RESEARCH ARTICLE

Assessment of the changes in the oral health related quality of life 24 hours following insertion of fixed orthodontic appliance components — An observational cross-sectional study conducted at Bahria University Medical and Dental College Karachi

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Abstract

Objective: To evaluate the changes in Oral Health Related Quality of Life 24 hours following insertion of fixed orthodontic appliance components, and to compare the results between different age groups and genders.

Methods: The observational cross-sectional study was conducted from July to December 2017 at Bahria University Medical and Dental College, Karachi, and comprised patients from the Orthodontics outpatient department enrolled via convenience sampling. Oral Health Impact Profile questionnaire was used to assess the Oral Health Related Quality of Life after placement of separators, bands and brackets. Patients were assessed before the appliances were placed and 24 hours after the insertions. Changes were evaluated and age and gender groups were compared using SPSS 17.

Results: Of the 70 patients, 20(28%) were males and 50(72%) were females. The overall mean age of the sample was 18.3±3.8 years. Oral Health Impact Profile scores showed significant deterioration of oral health quality 24 hours after the placement of brackets ($p<0.05$). However, there was no significant deterioration of lack of self-confidence ($p=0.19$), avoid smiling ($p=0.11$) and embarrassment ($p=0.62$) after the placement of separators and bands. There was no significant difference across genders ($p>0.05$), but young adults had significantly higher mean difference compared to adolescents after placement of bands ($p<0.05$).

Conclusion: The Oral Health Related Quality of Life significantly deteriorated 24hours following the insertion of separators, bands and brackets.

Keywords: OHRQoL, OHIP, Fixed orthodontic treatment, Separators, Bands, Brackets. (JPMA 69: 677; 2019)

Introduction

Oral Health-Related Quality of Life (OHRQoL) deals with a person's comfort while eating, sleeping and engaging in social interaction; their self-confidence; and their satisfaction with regard to their oral health. It deals with functional, psychological and social domains as well as discomfort and pain experience.[1,2]

Orthodontic treatment brings about an improvement in aesthetics as well as subsequent enhancement of psychosocial wellbeing, which in turn leads to a better QoL.[3-7] However, the QoL might deteriorate during the course of treatment. Patient's prior knowledge regarding the treatment procedure and the possible discomfort that might be experienced during the treatment might help in improving QoL during this time.[8]

Apart from improving the aesthetics and basic oral functions, orthodontic treatment is sought for various other reasons, as studies have shown that patients see this treatment as a way of achieving better psychosocial wellbeing which contributes to a better QoL).[5,9,10] A study[10] reported that the most significant motivating factors for patients seeking orthodontic treatment were improvement in dento-facial appearance and self-confidence. OHRQoL assessments are recommended in orthodontics for a variety of reasons which include assessment of treatment needs and outcomes, to evaluate a therapy's efficiency and its impact on the oral tissues during the required period of treatment, and as part of clinical trials.[3] Few studies have investigated the physical, social or psychological effects of orthodontic treatment on patients or how pain and discomfort affect QoL.[11]

A number of studies have concluded that QoL is affected by fixed orthodontic therapy.[11-16] The intensity of the negative oral impact on QoL depends on the type of therapy received.[17] A study[12] found that adolescents who were wearing fixed appliances had a

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higher frequency of psychosocial impact than those wearing removable appliances. Another study[13] reported that patients wearing fixed appliance had decreased QoL than those who were wearing the Invisalign aligners.

Time is a major factor while studying the effect of orthodontic treatment on QoL.[17] A study[13] assessed the QoL impact between subjects treated with Invisalign aligners and those with fixed appliances, and found that the time duration affected the physical, functional and psychological wellbeing of the patient. One study[11] reported that when compared with pretreatment phase, a patient's OHRQoL was frequently worsened during treatment. The first month after the insertion of fixed orthodontic appliance reveals the most prominent change in OHRQoL. Mansor et al[17] reported a deterioration in OHRQoL 24 hours following insertion of fixed orthodontic appliances. This decline affects almost all domains, and such type of information can and should be used for 'informed consent' prior to the treatment, which may increase patients' compliance as they are aware of what is going to happen in the first phase of fixed orthodontic therapy.

