Community Dental Health (2011) **28,** 82–88
Received 16 January 2009; Accepted 30 August 2009

doi:10.1922/CDH_2511Ravaghi07

Comparison of the COHIP and OHIP- 14 as measures of the oral health-related quality of life of adolescents

V. Ravaghi[1], M.M. Mokhatry Ardakan[2], S. Shahriari[2], N. Mokhtari[3] and M. Underwood[4]

[1]Centre for Health Sciences, Barts and The London, Queen Mary University of London, United Kingdom. [2]Department of Endodontics, Hamedan University of Medical Sciences, Iran. [3]Department of Operative Dentistry, Shahid Beheshti University of Medical Sciences, Iran.[4]Health Sciences Research Institute, Warwick Medical School, University of Warwick, United Kingdom

Aim: To compare the validity and reliability of the Oral Health Impact Profile-14 (OHIP-14) and the Child Oral Health Impact Profile (COHIP) for investigating oral health related quality of life (OHRQoL) of adolescents. ***Method:*** We studied 234 adolescents from two publicly funded schools in Hamedan, Iran. Participants completed questionnaires and had a clinical examination. We compared convergent and discriminative validity of the instruments by analyzing their association with self reported health indicators and number of decayed teeth. ***Results:*** Both instruments showed good convergence with self-rated health and self-rated oral health. Those who perceived dental treatment needs, who had experienced dental pain in last month, were more dissatisfied with their oral health, or had more decayed teeth scored higher on both OHIP-14 and COHIP. The discriminative validity of the two instruments varied slightly and inconsistently. The convergent and discriminative validity of both instruments were established independent of their scoring methods. ***Conclusion:*** Both the OHIP-14 and COHIP were valid and reliable measures for investigating OHRQoL among 15-17 year old adolescents. The COHIP is preferable when the aim is identifying more impacts. Both measures have shown good convergent and discriminative validity, however, for practical reasons; the shorter instrument (OHIP-14) may be more suitable for epidemiological studies.

Key words: Adolescent, epidemiology, oral health related quality of life, oral health.

Introduction

Oral health-related quality of life (OHRQoL) is an important outcome of oral health surveys and clinical trials in dentistry and several measures have been developed for assessing this. The *Oral Health Impact Profile* (OHIP-49) (Slade and Spencer, 1994), the short-form Oral Health Impact Profile (OHIP-14) (Slade, 1997), and the Oral Impacts on Daily Performance (OIDP) (Adulyanon and Sheiham, 1997) are the most well known. More recently measures of children's oral health-related quality of life have also been developed; these include, child's version of Oral Impacts on Daily Performances (CHILD-OIDP) (Gherunpong *et al.*, 2004), the Child Perception Questionnaire (CPQ11-14) (Jokovic *et al.*, 2002), and the Child Oral Health Impact Profile (COHIP) (Broder and Wilson-Genderson, 2007) .

It cannot be assumed that either child or adult measures are appropriate for use in adolescents. Inconsistent findings are reported, in the few studies of the validity of OHRQoL instruments for adolescents. One study of 14 year olds in Myanmar found the OHIP-14 to have better validity than OIDP, although both instruments were criticized for their shortcomings in detecting impacts of oral health (Soe *et al.*, 2004). Two other studies of 12-17 year old American and 12-21 year old Chilean participants support the validity of the OHIP (Broder *et al.*, 2000; Lopez and Baelum, 2006). However, a more recent pilot study in Sweden did not find the OHIP-14 to be valid in 19 year olds (Oscarson *et al.*, 2007). We are not aware of any validation work on the COHIP in adolescents.

To inform our choice of oral health related quality of life (OHRQoL) measure for a cross-sectional study of oral health in adolescents, we have compared the validity and reliability of the OHIP-14 (Slade, 1997) and COHIP (Broder *et al.*, 2007) amongst an adolescent population.

