Relationship Between Patients’ Oral Health–Related Quality of Life, Satisfaction with Dentition, and Personality Profiles

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Abstract

Aim: The aim of this study was to investigate the relationship between patients’ oral health–related quality of life, satisfaction with their dentition, and their personality profiles.

Methods and Materials: Eighty-four patients (30 males and 54 females; mean age 31.9±12.7 years) seeking routine dental treatment were recruited for this study. A “Dental Impact on Daily Living” (DIDL) questionnaire was used to assess dental satisfaction and impact on daily living. An “Oral Health Impact Profile” (OHIP) was used to measure self-reported discomfort, disability, and dysfunction caused by oral conditions. Oral health–related quality of life was assessed using the “United Kingdom Oral Health Related Quality of Life” measure (OHQoL-U.K). A “NEO Five Factor inventory” (NEO-FFI) was used to assess personality profiles.

Results: The dentition has a measurable impact on daily living as well as with satisfaction with appearance, pain levels, oral comfort, general performance, and eating capability (p=0.000). Younger patients had more profound oral health impacts (p=0.045) and higher neuroticism scores (0.043). OHIP scores were significantly related to OHQoL-UK scores (p=0.000). DIDL scores had significant correlations with OHIP and OHQoL-UK scores (p<0.05). Significant correlations were established between neuroticism and satisfaction with oral comfort, extraversion and total satisfaction and satisfaction with general performance, and openness and satisfaction with appearance (p<0.05). OHIP and OHQoL-UK scores had no significant correlations with psychological profiles.

Conclusions: The status of the oral cavity can have a definitive impact on patients’ daily living and quality of life regardless age, gender, and level of education. Patients’ satisfaction with their dentition has definitive impacts on daily living, quality of life, and dental perceptions. Personality profiles (neuroticism; extraversion, and openness) may influence dental perceptions, play a significant role in shaping satisfaction with dentition, and help with the prediction of the dental impact on daily living.
Clinical Significance: Since patients’ satisfaction with their dentitions impacts their daily living and quality of life while affected by their psychological profiles, this should be considered when formulating a treatment plan for management for their dentition in order to obtain patient acceptance of the proposed treatment.

Keywords: DIDL, OHIP, OHQoL-Uk, NEO-FFI, dental impact on daily living, oral health, psychology.


Introduction

Among the most important goals of dental care is helping patients in their attempts to reach an acceptable level of satisfaction with their oral cavity and dentition. Since they are rarely life threatening, little attention has been paid to the psychosocial impact of oral conditions. Moreover, many researchers used to ignore effects of the oral cavity on general health status. However, the need for consideration of oral health–related quality of life has been increasingly acknowledged over the last few decades and many studies have highlighted the psychosocial impact of oral conditions. Reisine and Gift et al reported the loss of nearly 160 million work hours a year related to oral problems. Oral conditions might affect social functioning and behaviors such as the ability to work, school attendance, and carrying out parental or household duties.

Dentofacial problems have known effects on patients’ satisfaction with their dentition as it affects esthetics, performance, and function. Dental professionals need an accurate perception of how patients feel about their teeth and the impact this has on their daily living. Strauss and Hunt concluded dental disease may influence an individual’s capacity to live comfortably, enjoy life, experience relationships, be successful in employment, and possess a positive self-image.

Various factors such as chewing ability, taste, pain, speech, and aesthetics could affect different aspects of life quality as well as satisfaction with the dentition. Different levels of oral health status have varying impacts on people’s daily living; therefore, the clinical status and psychological dimensions should be assessed whenever dental needs are assessed. The clinician should be mindful of some patients who are not satisfied with their oral condition even if it is favorable, or of any dental treatment received regardless of the quality of care. On the other hand, some patients are satisfied with their dentition and dental treatment even when they are unfavorable because of their high level of psychogenic tolerance.

Clinical indices that measure absence or presence of oral disease are the center of traditional methods of measuring oral health. Such methods do not identify patients’ feelings of oral wellbeing and their ability to function properly. This shortcoming was the basis for the development of oral health–related quality of life measures to assess oral wellbeing and oral impacts on the quality of life. Measures used to detect oral health–related quality of life provide important information about the impact of oral disease on social functioning and behaviors, the evaluation of treatment needs, assessment of clinical decisions, oral health services, as well as plans and programs directed to improve oral health.

