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RESEARCH ARTICLE

A Study on the Effect of Fixed Orthodontic Treatment on the BMI of Patients During the Early Stage of Treatment

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Abstract: ***Background***: Fixed orthodontic treatment is widely used to correct malocclusions; however, its early phase often involves discomfort and dietary changes that may affect patients' nutritional status. These factors can lead to temporary variations in body mass index (BMI). This study aimed to evaluate the impact of fixed orthodontic treatment on BMI during the early months of therapy. ***Methods:*** A prospective observational study was conducted in the Department of Orthodontics, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, from October 2022 to September 2023. A total of 130 patients aged ≥18 years undergoing fixed orthodontic treatment were selected by simple random sampling. Body weight and height were measured, and BMI was calculated at baseline (T1), one month (T2), and three months (T3) after appliance placement. Data were analyzed using paired and unpaired t-tests, with $p < 0.05$ considered significant. ***Results:*** Participants had a mean age of 21.26 ± 2.40 years, and females comprised 59.2%. At baseline, 68.5% had a normal BMI. Mean BMI decreased significantly from 21.92 ± 2.93 at T1 to 21.74 ± 3.02 at T2 ($p < 0.001$), then increased to 21.95 ± 2.96 at T3 ($p < 0.001$ vs. T2; $p = 0.34$ vs. T1). BMI decreased in 53.1% of participants at one month but increased in 74.6% between one and three months. No significant sex differences were observed ($p > 0.05$). ***Conclusion:*** Fixed orthodontic treatment caused a temporary decline in BMI during the first month, followed by recovery to baseline levels by three months. Early nutritional monitoring and dietary counseling are recommended during the initial treatment phase.

Keywords: Fixed orthodontic treatment; Body mass index (BMI); Early treatment phase; Weight change .

INTRODUCTION

Orthodontic treatment offers multiple benefits, including improved facial aesthetics, enhanced oral function, and increased self-esteem and self-confidence. With growing aesthetic awareness, the demand for orthodontic care has significantly increased.[1]. However, despite its benefits, fixed orthodontic treatment is often associated with discomfort and adverse effects that may influence patient compliance and satisfaction. Common side effects include pain and pressure from tooth movement.[2] as well as oral ulcerations and tongue soreness [3]. Functional limitations such as difficulty in chewing, swallowing, and speech have also been reported [4 ,5,6,7]. Pain typically begins within four hours of appliance insertion, peaks between 12 hours and three days, and gradually subsides after seven days [8].

Orthodontic treatment can also affect dietary habits and masticatory function. Patients often experience difficulty chewing hard foods within the first 24 hours after appliance insertion, although masticatory efficiency generally returns to baseline within four to six weeks [9] .Consequently, many patients adopt a soft-food diet and reduce their overall food intake to minimize pain and discomfort [10] Additionally, food restrictions—especially avoidance of hard, sticky, and fibrous foods to prevent appliance damage and maintain oral hygiene—can diminish the pleasure of eating and lead to concerns about inadequate nutrition or weight loss [11,12] .

Because of these dietary modifications, both patients and parents frequently express apprehension regarding possible weight changes during orthodontic treatment. However, few studies have evaluated the relationship between fixed orthodontic therapy and body weight. Body Mass Index (BMI) measurement is a simple, inexpensive, and reliable tool for assessing such changes [13]. Understanding fluctuations in BMI during orthodontic treatment may help clinicians provide better patient counseling, improve compliance, and address concerns related to nutrition and overall well-being. Therefore, the present study aims to evaluate changes in BMI and validate concerns about weight loss during the early stages of fixed orthodontic treatment.

MATERIALS AND METHODS

Study Design and Setting

This was a prospective observational study conducted in the Department of Orthodontics, Bangabandhu Sheikh Mujib Medical University (BSMMU), Shahbagh, Dhaka, from October 2022 to September 2023.