Materials and Method

We used a convenience sample of 15-17 year old adolescents studying at two publicly funded high schools in Hamedan, west of Iran. Hamedan is the capital of Hamedan province; it had a population of around 480,000 in 2005 (http://www.sci.org.ir). High school education is free in Iran; (and there are few privately funded schools.), our sample is, therefore, likely to be reasonably representative of the Iranian population of this age. We approached 241 students from six classes: three from a girls school and three from a boys school. Students were invited to take part in the study by both completing the questionnaires and attending for a clinical examination. The self-administered questionnaire was completed by students. The questionnaires were filled in the classrooms after a brief instruction. Parental consent to take part was not required because, in Iran, this age group is deemed competent to make their own decisions whether to take part in such studies. The consent to take part in the study was obtained by stating that

Correspondence to: Dr. Vahid Ravaghi, Centre for Health Sciences, Abernethy Building, 2 Newark Street, Barts and The London, Whitechapel, London, E1 2AT. E-mail: v.ravaghi@qmul.ac.u

"My completion of this anonymous questionnaire is an indication of my agreement to participate in this study". Ethical approval was primarily obtained from the Ethics Committee of Dental School, Hamedan University of Medical Sciences. Then, the educational administration of Hamedan province provided us with an approval letter that enabled us to get access to the schools.

The OHIP was first developed as a 49 question measure (OHIP-49) (Slade and Spencer, 1994) and was subsequently shortened to 14 items (OHIP-14) (Slade, 1997). The OHIP-14 asks participants to rate impact of their oral health on different dimensions of their lives capturing seven dimensions related to oral health, functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. We have recently shown the Persian (Farsi) version of the OHIP-14 to be valid and reliable in adults attending a dental clinic (Ravaghi *et al*., 2010).

The Child Oral Health Impact Profile (COHIP) consists of 34 items forming five subscales: oral health, functional well-being, social/emotional well-being, school environment and self-image. We translated this into Persian (Farsi) for the purpose of this study. We did forward and backward translations, synthesis and review of the translations by bilingual translators who were invited from university students in the UK. The objective of the translation was to produce a cross-culturally equivalent translation that was conceptually equivalent to the original English version. The differences between the original English version and the back translation were deemed acceptable as they maintained the original construct of the instrument. Produced translations were combined following the resolution of discrepancies and variations.

To compare the psychometric properties of the OHRQoL instruments we included global measures of self-rated health (SRH) and self-rated oral health (SROH). We used the single question 'Generally speaking, would you say that your (oral) health is excellent/very good/good/fair/poor' and the variable is finally dichotomized into good health (excellent/very good/good) and poor health (fair/poor). Additionally we asked about satisfaction with oral health, experience of dental pain in last month, and perceived dental treatment using a yes/no question.

All participants were clinically examined to identify the number of decayed teeth using a standard dental caries examination (WHO, 1997). Clinical examinations were performed immediately after completion of the questionnaires by a trained dentist (MMMA) who was blind to the questionnaire data.

For the purpose of validating quality of life measures, sample size of 100 – 200 using a convenience sample of the population is typically needed (Abeles *et al.*, 1994). Allowing for some non-response we approached 241 people to take part. All analyses were done using the SPSS version 13.1 (SPSS Inc., Chicago, IL, USA).

For each of the OHIP-14 and COHIP items, subjects are asked how frequently they had experienced an impact in last month using a five point Likert scale coded [never = 0, hardly ever = 1, occasionally = 2, fairly often =3, and very often =4]. We used two methods to score OHIP-14 and COHIP: the additive (ADD) score and simple count method (SC). Additive scores for both the OHIP-14 and COHIP were calculated by summing the response codes for items. Using this method, the OHIP-14 scale ranged from 0 to 56 and the COHIP scale from 0 to 136. Simple count (SC) scores were obtained for both instruments by summing the number of items which indicated presence of impact. In other words, the threshold of "hardly ever" or more often was applied to determine the presence of impact. We chose this low threshold because adolescents would be expected to have generally good oral health. Using simple count methods, scores range from 0 to 14 for OHIP-14 and from 0 to 34 for COHIP. For both scoring methods, scores of the six positively-worded items of the COHIP were reversed. Accordingly, higher scores from either of OHRQoL instruments reflect worse oral health.

