Orthodontic Treatment Need and Oral Health Related Quality of Life in Students in Isfahan

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Abstract

Objective: Oral health status particularly maxillofacial disorders in adolescents can affect different aspects of the quality of life. This study aimed to assess the age-related quality of life of students in two age groups of 11-14 years and 14-18 years to evaluate its correlation with orthodontic treatment need in adolescents in Isfahan.

Methods: This cross-sectional study was conducted on 11-18 year-old middle school and high-school students. Subjects were selected via two-stage stratified random sampling from 30 schools in different areas of Isfahan city. After examination by two calibrated clinicians, Dental Health Component of Index of Orthodontic Treatment Need (DHC-IOTN) was recorded for all subjects. The Oral Health Related Quality of Life (OHRQoL) was assessed using self-reported Child Perception Questionnaire (CPQ) in 11-14 year-olds and Child Oral Health Impact Profile (COHIP) in 14-18 year-olds. After descriptive analyses, the correlation between the DHC-IOTN and the quality of life score of subjects was assessed using the Spearman's correlation test and the Mann Whitney U test.

Results: A total of 1,227 students were evaluated. The mean and standard deviation (SD) was found to be 18.3 (13.7) for CPQ score in 11-14 year olds. For COHIP score it was found to be 103.6 (18) in 14-18 year olds. A total of 22% from the 604 students examined in the first group, and 17% of 570 students in the second group definitely needed orthodontic treatment. Significant differences existed in the mean quality of life score among the three groups requiring orthodontic treatment in the two age groups (p<0.05). The correlation between the malocclusion severity and quality of life subscales was weak.

Conclusion: Based on the results, malocclusion significantly affects the dental function and social and emotional domains of quality of life. However, considering the role of confounders, studies with condition-specific formats of the questionnaire are required to assess the correlation of malocclusions with the quality of life after controlling for other factors.

Key words: COHIP, CPQ, Index of Orthodontic Treatment Need, Malocclusion, Oral Health Related Quality of Life.

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Introduction:

By the advances in science and technology, people anticipate higher quality of life particularly when it comes to health status. The ultimate goal of all dental treatments is to promote oral health and related quality of life in the function, social and emotional aspects (1, 2). Malocclusion is a common dental problem with high prevalence rates of 70% in the United States (3), 36.4% in a province in India (4), 92% in Jordan (5), 76% in Nigeria (6), 70% in Hungary (7) and 64% in Tanzania (8). According to a study by Borzabadi-Farahani *et*

al. in 2009, the prevalence of malocclusion in Iranian adolescents was 84% (9). In the recent decades, demand for orthodontic treatment to correct dental anomalies has greatly increased worldwide. This increase cannot be justified by the clinical criteria for oral and dental health. Children and their parents believe that orthodontic treatment can improve their dental function, esthetics and quality of life (1, 10, 11). Moreover, psychosocial aspects of the OHRQoL (such as a beautiful smile, showing the teeth with no concerns and not being mocked because of the anesthetic appearance of the teeth) are among the main reasons for patients seeking orthodontic treatment (10).

The relationship of OHRQoL with different fields of dentistry especially orthodontics has been well established (1, 11, 12). In a large number of patients, the appearance of the teeth and face has reported to be a more important reason for orthodontic treatment compared to the function of the teeth (5, 13). Thus, for orthodontic treatment need assessment, factors related to the quality of life from the perspectives of patients as well as occlusal parameters from the clinicians' perceptive must be considered; because occlusal factors alone cannot accurately assess the need for orthodontic treatment (10, 14-16). The relationship of the OHRQoL with malocclusion is unpredictable in different populations or groups in one community. Thus, this issue must be investigated separately in different populations (1, 11, 17). On the other hand, children and adolescents are the main candidates for orthodontic treatment from both the psychosocial and functional aspects (11). Thus, studies on the relationship of orthodontic treatment and quality of life must mainly focus on this age group. Orthodontic treatment is costly and imposes a high cost on patients and the community (10, 12). Therefore, it should be evaluated that whether or not the malocclusion or the need for orthodontic treatment decreases the quality of life of subjects in developing countries like Iran.

