# Impact of Masticatory Performance on Oral Health–Related Quality of Life for Elderly Japanese

Kazunori Ikebe, DDS, PhD[a]/Tomohiro Hazeyama, DDS[b]/Kentaro Morii, DDS, PhD[c]/
Ken-ichi Matsuda, DDS[c]/Yoshinobu Maeda, DDS, PhD[d]/Takashi Nokubi, DDS, PhD[e]

***Purpose:*** This study aimed to investigate the association of masticatory performance with oral health–related quality of life in independently living elderly Japanese subjects. ***Materials and Methods:*** The study sample consisted of 1,028 independently living people over the age of 60 years. Masticatory performance was determined by the concentration of dissolved glucose obtained from test gummy jellies, which are the standardized food developed for measuring masticatory performance. The short-form Oral Health Impact Profile (OHIP-14) and Geriatric Oral Health Assessment Index (GOHAI) were used to measure the impact of oral conditions on oral health–related quality of life. ***Results:*** Subjects with lower masticatory performance had significantly higher total OHIP-14 and GOHAI scores (15.0 ± 9.0 and 14.5 ± 9.2, respectively) than their counterparts (10.0 ± 7.5 and 11.3 ± 7.1, respectively) ($P < .01$). Logistic regression analyses showed that after controlling for age, gender, self-perceived general health, satisfaction with financial status, and number of teeth, a higher GOHAI score was significantly related to lower masticatory performance ($P = .001$; odds ratio: 0.56; 95% CI: 0.40 to 0.79). A higher OHIP-14 score was associated with lower masticatory performance but at a level below statistical significance ($P = .096$; odds ratio: 0.75; 95% CI: 0.53 to 1.05). ***Conclusion:*** It is suggested that masticatory performance is an important factor influencing the quality of life in independently living, relatively healthy elderly Japanese subjects. *Int J Prosthodont 2007;20:478–485.*

The development of patient-based outcome measures[1,2] has enhanced clinicians' ability to assess the oral health–related quality of life (OHRQoL) of elderly populations. Among oral-specific measures, the Oral Health Impact Profile (OHIP)[1] and Geriatric Oral Health Assessment Index (GOHAI)[2] are currently the most comprehensive instruments for measuring the impact of oral conditions on OHRQoL.[3–5] OHIP-I4, the short-form of OHIP, was developed by Slade[6] to quantify levels of impact on well-being in settings where only a limited number of questions can be used.

A primary goal for dental treatment is to restore oral function, especially masticatory ability. An individual's OHRQoL appears to be enhanced when masticatory function is improved through dental treatment. Previous studies have shown the relationship between self-assessed oral function and OHRQoL.[4,7–9] For example, Locker et al[7] reported that both the OHIP-14 and GOHAI discriminated between subjects with and without a self-perceived chewing problem, as opposed to an objectively measured chewing problem. However, there has been no research on the impact of objectively measured masticatory function on OHRQoL.

Testing masticatory performance is a way to examine the level of chewing function. There are several clinical tests of masticatory performance; however, most are complicated and time-consuming.[10] As a result, self-assessed masticatory ability has been used more

[a]*Associate Professor, Division of Oromaxillofacial Regeneration, Osaka University Graduate School of Dentistry, Osaka, Japan.*
[b]*Graduate Student, Division of Oromaxillofacial Regeneration, Osaka University Graduate School of Dentistry, Osaka, Japan.*
[c]*Clinical Instructor, Division of Oromaxillofacial Regeneration, Osaka University Graduate School of Dentistry, Osaka, Japan.*
[d]*Professor, Division of Oromaxillofacial Regeneration, Osaka University Graduate School of Dentistry, Osaka, Japan.*
[e]*Professor Emeritus, Division of Oromaxillofacial Regeneration, Osaka University Graduate School of Dentistry, Osaka, Japan.*

***Correspondence to:*** *Dr Kazunori Ikebe, Division of Oromaxillofacial Regeneration, Osaka University Graduate School of Dentistry, 1-8 Yamadaoka Suita Osaka 565-0871, Japan. Fax: +81 6 6879 2957. E-mail: ikebe@dent.osaka-u.ac.jp*

frequently than objective measures in investigating large populations. However, a prior study reported a significant discrepancy between satisfaction with mastication, self-assessed masticatory ability, and objectively measured masticatory performance in older adults.[11] Objective masticatory function must be investigated separately from subjective feelings of masticatory ability. In addition, because both self-assessed masticatory ability and OHRQoL are subjective responses, it is to be expected that they have strong correlations. Therefore, the authors believe that to assess the actual relationship between masticatory function and OHRQoL, an objective measurement of masticatory performance should be used to exclude confounding factors such as respondents' personality.

