

Quality of Life and Oral Health among the Patients with Fixed Orthodontic Appliances Attending a Tertiary Dental Center in Bangladesh

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ABSTRACT

Background: Fixed orthodontic appliances are commonly used for malocclusion correction among adolescents, and their impact on oral-health-related quality of life is incompletely understood. Temporal changes in Oral Health-Related Quality of Life (OHRQoL) during treatment need to be understood for undertaking appropriate patient counseling and treatment planning. This study aims to evaluate how fixed orthodontic appliances affect adolescents' oral health-related quality of life over the course of treatment.

Methods: This quasi-experimental study was conducted at the Military Dental Centre, Dhaka, between January and December 2023. A total of 60 orthodontic patients, aged 12-18 years, with mild-to-moderate malocclusion were enrolled in this study. Oral Health Impact Profile-14 (OHIP-14) questionnaires have been used to assess OHRQoL at baseline and at 3, 6, and 12 months. Clinical parameters were recorded monthly, along with the Plaque Index according to Silness & L  e and the gingival bleeding percentage. Statistical analyses were performed in Statistical Package for the Social Sciences (SPSS) version 26.

Results: The mean and standard deviation (SD) OHIP-14 score increased substantially from baseline (8.2 ± 3.1) to 3 months (28.4 ± 5.6), showing an early decline in oral-health-related quality of life. Scores improved gradually at 6 months (18.9 ± 4.3) and 12 months (12.1 ± 3.8), but remained higher than baseline. The Plaque Index and gingival bleeding rose during therapy, peaking at 6 months (1.6 ± 0.4 and 38%, respectively), with partial recovery by 12 months. Higher plaque levels, longer treatment time, and lower patient compliance were all related to poorer 12-month OHRQoL results.

Conclusion: Fixed orthodontic appliances significantly impair OHRQoL at the outset but improve over 12 months. Oral hygiene maintenance and patient compliance are the critical determinants of treatment outcomes and quality of life.

Keywords: Orthodontic appliances, OHRQoL, OHIP-14, Malocclusion.

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INTRODUCTION

Malocclusion is recognized as one of the most common problems of oral health, affecting 60-75% of adolescents, and is significantly associated with reduced oral function, aesthetic impairment, and undesirable psychosocial effects¹. In addition to its biological effects, malocclusion can also have adverse effects on self-esteem, social interactions, and general well-being in adolescence, a crucial phase of psychological and social development. Therefore, orthodontic treatment has become an integral part of contemporary dental practice, and fixed orthodontic appliances are considered the standard treatment for correcting dental misalignment and establishing a stable occlusion.² However, despite the therapeutic efficacy of fixed orthodontic appliances, several biological and behavioral problems have been associated with them. The presence of brackets, bands, and wires creates areas that are highly retentive to plaque, thereby predisposing the patient to gingival inflammatory changes, enamel demineralization, and periodontal problems during orthodontic treatment.³ The effects of these changes may not be limited to the oral cavity, as they may affect the patient's activities, comfort, and social life. Over the past few years, there has been growing interest in the assessment of the results of orthodontic treatment not only in terms of clinical correction but also in relation to the patient, as measured by the Oral Health Related Quality of Life (OHRQoL) index, which includes the functional, psychological, and social consequences of oral health and its treatment.⁴ The Oral Health Impact Profile-14 (OHIP-14) is one of the most extensively validated tools for measuring OHRQoL and covers seven major domains: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and

