

Comparison of two measures to determine the oral health-related quality of life in elders with periodontal disease

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The Oral Health Impact Profile (OHIP) and Geriatric Oral Health Assessment Index (GOHAI) are accepted as comprehensive and widely used tools for assessing oral health-related quality of life (OHQoL). However, OHQoL assessment of elders with periodontal disease has not yet been investigated. **Objective:** To assess the discriminative performance of GOHAI and OHIP-14 and to compare the psychometric properties of the scales in older people with periodontal disease. **Method:** Participants were 155 elderly patients with periodontal disease attending a university periodontal department. Periodontal measures included gingival index, plaque index, probing pocket depth, clinical attachment level, and bleeding on probing. GOHAI and OHIP-14 scales were used to assess OHQoL. In addition, participants completed a checklist of symptoms related to periodontal disease. **Results:** Using the additive method for scoring, 22 participants (14.2%) had a GOHAI score of 0, indicating no impact from periodontal conditions, while 2 participants (1.3%) had an OHIP-14 score of 0. Over two-thirds of participants (70.96%) reported that their self-rated oral health was poor. **Conclusions:** Both OHIP-14 and GOHAI detected the impacts of oral disease in the elderly with periodontal diseases. Despite differences in content and emphasis, these two scales can be considered broadly equivalent. The main difference between them is the percentage of elderly participants scoring 0; the number of participants with a score of 0 for GOHAI is higher than OHIP-14. In this respect the improvements in OHQoL of the elderly items may be more difficult to detect with GOHAI.

Keywords: Elderly, oral health-related quality of life, periodontal health

Introduction

There are 400 million people over 65 years of age living worldwide, and it is estimated that this number will increase about fourfold by 2050 (WHO, 2004). According to local population statistics, the population older than 65 years in Turkey is around 7 million (Turkish Ministry of Interior, 2016). The aging population is more affected by non-communicable chronic diseases such as diabetes, cardiovascular disease, and cognitive impairment, and this deteriorating general health negatively affects oral health (Lamster, 2016). Moreover, most of the drugs used in the treatment of these diseases have xerostomia as a side effect (Thomson, 2015). A recent systematic review by Lamster (2016) remarked that for older people, the importance of periodontal health is also high because there is a link between periodontitis and dental caries that is usually not present in young individuals. The severity of periodontitis increases with age, gingival recession occurs, and the exposed root surfaces may be more susceptible to the development of caries. As a result, the progression of caries and periodontitis may lead to tooth loss. Usually, tooth loss in the elderly leads to disability and may be highly related to quality of life (Somsak and Kaewplung, 2016).

Oral health-related quality of life (OHQoL) is a multidimensional concept that includes an individual's nutrition and sleeping habits, the variables affecting their communication with other individuals, and their satisfaction with oral health (Satcher, 2000). Periodontitis, which is characterized by periodontal destruction and inflammation, has many symptoms that can affect the quality of life, such as bleeding, mouth

odor, and mobile teeth (Ng and Leung, 2006). Recently, patient-centered outcomes of periodontal therapy have become a popular topic of interest (Shah *et al.*, 2017, Baiju *et al.*, 2017). Nevertheless, the effect of periodontal disease on OHQoL is less investigated than other oral problems such as tooth loss and dental caries (Ferreira *et al.*, 2017). Moreover, periodontal disease is a widespread problem among the elderly worldwide and the leading cause of oral health problems in elderly people (Petersen and Yamamoto, 2005). However, little is known about the effect of periodontal disease on OHQoL in the elderly.

Various OHQoL tools have been developed to evaluate the psychosocial and functional effects of oral problems (El Osta *et al.*, 2012). Two comprehensive and commonly used tools for measuring oral health-related quality of life are the Oral Health Impact Profile (OHIP) and the Geriatric/General Oral Health Assessment Index (GOHAI) (Rodakowska *et al.*, 2014). As a shorter version of OHIP-49, OHIP-14, retains the seven conceptual dimensions of the original: Functional Limitation, Physical Pain, Psychological Discomfort, Physical Disability, Psychological Disability, Social Disability, and Handicap (Slade and Spencer, 1994; Slade, 1997). OHIP-14 was designed to evaluate the impacts of oral conditions on the OHQoL of people over a one-year reference period (Slade, 1997). The GOHAI is a 12-item questionnaire with three months' time reference, developed for use in elderly populations to evaluate three dimensions (physical functions, psychosocial functions, and pain or discomfort) of oral health-related quality of life (Atchison and Dolan, 1990).