Nationally, there is hardly any work on OHRQoL and internationally there are a very few studies evaluating the physical, social and psychological effects of orthodontic treatment and almost none has assessed OHRQoL changes due to the placement of multiple components of fixed orthodontic treatment. Third world countries in general face many more hardships in everyday life compared to the more developed countries and, therefore, there might be a marked difference between the results of such studies carried out in the two settings. The current study was planned to evaluate the changes in OHRQoL 24h following the insertion of different fixed orthodontic appliance components, and to determine age and gender variations in OHRQoL following the insertion of such components.

Subjects and Methods

The observational cross-sectional study was conducted at Bahria University Medical and Dental College, Karachi, from July to December 2017, and comprised patients registered for orthodontic treatment at the orthodontic outpatient department (OPD) who were enrolled using convenient consecutive sampling after approval was obtained from the institutional ethics review committee.

The sample size was calculated using GPower 3.1.9.2 by assuming 5% margin of error, 95% confidence interval (CI) for mean, and effect size as 0.4. Those included were healthy individuals with no systemic disease, aged 13-26 years, having a skeletal base pattern of Class I, Class II, or Class III, with mild to severe crowding or spacing in upper and lower arches, intact healthy permanent first molars, on whom no therapeutic intervention was planned with any intra-oral and extra-oral appliances other than fixed appliance therapy. Patients with severe skeletal pattern (Class II or Class III) who required orthognathic surgery, patients in which brass-wire separators were needed to be placed instead of elastic separators, patients who required molar tubes instead of bands, any history of ongoing or previous periodontal disease or bone loss (periodontal pockets >4mm) and syndromic patients were excluded. Informed consent was obtained from all the participants. For patients <18 years, consent was obtained from the parents concerned, but the questionnaire was filled by the patients themselves.

A Malaysian short version of the Oral Health Impact Profile (OHIP-14[M])[18,19] questionnaire with two additional questions, which is called OHIP-16[M][17] was used to assess OHRQoL. Pre-testing of the questionnaire was done to check for face validity. Orthodontists (Associate and Assistant Professors) from different dental colleges checked the face validity of the questionnaire to test the proposed methodology. Results revealed there was no need to change the proposed questionnaire. OHIP-16 measures how a person's oral health condition affects QoL. It includes functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap domains. Responses of each item are made on a Likertscale coded as: 1=never, 2=hardly ever, 3=occasionally, 4=fairly often, and 5=very often. The questionnaire scores range 16-80, where a total of 16 or less indicates no impact, and a score of 80 indicates the worst possible impact on QoL. Individual domain scores are calculated by summing up responses to the items within that particular domain, with higher scores indicating greater impact.

All the procedures were performed by a single calibrated operator to reduce bias. After registering the patients and finalizing their treatment plan, the subjects were briefed about the nature of the study. The questionnaire, which was in English language, was then handed to the subjects to fill.

It was ensured that the questionnaire was completely

and correctly filled in by all the participants and therefore none of the forms needed to be discarded. Patients completed the first questionnaire, which was used as the baseline (T0), before insertion of the fixed orthodontic appliance components, and they were given the second questionnaire to be completed 24hours after insertion (T1) of that component. T0 and T1 readings were taken for each separator's bands and brackets. The participants were called after 24hours to ensure that the questionnaires were duly filled, and the patients returned them on their next visit.

Patients were asked to avoid using analgesics, but if they did, they were asked to mention it on their questionnaire. The patients who used analgesics were excluded from the study.

