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Nutrition and oral health

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ABSTRACT

Mouth being a reflecting mirror of general health often helps in early diagnosis of many diseases and disturbances. Like any other system of our body, oral cavity relies on adequate nutritional supply but with certain special cautions to protect the dental structures which in turn help for consumption of nutrients. In this way nutrition and oral health are mutually dependent and hence an extensive understanding of this inter relationship is essential for healthy life. This review reveals the essence of knowledge required to maintain high-quality oral and general health by precise diet.

1. Introduction

Nowadays people are conscious in knowing about the healthy diet through various media and try to practice it to their kitchen style. Diet, the customary allowance of food and drink taken by any person per day varies from nutrition, which involves the metabolic processes and utilization of nutrients in the food. The nutritional status of a person is implicated on oral mucosa due to rapid turnover of their epithelial cells, which is five times faster than it is in the skin. These self renewing cells live for approximately 5 to 6 days[1]. This turnover keeps the mucosa healthy and acts as a barrier to many toxins, drugs, chemicals and bacteria. Inadequate nutrition may lead to tissue breakdown, infection, and inflammation[2].

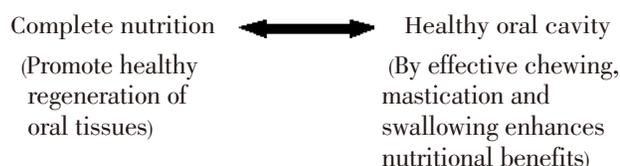
Worldwide there are more than 2 billion people, particularly pregnant women and young children are at mal nourished status with compromised health circumstance[3]. This review deals with

complex relationship among diet, nutrition and their implications on oral health and so the need for effective contribution of dietitians in dental team to enhance the general health status of population.

2. Mutual relationship between nutrition and oral tissue

1. Vitamins and minerals produce characteristic manifestation on teeth, periodontal tissues, salivary glands and perioral skin in their deficiency state[4]. (Table 1)
2. Systemic diseases associated with malnutrition also accompanying oral manifestations[5].
3. Altered anatomic and functional effects of oral cavity like advanced dental caries, periodontal diseases and the resulting edentulousness may cause chewing difficulty and thus put in malnutrition[6].

So there exists a dynamic interaction.



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3. Oral diseases and disorders associated with nutritional risk

3.1 Oral ulcerations

This may vary from acute aphthous ulcers (Common mouth ulcers) to chronic lesions like lichenplanus, Pemphigus, pemphigoid and carcinomatous ulcers. The associated pain and burning sensation extremely affects the normal diet intake and leads to malnutrition[7].

3.2 Infections

Many bacteria, virus and fungi are capable of producing oral infections on both bony and soft tissue counterpart, which adversely affects regular food habits due to difficulty in chewing and swallowing[8].

3.3 Altered taste and burning mouth

This may be due to the reflection of underlying systemic disorder like diabetes mellitus[9] or severe nutritional imbalance itself. The patient may hesitate to take regular diet.

3.4 Xerostomia

Table.1

Manifestations of nutritional deficiency in oro–facial region.

Site	Manifestation	Nutrient deficiency
Face	Edematous appearance	Protein
	Paleness	Iron
	Malar pigmentation	Niacin, riboflavin
	Nasolabial seborrhea	B ₆ , niacin, riboflavin
Lips	Fissuring at corners	Niacin, riboflavin
	Swelling and redness	B ₆ , Iron
Gingiva	Red, swollen, spongy and bleeding gums	Vitamin C
Tongue	Red and fissured tongue	Folate, niacin, B ₁₂ , B ₆ , riboflavin, Fe ⁺⁺
	Pale, smooth and glossy tongue	B ₁₂ , Fe ⁺⁺

function.

3.7 Oral and maxillofacial surgeries

Various maxillofacial surgical corrections for fracture of jawbones, zygomatic nasal complex and orthognathic surgeries create an acute profound insult to the nutritional status. Maxillo mandibular fixation for several weeks reduces the sufficient caloric intake and gross malnutrition due to considerable loss of chewing and swallowing functions. The increased time with structural alteration required for food consumption may reduce the dietary intake.

The average caloric requirement of as 70 kg surgical patient under different condition is proposed as follows[13].

Uncomplicated post operative = 1 500–1 700 kcal/D

Septic complications= 2 000–2 400 kcal/D

Reduced salivary secretion caused by any affect the food bolus formation and swallowing and hence eating will be difficult especially for dry foods. Other disturbances like reduced taste perception, burning sensation of mouth and altered taste sense like bitter taste or metallic taste altogether reduce food consumption[10].