Study Population

The study population comprised patients aged 18 years and above who sought fixed orthodontic treatment to correct malocclusion at the Department of Orthodontics, BSMMU. Eligible participants included those willing to provide written informed consent. Patients were excluded if they had a history of previous orthodontic treatment, were undergoing other dental treatments simultaneously, or had chronic or systemic diseases, hormonal disturbances, physical disabilities, or psychological stress. Individuals taking long-term medications that could affect body weight or nutrition (such as antidiabetic, anti-obesity, or steroid drugs), those following specific diet or exercise regimens, fasting, or weight-reduction plans, as well as pregnant women, athletes, and patients who developed any systemic illness during treatment were also excluded.

Sampling Technique and Sample Size

A simple random sampling technique was used, allowing each registered patient an equal chance of selection. Participants were chosen by a lottery method from the department registry. Based on eligibility and consent, a total of 130 participants were included in the study.

Data Collection Tools and Procedure

Data were collected using a structured data sheet. Body weight and height were measured using a digital scale and stadiometer, respectively, and Body Mass Index (BMI) was calculated using the standard formula (weight in kg/height in m^2).

BMI measurements were recorded at three time points:

- ✓ T1: Before initiation of orthodontic treatment
- ✓ T2: One month after fixed appliance placement
- ✓ T3: Three months after fixed appliance placement

All measurements were performed by the same investigator to ensure consistency.

Data Analysis

Data were compiled and analyzed using SPSS version 23.0 (IBM Corp., Armonk, NY, USA). Quantitative variables were expressed as mean ± standard deviation (SD), and qualitative variables as frequency and percentage. Paired t-tests were used to compare BMI changes within groups over time, while unpaired t-tests were used to assess differences between males and females. A p-value < 0.05 was considered statistically significant.

Ethical Considerations

Ethical approval was obtained from the Institutional Review Board (IRB) of BSMMU prior to data collection. Written informed consent was obtained from all participants. Confidentiality of data and voluntary participation were strictly maintained throughout the study.

Operational definition

Fixed orthodontic treatment:

Orthodontic treatment with appliances that are fixed or fitted on to the teeth by the operator and cannot be removed by the patient at will are termed as fixed orthodontic treatment [14].

Figure 1: Fixed orthodontic appliance in a patients mouth [14]

Body Mass Index (BMI):

The BMI is defined as the weight in kilograms divided by height in meters squared. It gives a measure of relative weight adjusted for height.

BMI= Body weight in kg/ (Height in meter)^2 [15]

Early stage of treatment:

This is the initial 3 months following the application of a fixed orthodontic appliance. [10] used first three months as early stage in his study. During this stage leveling and alignment are usually achieved.

Stadiometer:

A stadiometer is a piece of medical equipment used for measuring human height. It is usually constructed out of

a ruler and a sliding horizontal headpiece which is adjusted to rest on the top of the head. Stadiometers are used in routine medical examinations and also clinical tests and experiments.

Digital weighing scale:

A scale or balance is a device used to measure weight or mass. These are also known as mass scales, weight scales, mass balances, and weight balances. A digital weighing scale is a scale on the floor which a person stands on. The weight is shown on an LED or LCD display.

RESULTS

Table 1: Demographic characteristics of the study respondents (n=130)

Age in years	**Number**	**Percentage**
< 20 years	47	36.2
> 20 years	83	63.8
Mean ±SD	**21.26 (±2.40)**	**18-27**
Sex		
Male	53	40.8
Female	77	59.2

The mean age was 21.26 (±2.40) years, female was predominant with 77(59.2%) of the 130 participants being female. (Table 1)

Table 2: Distribution of Respondents by BMI Category Before and After Treatment (n = 130)

