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SELECTIVE EATING IN ORTHODONTICS: AN IMPORTANT CONSIDERATION

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ABSTRACT

The first wealth of human is health. The field of Orthodontics is concerned to achieve pleasant aesthetics with optimum functional efficiency. Nutrition and balance diet is the most

important factor for a successful orthodontic treatment. The force elements and the various attachments involved in the treatment keep the patients deprived from the essential nutrients which will help us to achieve good results. This is a two-way relationship between the nutrition and the Orthodontic treatment which aids in maintaining in good oral health of tissues and bone remodelling. The aim of this review article is to highlight the effects of nutrition and hormones in orthodontic treatment outcome to improve the quality of life of patients.

Keywords: Nutrition, Braces, Balanced diet, interrelationship

INTRODUCTION

Good nutrition creates health in all the areas of our existence. In today's era of competition in every field, people are more concern about the healthy diet and a healthy lifestyle. Infact the governments of various countries have been working to formalize national nutrition monitoring system, and there are new labelling laws for foods regarding fat and salt content **[1]**.

Nutrition is a predominant factor responsible for growth and development of human body. Nutrition according to Council of food and nutrition of the American Medical Association is, "The science of food, the nutrients and other substances there in, their action, interaction and balance in relation to health and diseases and the processes by which the organism ingest, digest, absorbs, transports, utilizes and excretes food substances" **[2]**. The importance of nutrition has been emphasized by Hippocrates as, "There are many other ills different from those of repletion, but no less dreadful, arising from deficiency of diet" **[3]**.

Orthodontics and nutrition together play a key role in defining facial balance and dental arches proportions to accommodate all teeth. A well proportionate diet determines periodontal status, oral flora, healing potential, immune response, and growth of the individual while orthodontic treatment affects the intake, quality, and consistency of food. Orthodontic treatment generates physical, physiologic, and psychological stresses, which demands additional nutritional requirements already hiked by the stresses, activities, and growth during pubertal period **[4]**. A fixed orthodontic treatment mostly last for around 1½ to 3 years, during which certain dietary restrictions and modifications are advised.

Nutrients can be broadly classified as

1) Carbohydrates
2) Proteins
3) Lipids
4) Vitamins
5) Minerals
6) Water

EFFECT OF NUTRITION ON DENTOFACIAL STRUCTURE

1) Carbohydrates:

Cereals (Carbohydrates): - Carbohydrates are the sugar molecules which provides energy to the body. Recently the consumption of refined food has increased which has led to increased prevalence of malocclusions and decrease in the jaw size. Other features include lower level of eruption, narrow maxillary arches, short mandibles and thin condyles, less tonicity of temporal & masseter muscles and the linear dimension of skull is also reduced. Thus, insufficient intake of coarse diet leads to deficient stimulus to muscles and thus there is occurrence of narrow maxillary arches **[5]**. This altered growth of craniofacial bones leads to insufficient space for teeth eruption resulting in crowding, impactions, and ectopic eruptions.

2) Proteins:

Malnutrition may result in reduction of skull base length, jaw height, maxilla and mandibular width and lower facial height. According to Miller, "Critical Periods" exist during the development of organ and if stress is imposed in such period it can result in irreversible changes **[7]**.

3) Lipids:

Disturbances in the lipid metabolism are not quite common but they do occur as:

- Gaucher's disease
- Niemann Pick disease

NEELEY & GONZALES observed in their study that

- There is a risk associated: Diabetes Type II, congestive heart failure, hypertension, coronary artery disease & arrhythmias, obstructive sleep apnea. These are not common in adolescent but with increasing inflow of adult patients' knowledge is must. In adults for sleep apnea splints for anterior positioning of mandible are given **[8, 9]**.
- The predominant hormone of the fat regulation is leptin, which is produced by adipocytes causing feedback mechanisms **[10]**.
- Yagasaki *et al* **[11]** conducted experiment to evaluate the role of leptin in craniofacial growth development. In the mice the leptin deficiency caused decrease in Go-Pg, Co-Gn, Co-Pg & Go-ME & recovered after they received leptin. But interestingly the mandibular width increased & long bones' width increased.
- Ohrn *et al* **[12]** proposed that short upper face heights could be attributed to decrease level of growth hormone which is down regulated by obese state. Nutritional deficiencies can significantly alter the functioning of

endocrine glands which influences the dentition.