The CPQ is among the most reliable tools for assessment of OHRQoL in children, which was introduced by Jockovic *et al*. in 2002 and its reliability and validity were confirmed (18). Children in different age groups based on their stage of cognitive perception use this questionnaire designed for the three age groups of 6-7 years, 8-10 years and 11-14 years (19). This questionnaire is the most commonly used tool for the assessment of the quality of life in relevant studies on 11-14 year olds (10). The reliability and validity of the Farsi version of this questionnaire have also been confirmed (20).

The COHIP questionnaire is also a suitable tool to determine the quality of life of adolescents. It was first introduced by Broder in New Jersey University in 2007 to assess the quality of life of subjects aged 8-17 years (21). This tool was also used in an Iranian population and its reliability and validity were confirmed (22).

Bernabe *et al*. (2008) assessed the correlation of the need for orthodontic treatment with the quality of life of Brazilian adolescents using Oral Impacts on Daily Performances questionnaire and concluded that this correlation was significant and by decreased need for orthodontic treatment, the quality of life improved (23). According to a study by Zhang *et al*. in 2009, subjects who did not require orthodontic treatment had higher OHRQoL compared to those requiring orthodontic treatment. They used CPQ and Index of Orthodontic Treatment Need (IOTN) questionnaires (24). Liu *et al*. in 2009 in a systematic review assessed this correlation and showed a mild relationship between the malocclusion and the need for orthodontic treatment with the quality of life. They recommended further studies in this respect (10). In Iran, a study was conducted by Heravi *et al*. (2011) in Mashhad using CPQ and Index of Complexity, Outcome Need questionnaires and

reported a significant association between the quality of life and the need for orthodontic treatment (25). Considering the fact that CPQ is not suitable for use in the age group of 14-17 years (18), as well as limited number of subjects in the mentioned study, the current study was required to be conducted on an Iranian population. The current study was conducted in Isfahan since it is the third largest city and the second most populated city in the country and thus, can provide a suitable sample of the Iranian urban population.

This study aimed to assess the relationship of OHRQoL with IOTN in Isfahani adolescents using CPQ (for 11-14 year olds) and COHIP (14-18 years) questionnaires.

Methods:

This analytical cross-sectional study was conducted on 11-18 year old students in Isfahan (middle schoolers and high schoolers). Two-stage stratified sampling was conducted considering 5 educational districts in the city. In each district, six boys and six girl schools including three middle schools and three high schools were selected (a total of 30 schools). Next, 30 subjects were randomly selected using the inclusion criteria. The inclusion criteria were 11-18 years of age, signing a consent form and no history of current or previous orthodontic treatment. Also, subjects in the mixed dentition period or those with craniofacial syndromes were excluded. Considering type one error of 5% and variance for the quality of life variable of 18 for COHIP according to a pilot study and the detectable difference of 3 in each age and sex groups, the sample size for 14-18 year olds was calculated to be 138 subjects. Considering the effect of sampling of 2 and possible drop outs, sample size was calculated to be 600 subjects in the mentioned group. For 11-14 year olds, considering the variance of 8 for CPQ questionnaire based on the pilot study and the minimum difference of 1, sample size was calculated to be 256 in each sex group. Considering the sampling effect of 1.2, sample size was calculated to be 614 subjects. The study design was approved by the ethic committee of Isfahan University of Medical Sciences. Parents signed written informed consent forms.

The OHRQoL in 11-14 year olds (middle schoolers) was assessed using the translated version of CPQ and in 14-18 year olds (high schoolers) using the Farsi version of COHIP. The reliability and validity of both questionnaires had been previously confirmed. The CPQ has 35 questions in 4 domains of oral health (5 questions), functional problems (9 questions), emotional health (9 questions) and social health (12 questions). Responses were scored using five-point Likert scale. The score 0 indicated never and the score 4 indicated every day. The total score ranged from 0 to 140. The higher the obtained score, the lower the quality of life.