We tested for convergent validity by comparing the OHRQoL scores of those who rated their health poorly with of those who scored well on global measure of self-rated health (SRH) and self-rated oral health (SROH). Convergent validity is supported when different methods of measuring the same construct provide similar results. We tested discriminative validity using dichotomized perceived and clinical indicators of oral health. Discriminative validity is confirmed when a measure of one underlying construct can be differentiated from another construct. We hypothesized that those with perceived dental treatment needs, who were less satisfied with their oral health, those who experienced dental pain within last month, and those with more decayed teeth would have higher scores. The discriminative validity of the instruments for dental caries was tested in two ways. First we compared the scores of those with and without decayed teeth. Then, the number of decayed teeth was dichotomized with the cut-off being the median score of three, so those with zero to two decayed teeth were considered to have fewer dental caries versus those with three or more decayed teeth. For both convergent and discriminative validity, non-parametric tests (Mann-Whitney statistics) were used to compare the statistical significance of the difference between OHRQoL scores of dichotomised categories. Apart from standard statistical significance, additional analysis was performed to test the ability of two instruments to discriminate between those with decayed teeth. The receiver operating characteristic curve (ROC) and area under the curve (AUC) was used to compare the ability of two measures to predict the number of decayed teeth (Hanley and McNeil, 1982; Hanley and McNeil, 1983). In this study, statistical significance was set at $p<0.05$. We also tested internal consistency using Cronbach's α (Cronbach, 1951).

Results

The six classes had 241 students, seven students were absent in the day of study. All those present (105 boys, 129 girls) agreed to participate in the study. Of these 87 (37%) rated their oral health as poor/fair which is labelled as 'poor health', 32 (14%) rated their general health as poor/fair, 127 (54%) of the subjects perceived dental treatment needs, 61 (26%) had dental pain in last month, and 53 (23%) were dissatisfied with their oral health. In terms of clinical health, 197 (84%) of the participants had at least one decayed tooth and 118 (51%) had three or more decayed teeth (Table 1). The mean number of decayed teeth was 3.23 (SD=2.76).

Table 1. Prevalence of oral health indicators

Oral health indicators	*n=234 n (%)*
Self-rated health	
Poor health (poor/fair)	32 (14)
Good health (Excellent/very good/good)	202 (86)
Self-rated oral health	
Poor health (poor/fair)	87 (37)
Good health (Excellent/very good/good)	147 (63)
Perceived dental treatment needs	
Yes	127 (54)
No	107 (46)
Dental pain in last month	
Yes	61 (26)
No	173 (74)
Satisfaction with oral health	
Satisfied	181 (77)
Dissatisfied	53 (23)
Decayed teeth	
Presence	197 (84)
Absence	37 (16)
Decayed teeth	
0-2 decayed teeth	116 (49)
3 and more decayed teeth	118 (51)

Neither OHIP-14 nor COHIP scores were normally distributed (Fig.1). The OHIP-14 scores were more skewed than COHIP scores on both scoring methods. The most frequent score (mode) that was recorded from OHIP-14 scores is zero suggesting that the OHIP-14 did not find any impact in considerable number of participants (Table 2). The frequency of the OHIP-14 and COHIP scores showed that only one subject (0.4%) scored zero on COHIP whereas 43 (18%) scored zero on OHIP-14 indicating that COHIP had better ability to detect oral health impacts (data not shown in table).

