

Impact of malocclusion on oral health related quality of life of 11-14-year-old children

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Abstract

Background

This study investigates the impact of malocclusion on the oral health-related quality of life (OHRQoL) of 11-14-year-old children.

Methods

This cross-sectional study was conducted among 250 caregiver/child (11-14-year-olds) dyads seeking orthodontic consultation at the orthodontic center at King Abdulaziz Medical City (KAMC), Riyadh, Saudi Arabia. Oral health related quality of life (OHRQoL) was assessed using child perception questionnaire 11-14 (CPQ 11–14) and the Dental Aesthetic Index (DAI) was used to assess severity of malocclusion. CPQ 11–14 scores ranged from 0 to 64, with lower scores representing a better quality of life. Multivariate analysis of variance (MANOVA) was used to assess differences between domain and total CPQ 11–14 scores with the co-variates.

Results

The mean CPQ 11–14 score was 19.89 ± 9.8 . Mean scores for the global rating, oral symptoms, functional limitations, emotional well-being, and social well-being domains were 4.91 ± 2.15 , 5.26 ± 3.22 , 3.67 ± 3.58 , 3.98 ± 3.89 and 2.08 ± 2.98 , respectively. The distribution of subjects across the four severity categories was minor/none – 37%, definite – 22%, severe – 15% and very severe 24%. The overall and domain-specific scores of CPQ 11–14 varied across the different categories of malocclusion. In the comparisons by pairs, it was found that children with very severe malocclusion had significantly higher scores for the social well-being domain and global rating of oral health as compared to children with no/minor malocclusion ($p < 0.05$).

Conclusion

Substantial variability in the well-being domain of CPQ 11–14 was observed among children with no/minor malocclusions as compared to children with severe malocclusions.

Background

Malocclusion is a developmental condition where there is a deflection from the normal relation or alignment of the teeth to other teeth in the same arch and/or to the teeth in the opposing arch.[1] The etiology of malocclusion is multifactorial and can be a combination of hereditary factors including some stimulus during the formation and development of orofacial structures and environmental factors such as oral habits, social characteristics and diet.[2] High prevalence of malocclusion has been reported in the literature [3]. A study conducted in Saudi population found that the prevalence of malocclusion was about 68%.[4] The high prevalence of malocclusion makes it a significant public health problem and is now being given the third highest oral health priority by the World Health Organization. [5]

Malocclusion negatively impacts not only the oral health but also the quality of life. Malocclusion affects the function, appearance, social life and self-esteem, which are different components of Oral Health-Related

Quality of Life (OHRQoL).[6] The OHRQoL is frequently defined as a composition of self-report, specifically pertaining to oral health that captures the functional, social and psychological impacts of oral disease.[7] Factors that can influence OHRQoL include dental caries, gingivitis, and malocclusion. However, malocclusion may have a stronger and longer-lasting impact on OHRQoL than the other factors due to the significant functional limitations in severe cases.[8] Child Perceptions Questionnaire for 11-14-year-old (CPQ11–14) children is a validated and reliable questionnaire to assess the child's OHRQoL. CPQ11–14 has been widely used to assess the quality of life of children in the age group of 11–14 years.[9] The long version of the CPQ11–14 has been cross-culturally validated among Saudi children.[4, 10] Bhayat et al.[11] validated the short Arabic version of CPQ_{11–14}.

The Dental Aesthetic Index (DAI) is one of the several indices used to measure malocclusion.[12] It also aims to predict the clinical judgment of orthodontists by separating handicapping and non-handicapping malocclusions. The DAI has been found acceptable due to its simplicity, reproducibility and validity. It has been adopted by the World Health Organization as a crosscultural index[13] and applied in diverse ethnic groups without modification.[14, 15]

Several studies have shown the association between malocclusion and OHRQoL in different populations and different age-groups. [9, 16–18] Although several studies have explored the relationship between malocclusion and children's OHRQoL, results are conflicting; some report a significant association between DAI and CPQ_{11–14} scores[4, 17] and others fail to do so.[19–21] This highlights the importance of reestablishing the psychometric properties of any instrument by using it in different settings and cultural contexts. Therefore, the aim of this study was to assess the relationship between malocclusion severity and 11-14-year-old children's quality of life at a tertiary dental care center in Riyadh, Saudi Arabia.

Materials And Methods

Ethical Approval

This study received ethical approval from the Institutional Review Board of King Abdullah International Medical Research Center, Riyadh, and is reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for observational studies.[22] Written informed consents were obtained from those parents who agreed to participate in this study.

