Does the Oral Health Impact Profile Questionnaire Measure Dental Appearance?

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> **Purpose:** The aim of this study was to evaluate whether there is a need to develop a new questionnaire measuring dental appearance or if this is already covered by the Oral Health Impact Profile (OHIP-49). Materials and Methods: Based on internationally accepted guidelines about dental esthetics, a questionnaire was developed to measure dental appearance (QDA). Eleven items defined a QDA sum score (0 = absolutely satisfied, 44 = absolutely dissatisfied). Furthermore, oral health-related quality of life was evaluated using the German version of the OHIP-49 and the OHIPesthetic. Thirty patients (14 women, 16 men; mean age 59 ± 10 years) were included in the study. All patients received a complete oral rehabilitation including the anterior teeth of the maxilla. Questionnaires were completed before and after treatment. **Results:** The median values were 16 and 1.5 for the QDA sum score. 46 and 16 for the OHIP sum score, and 14.5 and 2 for the OHIP-esthetic before and after rehabilitation, respectively. The improvement after treatment was significant for all questionnaires ($P \leq .0001$). Between the QDA sum score and the OHIP sum score or any of the OHIP subscales (the only exception being "psychological discomfort"), no significant correlation could be found (P > .05). Between the QDA sum score and the OHIPesthetic, a significant correlation could be found before treatment (r = 0.505, P = .004) but not after treatment (P > .05). **Conclusions:** If the OHIP-49 is used in clinical studies and a profound evaluation of dental appearance is desired, it is reasonable to use an additional esthetic modulus. Int J Prosthodont 2009;22:87-93.

Nowadays, esthetics in general, and dental esthetics in particular, seem to be increasingly important in Western societies. A significant number of publications are currently dealing with dental esthetics,¹⁻⁸ and dental companies have begun to excessively market the benefits received from pleasing esthetics through such mediums as magazines and TV shows.⁹

Concerning dental appearance, several authors have indicated a correlation between dental esthetics and quality of life.¹⁰⁻¹² For example, Davis et al¹⁰ showed that restorations that improve the dental appearance of a person result in a clearly positive effect on a patient's self-esteem and quality of life. Other authors⁸ have reported that, in the absence of other information, personal judgments about strangers are significantly influenced by their dental appearance.

However, the term "oral health-related quality of life" (OHRQOL) has no strict definition. There is an overall agreement that it is a multidimensional concept.¹³ In general, there are 3 categories used to measure OHRQOL, as indicated by Slade.¹⁴ These are: so-cial indicators, global self-ratings, and multiple-item questionnaires. Multiple-item questionnaires are the most widely used method of assessment.¹⁵

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An example of a multiple-item test instrument for evaluating OHRQOL is the Oral Health Impact Profile (OHIP), introduced by Slade in 1994.¹⁶ As such, its validity and reliability have been previously established.^{17,18} This questionnaire has been translated and published in several languages,^{19,20} including German.¹⁸

The Oral Health Impact Profile consists of 49 items (OHIP-49) which are grouped into 7 subdomains based on a model of oral health that uses the framework of the WHO International Classification of Impairments, Disabilities, and Handicaps.²¹ The OHIP-49 subdomains are: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicaps. Dental appearance is not listed separately.

The OHIP-49 has been used in a number of clinical trials investigating the impact of implants or removable partial dentures on OHRQOL.22-25 According to the authors' knowledge, no study is available where the OHIP-49 was specially used for dental or facial esthetic screening. However, Wong et al²⁶ developed a short form of the OHIP-49 specifically for dental esthetics (OHIP-esthetic). With an expert-based approach, they analyzed the original 49 items and selected 14 items, 2 from each subdomain, and attempted to find questions that were logically related to dental appearance. The limitation of this selection was that the OHIP-49 includes only 2 items asking directly about dental esthetics (no. 22: "Have you felt uncomfortable about the appearance of your teeth, mouth, or dentures?" and no. 31: "Have you avoided smiling because of problems with your teeth, mouth, or dentures?"). Therefore, in some domains, the selected items were not directly related to dental appearance, for example item no. 26 ("Have you felt that there has been less flavor in your food because of problems with your teeth, mouth, or dentures?"). On the other hand, the authors showed that the OHIP-esthetic was reliable and sensitive to the dental esthetic intervention of tooth whitening.

In contrast to tooth whitening, comprehensive oral rehabilitation in restorative dentistry is more complex, resulting in the alteration of many characteristics of the smile (ie, size, shape, and position of the teeth). These aspects affect the dental appearance of a person considerably more than only the change of tooth color.

