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Evaluation of Oral-Health-Related Quality of Life (OHRQoL) of Patients Treated with Fixed Orthodontic Therapy: An Observational Cross-Sectional Study

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ABSTRACT

Background: The rising number of adult orthodontic patients has led to a rise in the demand for cosmetic orthodontic equipment in recent years. Oral health-related quality of life (OHRQoL) corresponds to the QoL characteristics that individuals use to describe how they feel about their oral health state. No cross-sectional observational study comparing OHRQoL outcomes between buccal and lingual fixed orthodontic treatment has been reported. Therefore, using the OHIP-14 questionnaire, this study aimed to compare the OHRQoL of patients with lingual vs buccal orthodontic appliances. **Objective:** The objective of the study is to determine the impact of fixed orthodontic treatment on patients' oral health-related quality of life. **Study Design:** Observational cross-sectional study. **Settings:** This study was conducted at Azra Naheed Dental College, Lahore Pakistan. **Duration:** September 2022 to February 2023. **Methods:** A demographic questionnaire was used in this investigation. Each patient's demographics (age, gender, socioeconomic and educational status), clinical characteristics, investigations, and treatment were recorded on a data sheet. In the Lingual and Buccal appliance groups, 37 patients were studied. The OHIP-14 questionnaire assessed OHRQoL. This includes functional limitation, pain, psychological discomfort, disability, social impairment, and handicap. The researcher used English and Urdu translation of the OHIP14 questionnaire for patient recruitment. SPSS 20 analyzed the data. **Results:** There was a total of 25 males and 49 females. The unmarried, low-income status, and at least graduated were shown the high frequency. In the lingual appliance group, the age between 17-25 years with mean 12.97 months of treatment. However, the patients included in the buccal appliance group had the age between 18-25 years with the mean 13 months of treatment. Average OHIP-14 scores were 9.819 and 9.790 for the lingual and buccal groups, respectively, before the brackets were put in place (T0). Domains of OHIP were significantly different within the group as compared with T0 ($p<0.005$). Compared to pre-treatment values, functional limitation, physical pain, and the other domains were increased significantly ($p<0.001$) and peaked in the initial week after treatment in the lingual and buccal appliance groups. **Conclusion:** Therapy improved OHRQoL in both lingual and buccal groups. After one month of treatment, the lingual group showed better performance than the buccal group. Both groups had OHRQoL drop in the initial week then recover steadily. Buccal patients experienced higher functional limitation, somatic pain, physical impairment, and social incapacity than lingual patients.

Keywords: *OHRQoL, OHIP-14, Lingual appliances, Buccal appliances, Orthodontic therapy.*

INTRODUCTION

The rising number of adult orthodontic patients has led to a rise in the demand for cosmetic orthodontic equipment in recent years. Not all patients are comfortable with traditional metal or ceramic brackets and there has been a rise in interest in less conspicuous alternatives to these.[1] The goal of orthodontic treatment, regardless of the appliance used, is to create a stable, long-lasting occlusion that is healthy, functional, and aesthetically pleasing.[2] Clinicians should care not only about the eventual occlusal and aesthetic outcome of orthodontic treatment but also about the patient-centered effects of such therapy and the possible health consequences.[3]

An individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns" is how the term "quality of life" (QoL) is described.[4] Oral health-related quality of life (OHRQoL) corresponds to the QoL characteristics that individuals use to describe how they feel about their oral health state.[5] Positive experiences have been highlighted in social media studies, and reports of an improvement in OHRQoL after orthodontic treatment have been documented. Pain and functional constraints, as well as concerns about the aesthetics of traditional orthodontic equipment, have been identified as negative influences on OHRQoL.[6,7]

