

Oral health-related quality of life of elderly Germans - comparison of GOHAI and OHIP-14

A. J. Hassel¹, B. Steuker¹, C. Rolko², L. Keller¹, P. Rammelsberg¹ and I. Nitschke³

¹Department of Prosthodontics, University of Heidelberg, Heidelberg, Germany; ²Centrum für Integrative Psychotherapie CIP, Munich, Germany; ³Department of Geriatrics and Special Care Dentistry, University of Zurich, Zurich, Switzerland

Objective: To obtain information about the subjective oral health status of non-clinical elderly populations of urban regions of Germany, one in the East and one in the West, by using OHIP-14 and, for first time, the GOHAI, and, furthermore, to compare the results obtained by use of both instruments. **Basic research design:** cross-sectional. **Clinical setting:** randomly chosen, non-clinical elderly population in urban regions of Germany. **Participants:** 197 participants (51% male) born in the years 1930–1932. **Main outcome measures:** GOHAI, OHIP-14. **Results:** Median GOHAI score was 54; median OHIP-14 score was 2. Scores indicative of severely impaired oral health were rare. The effect of living in eastern or western Germany was of minor significance. Although the internal consistency of both measures was comparable and the same positive association with psychological wellbeing, absence of dry mouth, burning mouth, and removable dentures ($p < 0.05$) was observed, differences occurred. In simultaneous analysis of all items, factor analysis revealed only partial overlap of the items in extracted factors. Furthermore, the extreme score indicating no impairment was five times more frequent for OHIP-14. Of those who scored zero in OHIP-14, only 20% had the GOHAI equivalent score of 60, and for some GOHAI items the answer category for highest impairment was obtained. **Conclusions:** GOHAI scores for this randomly chosen non-clinical group enable comparison with scores for Germany measured in the future. The differences between GOHAI and OHIP-14 make it necessary to select the most appropriate instrument for a planned purpose and study population.

Keywords. Elderly, GOHAI, OHIP, OHRQoL

Introduction

In addition to clinical data, oral health-related quality of life (OHRQoL) is of increasing interest in dentistry for describing oral health or changes in oral health, because it reflects a subjective, patient-centred view of oral health (Rohr Inglehart and Bagramian, 2002). Although various generic measures of OHRQoL have been developed in recent decades (Adulyanon *et al.*, 1996; Atchison and Dolan, 1990; Slade and Spencer, 1994), the theory underlying the measures has not always been clearly defined and there has been insufficient discussion about which measure to use for a specific purpose or study population. It has been stated that no distinction is made between measures of subjective oral health status, or socio-dental indicators, to which the Geriatric/General Oral Health Assessment Index (GOHAI) is supposed to belong, and measures of OHRQoL, among which the Oral Health Impact Profile (OHIP) is supposed to be included (Locker and Allen, 2007).

In addition to cross-sectional non-representative studies of short or long-term hospitalized collectives (Hassel *et al.*, 2006; Hassel *et al.*, 2007), the OHRQoL of normal elderly people in Germany has so far been described solely for one representative sample of participants up to 79 years of age (John *et al.*, 2003). This is important with regard to the expected future development of the structure of the population, with a “demographic revolution” toward a

higher proportion of elderly people (Statistisches Bundesamt, 2003). For Germany, it has been demonstrated that OHRQoL decreases with increasing age—an increase of ten years was associated with an increase of the OHIP median of 1.7 units (OHIP-G with 49 items; John *et al.*, 2004a). In the 60 to 70-years-old group an OHIP median score of five was obtained for those without dentures, a median score of twelve for those with removable dentures, and a median score of twenty-three for those with complete dentures. In addition to the OHIP, the Geriatric Oral Health Assessment Index (GOHAI) is now also available in German (Hassel *et al.*, 2008). The OHIP-14 short form and the GOHAI have not yet been compared for an elderly German population; this is an important concern, because these short measures are appropriate for larger surveys with time constraints, especially for the elderly.

