Comparing Axis II Scores According to the RDC/TMD and DC/TMD in Israeli Patients

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Aims: To use the Symptom Checklist-90-Revised (SCL-90-R)–based instruments of the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) and the Primary Care Evaluation of Mental Disorders (PRIME-MD)–based instruments of the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) in order to compare these Axis II scores in temporomandibular disorder (TMD) patients. **Methods:** Demographic and socioeconomic data, Axis I diagnoses, and Axis II evaluations (depression, nonspecific physical symptoms, anxiety, and Graded Chronic Pain Scale [GCPS]) were compared between two groups of patients—142 TMD patients diagnosed according to the RDC/TMD (RDC group) and 157 TMD patients diagnosed according to the DC/TMD (DC group). Pearson's chi-square test, Fisher's exact test, and Mann-Whitney test were used, and *P* values were adjusted for multiple comparisons. **Results:** The prevalences of severe depression, nonspecific physical symptoms, and anxiety were significantly lower in the DC group than in the RDC group, with no differences between groups for Axis I diagnoses, characteristic pain intensity (CPI), or GCPS. **Conclusion:** Within the limitations of this study, the present findings reveal differences in the presence of severe depression, nonspecific physical symptoms, and anxiety between the RDC and DC groups. The differences may reflect the cut-off scores of the SCL-90-R and the PRIME-MD tools. *J Oral Facial Pain Headache 2017;31:323–330. doi: 10.11607/ofph.1771*

Keywords: *Axis II, Diagnostic Criteria for Temporomandibular Disorders (DC/TMD), Primary Care Evaluation of Mental Disorders (PRIME-MD), Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD), Symptom Checklist-90-Revised (SCL-90-R)*

The major contribution of the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) is their recognition of the importance of incorporating the biopsychosocial model of chronic pain[1] as an essential component in the evaluation of TMD pain patients. Since its initial publication in 1992,[2] researchers and clinicians worldwide have been using the RDC/TMD for evaluation of both physical diagnoses (Axis I) and psychological parameters (Axis II) in TMD patients. As originally detailed,[2] the tools used in Axis II of the RDC/TMD were derived from the Symptom Checklist-90-Revised (SCL-90-R) questionnaire. A patient's level of depression was based on 13 items taken from the depression and vegetative symptoms scale of the SCL-90-R and 7 additional items, and the questionnaire used to assess nonspecific physical symptoms was based on the nonspecific physical symptoms scale from the SCL-90-R. Cut-off scoring instructions for these scales were included for differentiating between normal, moderate, and severe levels of depression and nonspecific physical symptoms.[2]

Using these instruments and a cut-off scoring system, the RDC/TMD has shown similar prevalences of depression, nonspecific physical symptoms, and graded chronic pain scale (GCPS) scores worldwide.[3–5] However, results indicated higher levels of severe depression and nonspecific physical symptoms in studies in Israel[6,7] and Italy,[5] as well as in a validation study of the Finnish version of the SCL-90.[8]

These results highlighted possible ethnic influences and overall conformed to studies that used the gold standard for psychiatric classification and diagnosis of mental and emotional disorders, the Diagnostic and Statistical Manual of Mental Disorders (DSM), which has shown that a large proportion of TMD patients meet the criteria for depression, anxiety, and nonspecific physical symptoms disorders. Indeed, numerous studies have reported higher levels of depression and anxiety in TMD patients compared to normal controls.[9–13]

Axis II measurements were first examined for their validity and reliability in 2002.[14] The results supported the validity of the depression tool and its use for screening. The nonspecific physical symptoms scale was found to have acceptable reliability, and the GCPS was found to have clinical utility for tailoring TMD treatment. In 2010, as part of the RDC/TMD validation project, a need emerged again to assess the ability of the nonspecific physical symptoms and depression instruments to identify TMD patients who might have these psychiatric disorders.[15] The cut-off scores between normal, moderate, and severe levels of depression and nonspecific physical symptoms used in this study were those set by the RDC/TMD original project in 1992.[2] For depression, Ohrbach et al[15] showed that a low cut-off point (normal vs moderate to severe depression) had 87% sensitivity and 53% specificity, while a high cut-off point (normal to moderate vs severe depression) showed 56% sensitivity and 91% specificity. These results indicated that the depression instrument was most useful if a patient scored in the normal range and was unlikely to have a diagnosis of depression. The nonspecific physical symptoms assessment tool did not have high utility for detecting psychiatric disorders (sensitivity 86%, specificity 31%). The authors also highlighted a need to include another measure of anxiety in the RDC/TMD and, due to the low specificity of the depression screener, to use the Patient Health Questionnaire-9 (PHQ-9) instead.[16]

In 2014, the RDC/TMD Axis II protocols were modified to create the Diagnostic Criteria for TMD (DC/TMD).[17] The changes in Axis II included moving away from the SCL-90-R–based instrument to one based on the Primary Care Evaluation of Mental Disorders (PRIME-MD) and the addition of an assessment of Generalized Anxiety Disorder (GAD) provided by the GAD-7 questionnaire. The PRIME-MD is a well-validated instrument[18–20] that has been translated into numerous languages, including Hebrew. Additionally, the new DC/TMD allows the substitution of the newly added Patient Health Questionnaires (PHQ-9 and PHQ-15) with the RDC/TMD depression and nonspecific physical symptoms questionnaires if continuity with legacy data is important.