The COHIP questionnaire had 34 questions and included 5 domains of oral health (10 questions), functional wellbeing (6 questions), social-emotional wellbeing (8 questions), school environment (4 questions), and self-image (6 questions). Questions were scored from 0 (never) to 4 (always). The scores for each domain were calculated and the total score was the sum of all scores ranging from 0 to 136. The higher scores showed higher quality of life. The students filled out the questionnaires and underwent dental examination. The IOTN was calculated for them. Examinations were done by two dentists trained according to the protocol of the British Association for the Study of Community Dentistry (26). To calibrate the examiners, theoretical and practical trainings were provided by a community orthodontist. They examined 20 subjects under similar conditions and the inter-examiner agreement was calculated for them. To assess the internal reliability, 20 subjects were examined again by

the two dentists after one-week interval and the obtained values were compared with the baseline values. Using inter-class correlation coefficient, the inter-examiner agreement was found to be 95% and the internal reliability for both dentists was found to be over 0.9.

The occlusal characteristics recorded in DHC-IOTN included increased overjet, reverse overjet, anterior-posterior cross-bite, tooth crowding, anterior-lateral open bite, increased overbite, hypodontia, cleft lip and palate, impacted tooth, and Angle's class of occlusion. In this regard, subjects were classified into 5 groups of no need for treatment, slight need, borderline need, high need and definite need for treatment. The highest degree of need was considered as the DHC score. For the purpose of analysis, according to simplified IOTN, groups 1 and 2 were considered as no need for treatment, group3 was considered as borderline need and the groups4 and 5 were considered as definite need for orthodontic treatment.

Variables were expressed as mean, SD and frequency. The frequency of quality of life subscales and response codes as dichotomous variables of frequent (codes 3 and 4) or no frequent problem (other classes) was also reported. Non-parametric Mann Whitney test was used to assess the correlation of age and gender with the need for treatment. The Spearman's correlation test was used to assess the correlation of the need for treatment and the quality of life. Using the Mann Whitney and the Kruskal Wallis tests, the correlation of the mean quality of life and its subscale scores with the need for orthodontic treatment was compared among the three groups. $p<0.05$ was considered statistically significant.

Results:

A total of 1,227 middle school and high school students aged 11-18 years in Isfahan were evaluated. The mean and SD of age was 13.9 (1.4) years. Demographic information of students is summarized in Table 1.

Table 1- Demographic information of students

Variable		Percentage	Number
Father's level of education	Below high school diploma	34.6	424
	High school diploma	40.4	496
	Above high school diploma	21.7	267
	Missing data	3.3	40
Mother's level of education	Below high school diploma	38.5	473
	High school diploma	45.4	557
	Above high school diploma	13.2	161
	Missing data	2.9	36
Sex	Male	48	588
	Female	52	639
School	Middle school (11-14 years)	51	630
	High school (14-18 years)	49	597

Quality of life in 11-14year olds:

The mean± SD CPQ score in this group was 18.3 (13.7) (Table 2). Half the population in both genders acquired a score less than 15. The most common problems stated by subjects in this group were food impaction, time consuming eating, and mouth breathing with 20, 14 and 12% frequency, respectively. Although OHRQoL increased with age, one-way ANOVA showed that this correlation was not significant ($p>0.05$). Moreover, the OHRQoL score in females was higher than in males but not

significantly (p>0.05).

Table 2-The mean score of quality of life and its subscales in the understudy groups (CPQ in 11-13 year olds and COHIP in 14-18 year olds)

Quality of life	Total CPQ	CPQ subscales				Total COHIP	COHIP subscales				
		Oral health (20-0)	Functional well being (36-0)	Emotional well being (36-0)	Social well being (48-0)		Oral health (40-0)	Functional well being (24-0)	Social-emotional well being (36-0)	School environment (16-0)	Self-image (24-0)
Mean (SD)	18.3 (13.7)	4.7 (2.7)	4.9 (4.4)	5.2 (5.5)	3.5 (4.5)	103.6 (18)	27.6 (5.7)	21.4 (3.4)	25.7 (6.4)	14.9 (1.6)	15 (5)
Score range	95-0	18-0	28-0	33-0	30-0	135-15	40-11	24-2	32-0	16-6	24-0

Quality of life in 14-18 year olds:

