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An evaluation of oral health-related quality of life in orthodontic patients treated with fixed and twin blocks appliances

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Abstract:

OBJECTIVE: To study the impact of orthodontic treatment on the quality of life in two patient groups, one treated with the twin block appliance and the other with fixed appliances.

MATERIALS AND METHODS: Ninety-eight patients, aged between 10 and 16 years, were recruited in the fixed (20 males and 29 females) or functional (29 males and 20 females) treatment groups. The oral health-related quality of life (OHRQoL) was measured before treatment and followed up at the end of the treatment. The instrument used to measure OHRQoL was a modified self-administered short version of the English Oral Health Impact Profile (OHIP-16[E]) questionnaire.

RESULTS: OHRQoL worsened at the initial stages of the treatment. The overall score of OHRQoL reduced significantly at the end of the treatment in both groups. Both groups showed comparable improvements in OHRQoL as the treatment progressed (analysis of variance test $P = 0.05$).

CONCLUSIONS: The OHRQoL patterns, during the treatment with fixed and twin block appliances, were very similar. This suggests that the functional appliance's impact on the QoL may be overestimated by clinicians. OHRQoL improved significantly with both fixed and functional appliances by the end of the treatment. The OHRQoL trends observed during the study can be communicated to patients and used to increase patients' compliance since they are made aware of the whole treatment process.

Keywords:

Fixed appliance, oral health related quality of life, quality of life, twin block appliances

Introduction

The World Health Organization (WHO) in 1948 defined health as "Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity." This underscores the importance of quality of life, defined as "patients' perceptions of their position in life in the context of culture and value systems in which they live, and in relation to their goals, expectations, standards, and concerns."^[1]

A person's quality of life (QoL) can be affected by poor oral health.^[2] Measurement of oral

health related quality of life (OHRQoL) helps professionals clarify the role of oral health status on the overall QoL.^[3] It also assists in clinical decisions taking into account patient's needs, and serves as an effective communication mechanism with policy makers.^[4,5] Consequently, modern healthcare systems should address patient's health complaints, taking into consideration the impact of patients' illness on QoL.^[6]

Modern dental procedures endeavour to improve patients' QoL. Orthodontic treatment based on purely clinical and functional perceptions may not fully address patient's concerns. It has been shown

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that patients and their parents share similar treatment expectations, although parents reported more realistic prospects. Ethnicity significantly influences expectations for orthodontic treatment, which may relate to differences in the patients' and parents' assessment of the clinical outcome.^[7] Although improvement of QoL is considered to be the major goal of orthodontic treatment, it is established that, to obtain enhancement in QoL, patients must go through some treatment-related undesirable side effects when using orthodontic appliances.^[8]

Several studies have reported that OHRQoL worsened during the initial part of the treatment; however, a considerable improvement was observed afterwards.^[9-11] Evidence has shown that orthodontic treatment affects QoL and that the magnitude of the negative impact is related to the type of therapy received.^[12] For example, Bernabè *et al.* found that adolescents wearing fixed appliances had a higher frequency of impact than those wearing removable or both types of appliances simultaneously.

There is a dearth of evidence investigating patients treated with two types of treatment modalities and the impact on the OHRQoL. The findings of this study can be used as a part of the "informed consent" to the patient. By informing the patients the anticipated effects associated with orthodontic treatment, they can consider the advantages and disadvantages of orthodontic treatment.^[6]

The aim of this prospective study was to assess the impact of two orthodontic treatment modalities, fixed and twin block appliances, on patients' QoL.

Material and Methods

A pilot study was conducted to estimate the sample size and power analyses of this study.