The objectives of this study were, therefore:

- to obtain information about subjective oral-health status with OHIP-14 and, for the first time in Germany, with the GOHAI, for a non-clinical elderly population in two urban regions, one in eastern Germany and one in western Germany;
- to compare results from OHIP-14 and GOHAI with regard to distribution and floor/ceiling effects of the summary scores and item analysis, and to conduct a mutual comparison of the responses of

subjects with no subjective impact in one of the instruments; and

- to perform an initial test of comparative reliability and validity.

Materials & Methods

The subjects were recruited from the interdisciplinary longitudinal study of adult development (ILSE), which studied two age cohorts and was originally designed as a representative study (Martin *et al.*, 2001). Data in this report for the elderly cohort born from 1930 to 1932 (73 to 75 years of age) were used. The participants lived in two urban regions of Germany, one in the south west (Heidelberg) and one in eastern Germany (Leipzig). Historically, both groups spent their youth in the Third Reich but were then divided—until the reunion Leipzig was part of the socialist German Democratic Republic whereas Heidelberg was part of democratic Germany. This may possibly have led to different imprinting and different opinions on oral health. The data were collected during the third ILSE measurement, which included, in addition to psychological and medical aspects, dental examination for the first time. Before the clinical dental examination, participants received a questionnaire by mail, which they were asked to complete and bring to the psychological or medical examination, where the questionnaires were collected centrally. Occasionally, because of the immobility of the participant, the examination took place at home. The study was approved by the local university review board and all participants gave written informed consent (no. 181/2005).

OHRQoL/subjective oral health was measured by use of the OHIP (OHIP-G14; G for German version, 14 for 14-item short version, reference period the previous month; the translation into German and subsequent validation of the OHIP are described in John *et al.*, 2006) and the GOHAI (GOHAI-G; 12 items, reference period the last three months; Hassel *et al.*, 2008). For ease of reading, in the following text OHIP-G14 will be abbreviated to OHIP. The answer categories were similar for both instruments: very often, often, sometimes, seldom, or never. A summary score (unweighted addition) was calculated in both cases after recoding some inverse items in the GOHAI. Because of opposite scoring of the answer categories, a high score in the OHIP is indicative of impaired OHRQoL whereas a high score in the GOHAI means low impairment (range: GOHAI 12–60, with 60 indicative of no impairment; OHIP 0–56, with 0 indicative of no impairment).

Participants were also asked to rate their actual self-perceived oral-health on a five-point Likert-type scale (scale: excellent, very good, good, moderate, or bad). The presence or absence of dry-mouth, mouth-burning, and removable dentures was recorded. Psychological well-being was measured using the seventeen-item German version of the revised standardized Philadelphia Geriatric Center Morale Scale (PGCMS) (Lawton, 1975). The participants could answer “Yes” or “No” to each item. Data were encoded so that each high-satisfaction response received a score of “2” and each low-satisfaction response was scored “1”, so total scores ranged from 17 to 34 and a higher score indicates a higher level of psychological well-being. Education was recorded by summing years of school education, professional education, and other studies.

Only ILSE participants with complete OHIP and GOHAI or with a maximum of one missing value, which was replaced by the answer given most often, were used for analysis (197 cases out of a total of 314 who were contacted for the whole ILSE study). The questionnaires concerning oral health were collected centrally and, therefore, not controlled for completeness by the dental-examination team, which resulted in a smaller number of complete cases. This, and the fact that more highly educated participants were over-represented in the third ILSE measurement, meant the sample was not representative.

The summary scores of both instruments were displayed as percentiles for all participants and divided into eastern/western Germany and into denture status.

For further comparison, the floor effect of both questionnaires is reported, by means of the frequency of a summary score of “0” in the OHIP and “60” in the GOHAI. Frequency distributions of the summary score and of the ratings for single items were displayed for each instrument for participants indicating no impairment in the other instrument.

