

Nutritional Essentiality and its Consequences on Orthodontic Therapy

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Abstract:- The nutritive state of the individual influences the oral cavity evolution as well as the structures of it. Abnormalities are caused by both deficiencies as well as toxicities of the nutrients. The pertinent biological retaliation of the periodontal structure and alveolar support of the bone to an orthodontic force can be enhanced by the beneficial consumption of nutrition while it can be kept down by the deprived nutrition. Teeth cannot be absent or disarranged as well as maxilla and mandible cannot be distorted, unless and until it has been interfered by some substance or something else and ordinarily it should be the consumption of food as nature has no tendency for any inaccuracies. Orthodontic as well as dentofacial therapy includes the utilization of force elements as well as orthodontic appliances that can unfavorably act on food intake, consumption of the nutrition of the orthodontic patient. Requirement of balanced nutrients is must for effective orthodontic treatment. Orthodontia has some evidence based laboratory studies that have divulged that vitamin D accelerates tooth movement. Osteoclastic and osteoblastic activities take place throughout the orthodontic therapy; this bone remodeling process authorizes the tooth movement. Bone remodeling can be influenced by so many factors including nutritional intake at the cellular basis that can affect the orthodontic tooth movement. Orthodontic tooth movement can be influenced by the supplementation of vitamin C as vitamin C is the factor which can accelerate the bone remodeling activities.

I. INTRODUCTION

➤ *What is Nutrition?*

Many of the population have the thought that nutrition is exactly the process of food intake towards the inside of the oral cavity, chewing it, and passing it towards the stomach as well as intestine, where it can be break apart up into tiny parts that are enough to move from end to end of the intestinal wall and it can be absorbed by the blood, or preserved into the liver and tissues. The fact is different, as the true nutrition comes about only while cells absorb that specific material separately and prepare it for a part of its living substance. This is the

actual nutrition; or, as an alternative, living cells have been supplied by energy of life. Guilford was included in prior pioneers to propose that nutritive deficiencies are also the etiological factor for the orthodontic and dentofacial defects.⁸

II. NUTRITION, GROWTH AND ORTHODONTICS AND DENTOFACIAL ORTHOPAEDICS

Habitually, the treatment of orthodontic treatment seeking patient have been particularly done throughout the pubescent spurt of growth, that is why an additional challenge is provided to his/her nutritious level. Some nutrients are otherwise inessential for an outstanding growth throughout the growth and healing. The additional challenges along with the adolescent period maximize the psychological stress, the greater amount of physical activities as well as irregularities in dietary habits that epitomizes an age group. Prolonged nutritional negligence in growing individual displays the retarding impact on each of the 28 bone centres in the hand and wrist which can be used as the skeletal indicators of the growth prediction. Kuftinec concluded that the bone develops in a similar manner to the development of other soft tissues. The greater amount of bone growth can gladly be exhibited around the period of tapering when nutritive habits interchanges from a relatively minimal protein to the maximum protein diet which should be remaining throughout the hyperplastic growth phase. That is why it is called the censorious time in the bone development. In addition, any nutritive defect happening during an active growth phase can be terrible. Vitamin A insufficiency which repeatedly leads to the protein calorie malnourishment that can result in deficient growth of bone patterns along with consequent malocclusion. The toxicity of vitamin A at the period of the censorious growth period noticeably retards the development of neural crest cell as well as it inhibits the usual balance between the osteoclastic and osteoblastic activities.⁷