Study design and study subjects:

This cross-sectional study was conducted among 250 caregiver/child (11-14-year-olds) dyads seeking orthodontic consultation at the orthodontic center at King Abdulaziz Medical City (KAMC), Riyadh, Saudi Arabia. All children who are currently undergoing or had undergone orthodontic treatment in the past were excluded from the study.

Sample Size:

The mean CPQ11–14 score in the unexposed group (those without treatment needs, as defined by the DAI) was taken as 15.7 (standard deviation [SD] 16.7) and in the exposed group (those with treatment needs, as

defined by the DAI) was taken as 25.5 (SD 16.5).[4] The ratio of exposed to unexposed was 1:1, and a correction factor of 2 (design effect) was applied to increase precision. The minimum sample size to satisfy the requirements was estimated to be 184 children. Taking into consideration possible nonresponse attrition, it was determined that 250 children would be required to obtain a power of 80% with a 95% confidence interval (95% CI).

Data collection methods, instruments used, measurements :

This cross-sectional study was conducted between September to December, 2017 at the dental center of King Abdulaziz Medical City (KAMC) Riyadh, Saudi Arabia. Convenient sampling technique was adopted to recruit the participants for this study. Data were collected using questionnaires and clinical examination. The questionnaire collected the background information of the parents and the CPQ₁₁₋₁₄. CPQ₁₁₋₁₄ consists of 16 closed-ended questions that are divided into 4 domains of 4 questions each: oral symptoms; functional limitations; emotional well-being and social well-being. Each questions was scores as: 0-never, 1-once\twice, 2-sometimes, 3-often and 4-every day\almost every day. Each domain was added separately to give a mean total CPQ₁₁₋₁₄ score. The scores ranged from 0 to 64, with lower scores representing a better quality of life. In addition, global rating of oral health was assessed using two specific questions: 1) rate the quality of their oral health (scored as: 1-fair, 2-good, 3-very good, 4-excellent; and 2) the importance of good oral health for general well-being (scored as: 1-less important, 2-somewhat important, 3-important, 4-very important).

Malocclusion was assessed using Dental Aesthetic Index (DAI) (number of variables= 10).[23] The DAI measures 10 prominent traits of malocclusion, weighted on the basis of their relative importance, to produce a single score.[24] The 10 traits are: missing teeth, crowding, spacing, diastema, overjet, reverse overjet, and open bite and molar relationship. Each variable is given a certain score according to the criteria proposed by its author. The scores are further calculated according to a formula that will result in a final single score ranging from 0 to 36 or higher. DAI of 25 or below are considered normal; 26-30 are those with definite malocclusion and treatment is elective; 31-35 denote severe malocclusion with treatment considered as highly desirable; scores of 36 and higher represent very severe malocclusion with treatment indicated mandatory. Five final year dental students underwent training and calibration for recording DAI at the College of Dentistry, King Saud Bin Abdulaziz University for Health Science Studies, Riyadh. Kappa scores for inter- and intra-examiner reliability were 0.80 and 0.86 respectively.

Data Management and Analysis Plan:

Data were entered and cleaned using SPSS version 22 (Statistical Package for the Social Sciences for Windows; SPSS Inc., Chicago, IL, USA). Multivariate analysis of variance (MANOVA) was used to assess differences between domain and total CPQ₁₁₋₁₄ scores with the co-variates (socio-demographic variables and DAI categories) . Post hoc comparisons between pairs of malocclusion groups were conducted using Bonferroni test. A p value of <0.05 was chosen as the cut off for statistical significance.

Results

A total of 250 (response rate = 83%) child-parent dyads participated in this study. The distribution of the socio-demographic variables by CPQ₁₁₋₁₄ mean scores is shown in Table 1. The domain and total scores of

CPQ₁₁₋₁₄ is shown in Table 2. The mean CPQ₁₁₋₁₄ score was 19.89±9.8. Mean scores for the global rating, oral symptoms, functional limitations, emotional well-being, and social well-being domains were 4.91±2.15, 5.26±3.22, 3.67±3.58, 3.98±3.89 and 2.08±2.98, respectively (Table 3). Domain-specific scores showed that the highest mean score was for oral symptoms and the lowest score was for social well-being. The distribution of subjects across the four severity categories was minor/none – 37%, definite – 22%, severe – 15% and very severe 24% (Table 3). The overall and domain-specific scores of CPQ₁₁₋₁₄ varied across the different categories of malocclusion. In the comparisons by pairs, it was found that children with very severe malocclusion had significantly higher scores for the social well-being domain and global rating of oral health as compared to children with no/minor malocclusion. There was no statistically significant difference in the domain or total CPQ₁₁₋₁₄ scores by any of the sociodemographic variables.