These tools are widely used in clinical studies in various populations. However, the ability of OHQoL measures to assess oral health may vary according to the population (Locker *et al.*, 2001; Hassel *et al.*, 2010; Ikebe *et al.*, 2012). It is necessary to consider the discriminative performance of the OHQoL instrument when choosing a suitable instrument to measure the oral health of a population (Ikebe *et al.*, 2012). Such a comparison study in the Turkish population has not been done before. The purpose of this study was to assess the discriminative performance between GOHAI and OHIP-14 in elders with periodontal disease and to compare their psychometric properties.

Method

Study procedures

Between December 2016 and May 2017, 240 elderly people were invited to participate from the Periodontology Department, Faculty of Dentistry, Gaziosmanpasa University. Of the 195 participants who originally agreed (age range 65 to 92), 6 declined to participate, and 34 did not meet the inclusion criteria. Consequently, 155 participants were included in the study.

The Ethics Committee of Abant İzzet Baysal University reviewed and approved the study. The study protocol was performed in accordance with the relevant guidelines of the Declaration of Helsinki. Information on content, purpose, and procedures was provided in writing and verbally on the consent form. Participants who were invited to complete the questionnaire had signed the consent form.

Inclusion criteria included, 1) participants being in between 65 to 92 of age, 2) the presence of at least 15 teeth (third molars not included), 3) the presence of moderate to severe chronic periodontitis and/or gingivitis, 4) ability to understand what is written and 5) ability to speak in the Turkish language.

The exclusion criteria included patients presenting with acute periodontal diseases, systemic conditions associated with periodontal disease, and those who had received periodontal therapy during the last 6 months. In addition, patients taking drugs that could affect periodontal disease, those having active caries and/or a fixed prosthesis that caused pain or discomfort, or a removable prosthesis were excluded.

Data collection

The data were collected using a self-administered structured questionnaire that included both the OHIP-14 and GOHAI scales adapted and approved for Turkish adults (Ergül and Akar, 2008; Mumcu *et al.*, 2006). The participants were given a separate cubicle and time to complete the questionnaires before their periodontal examination. The receptionist, who was not a researcher, helped participants who were unable to read the questions due to the lack of reading glasses and noted their response.

GOHAI consists of 12 items. It is used to examine the perceived oral functional problems and evaluate psychosocial effects due to oral disease in elderly populations. OHIP-14, which consists of 14 items, is used to examine the seven dimensions of oral health-related quality of life. Both scales use Likert-type frequency response formats and a time reference. For both, 1 year was used as the reference period, with Likert-type response scales coded “very often = 4”, “quite often = 3”, “sometimes = 2”, “almost never = 1”, and “never

= 0” (Slade, 1997). The response format was standardized to compare two measures so that the answers for GOHAI and OHIP could be compared.

There are three positively worded items (items 3, 5, 7) in GOHAI. All other items are negatively worded. Therefore, GOHAI was scored by reversing the coding of the positively worded items. The additive scoring method (ADD, or Total Score) was used to summarize OHIP-14 and GOHAI scores as the sum of the item codes for each person. Thus, for the 14 items of OHIP-14 the possible range of scores was 0 – 56 and for the 12 items of GOHAI the possible range was 0 – 48. In both cases higher total scores indicate worse OHQoL.

Other variables included age, gender, marital status, education levels, self-ratings of oral health and chewing problems. In addition, participants completed a checklist of symptoms related to periodontal disease, including gingival recession, sensitivity, bleeding gums, swollen gums, mobile teeth, and oral malodor compared to past years, in each case responded to as ‘yes’ or ‘no.’

