Oral Health–Related Quality of Life in Patients with Temporomandibular Disorders

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Aims: *To characterize the level of impairment of oral health-related quality of life (OHRQoL) in a temporomandibular disorder (TMD) patient population.* ***Methods:*** *OHRQoL was measured using the German version of the Oral Health Impact Profile (OHIP-G) in a consecutive sample of 416 patients seeking treatment for their complaints in the masticatory muscles and temporomandibular joints and with at least 1 diagnosis according to the German version of the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD). The level of impairment of OHRQoL was characterized by the OHIP summary score mean and its 95% confidence interval. OHRQoL was described for each of the 8 RDC/TMD diagnoses (Axis I) and the RDC/TMD Axis II measures (Graded Chronic Pain Scale [GCPS], jaw disability list, depression, and somatization). These findings were compared with the level of impairment of OHRQoL in the adult general population derived from a national sample (n = 2,026).* ***Results:*** *Among the RDC/TMD Axis I measures, all diagnoses were correlated with much higher impacts compared to the normal population (means for all diagnoses were 32.8 to 53.7 versus 15.8 in the general population). All diagnoses had a similar level of impact except for disc displacement with reduction (which had a lower impact). There were larger differences in mean OHIP-G scores among subgroups of RDC/TMD Axis II measures than among subgroups of RDC/TMD Axis I characteristics. The strongest association was with GCPS, with mean OHIP scores of 33.3 for grade I, 48.1 for grade II, 71.7 for grade III, and 88.5 for grade IV.* ***Conclusion:*** *OHRQoL was markedly impaired in TMD patients. The level of OHRQoL varied across diagnostic categories but more across Axis II, ie, the psychosocial axis; the variation was reflected especially in their level of graded chronic pain.* J OROFAC PAIN 2007;21:46–54

Key words: depression, Graded Chronic Pain Scale, jaw disability, Oral Health Impact Profile, oral health-related quality of life, Research Diagnostic Criteria for Temporomandibular Disorders, somatization, temporomandibular disorders,

Oral health–related quality of life (OHRQoL) measurement is a well-accepted way of characterizing the impact of a disease on the subject's perceived oral health. Using OHRQoL measurements, it is possible to compare the impact of different conditions.

The Oral Health Impact Profile (OHIP)[1] is 1 of the most widely used OHRQoL instruments. As a comprehensive instrument, it is potentially well-suited to characterize patients suffering from tem-

poromandibular disorders (TMD), as pain, functional limitations, discomfort, disability, and handicap affect a substantial part of this population. The OHIP has been used in a study of craniofacial pain patients, including TMD patients.[2] Substantial effects were found when 30 of the 49 OHIP items were included in the investigation. Another study used a subset of OHIP questions for the development of a special abbreviated OHIP for TMD patients.[3] The usefulness of OHRQoL data to characterize TMD prompted the utilization of these patients in the development and validity analyses of long[4,5] as well as short[6] versions of the OHIP.

Although these studies indicate the interest of TMD investigators in applying an instrument which is standardized and widely used for other oral conditions, TMD has not yet been comprehensively characterized with the full set of OHIP items. Only this would make results comparable with results obtained for other oral patient populations, eg, prosthodontic patients,[7] with the full item set. In addition, the TMD literature suffers from a lack of standardization of TMD diagnoses, making findings difficult to compare across studies. The Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD),[8] which has at least 17 language versions,[9] overcomes this limitation. It provides a means to characterize TMD in a standardized and internationally compatible way. The application of the OHIP to a TMD population examined and diagnosed with the RDC/TMD will provide clinically relevant results which are widely interpretable and generalizable.

The aim of this study was to use the OHIP to characterize the level of impaired oral health-related quality of life in a TMD patient population diagnosed with the RDC/TMD. The specific objectives of the study were to compare results from this TMD patient group with population normative data; to compare OHIP scores among diagnostic subgroups of both Axis I and Axis II of the RDC/TMD; to investigate the correlation between Axis II measures and OHIP scores; and to investigate age and gender differences for OHIP scores according to RDC/TMD classification.

Materials and Methods

Subjects, Study Design, and Setting

This cross-sectional study was carried out using a series of consecutive patients seeking treatment for the complaints with respect to the masticatory muscles and the temporomandibular joints at the Department of Prosthodontics, Martin Luther University, and the Department of Prosthodontics and Materials Sciences, University of Leipzig, Germany. A total of 416 subjects at least 14 years of age (mean age ± SD: 37.4 ± 16.2 years, 79% women) took part. The Departments of Prosthodontics are both primary care clinics staffed with a small number of dentists experienced with TMD management where TMD patients are diagnosed and treated and, if necessary, referred to other health providers within and outside the university. Patients attended by their own initiative or were referred by their dentist, physician, or physiotherapist.

