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Factors associated with oral health-related quality of life in institutionalized elderly

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Abstract

Objective. The aim of this study was to investigate factors associated with the oral health-related quality of life (OHRQoL) of institutionalized elderly in Germany. ***Material and Methods***. One-hundred-and-fifty-eight subjects from old people's homes were selected (mean 82.8 years). OHRQoL was measured using the Oral Health Impact Profile (OHIP). Denture characteristics (kind and age of denture, retention of removable denture, number of teeth in static occlusion) and general issues (age, gender, education level, and general pain status) were assessed. All factors were subjected to bivariate testing for their effects on the OHIP summary score (OHIP-SC) and to multivariate testing in subjects with removable dentures ($n = 128$); a linear regression model with backward elimination was used, with OHIP-SC as the dependent variable. ***Results***. In the context of other studies, a median OHIP-SC of 29 indicated highly impaired OHRQoL. According to the bivariate analysis, retention, age of denture, number of teeth in static occlusion, general pain status, and education all exhibited significant influence on OHIP-SC. In the final linear regression model, general pain status, education level, and retention of denture remained at a statistically significant level. The model explained 34% ($R^2 = 0.34$) of the variance of the OHIP-SC. The kind of denture had no significant impact on OHIP-SC. ***Conclusions***. In contrast to other groups, the kind of denture exhibited little impact on OHIP-SC for this highly specific collective. However, there were functional aspects of dentures which seemed to be important. Non-dental factors had a striking effect on OHRQoL.

Key Words: *Denture characteristics, kind of denture, OHIP, OHRQoL, pain status*

Introduction

The demography in Western countries includes an increasing proportion of the elderly. In 2050, every third person in Germany will be 60 years or older [1]. The prognosis is that with increasing age an increasing number of the elderly will be living in old people's homes. This percentage is set to increase, especially in men [2]. The Berlin Aging Study demonstrated that the interval between regular dental visits increases in the elderly with increasing age [3]. The poor oral conditions and critical circumstances for oral health (e.g. drugs reducing salivation rate) of the institutionalized elderly have been described [4]. In many cases, the dental treatments need to take place in the old people's homes and are therefore technically complicated and limited. The patient's health, well-being, and benefit derived from the different dental therapies have also to be borne in mind. A helpful tool for assessing the subjective oral situation is the concept of Oral Health Related Quality of Life (OHRQoL). The OHRQoL comprises components such as function (e.g. chewing), pain, psychological components (e.g. self-consciousness), and social aspects (e.g. communication) [5,6]. This is in accordance with the World Health Organization definition of health, including the patient's overall well-being. Many instruments for measuring the OHRQoL have been developed and validated in the past [7–11]. The Oral Health Impact Profile (OHIP) is a frequently used questionnaire for measuring the OHRQoL in the complete (OHIP-49) or shortened versions [12–16]. There have been few previous studies on the OHRQoL with institutionalized elderly subjects [13,17–19]. Previous studies in Germany have been restricted to non-institutionalized patients and to subjects under 79 years of age [20–22]. This is an important limitation in view of the poor oral status

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and major treatment requirements of this group [23,24], and the recognized special status of institutionalized subjects compared to elderly subjects living independently [25]. Because of the special status of this group, the poor oral conditions and the more complicated treatments, additional information was required on factors influencing OHRQoL of institutionalized elderly subjects. Consequently, the aim of this study was to evaluate factors influencing the OHRQoL of the institutionalized elderly. The impact of the prosthetic status and denture characteristics and of general issues such as age, gender, general health, and social status were investigated.

Material and methods

Subjects: Selection method and inclusion criteria

The study took place from August 2003 to May 2004 in Heidelberg (148,000 inhabitants) and in one city in the vicinity of Heidelberg (Schriesheim, with 13,900 inhabitants) in the southeast of Germany. All geriatric institutions listed in the telephone book (12 with inhabitants of care level 1) were asked to participate. The head offices of five agreed (Institution 1 is divided into two houses; a and b). One center refused because other studies were being conducted at the same time; the others were either concerned about the additional burden on their inhabitants or showed no interest in the study. The elderly sample was chosen from the inhabitants needing moderate care (so-called care level 1): needing help for at least one of the following activities once a day: personal hygiene, eating or mobility, and not suffering from any kind of dementia (according to the medical report). With the exception of institution 2, all elderly subjects fulfilling these inclusion criteria in the chosen institutions were asked to participate. The study was approved by the university review board and the participating subjects received written information and signed an informed consent form. To avoid overrepresentation of one house (not more than approximately 25% of the study population), a random sample was chosen in institution 2. A computerized random list of the eligible subjects was compiled and they were asked to participate following this list.