Elastomeric separators and bands were then placed on all first permanent molars in one visit, whereas second molars were banded later after the data-collection was complete. 0.012'NiTi wire was placed after bonding and secured with elastomeric o-rings. Fixation of all the appliances followed the standard protocol by the manufacturer.

In patients who required extractions for their treatments due to crowding, fixation of the brackets was performed 2 weeks after the extractions to allow complete healing of the wound to prevent any overlapping of pain due to extraction and bonding.

Statistical analysis was done using SPSS 17. The level of significance was set at $p<0.05$. Initially, descriptive analysis and cross-tabulation was performed to estimate the mean scores along with standard deviations and frequencies and percentages of gender and age. Changes in the OHRQoL between T0 and T1 was evaluated using paired sample t test. Independent sample t test was used to compare variations of results with age and gender.

Results

Of the 70 patients, 20(28%) were males and 50(72%) were females. The overall mean age of the sample was 18.3±3.8 years (Table-1).

All OHIP-16 domains had significantly higher values 24 hours after the placement of each of the components (Table-2).

There was significant deterioration of OHRQoL except for embarrassment, lack of self-confidence and in avoiding smile ($p>0.05$) (Table-3). Subjects avoided going out after the placement of separators and brackets, but this was not significant after the bands were placed ($p>0.05$).

There was no gender variation in OHRQoL due to the placement of bands and brackets ($p>0.05$). However, females showed significantly more deterioration of OHRQoL ($p<0.05$). Age group comparison showed no variation after separators and brackets ($p>0.05$), but young adults showed significantly more deterioration of OHRQoL after band placement compared to the adolescents ($p<0.05$) (Table-4).

Table-1: Demographics of the study sample.

	Frequency n (%)	Mean(S.D)
Gender		
Male	20(28)	
Female	50(72)	
Age (Years)		
Adolescent(13-19)	41(58)	15.5(1.7)
Young Adult (20-26)	29(42)	22.3(2.0)
Total	70(100)	18.3(3.8)

SD: Standard deviation.

Table-2: Mean score OHIP-baseline and 24h following insertion of each domain.

Domain	Separators			Bands			Brackets		
	B.L Mean (S.D)	After 24 HR Mean (S.D)	P	B.L Mean (S.D)	After 24 HR Mean (S.D)	P	B.L Mean (S.D)	After 24 HR Mean (S.D)	P
Functional Limitation	4.3(1.4)	9.8(2.8)	<0.001	5.1(2.5)	9.2(3.9)	<0.001	4.8(1.8)	11.3(3.5)	<0.001
Physical Pain	2.0(0.3)	4.3(1.3)	<0.001	2.3(0.7)	5.0(2.2)	<0.001	2.4(1.1)	6.1(1.9)	<0.001
Psychological discomfort	2.6(1.1)	4.0(1.7)	<0.001	2.7(1.2)	4.0(1.6)	<0.001	2.5(1.1)	5.2(2.0)	<0.001
Physical disability	2.5(1.0)	4.7(2.1)	<0.001	2.9(1.7)	4.3(1.9)	<0.001	2.4(1.0)	5.4(2.3)	<0.001
Psychological Disability	2.0(0.2)	3.6(1.8)	<0.001	2.3(1.1)	3.3(1.9)	<0.001	2.2(0.7)	3.7(1.9)	<0.001
Social disability	2.0(0.1)	2.8(1.6)	<0.001	2.1(0.5)	2.7(1.8)	.004	2.1(0.5)	2.8(1.6)	<0.001
Handicap	2.2(0.7)	3.9(1.8)	<0.001	2.3(0.8)	3.8(1.6)	<0.001	2.6(0.9)	5.3(1.6)	<0.001
OHIP	17.9(2.8)	33.4(9.0)	<0.001	20.1(6.0)	32.6(11.4)	<0.001	19.36(5.8)	40.1(10.6)	<0.001

Results show P-values from paired t-test.
OHIP: Oran Health Impact Profile.
SD: Standard deviation.