handicap.⁵ International studies have confirmed that fixed orthodontic appliances can impair OHRQoL, particularly in the early stages following the commencement of orthodontic treatment when patients report pain, difficulties with speech, mastication, and aesthetics.^{6,7} However, longitudinal studies have also confirmed that a distinct time course occurs, where OHRQoL deteriorates initially and then gradually improves as the patient becomes accustomed to the orthodontic appliances.⁸ In fact, the peak OHIP-14 scores have been reported in the first month following the insertion of the orthodontic appliances, indicating an acute adaptation phase where the patient experiences discomfort and disruption.⁹ Despite growing evidence, critical gaps in the existing literature have yet to be adequately addressed. Although several articles have focused on the short-term effects of OHRQoL, few have focused on the long-term association between oral hygiene status, treatment duration, and patient compliance. This has been particularly observed in the South Asian population, in whom dietary habits and oral hygiene practices vary significantly compared to their Western counterparts. Another factor that has been somewhat neglected in its association with OHRQoL during fixed orthodontic treatment is patient compliance, which is a significant factor in the success and experience of treatment itself.¹⁰ Non-compliance can lead to increased treatment duration and clinical complications, causing a detrimental impact on the quality of life. Taking into account these factors, it is evident that there is a need for research that is longitudinal and context-specific, and which combines patient-reported outcomes with clinical parameters of oral hygiene. Specifically, there is a lack of evidence in the context of institutional and military healthcare, where the demographics of patients and their compliance rates may differ from the

general population. This study, therefore, aimed to assess the effect of fixed orthodontic appliance therapy on the oral health-related quality of life of adolescents.

MATERIALS AND METHODS

This quasi-experimental longitudinal study was carried out in the Military Dental Centre, Dhaka, from January to December 2023. A total of 60 adolescent patients, aged between 12 and 18 years, suffering from mild and moderate malocclusion, were included in the study using the purposive sampling technique. The patients were divided into two groups, namely the Driftodontic group (n=30) and the Traditional fixed appliance group (n=30), on the basis of the orthodontic appliance system used. The allocation of the patients into the groups was carried out on the basis of the routine treatment plan, as the randomization of the patients was not feasible in this clinical scenario. The patients suffering from severe skeletal malocclusion, systemic disease, periodontal disease, and those who had undergone orthodontic treatment previously were excluded from the study.

Since all the participants were minors, informed assent was sought from all the participants, and informed consent was sought from their parents or legal guardians before the study began. Oral health-related quality of life was measured using a validated Oral Health Impact Profile-14 (OHIP-14) questionnaire. The OHIP-14 has 14 questions that cover seven dimensions or domains: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. Each question has a 5-point Likert scale ranging from 0 (never) to 4 (very often). The range of scores is from 0 to 56. The higher the score, the worse the oral health-related quality of life. No specific score was used; rather, the scores

from the OHIP-14 questionnaire were considered continuous data. The questionnaire was completed at baseline before appliance placement and at 3, 6, and 12 months.

Oral hygiene status was assessed by clinical examination using standardized periodontal indices. The assessment of dental plaque accumulation was done using the Plaque Index of Silness and Löe. Gingival inflammation was measured by the gingival bleeding percentage, which is the proportion of bleeding sites after gentle probing. These indices were recorded monthly and were objective measures of the patient's oral hygiene status during the course of orthodontic treatment.

Compliance of patients was evaluated based on attendance to scheduled orthodontic appointments. Compliance was considered to be full or partial depending on the number of appointments missed during the period of study. The time taken for treatment in months from the time appliances were placed to the 12-month period was recorded.

Statistical analysis of the data was done using the Statistical Package for Social Sciences (SPSS) software package version 26. The distribution of the data was checked for normality using histograms and the Shapiro-Wilk test. For variables that were normally distributed, parametric tests were conducted. This included paired t-tests to check for differences in OHIP-14 scores over time using repeated measures ANOVA. In addition to that, Pearson's correlation coefficient was used to check for associations in variables. In cases where variables were not normally distributed, alternative tests were planned to be used. This included the Wilcoxon signed-rank test for non-parametric paired data and Spearman's correlation coefficient for non-parametric correlation tests. To determine

independent predictors of quality of life at 12 months post-treatment, multiple linear regression analysis was conducted. In this analysis, the dependent variable was set to be the OHIP-14 scores, while the independent variables were plaque index, bleeding, treatment duration, and compliance. $P < 0.05$ was considered to be statistically significant.

RESULTS

Table 1 summarizes the demographic characteristics of the 60 participants who were assigned to either the Driftodontic or Traditional orthodontic groups in equal numbers ($n=30$ each). The mean age was similar for the two groups, at 14.2 ± 2.1 years versus 14.5 ± 1.9 years. Regarding the distribution of participants by gender, there was a slight male preponderance in the Driftodontic group (60% male, 40% female) compared to the more balanced distribution of the Traditional group (55% male, 45% female).