However, if dental appearance is of importance to OHRQOL,^{10,27} test instruments should be able to measure satisfaction levels regarding dental appearance. Therefore, the main aim of this study was to evaluate whether the OHIP sum score, the OHIP subdomains, the OHIP-esthetic, or single items (no. 22 and no. 31) correlate with a reliable, valid test instrument measuring dental appearance.

The null hypothesis was: Dental appearance evaluated with a valid test instrument directly correlates with the OHIP-49 or the OHIP-esthetic, respectively.

Materials and Methods

Participants

Thirty-two participants (16 men, 16 women) were selected. The mean age of the participants was 59 ± 10 years; they were unpaid volunteers. The participants had been treated in a student course in the Department of Prosthodontics, Propaedeutics, and Dental Materials at Christian-Albrechts University, Kiel between April 2003 and April 2004 and had received either a fixed or removable restoration. All treatments were performed in the Prosthodontics II course. The students were supervised by faculty members as well as the responsible assistant medical director or the head of the department. The restorations were fabricated in either commercial dental laboratories or the department's dental laboratory.

For additional test-retest reliability, the self-developed esthetics questionnaire and the OHIP-49 were answered by a second group of 20 participants from a handball team (mean age 27 ± 8.7 years). They completed the self-developed esthetic questionnaire twice—the second survey was completed 4 weeks after the first. No dental treatment was performed during this period.

Study Procedures

Throughout the 4 months of the student course, each participant received a complete oral rehabilitation performed by an undergraduate student (Fig 1). The treatment included oral hygiene instruction and motivation, a provisional phase that lasted nearly 2 months, a prosthetic treatment, and a final recall session 4 weeks after finishing the rehabilitation. The treatment was permanently supervised by 3 assistant professors who were calibrated with lectures and an esthetics curriculum. Before insertion of the completed fixed or removable restorations, the oral rehabilitation was supervised again by the responsible assistant medical director or the head of the department, both with working experience in the area of esthetic dentistry for more than 10 years.^{5,6,12}

The oral rehabilitation was performed either with fixed partial dentures (n = 12), removable partial dentures (n = 13), or full dentures in the maxilla (n = 5). In all participants the anterior teeth of the maxilla were restored.

The participants had to answer 3 questionnaires in the following order: The OHIP-49,¹⁸ the Beltz-Test,²⁸

Fig 1 Examples of a rehabilitation of the anterior maxilla with full-coverage fixed partial dentures.



and a questionnaire asking for "satisfaction with one's own dental appearance" (QDA).¹² All 3 questionnaires were completed before therapy and 4 weeks after oral rehabilitation.

Questionnaires

Oral health–related quality of life: Oral Health Impact Profile. The OHIP-49 contains 49 items subdivided into 7 subdomains, as previously explained. A Likert scale with 5 categories of choice per item (not at all, slightly, moderate, quite, and very much) was used. The mathematical equivalents for these categories ranged from 0 for "not at all" to 4 for "very much." The OHIP sum score consisted of the summated 49 single scores. These scores were not weighted.²⁹

Short form of Oral Health Impact Profile: OHIPesthetic. In a study conducted by Wong et al,²⁶ a short form of the OHIP-49 was developed to measure changes in tooth whitening. Eighty-seven patients completed the 49-item OHIP-49 at baseline and 63 patients at a follow-up 8 weeks later. Expert-based approach and regression analyses were undertaken on baseline data to derive 2 subset questionnaires (OHIP-conceptional and OHIP-regression). The more favorable OHIPshort form was the OHIP-conceptual, which is used in this study (as OHIP-esthetic). This short form consists of 14 items.

Well-being: Beltz-Test. To ensure that the participants did not differ notably from the general population in well-being, a long-established and highly reliable test was used, which contains 28 items (Befindlichkeitsbogen, Beltz-Test).^{28,30} In consideration of the age and gender of the participants, the results were transformed to standardized so-called stanine values. These stanine values ranged from 2 to 9. Values from 3 to 7 define a normal state of well-being, whereas values lower than 3 define a euphoric state and values higher than 7 indicate a depressive state. Only participants with normal well-being were accepted for the study.