Periodontal examination

All participants were evaluated clinically by a calibrated examiner (F.UY). Calibration before the study involved 10 volunteers and reproducibility was determined by calculation of the proportion of measurements the same or within 1 mm. on repeated measurement. Assessment of the mean difference (with 90% accuracy) between two measurements was taken to indicate no systematic bias in measurements. Gingival index (GI) (Löe, 1967), plaque index (PI) (Silness and Löe, 1964), probing pocket depth (PPD), clinical attachment level (CAL) and bleeding on probing (BOP) measurements were performed. The measurements were performed at six sites per tooth (excluding third molars) by the same examiner with a periodontal probe (Hu-Friedy Co., Chicago, IL, USA). Gingivitis and chronic periodontitis were diagnosed in accordance with the clinical and radiographic criteria proposed by the 1999 International World Workshop for a Classification of Periodontal Diseases and Conditions (Armitage, 1999).

Data analysis

The sample size was calculated based on previous studies (Locker *et al.*, 2001; El Osta *et al.*, 2012). Accounting for an anticipated dropout rate of 20%, the projected sample size was set at 195 with the effect size of 0.210, α error of 0.05 and β error of 0.1. The study was completed with 155 participants, yielding a power of 0.87.

Data were analyzed using the SPSS 11.0 statistical package (SPSS Inc., 2002). The significance level of the statistical hypothesis was verified as 0.05. The values of Cronbach’s alpha used to assess internal consistency. One-way analysis of variance (ANOVA) and the independent samples t-test were used to compare OHIP-14 and GOHAI scores in relation to clinical periodontal measurements and periodontal status. OHIP-14 and GOHAI scores were dichotomized using median splits. In addition, odds ratios were calculated to provide a more readily interpretable measure of the strength of the associations between dependent and independent variables. Pearson correlation coefficients were used to measure correlations of the GOHAI and OHIP-14 scores with periodontal clinical measures of the elderly participants as well as item-score and inter-item correlations.

Results

One hundred and fifty-five people (71 men and 84 women) participated in the study. Their age range was 65 to 97 years, and the mean age was 78.48 ± 5.20 years. Cronbach's alpha for internal reliability was 0.88 for OHIP-14 and 0.76 for GOHAI. The correlation between OHIP-14 and GOHAI scores was 0.62 ($p < 0.01$).

Demographic and self-reported characteristics of elderly participants are presented in Table 1 along with OHIP-14 and GOHAI scores. Both measures showed significant associations with gender. OHIP-14 showed significant associations with education level. For discriminative and concurrent validity, the data in Table 1 show neither GOHAI nor OHIP-14 discriminated between gingivitis, mild periodontitis, and severe periodontitis. Neither questionnaire discriminated between the elderly participants who did and did not report gingival bleeding. However, participants who reported oral malodor had a significantly higher GOHAI scores, while OHIP-14 showed significant differences in relation to chewing

problems. Both OHIP-14 and GOHAI scores were significantly higher in participants who classified their oral health only as poor. In this respect, both measures displayed good discriminant and concurrent validity.

The periodontal status of participants (GI, PI, PPD, CAL, and BOP) with gingivitis, moderate periodontitis and severe periodontitis is summarized in Table 2. There were no significant differences in GI, PI and BOP scores between groups. PPD and CAL measures in the severe periodontitis group were higher than in the gingivitis and moderate periodontitis groups.

The impact on OHQoL was considerable, with social, psychological and physical effects. The percentage of the elderly participants who responded to the OHIP-14 and GOHAI items as "sometimes", "often" and "very often" are shown in Table 3. Using OHIP-14 ADD scores, 38.8% reported no functional limitations, 41.9% no pain or discomfort, 26.5% no psychological impacts and 38.7% no behavioral impacts. The corresponding values when GOHAI ADD scores were used were 34.8%, 21.3%, 20.6% and 55.5%.