The physical, social, and mental health of adult patients is impacted by the patients of their orthodontic equipment.[8] Today's orthodontics focuses on giving patients the attractive smiles they envision. Buccal braces may limit your ability to eat and speak normally. Successful treatment of most adults and adolescents is now also possible with the use of lingual appliances.[7] In addition to giving patients what they want—a purely cosmetic appliance—they also provide orthodontists full freedom of movement in all three dimensions of the teeth.[9] The primary objective of orthodontic treatment is to enhance the patient's quality of life by achieving a balance between aesthetics, function, and their personal goals.[10] Pain, trouble eating, changes in speech, and dietary restrictions are only some of the problems that might lower quality of life during orthodontic treatment.[11] As a result, we get insight into the consequences of malocclusion. The Oral Health Impact Profile (OHIP) is the most popular and comprehensive questionnaire used to assess OHRQoL. After seeing that the OHIP questionnaire was taking too much time to complete, Slade reduced the number of questions from 49 to 14.[12] The OHIP-14 is favored by researchers and physicians over the OHIP-49 because to its usability, validity, and dependability.[13] Quality of life evaluation is recommended in orthodontics for treatment planning, assessing therapy efficacy, gaining insight into patients' expectations, and easing their adjustment to treatment's aftereffects. Due to functional restrictions, most studies assessing the impact of orthodontic therapy on OHRQoL have shown a decline in initial changes in OHRQoL with therapy and an increase thereafter.[14] More social humiliation is associated with lingual (within the cheek) brackets than with buccal (outside the cheek) brackets. During orthodontic treatment with fixed buccal appliances, the OHRQoL has been the subject of many researches. Most research comparing lingual and buccal appliances has concentrated on negative side effects such pain and discomfort, while other research has looked at the biomechanical features of the two.[11]

Among buccal, lingual, low-friction and brackets OHRQoL was only compared in one research. Nonetheless, this investigation contained a number of flaws. Since OHRQoL was only examined once, a month after the start of therapy, neither pre-treatment status nor changes brought on by appliance wear could be determined. Second, patients' reactions to the provided appliances were not captured in their entirety since pain and discomfort were only evaluated on many occasions in the initial week of therapy. Third, there was too wide of a gap in age between the recruited patients.[15] Finally, there were statistically significant differences in the age and sex distribution of the four groups at the baseline assessment, casting doubt on the reliability of the comparisons.

However, it is not yet evident how lingual appliances compare to buccal appliances in terms of their influence on OHRQoL and how severe that impact is. No cross-sectional observational study comparing OHRQoL outcomes between buccal and lingual fixed orthodontic treatment has been reported. Therefore, using the OHIP-14 questionnaire, this study aimed to compare the OHRQoL of patients compared with lingual vs buccal orthodontic appliances.

METHODS

This observational cross-sectional study was conducted at Azra Naheed Dental College, Lahore Pakistan from September 2022 to February 2023. Class I connections between the molars and canines on both sides; non-extractionable, moderate crowding of 4–6 mm in both arches, age between 18 and 25; lack of anterior crossbites; absence of cleft lip and/or cleft palate (soft and/or hard); and absence of craniofacial syndromes were all required for inclusion. Other patients above the age of 25 years and don't need orthodontic therapy were excluded from the study. On the WHO sample size calculator, a total of 75 subjects were chosen in this study based on a prevalence of 60% orthodontic therapy prevalence with 95% confidence interval and margin of 5%.[16]

A total of 74 patients who matched the inclusion criteria were randomly chosen and split into two groups of lingual appliance and buccal appliance in similar size. Prior to enrolling in the trial, individuals were briefed about the treatment plan. Patients were made aware of the voluntary nature of the study, and those who agreed were then requested to provide written permission and filled the questionnaire with the demographic details.

Patients in lingual and buccal groups were monitored after the initial arch wire was placed in their orthodontic appliances. When the tooth's alignment had improved to the point that the next arch wire could be introduced with minimum bending and without putting undue effort on the teeth, the previous arch wire was not replaced. To provide room for the proper alignment of the crowded teeth, a mild interproximal reduction was performed using single-sided, portable metal abrasion strips (Company name) from canine to canine. Finally, 0.014" stainless steel archwire was used to provide occlusal stability and provide precision when needed in the treatment.

