International Journal of Research and Review
www.ijrrjournal.com E-ISSN: 2349-9788; P-ISSN: 2454-2237

Review Article

"How Diet Affects an Orthodontic Treatment Outcome"- A Review

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ABSTRACT

The development of the oral cavity and its structures is influenced by the nutritional state of an individual and both deficiencies and toxicities may cause malformations. Good nutrition can maximize while poor nutrition can undermine the appropriate biological response of the periodontal ligament and alveolar bone to orthodontic forces. While orthodontists will rarely see frank manifestations of nutritional deficiencies, it should be recognized that suboptimal levels of certain nutrients are common and have an effect on the biologic responses of the tissues influenced by orthodontic treatment. A basic understanding of nutrition as well as good guidance and communication skills, will help orthodontic practitioners to improve their orthodontic outcomes in addition to helping improve the quality of life of their patients.

***Keywords*:** Diet, Nutrition, Orthodontics,

INTRODUCTION

Growth and development are affected by nutritional environment. The diet can affect the process of cell replication and enlargement thus influencing tissue and organ growth. Many nutrients affect the enzymatic processes of the body and thus enzymatic regulation is also influenced by diet. [1] The orthodontist is well positioned to help screen for dietary issues, as well as provide meaningful dietary advice. Many orthodontists report regularly engaging in dietary discussions with their patients. [2] Orthodontists usually see patients in childhood or early adolescence which allows for early detection of and intervention for dietary problems. When nutrition issues relate directly to dental or orthodontic issues, the orthodontist can assist in promoting behavior change for oral health.

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. [3] This article will review the relevance of nutrition to orthodontics and how the orthodontist can assist in facilitating good nutrition for good oral health.

CLASSIFICATION OF NUTRITION AND ITS ORTHODONTIC

IMPLICATIONS

Nutrients can be broadly classified as-

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

ORTHODONTIC IMPLICATIONS

CARBOHYDRATES

Fibers are long strands of simple sugar which are important for digestion & forms roughage for bowel movements. With present day usage of refined food with decrease in fiber diet the use of masticatory apparatus is decreasing with reduction in jaw size & increase in incidence of malocclusions.

- With inclusion of soft diet following morphological changes are observed in animals
  - Lower level of eruption, especially posterior eruption.
  - Maxillary arches are narrow.
  - Mandibles are shorter & condyles are thinner
  - Temporal & masseter muscles have less tone.
  - The linear dimension of skull is reduced.

Throughout its various stages of growth mouth is affected by complex system of forces. Diet that does not supply food of a sufficient hard consistency does not supply adequate stimulus for proper mastication resulting in a narrow maxillary arch .Similar observations have been made in humans –arch collapse syndrome.

Growth and development of all tissues and structures, including that of the oral cavity, directly depend on adequate nutrition. In both young people and adults, nutrition plays an important role in determining the nature of tissue growth, remodeling, and the individual response to physical and chemical challenges. Thus, all age groups are dependent on consistent good nutrition. [4] There is an association between malnutrition and impaired growth and the development of facial bones. [5,6]

PROTEINS

Malnutrition may result in reduction of skull base length, jaw height, maxilla-mandibular width and lower facial height. Guilford in 1874 advocated dietary deficiencies as an underlying cause of dentofacial irregularities. There exist an important relationship between diet and development which can be seen during the nutrition of the foetus; placenta is the provider of the essential nutrient substrates and fetal tissue synthesizes its own proteins and nucleic acids. Therefore interferences with substrate availability results in decreased protein metabolic activity. [6] 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]

LIPIDS

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

-Gauchers disease

-Neimann Pick disease

A study demonstrated by NEELEY & GONZALES [8] had drawn the following observation:

- Risks 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.
- The predominant hormone of the fat regulation is leptin; which is produced by adipocytes causing feed back mechanisms.
- Yagasaki et al [9] conducted experiment to evaluate the role of leptin in craniofacial growth development. In the mices 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 [10] 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 has an effect on the dentition .There is increasing evidence to suggest that poor nutrition in early life may be an important factor in growth disturbances seen in later life. [11]

VITAMINS AND MINERALS

Cortical thinning, enlargement of medullary spaces and reduced osteoblastic and osteoclastic activity are other unfavorable skeletal effects that has been observed. [12] 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. [13]

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.