BMI Category (kg/m²)	**Before Treatment n (%)**	**After 1 Month n (%)**	**After 3 Months n (%)**
Underweight (<18.5)	20 (15.4)	22 (16.9)	17 (13.1)
Normal weight (18.5–24.9)	89 (68.5)	86 (66.2)	75 (57.7)
Overweight (25–29.9)	21 (16.2)	22 (16.9)	38 (29.2)
Total	130 (100.0)	130 (100.0)	130 (100.0)

Table 2 shows the changes in BMI distribution among participants before and after treatment. Initially, most participants (68.5%) had a normal BMI, while 15.4% were underweight and 16.2% were overweight. After one month of treatment, the proportion of normal-weight individuals slightly decreased to 66.2%, whereas both underweight and overweight categories increased to 16.9% each. After three months, the percentage of participants with normal BMI further declined to 57.7%, while the proportion of overweight individuals rose markedly to 29.2%.

Table 3: BMI change at three different time periods (T1, T2, T3)

Time	**BMI**						**Total**
	Decreased		**Increased**		**No change**		
	n	**%**	**n**	**%**	**n**	**%**	
T1-T2	69	53.1	55	42.3	06	4.6	130
T1-T3	58	44.6	70	53.8	02	1.5	130
T2-T3	31	23.8	97	74.6	02	1.5	130

Table 3 illustrates the pattern of BMI change across three time intervals during the treatment period. Between the first and second assessments (T1–T2), BMI decreased in 53.1% of participants, increased in 42.3%, and remained unchanged in 4.6%. Between T1 and T3, a larger proportion (53.8%) experienced an increase in BMI, while 44.6% showed a decrease, and 1.5% showed no change. The most notable change occurred between T2 and T3, where BMI increased in 74.6% of participants, decreased in 23.8%, and remained unchanged in 1.5%.

Figure I shows the trend of participants who experienced a decrease in BMI across three different time intervals (T1–T2, T1–T3, and T2–T3).

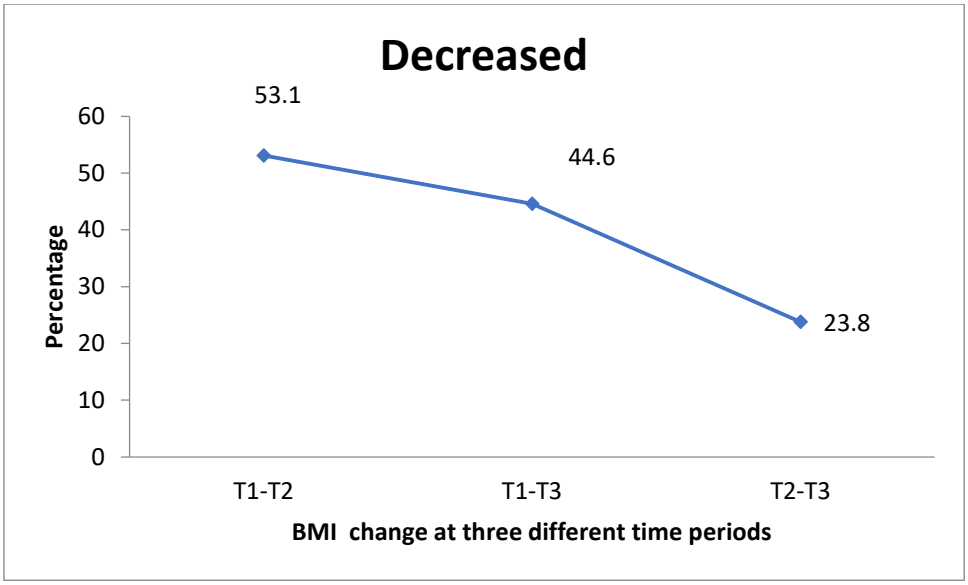

Figure I: BMI change between three different time periods (n=130)

Table 4: Mean BMI change in different time periods (T1, T2, T3)