Table 1. OHIP-14 and GOHAI by demographic and self-reported status in 155 elderly participants

<i>Variable</i>	<i>N (%)</i>	<i>OHIP-14 Mean (SD)</i>	<i>GOHAI Mean (SD)</i>
<i>Gender</i>			
Men	71 (45.8)	6.55±7.85	12.39±6.82
Women	84 (54.2)	10.43±10.03	15.08±8.03
P value		0.009	0.028
<i>Marital status</i>			
Married	101	9.87±10.31	14.17±7.05
Widowed	54	9.92±9.89	13.87±7.37
P value		0.977	0.906
<i>Education Level</i>			
Primary school	137 (88.4)	8.82±9.21	14.06±7.72
High school	6 (3.9)	14.83±12.86	12.67±8.94
University	12 (7.7)	3.67±5.53	12.08±5.43
P value		0.044	0.641
<i>Periodontal status</i>			
Gingivitis	40 (25.8)	8.98±10.83	14.35±9.74
Mild periodontitis	57 (36.8)	7.77±9.72	12.44±6.53
Severe periodontitis	58 (37.4)	9.29±7.61	14.9±6.76
P value		0.660	0.198
<i>Chewing problem</i>			
Yes	75 (48.4)	7.01±7.23	13.12±7.3
No	80 (51.6)	10.19±10.66	14.54±7.84
P value		0.033	0.247
<i>Bleeding Gums</i>			
Yes	77 (49.7)	10.01±9.43	14.06±8.28
No	78 (50.3)	7.31±8.91	13.64±6.9
P value		0.069	0.729
<i>Oral Malodor</i>			
Yes	71 (45.8)	7.92±9.6	11.85±6.02
No	84 (54.2)	9.27±9.0	15.55±8.37
P value		0.365	0.002
<i>Self-rated oral health</i>			
Good	45 (29.1)	5.73±5.82	12.71±7.25
Poor	110 (70.9)	10.88±12.32	18.25±13.01
P value		0.001	0.001

In total, for the OHIP-14, the proportion reporting an impact for each item ranged from 9.7 % to 45.8% and with six of 14 items being reported by 20% or more and two reported by 33.3% or more. For the GOHAI, the proportion reporting an impact for each item ranged from 8.6% to 32.3% and with ten of 12 items being reported by 20% or more and none items being reported by 33.3% or more. None of the participants scored the maximum in both measures. The OHIP-14 score ranged from 0 to 44 and the GOHAI score ranged from 0 to 40.

The distributions of OHIP-14 and GOHAI scores are presented in Table 4. Using the additive scoring method, 14.2% (22 participants) had a GOHAI score of 0, indicating no impact from periodontal conditions, while 1.3% (2

participants) had an OHIP-14 score of 0. The skewness was 0.806 for the OHIP-14 and 1.551 for the GOHAI.

Sensitivity and bleeding gums were significantly associated with OHIP-14 (Table 5). Mobile teeth and oral malodor were significantly associated with GOHAI. Participants reporting bleeding gums had a 0.420 times greater risk of having an OHIP-14 score above the median than those without bleeding gums, whereas the risk of having a GOHAI score above the median was 1.084 (Table 5).

Table 6 shows the correlations between OHIP-14 and GOHAI scores and periodontal clinical measures. Clinical parameters were related to OHIP-14 and GOHAI items in different ways. While OHIP-14 scores were related to the plaque index, GOHAI was associated with gingival recession.

Table 2. Periodontal status of 155 elderly participants

	<i>Gingivitis</i> (N=40)	<i>Mild periodontitis</i> (N=57)	<i>Severe periodontitis</i> (N=58)
CAL(mm)	-	4.88±1.15	6.93±1.32
PPD(mm)	2.25 ± 0.37	4.13 ± 1.03	5.60 ± 1.25
GI	2.05±0.64	2.14±0.77	2.34±0.58
BOP (%)	73.42±20.56	75.38±19.44	83.68±18.95
PI	1.80 ± 0.69	2.25±0.74	2.47±0.68

Mean scores ±SD,

PI, plaque index; GI, gingival index; PPD, probing pocket depth; CAL clinical attachment level; BOP bleeding on probing

Table 3. Proportion of participants responding sometimes, often or very often to each OHIP-14 and GOHAI item