The OHRQoL was evaluated using the OHIP-14 questionnaire. Functional restriction, physical pain, psychological discomfort, physical disability, psychological disability, social impairment, and handicap were some of the topics covered by the 14-item scale. Patients in the present experiment were recruited from Urdu-speaking country, thus the investigators employed the validated and reliable English and Urdu translation of the OHIP14 questionnaire.[17]

After the appliance was placed, patients filled out an OHIP14 survey to assess how the device affected their OHRQoL. Before therapy (T0), following treatment (T1), one month (T2), three months (T3), six months (T4), and at the conclusion of treatment (T5), patients were given this questionnaire to evaluate any changes. Each question was answered using a five-point Likert scale (with zero meaning never and four meaning very frequently). Quality of life was rated from -5 to +5, with -5 being the best and +5 the worst. Each category might get a score between 0 and 8. Total OHIP-14 scores, which included all seven subscores, could be anywhere from 0 to 56. Lower quality of life was associated with higher OHIP-14 scores.

All information was concealed before being imported into an Excel spreadsheet for analysis using SPSS version 22.0. Due to the normality of the data, two-sample t-tests were used to compare the two groups. To satisfy the multiple comparisons, we analyzed intragroup shifts using paired sample t-tests. The $p<0.05$ threshold was chosen as the level of statistical significance.

RESULTS

No patients dropped out throughout any of the evaluation phases. Thus, a perfect response rate was attained. Table 1 displays the research sample's fundamental features of patients. There was total 25 male and 49 females. The unmarried, low-income status and at least graduated were showed the high frequency. In the lingual appliance group, the age between 17-25 years with the mean 12.97 months of treatment. However, the patients included in buccal appliance group had the age between 18-25 years with the mean 13 months of treatment.

Table 1: Demographic Details of Lingual and Buccal Appliance Group

Variables		Lingual Appliance		Buccal Appliance	
		Frequency	Percentage	Frequency	Percentage
Gender	Male	15	40.5	10	27.0
	Female	22	59.5	27	73.0
Marital Status	Unmarried	30	81.1	28	75.7
	Married	7	18.9	9	24.3
Socioeconomic Status	Low Income Status	20	54.1	21	56.8
	Middle Income Status	7	18.9	8	21.6
	High Income Status	10	27.0	8	21.6
Educational Status	Matriculation	11	29.7	7	18.9
	Intermediate	12	32.4	11	29.7
	Graduation	14	37.8	19	51.4

Table 2: Age and treatment length of lingual and buccal appliance group

Variables		Minimum	Maximum	Mean	Std. Deviation
Lingual Appliance	**Age in Years**	17	25	20.46	2.206
	Treatment in Months	12	14	12.97	.763
Buccal Appliance	**Age in Years**	18	25	21.11	1.629
	Treatment in Months	11	14	13.00	.816

Average OHIP-14 scores were 9.819 and 9.790 for the lingual and buccal groups, respectively, before the brackets were put in place (T0). The all domain of OHIP were significant different within the group as compared with T0 ($p<0.005$). Table 3 shows the descriptive analysis of all features of OHIP.