The mean (SD) COHIP score in this group was 103.6 (18) (Table 2). Half the subjects had a score over 107; 66% of students (n=391) reported oral health problems such as tooth hypersensitivity, gingival bleeding, food impaction, crowding and discoloration. A total of 34% (n=204) and 32% (n=190) of subjects reported the adverse effects of dental problems on social-emotional well being and self-image domains, respectively. The lowest prevalence of adverse effects was reported on the domain of school environment with 7% frequency (n=20). Tooth hypersensitivity, food impaction, malformation or discoloration of teeth, lip dryness and concerns regarding dental status were among the most common problems reported in this age group. The frequency distribution and normal distribution curve of quality of life parameters based on CPQ in 11-14 year olds and COHIP in 14-18 year olds are shown in Table 2 and Diagram 1.

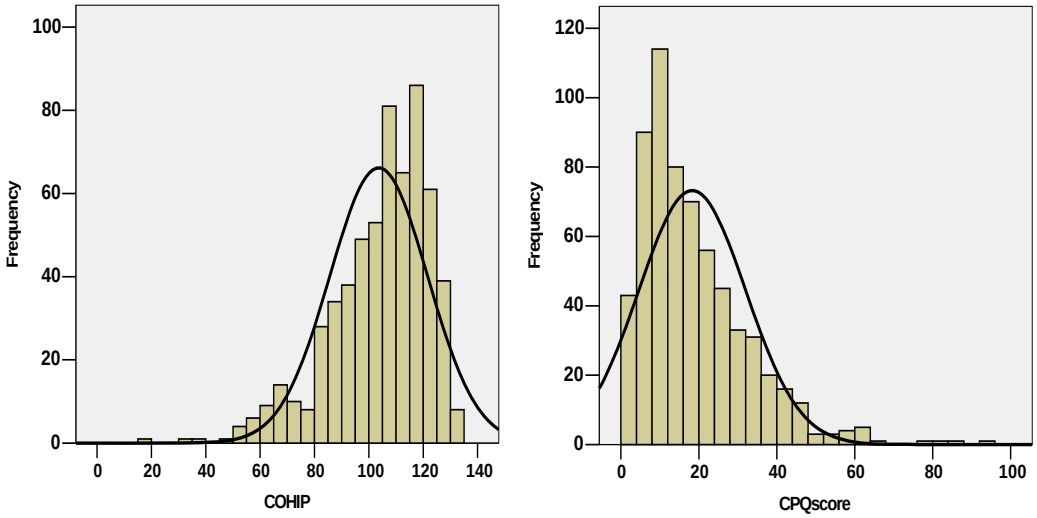

Diagram 1- Histogram and normal distribution curve of the quality of life indices: A. CPQ; B. COHIP

Need for orthodontic treatment:

Of 630 students aged 11-14 years examined for presence of malocclusion, 26 were in mixed dentition period and were excluded from the study. Of the remaining, 309 (51%) did not require orthodontic treatment, 156 (26%) had borderline need for orthodontic treatment and 139 (23%) definitely needed orthodontic treatment. Of all 597 subjects aged 14-18 years, 27 were excluded due to history of orthodontic

treatment. Of examined subjects, 306 (53%) did not require treatment, 169 (30%) had borderline need and 95 (17%) definitely needed orthodontic treatment. The percentage of subject's definitely requiring orthodontic treatment based on gender is shown in Diagram 2.