Inclusion criteria were at least 1 diagnosis according to the German version[10] of the RDC/TMD.[8] To allow assessment of the TMD-related impact on the subjects, the OHIP scores from patients were compared with the level of impaired OHRQoL in a national sample of subjects (n = 2,026, age: 16 to 79 years; mean age ± SD: 43.2 ± 16.2 years, 52% women) where normative OHIP data were available.[11]

Diagnoses and Classification of TMD

Patients were examined using the RDC/TMD. The German version of the RDC/TMD is identical to the English-language original, including a Graded Chronic Pain Scale (GCPS) score, a jaw disability score, and measures to assess depression and somatization. The only difference from the English language version is that the latter 2 constructs (depression and somatization) are assessed according to recommendations of the working group on pain assessment of the German chapter of the International Association for the Study of Pain.[12] The Allgemeine Depressionsskala,[13] with 20 items, is the German translation of the Center for Epidemiological Studies Depression Scale (CES-D),[14] and is used to assess depression, while the Beschwerdenliste,[15] a 24-item instrument, is used to assess somatization. Population-based normative data are available for these instruments that allow for the classification of "no," "moderate" (above 70th percentile on population norms), and "severe" (above 90th percentile on population norms) depression or somatization—the categorization recommended by the original English-language RDC/TMD. For some of the subjects, depression was assessed using the Gießen-Test,[16] which, with 6 items, is another well-accepted instrument in Germany for the assessment of depression. The Gießen-Test's population-based norms allow categories of depression recom-

Table 1 Classification of Subjects According to the RDC/TMD

	Frequency (%)
Axis I measures (physical diagnoses)*	
Myofascial pain (Ia)	27.4
Myofascial pain with limited opening (Ib)	21.4
Disc displacement with reduction (IIa)	44.2
Disc displacement without reduction, with limited opening (IIb)	6.3
Disc displacement without reduction, without limited opening (IIc)	4.8
Arthralgia (IIIa)	33.2
Osteoarthritis of the TMJ (IIIb)	3.6
Osteoarthrosis of the TMJ (IIIc)	3.4
Axis II measures	
GCPS I	25.0
GCPS II	38.0
GCPS III	6.3
GCPS IV	3.1
Jaw disability	
0 to 3 limited oral functions	49.5
4 to 6 limited oral functions	38.7
7 to 12 limited oral functions	11.8
Depression	
No	46.4
Moderate	17.1
Severe	22.8
Somatization	
No	55.1
Moderate	24.8
Severe	19.0

*The percentages do not add to 100% because some subjects received multiple diagnoses. Data were missing for depression (13.7%) and somatization (1.2%). For GCPS, only subjects with TMD pain in the 6 months prior to the study were included.

mended by the RDC/TMD—no, moderate, and severe—to be applied. Some patients had missing data for depression (n = 57, 13.7%) and somatization (n = 5, 1.2%) and have been excluded from the analyses of these 2 constructs. Only subjects with TMD pain in the 6 months prior to this study filled in the GCPS (n = 301).

The reliability of the clinical examination for participating examiners was considered sufficient.[17,18] Internal consistency, a measure for the homogeneity of the assessed construct, was 0.73 for jaw disability, 0.86 for GCPS, 0.90 for somatization, 0.66 for the Gießen-Test, and 0.90 for Allgemeine Depressionsskala.

OHRQoL

OHRQoL was measured using OHIP-G, the German version[4] of the Oral Health Impact Profile.[1] The OHIP-G has 49 items derived from the English-language OHIP and 4 items specific for the German population. For each OHIP question, subjects were asked how frequently they had experienced the impact in the last month. Responses were made on a scale 0 (never), 1 (hardly ever), 2 (occasionally), 3 (fairly often), and 4 (very often). OHRQoL impairment was characterized by the OHIP-G summary score (OHIP-G49)—the sum of all 49 items' frequencies contained in the English-language OHIP (the 4 German-specific items were omitted to maintain international comparability).

Reliability was assessed by calculating Cronbach's alpha, a measure of the construct's internal consistency (0.95 for TMD patients and 0.98 for the general population subjects).

Statistical Analyses

OHIP-G summary scores are presented as means, and their 95% confidence intervals for TMD patients are classified according to RDC/TMD Axis I (physical diagnoses) and II (psychosocial measures) classifications as well as the normative score for general population subjects. Summary scores are also stratified by gender and age (14 to 39 years versus 40+ years). Differences between age and gender strata were tested by *t* tests. To assess the correlation between the 4 Axis II measures and OHRQoL, Pearson correlation coefficients were calculated.