A total of 98 patients seeking orthodontic care at the Postgraduate Clinic, Faculty of Dentistry were selected randomly based on the inclusion and exclusion criteria. All patient's occlusions for both groups were Class II division 1.^[13] The inclusion criteria were: Age between 10 and 16 years, Class II division 1, skeletal pattern Class I, Class II, mild-to-moderate crowding or spacing in upper and lower arches (4–8 mm), and no extraoral or intraoral appliances other than fixed appliances (e.g., transpalatal arch or Nance button) within the first 8 months of orthodontic treatment. Patients who needed anchorage reinforcement had to wear transpalatal arches or Nance buttons at the beginning of the treatment not before because T0 purely assessed the patients OHRQoL prior to the beginning of the treatment as base reference point. The exclusion criteria were: Patients with severe skeletal Class II patterns who required orthognathic surgery,

syndromic patients (cleft lip and/or palate), patients above the age of 16, and patients who were young and reluctant to undergo treatment.

The fixed appliances group was treated with MIM brackets pre-adjusted straight wire appliance (0.022 × 0.028 inch) with Class II elastics to correct the overjet, while the second group received twin block removable functional appliances.

The OHRQoL was measured with the OHIP-14 questionnaire, which consists of the following seven domains: Functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. Patients completed the questionnaire in their preferred language^[14,15] five times, i.e., prior to treatment, as a baseline (T0), 6 weeks after fitting the appliances (T1), 12 weeks after (T2), 6 months after (T3), and at the end of the treatment (T4). OHIP-14 scores follow a Likert scale: The lowest score is never = 1, hardly ever = 2, occasionally = 3, fairly often = 4, very often (highest) = 5.

Once patients had accepted to participate in the research, the clinician explained the study to the patients. Each patient was given an oral and a written explanation sheet about the research. A written informed consent was signed before the first questionnaire was administered. For patients below 16 years of age, consent was obtained from the parents or guardians.

Statistical analyses

Data analysis was done using the Statistical Package for Social Sciences (SPSS) software for Windows version 12.0 (SPSS Inc., Chicago, IL, USA). A General Linear Model (GLM) for repeated measurements (ANOVA) was performed to test the differences at means of an OHIP-14 outcome over time, between appliance groups, and according to factors such as gender or extraction. For multiple comparisons, Bonferroni's test was used.

Significance level used in the analysis was 5% ($\alpha = 0.05$). An ANOVA F-test reached a power of 87.2% to detect a medium-magnitude effect ($f = 0.25$) at a difference between appliance groups and 99.8% for between time-point differences, with confidence at 95%.

Results

The sample consisted of 98 participants divided into two balanced groups according to the orthodontic appliances used. The study included 20 males and 29 females in the fixed group and 29 females and 20 males in the functional group [Table 1]. The ages were years old for females [Table 2]. The observation period was approximately 25 months.

Table 1: Demographics of the study sample

Frequency	Fixed groups (N)	Functional group (N)	Age
Male	20	29	13±1.18
Female	29	20	12.4±1.24

Table 2: Individual and total OHIP14 scores by group over time

Domain	Group	T0	T4
Functional limitation			
Q1. Problems with pronunciation	Fixed	1.5 (0.9)	1.0* (0.0)
	Functional	2.4 (1.2)	1.0*** (0.1)
Q2. Worse sense of taste	Fixed	1.5 (0.9)	1.0** (0.0)
	Functional	2.1 (1.0)	1.0*** (0.1)
Physical pain			
Q3. Painful	Fixed	1.8 (1.0)	1.0*** (0.0)
	Functional	1.9 (0.9)	1.0*** (0.2)
Q4. Uncomfortable to eat	Fixed	2.0 (1.0)	1.0*** (0.0)
	Functional	2.2 (0.9)	1.0*** (0.2)
Psychological discomfort			
Q5. Self-consciousness	Fixed	2.0 (1.1)	1.0*** (0.0)
	Functional	2.0 (0.9)	1.0*** (0.2)
Q6. Tense	Fixed	2.0 (1.0)	1.0*** (0.0)
	Functional	2.0 (0.9)	1.1*** (0.3)
Physical disability			
Q7. Unsatisfactory diet	Fixed	1.5 (0.8)	1.0*** (0.0)
	Functional	1.6 (0.8)	1.0*** (0.2)
Q8. Interrupted meals	Fixed	1.7 (0.8)	1.0*** (0.0)
	Functional	1.8 (0.8)	1.1*** (0.3)
Psychological disability			
Q9. Difficult to relax	Fixed	1.7 (0.9)	1.0*** (0.0)
	Functional	1.8 (0.9)	1.1*** (0.3)
Q10. Embarrassed	Fixed	1.9 (1.0)	1.0*** (0.0)
	Functional	2.1 (1.1)	1.1*** (0.2)
Social disability			
Q11. Irritable	Fixed	1.6 (0.8)	1.0*** (0.0)
	Functional	2.0 (1.1)	1.1*** (0.3)
Q12. Difficult to do usual job	Fixed	1.5 (0.8)	1.0*** (0.0)
	Functional	1.7 (0.9)	1.1*** (0.2)
Social handicap			
Q13. Life less satisfying	Fixed	1.6 (0.8)	1.0*** (0.0)
	Functional	1.7 (0.8)	1.1*** (0.3)
Q14. Unable to function	Fixed	1.5 (0.7)	1.0*** (0.0)
	Functional	1.6 (0.8)	1.1*** (0.3)
Total OHIP14 Score	Fixed	23.7 (8.8)	14.0*** (0.1)
	Functional	26.7 (6.8)	14.9*** (1.6)