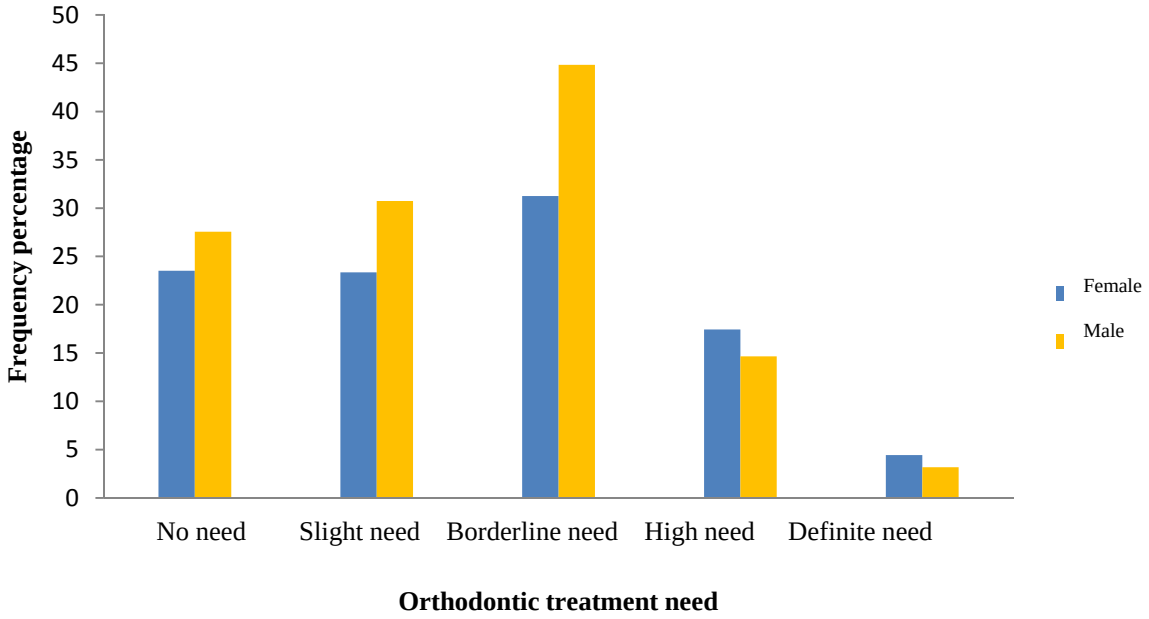

Diagram 2- The frequency distribution of orthodontic treatment need based on DHC-IOTN in males and females aged 11-18 years in Isfahan (n=1,174 including 608 females and 566 males)

The DHC-IOTN was significantly different between males and females and the need for orthodontic treatment was significantly higher among females (p<0.05). Spearman's correlation test did not show a significant association between the severity of malocclusion and age (p=0.16). Among subjects with definite need for treatment (n=234) in different ages, 13 year olds had the highest frequency (7%, n=80).

Relationship of orthodontic treatment need and quality of life:

As seen in Table 3, significant differences were found in terms of quality of life among the three malocclusion degrees in both genders (p<0.05).

Table 3- The mean CPQ and its subscale scores in 11-14 year olds and the mean COHIP and its subscale scores in 14-18 year olds based on the level of need for orthodontic treatment

	No or slight need	Borderline need	Definite need	p-value
CPQ total score	(12.5) 16.6	(12.2) 18.7	(16.5) 22	0.001*
Oral health	(2.5) 4.5	(2.9) 4.7	(2.9) 5.3	0.03*
Functional well-being	(4.1) 4.7	(4.4) 5.3	(4.9) 5.3	0.2
Emotional well-being	(5.3) 4.5	(5.3) 5.4	(6.1) 6.5	0.001*
Social well-being	(3.9) 3	(4.4) 3.4	(5.6) 4.9	0.0001*
COHIP total score	(16.3) 105.6	(19.6) 102.4	(19.4) 98	0.002*
Oral health	(5.3) 27.9	(6.2) 27.2	(5.9) 26.9	0.3
Functional well-being	(3) 21.6	(3.1) 21	(3.4) 21.2	0.3
Emotional & Social well-being	(5.9) 26.3	(6.6) 25.5	(7) 23.7	0.002*
School environment	(1.4) 15.1	(2) 14.8	(1.5) 14.9	05
Self-image	(4.8) 15.4	(5) 15.2	(5) 12.9	0.0001*

In 11-14 year olds, CPQ scores were higher in the group with more severe malocclusion. In 14-18 year olds, by increasing the severity of malocclusion, the COHIP score decreased. In the first group, this correlation was also true for oral problems, social-emotional well-being and school environment domains; while in the second group, the difference in quality of life was only significant in social-emotional well-being and self-image domains.