The hypothesis tested was that masticatory performance is associated with OHRQoL for independently living elderly Japanese people. In this test, a cross-sectional study using multiple logistic regression analysis was conducted.

## Materials and Methods

### *Study Population*

The subjects were participants of the Senior Citizens' College of Osaka prefecture who were living in the prefecture and voluntarily attended lectures once a week. This college, which enrolls volunteers for a period of 1 year and is supported by the government of Osaka prefecture, is part of the adult education system for those over the age of 60. Consequently, the participants were community-dwelling, independently living elderly people. At the end of a lecture on oral-health issues, the purpose and procedures of this study were explained to the audience, and volunteers were asked to return for a dental examination on a later date. The dental examinations were carried out by 5 calibrated dentists with a mirror and a light source. The final study population was randomly divided into 2 groups, comprising 588 subjects for OHIP-14 and 440 subjects for GOHAI (Table 1). The mean age and proportion of each gender were quite similar between the groups.

The protocol of this study was approved by the ethical review committee of Osaka University Graduate School of Dentistry. All subjects gave written informed consent for their participation.

### *Masticatory Performance*

Masticatory performance was determined by the concentration of dissolved glucose obtained from test gummy jellies, which are the standardized food developed for measuring masticatory performance.[12] The subjects were instructed to chew the gummy jelly using 30 chewing strokes on their preferred chewing side (left, right, or both). Masticatory performance was assessed by calculating the surface area of the particles ($mm^2$) from the glucose concentration using linear regression. Further details of this measurement and its accuracy were described in a previous report.[11] Based on the results of masticatory performance, subjects were divided into 2 groups, identified as "lower" (less than 25%) and "middle and higher" (more than 25%).[13,14]

**Table 1** Characteristics of the Study Population

| | OHIP-14 | GOHAI |
|---|---|---|
| No. of subjects | 588 | 440 |
| Male/female (%) | 56.6/43.4 | 48.6/51.4 |
| Mean age (y) (SD) | 66.2 (4.2) | 65.8 (4.2) |
| Age range (y) | 60–84 | 60–80 |
| Mean no. of teeth (SD) | 22.4 (7.8) | 22.8 (7.8) |
| Mean masticatory performance ($mm^2$) (SD) | 2,068 (704) | 2,096 (920) |

### *Self-Assessed General Health and Financial Status*

Questions were asked regarding self-perceived general health and satisfaction with financial status. The responses were "good," "fair," or "bad" for the former and "satisfied," "fair," or "dissatisfied" for the latter.

### *Oral Health–Related Quality of Life*

The OHIP-14 includes 2 question items from each of the 7 impact subdomains, such as functional limitations, physical pain, psychologic discomfort, disability, and handicap domains.[6,15] Responses were given on a 5-point scale.

The GOHAI has 4 subdomains, which include 12 questions altogether. These domains consist of functional limitation, pain and discomfort, psychologic impacts, and behavioral impacts. Responses were given on a 6-point scale. The codings of the 3 positively worded items (swallowing, appearance, discomfort when eating) were reversed. The OHIP-14 and GOHAI scores were obtained by summing the response score for the 14 and 12 items, respectively, producing a single score for each respondent.[7]

Both instruments had been translated into Japanese,[9,16] and their validity and reliability had been confirmed. The internal reliability of each instrument was calculated with Cronbach $\alpha$ for all items and found to be high (0.93 for OHIP-14 and 0.87 for GOHAI). The test-retest reliability of the instrument was calculated using the intraclass correlation coefficient based on a second administration of the ques-