The aim of this study was to use the SCL-90-R–based instruments of the RDC/TMD and the PRIME-MD–based instruments of the DC/TMD to compare Axis II depression, nonspecific physical symptoms, anxiety, and GCPS scores in TMD patients.

Materials and Methods

The study was approved by the committee for conducting studies on human subjects of Tel Aviv University. Each patient signed an informed consent form in which s/he agreed that his/her data could be used for research purposes. The sample size needed for the study was evaluated using effect size (w) and 2 degrees of freedom. To evaluate the differences between the groups at a significance level of 5% and power of 80% and for evaluating a small to medium effect (w = .2), a total of 242 participants was required. The study included two groups of patients: the RDC group and the DC group.

RDC Group

The RDC group consisted of 142 consecutive Israeli Jewish TMD patients aged 18 years or older who were referred to the Orofacial Pain Clinic at the School of Dental Medicine, Tel Aviv University, Israel during the year 2003. All patients were examined according to the RDC/TMD protocol[2] by calibrated Clinic members.

All RDC patients completed the Hebrew version of the RDC/TMD questionnaire and underwent a clinical examination according to the RDC/TMD protocol. The questionnaire was translated to Hebrew and then translated back into English to verify accuracy as part of the international RDC/TMD consortium.[21]

Accordingly, each patient received an RDC/TMD Axis I diagnosis and Axis II evaluation. For Axis I group 1 diagnoses, the prevalence was calculated separately for myofascial pain without limited opening and for myofascial pain with limited opening. For Axis I group 2 diagnoses, the prevalences of all three subgroups (disc displacement with reduction, disc displacement without reduction with limited opening, and disc displacement without reduction without limited opening) were calculated as one group. For Axis I group 3 diagnoses, the prevalences of two subgroups were considered: arthralgia and degenerative joint disease (DJD) (ie, osteoarthritis/osteoarthrosis).

Evaluation of Axis II parameters included depression, nonspecific physical symptoms with pain items, and anxiety levels. To assess anxiety, 10 items were added to the original RDC/TMD questionnaire derived from the initial SCL-90-R questionnaire for

assessing anxiety. A detailed description of the anxiety tool is presented elsewhere.[22]

Calculation of depression, nonspecific physical symptoms, and anxiety levels was performed as specified by the original publication of the RDC/TMD in 1992.[2] The cut-off point calculations as modified for determining normal, moderate, and severe levels were as follows:

- Depression: score 1 (normal): < 0.535; score 2 (moderate): 0.535 < 1.105; score 3 (severe): ≥ 1.105.
- Nonspecific physical symptoms: score 1 (normal): < 0.5000; score 2 (moderate): 0.500 < 1.000; score 3 (severe): ≥ 1.000.
- Anxiety: score 1 (normal): < 0.445; score 2 (moderate): 0.445 < 1.100; score 3 (severe): ≥ 1.100.

Calculation of the GCPS was performed for each patient according to the RDC/TMD protocol (levels 0–4).

DC Group

This group consisted of 157 consecutive Israeli Jewish TMD patients aged 18 years or older who were referred to the Orofacial Pain Clinic at the School of Dental Medicine, Tel Aviv University, Israel from 2015 to 2016. Examination of all patients was performed by four senior Clinic members who completed the calibration process at the DC/TMD Training and Calibration Course at the Department of Orofacial Pain and Jaw Function at the Faculty of Odontology at Malmö University, Sweden. Two of the examiners were part of the original team that had examined the RDC group.

Prior to the clinical examination, all patients in the DC group completed the Hebrew version of the DC/TMD questionnaire, which was translated into Hebrew and then back-translated into English according to the Guidelines for Establishing Cultural Equivalency of Instruments documentation according to the international DC/TMD consortium.[21] The Hebrew translation project of the DC/TMD has completed the external review stage (phase 1, stage 7 of the translation and cultural adaptation process) as of September 2017. The Hebrew versions of the PHQ-9, PHQ-15, and GAD-7 questionnaires incorporated into the Hebrew version of the DC/TMD were downloaded from http://www.phqscreeners.com/select-screener. It is noteworthy that the Hebrew translation of the PHQ-9 has been validated in Israeli Jewish and Palestinian populations.[23–29] Accordingly, each patient received a DC/TMD Axis I diagnosis and evaluation of Axis II parameters.