Table-3: Mean score OHIP-16 baseline (BL) and 24h post-fixation for each item.

Domain	Items	Separators			Bands			Brackets		
		B.L Mean (S.D)	After 24 HR Mean (S.D)	P	B.L Mean (S.D)	After 24 HR Mean (S.D)	P	B.L Mean (S.D)	After 24 HR Mean (S.D)	P
Functional Limitation	Difficulty in chewing	1.0(0.5)	3.4(1.0)	<0.001	1.4(0.9)	2.8(1.3)	<0.001	1.2(0.6)	3.4(1.3)	<0.001
	Bad Breath	1.0(0.4)	1.3(0.7)	.003	1.1(0.4)	1.7(1.0)	<0.001	1.1(0.5)	1.9(1.1)	<0.001
	Difficulty in pronunciation	1.1(0.4)	1.7(1.0)	<0.001	1.1(0.5)	1.8(1.1)	<0.001	1.1(0.5)	2.4(1.3)	<0.001
	Discomfort in eating	1.1(0.4)	3.3(1.1)	<0.001	1.4(0.8)	2.8(1.3)	<0.001	1.2(0.5)	3.5(1.2)	<0.001
Physical Pain	Ulcer	1.0(0.2)	1.2(0.7)	.010	1.1(0.5)	2.3(1.3)	<0.001	1.2(0.7)	2.7(1.3)	<0.001
	Pain	1.0(0.2)	3.0(1.2)	<0.001	1.2(0.4)	2.7(1.2)	<0.001	1.2(0.6)	3.4(1.0)	<0.001
Psychological discomfort	Food stagnation b/w teeth	1.2(0.6)	2.5(1.2)	<0.001	1.4(0.9)	2.5(1.3)	<0.001	1.3(0.8)	3.2(1.2)	<0.001
	Embarrassment	1.4(0.9)	1.4(0.9)	.062	1.3(0.7)	1.4(1.0)	.085	1.1(0.5)	2.0(1.3)	<0.001
Physical disability	Avoidance of eating certain food	1.0(0.1)	3.0(1.3)	<0.001	1.5(1.0)	2.7(1.3)	<0.001	1.2 (0.7)	3.2(1.4)	<0.001
	Avoid smiling	1.5(1.0)	1.7(1.2)	0.11	1.4(1.0)	1.6(1.1)	.075	1.2(0.6)	2.2(1.3)	<0.001
Psychological Disability	Disturbed sleep	1.0(0.1)	1.7(1.0)	<0.001	1.1(0.4)	1.6(1.0)	<0.001	1.0(0.3)	1.9(1.1	<0.001
	Concentration affected	1.0(0.1)	1.8(1.2)	<0.001	1.2(0.8)	1.7(1.2)	<0.001	1.1(0.6)	1.7(1.1)	<0.001
Social disability	Avoid going out	1.0(0.1)	1.4(1.0)	.001	1.0(0.4)	1.3(0.9)	.023	1.0(0.2)	1.4(0.8)	<0.001
	Difficulty carrying out daily activities	1.0(0.0)	1.3(0.8)	.001	1.0(0.2)	1.4(1.0)	.002	1.1(0.4)	1.3(0.9)	<0.001
Handicap	Lack of self confidence	1.1(0.6)	1.3(0.7)	0.19	1.0(0.3)	1.2(0.7)	.083	1.0(0.2)	1.5(1.0)	<0.001
	Difficulties in cleaning	1.0(0.3)	2.6(1.4)	<0.001	1.3(0.6)	2.6(1.3)	<0.001	1.5(0.8)	3.7(1.1)	<0.001

Results show P-values from paired t-test.
OHIP: Oran Health Impact Profile.
SD: Standard deviation.

Table-4: Comparing mean difference of OHIP-16 baseline and 24 h following insertion between gender and age groups.

