



## LONG TERM COMPARATIVE ASSESSMENT OF NUTRIENT INTAKE IN ADOLESCENT URBAN INDIAN POPULATION UNDERGOING ORTHODONTIC TREATMENT

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### Abstract

**Introduction:** The study aims to compare the nutrient intake in adolescent urban Indian population undergoing fixed Orthodontic treatment and clear aligner treatment.

**Material & Methods:** Forty adolescents (20 undergoing fixed Orthodontic treatment and 20 undergoing clear aligner treatment) aged between 12 and 18 years participated in the study. Before the treatment, the participants were interviewed, and their food consumption frequency and 24-hour retrospective food consumption records were taken. Participants were followed up for 12 months, i.e., just before treatment, 1<sup>st</sup>, 3<sup>rd</sup>, 6<sup>th</sup> and 12<sup>th</sup> month of the treatment. In the interviews, questions about food consumption changes and post treatment pain were asked to the participants and 24-hour retrospective food consumption records were obtained.

**Results:** When the food consumption records of the adolescents before the orthodontic treatment and at the 1<sup>st</sup>, 3<sup>rd</sup>, 6<sup>th</sup> and 12<sup>th</sup> month of the active fixed Orthodontic treatment and aligner treatment were compared, the amount of fat (0.040), fibre (0.013), Vitamin E (0.019), Calcium (0.038) were significantly decreased in patients undergoing fixed Orthodontic treatment during the first month up to three months whereas no significant change was observed in patients undergoing clear aligner treatment.

**Conclusion:** It is found that the nutritional intake remains unaltered in patients undergoing clear aligner treatment for the entire duration while there was a significant difference in the nutritional intake of patients undergoing fixed Orthodontic treatment for the first 3 months followed by a gradual phase of recovery up to the 12<sup>th</sup> month.

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## **1. Introduction**

There is a dynamic, two-way relationship that exists between nutrition and oral health: a balanced diet with adequate energy and nutrients is necessary for oral health, and the condition of the oral cavity and surrounding structures can directly have an impact on diet and nutritional well-being.<sup>1</sup> In recent years, people have realized the importance and are concerned about maintaining good health and having a healthy life style.

A good diet plays a crucial role in maintaining good oral & overall health.<sup>2</sup> 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.

Orthodontic treatment aims to improve aesthetics as well as functions in an individual, it enhances the patient's quality of life by attaining better occlusion and enhancing the masticatory function.<sup>3</sup> Physical, physiologic, and emotional stresses could be created due to Orthodontic treatment that could increase the nutrient mobilization and utilization, thus elevating the nutritional requirements of the patient. This along with the fact that the nutritional needs of adolescents are already stressed by growth and development as well as the emotional stress of puberty, maintenance of a well-balanced diet is of great importance.<sup>4</sup>

It is accepted that orthodontic treatment can cause pressure sensitivity to the teeth which can lead to pain, discomfort, and functional limitations.<sup>5-8</sup> The mastication of hard food is therefore strenuous 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,<sup>9-12</sup> stringy foods such as meat, and dry foods such as bread or bagels, from the diet of the patient.<sup>13-14</sup> These changes in the dietary consumption could result in decreased intake of protein, calcium, fibre and some vitamins.<sup>15</sup> Preferential intake of soft food while avoiding hard food items during orthodontic treatment could cause decrease in the protein and fibre consumption and therefore an increase in the carbohydrate and fat consumption.<sup>16</sup>

This study aims at comparing the nutrient intake in adolescent urban Indian population undergoing fixed orthodontic treatment versus those undergoing aligner treatment.

## **2. Materials and Methods**

Ethics committee approval was acquired from the Ethical Committee of MGM Dental College and Hospital, Navi Mumbai. A different Orthodontic treatment plan had not been used as a prospective cohort study, rather, the standard orthodontic care was delivered. All participants provided their written, informed consent. Patients under the age of 18 were included in the study, therefore informed permission papers had to be signed by both them and their parents.

Patients who had begun orthodontic treatment at the Department of Orthodontics and Dentofacial Orthopaedics, MGM Dental College, Navi Mumbai, made up the study's population. Without taking into consideration gender variations, this follow-up study was intended to include 20 adolescents receiving fixed Orthodontic treatment and 20 adolescents receiving aligner treatment. The sample size was determined and it was found

to be 16, but the number of the sample was determined as 20 by considering the losses that may occur because of the follow-up nature of the study.<sup>17</sup>

The study was carried out with 20 adolescents who started fixed orthodontic treatment at the Department of Orthodontics, MGM Dental College, Navi Mumbai and 20 adolescents undergoing aligner treatment.