Table 1

Total Scores on the Child Perception Questionnaire (CPQ₁₁₋₁₄) for the socio-demographic variables

Co-variables		N (%)	CPQ ₁₁₋₁₄ Mean (SD)	p value*
Age	11 years	106 (42.4)	20.14 (9.90)	0.20
	12 years	55 (22.0)	18.65 (9.01)	
	13 years	49 (19.6)	22.04 (10.75)	
	14 years	40 (16.0)	18.02 (9.26)	
Gender	Male	64 (25.6)	19.45(10.88)	0.68
	Female	186 (74.4)	19.97(9.44)	
Mother's educational level [^]	Less than high school	84 (33.6)	20.68(10.16)	0.49
	High school or diploma	73 (29.2)	19.57(8.43)	
	Bachelor	77 (30.8)	19.86(9.39)	
	Master and above	11 (3.2)	18.75(21.78)	
Father's educational level [^]	Less than high school	47 (18.8)	20.91(11.09)	0.26
	High school or diploma	97 (38.8)	20.11(9.10)	
	Bachelor	83 (33.2)	18.79(8.85)	
	Master and above	17 (5.2)	24.00(17.45)	
Family monthly income [^]	Less than 5000 SAR	42 (16.8)	22.09(12.36)	0.40
	5000-15,000 SAR	88 (35.2)	20.10(9.02)	
	15,000–20,000 SAR	72 (28.8)	18.94(8.12)	
	More than 20,000 SAR	38 (15.2)	19.44(11.89)	
[^] Presence of missing values * Analysis of variance (ANOVA) SAR – Saudi Arabian Riyals				

Table 2
Domain and Total Scores on the Child Perception Questionnaire (CPQ₁₁₋₁₄) for 11- to 14-year-old children in the sample

Items	No. of Items	Possible Range	Observed Range	Mean(SD)
Oral symptoms	4	0–16	0–16	5.26 (3.22)
Functional limitation	4	0–16	0–16	3.67 (3.58)
Emotional well-being	4	0–16	0–16	3.98 (3.89)
Social well-being	4	0–16	0–16	2.08 (2.98)
Total CPQ11-14 score	16	0–64	2–62	19.89 (9.80)

Table 3

Domain and Total Scores on the Child Perception Questionnaire for 11- to 14-year-old Children (CPQ₁₁₋₁₄) by Dental Aesthetic Index (DAI) Malocclusion Severity

Severity of Malocclusion	N (%)	Global Rating Mean(SD)	Oral health related quality of life (OHRQoL)				
			Oral symptoms Mean(SD)	Functional limitation Mean(SD)	Emotional well-being Mean(SD)	Social well-being Mean(SD)	Total CPQ ₁₁₋₁₄ score Mean(SD)
No/Minor	94 (37.6)	5.34 (2.02) ^a	5.28 (3.17)	3.55 (3.60)	3.92 (3.97)	1.51 (2.33) ^b	19.62 (9.83)
Definite	56 (22.4)	5.07 (2.13)	4.80 (2.85)	3.53 (3.25)	3.43 (3.54)	1.75 (2.54)	18.59 (8.14)
Severe	38 (15.2)	4.79 (2.06)	5.71 (3.86)	3.57 (4.38)	3.68 (4.26)	2.65 (4.08)	20.42 (13.05)
Very severe	62 (24.8)	4.19 (2.23) ^a	5.40 (3.22)	3.87 (3.38)	4.80 (3.76)	2.88 (3.20) ^b	21.16 (8.83)
Total Mean Score	250 (100.0)	4.91 (2.15) [*]	5.26 (3.22)	3.67 (3.58)	3.98 (3.89)	2.08 (2.98) [*]	19.89 (9.80)
<p>[*] Multivariate analysis of variance (MANOVA) was used for combined and individual comparisons (Wilks' lambda test; $p < 0.05$). The P values were obtained from individual three-way analysis of variance tests controlling for child's demographic characteristics (age, gender, parents educational levels and family income status). Superscripts indicate which pairs of malocclusion severity groups were statistically different ($p < 0.05$) for a particular domain score or the total score</p> <p>^{a,b} Significant at $p < 0.05$</p>							

