers, scaling of lips, peri oral erythematous rash

**Folic acid deficiency**- Angular cheilitis, ulcers, glossitis, impairment of keratinisation

### Malnutrition and growth and development

Malnutrition not only results in scurvy, but also disturbs tooth development and delays tooth eruption, exacerbates infection and periodontal diseases. Research doesn't support a relationship between tooth crowding and malnutrition. (Thomas, 2010) Malnutrition may also increase the incidence of primary teeth, enamel hypoplasia, salivary gland hypo function and delayed eruption. (Psoster *et al.*, 2005)

### Dry mouth

Some food can attribute to dry mouth and due to dry mouth, the food that is eaten may be altered. Severe dry mouth was associated with a lower intake of whole grains and a higher intake of fruit. Caffeinated drinks such as coffee, tea and soda may cause or exacerbate dry mouth. For every cup of coffee consumed, the body dehydrates at the same rate. Consumption of spicy foods and foods heavily salted may also contribute to oral dryness. Foods that help to mitigate dry mouth include bananas, water melon and steamed vegetables. (Crogan, 2011)

### Oral cancer

The relationship between diet and oral cancer is complex. The chewing of arecanuts, betelnuts, paan and ghutka has been linked to oral cancer. (Warnakulasurya *et al.*, 2002) A dose dependent relationship between fresh fruit consumption and oral cancer has been established. Reduced risk is seen with consumption of herbal tea and herbal slow cooked soup. (Jia *et al.*, 2010) The consumption of cereals, fruits, dairy products and lipids in the form of olive oil and micronutrients including riboflavin, Mg, Fe were found to be inversely associated with the risk of oral cancer. This study also suggests that risk of oral cancer in individuals who smoke and drink may be potentially altered by diet. (Petridou *et al.*, 2002) Several case control studies have shown a protective role of vitamin C. The vegetables that appear to be protective include the carrots, green vegetables, cruciferous vegetables and tomatoes and the greatest benefit accrues when these foods are eaten raw. (Latino Martel, 2011; Steinmetz *et al.*, 1996) Foods rich in antioxidants are broccoli, spinach, berries, beans, kiwi, avocados, red wine, dark chocolate, carrots, tomatoes. etc. Foods that might be recommended to at risk patients (smokers, alcohol users) include the following;

**Beta carotene** - Potatoes, carrots, pumpkin, squash, mangos, green leafy vegetables.

**Vitamin A** - Liver, sweet potatoes, carrots, milk, egg yolks, mozzarella cheese

**Vitamin C** – Fruits, vegetables, cereals, poultry and fish

**Selenium** - Rice, wheat, meat, bread, nuts.

Antioxidant supplementation as a means of reducing cancer risk has been evaluated in animal and human studies. Evidence suggests that antioxidant substances may reduce cancer risk and could be incorporated as supplements. Patients undergoing treatment for oral cancer may experience significant disturbances in their dietary habits and undernourishment. For those able to take food by mouth, a bland soft diet and liquid diet supplementation are considered the most reasonable approach for providing adequate nutrition.

### HIV/AIDS

Poor nutritional status may compound the impaired immune status associated with HIV, possibly contributing to more rapid development of oral symptoms. (Patel and Glick, 2004) Nutritional intervention together with oral care is essential to prevent the patient becoming nutritionally compromised.

### Tooth loss

Teeth are important in enabling consumption of a varied diet and in preparing the food for digestion. Dental caries also results in tooth loss, which reduces the ability to eat a varied diet. It is in particular associated with a diet low in fruits, vegetables and non starch polysaccharides and with a low plasma vitamin –C level. Dentures are not a satisfactory substitute for natural teeth and limit the ability to consume a healthy diet adequate in fruits, vegetables and non starch polysaccharides. (Steele and Sheiham, 1998)

### Polymorphonuclear (<http://www.third-line.com>)

Nutritional deficiency may not initiate periodontal disease but perpetuates it. It has been acknowledged for many years that nutritional intake may impact upon the levels of inflammation seen in a number of diseases and this is no less the case in Periodontitis. Sugar intake increases plaque accumulation while decreasing chemo taxis and phagocytosis of polymorph nuclear leukocytes. Folic acid nutrition has been shown to be directly related to gingival health. Folate mouthwashes were found to be more effective than dietary supplements. (Thomson and Pack, 1982)

A deficiency of vitamin A is well known to predispose to periodontal diseases. Vitamin C protects the oral mucosal epithelium against the infiltration of antigenic materials such as bacterial endotoxins. Dietary vitamin C intake shows an inverse relation upto an intake of 180 mg daily. Vitamin E reduces gingival inflammation. Calcium intake is inversely related to the risk of periodontal diseases. Calcium intake is increased by reducing phosphorous intake. Phosphorous is high in meat, grains, potatoes and soft drinks. Serum zinc levels are negatively correlated with marginal alveolar bone loss. Obesity has significant metabolic and systemic immune and inflammatory effects and also may increase the host's susceptibility to periodontal diseases through its impact on

metabolic and immune parameters. Increasing body fat may induce a hyper inflammatory response in periodontal diseases. Carotenoids function as radical trapping antioxidants. High levels of oxidative stress have been demonstrated in Papillon Lefevre syndrome, suggesting a potential role for antioxidants. (Lundgren *et al.*, 1996) Gingival crevicular epithelium has one of the fastest turnover rates in the body and this tissue is probably completely removed in 3-6 days. To maintain this short turnover time the tissue must be in a state of continuous rapid RNA, DNA, and protein synthesis. Thus the tissue is sensitive to nutrient levels.

### Nutritional counseling (Moynihan, 2005)

A healthy diet provides adequate amounts of all essential nutrients to avoid deficiencies and promote optimal oral and systemic health.

The following is a step by step procedure for giving personalized nutritional guidance to dental patients.

#### Step I

Evaluate the diet and if necessary demonstrate the method of keeping a food diary

#### Step II

Explain the nutrition oral health relationship

#### Step III

Assess nutritional status

#### Step IV

Prescribe a balanced diet.

#### Step V

Follow up

As members of a multidisciplinary health care team dentists are uniquely positioned to provide diet screening, dietary guidance and or referral to a physician or registered dietician as part of comprehensive dental care. Just as home care oral hygiene procedure must be constantly reinforced and checked for proficiency so should the patient's prescribed diet be periodically reviewed.

### Conclusion

There is now overwhelming evidence of the importance of diet in a wide range of systemic diseases. In line with the dietary roles for the prevention of all major diet related chronic diseases, a diet that is high in fruits, vegetables and whole grain starchy foods and low in free sugars and fat is likely to benefit many aspects of oral health.

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