Disease-specific or generic measures are used to assess health-related quality of life. Disease-specific measures assess disease-related...
attributes and provide greater sensitivity to the clinical condition in question. Generic measures, on the other hand, are used to compare between different diseases and when the related variables are addressed. Together these measures could tackle both clinical and broader strategy questions, and identify unpredicted differences.\textsuperscript{27}

The literature has shown patient satisfaction with oral status is associated with the existence of certain personality profiles. Psychological factors have been shown to have a profound role in shaping patient satisfaction and compliance with dental status and treatment.\textsuperscript{28} The assessment of personality characteristics might be useful in predicting patient behavior and may have an effect on the provision of therapy.\textsuperscript{29} This prompted dental researchers to investigate the effect of different psychological characteristics on the success and acceptance of conventional dental treatment. More neurotic, less stable, less intelligent, more self-centered, more careful patients were found to be less satisfied with their conventional complete denture prostheses.\textsuperscript{30,31}

Patients’ satisfaction with their dentition and dental treatment could be associated with some personality traits that might be considered as predictors for such evaluation. Examples of these traits are self-respect, self-confidence, compliance, accommodating, quietness, extraversion, openness, anxiety, kindliness, neuroticism, and meticulousness.\textsuperscript{32-37} Al-Omiri et al.\textsuperscript{35} and Al-Omiri and Abu Alhaija\textsuperscript{36} concluded that certain personality profiles such as extraversion and neuroticism had influential effects on patients’ perception of their dentofacial appearance. Other psychological traits such as conscientiousness, openness, and agreeableness were also found to affect different dimensions of dental satisfaction.\textsuperscript{34-37}

The literature contains many studies that explored the unique and vague relationship between psychological profiles and satisfaction with the dental status in many fields of dentistry. Unfortunately, the literature lacks valid studies of the relationship between patient oral health–related quality of life, satisfaction with dentition, and personality profiles. Further evaluation and careful scientific-based evidence are required to explore whether the assessment of certain psychological traits of patients can predict their oral health–related quality of life and satisfaction with their dentitions.

This study investigates the relationships between patient satisfaction with dentition, oral health impacts, oral health–related quality of life, and psychological traits using valid and reliable socio-dental and psychological measures.

**Methods and Materials**

Eighty-four consecutive patients were recruited into this study that included 30 men (35.7\%) and 54 women (64.3\%) between 17 and 66 years of age (mean age: 31.92 years, SD: 12.7 years), who sought routine dental care at the Dental Health Teaching Center of the Jordan University of Science and Technology in Irbid, Jordan.

Recruited patients had to be 17 years of age or older for inclusion in the study with no medical disease (including mental problems and psychological disorders) that might affect their ability to understand and/or to score the questionnaires.

An invitation to participate in the study was extended to the patients. Each participant was given a brief explanation of the study and an informed consent was obtained from each subject before being recruited into the study. All clinical procedures were approved by the dean of research of the Jordan University of Science and Technology.

One investigator conducted all clinical examinations in the Oral Diagnosis Clinic, where each patient was assessed thoroughly to record the position and number of teeth. The
assessment also included patient dental and medical histories, complaints, and personal information regarding name, age, gender, education, occupation, address, and marital status. Intra-examiner reliability was performed on five duplicate clinical examinations using Kappa statistics. Kappa was 1.00, indicating substantial agreement.

**Dental Impact on Daily Living Questionnaire (DIDL)**

Assessment of patients’ satisfaction with their dentition was carried out using the Dental Impact on Daily Living Questionnaire (DIDL) and its scale (Figure 1). This questionnaire was validated for the Jordanian population in previous studies and was found to be valid and reliable.

The DIDL consists of 36 items grouped into five dimensions—comfort, appearance, pain, performance, and eating restriction—and impacts for each item are scored. It measures the impact and proportional importance of each dimension (weight of the dimension) to the patient. A weight for each dimension is calculated on an individual basis by dividing the summed responses of that dimension by the total possible scale score. To construct an overall score, scores within each dimension are first calculated by multiplying the summed dimension responses by the dimension weight. Weighted dimension scores are then summed to give a DIDL score. Total score of the DIDL ranged from −1 to +1 in all sample individuals. Patients responded to each item by selecting one of three response categories in the form of a Likert response format that includes agree (score +1), disagree (score –1), or neutral (score 0).

The DIDL was chosen in this study because it is an efficient tool for use by the patients and clinicians that can be completed within a relatively short time period. The items of this tool were simple and could be easily understood and scored. The literature confirms the test to be considered reliable, accurate, and reproducible.

**NEO Five Factor Inventory (NEO-FFI)**

Each participant completed the NEO-FFI test to assess his/her personality profile. The test consisted of 60 questions analyzing the five major personality dimensions: neuroticism, extraversion, openness, agreeableness, and conscientiousness. Each dimension was assessed using 12 questions. This test is a comprehensive method of measuring personality. In addition, it has a good reliability and validity structure.

