

NUTRITION AND ORAL HEALTH

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ABSTRACT

There is an interdependent relationship between nutrition and health of oral tissues. The well-being of the oral tissues, the quantity and quality of saliva and the dimension of taste depend on the intake of nutrients. Oral health determines the type of food consumed and ultimately the nutritional level. A review of literature was to outline this interdependent relationship.

INTRODUCTION

Nutrition is the study of how food affects the body. It is the adequate provision of materials like vitamins, minerals, fiber, water and other food components to cells and organisms, to support life. Many common health problems can be prevented or alleviated with good nutrition.

The World Health Organization defines malnutrition as the cellular imbalance between supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions¹. Malnutrition can either be over-nutrition or under-nutrition. Nutrients generally refer to both micronutrients and macronutrients.

Nutrition is an integral component of oral health. There is a continuous synergy between nutrition

and the integrity of the oral cavity in health and disease². Malnutrition may affect the development of the oral cavity and the progression of oral diseases through altered tissue homeostasis, reduced resistance to microbial biofilms and reduced tissue repair capacity³. In the absence of other contributing factors, compromised nutritional status must be considered in patients with refractory periodontitis, poor healing response to surgical procedures, or recurrent oral disease. This is particularly true for elderly patients and patients in institutional settings³⁻⁶.

Nutrition affects oral health, and oral health affects nutrition. This interdependent relationship sees good nutritional health promoting good oral health and vice versa⁷. Nutrition is a major factor in infection and inflammation⁸. Several reports emphasize the synergistic relationship between malnutrition, infectious diseases and the immune system; for example, infections promote malnutrition, the malnutrition elicits dysfunctions of the immune system, and this impaired immunity intensifies the infectious disease⁹. In oral health, dental caries and gum disease, as well as many diseases of the mucous membranes, tongue and salivary glands, are infectious and not only

disrupt the integrity of the oral cavity, but also affect general health¹⁰.

Periodontal diseases, characterized by chronic inflammation and a loss of the bone and soft tissues that surround the teeth, constitute one of the most common chronic infections in humans⁸.

A nutritious diet, including adequate amounts of protein, vitamins, essential fatty acids and micronutrients, can play an important role in the resistance to infectious conditions including periodontitis^{8,9}.

EFFECT OF NUTRITION ON ORAL HEALTH

Nutritional intake influences the oral tissues to which bacteria bind (i.e. epithelium, collagen, bone, teeth), as well as saliva⁸. Secretory proteins (mucin) found within saliva provide an effective barrier against desiccation, penetration, physical and chemical irritants, and bacteria¹⁰. Synthesis of glycoproteins, such as mucin, requires vitamin A. Retinol deficiency can reduce mucin production, leading to compromised salivary flow, weakened tooth integrity, and a marked increase in risk for caries¹⁰.

Malnutrition is also characterized by increased production and secretion of stress hormones (glucocorticoid) and decreased secretion of insulin⁴. Elevated circulating levels of cortisol in malnutrition imply a similar change in the content of this hormone in saliva and gingival fluid. Elevated circulating glucocorticoid levels, even at physiological concentrations, elicit macrophage dysfunction and reduce the production of cytokines in response to inflammatory stimuli. Cytokines play a prominent role in growth, differentiation, host defenses, and tissue damage. Cytokines also inhibit chemokines and other cells involved in attracting inflammatory

cells at the site of inflammation, which ultimately impact the tissue healing process⁹.

The most common relationship between oral health and poor nutritional habits or deficiencies is seen in the pathogenesis of caries. There is a strong association between caries and frequency of sugar and carbohydrate intake.

A *Candida albicans* infection has a variety of predisposing factors, but high carbohydrate diets and iron or folate deficiencies have been strongly implicated.

Recurrent aphthous stomatitis most often is a mild condition; however, severe cases may be caused by nutritional deficiencies such as iron, vitamin B12 and folate deficiencies. These deficiencies can also result to atrophic glossitis or painful burning tongue which is characterized by inflammation and defoliation of the tongue.

