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ORIGINAL ARTICLE

Association between patient satisfaction with complete dentures and oral health-related quality of life: two-year longitudinal assessment

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Abstract The objective was to evaluate the development of oral health-related quality of life (OHRQoL) in patients with complete dentures and the association between OHRQoL and patient satisfaction. Fifty-two patients (mean age, 66.3, 48.1% male) received dentures in at least one jaw. The analysis was conducted on participants with dentures in both jaws (CD-Both; n=22) or in the upper jaw only (CD-Max; n=28). Data were collected 4 weeks, 6 months, and 1 and 2 years after insertion. OHRQoL was measured by use of the OHIP-EDENT. Self-rated patient satisfaction was assessed on a scale of 0–10. To prove the hypothesis that patient satisfaction would be a meaningful predictor of OHRQoL, and not vice versa, multilevel analysis and cross-lagged correlation analysis were performed for both groups separately. OHRQoL improved from 22.9 (SD, 20.7) to 12.1 (SD, 14.5) for CD-Both and from 20.3 (SD, 17.2) to 14.7 (SD, 15.1) for CD-Max. Multilevel analysis revealed that patient satisfaction and OHRQoL were significantly associated (p<0.0001) for both groups. Differences between the groups were found with regard to the effect of time after insertion and the interaction between time and satisfaction with OHRQoL which were significant only for the group CD-Both; however, no evidence was found for the causality of this association in the cross-lagged analysis for both groups (ZPF test, p>0.016). Patient satisfaction and OHRQoL were associated for wearers of complete dentures. Within the limitations of the study, however, the causality that patient satisfaction predicts OHRQoL, and not vice versa, could not be proven.

Keywords Oral health-related quality of life · Oral health impact profile · Patient satisfaction · Treatment outcomes · Complete dentures · Edentulism

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Introduction

Patient-centred evaluation of the outcome of therapy is attracting growing interest. It can be measured by using the concept of oral health-related quality of life (OHRQoL). To measure OHRQoL, multi-item instruments, for example the widely used Oral Health Impact Profile (OHIP), can be used [1]. Previous studies have revealed that prosthodontic treatment can improve OHRQoL [2]. This was also found for patients receiving complete dentures [3, 4].

Despite declining endentulism and increasing implant treatment, the need for complete denture treatment will remain substantial in the future [5]. Although implant-supported dentures can substantially improve the quality of life, in particular for patients unable to adapt to dentures [6–8], for most edentulous patients complete dentures will remain the only treatment option [5].

Rehabilitation of edentulous patients with complete dentures is a great challenge and not only anatomic, clinical and technical factors determine treatment success. Studies have revealed that psychogenic factors, for example a good relationship between patient and dentist, may be even more important aspects of patient satisfaction with treatment

outcome [5, 9, 10]. Furthermore, success of treatment with complete dentures is often assessed differently by dentists and patients [11–13]. Many studies have reported a high mean level of self-rated satisfaction of people with complete dentures [5, 14, 15], although there are edentulous patients who need a long adaptation period or even cannot adapt to dentures [5, 16, 17].

The effect of new complete dentures on OHRQoL and factors affecting patients' satisfaction with new dentures a short time after treatment, have been reported [2, 4, 18, 19]. A recent study described associations between self-rated denture function and OHRQoL for different age groups and reported a consistent positive correlation between self-reported satisfaction with dentures and OHRQoL (high satisfaction, low impairment of OHRQoL) for older people, but not for younger patients [20]. Another study also found a positive correlation between professional rating of removable denture quality and OHRQoL (good quality, low impairment of OHRQoL) [21]. There is, however, little information about the association between OHRQoL and patients' self-rated satisfaction during a longer period of time after rehabilitation with complete dentures, especially with regard to the direction of this relationship.

The objective of this investigation was, therefore, to evaluate the development of OHRQoL and patient satisfaction, and the association between these, during a period of 2 years after placement for patients who had received complete dentures. From previous research, a conceptual model was formulated with the hypothesis that patient satisfaction would be a meaningful predictor of OHRQoL and not vice versa.

Materials and methods

Participants The participants in this study on OHRQoL were 52 patients who were edentulous in one or both jaws. The mean age of the participants was 66.3 years (SD, 11.6; range, 45–87); 48.1% were male. In accordance with their dental status, 28 participants received complete dentures in the maxilla only, two in the mandible only, and 22 in the maxilla and mandible. These participants were originally recruited for a study evaluating technical and clinical complications of two different denture materials (conventional polymer PalaXpress; Heraeus Kulzer, Germany and hypoallergenic polymer; Versyo.com; Heraeus Kulzer; ethical approval: local university review board, Nr. 295/2003).