Table 3: Descriptive analysis of OHIP-14 of lingual and buccal appliance group

Assessment	Time	Lingual Appliance			Buccal Appliance		
		Mean	Std. Deviation	P value	Mean	Std. Deviation	P value
Functional Limitation	**T0**	.15	.022	-	.15	.022	-
	T0 vs T1	5.37	.063	.010	2.23	.017	.003
	T0 vsT2	3.26	.029	.005	.87	.013	.002
	T0 vs T3	1.45	.023	.004	.24	.022	.289
	T0 vs T4	.57	.009	.001	.24	.023	.456
	T0 vs T5	.51	.026	.004	.16	.008	.689
Physical Pain	**T0**	.44	.016	-	.42	.014	-
	T0 vs T1	5.95	.028	.005	4.18	.012	.002
	T0 vsT2	3.65	.023	.004	2.35	.024	.004
	T0 vs T3	2.22	.014	.002	1.23	.012	.578
	T0 vs T4	.87	.023	.004	.55	.021	.489
	T0 vs T5	.67	.017	.003	.33	.017	.660
Physical Disability	**T0**	2.20	.051	-	1.55	.021	-
	T0 vs T1	3.59	.140	.023	3.55	.027	.224
	T0 vsT2	1.67	.017	.003	1.73	.011	.002
	T0 vs T3	.84	.028	.005	.85	.028	.256
	T0 vs T4	2.46	10.905	1.793	.56	.018	.003
	T0 vs T5	.33	.016	.003	.34	.026	.004
Psychological Disability	**T0**	.78	.010	-	.77	.019	-
	T0 vs T1	4.65	.021	.003	3.55	.029	.005
	T0 vsT2	2.47	.026	.004	1.57	.018	.003
	T0 vs T3	1.45	.022	.004	.58	.010	.002
	T0 vs T4	.83	.018	.003	.52	.008	.001
	T0 vs T5	.60	.022	.004	.51	.012	.002
Social Disability	**T0**	2.44	.028	-	2.17	.010	-
	T0 vs T1	3.45	.029	.005	1.67	.011	.002
	T0 vsT2	1.79	.010	.002	.86	.027	.004
	T0 vs T3	.76	.023	.004	.67	.014	.549
	T0 vs T4	.57	.022	.004	.46	.018	.486
	T0 vs T5	.43	.016	.003	.33	.014	.325
Handicap	**T0**	1.75	.029	-	2.33	.016	-
	T0 vs T1	1.14	.019	.003	1.20	.013	.002
	T0 vsT2	.57	.020	.003	.48	.010	.002
	T0 vs T3	.42	.015	.002	.42	.009	.001
	T0 vs T4	.44	.023	.004	.36	.009	.002
	T0 vs T5	.43	.013	.002	.32	.011	.002
Total OHIP	**T0**	9.82	.066	-	9.79	.031	-
	T0 vs T1	28.22	2.440	.401	26.38	.794	.131
	T0 vsT2	14.86	.751	.124	15.22	.516	.085
	T0 vs T3	7.46	.210	.035	7.80	.061	.010
	T0 vs T4	4.13	.113	.019	4.36	.008	.001
	T0 vs T5	3.56	.072	.012	3.52	.023	.004

In table 4, the all domains of OHIP-14 were mostly significant when compared between the groups of each score from T0 to T5. Compared to pre-treatment values, functional limitation and physical pain and the other domains significantly increased ($p<0.001$) and peaked in the initial week after treatment in both groups, before gradually decreasing over time; however, the scores were still significant in the lingual group at all assessment times for functional limitation and up to T4 for physical pain ($p <0.05$). At each point of evaluation, the lingual group reported higher levels of functional restriction and physical discomfort than the buccal group.