Variable	n	Separators Mean Differences (SD)	P	Bands Mean Differences(SD)	P	Brackets Mean Differences (SD)	P
Gender							
Male	20	1.8(1.1)	0.04	1.6(1.2)	0.11	2.2(1.1)	0.7
Female	50	2.1(1.3)		1.8(1.4)		2.1(1.2)	
Age Group							
Adolescent	41	2.0(1.3)	0.85	1.5(1.4)	0.01	2.2(1.2)	0.7
Young adult	29	2.1(1.2)		1.9(1.3)		2.1(1.2)	

Results show P-values from independent sample t-test.
OHIP: Oran Health Impact Profile.
SD: Standard deviation.

Discussions

The study was carried out to evaluate OHRQoL changes 24h after the insertion of fixed orthodontic appliance therapy components like separators, bands and brackets. OHRQoL was assessed at 6 steps; before and 24h after the insertion of elastomeric separators, bands and brackets. The mean scores for each domain and item of OHIP-16 was compared at baseline and 24 hours after the fixation of orthodontic appliances.

Interestingly, OHIP-16 scores at T0 were low for all separators, bands and brackets, suggesting that despite having a perceived orthodontic treatment need, the effect of malocclusion on OHRQoL was insignificant. These findings were similar to other studies involving other patient groups.[20] However, a few patients reported embarrassment and lack of self-confidence before the placement of separators due to their malocclusion which had indirect effects on their aesthetics, but the results were statistically insignificant.

In our study, all OHIP-16 domains were significantly higher 24 hours after the insertion of fixed orthodontic appliances, which is in line with another study[17] in which all OHIP-16 domains significantly increased 24h after orthodontic brackets except for the social disability and handicap domains.

Another study found that fixed orthodontic treatment had a negative impact on the OHRQoL of adults during the first 3 months of therapy, with a declining tendency in

scores after 6 months of treatment, and scores returned to the pre-treatment levels only at the end of the treatment.[21]

The current found that OHIP-16 items were significantly affected 24 hours after the insertion of orthodontic brackets. However, in case of separators and bands, lack of self-confidence, avoid smiling and embarrassment were not significantly affected because patients did not feel that separators and bands affected their appearance compared to the brackets which would easily show when the patients smile as face is the centre of attraction when communicating with people, leading to an increased embarrassment and lack of self-confidence. A study[17] concluded that all OHIP-16[M] items were significantly affected except for food stuck in between teeth and avoiding going out. In the current study the participants complained about the food impaction because of being unable to clean the food which got stuck between their teeth, although oral hygiene instructions were given to all the patients in each visit. Participants avoided going out due to the pain and discomfort they perceived 24 hours after the insertion of separators, bands and brackets.

A study[21] found OHIP domains most significantly affected were physical pain, psychological discomfort, and physical disability within 1 week after the fixation of the appliances.

Similar but more pronounced results were found in the current study as all the OHIP-16 domains were equally affected 24 hours after the insertion of appliances.

According to a study,[4] the psychological discomfort and disability domains contributed most significantly to impact reduction in OHRQoL. Similarly, in our study the psychological disability domain items, such as sleep and concentration, were significantly affected a day after the insertion of the components, which may be because these domains are related to the adaptation period required to cope up with the newly-placed therapeutic components in the oral cavity.

In our study, almost all participants reported pain and discomfort on chewing and eating 24h after the insertions. Other studies with similar results reported a significant increase in the level of discomfort post-intervention at 4 hours and 24 hours which gradually decreased by day 3.[22-26]

Studies have also stated that the pain and discomfort after wearing fixed appliances starts 2h after the placement of the appliances, reaches its peak intensity at 24h, and decreases progressively over the next 5-7 days.[27,28]

A study[29] reported that pain resulting from orthodontic therapy has pronounced influence on the daily activities of patients. These findings are in accordance with our study where participants reported significantly marked influence in carrying out daily activities 24hours after insertion of separators, bands and brackets among which separators affected the daily activities more than the bands and the brackets.