Measurements OHRQoL was measured using an abbreviated version of the OHIP for edentulous patients, the OHIP-EDENT with 19 items [22]. A simple score was calculated by summing the responses to all the questions (0=never; 1=seldom; 2=fairly often; 3=often; 4=very often), where a high score means high impairment of OHRQoL (range of sum score, 0–76). Patient satisfaction was assessed by use of a ten-point scale (from 0=not satisfied at all to 10=best possible). Measurement points were baseline (4 weeks after denture placement, t1) and 6 months (t2) and 1 (t3) and 2 years (t4) after baseline. Dental status was assessed as edentulous in both jaws, in the maxilla only or in the mandible only.

Statistical evaluation Because dental status differed between the participants, which may affect the results, the analysis was performed groupwise. The two participants with complete dentures in the lower jaw only were excluded. The 28 participants with complete dentures in the maxilla only formed group CD-Max; the 22 participants with complete dentures in both jaws formed group CD-Both.

To test whether patient satisfaction is a significant predictor of OHRQoL, a multilevel model was calculated using OHIP-EDENT as dependent variable with variation between all measurements (of the OHIP-EDENT) on level one and variation between persons on level two. This was considered superior to regression analysis because assumption of homoscedasticity was violated (ICC, 0.50) and baseline OHIP-EDENT and change of OHIP-EDENT over time differed between patients. The assumptions for application of the model were checked in terms of skewness [(OHIP, patient satisfaction)<2] and curtosis [(OHIP, patient satisfaction)<2] of OHIP-EDENT and patient satisfaction rating scores. Modelled effects were measurement point, patient satisfaction, patient satisfaction×measurement point, and dental status.

To prove the hypothesis that patient satisfaction predicts OHRQoL and not vice versa, cross-lagged correlation analysis was performed [23, 24]. Causal predominance in cross-lagged analysis means that a variable Y (measured at t2) can be better predicted by a variable X (measured at t1) than the variable X (measured at t2) can be predicted by the variable Y (measured at t1). Three types of correlation were present: autocorrelations (between two measures of a variable at different times), synchronous correlations (between different variables at the same time) and cross-lagged correlations (between different variables at different times). Synchronicity and stationarity have to be met to enable use of cross-lagged correlation analysis [23]. Synchronicity means that both variables are measured at the same time, which was true in this study, and stationarity means that the structural equation for both variables is the same at both points in time. If this condition is true, then the synchronous correlations should be equal. If the cross-lagged correlations differ from each other, one variable is causally predominant over the other. The difference between cross-lagged correlations can be tested with a modified Pearson–Filon ZPF test [25]. One cross-lagged

analysis was performed for each time lag, resulting in three cross-lagged analyses for each group. The local level of alpha was set to .016 (adjustment for multiple testing, three comparisons with ZPF test). Statistical analysis was performed using SAS 9.2.

Results

The mean OHIP-EDENT scores and patient satisfaction ratings for each measurement point for both groups are listed in Table 1.

The multilevel analysis (Tables 2 and 3) showed for both groups that patient satisfaction and OHRQoL were significantly associated ($p<0.0001$). For the group CD-Max, measurement point and the interaction between measurement point and patient satisfaction were not significantly associated with OHIP-EDENT (Table 2). This is in contrast with the group CD-Both. When a patient had complete dentures in both jaws, the OHIP-EDENT scores dropped significantly over time. Furthermore, the interaction between measurement point and patient satisfaction was significant (positive estimate) meaning that the improvement in the OHIP-EDENT score was less when the patients were more satisfied (Table 3).

Cross-lagged correlation analysis For the group CD-Max, the cross-lagged correlations between OHIP-EDENT and patient satisfaction were not significantly different for any two measurement points (Fig. 1). Furthermore, the correlation between OHIP-EDENT to t2 and to t4 and denture satisfaction to t1 and to t3 was larger than vice versa ($r=-0.46$ to $r=-0.38$ for t1 and t2; $r=-0.19$ to $r=-0.71$ for t3 and t4); the opposite was true for measurement points t2 and t3 ($r=-0.75$ to $r=-0.39$). The interpretation of this is that there is no causal predominance of one or both of OHRQoL and satisfaction. In group CD-Both, the correlations between OHIP-EDENT to the previous measurement point and satisfaction to the following point were always greater than vice versa, although not significantly greater (Fig. 2). This again means that no causal predominance of one of both of OHRQoL and satisfaction could be proven, although a trend may exist indicating that OHRQoL will predict satisfaction rather than satisfaction predicting OHRQoL.