Table 4: Comparison of OHIP-14 of Lingual and Buccal Appliance Group

Assessment	Group		Mean	Std. Deviation	P value
Functional Limitation	T0	Lingual Appliance	.146	.022	1.000
		Buccal Appliance	.146	.022	
	T1	Lingual Appliance	5.368	.063	.000
		Buccal Appliance	2.232	.017	
	T2	Lingual Appliance	3.257	.029	.000
		Buccal Appliance	.870	.013	
	T3	Lingual Appliance	1.455	.023	.697
		Buccal Appliance	.242	.022	
	T4	Lingual Appliance	.573	.009	.000
		Buccal Appliance	.235	.023	
	T5	Lingual Appliance	.515	.026	.000
		Buccal Appliance	.159	.008	
Physical Pain	T0	Lingual Appliance	.440	.016	.027
		Buccal Appliance	.420	.014	
	T1	Lingual Appliance	5.952	.028	.000
		Buccal Appliance	4.175	.012	
	T2	Lingual Appliance	3.649	.023	.829
		Buccal Appliance	2.352	.024	
	T3	Lingual Appliance	2.219	.014	.267
		Buccal Appliance	1.227	.012	
	T4	Lingual Appliance	.875	.023	.421
		Buccal Appliance	.552	.021	
	T5	Lingual Appliance	.668	.017	.828
		Buccal Appliance	.331	.017	
Physical Disability	T0	Lingual Appliance	2.202	.051	.087
		Buccal Appliance	1.554	.021	
	T1	Lingual Appliance	3.585	.140	.000
		Buccal Appliance	3.550	.027	
	T2	Lingual Appliance	1.667	.017	.002
		Buccal Appliance	1.729	.011	
	T3	Lingual Appliance	.840	.028	.631
		Buccal Appliance	.846	.028	
	T4	Lingual Appliance	2.458	10.905	.044
		Buccal Appliance	.556	.018	
	T5	Lingual Appliance	.328	.016	.000
		Buccal Appliance	.344	.026	
Psychological Disability	T0	Lingual Appliance	.776	.010	.002
		Buccal Appliance	.771	.019	
	T1	Lingual Appliance	4.648	.021	.001
		Buccal Appliance	3.554	.029	
	T2	Lingual Appliance	2.471	.026	.017
		Buccal Appliance	1.565	.018	
	T3	Lingual Appliance	1.454	.022	.000
		Buccal Appliance	.576	.010	
	T4	Lingual Appliance	.831	.018	.000
		Buccal Appliance	.522	.008	
	T5	Lingual Appliance	.598	.022	.000
		Buccal Appliance	.513	.012	

Social Disability	**T0**	**Lingual Appliance**	2.441	.028	.000
		Buccal Appliance	2.171	.010	
	T1	**Lingual Appliance**	3.452	.029	.000
		Buccal Appliance	1.666	.011	
	T2	**Lingual Appliance**	1.785	.010	.000
		Buccal Appliance	.858	.027	
	T3	**Lingual Appliance**	.762	.023	.000
		Buccal Appliance	.671	.014	
	T4	**Lingual Appliance**	.566	.022	.008
		Buccal Appliance	.461	.018	
	T5	**Lingual Appliance**	.434	.016	.301
		Buccal Appliance	.328	.014	
Handicap	**T0**	**Lingual Appliance**	1.746	.029	.371
		Buccal Appliance	2.335	.016	
	T1	**Lingual Appliance**	1.142	.019	.000
		Buccal Appliance	1.202	.013	
	T2	**Lingual Appliance**	.565	.020	.047
		Buccal Appliance	.483	.010	
	T3	**Lingual Appliance**	.422	.015	.005
		Buccal Appliance	.420	.009	
	T4	**Lingual Appliance**	.443	.023	.000
		Buccal Appliance	.365	.009	
	T5	**Lingual Appliance**	.428	.013	.000
		Buccal Appliance	.323	.011	
Total OHIP	**T0**	**Lingual Appliance**	9.819	.066	.561
		Buccal Appliance	9.790	.031	
	T1	**Lingual Appliance**	28.216	2.440	.000
		Buccal Appliance	26.378	.794	
	T2	**Lingual Appliance**	14.865	.751	.003
		Buccal Appliance	15.222	.516	
	T3	**Lingual Appliance**	7.462	.210	.000
		Buccal Appliance	7.802	.061	
	T4	**Lingual Appliance**	4.130	.113	.000
		Buccal Appliance	4.358	.008	
	T5	**Lingual Appliance**	3.562	.072	.000
		Buccal Appliance	3.517	.023	

DISCUSSION

Despite the potential for the lingual appliance to have an impact on a person's physical, emotional, and mental well-being, very little research has been conducted into this topic and published. This is the initial cross sectional observational study comparing OHRQoL between lingual and buccal fixed appliances at various stages of orthodontic therapy. The OHIP-14 questionnaire was used to assess OHRQoL in this research because to its popularity and user-friendliness in the medical literature and among patients.