Table 2 shows dynamic changes in oral health-related quality of life across a 12-month treatment period. The average baseline OHIP-14 score was 8.2 ± 3.1 . At 3 months, the mean score climbed to 28.4 ± 5.6 ($p < 0.001$), approximately a 3.5-fold rise compared to the baseline value. OHIP-14 scores decreased to 18.9 ± 4.3 at 6 months ($p < 0.001$) and 12.1 ± 3.8 at 12 months ($p = 0.02$ compared to baseline). Although the 12-month score remained considerably higher than the baseline, it was 68% lower than the peak value reported at 3 months, showing that oral health-related quality of life is gradually improving. Using paired t-tests, p-values show comparisons between baseline and each follow-up time point.

Table 3 measures the clinical periodontal implications of fixed appliance treatment throughout the treatment period. Plaque Indices jumped from baseline (0.8 ± 0.3) to 6 months

(1.6 ± 0.4 ; $p=0.002$), doubling the treatment effect in P accumulation, although intermediate recovery towards 1.2 ± 0.3 after 12 months remained higher than at baseline by half of that level. Gingival bleeding percentage also rose from 12% during baseline to 38% at 6 months, $p=0.01$, demonstrating a robust inflammatory response which partially resolved to 22% by year's end. Paired t-tests comparing baseline with 6-month and 12-month results were used to compute p-values.

Table 4 demonstrates clear differences in patterns of compliance between the Driftodontics and traditional groups. Driftodontics presented better compliance, showing 85% with full adherence to scheduled appointments, while 15% missed two or more appointments. For the traditional group, the compliance rate was lower: 70% showed full compliance, and 30% missed ≥ 2 appointments.

The relationship between treatment duration and oral health-related quality of life at 12 months is represented in Table 5. The mean OHIP-14 score at 12 months was lower for patients whose treatment lasted less than 12 months (10.3 ± 2.9) compared to patients whose treatment lasted 12 months or more (13.8 ± 3.5). An independent t-test was used for between-group comparisons, and the results showed that the two duration groups differed statistically significantly ($p < 0.05$).

The relationships between clinical and treatment-related variables and oral health-related quality of life at 12 months were evaluated using Pearson's correlation coefficient were shown in Table 6. The Plaque Index ($r=+0.48$, $p=0.001$) and gingival bleeding ($r=+0.42$, $p=0.003$) showed positive associations. Treatment time also had a positive association ($r=+0.36$, $p=0.02$). Most importantly, compliance had the highest association ($r=-0.51$, $p<0.001$), with a negative

association meaning higher the compliance, the better the OHRQoL.

The multiple linear regression in Table 7 identifies independent predictors of 12-month OHRQoL, accounting for interrelationships among variables. It explains 46% of outcome variance, with $R^2=0.46$. Plaque Index at 6 months emerged as the strongest predictor ($\beta=+2.13$, $p=0.002$), with each unit increase associated with a 2.13-point OHIP-14 elevation. Treatment duration also predicted poorer outcomes ($\beta=+0.27$, $p=0.018$), while higher compliance predicted better OHRQoL ($\beta=-0.09$, $p=0.003$).

TABLE-I: Baseline Demographic Characteristics of Study Participants (n=60)

Variable	Driftodontics Group (n=30)	Traditional Group (n=30)
Age (Mean $\pm$ SD)	14.2 $\pm$ 2.1	14.5 $\pm$ 1.9
Male (n) (%)	60% (18)	55% (16)
Female (n) (%)	40% (12)	45% (14)

TABLE II: Longitudinal Changes in OHIP-14 Scores Over the Treatment Period (n=60)

Timepoint	Mean OHIP-14 Score $\pm$ SD	p-value (vs. Baseline)
Baseline	8.2 $\pm$ 3.1	-
3 Months	28.4 $\pm$ 5.6	<0.001
6 Months	18.9 $\pm$ 4.3	<0.001
12 Months	12.1 $\pm$ 3.8	0.02