For Axis I group 1 diagnoses, the prevalences of myalgia and myofascial pain with referral were calculated separately. For Axis I group 2 diagnoses, the prevalences of all four subgroups (disc displacement with reduction, disc displacement with reduction with intermittent locking, disc displacement without reduction with limited opening, and disc displacement without reduction without limited opening) were calculated as one group. For Axis I group 3, the prevalence of two subgroups was considered: arthralgia and DJD.

Axis II evaluation included calculation of levels of depression (as assessed by the Hebrew validated version of the PHQ-9 questionnaire), anxiety (as assessed by the Hebrew version of the GAD-7 questionnaire), and nonspecific physical symptoms (as assessed by the Hebrew version of the PHQ-15 questionnaire).

For each questionnaire, the scores for all items were added, and severity was determined as follows:

- Anxiety and nonspecific physical symptoms: normal = total score of 0–4; mild = total score of 5–9; moderate = total score of 10–14; severe = total score of 15 or above.
- Depression: normal = total score of 0–4; mild = total score of 5–9; moderate = total score of 10–14; moderately severe-severe = total score of 15 or above.[17]

In addition, characteristic pain intensity (CPI) and GCPS version 2 were calculated for each patient.[30]

Demographic and socioeconomic data, Axis I diagnoses, evaluation of Axis II parameters, and disability were assessed separately for each group and then compared between groups.

Statistical Analyses

Continuous variables were evaluated for normal distribution by using histogram and quantile-quantile (Q-Q) plots. Since the continuous variables did not distribute normally, they were reported as the median and interquartile range (IQR) and analyzed using nonparametric tests. Categorical variables were described as frequencies and percentages. Pearson's chi-square test and Fisher's exact test were used to test the associations between categorical variables. Mann-Whitney test was used to assess differences in continuous variables between binary categories. All *P* values were adjusted for multiple comparisons by using the false discovery rate (FDR) method as proposed by Benjamini-Hochberg.[31] $P < .05$ was considered to reflect statistical significance. All tests were two tailed, and SPSS version 23 was used for all statistical analyses.

Table 1 Comparison of Demographic and Socioeconomic Data Between the RDC and DC Groups

	RDC group	DC group	*P* value*
Male:Female	1:3.7	1:2.7	.469
Female, n (%)	112 (78.9)	115 (73.2)	
Age (y)			
Mean ± SD	37.97 ± 5.11	36.88 ± 14.69	.712
Median (IQR)	33.0 (25.00–48.0)	31.0 (25.0–46.0)	
Education level, n (%)			
Elementary school	6 (4.5)	2 (1.3)	.085
High school	56 (42.1)	46 (29.7)	
College	52 (39.1)	76 (49.0)	
Graduate school/PhD	19 (14.3)	31 (20.0)	
Income			
Very low	12 (10.1)	4 (2.8)	.033
Low	15 (12.6)	13 (9.0)	
Average	79 (66.4)	97 (66.9)	
High/very high	13 (10.9)	31 (21.3)	
Marital status			
Single	59 (44.4)	69 (44.5)	.701
Married	60 (45.1)	76 (49.0)	
Divorced/separated	9 (6.8)	6 (3.9)	
Widowed	5 (3.7)	4 (2.6)	

*$P < .05$.

Table 2 Comparison of Axis I Diagnoses Between the RDC and DC Groups

	RDC group n (%)	DC group n (%)	*P* value
Group 1			
Muscle disorders	98 (69.0)	111 (70.7)	.751
Myalgia		75 (47.8)	
Myofascial pain with referral		36 (22.9)	
Myofascial pain with limited opening	28 (19.7)		
Myofascial pain without limited opening	70 (49.3)		
Group 2			
Disc disorders	55 (38.7)	69 (43.9)	.572
Group 3			
Arthralgia	20 (14.1)	27 (17.2)	.674
Degenerative joint disease	17 (12.0)	27 (17.2)	.406

Table 3 Comparison of Depression, Nonspecific Physical Symptoms, and Anxiety Levels Between the RDC and DC Groups

	RDC group n (%)	DC group[a] n (%)	*P* value
Depression			
Normal-mild	65 (45.8)	129 (82.2)	< .001
Moderate	42 (29.6)	15 (9.6)	
Severe[a]	35 (24.6)	13 (8.2)	
Moderately-severe	77 (54.2)	28 (17.8)	< .001
Nonspecific physical symptoms			
Normal-mild	37 (26.1)	122 (77.7)	< .001
Moderate	41 (28.9)	24 (15.3)	
Severe	64 (45.0)	11 (7.0)	
Moderate-severe	105 (73.9)	35 (22.3)	< .001
Anxiety			
Normal-mild	68 (48.6)	141 (89.8)	< .001
Moderate	39 (27.9)	12 (7.6)	< .001
Severe	33 (23.5)	4 (2.6)	
Moderate-severe	72 (51.4)	16 (10.2)	

[a]Severe depression according to the PHQ-9 was termed "moderately severe-severe."

