

A systematic nutritional and dietary guideline for orthodontic and orthognathic surgery patients

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Abstract

Nutritional considerations are most critical during growth and development of Individuals because of increased dietary requirements during this period. Those who seek orthodontic treatment avoid many types of food, especially fruits, raw vegetables, and other hard and tough foods because of pressure sensitivity. This results in deficiency of proteins and other key nutrients. Also mouth is portal for entry of food into the body, thus surgery of these structures may result in impaired food intake and eventually in nutrient deficiency. In both instances special dietary concern and guidelines are mandatory for the success of the treatment and overall wellbeing of the patient. This paper presents an overview of the relation between diet and orthodontic treatment including orthognathic surgeries.

Keywords: Nutrition, Orthodontics, Orthognathic surgery, Fruits, Vegetables

Introduction

In recent years, people have become more aware & concerned about maintaining good health & having a healthy life style. A good diet plays an important role in maintaining good oral & overall health.⁽¹⁾

A diet that contains adequate amounts of all the necessary nutrients required for healthy growth and activity is a balanced diet.⁽²⁾ The importance of a balanced diet cannot be overstated. A balanced diet provides natural disease prevention, weight control, and proper sleep without the use of sleeping pills. Balanced diet is also important because it enables to meet daily nutritional needs and enjoy a higher overall quality of life. With nutritional issues in the spotlight, it seems a good time to evaluate how orthodontic treatment affects a patient's diet and their overall health.⁽³⁾

A review of basic principles of nutritional science indicates its applicability to the orthodontics to the many levels. Nutritional considerations are most critical during growth and development and environmental challenges. The literature suggests that the nutritional status of the orthodontic patients can affect the biologic response of the periodontal ligaments and the bone to orthodontic bands and brackets Adolescence is a period of profound physiological and psychosocial change that is also associated with altered nutritional needs.⁽⁴⁾ Adolescents are vulnerable because of increased dietary requirements during this period when changes in lifestyle and food habits greatly affect nutrient intake.⁽⁵⁾ In addition, adolescents are typically involved in orthodontic treatment, during which modified nutritional needs are required but poor dietary behaviour is likely.⁽⁶⁾ It is accepted that orthodontic treatment causes pressure sensitivity to the teeth which leads to pain, discomfort and functional limitations.⁽⁷⁻¹⁰⁾ The mastication of hard foods is therefore difficult for

patients and there is a tendency for soft foods to be eaten. The avoidance of hard to chew natural foods usually involves the elimination of solid foods such as raw vegetables and fresh fruit,⁽¹¹⁻¹⁴⁾ stringy foods such as meat, and dry foods such as bread or bagels,⁽¹⁵⁻¹⁶⁾ from the diet.

Orthodontic treatment creates physical, physiologic, and emotional stresses that increase the nutrient mobilization and utilization, thus raising the nutritional requirements of the person. This along with the fact that the nutritional needs of adolescents (the age of a typical orthodontic patient) is already stressed by growth and development as well as the emotional stress of puberty, maintenance of a well balanced diet is of great importance.⁽¹⁸⁾ Fixed orthodontic treatment typically lasts for around 1½ to 3 yrs and during this duration certain dietary restrictions and modifications are advised. A previous examination of patient's nutrient intake before and after orthodontic adjustment reported a decrease in the intake of copper and manganese and a possible detrimental effect on the rate of tooth movement.⁽¹⁹⁾ Orthodontists recommend that patients avoid hard foods that may cause appliance damage which, in turn, may affect nutrient intake.

Moreover, occlusal changes during treatment may also impair mastication and patients may cope by altering their diet or by swallowing coarse particles leading to digestive disorders. In both circumstances, impaired dietary intake may increase nutrition-induced disease risks.⁽²⁰⁾ The mouth is the portal for entry of food into the body, thus maxillofacial surgery including the orthognathic surgery of these structures may result in impaired food intake both prior to & after surgery. Adequate nutritional support in such patients are mandatory. In this review article we discuss about nutritional consideration in orthodontic and

orthognathic patients as it affects growth, tooth movement & treatment response.

Effect of Nutritional status on teeth movement and tissue response

Orthodontic treatment relies on the biologic response of the periodontal ligament and the alveolar bone to applied force system. The orthodontic patient is usually selectively treated during adolescent growth spurt, which provides an additional challenge to his nutritional status. During growth or healing, some nutrients that are otherwise non-essential for optimal growth. Other challenges accompanying the adolescent period are increased emotional stress, a higher level of physical activity and the unbalanced diet that typifies the age group. Ascorbic acid that may influence the biologic response for orthodontic forces is a classical example. If involved in the biologic response to the tooth movement, ascorbic acid may also influence retention. Stephen-F-Litton studied the effect of ascorbic acid deficiency during tooth movement in guinea pig to determine what morphologic change would be observed during vitamin deficiency Lack of normal collagen synthesis, because of the lack of ascorbic acid, resulted in an almost complete cessation of osteogenesis & disorganization of periodontal ligament. It appeared that ascorbic acid is necessary for the normal morphology of periodontal ligament and alveolar bone.⁽²¹⁾