Patients who used analgesics pre- or post-operatively were excluded from our study because analgesics tend to reduce the pre and post-operative orthodontic pain and could contribute to biased results. Several studies have found that analgesics reduce orthodontic pain. The efficacy of anti-inflammatory drugs such as aspirin and ibuprofen have been evaluated previously.[30-33]

The participants in our study reported that they had significant disturbances in sleeping after the placement of all the three elements which is due to the quality of sleep affected as a result of newly-placed appliances in the oral cavity. Our results are consistent with other studies[28] that reported a diurnal variation due to increase in perceived pain in evenings and night time. On the other hand, another study[34] found no significant effects on the sleep quality of patients wearing orthodontic appliances with those who were not wearing them.

Most of the patients in our study reported frequent ulceration which followed the procedures. This is due to the mechanical trauma of the oral tissues caused by fixed orthodontic appliances. These results related with a study[35] which reported that 47% of the patients complained of frequent ulceration during fixed orthodontic treatment.

We found that females had significantly higher mean difference in OHRQoL 24h after the procedures compared to males. These results are similar to other studies.[17,36,37]

Our study showed no significant mean differences in OHRQoL between males and females, which is in accordance with other studies.[23,24,26]

No significant mean difference was found between the two age groups in our study. However, young adults had significantly higher mean difference following insertion of bands compared to the adolescents. Literature[17,25,30,38] has reported that younger patients perceived pain significantly less frequently than the elder patients. However, one study[27] found that age did not have significant impact on the discomfort level in patients undergoing orthodontic treatment.

The present study has limitations that should be

addressed. Sample size was relatively small, and, hence, interpretation of the results has to be done with caution. A bigger sample size could have provided a more detailed information regarding the impact of orthodontic treatment on patients' OHRQoL. Secondly, the sample was collected from the orthodontics department of a single institution. A multi-centre study may have produced diverse results. Also, this was done by a single practitioner, so no comments can be made on technique variations. The follow-up period was only 24h for each component of the fixed appliance therapy. A longer follow-up should be observed in future studies. As the second questionnaire was filled after 24h, we could not find out if the pain was more severe before 24h, at 24h or after that. It is quite possible that the variability in options of answers which need to be selected in OHRQoL might have caused difficulties for participants in choosing one of them. However, the instrument used in the study has had its validity demonstrated in several countries.[17,18,39-43] Future studies should aim at minimizing these limitations and should also evaluate the association between clinical parameters and OHRQoL.

Conclusions

OHRQoL significantly deteriorated 24 hours after the insertion of separators, bands and brackets placed for fixed orthodontic treatment. There was no significant gender variation in quality of oral health deterioration for bands and brackets, but males showed better toleration for separator placement. There was not significant age variation in tolerating separators and brackets, but the adolescents showed better oral health quality after band placement compared to the young adults.