TABLE-III: Comparison of Clinical Oral Hygiene Parameters at Baseline, 6 Months, and 12 Months (n=60)

Parameter	Baseline	6 Months	12 Months	p-value
Plaque Index	0.8 $\pm$ 0.3	1.6 $\pm$ 0.4	1.2 $\pm$ 0.3	0.002
Gingival Bleeding (%)	12%	38%	22%	0.01

TABLE-IV: Patient Compliance and Missed Appointment Patterns Across Groups (n=60)

Group	Full Compliance (%)	Missed ≥ 2 Appointments (%)
Driftodontics	85%	15%
Traditional	70%	30%

TABLE -V: Association Between Treatment Duration and OHRQoL at 12 Months (n=60)

Duration (Months)	OHIP-14 Score at 12 Months	p-value
<12 (n=15)	10.3 $\pm$ 2.9	0.03
≥ 12 (n=45)	13.8 $\pm$ 3.5	0.04

TABLE-VI: Correlation Between Oral Hygiene Indicators and OHRQoL at 12 Months (n=60)

Variable	Mean $\pm$ SD	OHIP-14 Score at 12 Months (Mean $\pm$ SD)	Correlation Coefficient (r)	p-value
Plaque Index	1.2 $\pm$ 0.3	12.1 $\pm$ 3.8	+0.48	0.001
Gingival Bleeding (%)	22 $\pm$ 6	12.1 $\pm$ 3.8	+0.42	0.003
Treatment Duration (months)	14.8 $\pm$ 2.5	12.1 $\pm$ 3.8	+0.36	0.02
Compliance (%)	77.5 $\pm$ 12.3	12.1 $\pm$ 3.8	-0.51	<0.001

TABLE-VII: Multiple Linear Regression Model Predicting OHRQoL at 12 Months

Predictor Variable	β Coefficient	Standard Error	t-value	p-value
Plaque Index (6 months)	+2.13	0.67	3.18	0.002
Treatment Duration (months)	+0.27	0.11	2.45	0.018
Compliance (%)	-0.09	0.03	-3.07	0.003

DISCUSSION

This study was carried out at the Military Dental Centre, Dhaka, which is a tertiary care institutional dental center. In this context, this study assessed the changes in oral health-related quality of life and its related clinical variables among adolescents receiving fixed orthodontic appliances for a period of 12 months. A typical biphasic trend of OHRQoL could be shown with strong early deterioration and partial recovery, which was reflected by substantial changes in clinical oral hygiene data correlating to patient-reported outcomes. These results demand us to extend our view beyond traditional medical factors and integrate a comprehensive patient-focused assessment in an orthodontic treatment. The 3-fold increase in OHIP-14 values at 3 months compared to baseline (8.2 ± 3.1 vs 28.4 ± 5.6) is also consistent with the results of Ferrando-Magraner et al. on the short-term effects of fixed appliances on comfort and function [12]. This finding is highly supported by the results from Baidas et al., who also observed greater significant early OHIP-14 scores at least within physical pain and functional limitation scales [13]. The amount of deterioration observed in the cohort is consistent with that found by Alrashed et al.'s systematic review, which concluded that the first 3–6 months were the worst period during treatment [14]. This subsequently rises to 12.1 ± 3.8 at 12 months (though still higher than baseline), indicating significant adaptation and Coping over time. The results underline the importance of pretreatment counseling on the anticipated QoL trajectory to limit unrealistic expectations and prevent early treatment discontinuation. Clinical parameters showed a significant deterioration of the oral hygiene Plaque Index from 0.8 ± 0.3 to 1.6 ± 0.4 at 6 months and a rate of gingival bleeding from 12% to 38%. These results are consistent with recent