Results

Demographic and Socioeconomic Data

There were no significant differences between groups (RDC vs DC) for gender, age, education, or marital status. A significant difference was found only for income level, which was significantly higher in the DC group ($P < .05$) (Table 1).

Axis I Diagnoses

There were no significant differences between groups for any Axis I diagnosis, including group 1 (muscle disorders), group 2 (disc disorders), and group 3 diagnoses (arthralgia, DJD) (Table 2).

Axis II Evaluation

Comparisons of depression, nonspecific physical symptoms, and anxiety between groups were performed in two ways: *(1)* by comparing scores of 0–1, 2, and 3 in the DC group to scores of 1, 2, and 3 in the RDC group; and *(2)* by comparing scores of normal to mild levels of depression, nonspecific physical symptoms, and anxiety (scores of 0 and 1) in the DC group to scores of normal (score of 1) depression, nonspecific physical symptoms, and anxiety (score of 1) in the RDC group, as well as comparing scores of 2 to 3 in both groups (which corresponded to moderate to severe levels of depression, nonspecific physical symptoms, and anxiety) (Table 3).

Depression. Significant differences were found between the RDC and DC groups after both methods of comparison: 8.2% of the DC group showed scores of moderately severe to severe depression, while 24.6% of the RDC group scored severe on the depression scale ($P = .001$, Fig 1). In the DC group, 17.8% showed scores of moderate to severe levels of depression compared to 54.2% in the RDC group ($P = .001$, Table 3).

Nonspecific Physical Symptoms. Significant differences were found between the RDC and DC groups after both methods of comparison: The prevalence of severe nonspecific physical symptoms in the DC group was 7.0%, and in the RDC group was 45.0% ($P < .001$, Table 3); for moderate to severe nonspecific physical symptoms, the prevalence was 22.3% and 73.9%, respectively ($P < .001$).

Anxiety. Significant differences were found between the RDC and DC groups

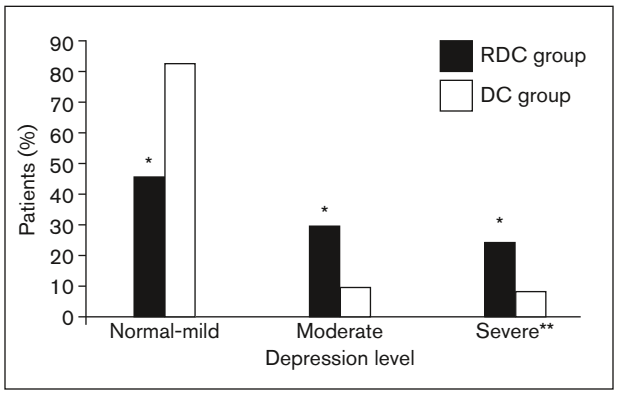

Fig 1 Comparison of distribution of depression levels between RDC and DC groups (%). *Significant difference ($P < .001$). Severe depression according to the PHQ-9 was termed "moderately severe-severe."

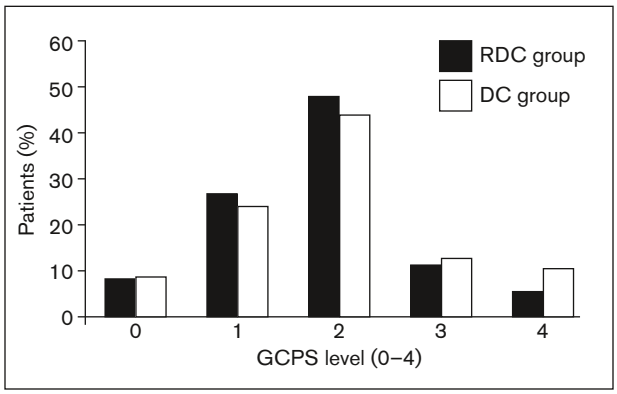

Fig 2 Comparison of distribution of GCPS levels in RDC and DC (GCPS version 2) groups (in %)* There were no significant differences between groups ($P = .7$).

after both methods of comparison: Severe anxiety was noted in 2.6% of the DC group and in 23.5% in the RDC group ($P < .001$, Table 3), while moderate to severe anxiety was noted in 10.2% of the DC group and 51.4% of the RDC group ($P < .001$, Table 3).

Pain Intensity, Duration, CPI, and GCPS

No significant differences were found between groups for pain duration, current facial pain intensity, worse facial pain intensity, average facial pain intensity, CPI, or GCPS (Table 4, Fig 2).