Milk and milk products: These products should comprise about ¼th of the total dietary requirements. Strong bones and teeth rely on a diet that is rich in calcium. Dairy products provide us with calcium, Vitamin D, potassium, and even protein. Dairy products are an excellent choice for braces wearers because most dairy products are soft and require truly little chewing. Milk, milk shakes, yogurt (curd), and cheese are the commonly used milk products in Indian diets and their consumption by Orthodontic patients should be encouraged

4) Vitamins and minerals

Vitamins and minerals: - Even a trace amount has a profound impact on development of teeth and other dentofacial structures. Presence of optimum amount of Vitamins A, D and C and calcium and phosphorus during calcification ensures adequate and skeletal and dental growth. Cortical thinning, enlargement of medullary spaces and reduced osteoblastic and osteoclastic activity are other unfavourable skeletal effects that has been observed **[13]**. Calcium, Vitamin A, Vitamin D and Phosphorus are essential for the formation of bone and teeth. Deficiency of these nutrients causes retarded jaw, teeth, and condylar growth **[14]**. Therefore a variety of amino acids, vitamin A, D and C, Calcium and Phosphorus must be present to ensure optimal calcification during the teeth formation and calcifying periods.

Vitamin C: Tooth movement involves biologic response to orthodontic forces, which may be influence by Vitamin C. Lack of this vitamin also interferes with collagen synthesis thus affecting both periodontal ligament and formation of Osteoid. It also effects retention after orthodontic treatment as its deficiency leads to more relapse. Its main effect is on the periodontal ligament (PDL) **[14-16]**.

Vitamin A: deficiency causes keratinizing metaplasia of the epithelium, thus, increasing vulnerability to infections **[17]**.

Vitamin B: Deficiency is established as a cause of gingivitis, glossitis, angular cheilitis and oral mucositis **[18]**.

Folic acid efficiency is characterized by non-inflammatory necrosis of gingiva, periodontal ligament, and alveolar bone **[19]**.

Vitamin-D:

Vitamin D deficiency causes skull softening following decreased calcium deposition and increase the susceptibility for cleft lip and palate **[20]**. Vitamin D helps in metabolism of calcium and phosphorous which are required for skeletal and dental growth. Vitamin D deficiency causes rickets and maxillary dysplasia, Closure of facial sutures is hampered

leading to open bite, transverse hypo dimension and misshapen palate **[21]**. The individual with magnesium deficiency may lead to habit of bruxism **[22]**.

5) Water:

Dehydration in the body can have various oral manifestations like dry mouth, bad breath, increased risk of tooth decay etc. so one should be well hydrated while wearing orthodontic appliance.

EFFECT OF ORTHODONTIC TREATMENT ON NUTRITION

Orthodontic treatment leads to physical, physiological, and emotional stresses which induce changes in the nutrition of patients. Orthodontic treatment may alter the consistency, quality, and quantity of a person's diet. Patients having orthodontic treatment will have to alter their food choices because of discomfort, sensitivity and pain on biting and chewing **[23]**.

To avoid bracket debonding and appliance breakage throughout fixed orthodontic therapy, orthodontists advise patients to avoid gummy, sticky, chewy, or extremely hard foods. Throughout orthodontic treatments, a preference to soft food is given which affects to dietary changes that decreases carbohydrate and fibre intake during which fat intake is increased. Manganese and copper levels were found to be in short supply with orthodontic treatments by Strause and Saltzmann **[24]**. It was linked to a lack of whole grains, nuts, and a reduction in vegetable and fruit consumption.

Copper is crucial to produce red blood cells and haemoglobin, as well as being a component of redox system enzymes and collagen cross-linking, in addition to normal pigmentation. Manganese is vital for bone remodelling as well as glucose metabolism **[25]**.