All analyses were performed using the statistical software package STATA (Stata Statistical Software: Release 9), with the probability of a type I error set at the .05 level.

Results

Patients were predominantly women aged 20 to 55 years. When classified according to the RDC/TMD, 266 patients received 1 diagnosis, 117 had 2 diagnoses, 32 had 3 diagnoses, and 1 had 4 diagnoses because the 8 diagnostic categories are not mutually exclusive. The distribution of the Axis I and Axis II diagnostic classifications is presented in Table 1.

RDC/TMD Axis I Diagnoses and OHRQoL

Patients with all diagnoses presented considerably impaired OHRQoL in comparison with the general population (Fig 1). The mean OHIP score for all diagnoses was 42.9, compared with 15.8 for the general population. The lowest OHIP score was observed for disc displacement with reduction (32.8), which is often pain free and may be discov-

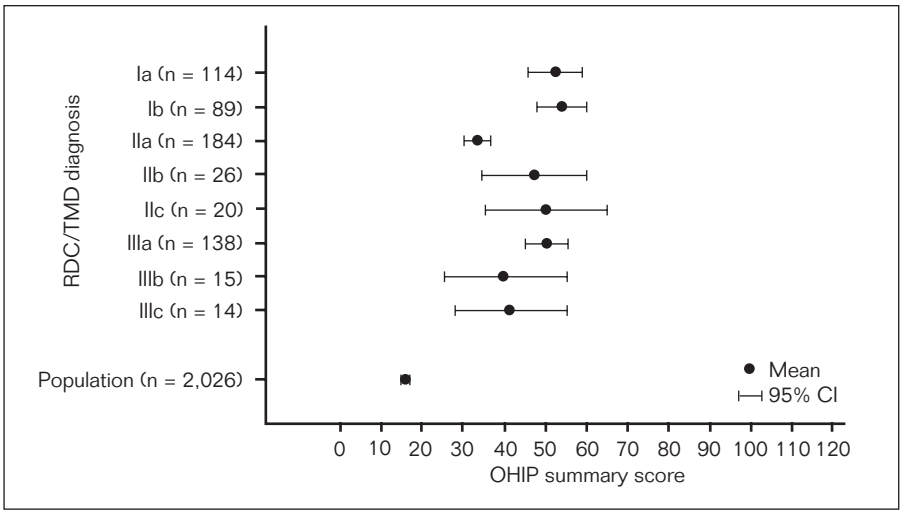

Fig 1 OHIP scores in relation to RDC/TMD clinical diagnoses in comparison with the general population. Some subjects received multiple diagnoses because the RDC/TMD physical diagnoses are not mutually exclusive. Ia = myofascial pain, Ib = myofascial pain with limited opening, IIa = disc displacement with reduction, IIb = disc displacement without reduction with limited opening, IIc = disc displacement without reduction without limited opening, IIIa = arthralgia, IIIb = osteoarthritis, IIIc = osteoarthrosis.

ered when the patient seeks advice relating to joint sounds. The lowest OHRQoL level was observed for disc displacement with reduction (32.8), which is often pain free (although joint sounds may be experienced). Other diagnoses did not differ substantially in mean OHIP scores. When stratified by gender (Table 2), female patients presented higher scores for all diagnoses, although the differences were not statistically significant. In the general population, male subjects tended to have more problems than female subjects. When stratified into 2 age groups, older patients and population subjects showed higher scores than younger subjects. In patients, these differences were statistically significant for all diagnoses except for disc displacement without reduction and without limited opening, osteoarthritis, and osteoarthrosis—the diagnoses with the lowest prevalences in the sample.

RDC/TMD Axis II Diagnoses and OHRQoL

Mean OHIP scores differed markedly among subgroups classified according to categories of Axis II, as evidenced by a lack of overlap of 95% confidence intervals for mean OHIP scores for most measures (Figs 2 and 3). Increasing levels of jaw disability or GCPS score were associated with increasingly impaired OHRQoL. The largest increase was observed for GCPS levels, with OHIP scores ranging from 33.3 in grade I to 88.5 in grade IV. The difference between nondysfunctional pain patients, ie, GCPS grades I and II, and dysfunctional pain patients (grades III and IV) was larger than OHIP score differences within the 2 groups.

The association between somatization or depression and OHRQoL was different. Somatization scores were strongly related to OHIP scores, depression was weakly related. However, for both measures, higher scores for depression or somatization were related to higher OHIP scores (Fig 3).