Table 1 Mean OHIP-EDENT scores and denture satisfaction ratings

Measurement point	Group	OHIP-EDENT (SD)	Patient satisfaction (SD)
Baseline	CD-Max	20.3 (17.2)	7.1 (3.1)
	CD-Both	22.9 (20.7)	7.7 (2.5)
6 months	CD-Max	18.8 (17.6)	7.6 (2.7)
	CD-Both	15.1 (13.2)	8.2 (2.2)
1 year	CD-Max	16.2 (18.0)	8.1 (2.3)
	CD-Both	15.3 (16.5)	8.0 (2.9)
2 years	CD-Max	14.7 (15.1)	8.3 (2.3)
	CD-Both	12.1 (14.5)	8.2 (3.1)

Table 2 Multilevel analysis (fixed effects) for group CD-Max

Effect	Estimate	Standard error	*t* Value	Pr>|t|
Intercept	47.98	4.38	10.95	<0.0001
Time	5.19	3.26	1.59	0.1160
Satisfaction	−3.87	0.55	−7.06	<0.0001
Time×satisfaction	−0.68	0.39	−1.76	0.0828

Model test, $\chi^2(3)=15.85$; $p=0.0012$; time×satisfaction=change of satisfaction over time

Discussion

It has been proven in a variety of studies, in English and in other languages, that the outcome variable OHIP is a reliable and valid instrument suitable for assessment of OHRQoL in cross-sectional and longitudinal studies [1, 26, 27]. The modified short version for edentulous patients, OHIP-EDENT, has been shown to have measurement properties comparable with those of OHIP-49 [22, 28]. The post-treatment scores of OHIP-EDENT in this study (22.9; SD, 20.7 for patients with dentures in both jaws and 20.3; SD, 17.2 for patients with dentures in the upper jaw only) nearly match the post-treatment scores for complete dentures described by Allen and Locker (23.1; SD, 15) [22]. Another study found higher OHIP-EDENT scores (higher impairment) after provision of complete dentures [29]. The findings reported here confirm other research describing improvement of OHRQoL during the time after

Table 3 Multilevel analysis (fixed effects) for group CD-Both

Effect	Estimate	Standard error	*t* Value	Pr>|t|
Intercept	72.53	6.61	10.97	<0.0001
Time	−12.76	3.06	−4.17	0.0001
Satisfaction	−6.57	0.79	−8.35	<0.0001
Time×satisfaction	1.28	0.37	3.51	0.0009

Model test, $\chi^2(3)=24.31$; $p<0.0001$; time×satisfaction=change of satisfaction over time

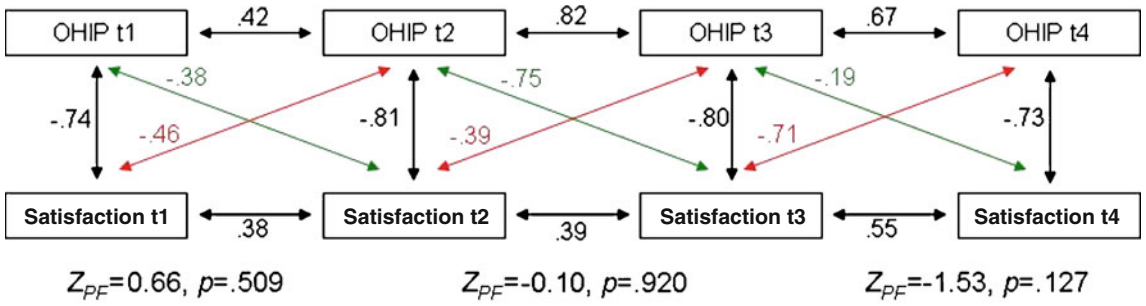

Fig. 1 Cross-lagged analysis for group CD-Max

treatment [2, 30]. For example, it was found by John et al. that OHRQoL improved rapidly within 1 month after treatment with fixed, removable, and complete dentures and continued to improve within 6 to 12 months after treatment [2]. For subjects treated with complete dentures, the median OHIP-49 score after 12 months was below the value for complete denture wearers in the general population [2]. The OHIP-EDENT scores obtained over 24 months in this study, however, did not show a "sine-curve"-like course of OHRQoL over time, as expected by other authors [31]. Instead we found a constant increase of OHRQoL during the 2 years after treatment, which could be interpreted as an indication that adaptation processes after provision with complete dentures may continue during this period.