Assessing the convergent validity, those who rated their health poorly on self-rated health (SRH) and self-rated oral health (SROH) have scored significantly higher scores on both the COHIP and the OHIP-14 (Table 3). Although both instruments were equally related with self rated oral health, they were slightly different when self-rated health was examined. Examining the discriminative validity, those who perceived dental treatment needs, who had experienced dental pain in last month, were more dissatisfied with their oral health, or had more decayed teeth scored more significantly on both OHIP-14 and COHIP (Table 3). The strengths of statistical significance of the OHIP-14 and COHIP differed slightly but inconsistently when the number of decayed teeth was examined. We found statistically significant relationships between the

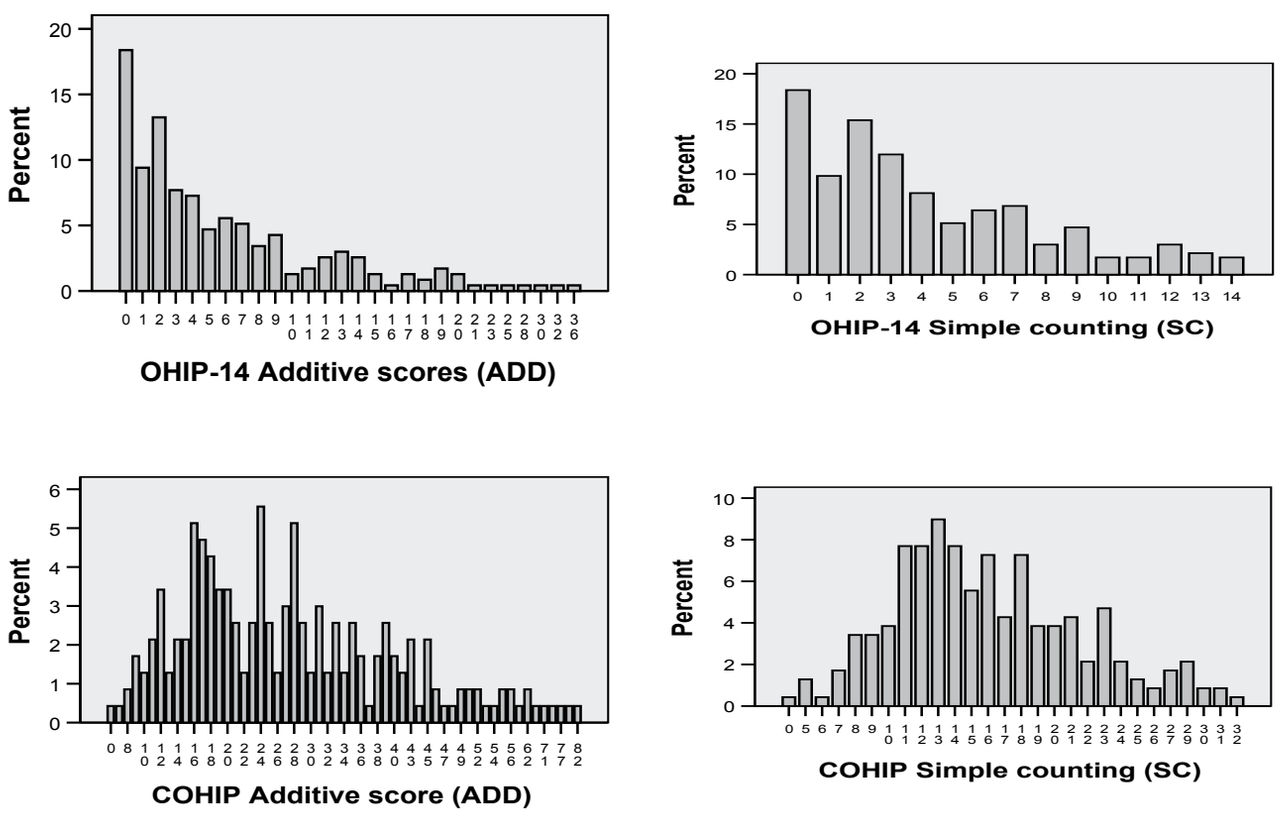

Figure 1. *Frequency distribution of the OHIP-14 and COHIP using additive (ADD) and simple count methods (SC)*