Correlations between Axis II measures and OHRQoL were of different magnitudes, but all were statistically significant (r_{GCPS}: 0.49, $r_{jaw\ disability}$: 0.39, $r_{somatization}$: 0.48, $r_{depression}$: 0.12; $P < .05$ for all correlation coefficients). When adjusted for the influence of gender or age, (partial) correlation coefficients and their level of statistical significance stayed nearly the same. The influence of gender was statistically significant when incorporated in the statistical model for the depression-OHRQoL and somatization-OHRQoL associations ($P < .05$). The influence of age was always statistically significant when the relationship between OHRQoL and each of the 4 Axis II measures was investigated ($P < .05$).

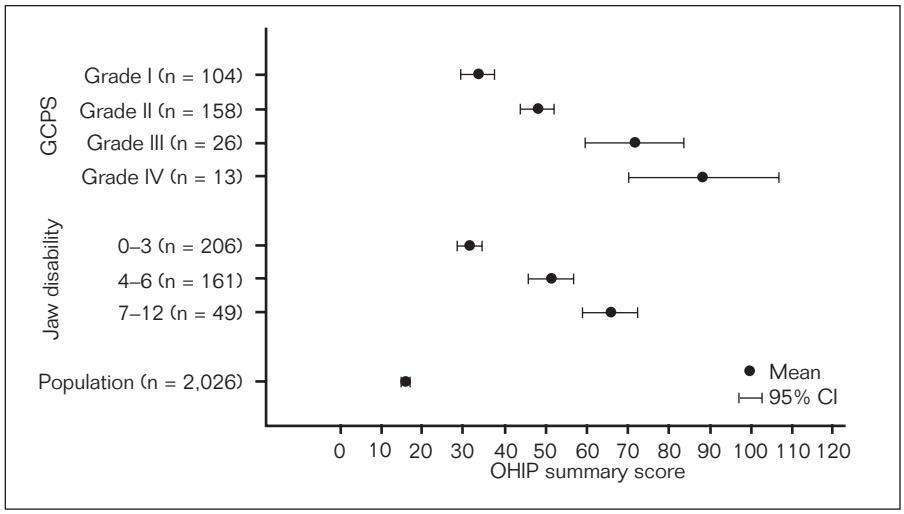

Fig 2 OHIP scores in groups of TMD patients with different GCPS categories and jaw disability levels compared with the general population.

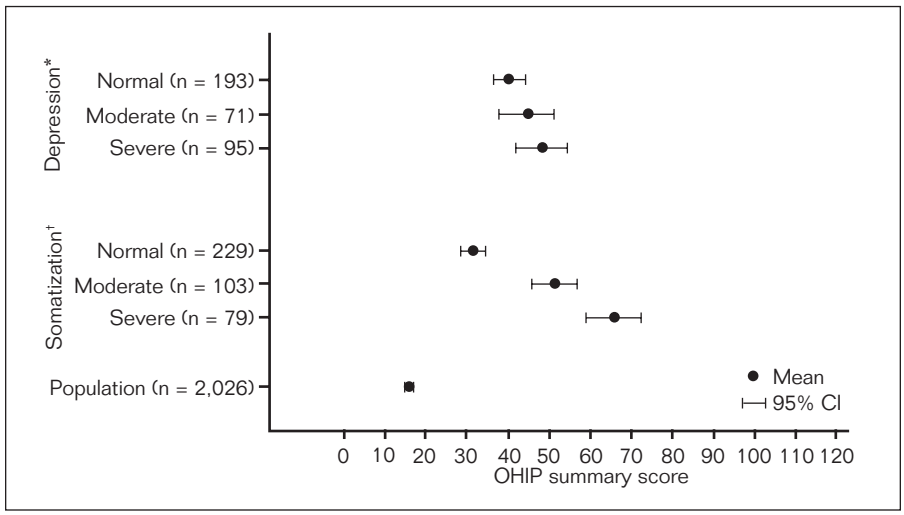

Fig 3 OHIP scores in groups of TMD patients with different states of depression and somatization. Moderate = above 70th percentile on population norms. Severe = above 90th percentile on population norms. *Analyses of depression missing for 57 subjects. †Analyses of somatization missing for 5 subjects.

Discussion

This is the first study to investigate the OHRQoL of TMD patients (measured using a widely used instrument, the OHIP), in the context of the diagnostic classifications of TMD that were made by another widely used instrument, the RDC/TMD, and in the context of the general population. Although there has been substantial interest in TMD and its psychosocial impact, the quality of life of patients suffering from TMD has so far only been characterized in a few studies. Application of the Sickness Impact Profile (SIP),[19] a generic measure of health-related quality of life, revealed comparable life quality impact in TMD and cardiac patients.[20] The SIP has also been used to compare several oral conditions, and TMD patients were shown to be more affected by their condition than periodontal or denture patients.[21] The finding that denture patients reported fewer problems than TMD patients is supported by a comparison with a previous OHRQoL study by the present authors.[7]