**Table 2** Percent of Subjects Responding "Sometimes," "Fairly Often," "Very Often," or "All the Time" to Each GOHAI Item and "Sometimes," "Fairly Often," or "Very Often" to Each OHIP-14 Item

| OHIP-14 | % | GOHAI | % |
|---|---|---|---|
| Functional limitation | | | |
| Trouble pronouncing words | 25.0 | Trouble biting/chewing food | 41.8 |
| Sense of taste worse | 17.5 | Uncomfortable to swallow | 13.9 |
| | | Prevented from speaking | 18.2 |
| Pain and discomfort | | | |
| Painful aching in mouth | 34.4 | Discomfort when eating | 24.1 |
| Uncomfortable to eat foods | 32.3 | Use medication to relieve pain | 16.6 |
| | | Teeth, gums sensitive to hot/cold | 57.0 |
| Psychologic impacts | | | |
| Been self-conscious | 41.5 | Unhappy with appearance | 44.3 |
| Felt tense | 26.2 | Worried or concerned | 58.9 |
| Difficult to relax | 16.7 | Nervous or self-conscious | 41.8 |
| Been embarrassed | 22.1 | Uncomfortable eating in front of people | 18.2 |
| Felt life dissatisfying | 11.2 | | |
| Behavioral impacts | | | |
| Diet been unsatisfactory | 20.1 | Limited kinds or amounts of food | 19.1 |
| Had to interrupt meals | 10.2 | Limited contacts with others | 5.9 |
| Been irritable with others | 11.4 | | |
| Difficulty doing usual jobs | 5.3 | | |
| Totally unable to function | 5.3 | | |

tionnaire to 34 subjects after a 3-week interval. The intraclass correlation coefficient of the summary score for each instrument was also high (0.77 for both OHIP-14 and GOHAI).

### *Statistical Analyses*

The data analyses were carried out using SPSS 13.0 for Windows (SPSS). Differences in OHIP-14 and GOHAI scores between groups were evaluated using the Mann-Whitney *U* test or Kruskal-Wallis test. Statistical significance was set at $P \leq .05$.

Because quality of life is multifactorial, a multiple regression analysis was needed to investigate associations of masticatory performance with OHRQoL. However, since the OHIP-14 score is an ordinal scale and its distribution is markedly skewed, multiple regressions would be inappropriate for this study. Therefore, the overall OHIP scores were dichotomized for the multivariate analysis. Although dichotomization of the OHIP-14 and GOHAI scores involves some loss of information, this is in accordance with the findings of previous studies of the OHIP where logistic regression has proven superior to ordinary regression analysis.[7,16–18]

There is no established cut-off value for the definition of a lower OHIP or GOHAI score in the literature. In this study, the OHIP-14 and GOHAI scores were reduced to 2 categories, where the 75th percentile was used to discriminate between the lower OHRQoL group and the middle/higher OHRQoL group. Masticatory performance was entered as a continuous variable in the models. The other independent variables were transformed into dichotomous variables. All independent variables were entered into the model.

## Results

The characteristics of the study population were quite similar between the OHIP-14 group and GOHAI group (Table 1). More than 90% of the subjects reported that their self-perceived general health was "good" or "fair." Only 10% reported dissatisfaction with their present financial status, suggesting that they might be a more middle-class group than would be found in the general population. Approximately 60% of the total subjects had 24 or more teeth. The means of masticatory performance were 2,068 $mm^2$ in the OHIP-14 group and 2,096 $mm^2$ in the GOHAI group.

Table 2 shows the percent of subjects responding "occasionally," "fairly often," or "very often" to each OHIP-14 item and "sometimes," "fairly often," "very often," or "all the time" to each GOHAI item. For the OHIP-14, the percent responding positively to each item ranged from 5.3% to 41.5%, with 7 of the 14 items being reported by 20% or more of the subjects and with only 1 item being reported by 40% or more. For the GOHAI, the percent responding positively to each item ranged from 5.9% to 58.9%, with 6 of the 12 items being reported by 20% or more of the subjects and 5 items being reported by 40% or more.