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. [13-15] vitamin A deficiency causes keratinizing metaplasia of the epithelium, thus, increasing vulnerability to infections. [16] Vitamin B deficiency is established as a cause of gingivitis, glossitis, angular chelitis and oral mucositis. [17] Folic acid deficiency is characterized by non-inflammatory necrosis of gingiva, periodontal ligament and alveolar bone. [18]

Some other important effects of nutrition on the Orthodontic treatment are:

- The unregulated sugar consumption, inadequate oral hygiene causes decalcification of teeth under the bands and brackets. Featherstone and Glatz reported measurable demineralization, gingival to bands and brackets in a period of 4 weeks. [19]
- Improper oral hygiene and the sticky foods raise the vulnerability of the dentition towards dental caries. Topical Fluoride application inhibits dental caries but excess fluoride should be avoided to prevent dental fluorosis characterized by brownish and corroded appearance of teeth. [20]
- Deficient diets cause greater root resorption as compared to adequate diets as seen through animal studies. [21] Vitamin D maintains calcium phosphorous balance and its deficiency leads to cemental resorption. [22,23]

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.

FOOD GROUPS WHICH ARE SAFE EATING WITH ORTHODONTIC APPLIANCES [3]

Vegetables: Theses are rich in vitamins and minerals which are essential for growing bodies.

Milk and Milk Products: These are an excellent choice for braces wearers as most dairy products are soft and require very little chewing, moreover they are rich in Calcium, vitamin D, potassium and even protein making the bones stronger.

Fruits: Hard fruits can be cut bite sized pieces so they can be chewed with the back teeth. If nothing else works fruit juice is always a healthy easy option.

Cereals: Most of grain products are very soft and easily chewed so they can be used effectively.

FOOD GROUPS WHICH SHOULD BE STRICTLY AVOIDED ARE:

- Hard foods such as hard candies or lollipops
- Crunchy foods such as nuts (Unless grinded) or popcorn, corn on the cob, pizza crusts
- Sticky foods such as taffy or caramels
- Chewy foods such as gum or chewy fruits snacks
- Chewing on ice cubes
- Hard fresh fruits or vegetables. Cut them into small pieces and chew them with your back teeth.

DISCUSSION

In Orthodontic appliance, elastics experience constant force expression, with considerable force degradation through the first day of use. [24] Mechanical degradation effects are thought to be the primary cause for degradation of orthodontic elastic bands during clinical use. [25] The effects of food-simulating oral environments on dental polymeric restorative materials have been studied where various forms of degradation of polymeric restorative materials have been found to be enhanced when they were subjected to Coca-Cola, [26] ethanol / water, [27,28] lactic acid, citric acid, heptane, and alcohol / water [29] ethanol / artificial saliva. [30]

A study conducted by Gokhan Oncag et al [26] where the effects of acidic soft drinks on the resistance of metal brackets to shear forces in vitro and in vivo was investigated and it was found that there was no statistical difference in de-bonding resistance in both groups. Acidic soft drinks such as Coca-Cola have a negative effect on bracket retention against shearing forces and enamel erosion.

A study carried by Yasuhiro et al, [31] where it was found that alveolar osteopenia is more extensive in the mandible than the maxilla in rats that experience low masticatory loading during growth.

A histological study demonstrated by Ricardo Lima Shintcovsk et al. [32] on the effect of Nicotine on bone remodeling during orthodontic tooth movement where they found that Nicotine affects bone remodeling during orthodontic movement, reducing angiogenesis, osteoclast-like cells and Howship's lacunae, thereby delaying the collagen maturation process in developed bone matrix.

In the study of Abalos et al., [33] corrosive action of soft drinks with low pH on the surface of Ni–Ti wires was reported.

A study conducted by Paulina Wołowiec et al. [34] where the results suggested that consumption of food products of low pH (such as fruit juices, coffee, yoghurt, and vinegar) can intensify aggressiveness of conditions in the oral cavity and may have an effect on increasing the release of Cr and Ni ions from orthodontic appliances.

A study conducted by Stause and Satzmann concluded that decrease in Mn and Cu intake during orthodontic therapy may lead to decrease bone remodeling. [35]

The unregulated sugar consumption, inadequate oral hygiene causes measurable demineralization, gingival to bands and brackets in a period of 4 weeks as reported by Featherstone and Glatz. [36]

CONCLUSION

Intake of requisite nutrition decides the proper growth and development of the individual. During the formative stages of tissues and organs, any nutrient depravity results in severe and permanent deformation. Adequate nutrition also allows proper healing response during applied orthodontic forces so to optimize patient's physiologic response to orthodontic treatment; it is advisable to provide dietary guidance to orthodontic patients in choosing soft food diets which includes obtaining nutrition history, evaluating the diet, educating the patient about diet components important for oral health.

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How to cite this article: Veneet Mehta V, Bagga MK, Bhatti BK. How diet affects an orthodontic treatment outcome- a review. International Journal of Research and Review. 2018; 5(5):46-51.

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