For assessment of comparative reliability, internal consistency (Cronbach’s alpha) and item–scale correlations (Spearman correlation) were calculated. Because of the cross-sectional study design it was not possible to assess comparative stability or responsiveness. Factor analysis was performed for the items of both the GOHAI and the OHIP simultaneously, to determine whether the items of both instruments load on the same factors (Varimax rotation, Eigenvalue > 1, item factor loading >0.5).

Comparative validity was also initially performed. The convergent validity of both instruments was tested by comparison with the self-rating of oral health (five-point scale, Kruskal–Wallis test) and the PGCMS (Spearman correlation), and by correlating the summary scores of both instruments with each other. Group validity was tested between groups with subjective dry mouth (yes/no, U-test), mouth burning (yes/no, U-test), and removable dentures present (yes/no, U-test), whereby subjects without burning or dry mouth and without removable dentures were supposed to show less impairment of subjective OHRQoL. Statistical associations between the summary scores and gender, living in eastern/western Germany, and years of education were also assessed. Finally, two regression models were calculated using the summary scores as dependent variables and the variables from the bivariate analyses as independent variables. The OHIP score was square-root transformed to prevent violation of the normal distribution of the standardized residuals of the model. Using the enter method, the above mentioned independent variables were introduced to the model, and adjusted R² was observed.

All statistics were obtained by use of SPSS Version 16.0 (SPSS Inc., Chicago, IL, USA). The level of probability for statistical significance was set at $\alpha = 0.05$.

Results

One-hundred-and-one participants (51.3%) of the study population were male, and 96 (48.7%) lived in western Germany. Mean PGCMS score was 28.6 (SD 3.8) and mean time in education was 13.5 years (SD 2.8). Thirty-six participants (18.3%) rated their oral health as “very good”, 123 (62.4%) as “good”, 36 (18.3%) as “moderate”, 2 (1%)

as “bad”, and no one as “excellent”. One third (n=63) of the population had no removable dentures, 108 (57.8%) did not suffer from dry mouth, and 175 (88.8%) did not suffer from mouth burning.

GOHAI and OHIP items and score distributions

The percentiles for the distributions of the summary scores are shown in Table 1. Median GOHAI score for all participants was 54 (25% quartile 49; 75% quartile 57), median OHIP score was 2 (25% quartile 0; 75% quartile 7). Scores indicative of highly impaired subjective oral health were not frequent in either instrument. The items with the highest frequency of the answer “never” in the OHIP were “trouble speaking” (87%) and “unable to function” (88%) whereas the lowest frequencies of the answer “never” were obtained for “life less satisfying” (64%) and “unconscious” (66%). For the GOHAI, the items with highest frequency of the answer “never” were “limit contact” (92%) and “trouble speaking” (77%) whereas the lowest frequencies of the answer “never” were obtained for “pleased with appearance” (31%) and “worried/concerned” (24%).

As mentioned above, ceiling effects were not present for either instrument. Fourteen (7.1%) of the participants had a GOHAI score of 60, however, indicating no impairment. In contrast, 34% (n=67) had an OHIP score of 0, indicating no impairment. Only one participant who scored “60” in the GOHAI had a score other than “0” in the OHIP—this participant responded “seldom” to one OHIP-14 item. When no impairment was measured with the GOHAI, 42.9% (n=6) rated their oral health as “good” and 57.1% (n=8) as “very good”, no one rated his or her oral health as “excellent”, “moderate”, or “bad”.

The participants who scored zero in the OHIP had a median GOHAI of 57 (25% quartile 55, 75% quartile 59), and 19.7% (n=13) had a GOHAI score of 60. Table 2 shows the responses to the GOHAI of these participants.

With regard to the items difficulty biting, uncomfortable to swallow, eat without discomfort, worries, and happy with appearance, the highest possible answer category, indicating maximum impairment, was used. If no impairment was measured with the OHIP, 1.5% (n=1) rated their oral health as “bad”, 3% (n=2) as “moderate”, 65.7% (n=44) as “good”, and 29.9% as “very good”.