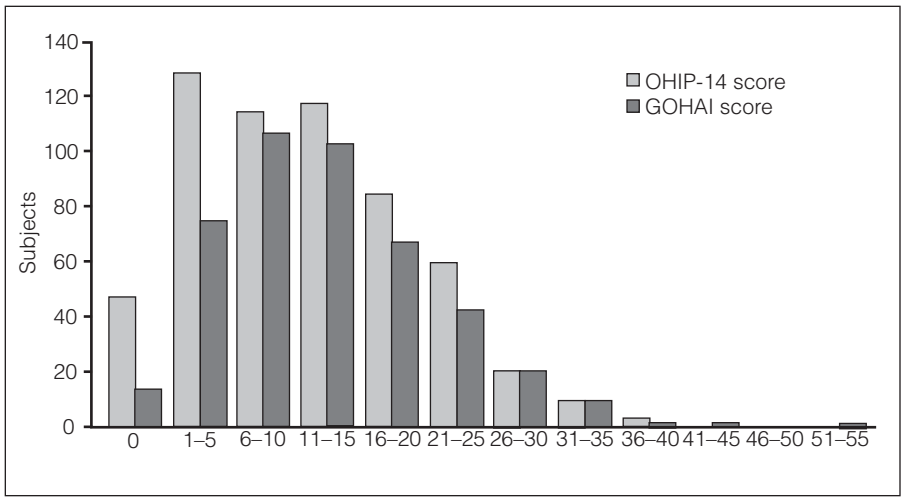


**Fig 1** Distribution of OHIP-14 score (n = 588) and GOHAI score (n = 440).

The distribution of the OHIP-14 and GOHAI scores is shown in Fig 1. Both the higher OHIP-14 (Table 3a) and GOHAI scores (Table 3b) were associated with lower levels of self-perceived general health, dissatisfaction with financial status, fewer residual teeth, and lower masticatory performance; however, they were not significantly associated with age or gender. Subjects who had lower masticatory performance had higher total OHIP-14 and GOHAI scores (15.0 ± 9.0 and 14.5 ± 9.2, respectively) than their counterparts (10.0 ± 7.5 and 11.3 ± 7.1, respectively).

The logistic regression analysis showed that a higher OHIP-14 score, indicating a lower OHRQoL, was significantly related to lower levels of self-perceived general health, dissatisfaction with financial status, and reduced number of teeth ($P < .05$). It also was likely to be associated with lower masticatory performance ($P = .096$; odds ratio: 0.75; 95% CI: 0.53 to 1.05) (Table 4a). The Nagelkerke $R^2$ of the model was 0.206. The overall accuracy of the model in predicting subjects having a high OHIP-14 score was 77.7%. Sensitivity was 93.8% and specificity was 30.9%.

Similarly, the logistic regression analysis showed that a higher GOHAI score was significantly related to younger age, lower levels of self-perceived general health, and a reduced number of teeth ($P < .05$). A higher score was likely to be associated with dissatisfaction with financial status ($P = .053$). A higher score was significantly associated with lower masticatory performance ($P = .001$; odds ratio: 0.56; 95% CI: 0.40 to 0.79) (Table 4b). The Nagelkerke $R^2$ of the model was 0.288. The overall accuracy of the model in predicting subjects having a high GOHAI score was 82.1%. Sensitivity was 95.7% and specificity was 35.2%.

## Discussion

This study evaluated a convenience sample of cognitively competent older adults living in an urban area and volunteering to participate in a free education program. It is not known how representative of elderly Japanese these individuals are. However, in Japan, the greater majority of elderly people (87% of those over 65 years old) are functionally independent and show no limitations in their daily activities.[19] Therefore, it seems important to know about the oral health and quality of life of these active elderly people because they appear to represent the majority of the elderly Japanese population. In addition, the most important factors that contribute to poor quality of life in elderly patients include general disease, cognitive problems (dementia), functional disabilities, lower socioeconomic status, and social isolation. Therefore, to exclude these factors and focus on oral health, comparatively healthy, functionally independent, cognitively normal, and financially independent subjects were used in this study.