Discussion

Malocclusion has been shown to play an important role in adolescents' psychological and social well-being. [25] In this study, severe malocclusion was found to negatively impact the social well-being domain of CPQ11–14. This is similar to the study findings of Agou et al.[17], which found DAI scores to be correlated with social well-being and emotional well-being domain scores. Although, lowest CPQ11–14 scores were observed for the 'minor' category of the DAI and highest for the 'severe' category, a clear gradient was not observed across the four categories and differences in the total CPQ11–14 scores were not significant. This is similar to the findings of Dawoodbhoy et al.[4] and Locker et al.[19], who also reported the lack of a clear gradient across different levels of malocclusion. It may be due to differences in the overall sample size, and the distribution of subjects and sample sizes across the four treatment need categories.

As with any quality of life study, respondents' socio economic factors are considered to be very important confounders. In the present study, the total CPQ11–14 scores were higher for females compared to males, though the difference did not reach statistical significance. Similarly, previous studies by de Paula Júnior *et al.* [26] and Tessarollo *et al.*[27] reported that females and males were equally affected on all the four domains of CPQ11–14. However, in the Foster Page *et al.*[28] study, the mean emotional well-being domain score was higher for girls than for boys. This difference can be attributed to the difference in the selection of subjects as Foster Page et al.[28] conducted a population based study as compared to our hospital based study. Our study sampling was conveniently done and focused on children whose ages are in between 11-14 years old as it is a sensitive age group which is considered as an early teenage. A recent systematic review by Kragt *et al.*[18], showed that the children between the age of 11 and 14 years were more likely to show impact of malocclusion on OHRQoL as compared to younger age group.

Subjective perception towards oral health is a very important as it directly influences oral health behaviors. In this study the global rating score can be considered as a measure of the respondents perception towards oral health. Higher scores, indicating better attitude towards oral health was observed among children who had no/minor malocclusion as compared with those who had severe malocclusion. This is in consensus with a previous study which reported strong relationship between self rating of OHRQoL and malocclusion.[29]

The OHRQoL measures have the potential to provide an understanding how oral conditions affect everyday life- aspects that are crucial to individuals.[30] Malocclusion may affect children's quality of life due to different reasons such as; cultural influences, treatment expectations, and access to orthodontic services. Our findings suggest that clinicians should consider subjective measures like quality of life along with their clinic assessment in treatment planning. The OHRQoL measures have the potential to provide insights into how oral conditions affect aspects of everyday life that are important to people. Consequently, they can complement traditional or professionally determined outcome measures for the assessment of orthodontic treatment needs in addition to prioritization of care to those who need it most.

There are several limitations to this study: firstly, this was a hospital based study on a convenient sample of patients reporting for orthodontic consultation at the dental center. Therefore, the sample may not represent the general population of children in Saudi Arabia. A population based study may not provide us with adequate number of children with severe or very severe malocclusion, to enable comparison across different levels of malocclusion severity. Secondly, CPQ11–14 is not a malocclusion specific OHRQoL measure, and as such, it captures effects on quality of life attributed by all oral conditions. Caries experience is a potential

confounder in these types of studies, however, the children in this study had undergone complete resorative care prior to being seen in the orthodontic clinics. Caution must be exercised in interpreting the study findings until these findings can be confirmed by larger, multicentric investigations.

Conclusions

Substantial variability in the well-being domain of CPQ11–14 was observed among children with no/minor malocclusions as compared to children with severe malocclusions.

Abbreviations

CPQ – Child perception questionnaire

DAI- Dental Aesthetic Index

OHRQoL – Oral health related quality of life

Declarations

Ethics approval and consent to participate: Written informed consent were obtained for study participation. The research was conducted in accordance with the World Medical Association Declaration of Helsinki and approved by the Institutional Review Board (IRB) of King Abdullah International Medical Research Center, Riyadh.

Consent for publication: Not Applicable

Availability of data and materials: The datasets used and/or analysed during the current study available from the corresponding author on reasonable request.

Competing interests: The author declare that he has no competing interests.

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Authors' contributions: AG and JKB designed the study and have taken an active role in data collection, analysis and drafting and revising the manuscript. WA, HA,AAG, AAE and AAM have taken an active role in data collection, analysis and drafting the manuscript. All the authors have read and approved the final manuscript.

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