Cronbach’s alpha was similarly high for both instruments (0.81 for GOHAI and 0.88 for OHIP), showing high internal consistency. The mean item–scale correlation was 0.59 for the GOHAI (0.30 to 0.79) and 0.58 (0.46 to 0.76) for the OHIP. In the factor analysis six factors were extracted with Eigenvalue>1 (explanation of 65% of total variance with the six factors; table 5). Items from both instruments loaded on factors one (roughly speaking, problems with eating and worry about this), three (roughly speaking, discomfort in social situations), and four (difficult to interpret, has some overlap with factor 4), only items of OHIP loaded on factor two (roughly speaking, limited mental well-being), and only GOHAI items loaded on factors five and six (both related to concrete oral-health-related disabilities).

When convergent validity was tested, comparable significant associations in the expected direction for PGCMS (higher PGCMS, better OHRQoL, $p<0.001$ for both instruments) and self-rating of oral health (better self-rating, better OHRQoL, $p<0.001$ for both instruments) were observed for both measures. High inter-correlation of the measures was also found ($r_s = -0.68$; $p<0.01$). Group validity could be established for both measures, as expected, for the presence of removable dentures, dry mouth, and burning mouth (when present, lower OHRQoL, $p<0.004$ in any assessment). Both measures showed no significant associations with gender or years of education ($p>0.05$ in any assessment). The only difference between the measures was with regard to living in eastern and western Germany—participants in western Germany had slightly different scores indicating

Table 1. Distribution of the scores (n=197; GOHAI range 60 “no impairment” to 0; OHIP range 0 “no impairment” to 56).

	Percentile	All participants (n=197)	Western Germany (n=96)	Eastern Germany (n=101)	No removable denture present (n=63)	Removable denture present n=127)
GOHAI	10	44	44	44.2	50	42.8
	20	48	48	47	52	46
	30	50	51.1	50	54	48
	40	52.2	53.8	51.8	55	50.2
	50	54	55	54	56	52
	60	55	56	55	57	54.8
	70	56.6	57	56	58	55
	80	58	59	57	59	57
	90	59	60	58	60	59
OHIP-14	10	14	13.3	14.8	8.6	15
	20	8	8	8	5	9
	30	5	5	6	3	7
	40	4	3	4.2	1.4	5
	50	2	1.5	3	1	3
	60	1	0.8	1.8	0	2
	70	0	0	1	0	1
	80	0	0	0	0	0
	90	0	0	0	0	0

lower impairment, but this difference reached statistical significance in the GOHAI only (GOHAI: $p=0.044$; OHIP: $p=0.195$). This significance was lost in multivariate analysis, however. All other variables with significant associations with the summary scores had significant associations in multivariate analysis also (Tables 4 and 5). The corrected R^2 of both models were comparable; the model for the GOHAI score could explain 21% of the variance in the score; for the OHIP it was 25%.

Discussion

Although the representative nature of the sample was partially violated, this is the first survey of GOHAI scores for community-dwelling elderly German citizens, and the results obtained from this randomly chosen non-clinical group enable normative comparison of future measured scores, for example before or after dental treatment. Although differences in OHRQoL between the samples from

Table 2. Responses (frequencies) to GOHAI items scoring zero in the OHIP-14

<i>Item (positively worded items inverted)</i>	<i>“Very often”</i>	<i>“Often”</i>	<i>“Sometimes”</i>	<i>“Seldom”</i>	<i>“Never”</i>
Limit food	0	1.5	0	17.9	80.6
Trouble biting	1.5	0	6	16.4	76.1
Uncomfortable to swallow	4.5	0	0	13.4	82.1
Prevented from speaking	0	0	0	3	97
Eat with discomfort	6	0	1.5	9	83.6
Limit contact	0	0	0	3	97
Use medication	0	0	0	7.5	92.5
Worried or concerned	3	3	10.4	37.3	46.3
Nervous or self-conscious	0	0	1.5	14.9	83.6
Uncomfortable eating	0	0	1.5	6	92.5
Sensitive teeth, gums	0	0	9	29.9	61.2
Unhappy with appearance	3	1.5	6	41.8	47.8

Table 3. Factor analysis, simultaneous for both items of GOHAI and OHIP-14 (opposite signs result from the different polarity of GOHAI and OHIP-14 items).