EFFECTS UPON TOOTH MOVEMENT AND ORTHODONTIC CORRECTION STABILITY

Orthodontic forces induce the biological responses which comprises of osteoblastic with osteoclastic activities. The movement of the tooth requires the concurrent synchronic collagen metabolism functioning.

The collagen metabolism is dependent upon the acceptable vitamin C supply for producing mature collagen. It was noticed in individuals who have vitamin C deficiency that the teeth that were orthodontically corrected lacked stability and relapse faster in comparison with individuals who are not vitamin C deficient because of an increase in the osteoclastic activities, that are secondary to the deficiency of vitamin C, which simultaneously slows the movement of the orthodontic tooth **[26]**.

Moreover, Miresmaeili *et al.* **[27]** found that oral administration of vitamin C for rats can enhance tooth movement with the

formation of more osteoclast lacunae around the root in the pressure site.

In addition, nutritional stress to the periodontium, coupled with the irritation of orthodontic bands and brackets may cause an transformed gingival response thereby impacting the movement of the tooth as well as the retention that follows the orthodontic treatments **[24, 28, 29]**.

Carbonated soft drinks have toxic effect on tooth movement as they may alter bone metabolism and impact the process of the bone remodelling and successive orthodontic tooth movement **[29]**.

For the modest bone health, the ratio of Calcium phosphorous must be > 1 in the adolescent diet **[30]**. Vitamin D had proved to increase the rate of tooth movement in human beings after local administration in the periodontal ligament space **[31]**.

EFFECT ON FIXED ORTHODONTIC APPLIANCE MATERIALS

1. Effect on the Shear Bond Strength

Both in-vivo and in-vitro studies have been carried to test the effect of different types of food simulants and carbonated soft drinks on the shear bond strength, adhesive remnant index and microleakage of orthodontic brackets. The results indicated that soft carbonated drinks might impact on the shear bond strength in two ways; first, through the deterioration of the adhesive material structure, and second, through leading to erosive lesions on the surface of the enamel that surrounds the brackets, with the main beverage composition effect and the overall acid content, instead of the beverage pH, which determines actual aggression towards enamel **[32]**.

2. Impacts upon the Chemical Characteristics, Surface Topography and Corrosion Resistance

Generally, food simulants and carbonated soft drinks play a role in the alteration of the chemical compositions and surface topography of different metal orthodontic brackets and archwires. These can be detected by releasing of different ions, developing surface roughness, and changed morphology due to the aggressiveness of these stuffs in destructing the protective oxide layer on these materials **[33, 34]**.

3. Effects upon the Color Stability of Clear Retainers, Elastics and Esthetic Brackets

There is general pact about developing discoloration of clear retainers, esthetic brackets and clear elastics by different food and beverages stuffs. This was confirmed by various in-vivo and in-vitro studies **[35]**.

4. Effects on Elastics' Force Decay

The findings of different studies suggested a controversial impact of carbonated soft drinks on the force decay of various types of elastics. This is related to the type, method, and configuration of the manufacturing in addition to the pH,

content, and temperature of carbonated soft drinks **[36]**.

DIETARY CONSIDERATIONS IN ORTHOGNATHIC SURGERY PATIENTS

After an orthognathic surgery, it is very important to eat well as healing requires good nutrition. The mouth is the only gateway of food to the body, which is why, any kind of maxillofacial surgery of those structures could lead to the impairment of the food intake before, as well as after the surgery. After surgery, it is often best adviced to take smaller meals or snacks more frequently rather than counting on the typical three meals per day **[37]**.

These patients need a source of energy as well as a source of protein. The proteins, carbohydrates, and fatty acids are energy sources. Glucose is a source of energy for vital organs like brain. Fatty acids produce more energy and certain essential fatty acids must be supplied by the diet. Protein is also important for cellular proliferation and imparting strength for the fracture repair. If it is reduced, then the wound healing is delayed.