Table 2 OHIP Scores in Groups of TMD Patients Stratified by Age and Gender and in a General Population Sample

	Gender				Age			
	Men (n = 88)		Women (n = 328)		14–39 y (n = 241)		40–85 y (n = 175)	
	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
Patients – Axis I (physical diagnoses)								
Myofascial pain (Ia)	49.7	37.8–61.7	52.7	46.1–59.3	43.3	36.5–50.1	60.7	51.9–69.5
Myofascial pain with limited opening (Ib)	42.5	32.0–53.1	55.6	48.3–62.9	47.8	39.4–56.2	61.9	52.3–71.6
DD* with reduction (IIa)	30.0	23.5–36.6	33.6	30.0–37.1	30.0	26.6–33.4	38.7	32.5–45.0
DD* without reduction, with lim. opening (IIb)	44.2	28.6–59.8	48.9	31.6–66.2	37.4	26.2–48.5	58.8	36.6–81.1
DD* without reduction, w/o lim. opening (IIc)	–	–	51.9	37.8–66.1	42.8	26.1–59.5	62.9	38.6–87.1
Arthralgia (IIIa)	40.2	30.6–49.8	53.5	47.6–59.3	45.3	38.7–51.8	57.8	49.9–65.7
Osteoarthritis of the TMJ (IIIb)	39.5	36.6–42.4	39.8	23.7–56.0	23.0	12.3–33.7	45.9	28.5–63.4
Osteoarthrosis of the TMJ (IIIc)	27.0	2.9–51.1	44.5	30.2–58.7	36.1	16.7–55.6	46.8	32.8–60.9
Patients – Axis II (psychosocial measures)								
GCPS								
I	27.9	20.6–35.2	34.7	30.1–39.4	30.9	26.3–35.5	37.0	29.8–44.2
II	46.7	39.9–53.4	48.6	43.9–53.2	42.7	38.5–46.9	56.0	49.0–63.0
III	57.3	47.1–67.6	73.5	60.8–86.2	52.1	38.0–66.3	78.8	65.3–92.3
IV	–		88.3	70.5–106.0	93.0	64.5–121.5	83.3	69.1–97.6
Jaw disability								
0–3 limited oral functions	28.8	23.2–34.5	34.4	30.3–38.5	27.0	23.6–30.4	41.7	35.5–48.0
4–6 limited oral functions	47.2	38.7–55.8	48.3	43.5–53.1	41.4	36.9–45.9	57.4	49.9–64.9
7–12 limited oral functions	55.9	41.4–70.4	69.9	60.1–79.7	67.1	53.7–80.6	67.6	56.9–78.2
Depression								
No	36.9	28.6–45.3	41.1	36.7–45.5	31.7	27.3–36.1	50.8	44.7–56.9
Moderate	33.2	25.6–40.8	50.3	41.6–58.9	39.2	31.5–46.9	52.1	41.1–63.2
Severe	47.2	36.8–57.6	48.4	41.5–55.2	43.7	36.7–50.6	56.5	44.7–68.2
Somatization								
No	28.8	22.8–34.9	32.3	29.0–35.6	28.0	24.9–31.1	38.8	33.0–44.6
Moderate	41.2	29.0–53.5	53.3	47.3–59.4	47.9	41.2–54.7	55.3	46.4–64.1
Severe	54.4	47.7–61.1	69.5	61.3–77.8	63.4	53.4–73.4	67.0	58.5–75.5
Population†	17.2	15.7–18.7	14.5	13.3–15.8	11.1	10.0–12.2	19.7	18.2–21.2

*DD = disc displacement.
†In the general population, there were 979 men, 1,047 women, 919 subjects less than 40 years old, and 1,117 subjects at least 40 years old.

In this study, not unexpectedly, treatment-seeking patients had considerably more problems, as defined by the OHIP, than subjects in the general population. Even subjects with little or no pain, eg, patients with disc displacement diagnoses, had OHIP summary scores twice those of general population subjects. Similar to the general population, older subjects had higher OHIP scores than younger subjects. In contrast to findings in the general population, female patients presented more problems than male patients. Differences in OHRQoL were observed between some physical diagnoses. Most notably, the mean OHIP score for disc displacement with reduction was lower compared to myofascial and arthralgic diagnoses. The former is often a relatively painless condition, with treatment often being sought because of the joint sounds, and the difference observed here may reflect the importance of pain as an influence on OHRQoL. Nevertheless, the raised OHIP scores seen in patients with disc displacements indicated that care-seeking may have a substantial influence on OHRQoL.