Dental erosion is the irreversible loss of dental hard tissue due to a chemical process of acid dissolution but not involving bacterial plaque acid, and not directly associated with mechanical or traumatic factors, or with dental caries. Erosion usually co-exists with attrition and/or abrasion. Attrition may be defined as direct tooth-to-tooth contact wear, whilst particles moving across and contacting the tooth surface results in abrasion. Soft drinks have been found to have erosive potential, particularly in young age groups^{11,12}. Some alcoholic drinks, such as dry wine and cider are also acidic^{13,14}. Alcohol consumption is linked with gastric reflux and erosion may therefore be from both intrinsic and extrinsic sources¹⁵. The frequency of, rather than total intake of these drinks may be critical in the erosive process. Fresh fruit, particularly citrus fruit, have erosive potential as do foods pickled in vinegar. Fruit drinks

from a feeding bottle, used as a comforter, may be particularly harmful to infants. Extreme dental destruction has been reported from such practices¹⁶. A vegetarian diet tends to be more acidic. Lacto-vegetarians were reported to have significant dental erosion¹⁷.

The health of periodontal tissues is strongly related to diet. There is a relationship between calcium intake and periodontal diseases. This may be due to calcium's role in building density in the alveolar bone that supports the teeth. Calcium is necessary for healthy bones, teeth, muscle contractions and other functions. The relationship between vitamin C and periodontal disease may be due to vitamin C's role in maintaining and repairing healthy connective tissue along with its antioxidant properties. Increased serum triglyceride levels in uncontrolled diabetics are also related to greater attachment loss and probing depths.

The micronutrient fluoride plays an important role in oral health. The addition of fluoride to the public drinking water supply is rated as one of the most effective preventive public health measures ever undertaken. Fluoride reduces dental caries by several different mechanisms. The fluoride ion may be integrated into enamel, making it more resistant to decay. In addition, fluoride may inhibit oral microbial metabolism, lowering the production of organic acids.

Nutritional deficiencies can greatly impact the function of the oral cavity. Taste, salivation, mastication, and swallowing can be impaired by a nutrient deficiency. Taste may become altered. Food may taste bitter, metallic, or bland. The production of saliva may be reduced and this can make mastication and swallowing very difficult and quite painful. This can

bring about malnutrition from the inability or lack of desire to eat. Nutrient deficiency then causes new symptoms and further oral health issues.

Systemic diseases and the medications used in their management can cause malnutrition that will manifest as oral health problems. For example, a deficiency of potassium is often caused by diuretics in patients with high blood pressure. Potassium deficiency can cause a sensation of a raw, sore tongue and burning mouth when eating, drinking, or talking. It can also cause gingival bleeding. The oral manifestation of other nutritional deficiencies can be seen in **Table I below**.

Eating a well balanced diet is imperative to maintaining good oral health. It is helpful to supplement the diet with a good quality multivitamin. The best food choices include cheeses, chicken or other meats, nuts, and milk. These foods are thought to protect tooth enamel by providing the calcium and phosphorus needed for remineralization. Finishing a meal with cheese or milk will neutralize intra-oral acid¹⁸. Other food choices include firm/crunchy fruits (for example, apples and pears) and vegetables. These foods have a high water content, which dilutes the effects of the sugars they contain, and stimulate the flow of saliva which helps protect against decay by washing away food particles and buffering acid. Acidic foods, such as citrus fruits, tomatoes and lemons, should be eaten as part of a larger meal to minimize the acidic environment to which your teeth and mouth must be exposed. The best beverage choices include water (especially fluoridated water), milk, and unsweetened tea. Consumption of sugar-containing drinks should be limited.

Poor food choices include candy - such as lollipops, hard candies, and mints -- cookies, cakes, pies, breads, muffins, potato chips French fries, bananas, raisins and other dried fruits. These foods contain large amounts of sugar and/or can stick to teeth, providing a fuel source for bacteria. In addition, cough drops should be used only when necessary as they, like sugary candy, contribute to tooth decay because they continuously coat the teeth with sugar.