#### **Selection Criteria**

- Patients between the age group of 12 to 18 years
- Patients who are not using an auxiliary appliance other than the brackets and routine arch wires or clear aligners during the 12 months.

#### **Exclusion Criteria**

- Patients not in the age group of 12 to 18 years
- Patients having skeletal class 2 or class 3 malocclusion
- Patients requiring extraction for Orthodontic treatment

Patients were monitored for a period of 12 months. A questionnaire was presented to the patients during the initial interview to gather information about their demographics and general eating habits. The patient's food intake patterns and 24-hour food consumption were recorded again.

To determine body mass index, measurements of height and weight were taken. Scales sensitive to 0.01 kg (Dr Trust, USA) model were used to assess each participant's body weight when they were wearing the fewest number of garments and without shoes. On the Frankfurt plane, the participants' heights were measured while their feet were touching.

In this session, in 20 patients the self-ligating brackets (Damon Q, Ormco Corporation, USA) were bonded to all maxillary teeth, and 0.014-in NiTi arch wires were ligated. At the fourth week, all mandibular teeth were bonded, and 0.014-in NiTi arch wires were ligated to the mandibular arch. At the eighth week, the maxillary arch wire was replaced,

- Patients having skeletal Class I malocclusion
- Patients having all permanent teeth erupted except third molars
- Patients having non-extraction treatment
- Patients starting orthodontic treatment with brackets (Damon Q, Ormco Corporation, USofA) bonded to all maxillary and mandibular teeth
- Patients starting with clear aligner treatment (Precision Align, India) for both maxillary and mandibular teeth

and the 0.016-in NiTi wire was ligated, and in the 12th week, the mandibular arch wire was replaced, and the 0.016-in NiTi arch wire was ligated.

In the other 20 patients clear aligners (Precision Align, India) were used. This sequence of treatment was followed in all patients for standardization. In the 1<sup>st</sup>, 3<sup>rd</sup>, 6<sup>th</sup> and 12<sup>th</sup> month, a questionnaire was given to the patients to evaluate their adaptation to the nutritional recommendations given by their Orthodontist and the impact of Orthodontic treatment on their food consumption.

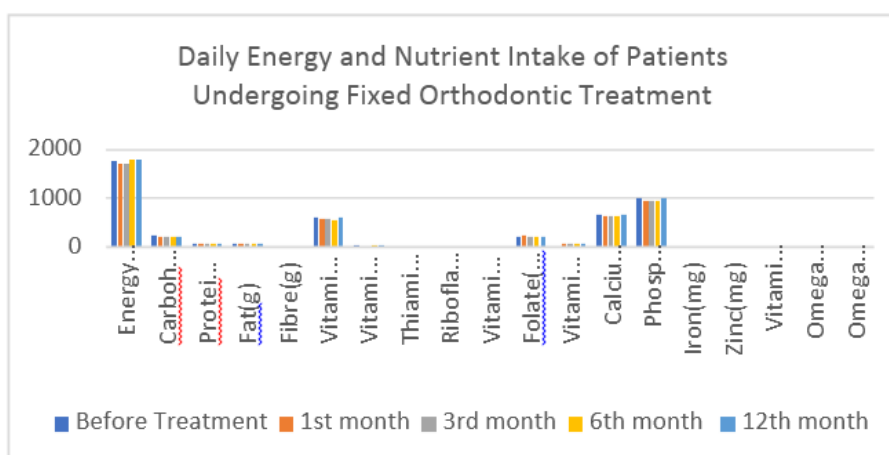
To observe the changes, we obtained 24-hour retrospective food consumption records in every visit. The data were obtained by face-to-face interviews with the participants. Each participant was interviewed 5 times (on the first day of orthodontic treatment and in the 1<sup>st</sup>, 3<sup>rd</sup>, 6<sup>th</sup>, 12<sup>th</sup> month after starting treatment).

#### **Statistical Analysis**

SPSS (version 23; IBM, Armonk, NY) package program was used for statistical analysis. Data were analysed via Kolmogorov-Smirnov test. Descriptive statistics are given as mean and standard deviation if the data are distributed normally and as median and interquartile distribution range, if not. While evaluating the statistical significance of the difference between 2 variables, One-way ANOVA test were used. The significance was set at  $P < 0.05$ . To evaluate the daily energy and nutrient intake of the participants, 24-hour food consumptions were recorded