Time	**BMI**			**p value**
	Mean	**±SD**	**Mean change**	
T1	21.92	±2.93	-0.18	***<0.001**
T2	21.74	±3.02		
T1	21.92	±2.93	0.03	0.34
T3	21.95	±2.96		
T2	21.74	±3.02	0.21	***<0.001**
T3	21.95	±2.96		

Paired T test was done; *p < 0.05, statistically significant

Table 4 shows that the mean BMI decreased significantly from 21.92 ± 2.93 at baseline (T1) to 21.74 ± 3.02 after one month (T2) (p < 0.001). However, by three months (T3), BMI slightly increased to 21.95 ± 2.96, showing no significant change from baseline (p = 0.34) but a significant rise compared to T2 (p < 0.001). Overall, BMI initially declined during the first month of treatment and then gradually returned to near baseline levels by the third month.

Table 5: Mean value of BMI for male and female at three different time periods (T1, T2, T3)

Time period	**BMI**		**p value**
	Male	**Female**	
	Mean±SD	Mean±SD	
T1	22.36 (±3.19)	21.61(±2.71)	0.15
T2	22.24 (±3.32)	21.41(±2.77)	0.12
T3	22.41 (±3.20)	21.63(±2.76)	0.14

Unpaired T test was done;

Table 5 shows that the mean BMI was consistently higher among males compared to females across all three time periods—T1 (22.36 ± 3.19 vs. 21.61 ± 2.71), T2 (22.24 ± 3.32 vs. 21.41 ± 2.77), and T3 (22.41 ± 3.20 vs. 21.63 ± 2.76). There were no appreciable differences between males and females at T1, T2, or T3 (p > 0.05), indicating that BMI changes over time were similar between male and female participants.

Table 6: Comparison of changes in BMI at three different time periods (T1, T2, T3) between males and females (n=130)

	Male			Female		
Time	Mean ±SD	Mean Difference	**p value**	Mean ±SD	Mean Difference	**p value**
T1	22.36(±3.19)	-0.15	***0.03**	21.61(±2.71)	-0.20	***0.005**
T2	22.21(±3.32)			21.41(±2.77)		
T1	22.36(±3.19)	0.04	0.30	21.61(±2.71)	0.02	0.65
T3	22.41(±3.20)			21.63(±2.76)		
T2	22.21(±3.32)	0.19	***<0.001**	21.41(±2.77)	0.22	***<0.001**
T3	22.41(±3.20)			21.63(±2.76)		

Paired T test was done; *p < 0.05, statistically significant

Table 6 shows that both males and females experienced slight but statistically significant changes in BMI across different time periods. From T1 to T2, BMI significantly decreased in both males (mean difference = –0.15, p = 0.03) and females (mean difference = –0.20, p = 0.005). From T1 to T3, BMI showed a minimal, nonsignificant increase in both groups (p > 0.05). However, between T2 and T3, BMI increased significantly in both males (mean difference = 0.19, p < 0.001) and females (mean difference = 0.22, p < 0.001).