A. *Nutritional Effects on Orthodontic Therapy*

The orthodontic therapy can be vastly depending upon the healthy oral tissues. Repeated ulcerations, demineralization, caries, resorption of root, inflammation in oral tissues and compromised periodontal status of tissues

critically impede the orthodontic therapy. The quality of nutrition is directly proportionate to the successful orthodontic therapy. Orthodontists direct the orthodontic patients to circumvent sticky, chewy, gummy or too hard intake of food to avoid appliance deterioration as well as debonding of brackets. Preferential soft food consumption during orthodontic therapy will lead to dietary changes as a result of reduced fiber as well as carbohydrate consumption and it will maximize the fat intake. Strause and Saltzmann reported that copper and manganese are depleted by orthodontic therapy. Lack of the intake of nuts, whole grains and minimized consumption of fruits as well as vegetables was also assigned. Copper plays a crucial role in the hemoglobin as well as red

blood cell construction; elements for enzymes of redox systems; collagen crosslinking; and usual pigmentation. Manganese is the essential mineral for bone remodeling as well as glucose metabolism. Chewing gum, caramel, toffee and all sticky candy, ice cubes, popcorns kernels, raw apple or carrot, corn on cob, hard pretzels, pizza crust, chocolate chips, nuts, carbonated drinks should not be eaten by orthodontic patients. Potato chips, steamed vegetables, french fries, yoghurt, pudding, jelly, soup, cereal in milk, cheese, eggs, milk shakes, ice cream without nuts should be taken by orthodontic patients.^{2,28-30} Various nutrients and its eatable sources during orthodontic treatment are given in the table 1.

Table 1: Various nutrients and its sources which are eatable during orthodontic treatment

Nutrient	Sources of Nutrient
Carbohydrates	Milk, Pieces of bread, wheat in soft form (pieces of Roti, bread etc...), Yogurt, Cereals in milk, Pieces of Apple, Banana, Berries...
Protein	Eggs, Greek yogurt, Milk, Cottage cheese, Steamed spinach, steamed vegetables, Broccoli, Nut butter, Soy milk
Lipids	Cheese, Milk, Avocado, Mozzarella, Eggs, Olives, Olive oil, Coconut products in soft form, nut butter
Vitamin D	Egg Yolk, Steamed spinach, Safe sun exposure, Ricotta cheese, Papaya, Pieces of carrot, Avocado, Broccoli
Vitamin C	Lemon, Orange, Kiwi, Strawberry, Soft guava, cranberry, Papaya
Vitamin A	Eggs, Mango, Cheese, Pieces of Apple, Pieces of carrot, Peaches, Papaya, Cod liver oil, Butter
Vitamin E	Olives, Avocado, Kiwi, Papaya, Mango, Sunflower seeds, Pomegranate, steamed spinach, Broccoli, Wheat germ oil, Sunflower
Vitamin B12	Eggs, Low fat milk, Butter, Cheese, Nonfat yogurt. Milk, cheese, eggs are the sources of other types of vitamin B like thiamin, riboflavin, niacin etc...
Calcium	Milk, Cheese, Steamed leafy green vegetables, Banana...
Chlorides	Tomato, Table salt
Magnesium	Steamed swiss chard, steamed spinach
Potassium	Pieces of banana, Potato in the soft form
Sodium	Table salt, Cheese, Vegetable juices
Phosphorus	Cheese, Milk, Butter

B. Essentiality of Vitamin D on Orthodontic Treatment

Bone remodeling process which is followed by the orthodontic force implementation, includes osteoclastic and osteoblastic phases at the level of alveolar bone process.¹¹ The interrelationship among the receptors of vitamin D polymorphisms, periodontitis and metabolism of bone has been exhibited.¹² Studies have shown that quantity of calcium and phosphorus is regulated by vitamin D, parathyroid hormone, and calcitonin.^{11,13} According to some researchers, vitamin D accelerates bone resorption by persuading the differentiation of osteoclasts from their predecessor and bone formation is taken place by the osteoblastic activities.¹⁴⁻¹⁶ Boyce and Weisbrode,¹⁷ they analyzed the outcome of metabolite injections of vitamin D as well as calcium-rich nutrients on the formation of bones in rats. Some of the researchers have proposed additionally that to rapid teeth movement, stability and retention can be enhanced by localized supplementation of vitamin D.⁹ Kawakami and Takano- Yamamoto¹¹ gave the conclusion that osteoblastic activities as well as remodeling of bone are increased by

calcitriol, which can maximize the stability and retention after orthodontic therapy.