The NEO-FFI test was used in this study because it measures five dimensions of personality; it is simple and can be completed in a short time; it is valid, reliable, and easy to use statistically.

This questionnaire was validated for the Jordanian population in previous studies and was found valid and reliable.

**Oral Health Impact Profile (OHIP)**

The OHIP is a questionnaire founded on a conceptual oral health model outlined by Locker and tailored from the WHO framework used to classify disabilities, handicaps, and impairments, and it measures self-reported discomfort, disability, and dysfunction caused by oral conditions. The original test consists of 49 items grouped into seven domains: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. The OHIP is sensitive to changes; is reliable; and shows adequate cross-cultural consistency.

A key advantage of the OHIP is that its statements were not conceived by dental professionals; instead, they were derived from a representative patient cluster. This increases its sensitivity to the important social impacts of oral conditions that are considered important from the patient’s point of view, and makes the OHIP among the most sophisticated measures of oral health.

A shorter version of the original OHIP is the OHIP-14 that consists of 14 items and has its response categories in the form of a Likert response format that ranges from never (zero score) to very often (score 5). The possible total OHIP-14 score ranges from 0 (no oral health impact) to 56 (worst possible oral health impact). It is also possible to calculate the frequency of impacts by summing the reported negative impacts (i.e., fairly often or very often) across the 14 statements. The OHIP-14 has adequate validity and reliability.
Figure 1. Dental Impact on Daily Living Questionnaire items and their respective dimensions.
The questionnaires were administered to the patients, and the process of completing the questionnaires was supervised by the investigator. Each patient was provided with a full explanation of the dimensions as well as the methods of scoring each questionnaire. Ten subjects answered the questionnaires twice with a one-week interval. The reliability test was carried out on all questions using the correlation coefficient. The correlation coefficients were high and ranged from 0.8 to 0.94.

**Statistical Analysis**

The data were analyzed using the SPSS software (Statistical Package for the Social Sciences, version 11.0, SPSS Inc., Chicago, IL, USA). The association between the variables was analyzed using the Pearson correlation test and t-test. For all statistical analyses, the significance level was set at \( p \leq 0.05 \).

**Results**

Eighty-four consecutive patients were recruited into this study that included 30 men (35.7%) and 54 women (64.3%) between 17 and 66 years of age (mean age: 31.92 years, SD: 12.7 years). The levels of patients’ education ranged from secondary to postgraduate education with 30 patients (35.7%) having received a secondary education (up to level A), 13 patients (15.5%) having received a college education (up to two years after level A), 32 patients (38.1%) having received a university education, and 9 patients (10.7%) having received a higher postgraduate education.

Excluding third molars, Table 1 presents the number of missing teeth among the study sample. Thirty patients (35.7%) had no missing teeth and 54 patients (64.3%) had one to seven missing teeth. Twenty-four patients (28.6%) had missing teeth from the upper jaw, 15 patients (17.9%) had missing teeth from the lower jaw, and 15 patients (17.9%) had missing teeth from both upper and lower jaws.

### Table 1. Distribution of missing teeth among the study sample (n=84).
With regard to extraversion, 11.9% of subjects had low scores, 47.6% had average scores, and 40.5% had high extraversion scores. As for the issue of openness, 58.3% of subjects had low scores, 39.3% had average scores, and 2.4% had high openness scores. Agreeableness findings showed 71.4% of subjects had low scores, 22.6% had average scores, and 6% had high agreeableness scores. Considering conscientiousness, 19% of subjects had low scores, 42.9% had average scores, and 38.1% had high conscientiousness scores.

Correlations

Age, gender, and education levels of subjects were correlated to the scores of the DIDL, NEO-FFI, OHIP, and OHQoL-UK questionnaires (Table 4).

No statistically significant relationships were detected except a negative significant relationship between age and both the OHIP and neuroticism scores (p=0.045 and 0.043 respectively). Both genders and different levels of education were comparable in their scores of the aforementioned questionnaires (p>0.05).
There were significant correlations between a jaw with missing teeth and some DIDL scores, including patient total satisfaction (p=0.021) and patient satisfaction with only appearance and oral comfort (p=0.048 and 0.026 respectively). The loss of teeth from both jaws was associated with the highest dissatisfaction while the loss of teeth from the upper jaw was associated with the lowest levels of dissatisfaction. However, the number of missing teeth has no relationship with the DIDL scores (p>0.05). Also, no significant relationship was detected between the number and position of missing teeth and each of NEO-FFI, OHIP, and OHQoL-UK scores (p>0.05).