EFFECT OF POOR ORAL HEALTH ON NUTRITION

Poor oral health can affect dietary quality and nutrient intake in a manner that potentially increases the risk of several systemic diseases⁷. Tooth loss can result in chewing difficulty because of inadequate occlusive surfaces⁷. Reduced masticatory ability alters food selection and dietary quality, which can affect nutritional status¹⁹. Oral pain resulting from caries, advanced periodontal disease, soft tissue lesions or poorly fitting prostheses may also lead to changes in diet and subsequent nutritional status⁷.

Most studies relating tooth loss and nutrition suggest that nutrient intake deteriorates in quality with fewer teeth⁷.

In one study, participants with more teeth generally consumed fewer calories, more vegetables, more fiber, more carotene, and less cholesterol and saturated fat than their counterparts with fewer teeth²⁰. Edentulous individuals are particularly prone to inappropriate dietary intake, ingesting too few nutrient-dense foods and too many calorie-rich, high fat foods. Research indicates that loss of natural teeth causes reduced masticatory efficiency even after replacement with dentures²⁰. Among community-dwelling older adults,

edentulousness is an important risk factor for weight loss, as chewing difficulty or oral discomfort due to poorly fitting dentures can contribute to food aversion and diminished nutrient intake¹⁹. It has also been reported that denture-wearing individuals consume more refined carbohydrates, sugar and dietary cholesterol than dentate individuals⁷. Such detrimental changes in food choices may, in turn, increase the risks of a variety of systemic diseases.

As masticatory efficiency becomes reduced, some people avoid foods that are difficult to chew, including stringy foods like beef or steak, crunchy foods like raw carrots, and dry, solid food like crusty bread. People with poor oral health status can, as a consequence, suffer from impaired intake of fruit and vegetables, dietary fibre and some key nutrients. The impact of masticatory efficiency on food selection is likely to be compounded by food preparation. A person with reduced chewing capability may overcook or over prepare fresh foods (e.g., removing all skin from fruits and vegetables) to make them easier to eat. A wide range of nutrients are affected by these actions, including food constituents that are thought to be important for preventing cancer and cardiovascular disease (i.e., non-starch polysaccharides or dietary fibre) and for cellular defence and combating the effects of aging (i.e., the anti-oxidant micronutrient vitamins C and E).

CONCLUSION

Malnutrition can cause poor oral health and poor oral health can indirectly cause malnutrition. To break this vicious circle, good nutritional habits must be imbibed. Dentists should be responsible for counseling patients on diet as it relates to oral health. Nutritional risk evaluation

should be done during initial and periodic dental examination. Monitoring and follow-up should include periodic diet recall to evaluate counseling outcome.

To achieve the overall health of an individual, oral health guidelines and questions about oral health problems and the use of dental prostheses should be incorporated into nutritional assessment protocol.

Table I: ORAL MANIFESTATION OF NUTRITIONAL DEFICIENCIES

NUTRIENT DEFICIENCY	CLINICAL MANIFESTATIONS
Vitamin A	Gingivitis, Periodontitis Hyperplasia of the gingiva.
Thiamine/ Vitamin B1	Cracked lips A satin looking gingiva and tongue Angular cheilosis
Vitamin B2/Riboflavin Niacin	Inflammation of the tongue. Fiery red inflammation of the tongue Angular cheilosis Ulcerative gingivitis
Vitamin B6	Teeth or bone decay Periodontal disease. Anemia Sore tongue Burning sensation in the oral cavity.
Vitamin B12	Angular cheilosis Halitosis Bone loss Hemorrhagic gingivitis Detachment of periodontal fibers Painful ulcers in the mouth
Vitamin C	Bleeding gums, Mobile teeth, Delayed wound healing
Vitamin D	Enamel hypoplasia Absence of lamina dura Abnormal alveolar bone patterns
Iron	Very red, painful tongue with a burning sensation Dysphagia Angular cheilosis

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