Study population characteristics

The distribution of eligible subjects, non-eligible subjects, and non-responders is given in Table I. One-hundred-and-ninety-six subjects were asked to participate and 158 complete cases resulted; 19% were male, 81% were female, ranging in age from 61 to 98 years (mean 82.8 years). The age of the participating subjects was missing in six cases and the age of the denture was missing in 16 cases. The missing values were replaced by the mean. The gender distribution of the non-responders was 91% female to 9% male. The age of the non-responders was known in 23 cases, ranging from 73 to 95, with a mean of 83.3 years.

Clinical examination

All examinations and questionnaires were performed in the private rooms of the subjects. Dental status and an assessment of the prosthetic treatment were recorded, i.e. age and kind of denture, retention of removable denture, and number of teeth in static occlusion. With respect to the kind of denture, the patients were classified according to their weaker restored jaw in four groups (no denture if edentulous, complete denture, partial denture, fixed denture or only natural teeth). For example, if a subject had a complete denture in the upper jaw and a partial denture in the lower, s/he was assigned to the group "complete denture". The retention of removable dentures was regarded as insufficient when the subject reported spontaneous loosening of the denture or when the denture loosened during functional movements in the clinical examination. If there were two dentures, the lower rating was recorded. The occlusal support was rated according to the number of teeth exhibiting static occlusal contact. The subject was therefore asked to bite onto a piece of foil (12 μm thickness) and the teeth with visible contacts were counted.

Questionnaires and general issues

The OHRQoL was measured with the OHIP-G49. The German translation and validation is described elsewhere (German version: OHIP-G49/53) [22]. The possible answers were – never, hardly ever, occasionally, fairly often, and very often – using a 5-point scale (0 = never). The questionnaire was carried out in the form of an interview. The summary score (OHIP-SC, same weight of items, simple addition; minimal score 0, maximal 196) was taken as an overview of the OHRQoL [26]. In addition, questions on the general situation of the subject – age, gender, education, general pain status – were recorded. General pain status was judged using self-rating on a 1 to 10 scale (10 worst possible). The subjects were asked: "How would you assess the intensity of pain during the last month which was not related to teeth or dentures on a scale from 1 to 10 – where 10 is the worst possible?" As most of the subjects refused to provide information on their income, the highest level of education was taken as a predictor of social status. The subjects were grouped, according to the three-tier German school system, into those who had received low education (no graduation or graduation in a school of the lowest education level), middle education

Table I. Response rates among institutions

	Institution					
	1a	1b	2	3	4	5
Total no.	113	93	420/345[1]	155	110	75
Complete cases	43	17	41	17	18	22
Some but not all data	1	0	0	1	0	0
Eligible but not successful in contacting	2	1	5	1	0	1
Refused	5	4	5	7	3	2
Response rate (%)	84	77	80	65	86	88

[1]Number of inhabitants fulfilling the inclusion criteria.

(graduation in a school of middle education level, so-called middle school or "Realschule"), and higher education (graduation in a school of high education or studies).

Statistics

The OHIP-SC was described using boxplots. The bivariate analysis between categorical factors and OHIP-SC was assessed using the Mann-Whitney U-test for two groups and the Kruskal-Wallis test for more than two groups. Continuous variables such as age were correlated to OHIP-SC using Spearman's correlation coefficient. A multivariate linear regression model was also calculated. Edentulous subjects wearing no denture were excluded. As the retention of removable dentures influences OHIP-SC and 81% of the study population were wearing removable dentures, only these subjects were included in this model ($n = 128$). The square root of the OHIP-SC was used as the dependent variable, since OHIP-SC was found not to exhibit normal distribution. A backward elimination process was used on all variables until parameters exceeded $p < 0.15$, eliminating the parameters with the highest p-value first. All statistics were performed using SPSS Version 11.5 (SPSS Inc., Chicago, Ill., USA). The level of probability for statistical significance was set at 0.05.