3.5 Substance abuse

Various research reports reveals tobacco, areca nut and panmasala habits have adverse effect on oral mucosa which ranges from oral ulceration, reduced mouth opening to inability of chewing and swallowing food[11]. Heavy consumption of tobacco and alcohol is a risk factor for oral cancer which has serious consequence on food consumption, immunity and general health.

3.6 Complete denture treatments

When total extraction is planned, the treatment time with healing period followed by denture fabrication and patient's acceptance together affects the regular intake of diet and nutritional status[12]. Patients undergoing denture treatment need dietary counseling to correct imbalance in nutrition. These patients prefer soft diet which lack fibers. They should be encouraged to take fruits, vegetables and cereals to promote normal bowl

Multitrauma (or) compound fracture = 2 200–2 600 kcal/D

3.8 Neurologic disorder

Overview of diet and nutritional imbalance in some cases often associated with neuropathies. Altered, impaired or absent taste perception and impaired swallowing are manifestations of facial and glossopharyngeal nerve palsy. Dietary adaptation with pureed food is suggested for patients with swallowing difficulties. Once their swallowing ability improves, their diet may be advanced to next levels of soft, semisolid and regular consistencies[14].

4. Dietary changes and dental health during pregnancy

Pregnancy period is a critical time to focus on preventive oral care approach. Pregnant women are at risk of deficiencies of vitamin A, folate and B-complex, minerals like iodine, iron and zinc. These insufficiencies lead to impairment of immune mechanism and make the oral mucosa vulnerable to pathogens³.

Pregnancy also exacerbates the response to local factors like plaque and calculus and thus periodontal infections. The repeated exposure of the endometrial endothelium to the periodontal pathogens and their toxins via the circulation activate the maternal immune system resulting in the release of inflammatory mediators, growth factors and cytokines which may trigger premature delivery and low birth weight

Table 2

Immune functions of Vitamins and their influence on oral health.

Vitamin	Function	Oral manifestations in deficient state
Vitamin A	Immune cell differentiation and lymphocyte proliferation	Bacterial Colonization
Vitamin E	Reduce cell membrane damage by anti-oxidant potential	Oral tissues will be more vulnerable for bacterial and chemical toxins
Vitamin C	Neutralizes toxins that are produced during phagocytes Anti-oxidant	Overwhelming acute and chronic bacterial infection. (Especially Gingiva)

4. Increased caries susceptibility.
5. Retarded jaw growth.
6. Crowded dentition.

6. Dental caries

Children and adolescent age groups are highly prone for dental caries. Their food choice is governed by environment, senses and emotions. Dental caries (DC) occurrence is due to the demineralization of enamel and dentin by organic acid derived from anaerobic metabolism of dietary sugars by plaque bacteria. Untreated dental caries may result in tooth loss and reduces the chewing and talking abilities.

Dietary sucrose also serves as nutritional source for bacterial plaque. Sucrose intake facilitates plaque formation and accumulation by assisting in the synthesis of glucan^[17]. There is an increased prevalence of dental caries in developing countries which have increased their sugar consumption.

7. Childhood and adolescent diet care to prevent dental caries

1. 3 Meals + 3 Snacks meal pattern.

babies^[15].

Frequent snacking in addition leads to increased dental caries and so non-cariogenic foods should be strongly recommended. The overall solution is to follow a balanced food pyramid for obtaining majority of calories from nutrient rich and non-cariogenic foods.

5. Dental defects on the child associated with pregnancy malnutrition

The association between dental defects on the fetus and pregnancy malnutrition is accounted as follows^[16].

1. Reduction in tooth size.
2. Delayed eruption time.
3. Enamel Hypoplasia.

2. Fibrous diet as an alternative for cariogenic foods.
3. Food consumption at regular time to reduce the recurrent snacking.

Frequent re-enforcement about disease risk diets and providing complement for positive dietary charges and encouraging non-cariogenic foods like nuts, vegetables, pop-corn and low cariogenic fruits, whole grain products and chocolate milk consumption will bring life-long results.

8. Impact of nutrient deficiencies on immune response and oral infections

Critical determinant of immune response is nutrition and there exists an interdependent relation of these two factors and oral health^[18]. Malnutrition severely affects the host immune resistant against microbial growth. This reduced immune response encourages the oral microbial colonization and leads to bacterial stomatitis and gingivitis which in turn affects the regular diet consumption due to pain and discomfort (Table 2).

9. Diet counseling for maxillo-facial surgical patients

These patients experience feeding difficulties and their demand for nutrients being high, planning of meal schedule is mandatory. During healing process new tissues are produced by the body and there is an increased demand for collagen and cellular turnover.