findings by Hussein et al. and Aykol-Sahin et al., that after appliance placement, plaque accumulation and gingival inflammation tend to increase [15,16]. Likewise, Lu et al. reported worse periodontal health indices in fixed appliance patients than aligner patients, with an overall plaque index mean difference of -0.53 for aligner treatment [17]. The signification and positive relationship between Plaque Index and OHIP-14 scores ($r=+0.48$, $p=0.001$) means that plaque-induced gingival inflammation, halitosis, and aesthetic disappointments immediately affect the deterioration of OHRQoL with such a potential mechanism. Full compliance was superior for the Driftodontics group (85%) than for the traditional group (70%), and compliance proved to be the most predictive factor of OHRQoL in correlation analysis ($r=-0.51$, $p<0.001$). Indeed, these results agree with the review by Raji Alrwuili et al., highlighting that patient cooperation is essential for an effective and satisfactory treatment [18]. The better compliance from the dependent individuals might be because of superior schedule flexibility and family cooperation, which are already recorded to positively influence orthodontic compliance [19]. The negative trend between compliance and OHIP-14 indicated that compliant patients still have a better QoL, associated with little treatment time, minimum complications, and confidence in healthcare teams and supportive measures (structured compliance scrutiny programme and policy interventions) for high-risk profiles. Time of treatment was also an influential factor on OHRQoL. Patients with treatment of less than 12 months scored better for OHIP-14 (10.3 ± 2.9) in comparison with patients who had over 12 months of it (13.8 ± 3.5). This is parallel with a study by Abreu et al., which showed the quality-of-life outcomes were long-term after prolonged orthodontic therapy [20]. The longer treatment time most likely reflects the accumulating

discomfort, treatment fatigue, and case complexity. An inverse correlation of a longer treatment duration on satisfaction has also been suggested by Johal et al. in groups of adults [21]. These findings suggest the importance of good planning, mechanics and minimizing the prolongation of treatment. Multivariate regression analysis showed that 46% of the variance in 12-month OHRQoL was explained by Plaque Index at 6 months ($\beta=+2.13$), duration of treatment ($\beta=+0.27$) and compliance with the study receiving orthodontic treatment during it ($\beta=-0.09$). Plaque Index was the strongest predictor ($p=0.002$), emphasizing middle treatment oral hygiene as being most pivotal for intervention. Clinically, these findings reinforce the introduction to routine OHRQoL follow-up by instruments such as OHIP-14, more intensive support of oral hygiene during 3-6 months, systematic attention toward behavior-influencing factors like compliance, and thorough pre-treatment counseling of anticipated changes in OHRQoL. The single-center study of a small sample size ($n=60$), the lack of a control group, and reliance on OHIP-14, which may not reflect adolescent-specific psychosocial concerns, were important limitations. Future studies should be multi-center, larger, and with a diverse population and longer follow-up beyond the post-retention period to analyze focused interventions like motivational interviewing, digital methods of increasing compliance rates, or alternative appliance systems. Comparative studies between orthodontic modalities (conventional brackets, self-ligating, lingual or clear aligners) are still needed to assist in truly patient-centered treatment planning.

Strengths and Limitations of the Study

The use of a validated OHIP-14, the longitudinal design with repeated follow-up over 12 months,

and the integration of patient-reported outcomes with objective oral hygiene measures are some of the study's strengths. Its clinical significance is further increased by the quasi-experimental comparison of two orthodontic appliance systems in an actual clinical scenario.

This was a single-centre, relatively small trial ($n=60$), and with follow-up for only 12 months, the results may not be generalizable to more widespread populations and longer treatment durations. The absence of a control group prevents us from drawing firm conclusions on orthodontic treatment versus natural adolescent growth and development, and OHIP-14 may not measure all the age-specific psychosocial aspects relevant to adolescents.

CONCLUSION

Orthodontic fixed appliances significantly affect oral-health-related quality of life in the initial stages of treatment, with a significant deterioration at 3 months followed by gradual improvement for a period of 12 months. Both clinical phenomena (especially plaque accumulation and gingival inflammation) deteriorate dramatically and have a significant negative impact on QoL. Patient adherence and duration of treatment were major modifiable factors that affected outcomes. Orthodontists may serve to maximize the patient experience and treatment success through a more rigorous approach with comprehensive QOL surveillance, improved OH intervention, and intervention in improving orthodontic compliance.

Recommendations

Larger multi-centre studies with diverse populations and extended follow-up periods will be necessary to confirm these findings.

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