In this study, patient satisfaction was significantly associated with OHRQoL for both groups, CD-Max and CD-Both. The estimate of the effect of patient satisfaction on OHIP-EDENT (19 items) could therefore be interpreted as being clinically meaningful (estimate −3.87 for group CD-Max and −6.57 for group CD-Both). John et al. described a minimum important difference of 6 OHIP units (95% CI, 2 to 9) using the OHIP questionnaire with 49 items [32]. Another research group suggested a mean score change of 7 to 10 representing the minimum important difference for OHIP-20 in patients with removable partial dentures [33]. The positive correlation between self-rated satisfaction and OHRQoL in this study confirms the results of a recent study which reported a consistent positive correlation between self-reported satisfaction with dentures and OHRQoL in the elderly [4, 20]. In contrast, however, a negative correlation for younger patients [20] or even discordance with regard to global satisfaction and OHRQoL [34], has been described. Different patient populations or different expectations and experiences with regard to their oral situation may be responsible for the different study findings. When controlled for satisfaction, the time after denture placement was only significantly associated with (lower) OHIP-EDENT scores for the group CD-Both, which suggests there was significant improvement over time for this group only. Furthermore, the interaction between time and satisfaction was significant in this group. The direction of the estimate is opposite to that of the estimate of measurement point and satisfaction. This means that subjects with high satisfaction levels improved less in OHIP-EDENT scores over time. This might be related to the measurement itself. Subjects with very low and therefore good OHIP-EDENT and high satisfaction scores could not improve further in OHIP over time. In both groups the cross-lagged panel analysis could not clarify the causal direction of the relation between OHIP-EDENT and satisfaction. Therefore, it was not possible to confirm the hypothesis that patient satisfaction predicts OHRQoL but not vice versa.

The results might be related to the rather small number of participants in the investigation. The power of the analysis is therefore limited and the conceptual model might have been proven or rejected for a larger sample; this must remain a topic for future research.

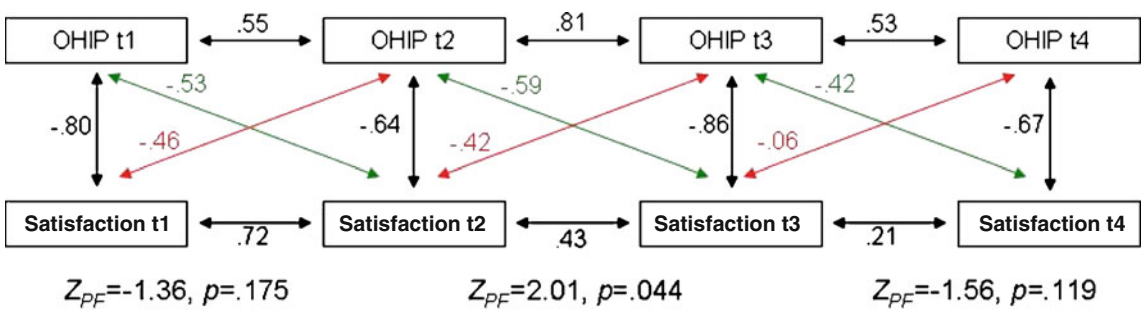

Fig. 2 Cross-lagged analysis for group CD-Both

A strength of the study was the relatively long follow-up period of 24 months after denture placement in a prospective study design. Furthermore, assessment of both OHRQoL and patient satisfaction was performed at each of four measurement points, enabling longitudinal data analysis. Weaknesses of the study were, as mentioned above, the relatively small number of participants, which limits the power of the results from cross-lagged analysis. Furthermore, an abbreviated version of the OHIP (the OHIP-EDENT) was used and some of the participants were edentulous in one jaw only. The use of the abbreviated OHIP-14 version was not possible because this version was derived for a sample excluding edentulous subjects; the use of the full version (OHIP-49) was seen as inappropriate because many of the participants were edentulous. Because patient satisfaction should only be rated with regard to the complete dentures, use of the OHIP-EDENT seemed feasible.

Conclusions

Patient satisfaction and OHRQoL were significantly and clinically meaningfully associated for complete denture wearers during the 24 months after denture placement, emphasising the importance of prosthodontic restorations in edentulous patients. Bearing in mind the limitations of the study design and the rather small number of participants, however, the causality that patient satisfaction predicts OHRQoL could not be proven.

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Conflict of interest The authors declare that they have no conflict of interest.

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