<i>Component</i>						
<i>Item</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>
GOHAI						
Limit food	-,544					
Trouble biting	-,596					
Comfortable to swallow					,827	
Prevented from speaking			-,534			
Eat without discomfort					,673	
Avoid social contact			-,730			
Use medication	-,683					
Worried or concerned	-,496					
Nervous or self-conscious	-,641					
Uncomfortable eating in presence of others			-,634			
Sensitive teeth, gums						,834
Happy with appearance				,740		
OHIP-14						
Trouble speaking			,686			
Taste worse	(,461)					
Life less satisfying		,535		-,580		
Difficult to relax				-,548		
Felt tense	,597					
Interrupt meals	,555					
Uncomfortable to eat	,635					
Been irritable		,810				
Difficulties with daily activities		,882				
Unable to do anything		,830				
Been embarrassed			(,491)			
Diet unsatisfactory		,567				
Painful arching	,679					
Self-conscious	,619					

eastern and western Germany were expected to occur for historical reasons, in both bivariate and multivariate analyses the region in which one lived was of minor significance in the GOHAI. The most impairment was shown for GOHAI items related to worries/concerns and happiness with appearance. This could give hints of dental treatment plans for this group of elderly patients, for example, to give the aesthetic outcome of dental treatment high priority in the elderly also.

Although GOHAI scores indicating very high impairment were rarely obtained, it was shown that only 7% reported no impairment of subjective oral health in this questionnaire; this corresponded to the self-rating of oral health, with not even one participant rating his/her oral health as “excellent”. From a dental perspective, factors found to be associated with OHRQoL in previous studies, namely dry mouth, mouth burning, and use of removable dentures, were explicitly tested in the GOHAI (Baker *et al.*, 2006; John *et al.*, 2004a; Szentpétery *et al.*, 2006). When controlled for gender, urban region, education, and psychological well-being, all these variables were found to be associated with higher GOHAI scores (greater impairment). Treatment to challenge these factors should, therefore, have the potential to improve subjective oral health status.

Reliability and validity were comparable for both measures. Internal consistency was high for both measures (Cronbach’s alpha > 0.8) and the item–scale correlations were comparable. Convergent validity to self-rated oral health and PGSCM could be demonstrated for both instruments, and inter-correlation of the scores was high. The known-group validity was in the expected direction for patients with/without dry mouth, mouth burning, and removable dentures. In this instance both measures, GOHAI and OHIP, gave very similar results. This was also true for the explanation

of the variance of both summary scores with regard to the same explanatory variables in multivariate analysis. It should, however, be noted that the comparative reliability assessment performed is initial and limited, because of the cross-sectional nature of the study design. It was not possible to give information about the responsiveness or stability of the indices. Summarizing, this could lead to the result that both measures were nearly interchangeable for this elderly collective; noticeable differences between the measures were found, however. The factor analysis revealed only partial overlap in factor loading of the items of GOHAI and OHIP; some factors were built from items of the GOHAI or OHIP only. Whereas most GOHAI items are very close to actual oral health-related behaviour and perceptions, the OHIP items are more open to general subjective state of health. It also seems as if positively and negatively phrased items may, indeed, not measure the same thing with only opposite polarity.

The lowest possible score, indicating no impairment of OHRQoL, was, furthermore, reported by one-third of the participants in the OHIP but by only 7% in the GOHAI. Furthermore, the median OHIP score was only 2. Although the reference time period for the GOHAI was larger, possibly leading to a greater range of scores, this greater “floor-effect” of OHIP could be seen as confirmation of previous results from comparative studies with equally long reference time periods. It was reported for participants with a mean age of 83 years in the city of Toronto that 8.4% of GOHAI scores and 30.3% of OHIP scores revealed no impairment over a one-year period (Locker *et al.*, 2001). This effect might be explained by the suggestion of Locker *et al.*, who interpreted the GOHAI rather as a measure of subjective oral health and only partially as a measure of OHRQoL, which encompasses more social and