Table 2. Descriptive statistics: OHIP-14 and COHIP

	COHIP (ADD)	*OHIP-14 (ADD)*	*COHIP (SC)*	*OHIP-14 (SC)*
Mean (SD)	28 (14.4)	5.9 (6.5)	15.9 (5.7)	4.1 (3.7)
Median	25	4	15	3
Mode	24	0	13	0
Skewness [a]	1.2	1.7	0.5	0.9
Range (Potential range)	0-82 (0-136)	0-36 (0-56)	0-32 (0-34)	0-14 (0-14)

[a] Higher skewness indicates that the data is more asymmetric
ADD= additive scores; SC= simple count

Table 3. Testing the convergent and discriminative validity of the OHIP-14 and COHIP using Mann-Whitney statistics

	COHIP				OHIP-14			
Scoring method	ADD		SC		ADD		SC	
	Mean score (95%CI)	P value [a]	Mean score (95%CI)	P value [a]	Mean score (95%CI)	P value [a]	Mean score (95%CI)	P value [a]
Self-rated health								
Poor health (poor/fair)	35.1 (30.7, 39.4)	<0.001	18.8 (17, 20.7)	0.001	8.3 (5.6, 11)	0.013	5.4 (4.1, 6.8)	0.017
Good health (Excellent/very good/good)	27 (25, 29)		15.5 (14.7, 16.3)		5.5 (4.6, 6.8)		3.9 (3.4, 4.4)	
Self-rated oral health								
Poor health (poor/fair)	34.7 (31.5, 38)	<0.001	18.3 (17.1, 19.5)	<0.001	7.7 (6.2, 9.1)	<0.001	5.3 (4.4, 6.1)	<0.001
Good health (Excellent/very good/good)	24.2 (22.1, 26.2)		14.6 (13.7, 15.5)		4.8 (3.9, 5.8)		3.4 (2.9, 4)	
Perceived dental treatment needs								
Yes	32.6 (30, 35.3)	<0.001	17.7 (16.7, 18.7)	<0.001	7.8 (6.5, 9)	<0.001	5.3 (4.6, 6)	<0.001
No	22.8 (20.6, 25)		13.9 (12.9, 14.9)		3.7 (2.7, 4.7)		2.7 (2.1, 3.3)	
Dental pain in last month								
Yes	35.1 (31.1, 39.1)	<0.001	18.4 (16.7, 20)	<0.001	9.4 (7.5, 11.3)	<0.001	5.9 (5, 6.9)	<0.001
No	25.6 (23.6, 27.6)		15.1 (14.3, 15.9)		4.6 (3.8, 5.5)		3.5 (3, 4)	
Satisfaction with oral health								
Dissatisfied	38.5 (34.5, 42.5)	<0.001	19.5 (18.1, 20.9)	<0.001	9.1 (7.1, 11.2)	<0.001	6.17 (5.1, 7.3)	<0.001
Satisfied	25.1 (23.1, 27)		14.9 (14.1, 15.8)		4.9 (4.1, 5.8)		3.5 (3, 4)	
Decayed teeth								
Absence	20 (16.5, 23.5)	<0.001	12.8 (11, 14.6)	<0.001	3.7 (1.7, 5.6)	0.001	2.5 (1.4, 3.6)	0.001
Presence	29.6 (27.6, 31.7)		16.6 (15.8, 17.4)		6.3 (5.4, 7.2)		4.4 (3.4, 5)	
Decayed teeth								
0-2	25.8 (23.3, 28.3)	0.014	14.8 (13.7, 15.8)	0.002	4.9 (3.9, 5.9)	0.011	3.4 (2.8, 4)	0.003
3 and more	30.4 (27.7, 33.1)		17.1 (16.1, 18.1)		6.9 (5.6, 8.2)		4.8 (4, 5.5)	

[a] Mann-Whitney statistics
ADD= additive scores; SC= simple count; (95% CI)= 95% confidence interval

ADD and SC scores of both instruments (OHIP-14 and COHIP) and indicators of oral health (Table 3). Comparing the statistical significance of scoring methods, the strengths significance was slightly but irregularly different when the number of decayed teeth was investigated.