Table 4 Comparison of the RDC and DC Groups for Pain Intensity, Duration, Disability, and GCPS

	RDC group	DC group[a]	*P* value
Pain duration (mo)			
Mean ± SD	36.48 ± 48.64	54.81 ± 75.00	.105
Median (IQR)	18.0 (5.5–54.0)	24.0 (6.50–72.0)	
Current pain intensity (VAS score)			
Mean ± SD	5.05 ± 3.19	4.93 ± 3.023	.700
Median (IQR)	6.0 (2.0–8.0)	5.0 (3.0–7.0)	
Worst pain intensity (VAS score)			.572
Mean ± SD	6.48 ± 3.28	6.30 ± 3.10	
Median (IQR)	8.0 (4.8–9.0)	7.0 (5.0–9.0)	
Average pain intensity (VAS score)			
Mean ± SD	5.06 ± 2.84	4.97 ± 2.87	.700
Median (IQR)	6.0 (3.0–7.0)	5.0 (3.0–7.0)	
CPI[a] (Sum of current pain, worst pain, and average pain)			
Mean ± SD	16.49 ± 8.51	16.68 ± 10.20	.700
Median (IQR)	18.5 (10.0–23.0)	17.0 (11.0–23.0)	
GCPS,[b] n (%)			
Grade 0: None	12 (8.5)	13 (8.7)	.700
Grade 1: Low-intensity pain, without disability	38 (26.8)	36 (24.0)	
Grade 2: High-intensity pain, without disability	68 (47.9)	66 (44.0)	
Grade 3: Moderately limiting	16 (11.3)	19 (12.7)	
Grade 4: Severely limiting	8 (5.5)	16 (10.6)	

[a]To compare CPI scores, calculation of the CPI in the RDC group was changed according to calculation specifications of GCPS version 2[27] (adding the scores for current pain intensity, worse pain intensity, and average pain intensity [range 0–30]).
[b]While the calculation of GCPS according to the RDC/TMD relates to the past 6 months, the calculation of GCPS version 2 according to the DC/TMD relates only to the past 30 days. Different calculations were used according to the specifications of the RDC/TMD and DC/TMD.

Discussion

This study revealed significant differences between patients diagnosed by the RDC/TMD and those diagnosed by the newly adopted DC/TMD for all Axis II parameters (depression, nonspecific physical symptoms, and anxiety levels). While as many as 24.6% of the patients in the RDC group scored severe on the depression scale, only 8.2% of the DC group had scores of moderately severe to severe depression (score of 15 and above). However, it is important to point out that the results refer to two different groups of patients more than a decade apart and who responded to two different questionnaires, a fact that may have significantly affected the results. Undoubtedly, an optimal setting for a comparison between the RDC/TMD and the DC/TMD tools would be a study in which each patient fills out both the SCL-90-R– and the PRIME-MD–based instruments. Although this may lead to increased subject burden and decreased reliability due to subject fatigue,[32] the collective length of the two questionnaires is not extremely long. Such studies are recommended in the future. In addition, the present study used a currently nonconfirmed translation and a relatively small convenience sample, facts that may have further impeded the ability to draw conclusions from the present results.

Table 5 Prevalence (%) of Axis II Parameters According to the RDC/TMD in the Present Study Compared to Available Data from Studies in the US,[3,4] Sweden,[4] Italy,[5] and the Netherlands[5]

	Present study	USA	Sweden	Italy	Netherlands
Depression					
Level 1	45.8	54.3	49	47.2	62.5
Level 2	29.6	26	33	21.1	24.9
Level 3	24.6	18.7	18	31.7	12.6
Nonspecific physical symptoms					
Level 1	26.1	37	39	28.2	59
Level 2	28.9	32	33	29.5	28
Level 3	45.1	31	28	42.3	13
GCPS					
Level 0	8.5	5.5	14	13.7	4.4
Level 1	26.8	34.5	35	43.3	30
Level 2	47.9	39	37	29.2	44
Level 3	11.3	15	11	8.8	13
Level 4	5.5	6	3	4.9	8.6

Nonetheless, the present findings indicate that a discrepancy may exist between some DC/TMD and RDC/TMD Axis II parameters and highlight the need for their further investigation. Indeed, the international RDC/TMD consortium workshop[32] acknowledged that some investigators may prefer to continue to use the Axis II instruments from the RDC/TMD to assess depression and nonspecific physical symptoms; however, they noted that one consequence of choosing instruments other than the PRIME-MD is a lack of comparability with other DC/TMD research settings, which would be a significant limitation in the overall implementation of the DC/TMD.

In general, Axis II parameters according to the RDC/TMD in the current study resembled previous data comparing studies in Israel,[6] the US,[3,4] Sweden,[4] and Italy.[5] It is noteworthy that in the Netherlands, a culturally adapted Dutch translation of the RDC/TMD was used, and during the translation and adaptation process, the newly translated SCL-90 scales were substituted with the existing translated and validated SCL-90 scales in Dutch.[33] Axis II results in the Netherlands yielded significantly lower levels of severe depression and nonspecific physical symptoms (12.6% and 13%, respectively)[5] compared to the US, Swedish, and Italian findings (Table 5), as well as Israeli findings.[6] When the Axis II parameters of the RDC and DC Israeli groups were compared, significant differences were observed in levels of depression, nonspecific physical symptoms, and anxiety. It is important to note that, as repeatedly emphasized by the authors of the RDC/TMD,[2] the Axis II tools were not intended to yield psychiatric diagnoses and were merely meant to assess the extent of cognitive, emotional, or behavioral impairment that might affect prognosis.