Based on the Spearman's correlation test, DHC-IOTN in males had a weak significant association (r=0.3) with COHIP quality of life scores and social-emotional and self-image domains in 14-18 year olds. A correlation between the need for orthodontic treatment and social-emotional well being was also observed in females but was weaker (r<0.2) (p=0.001). In 11-14 year olds, Spearman's correlation test showed a weak correlation (r=0.18) in girls and no linear correlation in boys in this regard.

Discussion:

The results of the current study showed that of a total of 1,174 subjects examined, 234 (20%) definitely needed orthodontic treatment. In this population, the quality of life domains had significant associations with the level of need for orthodontic treatment in both genders. Considering the mean score of quality of life, most students had good quality of life. Of every 5 students aged 11-18 years studying in public schools in Isfahan, one needed orthodontic treatment. This result is close to the results of studies conducted in Spain, France, Italy, Tehran and Shiraz reporting 1/5 to 1/6 ratios (26-30). The mean score of quality of life according to CPQ in 11 to 14 year olds was 18.3; this value is close to that reported in England, Saudi Arabia and Iran (20, 31, 32). In 14-18 year olds, this value was found to be 103.6 using COHIP, which is close to the value reported in a study conducted on Canadian adolescents (33). This finding can indicate almost similar effect of oral and dental health on different aspects of quality of life in different countries with variable levels of care. However, due to the dissimilarity of translated forms and malocclusion indices or age range, precise comparison was not feasible in some studies (31).

Previous studies have demonstrated the correlation of orthodontic treatment need and OHRQoL (6, 13, 18). The results of the current study indicated the significant effect of malocclusion on dental system and social-emotional aspect of quality of life in late childhood and adolescence. Children with malocclusion were more commonly mocked by their peers and classmates in school than others (34). In two studies in England, children definitely requiring orthodontic treatment evaluated by DHC-IOTN or AC-IOTN gained higher scores in the social-emotional domain of CPQ compared to children with slight need for orthodontic treatment (11, 31).

The negative effect of some occlusal parameters such as increased overjet on the quality of life of adolescents and their families has been shown among 13-15 year olds. Most studies on the association of quality of life and clinical oral and dental status showed the effect of malocclusion on functional and social-emotional domains of the quality of life (23, 35-38). However, a noteworthy issue is that the observed effects cannot be directly and solely attributed to clinical conditions. Thus, some researchers attempted to design condition-specific forms to assess the relationship of dental caries, malocclusion, periodontal disease and cancer with the quality of life (23). In general, despite the significance of this correlation, the correlation between the OHRQoL and the need for orthodontic treatment has not been very strong in many populations. This coefficient ranges from 0.15 to 0.45 (10) in the literature

while in the current study it was 0.15 and 0.19 in the two groups. Such differences may be attributed to the different definitions of health and disease from the perspectives of individuals with different personal and social backgrounds, complex association of biological variables, and difference between the needs of patients and the clinicians' opinions. The concept of quality of life is influenced by several factors including the psychological, economical, social and cultural factors, level of health literacy of an individual, and etc. These factors affect patients' expectations via a complex network of causality or correlation.

The main limitation of this study was assessing the relationship of a clinical variable (malocclusion) with the quality of life in a single-variable model without considering other factors. Future studies are required to assess this correlation in a suitable statistical model with consideration of confounding factors.

Because different quality of life assessment tools were used in the two groups in the current study, the effect of age on the quality of life score could not be evaluated. However, consideration of age characteristics in selection of the quality of life assessment tools was a strength point of this study. As Gherunpong *et al*. (2006) suggested a socio-dental model to determine the need for dental treatment (39), by combining the clinical need, the effect of malocclusion on the quality of life and the attitude of the patient towards orthodontic treatment, researchers can design a model based on ethnic conditions to determine the need for orthodontic treatment using individual and professional perspectives.

Conclusion:

Based on the results, malocclusion had significant effects on dental function and social-emotional domain of quality of life in adolescents. By increasing the severity of malocclusion, OHRQoL in both age groups significantly dropped. However, since these effects cannot be directly attributed to the malocclusion, future studies are required to assess this correlation using condition-specific forms. Also, all variables affecting the quality of life should be considered in a multifactorial model.

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Conflict of Interest: "None Declared"

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