Vitamin A helps in epithelization, synthesis of the collagen and the cross linking and differentiation of the fibroblasts. Vitamin C deficiency leads to impairment in the collagen synthesis and wound healing. Calcium and vitamin D help in healing the hard tissues. Vitamin E acts as an antioxidant and thus reduces the damage from the free oxygen radicals. Large vitamin E doses inhibit the healing as well. Vitamin K helps activate various factors of clotting and thus is essential for blood clot formation during healing **[30]**.

Initially after surgery, patients should eat and drink using a small spoon, plastic syringe or straw **[38]**.

Just like in normal orthodontic patients, orthognathic patients have a list of allowed and non-allowed food stuffs as followed **[38]**:

1. Foods preferred

Puree/liquidized diet

Use milk, fruit juice, sauces, gravy, soup etc.

Meat, poultry, fish, and alternatives should be liquidized with savoury Saur

Carbohydrates-mash potato with milk and butter

Fruit and vegetables can be liquidized

2. 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

ORTHODONTIC TREATMENT AND BALANCED DIET

A detailed diet history of the patient should be noted before orthodontic treatment, so that the orthodontist can guide the patient

according to their food habits. Dairy products make up about ¼ of the total diet. They are strong source of vitamin C and regulates bone metabolism. Vegetables and fruits should be cut into small pieces and consumed, as they are necessary for growing patients. Citrus fruits like oranges and berries can consumed 3-4 days after wire is changed. Fruit juices are always a good option. Eatables at room temperature are always preferred. Nuts and seeds are very hard and very small –two challenging aspects for braces wearers. During the duration of active orthodontic treatment, select nut spreads or coarsely grind your favorite nuts and seed **[11]**. Eating meat is difficult because it is fibrous and hard to chew. Tofu or cottage cheese provides a safe alternative to meat as a source of protein. Fleshy part of meat can be eaten after cutting it into small pieces and bone should be avoided.

BRACES-FRIENDLY EATING TIPS

With braces in the mouth, it is very important avoid certain food items that can cause damage or breakage of orthodontic appliance as it can cause delay in treatment.

Table 1: An orthodontic appliance friendly balanced diet

Sr No.	Food group	Main nutrients
1.	Cereals, grain products, rice and wheat flour, maize, rice flakes, and Maida	Energy, protein, invisible fats, Vitamins B and B2, folic acid, iron, and fibre
2.	Pulses - Legumes, Bengal gram, black gram, green gram, red gram, Rajma, soyabean	Energy, protein, invisible fats, Vitamins B and B2, folic acid, calcium, iron, and fibre
3.	Milk and meat products	Protein, fat, Vitamin B2, calcium
4.	Meat and chicken-liver, fish, eggs	Protein, fat, and Vitamin B2
5.	Fruits - Apple, guava, tomato ripe, papaya, orange, sweet lime, watermelon	Fibre, Vitamin C, carotenoids
6.	Vegetables (green leafy)	Invisible fat, carotenoids, Vitamin B2, folic acid, iron, calcium fibre
7	Other vegetables - Carrot, brinjal, Lady's finger, capsicum, beans, onion, cauliflower	Carotenoids, folic acid, calcium fibre
8.	Fat and sugar-butter, ghee, groundnut, coconut oil	Energy, fats, and essential fatty acids
9	Sugar and jiggery	Energy

Table 2: Braces Friendly Food

NEVER	THINK BEFORE YOU EAT	CAN EAT
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.	Chips, chicken wings, raw vegetables, hard fruits when cut into small pieces, loose corns, crusty bread, high sugar foods	Potato chips, steamed vegetables, French fries, yoghurt, pudding, jelly, soup, cereal in milk, cheese, eggs, milk shakes, ice cream without nuts

CONCLUSION

Nutrition and orthodontics are inter-related and inter-dependent on each other. Optimum amount of intake of balanced diet is important for growth and development of individual. Adequate nutrition also allows proper healing response during applied orthodontic forces for optimum patient's physiologic response to orthodontic treatment. Also maximum patient comfort

has to be ensured during orthodontic treatment which minimally affects patients diet ,thus proper nutrition intake is maintained.

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