In 1981, Nanda and Hickong⁽¹⁸⁾ stated that, although orthodontists rarely see manifestations of nutritional deficiencies in their patients, suboptimal levels of certain nutrients are common and may affect the biologic response of tissues. It has been reported that between 17 & 72 percent of orthodontic patients may have suboptimal levels of ascorbic acid & a deficiency may affect the connective tissue of the periodontal ligament and the formation of osteoid.⁽²²⁻²³⁾ In addition, nutritional stress to the periodontium, coupled with the irritation of orthodontic bands & brackets, may cause an altered gingival response.⁽¹⁸⁾

Nutrition and Skeletal & Muscular Maturation

Prolonged nutritive failure in growing children shows a retarding influence on each of the 28 bone centres in the hand and wrist which are used as indicators of skeletal maturation. Kufinec concluded bone develops in a manner similar to other soft tissues. A high rate of bone growth can readily be demonstrated around the time of weaning when diet changes from a relatively low protein to a high protein diet which is during the hyperplastic growth phase. Therefore it is the critical period in the development of bone. Any nutritional deficiency occurring during the active growth can be disastrous Vitamin A deficiency which frequently accompanies protein calorie malnutrition may result in inadequate bone growth patterns with concomitant malalignment and malocclusion of the

teeth. An excess of vitamin A during the critical growth period markedly inhibits the neural crest cell development and upsets the normal balance between bone formation and resorption Calcium, Vitamin D and phosphorous are essential for the formation of bones and teeth. Deficiencies of these nutrients cause retarded jaw, teeth and condyle development. Deficiency of Vitamin D causes rickets, maxillary dysplasia, susceptibility to muscular traction. Facial sutures close with difficulty leading to open bite, transverse hypodimension and misshapen palate Correction of dietary deficiencies bring the acceleration in the overall rate of skeletal maturation but doesn't equally affect all the bone centres. A soft diet does not provide adequate stimulus for the proper mastication, resulting in narrower maxillary arches and this can lead to 'arch collapse syndrome' Waugh, Klatsky and Fisher⁽²⁴⁾ documented a direct relation between reduction in chewing power and demand made on supporting structures leading to underdeveloped muscles of mastication and incidence of malocclusion Singh and Chawla(1994) conducted a study on the contribution of diet in malocclusion in north Indian population .They stated that occasional or no consumption of coarse and fibrous food had a positive influence on the incidence of class II div I and skeletal type of malocclusions. The diets of rural populations, which usually contain an abundance of raw vegetables offer adequate muscular stimulation and hence orthodontic problems. It thus appears that these changes to softer food caused unfavourable changes in muscle tone and a tendency for skeletal and dental problems to develop

Nutrition and root resorption

Root resorption is a common iatrogenic problem associated with orthodontic treatment. Resorption can be external or internal. Marshall in 1930⁽²⁵⁻²⁷⁾ concluded that animals on deficient diets showed greater degree of resorption than do those on adequate diets, using the same appliance and the resorbed areas are greater extent and are repaired more slowly in animals with deficient diets Low levels of serum calcium level is a determining factor for root resorption despite the decisive role of PTH in regulation of bone resorption(Engstrom et al 1988).⁽²⁸⁾ It thus seems likely that raised serum calcium level may inhibit PTH secretion and therefore inhibit root resorption.

Engstrom et al⁽²⁸⁾ in 1988 investigated the effect of orthodontic force on periodontal tissues normal and hypocalcaemic rats. Their observations gave information that the increase in the occurrence and severity of root resorption in moderate hypoglycemia was related to an increase in alveolar bone turnover.

Nutrition and stability of orthodontic correction⁽²⁹⁾

Vitamin C deficiency affects the stability of orthodontic correction. It affects the retention and this

has been confirmed from experiments on guinea pig incisors, where the vitamin C deficient group experienced more relapse.

Dietary Counselling in orthodontic patients

The orthodontic patient is subject to a number of challenges that will require a certain host response, which is partially dependent on nutritional status. These stresses include the requirement for tissues response to orthodontic forces in periodontal ligament and bone.⁽³⁰⁾ Increased irritation to the periodontium, the physical & emotional stresses, the increased requirements to adolescent growth & poor quality of diet during the period.⁽³¹⁻³²⁾

In addition use of alcohol or drugs may further increase the nutritional requirements.⁽²²⁻²³⁾ Use of oral contraceptive steroids increase the need for pyridoxine, foliates and ascorbic acids.⁽²¹⁾ The use of phenytoin by orthodontic patients with epilepsy cause drug induced vitamin.

Requirement: The increased amount of unmineralised new bone may result in a tendency for increased indirect bone resorption in patients. Literature of studies revealed that there is significantly higher intake of fat & low intake of fibre in the orthodontic group compared with normal people. In addition, the intake of chromium & beta carotene was lower in the orthodontic group. Furthermore, the intake of saturated, non-saturated & poly-saturated fat & cholesterol was significantly higher in orthodontic patients.