Results

Forty-nine percent of the study population suffered from chronic heart disease, 17% from problems with their gastrointestinal tract, 46% from rheumatism, and 17% from diabetes. The mean period living in the institutions was 4.7 years (from 2 months to 33 years). Eighty-one percent reported that they could leave their flat without help and 69% were able to reach the dentist without help. The last dental visit dated back 3.2 (95% CI: 2.3–4.1) years. A dental service on a regular basis was not offered.

The median value of OHIP-SC was found to be 29 (SD 25, in a range from 0 to 112 points); the distribution is shown in Figure 1. The mean number of teeth was 8. Fifty-two subjects were edentulous in both jaws. Eight subjects (5.1%) had no denture, but were edentulous (3 in the upper, 5 in the lower jaw, no subject in both), 85 (53.8%) a complete denture, 43 (27.2%) a partial removable denture, and 22 (13.9%) only fixed dentures (crowns and bridges) or natural teeth. No subject had implant-retained fixed or removable denture.

Bivariate analysis (Table II)

Edentulousness. There was no significant difference in the median OHIP-SC between subjects without their own teeth and those with at least one tooth of their own.

Denture status and characteristics. The median OHIP-SC was not dependent on denture status (complete denture, partial removable denture, or only fixed denture/natural teeth). In contrast, other denture characteristics were significantly associated with the OHIP-SC: retention, number of teeth in static occlusion, and age of the denture.

General issues. The median OHIP-SC exhibited no association for age and gender. By contrast, a high level of education and a low general pain-scale were significantly associated with a lower OHIP-SC.

Multivariate linear regression models (Table III). All tested variables of the 128 subjects wearing removable dentures were introduced in the starting model. The variables with the highest p-value were removed stepwise until every variable in the model reached a p-value < 0.15. The level of significance changed somewhat differently from that of the bivariate analysis. Number of teeth in static occlusion ($p = 0.71$), age ($p = 0.47$), edentulousness ($p = 0.47$), and gender ($p = 0.39$) were removed first. In the final model, education, general pain status, retention, age of denture, and kind of denture were retained ($p < 0.15$). The association with education, general pain status, and retention was significant. Table III gives the parameter estimates (B-coefficients) of these variables. The variance of OHIP-SC that could be explained by the final model was 34% (R^2 value 0.34). The B-values of the variable have to be added to the intercept and have to be interpreted

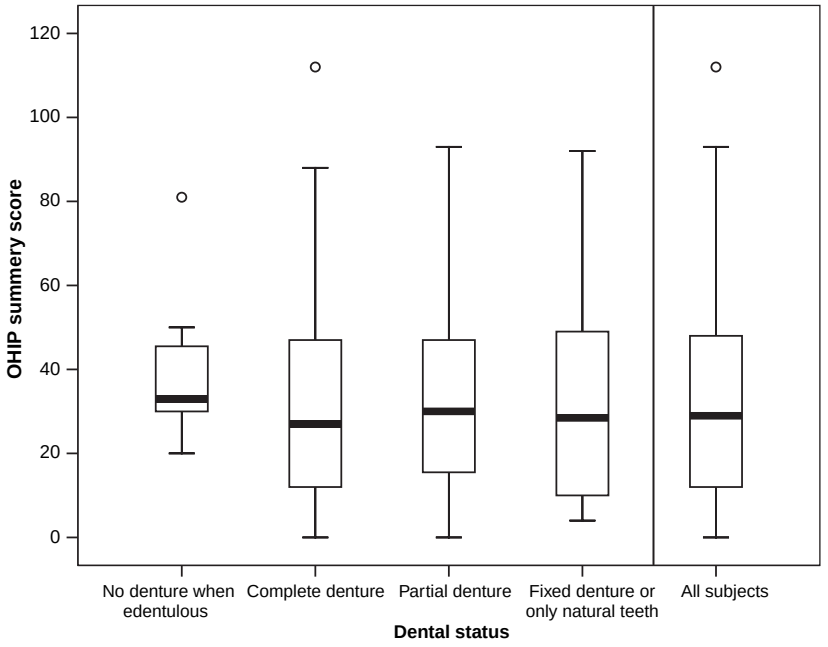

Figure 1. Distribution of OHIP-SC in the different groups of dental status and overall study population. Boxplot representation of the OHIP-SC: the bar represents the median, the box the middle 50% of the data, the whiskers are not extended to more than 1.5 times the lengths of the inner quartiles, outside are outliers.

in the quadratic form, as the square root of OHIP-SC was used as dependent variable. Based on this model, having the lowest education raises the OHIP-SC square root intercept (B = 5.31) by 1.39, lowest general pain lowers this intercept by 2.69 and sufficient retention by 1.74.