Our ROC analysis allowed us to compare the performances of two instruments and two scoring methods in detecting those with decayed teeth. The estimate of the area under the curve (AUC) ranged between 0.67 and 0.72 testing the presence and absence of decayed teeth, and ranged between 0.59 and 0.62 using the cut-off point of three for number of decayed teeth (Table 4). The AUCs for OHIP and COHIP were not greatly different within each level of decayed teeth. However, the AUCs were notably higher when presence and absence of decayed teeth was examined rather than when having three decayed teeth as cut-off. These findings were also confirmed by visual evaluation of the ROC curves (not presented in this report but available upon request)

Cronbach's α was 0.89 and 0.90 for OHIP-14 and COHIP, respectively; when we used additive method. Cronbach's alpha was 0.87 and 0.86 for OHIP-14 and COHIP with the simple counting method, respectively.

The scores of OHIP-14 and COHIP are strongly correlated with each other in both scoring methods (Table 5). Spearman's rank correlation coefficients of the OHIP-14 and COHIP were r=0.72 and r= 0.76 for additive and simple counting methods, respectively. Further, close correlation between the scores of OHIP-14 was observed when the OHIP-14 was scored in two different methods (r=0.98). Similarly, close correlation was recorded for the scores of COHIP from two scoring methods (r=0.93).

Discussion

In this study we investigated the validity of two instruments of OHRQoL among adolescents. A convenience sample of students from two schools was invited to complete the questionnaires and have a dental examination. The response rate of 100% is not unusual from school-based studies.

The oral health status of the students was poor as measured by both oral health indicators and clinical examination. A vast majority of the participants had at least one decayed tooth, and half of the subjects had three and more decayed teeth. However, caution is needed to extrapolate present findings from this convenience sample to the general population.

In terms of the ability to detect impacts of oral health, the COHIP had a greater ability to detect these, and a less skewed distribution. The better ability of the COHIP in detecting impact might be attributed to the structural differences of the instruments. First, the COHIP was developed for children aged 8–15 (Broder *et al.*, 2007) while the OHIP-14, although commonly used for all ages, was validated among an elderly population (Slade, 1997). It is

Table 4. Area under the ROC curves (AUC), and their 95% CIs for the COHIP and OHIP-14 scores of individuals with decayed teeth

Scoring method	*COHIP*				*OHIP-14*			
	ADD		*SC*		*ADD*		*SC*	
	AUC	*(95% CI)*	*AUC*	*(95% CI)*	*AUC*	*(95% CI)*	*AUC*	*(95% CI)*
Decayed teeth Absence Presence	0.72	(0.63, 0.81)	0.70	(0.60, 0.80)	0.67	(0.57, 0.77)	0.67	(0.58, 0.77)
Decayed teeth 0-2 3 and more	0.59	(0.52, 067)	0.62	(0.55, 069)	0.60	(0.52, 0.67)	0.61	(0.54, 0.68)

ADD= additive scores; SC= simple count; AUC= area under the *receiver* operating characteristic *curve;* (95% CI) = 95% confidence interval

Table 5. Spearman's rank correlation coefficients for COHIP and OHIP-14 scores

	r_s			
	COHIP (ADD)	OHIP-14 (ADD)	COHIP (SC)	OHIP-14 (SC)
COHIP (ADD)	1			
OHIP-14 (ADD)	0.72 [a]	1		
COHIP (SC)	0.93 [a]	0.75 [a]	1	
OHIP-14 (SC)	0.71 [a]	0.98 [a]	0.76 [a]	1

[a] Correlation is significant at the 0.05 level
ADD= additive scores; SC= simple count

plausible that the subjects of this study (15-17 years old adolescents) are more likely to report similar impacts to those of children rather than the elderly. Second, the COHIP has more items compared to OHIP-14 which enhance its ability for detecting more impacts. Nevertheless, the scores of OHIP-14 in our study were more skewed compared with COHIP. The high skewness of OHIP-14 scores is supported in a similar study (Soe *et al.*, 2004). The better ability of the COHIP to detect oral health impacts and the its output being less skewed may make it the preferred instrument for use in studies of adolescents in which the objective is to detect the more impacts.