Table 5 shows correlations between DIDL, OHIP, and OHQoL-UK scores among the study population. A highly significant negative correlation was found between the OHIP and OHQoL-UK scores (p=0.000). Patients with the least oral health impacts (lowest OHIP scores) were associated with the best oral health–related quality of life (highest scores of OHQoL-UK). Patients with the worst oral health impact (highest scores of OHIP) were associated with the worst effect on quality of life (lowest scores of OHQoL-UK).

A significant negative correlation was found between OHIP scores and all DIDL test scores (total satisfaction and satisfaction with each individual dimension). Patients with the least oral health impacts (lowest OHIP scores) were associated with the highest levels of total satisfaction and satisfaction with appearance, pain, oral comfort, general performance, and eating (p=0.000, 0.002, 0.000, 0.000, 0.003, and...
0.000 respectively). Also, a significant positive correlation was found between OHQoL-UK scores and some DIDL test scores (total satisfaction and satisfaction with appearance, pain, and eating dimensions). The best oral health–related quality of life (highest scores of OHQoL-UK) was associated with the highest levels of total satisfaction, satisfaction with appearance, pain, and eating (p=0.000, 0.002, 0.030, and 0.024 respectively).

Table 6 shows the correlations between NEO-FFI scores and each of DIDL, OHIP, and OHQoL-UK scores among the study population. No significant relationship was detected between NEO-FFI scores and each of OHIP and OHQoL-UK scores (p>0.05). Oral health impacts and oral health–related quality of life were not related to personality profiles. On the other hand, some NEO-FFI scores and some DIDL scores were significantly correlated. Neuroticism was negatively correlated to oral comfort (p=0.006): the higher the neuroticism scores, the less the satisfaction with oral comfort. Also, extraversion was negatively correlated to total satisfaction and satisfaction with general performance (p=0.040 and 0.047 respectively): the higher the extraversion scores, the less the total satisfaction and the satisfaction with general performance. Moreover, openness was negatively correlated to appearance (p=0.039): the higher the openness scores, the less the satisfaction with appearance.

**Discussion**

The DIDL is a socio-dental instrument used in this study because, unlike other socio-dental indicators, it assesses the dental impact on daily living, the relative importance that respondents attribute to each dimension, and oral status. Additionally, as impacts seldom occur separately,
Another finding revealed the older the patient, the lower the scores of neuroticism. This can be explained by older patients being more stable psychologically and leading a less stressful social life than younger patients.

The loss of teeth from both jaws was associated with the highest total dissatisfaction and dissatisfaction with appearance and oral comfort while the loss of teeth from the upper jaw was associated with the lowest dissatisfaction levels. This might be explained by the loss of teeth from both jaws affecting both function and appearance more than the loss of teeth from just one jaw as more opposing occlusal surfaces will be lost.

The results showed the less the oral health impacts (the lower the OHIP scores), the better the oral health–related quality of life (the higher the scores of OHQoL-UK). Also, the poorer the oral health impact (the higher the scores of OHIP), the poorer the effect on quality of life (the

Table 6. Correlations between NEO-FFI scores and each of DIDL, OHIP, and OHQoL-UK scores among the study population.

<table>
<thead>
<tr>
<th>DIDL Scores:</th>
<th>Neuroticism</th>
<th>Extraversion</th>
<th>Openness</th>
<th>Agreeableness</th>
<th>Conscientiousness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Total satisfaction</td>
<td>NS</td>
<td>$-0.225$</td>
<td>$0.040^*$</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>2. Appearance</td>
<td>NS</td>
<td>NS</td>
<td>$-0.226$</td>
<td>$0.039^*$</td>
<td>NS</td>
</tr>
<tr>
<td>3. Pain</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>4. Oral comfort</td>
<td>$-0.295$</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>5. General performance</td>
<td>NS</td>
<td>$-0.217$</td>
<td>$0.047^*$</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>6. Eating</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
<td>NS</td>
</tr>
</tbody>
</table>

$R = \text{Pearson's correlation coefficient.} ^* = \text{Significant relation. NS = Not significant relation.}$

The results showed the older the participant, the lower the scores of the OHIP (least oral health impacts). This might be explained by younger patients having more critical oral demands, being more concerned with respect to their appearance and function, and being less tolerant to changes in their dental status. Therefore, oral status impacts younger patients more than older ones.
aspects might play a vital role in dental impacts on daily living and patients’ satisfaction with their dentition. Personality profiles might be used to explain the levels of patient satisfaction present among the study population as well as to predict satisfactory outcomes before commencing dental treatment, which might save time and cost if the prediction is unfavorable. However, no significant correlations between NEO-FFI scores and each of OHIP and OHQoL-UK scores were detected. Consequently, the mutual effects of oral health impacts and oral health–related quality of life on one hand and the personality profiles on the other could not be detected in this study. This might be due to, in contrast with the DIDL instrument, the inferior sensitivity of OHIP and OHQoL-UK to variations and changes in personality profiles.