In contrast to the physical diagnoses of Axis I, which are categorical in nature, the Axis II measures are ordinal, with increasing scores representing increasing levels of severity. Given that this is the case, it is reassuring that 3 of the 4 measures (GCPS, jaw disability, and somatization) showed strong "dose-related" responses when measured against OHIP, particularly GCPS, which is a pain-

related measure. This lends support to the importance of the concept of "dysfunctional pain," a concept propagated by Turk, Rudy, and colleagues.[22,23] Dysfunctional pain patients showed higher levels of pain severity, pain interference, and affective disturbance, as well as lowered activity levels. Treatment outcome is related to the presence of dysfunctional pain.[24] The present finding that perceived oral health is also related to somatization, jaw disability, and, to a lesser extent, depression, is not unexpected and has led to several questionnaires characterizing related aspects of OHRQoL,[25–29] indicating the importance of such aspects in TMD patients. OHIP scores were related much more weakly to depression than to the other components.

OHIP's conceptual model is based on Locker's framework of oral health.[30] The model was recently supported empirically[31] and should be able to comprehensively assess the variety of functional and psychosocial consequences of TMD pain. In a sense OHIP is another Axis II measure and, as an ordinal or quasi-interval summary score, appears to capture 3 of the 4 components of Axis II quite effectively and demonstrates the potential for different psychosocial impacts to be related to specific Axis I diagnoses. It is a considerable advantage of a standardized internationally compatible instrument that results can be compared across studies. This opportunity is limited when abbreviated OHIP versions are used, because total scores no longer have the same range. However, single items reflecting specific problems that occur frequently in TMD (eg, difficulty chewing or felt tense) are still comparable and have provided easily interpretable and clinically relevant information.[32] Combinations of items which form subscales, domains or dimensions of the instrument would provide a useful means to characterize important aspects of OHRQoL across studies. However, there is still controversy regarding how many of these OHRQol factors exist and which items belong to them. The number of such domains ranges from seven[1,3] to four.[33] Using such domains, it was found that patients with musculoskeletal facial pain, ie, TMD patients, had OHRQoL levels comparable to those of neurologically-based facial pain patients.[2] It was also found that TMD patients presented more impaired OHRQoL than patients with Sjögren's syndrome, patients with burning sensations and pain in the oral mucosa with or without lesions, or patients with skeletal malocclusion.[5] These findings suggest that patients with TMD experienced more decreased OHRQoL than patients in almost any other dental subgroup.

Diversity of TMD and Importance of Psychosocial Aspects

TMD patients are a heterogeneous group in terms of their physical signs and diagnoses; they are probably even more heterogeneous in their psychosocial characteristics.[34–36] Differences in perceived oral health among clinical TMD subgroups are probably to be expected. In this study, patients with myogenous pain diagnoses presented (slightly) higher OHIP scores than patients with arthrogenous pain diagnoses. This is in line with other studies using the Pain Disability Index where higher impacts were observed for patients with myogenous complaints compared with those with discal disorders[37] and for myofascial pain and dysfunction patients than patients suffering from temporomandibular (joint) pain.[38] In this context, the marked differences between subdiagnoses are worthy of mention. The impact on OHRQoL of disc displacement with reduction was low compared to other disc displacement categories, while arthralgia scored quite high compared with other arthrogenous conditions.

Strengths and Limitations

RDC/TMD and OHIP are standardized measures, each with several language versions besides the English-language originals (eg, Chinese,[39] Swedish[5]). Reports about the translation process, the calibration of clinical examiners, and the evaluation of psychometric properties have been published for the RDC/TMD.[18,40] For OHIP, evidence of cross-cultural equivalence is available.[41] Therefore, the findings of this study should be widely generalizable. Some diagnoses were rare in the present study, such as osteoarthritis and disc displacement without reduction without limitation, and this has also been observed in multicenter studies.[42]

While the distribution of physical diagnoses in the present study was not much different from other TMD studies, the distribution of Axis II diagnoses may be different among TMD clinical centers around the world; thus, the absolute burden in a particular TMD population on perceived oral health may differ from setting to setting. For example, the prevalence of dysfunctional chronic pain has ranged from 5%[43] to 20%,[35] findings which would heavily influence impaired OHRQoL in a particular TMD patient population. The authors' clinic is mainly a primary care center, where the psychosocial impact of TMD is probably less pronounced than in secondary or tertiary care centers.

The present study investigated a particular aspect of TMD-related perceived oral health impact. The impact in subjects with specific diagnoses was characterized. Although this "impact" was measured in subjects with the condition, the "impact" was not necessarily due to the specific condition. A substantial number of TMD patients have multiple diagnoses, including many in this study, and therefore the impact of 1 diagnosis is mixed with those of the other diagnoses, which probably tends to dilute the differences in OHIP scores between individual diagnoses. In this context, the differences that were measured are particularly noteworthy.