Analysis of convergent validity indicates the OHIP-14 and COHIP scores converged with self-rated health (SRH) and self-rated oral health (SROH). However, despite being statistically significant, the links between scores of OHIP-14 and self-rated health (SRH) was slightly weaker in comparison with those of the COHIP and self-rated health (SRH). Both instruments have also demonstrated significant discriminative validity when examined against perceived indicators of oral health and the number of decayed teeth. The strengths of statistical significance were slightly different when the number of decayed teeth was examined although it was not consistently in favour of the better validity of either the OHIP-14 or COHIP. Therefore, additional ROC curve analysis was employed to examine the performances of the OHIP-14 and COHIP. Using the area under the curve (AUC) as an index of the instruments' performance, we did not achieve convincing evidence showing that either the OHIP-14 or COHIP was better. The similar characteristics of the OHIP-14 and COHIP were also reflected by their significant correlations tested by Spearman's rank correlation coefficients.

We also examined whether using additive (ADD) and simple count methods (SC) may affect validity of the instruments. The convergent and discriminative validity of both instruments were established independent of their scoring methods. However, a negligible difference was observed in terms of strength of significance for some health indicators. However, the similar ability of scoring methods was confirmed by additional ROC curve analysis and calculation of area under the curve (AUC). Also, computing the Spearman's rank correlation coefficients of ADD and SC scores of both instruments suggest that they are nearly perfectly correlated. Altogether, our findings suggest that the calculation of the additive scores do not add additional information.

We believe this is the first validation of the COHIP for adolescents. Establishing the validity of OHIP-14 in our study is consistent with former investigation of adolescents in Myanmar (Soe *et al.*, 2004) and is contrary to a pilot study of Swedish adolescents (Oscarson *et al.*, 2007). Both measures are valid for studying OHRQoL among adolescents. However researchers are recommended to consider the purpose of the study before selecting either instrument. If researchers aim to detect more impacts, the COHIP should be given priority to OHIP-14. For many studies the OHIP-14 may be preferred as it has only 14 items compared to the 34 items in the COHIP reducing the questionnaire burden for participants. The similar performance of both scoring methods in our study corroborated findings of investigations of the OHIP-14 among adolescents (Soe *et al.*, 2004) and the elderly (Locker *et al.*, 2001). Accordingly, we suggest that future studies of adolescents administer the OHIP-14 and the COHIP using dichotomised responses ('Yes' or 'No') rather than the ordinal Likert-type (never, hardly ever, occasionally, fairly often, and very often) to simplify the completion of the questionnaire, and data analysis.

Cronbach's α showed excellent internal reliability. The Cronbach's α obtained in this study ranged from 0.86 to 0.90 for the instruments being scored in both methods. These are similar to those obtained from the original derivation of the OHIP-14 (alpha=0.88), and the COHIP (alpha=0.91). An exact lower limit does not exist to confirm the reliability of the scales, but a Cronbach's alpha value of 0.70 is considered acceptable (Nunnally, 1978). A potential limitation of this study is that we did not conduct the test-retest reliability of the instruments. This is because the data collection occurred few weeks before exam period and students were not available during the exams and afterward.

Conclusion

Both the OHIP-14 and COHIP are valid and reliable instruments of investigating OHRQoL among 15-17 year old adolescents. The COHIP is superior to OHIP-14 in terms of identifying more impacts. Both measures have shown significant convergent and discriminative validity, however, for practical reasons; one might find the shorter instrument (OHIP-14) more suitable. The administration of the dichotomised rather than ordinal responses can facilitate the wider application of these instruments in school based studies and clinical setting.