"Satisfaction with one's own dental appearance": QDA. Based on the guidelines regarding anterior esthetics developed by Magne and Belser,⁷ a questionnaire with 14 items was developed, and its reliability and validity were tested.¹² In the same study, it was shown that out of the 14 items, 11 showed good reliability and validity and could be appropriate for further studies.⁶ This slightly modified questionnaire is shown in Table 1.

A Likert scale, similar to that used for the OHIP-49, with 5 categories of choice per item was used.

For the following analyses, the items asked in a positive way (Q_1, Q_2, Q_3, Q_5) were transformed (value_transform = value * [-1] + 4). For the QDA sum score, all items were added and could be at the most 44, meaning absolutely dissatisfied participants, whereas 0 indicated completely satisfied participants.

Statistical Analysis

The data were statistically analyzed using SPSS software for Windows (Version 11.5, SPSS) at a level of significance of $P \le .05$. The data were not distributed normally and therefore nonparametric tests were used. The Wilcoxon

| No. | Question* |
|-----|--|
| Q1 | I am content with the appearance of my teeth. |
| Q2 | I am content with the size (length and width) of my teeth. |
| Q3 | I am content with the color of my teeth. |
| Q4 | I don't like the position of my teeth. |
| Q5 | I am content with the appearance of my gums. |
| Q6 | I don't like the form of my teeth, they are too angular, too round, etc. |
| Q7 | I am dissatisfied if my teeth are recognized as artificial. |
| Q8 | I am dissatisfied with the black hole disease between my teeth. |
| Q9 | I tend to hide my teeth. |
| Q10 | I wish I had other teeth. |
| Q11 | Because of my teeth, I feel rather old. |

 Table 1
 Questionnaire "Satisfaction with Own Dental Appearance" (QDA)

*Questions were asked in German and translated for this table.

Table 2Oral Health Impact Profile Subdomain Scores and Sum Score, OHIP-Esthetic and the QDA Before and After OralRehabilitation (n = 30)

| Dationto | Before treatment | | After treatment | | Modion of |
|--------------------------|---------------------|---|---------------------|---|-------------|
| self-evaluation* | Median [†] | Percentiles (25 th ;75 th) | Median [†] | Percentiles (25 th ;75 th) | differences |
| Functional limitation | 11 | 7; 17 | 4.5 | 3: 11 | 7 |
| Physical pain | 9.5 | 6; 15 | 4 | 3; 15 | 4 |
| Psychological discomfort | 6.5 | 4; 9 | 0 | 0; 6 | 5 |
| Physical disability | 6.5 | 4; 13 | 1 | 0; 10 | 4,5 |
| Psychological disability | 3 | 2; 6 | 1 | 0; 5 | 2 |
| Social disability | 1.5 | 0; 3 | 0 | 0; 4 | 1 |
| Handicap | 3 | 2; 8 | 2 | 0; 8 | 1.5 |
| OHIP sum score | 46 | 26; 60 | 16 | 9; 30 | 24 |
| OHIP-esthetic | 14.5 | 7; 21 | 2 | 2; 8 | 11 |
| OHIP item no. 22 | 1.5 | 0; 2.25 | 0 | 0; 0 | 1.5 |
| OHIP item no. 31 | 1 | 0; 2 | 0 | 0; 0 | 1 |
| QDA sum score | 16 | 7; 17 | 1.5 | 0; 4 | 12 |

*Data are shown on a Likert scale with 5 categories of choice per item. The mathematical equivalents for these categories ranged from 0 for "not at all" to 4 for "very much".

[†]All items in this table are significantly different between before and after oral rehabilitation (*P* < .05, Wilcoxon rank sum test).

rank sum test was used to compare the data before and after oral rehabilitation. To assess the correlation between the OHIP (OHIP sum score, subdomains, single items, and OHIP-esthetic) and the QDA, the Spearman rank correlation coefficient was calculated.

Results

Out of the 32 participants, 30 (94%) showed a normal well-being (14 women and 16 men; mean age 59 ± 10 years, range 45 to 76). The other 2 participants had a stanine-value of 9 (depressive well-being), and were excluded from the study.

Data from the OHIP-49 and the QDA are shown in Table 2. The median of the OHIP sum score improved from 46 to 16 before and after oral rehabilitation, respectively. Furthermore the OHIP-esthetic (from 14.5 to 2) and the QDA sum score (from 16 to 1.5) significantly improved after oral rehabilitation ($P \le .001$, Wilcoxon rank sum test). Also, for the 7 OHIP subdomains and single items (no. 22 and no. 31), significant improvement could be found between both surveys ($P \le .05$, Wilcoxon rank sum test).