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$. Mean (SD) and Bonferroni's test from ANOVA model for differences over time respect T0 as control. (Scale for scores: 1.never, 2.hardly ever, 3.occasionally, 4.fairly often, 5.very often)

Changes over time within the appliance groups

The total OHIP-14 mean scores at the end of treatment (T4) showed significant differences compared to T0 ($P < 0.001$) for each group (Bonferroni's test) [Table 2].

Significant improvement occurred in the seven domains; functional limitation, physical pain, psychological discomfort, physical disability, psychological disability,

social disability, and handicap within both appliance groups (T4–T0).

Comparison between the fixed appliances group and the twin block appliance group

The overall QoL (OHIP-14) in both groups the fixed and twin block appliances showed comparable results at the end of the treatment (T4) in relation to the base point (T0).

The functional limitation domain at T3–T0 and T4–T0 was significant ($P = 0.032$) and ($P < 0.001$) in comparison to fixed appliances group. This involves worsening in the sense of taste and problems with pronunciation [Table 3].

The effect of extractions on both appliance groups

The fixed appliances group

The overall pattern of OHRQoL (OHIP-14) improved at each time interval in relation to the base point (T0), however, these changes had not reached the significance threshold at all time points. Physical pain domain was significantly high at T1–T0 which indicates higher pain threshold and physical discomfort compared to no-extraction individuals [Table 4]. This can be explained as all individuals extraction procedures were performed at (T1) [Table 4].

Twin block group

The overall pattern of OHRQoL (OHIP-14) improved at each time interval in relation to the base point (T0), however, these changes had not reached the significance threshold at all-time points [Table 5]. The functional limitation domain worsened significantly ($P = 0.028$) and ($P = 0.007$) respectively at (T0 to T1) within the extraction group. The physical pain domain was also worsened significantly ($P = 0.012$) at T0–T1. These results can be interrelated as pain and function are closely related.

Impact of gender on both treatment modalities

appliance groups

The fixed appliances group

The overall pattern of OHRQoL (OHIP-14) improved at each time interval in relation to the base point (T0), however, these changes had not reached the significance threshold at all-time points [Figure 1]. Psychological domain at T1–T0 showed a significant worsening within the male group ($P = 0.078$) whereas the female patients showed a significant improvement at two time intervals (T2–T0 and T4–T0). Social handicap domains showed improvement in the female patients which reached a significant level ($P = 0.022$) at (T3–T0).