Because the dependent variable partially measures pain, the model was rerun without the variable "general pain". The final model changed to some extent. Education ($p = 0.019/p = 0.26$), retention ($p < 0.001$), and kind of denture ($p = 0.137$) remained virtually the same, but the age of denture reached $p = 0.047$ (intercept B = 4.4; B = −0.77; 95% CI −1.53/−0.11). Number of teeth in static occlusion ($p = 0.89$), edentulousness ($p = 0.48$), gender ($p = 0.32$), and age ($p = 0.38$) were removed from this model first. The R^2 value was found to be 0.26.

Table II. Bivariate testing ($n = 158$) of variables to OHIP-SC

Variable	(n)	Median OHIP (SD)	Direction of effect	Significance
General issues				
Age	(158)	Higher OHIP-SC	Higher age	0.99 (r = 0.001)[1]
Gender				
Female	(128)	29 (25)		0.61[2]
Male	(30)	25.5 (25)		
Education level				
Low		(76)	31.5 (24)	0.018[3]
Middle	(56)	26.5 (26)		
High	(26)	20.5 (24)		
General pain	(158)	Higher OHIP-SC	Higher pain level	<0.001 (r = 0.45)[1]
Edentulous				
Edentulous	(52)	31 (24)		0.44[2]
Non-edentulous	(106)	28 (25)		
Prosthetic status/kind of denture				
No denture (edentulous)	(8)	33 (18)		0.62[3]
Complete denture	(85)	27 (26)		
RPD	(43)	30 (25)		
Fixed or natural	(22)	28.5 (27)		
Age of denture	(152)	Higher OHIP-SC	Higher age	0.02 (r = 0.19)[1]
Retention				
Sufficient	(81)	24 (18)		≤0.001[2]
Insufficient	(47)	48 (29)		
Teeth in static occlusion	(158)	Higher OHIP-SC	Less teeth in occlusion	0.004 (r = −0.23)[1]

[1]Spearman correlation coefficient. [2]U-test. [3]Kruskal-Wallis test.

Table III. Final model of multivariate linear regression including variable "general pain level" ($n = 128$)

Variable	(n)	B	Significance	95% CI (B)	
				Lower bound	Upper bound
Intercept		5.31	<0.001*	3.67	6.96
Education level					
Low	(61)	1.39	0.021*	0.21	2.57
Middle	(51)	0.77	0.21	−0.44	1.97
High	(16)	0			
General pain status					
0 – 1	(13)	−2.69	0.001*	−4.32	−1.07
2 – 5	(37)	−1.26	0.067	−2.61	0.09
6 – 8	(66)	−0.51	0.49	−1.79	0.77
9 – 10	(12)	0			
Retention					
Insufficient	(47)	1.74	≤0.001*	0.97	2.51
Sufficient	(81)	0			
Age of denture					
Younger or mean	(76)	−0.69	0.063	−1.42	0.04
Older mean	(52)	0			
Type of denture					
Complete	(85)	−0.61	0.12	−1.39	0.16
Partial	(43)	0			

Discussion

Representativeness of the study for the target population

Because of the limitation of the inclusion criteria (moderate care, no dementia), this study may not be representative for all institutionalized older people in Germany.

Of all care centers with inhabitants of care level 1 in Heidelberg, 42% agreed to participate in this cross-sectional study. The overall response rate in the participating centers was 81%. It has been suggested that response rates of >70% could be seen as acceptable [27]. The response rate varied from 65% to 88% in the different centers. A possible explanation for the suspect response rate of institution 3 could be seen in the low percentage of inhabitants with care level 1, possibly causing a different prevailing mood among these subjects. The age distribution of the non-responders was found to be comparable to the responders. Among the non-responders, no-one was younger than 73 years. Gender was comparable in so far as the percentage of women was clearly higher in both groups. However, there were no data for the non-responders or the population of non-participating institutions for the main variables of the study. The age and gender distribution in the chosen centers is comparable to that in Germany as a whole, according to census data (Table IV), in contrast to the distribution of care levels (higher percentage of care level 1 in the chosen centers) [2,28]. In summary, the representativeness is good, as there is an acceptable overall response rate, the age and gender of the non-responders is similar, and the demographic parameters are similar to the population as a whole. There are possible problems related to the suspect response rate of institution 3, the unknown variations of the main variables of the non-responders and the missing information from the non-participating institutions. Nevertheless, this is the first German study on OHRQoL and factors associated with denture function in elderly institutionalized people.