As seen in Table 3, the QDA sum score showed a significant correlation to the OHIP subscale "psychological discomfort" and the OHIP-esthetic (r > 0.424, $P \le .02$, Spearman rank correlation coefficient), but not to the OHIP sum score or any of the remaining OHIP subscales (P > .05) before oral rehabilitation. After oral rehabilitation, a significant correlation between QDA sum score and any of the OHIP scores could no longer be revealed.

Analyzing the single items of the OHIP-49, the only items that correlated with the QDA sum score both before and after oral rehabilitation were the items no. 22 and no. 31 (r > 0.394, $P \le .02$, Spearman rank correlation coefficient). Therefore, the results of these single items are listed together with the OHIP scores and the subdomains in Tables 2 and 3.

To gain a better understanding of the different correlations between the QDA sum score and OHIPesthetic before and after rehabilitation, Table 4 lists the

| | QDA sum s | score | QDA sum | score |
|--------------------------|-----------|-------|---------|-------|
| | Before | Р | After | Р |
| Functional limitation | 0.249 | 0.185 | -0.221 | 0.240 |
| Physical pain | 0.338 | 0.057 | -0.235 | 0.211 |
| Psychological discomfort | 0.424* | 0.019 | -0.235 | 0.211 |
| Physical disability | 0.338 | 0.068 | -0.256 | 0.172 |
| Psychological disability | 0.235 | 0.212 | -0.050 | 0.791 |
| Social disability | 0.133 | 0.484 | -0.058 | 0.760 |
| Handicap | 0.192 | 0.310 | -0.251 | 0.181 |
| OHIP sum score | 0.298 | 0.109 | 0.224 | 0.235 |
| OHIP-esthetic | 0.505* | 0.004 | 0.312 | 0.093 |
| OHIP item no. 22 | 0.430* | 0.018 | 0.414* | 0.023 |
| OHIP item no. 31 | 0.458* | 0.011 | 0.394* | 0.031 |
| | | | | |

Table 3 Correlations Between the QDA Sum Score and the OHIP Before and After Oral Rehabilitation

*Values correlate significantly (Spearman rank correlation coefficient).

OHIP-esthetic OHIP-esthetic Р Р Before After 0.395* Q1-appearance of teeth 0.031 0.226 0.229 O2-size of teeth 0.179 0.345 0.253 0.178 Q3-color of teeth 80.0 0.673 0.168 0.374 Q4-position of teeth 0 453* 0.289 0.012 0.121 Q5-appearance of gums 0.598* 0.00001 0.327 0.078 Q6-form of teeth 0.383* 0.037 0.361 0.05 Q7-teeth artificial 0.295 0.113 0.135 0.478 Q8-black hole disease 0.374* 0.042 0.302 0.105 0.548* Q9-hide teeth 0.002 0.162 0.393 Q10-wish of having other teeth 0.399* 0.029 0.125 0.511 Q11-feel old 0.424^* 0.019 -0.1950.302 QDA sum score 0.505* 0.004 0.312 0.093

Table 4Correlations Between the QDA Sum Score and the OHIP-EstheticBefore and After Oral Rehabilitation

*Values correlate significantly (Spearman rank correlation coefficient).

single items of the QDA sum score correlated with the OHIP-esthetic. Before oral rehabilitation, 8 of 11 items from the QDA significantly correlated with the OHIP-esthetic (r > 0.399, P < .05). However, after oral rehabilitation, only 1 of 11 QDA items significantly correlated with the OHIP-esthetic (r = 0.361, P = .05).

As far as the test-retest group is concerned, a statistically significant correlation was found for the QDA sum score and the OHIP sum score (QDA sum score: r = 0.858, P = .0001; OHIP sum score: r = 0.926, P = .0001).

Discussion

In this study, the prosthodontic treatment of the patients was performed by different students in the Prosthodontics II course. All patients were treated by a different student, which raises the question of the reproducibility of the esthetic outcome of the restorations. To assure the quality of treatment, the students were permanently supervised by 3 assistant professors, who were calibrated with lectures and an esthetics curriculum. Before insertion of the completed restorations, the oral rehabilitation was again supervised by the responsible assistant medical director or the head of department, both with a working experience in the area of esthetic dentistry of more than 10 years.^{5,6,12}

Because of the strong correlation between the current subjective well-being of a person and the personal judgment of one's own esthetic appearance, participants with a depressive mood were excluded from this study to avoid the falsification of results.⁶ For evaluation of participants' well-being, a highly reliable and valid test was used.²⁸

Validity and reliability of the QDA have been shown in a previous study.⁶ For the current study, the number of items was reduced from 14 to 11. To prove the reliability of this slightly modified questionnaire, a testretest was conducted by a second group of 20 participants from a handball team. It was shown that the QDA sum score was reproducible in the second survey, thus demonstrating stability in the participants' ratings. Using younger handball volunteers in contrast to the participants of the study may be seen as a limitation, as they might have a dissimilar appreciation of esthetics and an altogether different esthetic focus.