There are several objective measures of masticatory function, such as masticatory performance, masticatory efficiency, swallowing threshold, and occlusal force.[20] Masticatory performance, which is the ability to break down foods into discrete portions by chewing to permit swallowing, is usually assessed by measuring the size of test food samples that have been chewed for a specific number of chewing cycles.[21] Since 1950,[22] fractional sieving, with various natural and artificial foods,[20] has been used as a technique of separating foods after chewing to measure masticatory performance. Real foods, such as peanuts[22–26] or carrots,[25,27]

**Table 3a** Bivariate Analysis of OHIP-14 Score in Relation to Explanatory Variables

| | No. of subjects* | % of subjects | Mean | SD | *P* |
|---|---|---|---|---|---|
| Total | 588 | 100 | 11.3 | 8.3 | |
| Age | | | | | |
| 60–69 y | 473 | 80.4 | 11.2 | 8.4 | .21 |
| ≥ 70 y | 115 | 19.6 | 12.0 | 7.8 | |
| Gender | | | | | |
| Male | 333 | 56.6 | 11.0 | 8.0 | .29 |
| Female | 255 | 43.4 | 11.8 | 8.6 | |
| Self-perceived general health | | | | | |
| Good | 332 | 56.5 | 10.2 | 8.1 | |
| Fair | 221 | 37.6 | 12.1 | 7.6 | < .01 |
| Bad | 35 | 6.0 | 18.6 | 9.6 | |
| Financial status | | | | | |
| Satisfied | 407 | 70.1 | 10.2 | 8.0 | |
| Fair | 113 | 19.4 | 14.0 | 8.3 | < .01 |
| Dissatisfied | 61 | 10.5 | 14.1 | 8.5 | |
| No. of teeth | | | | | |
| ≤ 19 | 166 | 28.2 | 15.7 | 8.2 | |
| 20–23 | 76 | 12.9 | 13.4 | 8.6 | < .01 |
| ≥ 24 | 346 | 58.8 | 8.8 | 7.2 | |
| Masticatory performance | | | | | |
| Lower 25% | 140 | 25.0 | 15.0 | 9.0 | < .01 |
| Upper 75% | 420 | 75.0 | 10.0 | 7.5 | |

*May not equal 588 because of missing values.

**Table 3b** Bivariate Analysis of GOHAI Score in Relation to Explanatory Variables

| | No. of subjects* | % of subjects | Mean | SD | *P* |
|---|---|---|---|---|---|
| Total | 440 | 100 | 12.6 | 8.2 | |
| Age | | | | | |
| 60–69 y | 360 | 81.8 | 12.5 | 8.4 | .20 |
| ≥ 70 y | 80 | 18.2 | 13.1 | 6.9 | |
| Gender | | | | | |
| Male | 214 | 48.6 | 12.0 | 8.1 | .14 |
| Female | 226 | 51.4 | 13.2 | 8.2 | |
| Self-perceived general health | | | | | |
| Good | 236 | 55.3 | 10.5 | 7.0 | |
| Fair | 149 | 34.9 | 14.4 | 8.3 | < .01 |
| Bad | 42 | 9.8 | 17.9 | 10.1 | |
| Financial status | | | | | |
| Satisfied | 292 | 68.4 | 12.0 | 7.8 | |
| Fair | 94 | 22.0 | 12.3 | 8.1 | < .01 |
| Dissatisfied | 41 | 9.6 | 17.0 | 9.7 | |
| No. of teeth | | | | | |
| ≤ 19 | 101 | 23.0 | 18.7 | 8.8 | |
| 20–23 | 53 | 12.0 | 15.8 | 7.5 | < .01 |
| ≥ 24 | 286 | 65.0 | 9.9 | 6.6 | |
| Masticatory performance | | | | | |
| Lower 25% | 102 | 24.9 | 14.5 | 9.2 | < .01 |
| Upper 75% | 308 | 75.1 | 11.3 | 7.1 | |

*May not equal 440 because of missing values.