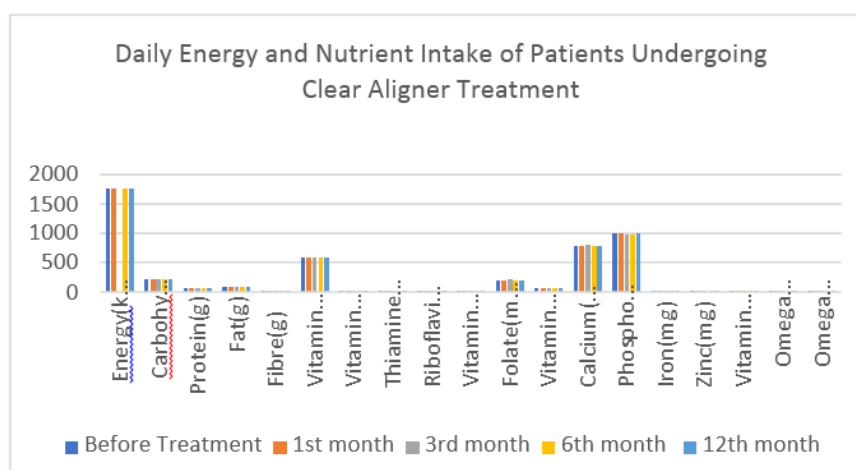
	Before Treatment	1 <sup>st</sup> month	3 <sup>rd</sup> month	6 <sup>th</sup> month	12 <sup>th</sup> month	P value*
Energy(kcal)	1783.13	1701.23	1729.45	1790.25	1789.67	0.702
Carbohydrate(g)	215.46	198.34	199.94	205.66	209.02	0.713
Protein(g)	66.89	65.01	65.9	63.28	70.64	0.130
Fat(g)	77.31	69.37	70.63	71.33	75.24	0.040*
Fibre(g)	18.34	14.38	13.98	12.67	13.89	0.013*
Vitamin A(mcg)	596.67	564.36	586.01	556.78	592.02	0.130
Vitamin E(mcg)	22.35	18.37	19.38	20.55	22.76	0.019*
Thiamine(mg)	0.84	0.77	0.76	0.77	0.77	0.500
Riboflavin(mg)	1.45	1.34	1.34	1.38	1.40	0.543
Vitamin B6(mg)	0.97	0.94	0.95	0.93	1.06	0.190
Folate(mcg)	209.06	211.81	217.61	199.68	206.87	0.214
Vitamin C(mg)	61.65	52.67	53.06	55.27	56.21	0.115
Calcium(mg)	669.68	621.26	624.28	634.71	669.12	0.028*
Phosphorus(mg)	993.45	934.91	944.23	936.21	985.23	0.053
Iron(mg)	9.27	8.86	8.91	8.51	9.24	0.161
Zinc(mg)	9.73	8.76	8.84	8.91	9.76	0.061
Vitamin B12(mcg)	4.78	3.93	4.11	4.38	4.60	0.064
Omega 3(g)	0.94	0.87	0.85	0.87	0.80	0.243
Omega 6(g)	15.07	14.22	14.57	14.53	15.09	0.066

**Table 1:** Daily Energy and Nutrient Intake of Patients Undergoing Fixed Orthodontic Treatment



	Before Treatment	1 <sup>st</sup> month	3 <sup>rd</sup> month	6 <sup>th</sup> month	12 <sup>th</sup> month	P value*
Energy(kcal)	1755.28	1750.32	1753.34	1756.56	1759.78	0.998
Carbohydrate(g)	218.78	220.66	221.21	217.58	222.67	0.957
Protein(g)	66.98	63.96	64.86	65.46	66.14	0.931
Fat(g)	75.98	79.34	78.93	74.13	75.82	0.153
Fibre(g)	18.95	19.34	19.87	18.21	17.38	0.260
Vitamin A(mcg)	592.59	590.81	596.30	597.37	591.34	0.958
Vitamin E(mcg)	22.67	21.34	22.12	21.78	22.61	0.579
Thiamine(mg)	0.89	0.82	0.85	0.88	0.79	0.109
Riboflavin(mg)	1.29	1.34	1.38	1.32	1.38	0.800
Vitamin B6(mg)	0.94	0.95	0.93	0.96	0.97	0.902
Folate(mcg)	205.17	206.12	211.32	204.17	202.73	0.806
Vitamin C(mg)	70.69	69.33	69.21	71.37	71.33	0.798
Calcium(mg)	776.67	775.37	789.34	772.98	775.42	0.861
Phosphorus(mg)	995.78	993.56	987.34	989.37	992.25	0.997
Iron(mg)	9.12	9.13	9.34	8.97	9.03	0.744
Zinc(mg)	9.54	9.38	9.45	9.93	9.37	0.394
Vitamin B12(mcg)	4.67	4.56	4.61	5.01	4.95	0.283
Omega 3(g)	0.94	0.92	0.89	0.95	0.94	0.406
Omega 6(g)	14.78	14.73	14.67	15.38	14.93	0.157

**Table 2** Daily Energy and Nutrient Intake of Patients Undergoing Clear Aligner Treatment



### **3. Result**

A total of 40 adolescent patients (20 undergoing fixed Orthodontic treatment and 20 undergoing clear aligner treatment) participated in the study. The 24-hour food consumption records of the participants were compared before the start of the orthodontic treatment and in the 1<sup>st</sup>, 3<sup>rd</sup>, 6<sup>th</sup>, 12<sup>th</sup> months.