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References

1. US Department of Health and Human Services. Oral Health in America: A Report of the Surgeon General-Executive Summary. Rockville, MD: National Institute of Dental and Craniofacial Research; 2000.
2. Inglehart MR, Bagramian RA, editors., editors (2002). Oral health-related quality of life: an introduction. In: Oral health-related quality of life. Chicago: Quintessence Publishing Co., Inc., pp. 1-6.
3. Mortensen MG, Kiyak HA, Omnell L. Patient and parent understanding of informed consent in orthodontics. Am J Orthod Dentofacial Orthop. 2003; 124: 541-550.
4. Feu D; Miguel J A ; Celestec R K ; Oliveirad B H. Effect of orthodontic treatment on oral health-related quality of life. Angle Orthod. 2013; 83: 892-898.
5. Johal A, Alyaqoobi I, Patel R and Cox S. The impact of orthodontic treatment on quality of life and self-esteem in adult patients. Eur J Orthod. 2015; 37: 233-237.
6. de Oliveira C. M. and Sheiham A. Orthodontic treatment and its impact on oral health-related quality of life in Brazilian adolescents. J Orthod. 2004; 31: 20-27.
7. Palomares N, Celeste R, de Oliverira B, Miguel J. How does orthodontic treatment affect young adults' oral health-related quality of life? Am J Orthod Dentofacial Orthop. 2012; 141: 751-758.
8. Oliver RG, Knapman YM. Attitudes to orthodontic treatment. Br J Orthod. 1985; 12: 179-188.
9. Kiyak HA. Does orthodontic treatment affect patient' quality of life? J Dent Educ 2008; 72: 886-94.
10. Lew KK. Attitudes and perceptions of adults towards orthodontic treatment in an Asian community. Community Dent Oral Epidemiol 1993; 21; 31-5.
11. Zhang M, McGrath C, Hagg U. Changes in oral health related quality of life during fixed orthodontic appliance therapy. Am J Orthod Dentofacial Orthop. 2008; 133: 25-29.
12. Bernab? E, Sheiham A, de Oliveira CM. Impacts on daily performances related to wearing orthodontic appliances. Angle Orthod 2008; 78: 482-6.
13. Miller KB, McGorray SP, Womack R, Quintero JC, Perelmuter M, Gibson J, et al. A comparison of treatment impacts between invisalign aligner and fixed appliance therapy during the first week of treatment. Am J Orthod Dentofacial Orthop 2007; 131: 302. e1-9.
14. Liu Z, McGrath C, Hägg U. Changes in oral health related quality of life during fixed orthodontic appliance therapy: An 18 month prospective longitudinal study. Am J Orthod Dentofacial Orthop 2011; 139: 214-9.
15. Costa AA, Ferreira MC, Serra Negra JM, PordeusI A, Paiva SM. Impact of wearing fixed orthodontic appliances on oral health related quality of life among Brazilian children. J Orthod 2011; 38: 275-81.
16. Shalish M, Cooper Kazaz R, Ivgi I, Canetti L, Tsur B, Bachar E, et al. Adult patients' adjustability to orthodontic appliances. Part I: A comparison between Labial, Lingual, and Invisalign TM. Eur J Orthod 2012; 34: 724-30.
17. Mansor N, SaubR, Othman S A, Changes in the oral health-related quality of life 24 h following insertion of fixed orthodontic appliances. J Orthod Sci. 2012; 1: 98-102.
18. Saub R. Development of an oral health related quality of life measure for the Malaysian adults' population: Cross cultural adaptation of the oral health impact profile. PhD Thesis, Canada: University of Toronto; 2004.
19. Saub R, Locker D, Allison P. Derivation and validation of the short version of the Malaysian oral health impact profile. Community Dent Oral Epidemiology 2005; 33: 378-83.
20. Zhang M ;McGrath ; Ha¨ggU.Patients' Expectations and Experiences of Fixed Orthodontic Appliance Therapy Impact on Quality of Life. Angle Orthod. 2007; 7: 2.
21. Chen M, Wang DW, Wu LP. Fixed orthodontic appliance therapy and its impact on oral health-related quality of life in Chinese patients. Angle Orthod. 2010; 80: 49-53.
22. Jones ML. An investigation into the initial discomfort caused by placement of an archwire. Eur J Orthod. 1984; 6: 48-54.
23. Ngan P, Kess B, Wilson S. Perception of discomfort by patients undergoing orthodontic treatment. Am J Orthod Dentofacial Orthop. 1989; 96: 47-53.
24. Scheurer PA, Firestone AR, Bürgin WB. Perception of pain as a result of orthodontic treatment with fixed appliances. Eur J Orthod. 1996; 18: 349-57.
25. Erdinc AM, Dincer B. Perception of pain during orthodontic treatment with fixed appliances. Eur J Orthod. 2004; 26: 79-85.
26. Scott P, Sherriff M, Dibiase AT, Cobourne MT. Perception of discomfort during initial orthodontic tooth alignment using a self-