**Table 4a** Logistic Regression Analysis with OHIP-14 Score as the Dependent Variable (n = 588)*

| Independent variables† | SE | *P* | Odds ratio | 95% CI |
|---|---|---|---|---|
| Age | | | | |
| 60–69 y | | | 1 | |
| ≥ 70 y | 0.275 | .472 | 0.82 | 0.48-1.41 |
| Gender | | | | |
| Male | | | 1 | |
| Female | 0.218 | .150 | 1.37 | 0.89-2.10 |
| Self-perceived general health | | .047 | | |
| Good | | | 1.00 | |
| Fair | 0.235 | .105 | 1.46 | 0.92-2.32 |
| Bad | 0.418 | .026 | 2.54 | 1.12-5.77 |
| Financial status | | .009 | | |
| Satisfied | | | 1 | |
| Fair | 0.262 | .005 | 2.08 | 1.25-3.48 |
| Dissatisfied | 0.343 | .048 | 1.97 | 1.01-3.85 |
| No. of teeth | | < .001 | | |
| ≤ 19 | 0.282 | < .001 | 3.86 | 2.22-6.72 |
| 20–23 | 0.306 | < .001 | 3.60 | 1.98-6.56 |
| ≥ 24 | | | 1 | |
| Masticatory performance‡ | 0.174 | .096 | 0.75 | 0.53-1.05 |

*OHIP–14 score: lower 75% (score 0–18) = 0, higher 25% (score ≥ 19) = 1.
†Age: 60–69 y = 0, ≥ 70 y = 1; Gender: male = 0, female = 1; Self-perceived general health: good = 0, fair/bad = 1; Financial status: satisfied = 0, fair/dissatisfied = 1; No. of teeth: ≥ 24 = 0, 20–23/≤ 19 = 1.
‡Continous variable (1,000 $mm^2$).

**Table 4b** Logistic Regression Analysis with GOHAI Score as the Dependent Variable (n = 440)*

| Independent variables† | SE | *P* | Odds ratio | 95% CI |
|---|---|---|---|---|
| Age | | | | |
| 60-69 y | | | 1 | |
| ≥ 70 y | 0.389 | .023 | 0.41 | 0.19-0.89 |
| Gender | | | | |
| Male | | | 1 | |
| Female | 0.279 | .794 | 0.93 | 0.54-1.61 |
| Self-perceived general health | | .001 | | |
| Good | | | 1.00 | |
| Fair | 0.301 | .003 | 2.48 | 1.37-4.47 |
| Bad | 0.467 | .001 | 4.80 | 1.92-11.99 |
| Financial status | | .053 | | |
| Satisfied | | | 1 | |
| Fair | 0.372 | .067 | 0.51 | 0.24-1.05 |
| Dissatisfied | 0.453 | .226 | 1.73 | 0.71-4.21 |
| No. of teeth | | < .001 | | |
| ≤ 19 | 0.343 | < .001 | 4.79 | 2.44-9.39 |
| 20–23 | 0.373 | < .001 | 4.61 | 2.22-9.58 |
| ≥ 24 | | | 1 | |
| Masticatory performance‡ | 0.176 | .001 | 0.56 | 0.40-0.79 |

*OHIP–14 score: lower 75% (score 0–18) = 0, higher 25% (score ≥ 19) = 1.
†Age: 60–69 y = 0, ≥ 70 y = 1; Gender: male = 0, female = 1; Self-perceived general health: good = 0, fair/bad = 1; Financial status: satisfied = 0, fair/dissatisfied = 1; No. of teeth: ≥ 24 = 0, 2–23/≤ 19 = 1.
‡Continous variable (1,000 $mm^2$).

and artificial materials, such as gelatin[28,29] or silicone,[30,31] have been used to measure masticatory performance. The authors of the present study have found a positive correlation in masticatory performance between the present test with gummy jelly and the sieving method with peanuts ($n = 10$, $rs = 0.56$, $P = .09$). However, it is reported that masticatory performance values assessed by calculating the area of the gelatin particles have a wider range than the sieving method, thus making it possible to differentiate between subjects.[28] Because of significant advantages such as speed and accuracy of measurement and discriminating ability, the gummy jelly is the preferred food for measuring masticatory performance.

When comparing 2 instruments for measuring OHRQoL, it is preferable to ask subjects to complete both the OHIP-14 and GOHAI. However, this is difficult because of time constraints, and may represent a burden to older subjects. Hence, sample populations matched in age, gender, and other relevant factors were used.