There was no significant difference between total energy, protein, and carbohydrate intake. However, the total fat intake had decreased in the 1<sup>st</sup> month of fixed orthodontic treatment and increased in the treatment process. Similarly, no significant difference was found in the total energy, protein, carbohydrate, and fat intake in patients undergoing aligner treatment.

After fixed orthodontic treatment a significant decrease was also noticed in the fibre intake, whereas no significant change was found during aligner treatment. The levels of Vitamin E and Vitamin C significantly reduced during fixed orthodontic treatment in the 1<sup>st</sup> month and gradually an increase was noticed, however no significant change in the levels of vitamin C and Vitamin E was noticed in the patients undergoing aligner treatment.

### **4. Discussion**

The daily requirements for energy and micronutrients vary throughout life. However a certain amount of nutrients are required for an average adult. In early adulthood there is an increased requirement for vitamin C, B1, B2, B3, K as well as iron whereas in later part of adulthood there is an increased requirement for Vit. B6, and Vit. D.

During adolescence there is an increased

requirement of proteins, calcium, phosphorous, magnesium and zinc. The recommended allowance of carbohydrates is 130g/day whereas the protein intake should be about 0.8 per kg of bodyweight. The requirement for Vit. B12 is about 2.4 micrograms, Vit. C is 75 grams, Vit. D 100 micrograms per day, calcium around 2500 milligrams per day.

Orthodontic treatment usually begins in early adolescence, however the treatment can be carried out in adults as well. The goal of orthodontic treatment is to achieve functional efficiency, aesthetic harmony and structural balance. The conventional fixed mechanotherapy consists of bands, brackets and wires along with ligatures and elastics all leading to difficulty during food consumption. Patients are advised certain dietary restrictions and are expected to follow the same till the end of treatment. This dietary restriction leads to reduction in intake of essential nutrients and vitamins.

Clear aligners are an emerging branch in Orthodontics, which is gaining a lot of demand. Clear aligners have proved to be a convenient, aesthetic alternative for the traditional fixed Orthodontic treatment.<sup>18-19</sup> This study was performed to assess changes in nutritional intake in patients undergoing fixed Orthodontic and clear aligner treatment. It was observed that there is little to no change in nutritional intake of patients undergoing clear aligner treatment. Following are the advantages of clear aligners:

- No dietary restrictions
- Less painful (No poking of sharp edges of orthodontic wires)
- Less chairside time

### **Less frequent appointments**

However, Fixed Orthodontic treatment in the form of braces has detrimental effect on nutrition. Patients must undergo a lot of limitations and avoid certain food items, maintaining a good oral hygiene could become a problem. 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 are already stressed by growth and development as well as the emotional stress of puberty, maintenance of a well-balanced diet is of great importance.<sup>4</sup>

There is a two-way relationship between nutrition and orthodontic treatment wherein the quality of nutrition affects the pace of orthodontic treatment and the rendering of orthodontic treatment affects the nutritional intake. A well-balanced diet provides all the essential elements to keep the oral tissues healthy and aid in bone remodeling thus enhancing orthodontic therapy. On the other hand, ensuring maximum comfort of the patient while administering orthodontic treatment, minimally affects the dietary pattern and thus, nutrition of the patient.<sup>20</sup>

Thus an increase in clear aligner treatment over the decade is seen due to increased comfort, adequate nutrient intake as well as aesthetics over fixed orthodontic treatment.

### **5. Conclusion**

This study gives us a detailed long term comparative nutrient intake evaluation of patients undergoing either fixed Orthodontic treatment or clear aligner treatment. Nutrient intake over a period of one year was evaluated and compared in fixed Orthodontic and clear aligner patients. It was found that nutrient intake was unaltered in patients undergoing clear aligner treatment for the entire duration whereas there was a significant decrease in the nutrient intake in those patients undergoing fixed orthodontic treatment for the first 3 months followed by a phase of recovery till the 12<sup>th</sup> month.

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