Table 4. Results from linear regression analysis (dependent variable GOHAI score)

<i>Variable</i>	<i>Not standardized B</i>	<i>Standardized Beta</i>	<i>T</i>	<i>Significance</i>
Constant	47.980	.	12.482	.000
Eastern/western Germany	-.792	-.070	-.989	.324
Gender	-.434	-.039	-.558	.577
Years of education	-.035	-.017	-.241	.810
PGSCM	.349	.228	3.275	.001
Dry mouth	-1.699	-.150	-2.137	.034
Burning mouth	-4.560	-.197	-2.882	.004
Removable denture	-3.262	-.270	-3.906	.000

Table 5. Results from linear regression analysis (dependent variable OHIP score)

<i>Variable</i>	<i>Not standardized B</i>	<i>Standardized Beta</i>	<i>T</i>	<i>Significance</i>
Constant	4.615		4.943	.000
Eastern/western Germany	.169	.060	.871	.385
Gender	-.054	-.019	-.287	.774
Years of education	-.012	-.025	-.356	.723
PGSCM	-.132	-.346	-5.088	.000
Dry mouth	.453	.161	2.347	.020
Burning mouth	1.156	.201	3.007	.003
Removable denture	.492	.164	2.427	.016

psychological effects (Locker and Allen, 2007). The OHIP was regarded as a measure of OHRQoL reflecting social effects of oral health and better meeting the main criteria for measurement of OHRQoL—being patient-centred and incorporating aspects of daily living (Locker and Allen, 2007). This is supported by our findings, which show that the GOHAI items related to limited food, difficulty biting, worries about teeth/dentures, or satisfaction with appearance could show impairment, but this impairment did not lead to a broader social impact which would be reflected by the OHIP. The other way round, underpinning this hypothesis, when the GOHAI indicated no impairment, the OHIP result was “no impairment” also. Moreover, the self-rated oral health of participants having no effect on the scores was better related to the GOHAI than to the OHIP, with no participant rating oral health as “moderate” or “bad” when the GOHAI score was 60, emphasizing that the GOHAI is rather a measure of subjective oral health. The greater floor effect of the OHIP may, however, limit the ability of this questionnaire to measure intra-individual changes in OHRQoL in the elderly, which can be achieved more easily with the GOHAI. For example, participants with zero OHIP score but only moderate or bad self-rated oral health at the beginning could not improve in subjective OHRQoL in a longitudinal study design. Ceiling effects, i.e. scores of maximum impairment, not allowing for deterioration in longitudinal designs, were not present for either measure in this collective. The OHIP-14 scores corresponded almost completely to the OHIP-14 results from the representative German sample reported by John et al. (2004b). This result was partly unexpected, because the representative sample had a wider age range than ours and it has already been reported that OHRQoL decreases with age (John et al., 2004a); it might also be related to sample structure, for example inclusion of subjects from an urban region only.

Researchers must therefore carefully plan which instrument, or which instrument version, to use. For example, use of the long or short forms of the OHIP, which differ in measured outcome, must be considered. OHIP short forms are appropriate for measuring the construct OHRQoL in a single summary score, whereas the long versions can also be used for measurement of the single dimensions of OHRQoL (John et al., 2006). The importance of planning which measurement instrument to use has already been pointed out for measures of health-related quality of life, even if the measures seem rather similar (Jacobs and Dessens, 1996).

When focussing more on subjective oral health, reflecting minor clinical changes, or assessing more immediate functional aspects, the GOHAI seems more appropriate in this collective. The results of this study could also be of help on the single-items level, showing which items show impairment in the GOHAI when the OHIP-14 score was zero. When researchers are additionally especially interested in these single aspects, for example happiness with appearance, the GOHAI is more appropriate than the OHIP. In contrast, when assessing a broader concept of OHRQoL, reflecting social effects of oral health, the OHIP should be chosen.