Clinical Implications

The results of this study emphasize the importance of perceived health status and psychosocial assessment (RDC/TMD Axis II measures) in the evaluation of TMD patients. The measurement of OHRQoL by means of the OHIP can be recommended to characterize and measure this impact in a simple and internationally compatible way. In addition to the original instrument with 49 questions, abbreviated versions with 14 or 5 items[6,44] are also available.

The present study in TMD patients adds compatible information to the widely available literature reports from other populations in dentistry. The popular use of OHIP as a measure of psychosocial impact across oral conditions makes the instrument attractive as a single, unified measure of psychosocial impact in dentistry.

References

1. Slade GD, Spencer AJ. Development and evaluation of the Oral Health Impact Profile. Community Dent Health 1994;11:3–11.
2. Murray H, Locker D, Mock D, Tenenbaum HC. Pain and the quality of life in patients referred to a craniofacial pain unit. J Orofac Pain 1996;10:316–323.
3. Segu M, Collesano V, Lobbia S, Rezzani C. Cross-cultural validation of a short form of the Oral Health Impact Profile for temporomandibular disorders. Community Dent Oral Epidemiol 2005;33:125–130.
4. John MT, Patrick DL, Slade GD. The German version of the Oral Health Impact Profile—Translation and psychometric properties. Eur J Oral Sciences 2002;110:425–433.
5. Larsson P, List T, Lundstrom I, Marcusson A, Ohrbach R. Reliability and validity of a Swedish version of the Oral Health Impact Profile (OHIP-S). Acta Odontol Scand 2004;62:147–152.
6. John MT, Miglioretti DL, LeResche L, Koepsell TD, Hujoel PP, Micheelis W. German short forms of the Oral Health Impact Profile. Community Dent Oral Epidemiol 2006;34:277–288.
7. John MT, Slade G, Szentpetery A, Setz J. Oral health-related quality of life in patients treated with fixed, removable and complete dentures 1 and 6-12 months after treatment. Int J Prosthodont 2004;17:503–511.
8. Dworkin SF, LeResche L (eds). Research Diagnostic Criteria for Temporomandibular Disorders: Review, criteria, examinations and specifications, critique. J Craniomandib Disord 1992;6:301–355.
9. International Consortium for RDC/TMD-based Research. Available at: http://www.rdc-tmdinternational.org
10. John MT, Hirsch C, Reiber T, Dworkin SF. Translating the Research Diagnostic Criteria for Temporomandibular Disorders into German: Evaluation of content and process. J Orofac Pain 2006;20:43–52.
11. John MT, LeResche L, Koepsell TD, Hujoel PP, Miglioretti DL, Micheelis W. Oral health-related quality of life in Germany. Eur J Oral Sci 2003;111:483–491.
12. Kröner-Herwig B, Denecke H, Glier B, et al. Qualitätssicherung in der Therapie chronischen Schmerzes - Ergebnisse einer Arbeitsgruppe der Deutschen Gesellschaft zum Studium des Schmerzes (DGSS) zur psychologischen Diagnostik - IX. Multidimensionale Verfahren zur Erfassung schmerzrelevanter Aspekte und Empfehlungen zur Standarddiagnostik. Der Schmerz 1996;10:47–52.
13. Hautzinger M, Bailer M. Allgemeine Depressionsskala (ADS). Weinheim: Beltz, 1995.
14. Radloff LS. The CES-D scale: A self-report depression scale for research in the general population. Appl Psychological Meas 1977;1:385–401.
15. Von Zerssen D. Die Beschwerden-Liste. Weinheim: Beltz, 1976.
16. Beckmann D, Brähler E, Richter H-E. Der Giessen-Test (GT): Ein Test zur Individual- und Gruppendiagnostik. Bern: Huber, 1990.
17. John MT, Zwijnenburg AJ. Interobserver variability in assessment of signs of TMD. Int J Prosthodont 2001;14: 265–270.
18. Schmitter M, Ohlmann B, John MT, Hirsch C, Rammelsberg P. Research Diagnostic Criteria for Temporomandibular Disorders: A calibration and reliability study. Cranio 2005;23:212–218.
19. Bergner M, Bobbitt RA, Kressel S, Pollard WE, Gilson BS, Morris JR. The Sickness Impact Profile: Conceptual formulation and methodology for the development of a health status measure. Int J Health Serv 1976;6:393–415.
20. Reisine ST, Weber J. The effects of temporomandibular joint disorders on patients' quality of life. Community Dent Health 1989;6:257-270.
21. Reisine ST, Fertig J, Weber J, Leder S. Impact of dental conditions on patients' quality of life. Community Dent Oral Epidemiol 1989;17:7–10.
22. Rudy TE, Turk DC, Zaki HS, Curtin HD. An empirical taxometric alternative to traditional classification of temporomandibular disorders. Pain 1989;36:311–320.
23. Turk DC, Rudy TE. Toward an empirically derived taxonomy of chronic pain patients: Integration of psychological assessment data. J Consult Clin Psychol 1988;56:233–238.
24. Rudy TE, Turk DC, Kubinski JA, Zaki HS. Differential treatment responses of TMD patients as a function of psychological characteristics. Pain 1995;61:103–112.
25. Aggarwal VR, Lunt M, Zakrzewska JM, Macfarlane GJ, Macfarlane TV. Development and validation of the Manchester orofacial pain disability scale. Community Dent Oral Epidemiol 2005;33:141–149.
26. List T, Helkimo M. A scale for measuring the activities of daily living (ADL) of patients with craniomandibular disorders. Swed Dent J 1995;19:33–40.