The OHRQoL can be measured with several different questionnaires [7,9,11]. However, the OHIP is the only existing valid questionnaire in German (OHIP-G49) [22] and was therefore selected to measure OHRQoL. There are different ways by which to analyze the OHIP outcome [29,30]. It could be demonstrated that the weighted summary score and the simple summary score of the German version were nearly the same in outcome [22]. Therefore, in this study the simple OHIP summary score was used as an overview of OHRQoL [26].

In comparison with German population data – reporting 50% of subjects without dentures had OHIP summary scores of 5 or less, with partial removable dentures scores of 15 or less, and scores of 23 or less for complete dentures – levels of impairment were much greater in this sample of institutionalized elderly (median OHIP-SC = 29) [21]. A possible reason for this may be seen in the multimorbidity and high pain level of this collective and the effects of these on OHRQoL. In addition, a questionnaire with 49 items could be a challenge for the concentration of those elderly subjects. Although it was performed as an interview, the possibility cannot be completely excluded that some questions were not answered exclusively for dental problems.

Table IV. Distribution of age, gender, and care level in the participating homes and in the institutionalized German population [28]

	Age and gender			
	% 60–80 years	% >80 years	Male	Female
Participating homes	33.6	66.4	19.0	81.0
German population	36.1	63.9	22.6	77.4
Distribution of care level	Care level 1		Care level 2+3	
Participating homes	51		49	
German population (1% without level)	33		66	

In contrast to our findings, John et al. reported a strong influence of dental status on OHRQoL, in confirmation of other studies [8,21]. However, a wide range of age of subjects was examined in those studies, and it is obvious that a removable denture is a very unsatisfying situation for younger subjects. It could be demonstrated that the impact of denture weakens with age [20]. In other studies, it could be shown that the type of denture affects chewing ability and has hardly any effect on OHRQoL [31].

In contrast to the type of denture, some denture characteristics – retention, number of teeth in static occlusion, and age of denture – influenced the OHIP-SC in bivariate testing. In both multivariate models, insufficient retention of denture remained as a significant negative influence. This strong influence is explainable because denture loosening affects many fields, both psychological and social, e.g. common lunch as an important – often the only – social event.

As a strong predictor affecting OHIP-SC, the general pain level – not related to teeth or dentures – remained. This can be partially explained by the fact that the OHIP asked several questions on pain symptoms. Because of this possible interaction and possible displacement of other variables from the model, the multivariate model was rerun, removing pain status. Changes in the model could be observed with respect to the age of denture. A negative influence of growing age of denture reaches a level of significance of $p = 0.047$. With the low dental aftercare of the study population (last dental visits dated in mean 3.2 years back), there could be a loss of function of dentures over the years. A higher educational level was found to be negatively correlated with the OHIP-SC in bivariate testing and also in both multivariate models. This is supported by other studies, indicating an influence of social status and education on OHRQoL [5,32].

In accordance with other institutionalized collectives with a comparable range of age, age showed no impact on OHIP-SC [18]. Other studies showed different effects of age on OHRQoL [5,21,33,34], but with a larger range of years compared to the narrow range in this study.

The R^2 value of the final multivariate model was found to be 0.34, which is acceptable in comparison with other studies [35]. After removing the variable "general pain level" from the model, the R^2 value decreased to 0.26. As not only dental associated factors were integrated, this could explain the greater variance in OHIP-SC than in studies using only dental associated factors.

Public health relevance of the findings

As denture-associated factors have an impact on OHRQoL, there is the possibility for dentists to increase QoL with the help of dental treatment or regular aftercare. From the results of this study for example, identification and increasing retention of insufficiently retained dentures could lead to a benefit for the patient. An important consideration is the low frequency of regular dental visits by the institutionalized elderly. With this low demand for dental aftercare, it should be the responsibility of the staff of the institutions to organize dental visits for those who are interested.

But besides dental treatment needs, non-dental associated factors have an important impact on OHRQoL, as described previously [32]. The close connection between pain status and OHRQoL could be demonstrated. With only 13 subjects reporting no or very low pain status and 50% of the study population reporting high or very high pain, the question of need for pain screening and therapy arises. This is not just to improve OHRQoL but the whole QoL.

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