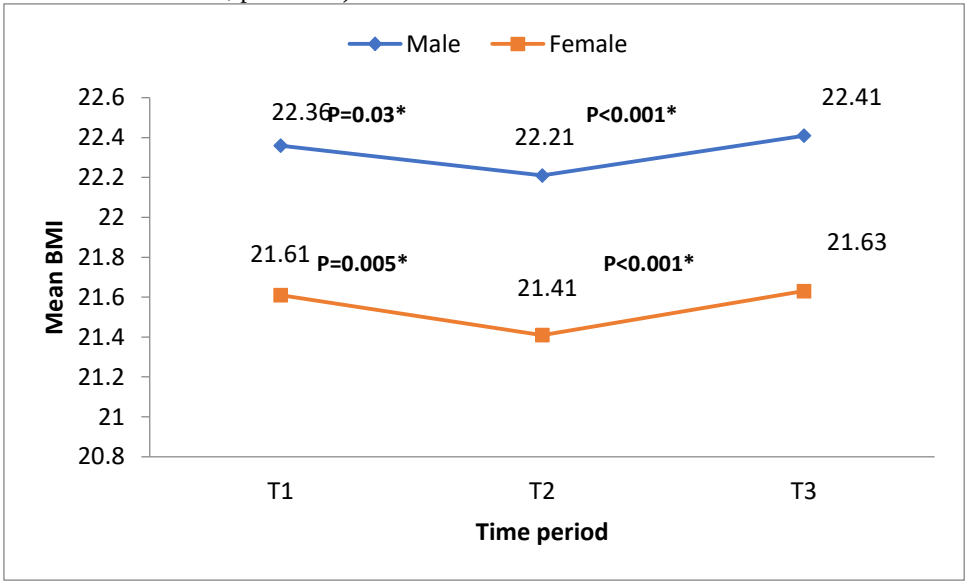

Figure II: Trend in BMI in different time periods (T1, T2, T3) between males and females

Overall, the pattern indicates an initial decline followed by a significant rebound in BMI over the three-month treatment period for both sexes. (Figure II).

DISCUSSION

Body Mass Index (BMI) is a common screening tool for weight-related disorders such as obesity. Various factors influence BMI, including age, gender, ethnicity, socioeconomic status, physical activity, and diet. Rising BMI trends may reflect unfavorable lifestyle and environmental conditions that promote inactivity and excessive energy intake [16]. Both underweight and overweight conditions are associated with health risks, with underweight individuals—especially children—being more prone to infections.[17].

This study included 130 healthy adult participants with no medical conditions affecting body weight. The mean age was 21.26 ± 2.40 years, and 59.2% were female. Most patients were aged 18–25 years, suggesting that young adult women are more likely to seek orthodontic treatment, likely due to aesthetic concerns. Before treatment, 16.2% of participants were overweight (25–29.9 kg/m²) and 68.5% had normal BMI (18–24.9 kg/m²). By the end of treatment, 44.6% showed a decrease in BMI, 53.8% an increase, and 1.5% no change similar to findings by [18]. The mean BMI significantly decreased between T1 and T2 (p < 0.001), showed results align with [16], who observed BMI reduction after one month of treatment no notable change from T1 to T3 (p > 0.05), but increased significantly between T2 and T3 (p < 0.001). These weight changes likely reflect the initial adaptation period to orthodontic appliances. Early discomfort and

pain may limit food intake, leading to temporary weight loss. As patients adapt after the first month, weight and BMI tend to recover to pre-treatment levels. Thus, while short-term BMI reduction occurs, orthodontic treatment should not be considered a means to control obesity [19].

No significant BMI differences were found between males and females at any time point ($p > 0.05$). However, males had a slightly higher overall BMI (22.36 ± 3.19 kg/m²) than females (21.61 ± 2.71 kg/m²). Females showed a marginally greater BMI decrease than males, differing from some previous reports [10,20]. The variation in BMI changes may relate to differences in pain perception, adaptability, or biological factors such as body fat and hormones. Orthodontic treatment and diet are interlinked; the physical and emotional stress of treatment alters nutritional demands [21]. Because soft diets are often recommended due to discomfort, temporary nutritional and weight changes are expected. This study concludes that BMI decreases initially during orthodontic treatment but returns to baseline as patients adapt.

CONCLUSION

We found that, BMI has steadily improved by the end of the 3rd month of fixed orthodontic treatment after lowering during the first month for both males and females. In early stage of treatment patient feels pain, discomfort, and subsequent dietary modifications. BMI alterations that occur following fixed orthodontic treatment may be considered temporary and of little overall significance. However, BMI tends to return to baseline levels by the third month as patients adapt to the appliances and resume normal dietary patterns. These results emphasize the need for orthodontists to be aware of possible short-term nutritional changes in patients undergoing fixed appliance therapy. Early dietary counseling and regular monitoring of nutritional status are recommended to ensure optimal patient health and treatment outcomes.

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