A variety of self-report questionnaires are available for research and clinical purposes to assess levels of depression, anxiety, and nonspecific physical symptoms. It is acknowledged that comparison of scores between different instruments could be problematic, and standardized metric methods should be developed to enable such comparisons. For example, Cameron et al[34] compared the PHQ-9 and the Hospital Anxiety and Depression Scale (HADS-D) instruments for measuring depression severity in primary care. Their study showed that the PHQ-9 categorized a significantly greater proportion of patients with moderate to severe depression than the HADS-D. Wahl et al[34] developed a common metric for 11 depression measures (including the PHQ-9, but not the depression scale, from the SCL-90-R) and identified three thresholds across instruments that were able to differentiate among depression severity levels. According to their data, the values of the PHQ-9 resembled the threshold values identified for mild, moderate, and severe depressive symptoms. The new metric allows comparison of threshold scores of different levels of depression across the 11 depression measures included, or can be theoretically obtained by any combination of items in the item bank.

Furthermore, it should be noted that differences in scores between measurement scales can possibly result from different responses to items in these scales (ie, due to factors such as age,[36] gender,[36] ethnicity,[37] or education levels). In some cases it is difficult to determine whether differences in the prevalence of symptoms between groups represent a true difference or whether the difference is due to item bias. Such a bias can be caused by differential item functioning (where items on a scale show bias) and/or by differential test functioning (where individuals from different groups have different scores on the scale).[36]

Nevertheless, the magnitude of the differences between the RDC and DC groups in levels of depression, anxiety, and nonspecific physical symptoms found in the present study is substantial. It is uncertain whether the differences found represent actual diversities between the different measures or an artifact due to low cut-off scores given to the SCL-90-R–based tools used in the RDC/TMD or if they reflect a combination of both. Thus, the high percentage of severe depression among TMD patients reported consistently by groups worldwide using the RDC/TMD[3–6] could be a result of skewed cut-off scores or as a result of the instrument chosen. Indeed, several studies have examined the performance of the SCL-90-R questionnaire by comparing its results to a psychiatric diagnosis as a gold standard. For example, poor diagnostic efficacy was found for most of the subscales of the SCL-90-R.[38,39] The mean SCL-90-R score calculated by Pedersen et al[38] was 2.37 for the depression scale

in patients diagnosed by the Diagnostic and Statistical Manual of Mental Disorders (DSM-III-R) with current depression, while patients without depression had a mean score of 1.98. They noted problems with cut-off scores and pointed out that increasing the cut-off scores will instantly increase the proportion of false negatives and decrease the proportion of true positives. In contrast, decreasing the cut-off scores would decrease the proportion of true negatives and increase the proportion of false positives.

While the RDC/TMD used a cut-off score of 1.05 for severe depression,[2] Veijola et al[40] showed that the SCL-25 (a scale similar to the SCL-90-R) is moderately well suited for screening present DSM-III-R Axis I diagnoses with a cut-off score of 1.55. On the other hand, high levels of depression have been reported in other chronic pain conditions (eg, fibromyalgia,[41] inflammatory bowel syndrome,[42] and chronic musculoskeletal pain[43]). Thus, overall, the prevalence of depression in various chronic pain conditions resembles the severe depression scores of TMD patients evaluated by the RDC/TMD and fits the current description of TMD as a chronic pain condition. At the same time, when depression was evaluated by the DC/TMD instrument (PHQ-9) in the present study, only 8.2% of the TMD patients were diagnosed with moderately severe to severe depression.

When combining the results of moderate to severe scores of depression (cut-off score of 10 and above), the combined scoring was 17.8%. Indeed, in a study on the validity of the PHQ-9 as a brief depression severity measure, the PHQ-9 had a sensitivity of 88% and a specificity of 88% at a cut-off score of 9 for detecting major depressive disorder when compared with a structured psychiatric interview.[18] Löwe et al[44] suggested a cut off-point of ≥ 11 for the diagnosis of major depressive disorder. Therefore, in using the DC/TMD for the diagnosis of TMD patients, it should be kept in mind that results might show differences in rates of severe depression, nonspecific physical symptoms, and anxiety compared to the previous RDC/TMD criteria.

These differences between instruments should be acknowledged early on to prevent skewed results (over- and underdiagnosis). While 19 of the 20 items of the SCL-90-R–based instrument for evaluating depression according to the RDC/TMD could be identified in the item bank developed by Wahl et al,[35] this item bank was performed in German. To facilitate this comparison, a similar metric bank should be performed in other languages as well. To facilitate comparison of the legacy SCL-90-R–based Axis II instruments and the PRIME-MD instruments, both completion of phase 2 of the translation as detailed by the International RDC/TMD consortium[21] in its Guidelines for Establishing Cultural Equivalency of Instruments and developing language-specific metric banks are recommended for each language. Another possibility is to use local PRIME-MD measures that have already been validated, as was done in the Netherlands[33] and in the current study for the PHQ-9.