27. Stegenga B, de Bont LG, de Leeuw R, Boering G. Assessment of mandibular function impairment associated with temporomandibular joint osteoarthrosis and internal derangement. J Orofac Pain 1993;7:183–195.
28. Sugisaki M, Kino K, Yoshida N, Ishikawa T, Amagasa T, Haketa T. Development of a new questionnaire to assess pain-related limitations of daily functions in Japanese patients with temporomandibular disorders. Community Dent Oral Epidemiol 2005;33:384–395.
29. List T, Paulin G, Lundström I, Ohrbach R. Orofacial disorders diagnosis: Relationship to the jaw limitation scale [abstract]. J Dent Res 2002;81(special issue A):1024.
30. Locker D. Measuring oral health: A conceptual framework. Community Dent Health 1988;5:3–18.
31. Nuttall NM, Slade GD, Sanders AE, Steele JG, Allen PF, Lahti S. An empirically derived population-response model of the short form of the Oral Health Impact Profile. Community Dent Oral Epidemiol 2006;34:18–24.
32. Szentpetery AG, John MT, Slade GD, Setz JM. Problems reported by patients before and after prosthodontic treatment. Int J Prosthodont 2005;18:124–131.
33. John MT, Hujoel P, Miglioretti DL, LeResche L, Koepsell TD, Micheelis W. Dimensions of oral-health-related quality of life. J Dent Res 2004;83:956–960.
34. Dworkin SF, Sherman J, Mancl L, Ohrbach R, LeResche L, Truelove E. Reliability, validity, and clinical utility of the Research Diagnostic Criteria for Temporomandibular Disorders Axis II Scales: Depression, non-specific physical symptoms, and graded chronic pain. J Orofac Pain 2002;16:207–220.
35. List T, Dworkin SF. Comparing TMD diagnoses and clinical findings at Swedish and US TMD centers using Research Diagnostic Criteria for Temporomandibular Disorders. J Orofac Pain 1996;10:240–253.
36. Yap AU, Dworkin SF, Chua EK, List T, Tan KB, Tan HH. Prevalence of temporomandibular disorder subtypes, psychologic distress, and psychosocial dysfunction in Asian patients. J Orofac Pain 2003;17:21–28.
37. Bush FM, Harkins SW. Pain-related limitation in activities of daily living in patients with chronic orofacial pain: Psychometric properties of a disability index. J Orofac Pain 1995;9:57–63.
38. Auerbach SM, Laskin DM, Frantsve LM, Orr T. Depression, pain, exposure to stressful life events, and long-term outcomes in temporomandibular disorder patients. J Oral Maxillofac Surg 2001;59:628–633.
39. Wong MC, Lo EC, McMillan AS. Validation of a Chinese version of the Oral Health Impact Profile (OHIP). Community Dent Oral Epidemiol 2002;30:423–430.
40. Lobbezoo F, van Selms MK, John MT, et al. Use of the Research Diagnostic Criteria for Temporomandibular Disorders for multinational research: Translation efforts and reliability assessments in The Netherlands. J Orofac Pain 2005;19:301–308.
41. Slade GD, Spencer AJ, Locker D, Hunt RJ, Strauss RP, Beck JD. Variations in the social impact of oral conditions among older adults in South Australia, Ontario, and North Carolina. J Dent Res 1996;75:1439–1450.
42. John MT, Dworkin SF, Mancl LA. Reliability of clinical temporomandibular disorder diagnoses. Pain 2005;118:61–69.
43. Yap AU, Chua EK, Hoe JK. Clinical TMD, pain-related disability and psychological status of TMD patients. J Oral Rehabil 2002;29:374–380.
44. Slade GD. Derivation and validation of a short-form oral health impact profile. Community Dent Oral Epidemiol 1997;25:284–290.