OHRQOL was measured at baseline and 1 month after finishing the oral rehabilitation. An improvement in OHRQOL for the sum score and all subdomains could be seen after oral rehabilitation. Similar results have been shown by John et al.³¹ The improvement of the OHIP sum score, subdomain scores, OHIP-esthetic, and the QDA sum score showed the success achieved by the oral rehabilitation in the current study. Further, this multidimensional improvement demonstrates that a comprehensive oral rehabilitation affects a lot of different aspects of OHRQOL.

Wong et al²⁶ showed that a modified short form of the OHIP-49 was more favorable in discriminating dental esthetics, reliable, and more sensitive to tooth whitening. This short form was based on a funded statistic using component factor analysis square regression. Therefore, this OHIP-esthetic and the 2 single items (no. 22 and no. 32) out of the OHIP-49 asking directly for dental appearance serve as a basis for the correlation with the new QDA sum score and its items.

It has been shown that before oral rehabilitation, the OHIP-esthetic correlated with the QDA sum score and nearly all of the single items. After oral rehabilitation, however, neither the QDA sum score nor one of the single items correlated significantly with the OHIPesthetic (Table 2).

A possible explanation for this phenomenon might be the undifferentiated approach of the patients at the beginning of treatment. Most of the patients, before treatment, had various problems (function, pain, esthetic, etc) and were often not able to differentiate these points. More specifically, the differentiation of the esthetic questions of the QDA may have been difficult for patients at the beginning of treatment. Although they knew that they were not happy at all with their dental appearance, they were not able to assign these emotions to the specific items shown in Table 1. After therapy, the participants had a better understanding of dental appearance because of the guidance from their dental clinicians throughout the therapy. Thus, after rehabilitation, most of the participants were satisfied with their dental appearance in general, but there are some areas capable of improvement, addressed by single items of the QDA. Therefore, after oral rehabilitation, the OHIP-esthetic does not correlate with the QDA sum score or any of its items, as several items included in the QDA do not appear in the OHIP-49 or the OHIP-esthetic.

In summary, the OHIP-esthetic is appropriate to measure an overall status of dental appearance. However, it seems that it cannot address the need to

specify esthetic problems after complex oral rehabilitation of the maxillary anterior teeth. In contrast to the OHIP-esthetic, the 2 items of the OHIP-49 that are directly related to dental appearance (no. 22 and no. 31) correlated statistically significantly with the QDA sum score before and after oral rehabilitation (Table 3). Therefore, these 2 items seem to be an indicator for dental appearance. If the response to these items is ambiguous, a special esthetic module^{12,27} may have merit to expand the depth of esthetic evaluation.

However, if the only approach of a study is the evaluation of dental appearance, it is reasonable to use a specific esthetic module.

Conclusions

Under the limitations of this study, the following conclusions can be drawn:

- An improvement for the OHIP sum score, all subdomains, and the OHIP-esthetic could be shown after oral rehabilitation. This multidimensional improvement of OHRQOL demonstrates that a comprehensive oral rehabilitation has a broad impact on OHRQOL aspects.
- None of the OHIP-sum scores nor 1 of the 7 subdomains (the only exception being "psychological discomfort") correlates with the present questionnaire asking about dental appearance.
- The OHIP-esthetic score correlated with the questionnaire asking for dental appearance before oral rehabilitation but not after.
- The only single items of the OHIP-49 questionnaire that correlated with the questionnaire asking for dental appearance before and after oral rehabilitation were items no. 22 and no. 31.

The OHIP-49 does not offer an in-depth evaluation of dental appearance for patients undergoing anterior reconstructive therapy. Therefore, items no. 22 and no. 31 of the OHIP-49 can be used as indicators for dissatisfaction in dental appearance. Studies aiming to measure dental appearance more deeply might benefit from a special esthetic modulus in addition to the OHIP-49.

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