Conclusions

Although the two different samples answered different questionnaires in the present study, both groups were similar in demographic variables, Axis I diagnoses, pain intensity, duration, CPI, and GCPS. This suggests that the differences in the Axis II findings could be due, at least partially, to the use of different cut-off values of the questionnaires. It is hoped that these findings will trigger further research that will better define the differences and similarities between the RDC/TMD and DC/TMD tools and enable more accurate comparisons between past and future research in this field.

Acknowledgments

The authors received no funding for this research and report no conflicts of interest.

References

1. Gatchel RJ, Peng YB, Peters ML, Fuchs PN, Turk DC. The biopsychosocial approach to chronic pain: Scientific advances and future directions. Psychol Bull 2007;133:581–624.
2. Dworkin SF, LeResche L. Research Diagnostic Criteria for Temporomandibular Disorders: Review, criteria, examinations and specifications, critique. J Craniomandib Disord 1992;6: 301–355.
3. Dworkin SF, Huggins KH, LeResche L, et al. Epidemiology of signs and symptoms in temporomandibular disorders: Clinical signs in cases and controls. J Am Dent Assoc 1990;120: 273–281.
4. 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.
5. Manfredini D, Winocur E, Ahlberg J, Guarda-Nardini L, Lobbezoo F. Psychosocial impairment in temporomandibular disorders patients. RDC/TMD Axis II findings from a multicentre study. J Dent 2010;38:765–772.
6. Winocur E, Steinkeller-Dekel M, Reiter S, Eli I. A retrospective analysis of temporomandibular findings among Israeli-born patients based on the RDC/TMD. J Oral Rehabil 2009;36:11–17.
7. Reiter S, Eli I, Gavish A, Winocur E. Ethnic differences in temporomandibular disorders between Jewish and Arab populations in Israel according to RDC/TMD evaluation. J Orofac Pain 2006;20:36–42.
8. Holi MM, Sammallahti PR, Aalberg VA. A Finnish validation study of the SCL-90. Acta Psychiatr Scand 1998;97:42–46.