Twin block group

The overall pattern of OHRQoL (OHIP-14) improved at each time interval in relation to the base point (T0), however, these changes had not reached the significance

Table 3: Differences T1–T0, T2–T0, T3–T0, T4–T0 of individual and total OHIP14 scores by group

Domain	Group	T1-T0	P	T2-T0	P	T3-T0	P	T4-T0	P
Functional limitation									
Q1. Problems with pronunciation	Fixed	0.0 (1.0)	0.564	-0.2 (0.9)	0.196	-0.1 (1.1)	0.032*	-0.5 (0.9)	<0.001***
	Functional	0.1 (1.7)		-0.5 (1.6)		-0.7 (1.6)		-1.3 (1.3)	
Q2. Worse sense of taste	Fixed	-0.1 (1.0)	0.619	-0.1 (1.1)	0.580	-0.1 (1.0)	0.125	-0.5 (0.9)	0.005**
	Functional	-0.1 (1.4)		-0.2 (1.1)		-0.5 (1.2)		-1.1 (1.0)	
Physical pain									
Q3. Painful	Fixed	0.4 (1.3)	0.565	0.1 (1.3)	1.000	-0.2 (1.1)	0.396	-0.8 (1.0)	0.743
	Functional	0.6 (1.1)		0.1 (1.2)		0.0 (1.3)		-0.8 (0.9)	
Q4. Uncomfortable to eat	Fixed	0.4 (1.3)	0.961	0.1 (1.5)	0.994	-0.5 (1.4)	0.420	-1.0 (1.0)	0.680
	Functional	0.4 (1.3)		-0.1 (1.3)		-0.2 (1.5)		-1.1 (1.1)	
Psychological discomfort									
Q5. Self-consciousness	Fixed	0.2 (1.3)	0.621	-0.2 (1.4)	0.817	-0.4 (1.3)	0.370	-1.0 (1.1)	1.000
	Functional	0.1 (1.1)		-0.2 (1.2)		-0.2 (1.4)		-1.0 (0.9)	
Q6. Tense	Fixed	0.0 (1.2)	0.354	-0.4 (1.1)	0.316	-0.3 (1.2)	0.869	-1.0 (1.0)	0.838
	Functional	-0.2 (1.1)		-0.1 (1.0)		-0.3 (1.2)		-0.9 (1.0)	
Physical disability									
Q7. Unsatisfactory diet	Fixed	0.5 (1.3)	0.209	0.1 (1.1)	0.787	0.1 (1.0)	0.926	-0.5 (0.8)	0.850
	Functional	0.2 (1.1)		0.1 (1.2)		0.1 (1.1)		-0.6 (0.8)	
Q8. Interrupted meals	Fixed	0.1 (1.2)	0.670	-0.2 (1.1)	0.186	-0.1 (1.1)	0.738	-0.7 (0.8)	0.805
	Functional	0.1 (1.2)		0.1 (1.2)		0.0 (1.3)		-0.7 (0.8)	
Psychological disability									
Q9. Difficult to relax	Fixed	0.2 (1.0)	0.725	0.0 (1.0)	0.635	-0.1 (1.1)	0.928	-0.7 (0.9)	0.818
	Functional	0.2 (1.3)		0.1 (1.5)		-0.2 (1.2)		-0.7 (0.9)	
Q10. Embarrassed	Fixed	0.0 (1.1)	0.757	-0.2 (1.3)	0.941	-0.3 (1.1)	0.881	-0.9 (1.0)	0.568
	Functional	-0.1 (1.5)		-0.2 (1.4)		-0.3 (1.5)		-1.0 (1.1)	
Social disability									
Q11. Irritable	Fixed	0.3 (1.1)	0.184	0.0 (1.0)	0.392	-0.2 (0.8)	0.865	-0.6 (0.8)	0.077
	Functional	0.0 (1.5)		-0.2 (1.3)		-0.2 (1.5)		-0.9 (1.1)	
Q12. Difficult to do usual job	Fixed	0.2 (1.1)	0.804	0.1 (1.1)	0.852	-0.1 (0.8)	0.844	-0.5 (0.8)	0.554
	Functional	0.1 (1.3)		0.1 (1.1)		-0.1 (1.2)		-0.6 (0.9)	
Social handicap									
Q13. Life less satisfying	Fixed	0.1 (1.0)	0.336	0.1 (1.0)	0.627	-0.2 (0.9)	0.369	-0.6 (0.8)	0.903
	Functional	-0.1 (1.1)		0.0 (1.1)		0.0 (1.1)		-0.6 (0.9)	
Q14. Unable to function	Fixed	0.2 (0.9)	0.072	0.2 (1.0)	0.924	-0.1 (0.8)	0.917	-0.5 (0.7)	0.793
	Functional	-0.1 (1.0)		0.2 (1.1)		-0.1 (1.1)		-0.5 (0.8)	
Total OHIP14 Score	Fixed	2.5 (9.8)	0.478	-0.5 (11.6)	0.962	-2.7 (10.0)	0.992	-9.7 (8.8)	0.179
	Functional	1.3 (7.6)		-0.6 (9.5)		-2.7 (10.2)		-11.8 (6.8)	

(* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$). Mean (SD) and F-test from ANOVA model for differences between groups

Table 4: Differences T1–T0 and total OHIP14 scores for fixed appliance group patients by extraction intervention

Domain	Extraction	T1-T0	P
Physical pain			
Pain	No	-0.1 (1.1)	0.032*
	Yes	0.7 (1.3)	

Mean (SD) and F-test from ANOVA model for differences between extractions (yes/no); * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

threshold at all-time points [Figure 2]. Psychological disability domain was higher for female patients in comparison to male patients at (T3–T0), which was interpreted as worsening in the psychological disability domain ($P = 0.019$). Social handicap domain worsened among female patients compared to male patients at (T2–T0) ($P = 0.041$).

Discussion

This prospective study showed that the QoL improved significantly with both fixed and twin block appliances by the end of the treatment. It corroborates with studies that found that patient satisfaction and OHRQoL improved significantly by the end of fixed orthodontic treatment.^[16,17] To date no studies have compared the changes in QoL following treatment with fixed and twin block functional appliances. This study underscores the fact that QoL improved significantly irrespective of the appliance and that the patients adapted and embraced treatment, implying that both appliances were equally effective. Chen *et al.* reported that fixed appliances deteriorated QoL in the first month, however, function and pain levels improved as treatment progressed.^[18,19]

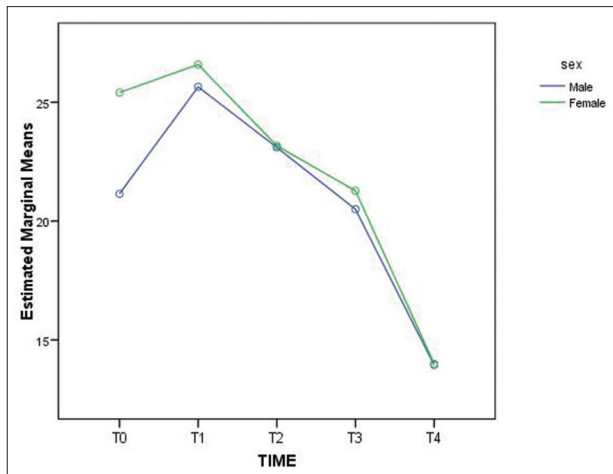


Figure 1: The total OHIP14 scores for Fixed group patients by gender

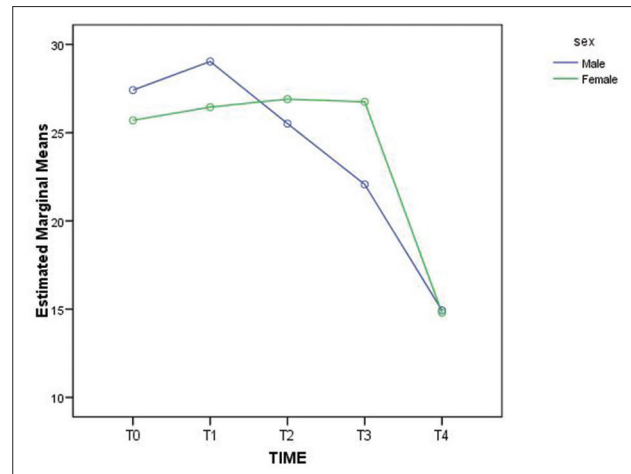


Figure 2: The total OHIP14 scores for Functional group patients by gender

Table 5: Differences T1–T0 and total OHIP14 scores for Twin block group patients by extraction intervention