C. Significance of Vitamin C on Orthodontic Therapy

Vitamin C also known as ascorbic acid, industrially obtainable as the dietary supplement, is notable as the key element in the remodeling of bone as well as in the synthesis of collagen¹⁸ and its insufficiency leads to total osteogenesis arrest, diminish the establishment of periodontal ligament and enhance the osteoclastic activities.^{19,20} Some researchers have evidence that deficiency of vitamin C may lead to the slower orthodontic tooth movement by hampering the collagen turnover.¹⁹⁻²¹ Mc Canlies et al.¹⁹ have shown the influence of vitamin C on the movement and retention of incisors with the effect of orthodontic force on guinea pigs as well as their research have found the rate and quantity were roughly equal in all three groups of vitamin C (1 mg daily vitamin C / 0.25 mg daily vitamin C / 0 mg daily vitamin C) along with the orthodontic appliances. But after removal of the appliance, cases of relapse are higher in the second and third groups than in the first group. The proliferation of osteoclastic activities at

the cellular level has been utilized as an effective measure to assess the area of tooth movement.²²⁻²³ Greatest osteoclast requirement takes place 5-14 days after the application of orthodontic forces.²⁴ Also, the tooth movement is the action that requires resorption of bone as well as deposition, and vitamin C persuades that osteoblasts can be differentiated by stem cells via type I collagen synthesis, interconnection with the integrins, protein kinase pathway activation and phosphorylation of osteoblast specific transcription factor.¹⁸ That's why, it is to be anticipated that tension site concurrently experience the incident of osteoblastic activity.¹⁰ De Laurenzi et al,²⁵ in their research on cultured neuroectodermal cells established that vitamin C acts like the pro-oxidant in its physiological concentration and it will result in cell apoptosis. Some of the researches reported that vitamin C intake is directly proportionate to reduced osteo-genesis caused by copper inadequacy.^{26,27} As stated by all these studies, it appears that further researches are vindicated to better explanation of the eternal consequences of vitamin C augmentation. Eternal effectiveness of ascorbic acid augmentation to intensify orthodontic tooth movement as well as the stability and retention of orthodontic tooth movement in the present situation must be forwardly scrutinized.¹⁰

D. Transmutation of Body Weight, Body Mass Index and Body Fat Percentage by Fixed Orthodontic Therapy and its Substitution

Explicit changes can be seen in the mass, BMI as well as in the BFP during orthodontic therapy. That is the reason the specialist should be accountable for acquiring nutrition history, assessing the diet, patient education for absolute diet supplements and its significance in the oral health, improving patient's enthusiasm for better diet and also the follow up for patients attempt for dietary changes. The patients during orthodontic therapy should be instructed for the significance of food like fruits, grains, vegetables, cereals in their daily diet in the place of cakes, wafers, soft drinks etc... which can be extreme in simple sugars as well as in fats. Variety of foods which are good enough in protein, carbohydrate, vitamin, fatty acids and minerals should be taken by orthodontic patients. Fat, salt and sugars are consumed in controlled manner. In addition, the patients with orthognathic surgeries are presented with special considerations.⁵

E. Braces Versus Aligners

Patients who are treated by aligners can manifest much better periodontal health as well as higher the rate of satisfaction during the orthodontic therapy rather than patients who are treated by fixed orthodontics.⁴ Patients with aligners also have better nutrition consumption than fixed orthodontic therapy.

III. CONCLUSION

There must be the reciprocal relation of nutrition with the orthodontic therapy wherein the orthodontic therapy can be influenced by the quality of food intake. Well balanced nutritional supplements provide all the key elements for the healthy oral tissue as well as aid in remodeling of bone thus it will be accelerating the orthodontic treatment. Also, securing the highest comfort of the patient during orthodontic treatment and minimal influence on the pattern of the diet can be the best nutritional supplementation for the orthodontic treatment seeking patient.

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