<i>OHIP-14 Items</i>	<i>%</i>	<i>GOHAI Items</i>	<i>%</i>
Functional limitation			
1. Trouble pronouncing words	41.9	2. Trouble biting/chewing food	32.3
2. Sense of taste worse	14.2	3. Uncomfortable from swallow	20.7
		4. Prevented from speaking	8.6
Pain and discomfort			
3. Painful aching in mouth	31	5. Discomfort when eating	29.8
4. Uncomfortable to eat foods	30.9	8. Use medication to relieve pain	29
		12. Teeth /gums sensitive to hot/cold	23.2
Psychological impacts			
5. Been self-conscious	18.7	7. Unhappy with appearance	30.1
6. Felt tense	23.9	9. Worried or concerned	27.2
9. Difficult to relax	45.8	10. Nervous or self-conscious	27.7
10. Been embarrassed	16.1	11. Uncomfortable eating in front of people	23.9
13. Felt life less satisfying	13.6		
Behavioral impacts			
7. Diet been unsatisfactory	26.1	1. Limit kinds or amounts of food	20.6
8. Had to interrupt meals	16.1	6. Limit contacts with others	18.4
11. Been irritable with others	9.7		
12. Difficulty doing usual jobs	12.2		
14. Totally unable to function	18.1		

GOHAI and OHIP-14 items were respond as “very often = 4”, “quite often = 3”, “sometimes = 2”, “almost never = 1”, and “never = 0”.

Table 4. Descriptive statistics for ADD-GOHAI and ADD-OHIP-14.

	<i>OHIP-14</i>	<i>GOHAI</i>
Range	0-44	0-40
% with score of 0	1.3	14.2
Mean±SD	13.85±7.59	8.65±9.27
Median	12.00	6.00
Skewness	0.806	1.551

ADD- additive method

Table 5. ADD-GOHAI and ADD-OHIP-14 scores in relation to self-reported periodontal status

	OHIP-14	CI 95%	GOHAI	CI 95%
Periodontal status (gingivitis vs. periodontitis)	1.240	0.600-2.563	0.672	0.326-1.383
Gingival Recession (yes vs. no)	0.853	0.452-1.610	1.042	0.552-1.967
Sensitivity (yes vs. no)	2.550 ^a	1.331-4.885	1.350	0.715-2.548
Bleeding Gums (yes vs. no)	0.420 ^a	0.220-0.802	1.084	0.576-2.041
Swollen Gums (yes vs. no)	0.725	0.384-1.366	1.365	0.722-2.579
Mobile Teeth (yes vs. no)	0.895	0.474-1.691	2.069 ^a	1.085-3.943
Oral Malodor (yes vs. no)	1.108	0.588-2.089	2.970 ^a	1.530-5.764

^a95% CI does not include 1

Table 6. OHIP-14 and GOHAI scores in relationship to clinical measures of periodontal status of 155 older people

	ADD scores	OHIP-14				ADD scores	GOHAI			
		Functional limitation	Pain and discomfort	Psychological impacts	Behavioral impacts		Functional limitation	Pain and discomfort	Psychological impacts	Behavioral impacts
PI	0.200 ^a	0.207 ^b	0.165 ^a	0.176 ^a	0.138	0.153	0.148	-0.017	0.134	0.181 ^a
GI	0.136	0.230 ^b	0.091	0.143	0.049	0.058	0.045	0.024	0.038	0.060
PPD	-0.053	-0.104	-0.010	0.030	-0.112	-0.155	-0.078	-0.113	-0.044	-0.235 ^b
REC	0.133	0.066 ^a	-0.090	0.241 ^b	0.122	0.170 ^a	-0.173 ^a	0.353 ^b	0.100	0.186 ^a

PI, plaque index; GI, gingival index; PPD, probing pocket depth; REC, gingival recession.

Statistical analysis was performed by a Pearson correlation test. ^a $P < 0.05$; ^b $P < 0.01$.

In total, for the OHIP-14, the proportion reporting an impact for each item ranged from 9.7 % to 45.8% and with six of 14 items being reported by 20% or more and two reported by 33.3% or more. For the GOHAI, the proportion reporting an impact for each item ranged from 8.6% to 32.3% and with ten of 12 items being reported by 20% or more and none items being reported by 33.3% or more. None of the participants scored the maximum in both measures. The OHIP-14 score ranged from 0 to 44 and the GOHAI score ranged from 0 to 40.