Domain	Extraction	T1–T0	P
Functional limitation			
Q1. Problems with pronunciation	No	-0.4 (1.7)	0.028*
	Yes	0.7 (1.6)	
Q2. Worse sense of taste	No	0.6 (1.2)	0.007**
	Yes	-0.4 (1.2)	
Physical pain			
Q3. Painful	No	1.0 (1.2)	0.012*
	Yes	0.2 (0.9)	
Total OHIP14 Score	No	2.5 (7.8)	0.287
	Yes	0.1 (7.4)	

Mean (SD) and F-test from ANOVA model for differences between extraction (yes/no); * $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

It is worth mentioning that malocclusion perception differs between professionals and patients and that self-perceived OHRQoL is not always a reflection of malocclusion severity. Individuals with severe malocclusions may not report a negative impact on QoL, whereas others, with minor irregularity, score high negative impact on QoL.^[20]

The fixed and the twin block appliances affected the outcome of several OHIP-14 domains, which was in agreement with other researchers such as Chen *et al.* who found that the physical pain and functional limitations were highly affected during the first week of appliance placement but that these variables improved with time^[18] Similar effects were found in this study; patients in both the treatment groups had a better OHRQoL towards the end of the treatment.

Brown and Moerenhout reported that pain from orthodontic treatments has a considerably impact on the daily activities of patients.^[21] Physical pain and discomfort were investigated after placement of fixed appliances. The results were that the pain increased in the first 2 hours,

reached a peak at 24 hours following the insertion, and finally the pain faded away within 3–5 days.^[13-19] These results agree with the ones found in our study, which showed pain increased in both groups from T0 to T1; however, we observed that the pain was temporary and that the patient’s QoL subsequently improved.

It was reported that nonsurgical (routine) tooth extraction prior to fixed appliance treatment could worsen the QoL, especially the functional aspects.^[19] We also observed similar trends. Extractions were a contributing factor, in addition to the orthodontic appliance itself, in worsening the QoL at the beginning of the treatment as evidenced by the OHIP scores. Indeed the OHIP-14 scores were high at T0–T1 indicating a worsening of QoL in both the groups. Following healing and adaptation, the QoL improved markedly.

Several authors have reported that patients with removable appliances experienced more issues with speech during treatment and had negative effects on schoolwork and leisure activities.^[22,23] This is due to the fact that removable appliances reduce and change the intraoral space, thus impeding the tongue from articulating certain speech sounds. In addition, speech problems in the removable appliance group can also be a contributing factor to the negative effect on schoolwork and leisure activities reported.^[24] This is in agreement with our study where pronunciation was affected at (T3–T0), but showed improvement towards the end of the treatment.

Females can experience a lower QoL in comparison to males, as reported by many authors.^[17-24] Kurtz reported that females can express more the characteristics of the experiences they go through better than males.^[25,26] This study showed that the female group OHRQoL in the fixed appliances group showed less irritability and physical limitation in comparison to male patients and that there was a noticeable improvement as the treatment reached T4.

Females in the twin block appliances group experienced a more negative impact on OHRQoL in comparison to males in certain domains, such as self-consciousness, embarrassment, and disability to function. Functional appliances compliance rate in females was higher than that in the males, this was recorded as male patients were reported by their parents or guardians not to wear the appliance as instructed by the clinician.

The results of this research help to illustrate the impact of fixed and twin block appliances on the QoL of patients. The findings can help clinicians understand what the patients go through during the treatment process; moreover, both appliances had a similar impact pattern on the OHRQoL in both the groups, which undermines the predictions that twin block's impact on OHRQoL is worse than with fixed appliances.

Conclusions

All patients reported an improvement in their QoL at the end of treatment and no statistically significant differences were found between the two groups. These results can be incorporated into the informed consent, which may increase patient's compliance since they and their parents, become better aware of the whole treatment process.

OHRQoL improved significantly with both fixed and functional appliances at the end of the treatment. The OHRQoL trends observed during the study can be communicated to patients and used to increase their compliance since they acquire greater awareness of the whole treatment process.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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