Perhaps the best method for patient education is dietary history. Proper instructions on how to keep a dietary history for several days can provide the basis of a brief educational session with the orthodontist or an auxillary. In addition, a general evaluation of the patient's diet in regard to its balance of nutrients and food groups can be made.

With so much focus on healthier foods and more nutritional food choices, dietary counseling and nutritional education relevant to oral health have become an important component of dental education. In fact,⁽³³⁾ 1987 guidelines for accreditation of dental schools by American Dental Association require "the graduate must be competent to provide dietary counselling and nutritional education relevant to oral health" Study of diet and nutrition is also a mandatory part of the curriculum in Indian dental schools.⁽³⁴⁾

Scientifically, food is divided into five major groups, each group provide some, but not all the nutrients we need. Each food group is as important as another, no one can replace other. For good health, we need them all. Here, we discuss about the groups of food that make up a good diet.

1. Vegetables
2. Fruit
3. Milk, yogurt, and cheese
4. Meat, poultry, fish, dry beans, eggs, nuts, oilseeds, and sweets

5. Bread, cereal, rice and pasta

This discussion emphasizes that nutrition is an important factor, influencing the general health and tissue tolerance of orthodontic patients at many levels. The age group typically involved in orthodontic treatment has particularly high nutritional demands and particularly poor dietary behavior.

Foods that cannot be cleaned off the braces may lead to discoloration and decay of teeth. Even though braces and wires are metal or ceramic, they are fragile and are usually damaged by eating the wrong foods, thus taking longer to finish.

Braces friendly eating tips: Even though your orthodontist give you dietary guidelines, when you are wearing orthodontic braces, it is your job to avoid certain foods that can damage the orthodontic appliances, brackets and wire which may cause delay in treatment. The key rule is: nothing hard, sticky or chewy. Here is an idea of what foods are safe to eat and what foods to avoid.

What to eat: Banana, Biryani, Cake, Boneless meat, Orange, Chapatti, Burger, Pulses, Litchi, Egg, Icecream, Fishes, Veg pulao, Puri, Bread.

What not to eat: Banana chips, Bhelpuri, Carrot, Chips, Chewing gum, Chocolate, Cold drink, Dry fruits, Guava, Meat with bone, Pizza, Popcorn, ice cream with nuts, Pan masala, Halwa, Sticky snacks.

Nutritional considerations in orthognathic surgery patients

The mouth is the portal for entry of food into the body thus maxillofacial surgery of these structures may result in impaired food intake both prior to and after surgery. We must ensure adequate nutritional support in such patients.

Patients require both an energy source and a protein source. Carbohydrates, proteins and fatty acids are sources of energy. Glucose is the energy source for vital organs like brain. However hyperglycemia is not desirable. Fatty acids produce more energy and certain essential fatty acids must be supplied by the diet. Protein is not an energy source but its primary purpose is for cellular proliferation and protein synthesis. Protein is also important for imparting strength to the fracture repair. If it is absent then the wound healing is delayed.

Vitamin A helps in epithelization, collagen synthesis & cross linking and fibroblast differentiation. Vitamin C deficiency leads to impaired wound healing and collagen synthesis. Vitamin D and calcium helps in the healing of the hard tissues. Vitamin E acts as an antioxidant and thus reduces the damage from the free oxygen radicals. Large doses of Vitamin E also inhibits healing. Vitamin K helps in activation of various

clotting factors and thus is essential for blood clot formation during healing.

After jaw surgery it is important to eat well as healing requires good nutrition. Initially need to eat and drink using a small spoon, plastic syringe or straw. It is often best to take smaller meals or snacks more frequently rather than relying on the typical three meals per day.

- Puree/Liquidised diet
- Initially need to make food into a liquid form
- Use milk, fruit juice, sauces, gravy, soup etc.
- Meat, poultry, fish and alternatives should be liquidized with savoury sauce
- Carbohydrates-mash potato with milk and butter
- Fruit and vegetables can be liquidized

Foods to avoid:

- Stringy foods such as green beans and celery
- Crunchy food such as muesli, crisps, toasts, nuts and crispy bread
- Foods with skins or husk such as sausages, peas etc.
- Chewy food such as tough meat and toffees
- As the week progresses, try to gradually include more solid food.⁽³⁵⁻³⁶⁾

Conclusion

It may be beneficial to provide adequate dietary guidance for the orthodontic patients to optimize patients physiologic response to the orthodontic treatment. The practitioners should take responsibility for obtaining nutrition history, evaluating the diet, educating the patient about diet components, their importance in oral health, motivating the patient to improve diet & follow up to support patients effort to change food behavior. Also the patients with braces should be advised about the importance of including foods like fruits, vegetables, grains and cereals in their diet rather than taking foods such as cakes, pastries, cool drinks etc. which are high in simple sugars and fats. Patient should be advised to eat a variety of foods containing proteins, fruits, vegetables and cereals. They should be advised to limit salt, fat and sugar intake. Furthermore, the patient undergoing orthognathic surgeries present special considerations.

Their diet should include soft food stuffs with adequate balance in all components, including carbohydrates, fatty acids, proteins, vitamins & minerals.

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