It is evident that it is of utmost importance to use valid, reliable, and comprehensive tests to study the relationship between psychological profiles and satisfaction. The DIDL test used in this study provided a more satisfactory answer for such an issue.

In this study, the number and position of missing teeth were not significantly related to patient satisfaction, oral health impacts, oral health–related quality of life, or personality profiles. This disagrees with the findings of previous studies that reported significant effects of the number of missing teeth on function and wellbeing. However, the results agree with Rosenoer and Sheiham, who reported a very poor association between satisfaction with the dentition and the number of missing posterior teeth. In this study most of the lost teeth were posterior teeth, which might explain such finding. Also, previous studies did not use an index that separates the esthetic element from chewing and occlusion, which might be the reason why they established an apparent relationship between tooth loss and oral health impacts, quality of life, and satisfaction with the dentition.

Omar et al. suggested esthetics could affect mastication and therefore there is a need to have an index that separates the esthetic element from chewing and occlusion. So, masticatory ability is influenced by factors other than just function. Consequently, many subjects with a satisfactory dental appearance and an impaired masticatory function, but who can still masticate,
do not need to have their dentition changed.\textsuperscript{68,69} Kayser\textsuperscript{70} concluded social functions such as communication and aesthetics were more important than chewing. Esthetics influence psychological values of humans.\textsuperscript{71}

In this study most of the lost teeth were posterior teeth that did not affect the aesthetics of patients, and this might explain the lack of association between the number of missing teeth and scores of the used socio-dental indicators. Also, the number of missing teeth ranged between one and seven (remaining teeth are $\geq 20$ teeth) and this number of missing teeth might be far less than what is needed to have a measurable relationship between tooth loss and oral health impacts, quality of life, and satisfaction with the dentition. Previous studies\textsuperscript{66,67} were carried out on subjects with a larger number of missing teeth and reported negative association between tooth loss and quality of life when all functional, psychosocial, and economic implications were considered.\textsuperscript{72}

Results from this study are the first examination of the relationships between oral health impacts, quality of life, satisfaction with the dentition, and psychological profiles among a Jordanian population. No reliable studies among other populations are available and investigations in this regard are required. Cultural or religious factors in different populations might affect the relationships between oral health impacts, quality of life, satisfaction with the dentition, and psychological profiles. Further studies are required to identify the potential effects of cultural or religious factors in this regard.

**Conclusions**

Patients’ satisfaction with different aspects of their dentition has definitive impacts on oral functions including chewing, speaking, oral comfort, general performance, communication, smiling, and appearance. This in turn will affect daily living and dental perceptions of patients. Personality profiles might influence a patient’s perception of his/her dentition and play a significant role in shaping the degree of satisfaction with it. Certain personality profiles—neuroticism, extraversion, and openness—might be very helpful in this regard and could be used for the assessment and prediction of a patient’s satisfaction with his/her dentition and the dental impacts it may have on daily living. Clinicians should consider this in order to provide suitable treatment for their patients to improve oral health and avoid any negative effects their dentitions might have on daily living. They also must prepare their patients socio-psychologically to accept the offered management for their dentition.

Using the DIDL measure could provide a more satisfactory answer to the effects of teeth on daily living and satisfaction with the oral cavity. Also, this instrument has strong correlations to the OHIP and OHQoL-UK and thus is capable of measuring the same dimensions that are measured by these instruments. Moreover, it seems more sensitive to the effect of variations in psychological profiles among the study population. Therefore, the use of the DIDL and a valid, reliable, and comprehensive psychological test such as the NEO-FFI is recommended to identify the relationship between personality profiles, satisfaction with the dentition, and oral health–related quality of life.

**Clinical Significance**

Since patients’ satisfaction with their dentition impacts their daily living and quality of life while affected by their psychological profiles, this should be considered when formulating a treatment plan for management of their dentition in order to obtain patient acceptance of the proposed treatment.

**References**


40. Costa PT Jr, McCrae RR. Revised NEO Personality Inventory (NEO PI-R) and NEO Five-Factor Inventory (NEO-FFI) professional manual. Florida: PAR Psychological Assessment Resources Inc; 1992.


40. Costa PT Jr, McCrae RR. Revised NEO Personality Inventory (NEO PI-R) and NEO Five-Factor Inventory (NEO-FFI) professional manual. Florida: PAR Psychological Assessment Resources Inc; 1992.


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