In bivariate analyses, the OHIP-14 and GOHAI scores were significantly associated with lower levels of self-perceived general health, dissatisfaction with financial status, fewer teeth, and lower masticatory performance. This result showed that OHRQoL is influenced not only by anatomic dental status and broad factors such as general health and financial status, but also by functional factors such as masticatory performance. That an individual's health, financial status, and number of teeth are strong predictors of OHRQoL is not surprising.[4,7–9] The authors controlled for the effects of these 3 variables in the model and then investigated the association of masticatory performance with OHRQoL.

The logistic regression analyses showed that with other variables controlled, a higher GOHAI score was significantly related to lower masticatory performance. A higher OHIP-14 score was not significantly related, although it was likely to be associated with lower masticatory performance. Locker et al[7] reported that the GOHAI gives greater weight to functional limitations and pain and discomfort, which are more immediate and therefore more common outcomes of oral disorders in this population. In contrast, the OHIP-14 places greater emphasis on psychologic and behavioral outcomes, which are more severe and therefore less common in this study population. In fact, the GOHAI includes 4 of 12 items directly related to eating or chewing, while the OHIP-14 has 3 of 14 items. Therefore, it is thought that the GOHAI was more successful than the OHIP-14 at detecting the relationship between masticatory performance and OHRQoL. If masticatory performance is related to OHRQoL, independent of sociodemographic variables, it is suggested that dental clinicians place high priority on improving OHRQoL by prosthetic restoration.

It is important to recognize the limitations of this study. Convenient individuals who were cognitively and physically healthy were used. Consequently, the results may be specific to this study sample and should not be generalized until these associations have been confirmed in other studies of a similar population. In addition, this study is cross sectional in design, so it does not discuss a causal linkage between masticatory performance and quality of life. The ideal method would be a longitudinal cohort study, but this requires exhaustive time and effort.

## Conclusion

Although it was not possible to completely eliminate the possible effects of all other factors, the authors conclude that masticatory performance is an important influence on OHRQoL in independently living, relatively healthy elderly Japanese subjects.

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*Literature Abstract*

**Head and neck cancer: To what extent can psychological factors explain differences between health-related quality of life and individual quality of life**


The purpose of this clinical study was to assess the extent to which standardized and individualized measures of Quality of Life (QoL) are related to each other. Another purpose of this study is to evaluate the extent to which standardized and individualized QoL before treatment can be explained by psychological variables, particularly those factors guided by the self-regulation model (how patients understand and adapt to a threat to their health). Fifty-five patients who were diagnosed with squamous cell carcinoma of the head and neck were recruited from 4 hospital sites from July 2003 to March 2004. The patients completed the following outcome instruments: *(1)* European Organization for the Research and Treatment of Cancer (EORTC), *(2)* the General Health Survey Questionnaire–SF 12, and *(3)* Patient Generated Index (PGI). The patients also completed the following questionnaires to assess their psychological factors: *(1)* Illness Perception Questionnaire-Revised, *(2)* the Beliefs about Medicines Questionnaire-Specific Scale, *(3)* the Hospital Anxiety and Depression Scale, and *(4)* the Brief COPE. Pearson correlations were calculated among all 3 outcomes. Variables were then entered into multiple linear regression models using a stepwise method to assess how much variation of the QoL measures could be explained by these variables. The standardized and individualized QoL measures were only partly correlated. The PGI correlated with EORTC domains of emotional and cognitive functioning and SF-12 domains of mental health, emotional role, social, and physical role. The psychological factors explaining each of the 3 outcome measures were varied. The PGI (captures aspects of QoL that are most important to the individual at that particular time) could be used as an adjunct to the more standardized QoL measures.



**Llewellyn CD, McGurk M, Weinman J.** *Br J Oral Maxillofac Surg* 2006;44:351–357. **References:** 23. **Reprints:** CD Llewellyn, Department of Psychology, King's College London, 5th Floor Thomas-Guy House, Guy's Hospital, London SE1 9RT, United Kingdom. E-mail: carrie.d.llewellyn@kcl.ac.uk—*Alvin G. Wee, OSU College of Dentistry, Columbus, OH*