ligating or conventional bracket system: A randomized clinical trial. Eur J Orthod. 2008; 30: 227-32.
27. Jones ML, Chan C. The pain and discomfort experienced during orthodontic treatment. A randomised clinical trial of two initial aligning arch wires. Am J Orthod Dentofacial Orthop. 1992; 102: 373-81.
28. Sergl, H.G., Klages, U. and Zenter, A. Pain and discomfort during orthodontic treatment: causative factors and effects on compliance. Am J Orthod Dentofacial Orthop. 1998; 114, 684-691.
29. Brown DF, Moerenhout RG. The pain experience and psychological adjustments to orthodontic treatment of preadolescents, adolescents and adults. Am J Orthod Dentofacial Orthop. 1991; 100: 349-56.
30. Ngan PW, Wilson S, Shanfeld J, Amini H. The effect of ibuprofen on the level of discomfort in patients undergoing orthodontic treatment. Am J Orthod Dentofacial Orthop. 1994; 106: 88-95.
31. Law SLS, Southard KS, Law AS, Logan HL, Jakobsen JR. An evaluation of postoperative ibuprofen treatment of painassociated with orthodontic separator placement. Am J Orthod Dentofacial Orthop. 2000; 118: 629-635.
32. Bernhart MK, Southhard KA, Batterson KD, Logan HL, BakerKA, Jakobsen JR. The effect of preemptive and/or postoperative ibuprofen therapy for orthodontic pain. Am J Orthod Dentofacial Orthop. 2001; 120: 20-27.
33. Jackson D, Moore P, Hargreaves K. Postoperative non-steroidal anti-inflammatory medication for the prevention of postoperative dental pain. J Am Dent Assoc. 1989; 119: 641-647.
34. Rawji A, Parker L, Deb P, Woodside D, Tompson B, Shapiro CM. Impact of orthodontic appliances on sleep quality. Am J Orthod Dentofacial Orthop. 2008; 134: 606-14.
35. Kvam E, Bondevik O, Gjerdet NR. Traumatic ulcers and pain during orthodontic treatment. Community Dent Oral Epidemiol. 1989; 17: 154-7.
36. McGrath C, Bedi R. Gender variations in the social impact of oral health. J Ir Dent Assoc. 2000; 46: 87-91.
37. Riley JL, 3rd, Robinson ME, Wise EA, Myers CD, Fillingim RB. Sex differences in the perception of noxious experimental stimuli: A meta-analysis. Pain. 1998; 74: 181-7.
38. Muir JC, Wareing MG, McDonald AJ. Orthodontic treatment for adults. N Z Dent J. 1986; 82: 143-6.
39. Jokovic A, Locker D, Stephens M, et al. Validity and reliability of a questionnaire for measuring child oral health-related quality of life. J Dent Res. 2002; 81: 459-463. 13.
40. Foster Page LA, Thomson WM, Jokovic A, et al. Validation of the Child Perceptions Questionnaire (CPQ 11-14). J Dent Res. 2005; 84: 649-652.
41. Ngom PI, Attebi P, Diouf JS, Diop Ba K, Badiane A, Diagne F. Translation and cultural adaptation of a French version of the psychosocial impact of dental aesthetics questionnaire: PIDAQ. Orthod Fr. 2013; 84: 319-331. 19.
42. Singh VP, Singh R. Translation and validation of a Nepalese version of the Psychosocial Impact of Dental Aesthetic Questionnaire (PIDAQ). J Orthod. 2014; 41: 6-12. 20.
43. Bucci R, Rongo R, Zito E, Galeotti A, Valletta R, D'Anto` V. Cross-cultural adaptation and validation of the Italian Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ). Qual Life Res. 2015; 24: 747-752.