Acknowledgment

This study was supported by the Research Committee of Dental School, Hamedan University of Medical Sciences. We are thankful to the Ethics Committee of Dental School, Hamedan University of Medical Sciences and educational administration of Hamedan province for providing us with necessary permission to access the schools and all participants for devoting their time to take part in the study. The authors are also grateful to Ms Neda Bayat for her help with data collection at the girls' school.

References

Abeles RP, Gift HC, Ory MG (1994). *Aging and quality of life: Conference : Papers* New York: Springer Pub Co.

Adulyanon S, Sheiham A (1997): Oral impacts on daily performances. In: Slade D, editor. Measuring oral health and quality of life.Chapel Hill, NC: University of North Carolina; 1997. pp. 151–60.

Broder HL, Slade G, Caine R, Reisine S (2000): Perceived impact of oral health conditions among minority adolescents. *Journal of Public Health Dentistry* **60**, 189-192.

Broder HL, McGrath C, Cisneros GJ (2007): Questionnaire development: face validity and item impact testing of the Child Oral Health Impact Profile. *Community Dent Oral Epidemiol* **35 Suppl 1**, 8-19.

Broder HL, Wilson-Genderson M (2007): Reliability and convergent and discriminant validity of the Child Oral Health Impact Profile (COHIP Child's version). *Community Dent Oral Epidemiol* **35 Suppl 1**, 20-31.

Cronbach LJ (1951): Coefficient alpha and the internal structure of tests. *Psychometrika* **16**, 297–334.

Gherunpong S, Tsakos G, Sheiham A (2004): Developing and evaluating an oral health-related quality of life index for children; the CHILD-OIDP. *Community Dent Health* **21**, 161-9.

Hanley JA, McNeil BJ (1982): The Meaning and Use of the Area under a Receiver Operating Characteristic (Roc) Curve. *Radiology* **143**, 29-36.

Hanley JA, McNeil BJ (1983): A Method of Comparing the Areas under Receiver Operating Characteristic Curves Derived from the Same Cases. *Radiology* **148**, 839-843.

Jokovic A, Locker D, Stephens M, Kenny D, Tompson B, Guyatt G (2002): Validity and reliability of a questionnaire for measuring child oral-health-related quality of life. *J Dent Res* **81**, 459-63.

Locker D, Matear D, Stephens M, Lawrence H, Payne B (2001): Comparison of the GOHAI and OHIP-14 as measures of the oral health-related quality of life of the elderly. *Community Dent Oral Epidemiol* **29**, 373-81.

Lopez R, Baelum V (2006): Spanish version of the Oral Health Impact Profile (OHIP-Sp). *BMC Oral Health* **6**, 11.

Nunnally JC (1978). *Psychometric theory*. 2nd ed. ed. New York ; London: McGraw-Hill.

Oral health surveys : basic methods (1997). 4th ed. ed.: World Health Organization.

Oscarson N, Kallestal C, Lindholm L (2007): A pilot study of the use of oral health-related quality of life measures as an outcome for analysing the impact of caries disease among Swedish 19-year-olds. *Caries Research* **41**, 85-92.

Ravaghi V, Farrahi-Avval N, Locker D, Underwood M (2010): Validation of the Persian Version of the Oral Health Impact Profile (OHIP-14). *Oral Health Prev Dent*. **3**:229-35.

Slade GD, Spencer AJ (1994): Development and evaluation of the Oral Health Impact Profile. *Community Dent Health* **11**, 3-11.

Slade GD (1997): Derivation and validation of a short-form oral health impact profile. *Community Dent Oral Epidemiol* **25**, 284-90.

Soe KK, Gelbier S, Robinson PG (2004): Reliability and validity of two oral health related quality of life measures in Myanmar adolescents. *Community Dent Health* **21**, 306-11.