The distributions of OHIP-14 and GOHAI scores are presented in Table 4. Using the additive scoring method, 14.2% (22 participants) had a GOHAI score of 0, indicating no impact from periodontal conditions, while 1.3% (2 participants) had an OHIP-14 score of 0. The skewness was 0.806 for the OHIP-14 and 1.551 for the GOHAI.

Sensitivity and bleeding gums were significantly associated with OHIP-14 (Table 5). Mobile teeth and oral malodor were significantly associated with GOHAI. Participants reporting bleeding gums had a 0.420 times greater risk of having an OHIP-14 score above the median than those without bleeding gums, whereas the risk of having a GOHAI score above the median was 1.084 (Table 5).

Table 6 shows the correlations between OHIP-14 and GOHAI scores and periodontal clinical measures. Clinical parameters were related to OHIP-14 and GOHAI items in different ways. While OHIP-14 scores were related to the plaque index, GOHAI was associated with gingival recession.

Discussion

Both OHIP-14 and GOHAI are accepted as tools used to assess OHQoL in individuals with respect to oral conditions. These measures differ in terms of their time reference and item content (Locker and Allen, 2007). A

limited number of comparisons of OHIP-14 and GOHAI have been published in relation to older people (Locker *et al.*, 2001; Hassel *et al.*, 2010; El Osta *et al.*, 2012; Rodakowska *et al.*, 2014) and there are no reports comparing the two measures in the Turkish population. In addition, this study is also a first in terms of the assessment of OHQoL of older people with periodontal disease.

The main purpose of this study to compare GOHAI and OHIP-14 in older people in relation to periodontal health. For this reason, it was useful to exclude diseases other than periodontal disease and to avoid major differences between participants. Participants were elderly individuals with only periodontal disease. Elderly individuals with dental caries or prosthetic conditions were excluded in order to restrict responses predominantly to those related to periodontal diseases.

In the original GOHAI scoring, higher scores indicated that oral health was more positive (Atchison and Dolan, 1990). Conversely, for OHIP-14, higher scores indicated that oral health quality was more negative (Slade, 1997). However, the GOHAI scoring here is similar to that of Locker *et al.*, (2001). This study was concerned with comparing the two measures in the same direction, so the original GOHAI score was reversed, and the response score format was standardized so that higher scores indicated worse OHQoL for both measures.

A greater number of individuals reporting no negative impacts on their lives and health indicates a lower prevalence of impact on quality of life and health in the community of which they are a part. A large proportion of participants reported many problems related to oral health. In the study by Locker *et al.*, (2001) which investigated many problems related to oral health and associations between general and oral health among residents of a geriatric care centre, the rate of participants scoring 0 was 30% for OHIP-14 and 8.4% for GOHAI. Rodakowska and

colleagues (2014) associated dental status, chewing ability, dry mouth and self-related oral health with GOHAI and the OHIP-14 scores in a group of older Polish people. The proportion reporting a score of 0 was 13.5% for OHIP-14 and 1.1% for GOHAI. A study in Japanese elderly people showed rates of 12% for OHIP-14 and 4.6% for GOHAI (Ikebe *et al.*, 2012). Another study of the subjective oral health status of non-clinical elderly urban populations of Germany reported the proportion scoring 0 was 34% for OHIP-14 and 7.1% for GOHAI (Hassel *et al.*, 2010). In the present study, the rate of a 0 score was 1.3% for OHIP-14 and 14.2% for GOHAI.