References

- Adulyanon, S., Vourapukjaru, J., Sheiham, A. (1996): Oral impacts affecting daily performance in a low dental disease Thai population. *Community Dentistry and Oral Epidemiology* **24**, 385-389.
- Atchison, K.A. and Dolan, T.A. (1990): Development of the Geriatric Oral Health Assessment Index. *Journal of Dental Education* **54**, 680-687.
- Baker, S.R., Pankhurst, C.L., Robinson, P.G. (2006): Utility of two oral health-related quality-of-life measures in patients with xerostomia. *Community Dentistry and Oral Epidemiology* **34**, 351-362.
- Hassel, A.J., Koke, U., Schmitter, M., Rammelsberg, P. (2006): Factors associated with oral health-related quality of life in institutionalized elderly. *Acta Odontologica Scandinavica* **64**, 9-15.
- Hassel, A.J., Rolko, C., Leisen, J., Schmitter M., Rexroth, W., Leckel, M. (2007): Oral health-related quality of life and somatization in the elderly. *Quality of Life Research* **16**, 253-261.
- Hassel, A.J., Rolko, C., Koke, U., Leisen, J., Rammelsberg P. (2008): A German version of the GOHAI. *Community Dentistry and Oral Epidemiology* **36**, 34-42.
- Jacobs, M. and Dessens, J. (1996): Which outcome measure? A methodological review. In: *Health outcome measures in primary and out-patient care*; ed. Hutchinson, A., McColl. E., Christie, M., Riccalton, C. The Netherlands: Harwood Academic Publishers.
- John, M.T., LeResche, L., Koepsell, T.D., Hujoel, P., Miglioretti, D.L., Micheelis, W. (2003): Oral health-related quality of life in Germany. *European Journal of Oral Science* **111**, 483-491.
- John, M.T., Koepsell, T.D., Hujoel, P., Miglioretti, D.L., LeResche, L., Micheelis, W. (2004a): Demographic factors, denture status and oral health-related quality of life. *Community Dentistry and Oral Epidemiology* **32**, 125-132.
- John, M.T., Micheelis, W., Biffar, R. (2004b): Reference values in oral health-related quality of life for the abbreviated version of the Oral Health Impact Profile. [Article in German] *Schweizer Monatsschrift für Zahnmedizin* **114**, 784-791.
- John M.T., Miglioretti, D.L., LeResche, L., Koepsell, T.D., Hujoel, P., Micheelis, W. (2006): German short forms of the Oral Health Impact Profile. *Community Dentistry and Oral Epidemiology* **34**, 277-288.
- Lawton, M.P. (1975): The Philadelphia Geriatric Center Morale Scale: A revision. *Journal of Gerontology* **30**, 85-89.
- 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 Dentistry and Oral Epidemiology* **29**, 373-381.
- Locker, D. and Allen, F. (2007): What do measures of ‘oral health-related quality of life’ measure? *Community Dentistry and Oral Epidemiology* **35**, 401-411.
- Martin, M., Grunendahl, M., Martin, P. (2001): Age differences in stress, social resources, and well-being in middle and older age. *The Journals of Gerontology Seires B Psychological Science and Social Science* **56**, 214-222.
- Rohr Inglehart, M. and Bagramian, R.A. (2002): Oral Health-Related Quality of Life: An Introduction. In: *Oral Health-Related Quality of Life*; ed. Rohr Inglehart, M. and Bagramian, R.A. p1-6. Chicago, Berlin: Quintessence Publishing Co, Ing.
- Slade, G.D. and Spencer, A.J. (1994): Development and evaluation of the Oral Health Impact Profile. *Community Dental Health* **11**, 3-11.
- Statistisches Bundesamt (2003): Bevölkerungsentwicklung bis zum Jahr 2050. Press release June 2003.
- Szentpétery, A., Szabó, G., Marada, G., Szántó, I., John, M.T. (2006): The Hungarian version of the Oral Health Impact Profile. *European Journal of Oral Science* **114**, 197-203.