9. Gatchel RJ, Garofalo JP, Ellis E, Holt C. Major psychological disorders in acute and chronic TMD: An initial examination. J Am Dent Assoc 1996;127:1365–1374.
10. Kight M, Gatchel RJ, Wesley L. Temporomandibular disorders: Evidence for significant overlap with psychopathology. Health Psychol 1999;18:177–182.
11. Marbach JJ, Lennon MC, Dohrenwend BP. Candidate risk factors for temporomandibular pain and dysfunction syndrome: Psychosocial, health behavior, physical illness and injury. Pain 1988;34:139–151.
12. Hoffmann RG, Kotchen JM, Kotchen TA, Cowley T, Dasgupta M, Cowley AW Jr. Temporomandibular disorders and associated clinical comorbidities. Clin J Pain 2011;27:268–274.
13. Carlson CR, Reid KI, Curran SL, et al. Psychological and physiological parameters of masticatory muscle pain. Pain 1998;76: 297–307.
14. 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.
15. Ohrbach R, Turner JA, Sherman JJ, et al. The Research Diagnostic Criteria from Temporomandibular Disorders. IV: Evaluation of the psychometric properties of the Axis II measures. J Orofac Pain 2010;24:48–62.
16. Anderson GC, Gonzalez YM, Ohrbach R, et al. The Research Diagnostic Criteria for Temporomandibular Disorders. VI: Future directions. J Orofac Pain 2010;24:79–88.
17. Schiffman E, Ohrbach R, Truelove E, et al. Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for Clinical and Research Applications: Recommendations of the International RDC/TMD Consortium Network and Orofacial Pain Special Interest Group. J Oral Facial Pain Headache 2014;28:6–27.
18. Kroenke K, Spitzer RL, Williams JB. The PHQ-9: Validity of a brief depression severity measure. J Gen Intern Med 2001; 16:606–613.
19. Kroenke K, Spitzer RL, Williams JB. The PHQ-15: Validity of a new measure for evaluating the severity of somatic symptoms. Psychosom Med 2002;64:258–266.
20. Löwe B, Decker O, Müller S, et al. Validation and standardization of the Generalized Anxiety Disorder Screener (GAD-7) in the general population. Med Care 2008;46:266–274.
21. International Network for Orofacial Pain and Related Disorders Methodology: A Consortium Focused on Clinical Translation Research. http://www.rdc-tmdinternational.org/. Accessed 22 August 2017.
22. Reiter S, Emodi-Perlman A, Goldsmith C, Friedman-Rubin P, Winocur E. Comorbidity between depression and anxiety in patients with temporomandibular disorders according to the research diagnostic criteria for temporomandibular disorders. J Oral Facial Pain Headache 2015;29:135–143.
23. Hobfoll SE, Canetti D, Hall BJ, et al. Are community studies of psychological trauma's impact accurate? A study among Jews and Palestinians. Psychol Assess 2011;23:599–605.
24. Hall BJ, Hobfoll SE, Canetti D, Johnson R, Palmieri P, Galea S. Exploring the association between posttraumatic growth and PTSD: A national study of Jews and Arabs during the 2006 Israeli-Hezbollah War. J Nerv Ment Dis 2010;198:180–186.
25. Hobfoll SE, Canetti-Nisim D, Johnson RJ. Exposure to terrorism, stress-related mental health symptoms, and defensive coping among Jews and Arabs in Israel. J Consult Clin Psychol 2006;74:207–218.
26. Hobfoll SE, Canetti-Nisim D, Johnson RJ, Palmieri PA, Varley JD, Galea S. The association of exposure, risk, and resiliency factors with PTSD among Jews and Arabs exposed to repeated acts of terrorism in Israel. J Trauma Stress 2008;21:9–21.
27. Palmieri PA, Canetti-Nisim D, Galea S, Johnson RJ, Hobfoll SE. The psychological impact of the Israel-Hezbollah War on Jews and Arabs in Israel: The impact of risk and resilience factors. Soc Sci Med 2008;67:1208–1216.
28. Palmieri PA, Chipman KJ, Canetti D, Johnson RJ, Hobfoll SE. Prevalence and correlates of sleep problems in adult Israeli Jews exposed to actual or threatened terrorist or rocket attacks. J Clin Sleep Med 2010;6:557–564.
29. Levy I, Goldstein A, Fischel T, Maor Y, Litachevsky V, Rahav G. Neurocognitive disturbances and psychiatric disorders among patients living with HIV-1 positive in Israel [in Hebrew]. Harefuah 2013;152:196–199, 248–249.
30. Von Korff M. Assessment of chronic pain in epidemiological and health services research: Empirical bases and new directions. In: Turk DC, Melzack R (eds). Handbook of Pain Assessment, ed 3. New York: Guilford, 2011:455–473.
31. Benjamini Y, Hochberg Y. Controlling the false discovery rate: A practical and powerful approach to multiple testing. J Roy Statist Soc Ser B 1995;57:289–300.
32. Michelotti A, Alstergren P, Goulet JP, et al. Next steps in development of the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD): Recommendations from the International RDC/TMD Consortium Network workshop. J Oral Rehabil 2016;43: 453–467.
33. 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.
34. Cameron IM, Crawford JR, Lawton K, Reid IC. Psychometric comparison of PHQ-9 and HADS for measuring depression severity in primary care. Br J Gen Pract 2008:58;32–36.
35. Wahl I, Löwe B, Bjorner JB, et al. Standardization of depression measurement: A common metric was developed for 11 self-report depression measures. J Clin Epidemiol 2014;67:73–78.
36. Cameron IM, Crawford JR, Lawton K, Reid IC. Differential item functioning of the HADS and PHQ-9: An investigation of age, gender and educational background in a clinical UK primary care sample. J Affect Disord 2013;147:262–268.
37. Huang FY, Chung H, Kroenke K, Dellucchi KL, Spitzer RL. Using the Patient Health Questionnaire-9 to measure depression among racially and ethnically diverse primary care patients. J Gen Intern Med 2006;21:547–552.
38. Pedersen G, Karterud S. Is SCL-90R helpful for the clinician in assessing DSM-IV symptom disorders? Acta Psychiatr Scand 2004;110:215–224.
39. Kim MJ, Lim MJ, Park WK, Kho HS. Comparison between the SCL-90-R and MMPI in TMD patients with psychological problems. Oral Dis 2012;18:140–146.
40. Veijola J, Jokelainen J, Läksy K, et al. The Hopkins Symptom Checklist-25 in screening DSM-III-R Axis-I disorders. Nord J Psychiatry 2003;57:119–123.
41. Thieme K, Turk DC, Flor H. Comorbid depression and anxiety in fibromyalgia syndrome: Relationship to somatic and psychosocial variables. Psychosom Med 2004;66:837–844.
42. Marks DM, Han C, Krulewicz S, et al. History of depressive and anxiety disorders and paroxetine response in patients with irritable bowel syndrome: Post hoc analysis from a placebo-controlled study. Prim Care Companion J Clin Psychiatry 2008;10:368–375.
43. Bair MJ, Wu J, Damush TM, Sutherland JM, Kroenke K. Association of depression and anxiety alone and in combination with chronic musculoskeletal pain in primary care patients. Psychosom Med 2008;70:890–897.
44. Löwe B, Spitzer RL, Gräfe K, et al. Comparative validity of three screening questionnaires for DSM-IV depressive disorders and physicians' diagnoses. J Affect Disord 2004;78:131–140.