OHIP-14 was more sensitive than GOHAI in detecting the impacts of oral disorders in older people with periodontal diseases, with fewer participants having a score of 0. Our finding that the sensitivity of OHIP-14 is greater than GOHAI differs from other studies. The previously mentioned studies showed that the GOHAI is more successful than OHIP-14 in detecting oral disease-related oral functional problems. A possible reason for this inconsistency may be the inclusion of only older individuals with periodontal disease in our study. Individuals affected by periodontal disease may not experience impacts at first because the disease is usually asymptomatic. Moreover, in chronic conditions, the loss of clinical attachment is slow and gradual, allowing an affected individual to adapt to the new situation (Ferreira *et al.*, 2017). At a more advanced stage, chronic periodontitis may be associated with signs and symptoms such as dental mobility, pain, difficulty eating, aesthetic loss of the anterior interproximal papillae, and discomfort (Cunha-Cruz *et al.*, 2007) OHIP-14 records the psychological and behavioral consequences and disabilities of oral diseases (Locker *et al.*, 2001), which may be affected by periodontal diseases.

When OHIP-14 scores were compared to GOHAI scores, the items were ranked similarly. Nevertheless, OHIP-14 seemed to be more sensitive to impacts on each of the domains of functional limitation, pain and discomfort, psychological effects, and environmental effects. In this study Behavioral impacts were the least frequently reported items using either OHIP-14 or GOHAI. This is consistent with the studies by Locker *et al.*, (2001) and Ikebe *et al.*, (2012). As was the case with the study by Rodakowska *et al.*, (2014) Psychological impacts were the most commonly impacted items in the OHIP-14 measure, and like the study by Locker *et al.*, (2001) Functional limitations were the most commonly impacted items in the GOHAI measure.

The results of this study show that both OHIP-14 and GOHAI detected the impacts of periodontal disease in older people. Nevertheless, there are differences in the content of the items that may affect the ability the measures to determine health-related quality of life. OHIP-14 and GOHAI showed a moderate correlation (0.62). This is a lower correlation than all other studies (Locker *et al.*, 2001; Hassel *et al.*, 2010; Ikebe *et al.*, 2012; El Osta *et al.*, 2012; Rodakowska *et al.*, 2014). However, both measures showed good psychometric properties. The Cronbach's alpha value of OHIP-14, which indicates the internal reliability of the test, was higher than GOHAI. This can be explained as OHIP-14 has more items than GOHAI and is a more homogeneous

measure of the majority of psychosocial consequences (Locker *et al.*, 2001).

When the correlations between OHIP-14 and GOHAI scores and periodontal clinical parameters were considered, both measures were correlated significantly with periodontal clinical parameters. While the OHIP-14 score was related to the plaque index, GOHAI score was associated with gingival recession. However, OHIP-14 performed somewhat better than GOHAI when evaluated in terms of the four health domains.

Oral health-related life quality in older people is also linked to demographic factors, such as gender, income, and education (Skaar and Hardie, 2006; Skaar and O'Connor, 2012). Controversially, some studies have found no relationship between OHIP-14 and GOHAI scores and gender or education level (Ikebe *et al.*, 2012, Rodakowska *et al.*, 2014). In this study, a relationship was observed between demographic status and OHIP-14 and GOHAI. Risk factors for high OHIP-14 included a low educational level. Similarly, López and colleagues (2015) found that individuals with poor self-perceived oral health tended to have low educational levels. In addition, high OHIP-14 and GOHAI scores were associated with female gender. However, Hernández-Palacios and colleagues (2015) found poor self-reported oral health to be associated with male gender, low income and educational level, living independently and poor oral health. Likewise, Tsakos *et al.* (2009) reported an association between male patients and high GOHAI scores. It should be considered that gender was significantly associated with OHQoL and GOHAI scores.

There are some limitations in terms of the study design. The individuals involved in this study were older people who attended a dental faculty. Although there is general health insurance in Turkey and the dental care system is easily accessible to almost everyone, our sample was not representative of the entire Turkish population. In addition, with aging, there may be changes in human needs, expectations, and wishes. In this respect, we must acknowledge the existing limitations of the current OHQoL measures in relation to the complex needs of the older adults.

Conclusion

There were differences between GOHAI and OHIP-14 in terms of determining quality of life in older people with periodontal disease. The most commonly reported impacts on OHIP-14 were Psychological, while the most common on GOHAI were Functional limitations. One main difference between the two scales is their sensitivity, denoted by the proportion of elderly participants scoring 0; GOHAI was less sensitive than OHIP-14. That floor effect may reduce the ability of GOHAI to detect change compared to OHIP-14.

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