To enhance healing and postoperative recovery care should be given for the following nutrient Supplementation^[19].

Protein: Aids in strengthening of fracture repair

Vitamin A: For surface epithelialization; Fibroblast differentiation; Collagen synthesis and their cross linking.

Vitamin C & Vitamin E: Anti-oxidant property aids in wound healing.

Vitamin D & Calcium: Hard tissue healing.

10. Oral manifestations of specific nutrient deficiency

10.1 Calcium

Teeth are the densest structure of the body with highest calcium content. Deficiency during developmental period (*in-vitro*) causes enamel hypoplasia and later increased incidents of dental caries. Systemic osteoporosis (reduction in bone mass due to inequity of bone metabolism

favoring bone resorption to compromise the calcium insufficiency) due to estrogen deficiency in post menopausal women and calcium deficiency during lactation also affecting the alveolar bone, and causes mobility and tooth loss^[20]. Food supply of calcium depends on the intake of yogurt, cheese, milk, turnips, spinach, soybeans and enriched breads and grains.

10.2 Fluoride

Being an essential micronutrient for healthy bone and teeth, its supplementation should be encouraged for growing children consuming non fluoridated water^[21]. Water containing fluoride level of less than 1 parts per million will prone for dental caries. The use of packaged water and utilization of water filtration devices, distillation system and reverse osmosis techniques result in 90% reduction of fluoride content. Rich sources of fluoride include tea leaves and fish.

10.3 Protein

Protein deficiency manifests as edema of tongue, pigmentation around lips, restarted jaw growth and crowded dentition^[22]. There is significant impairment of cell mediated immunity, phagocytic function, altered immune response and reduced IgA and lysozyme secretion in severely affected protein malnutrition patients and causes increased bacterial adhesion to oral epithelial cells, invasion and infection^[24].

Dietary intake of milk, fish, egg, soybean and cheese will provide adequate protein supply to the body.

10.4 Iron

The texture of oral mucosa is altered due to its deficiency due to epithelial atrophy, which attracts the microbial colonization. The bactericidal activity of iron, which enhances the movement of O₂ to the cells of system, also gets affected. Together iron deficiency encourages the opportunistic oral infection^[24].

Dietary source of iron include red meat, egg yolks, dark leafy greens, dried fruits, liver, beans and lentils.

10.5 Vitamin B₁₂

The oral signs and symptoms include glossitis, angular cheilitis, recurrent oral ulcer, oral candidiasis, and diffuse mucositis. Oral manifestations often precede the major complications of megaloblastic anemia, in which morphological abnormalities of red cell precursors in bone marrow occur^[25].

The clinical symptoms include weakness, fatigue, shortness of breath and neurologic abnormalities. Early oral findings in dietary deficiency of cobalamine may help to prevent the neurological signs which are often irreversible. Oysters, liver, caviar, octopus, crab and lobsters, cheese and yogurt are rich in Vitamin B₁₂.

10.6 Vitamin C

Collagen represents about 30% of total body protein and is involved in the matrix formation of dentin, cementum, alveolar bone and periodontal ligament. Deficiency of Vitamin C manifests first in oral cavity as swollen, bleeding gingiva and finally loosing of teeth^[26]. This is the result of under hydroxylation of collagen leading to increased vascular permeability of gingiva. Gingival bleeding decrease when Vitamin C is supplemented and bleeding score is increased in its deficiency state. Vitamin C deficiency on the other hand increases only the severity of gingival inflammation, but not the single cause.

Humans are unable to synthesis this vitamin and rely upon dietary intake to supply for the physiological needs. Being water soluble, body is incapable of storing it and necessitate continuous intake of fruits and vegetables like citrus fruits, mango, papaya, pineapple, strawberries, broccoli, cauliflower which are rich in Vitamin C.

11. Conclusion

An individual's general health is determined by genetic and environmental factors which are also potentially influenced by nutrition. Oral tissues are

susceptible to nutritional stresses that may affect a person's general health and wellness. Diet and nutrition of the host may establish the oral diseases by their influences on ecology of oral flora. Regular diet and nutritional counseling should include nutritional strategies for oral health as a part. To achieve the moderate level of oral health, we should aim for the following objects.

1. Individualized nutritional advice for dental patients by regular diet counseling.
2. Nutritional rehabilitation for immunocompromised individuals.
3. Regular diet screening programs for school children.

The co-ordination between the dentist and dietitian should go a long way in preventing and treating many of the unsolved dental problems associated with nutrition.

Conflict of interest statement

We declare that we have no conflict of interest.

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