After receiving therapy, both groups showed substantial improvements in OHRQoL. The better alignment of the teeth following the levelling and alignment phase may account for this change. This confirms the findings of other research showing Baherimoghaddam T *et al*. and Douglas-de-Oliveira DW *et al*. that both patient satisfaction and OHRQoL increase towards the completion of orthodontic therapy.[18,19] Our research showed that the biggest drop in OHRQoL happened in the initial week, and that it levelled out after that, maybe due to the patient's adaption or the knowledge obtained. Consistent with the findings of Owayda AM *et al*. who also found that OHRQoL was lowest a week after the implantation of fixed appliances, we observe the following. In addition, they said that this was due to the fact that their degrees of physical pain, psychological distress, and physical incapacity were all at their maximum.[20]

While the buccal group's ORHQoL was higher than the lingual group's in the initial month of the trial, no significant differences were seen between the groups after the third month. These findings are at odds with those of Kara-Boulad *et al*., who discovered statistically significant differences in in OHIP-14 score when

comparing the lingual bracket to the standard, low-friction, and aligner options.[11]

In this research, the lingual group had considerably higher levels of functional constraint and physical discomfort than the buccal group did throughout all evaluation intervals. Patients who use lingual appliances are more likely to express a sense of articulation alterations, as was previously noted, compared to patients who use buccal appliances.[21] When comparing conventional and lingual appliances, Kara-Boulad *et al*., found no significant variations in functional restriction, therefore these results don't add up.[11] Patients who had lingual brackets placed reported by Khattab TZ less discomfort than those who had permanent buccal brackets placed. conducted another investigation and found no significant differences between buccal and lingual appliances in terms of functional constraint and physical discomfort. While standard lingual brackets were known to be uncomfortable, Khattab TZ looked into a procedure called lingual bio-creative treatment, which included bonding a flat lingual retractor to the lingual surface of the front teeth.[22]

The present study found that the lingual group had a higher prevalence of physical handicap than the buccal group. This is because the bite planes cause a posterior disocclusion, making it difficult to swallow, especially in the beginning of treatment before the swallowing reflex was relearned because of the close proximity of the tongue to the lingual brackets. Duarte L *et al*.[23] and Alajmi S *et al*.,[24] both reported that patients treated with buccal appliances had greater problems swallowing and changing their diets than those treated with lingual appliances, therefore this conclusion is consistent with both of those studies. While Naveed N *et al*., observed no statistically significant difference in feeding difficulties between lingual and buccal appliances, we found the opposite to be true.[25] This might be because of the way the research was set up, the average ages of the participants, or the questions that were asked. Both lingual and buccal appliances impeded chewing, however the levels of impairment for lingual appliances were substantially greater than for buccal appliances.[11] Buccal group members had considerably higher levels of psychological impairment than lingual group members did at T2, T3, T4, and T5. Patients' outward looks, mental health, and social interactions all benefit greatly from lingual appliances, which are often regarded as the orthodontic therapy.[26]

CONCLUSION

After receiving therapy, both the lingual and buccal groups had an increase in OHRQoL. The lingual group fared better than the buccal group after the initial month of therapy. Both groups observed the spike in OHRQoL decline in the initial week, followed by a steady recovery. The buccal group also had more issues with functional restriction, bodily discomfort, physical impairment, and social disability than the lingual group.

LIMITATIONS

The current study strengths include its use of a well-established methodology and its narrow emphasis on study that directly compare outcomes for patients who had treatment with lingual vs buccal appliances. Exploratory quantitative data synthesis used a random effects OHIP-14 which helps to determine the Oral-Health-Related Quality of Life (OHRQoL). The small number of patients and on certain age groups included, introduce certain limitations.

SUGGESTIONS / RECOMMENDATIONS

Including participants of varying ages in the present study might strengthen its implications in future

CONFLICT OF INTEREST / DISCLOSURE

The authors have no conflicts of interest

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