Comorbidity Between Depression and Anxiety in Patients with Temporomandibular Disorders According to the Research Diagnostic Criteria for Temporomandibular Disorders

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Aims: To examine the extent of depression, anxiety, somatization, and comorbidity between depression and anxiety in patients with temporomandibular disorders (TMD) by adding the Symptom Checklist-90 Revised self-report questionnaire for anxiety to the Research Diagnostic Criteria for TMD. **Methods:** A total of 207 Israeli TMD patients were included in this retrospective study. Data included levels of depression, anxiety, somatization, and comorbidity in the study group as a whole, in chronic pain TMD patients compared to acute pain TMD patients, and in chronic pain TMD patients according to their Graded Chronic Pain Scale score. Spearman correlation was used to assess the level of correlation between depression, anxiety, and somatization. Fisher exact test or Pearson chi-square test was used to compare the categorical variables. **Results:** When depression, anxiety, somatization, and comorbidity were analyzed in a multidimensional approach, there were statistically significant differences between subgroups as to depression and somatization only. No statistically significant differences were found as to anxiety and comorbidity. **Conclusion:** Multidimensional assessment enabled differentiation between findings of depression, anxiety, somatization, and comorbidity in subgroups of TMD patients. The findings of no statistically significant differences between subgroups of TMD patients as to anxiety and comorbidity support previous studies on TMD and anxiety, which suggest a less significant role of anxiety in chronic TMD patients as compared to depression and somatization. *J Oral Facial Pain Headache 2015;29:135–143. doi: 10.11607/ofph.1297*

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Comorbidity between depression and anxiety has a critical relevance to the treatment approach and prognosis; patients who exhibit comorbidity have been shown to suffer from more severe and chronic illness, may suffer from greater impairment in work-related and psychosocial functioning,[1] and exhibit a worse prognosis as compared to patients suffering from non–anxious depression.[2] Accordingly, the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-V)[3] added an anxiety specifier to the latest classification of major depressive disorder to differentiate patients who in addition to this disorder suffer from anxiety symptoms.

While abundant research exists on psychosocial factors in chronic pain and medical conditions, the research on comorbidity still lags,[4] even though research so far on comorbidity in chronic pain conditions, including orofacial pain,[5–13] and medical conditions[14] has demonstrated greater disability, greater pain severity, and poorer prognosis and health-related quality of life. Previous research using the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD)[15] to study TMD patients lags behind even further. The majority of studies have so far focused on Axis I (biological) diagnoses, and for the most part have provided only descriptive data on Axis II (psychosocial) findings. In addition, these studies usually have viewed the TMD sample as a single group,[16,17] although it is well established that TMD patients

are composed of a heterogeneous patient population in terms of both Axis I and Axis II diagnoses. Few studies have focused on Axis II diagnoses and pain-related disability factors.[18–20] As emphasized by Palla,[21] "…improvement in TMD management likely requires definitions of the patients not only based on physical diagnosis and pain duration but also on psychosocial functioning" and that "it is mandatory to also define samples on chronic pain severity by using at least the chronic pain grade scale." Indeed, recent research has highlighted the correlation between Axis II findings and disability, rather than Axis I findings.[22–25] Unfortunately, anxiety levels have not been evaluated to date as part of the Axis II evaluation of the RDC/TMD, although research points to the desirability of including anxiety in future research in order to identify the factors that may increase the predictability of high disability.[25] Conflicting results as to the role of anxiety in TMD[26–38] may be explained by study design faults, different diagnostic criteria used in different studies, or no distinction between acute and chronic pain conditions in some of the studies.[39] Moreover, while comorbidity between depression and somatization according to the RDC/TMD was assessed in a few studies,[11] to the best of the authors' knowledge, comorbidity between depression and anxiety has not been assessed to date in studies using the RDC/TMD or other diagnostic criteria protocols in TMD patients, nor has it been assessed in different levels of disability as calculated by the Graded Chronic Pain Scale (GCPS).

It is not surprising that following the recommendations of the Diagnostic Criteria of TMD (DC/TMD) project,[40] the DC/TMD Axis II protocols were modified from being based on the Symptom Checklist-90 Revised (SCL-90-R) to the Primary Care Evaluation of Mental Disorders (PRIME-MD)–based instrument. In addition, assessment of anxiety level was applied to the DC/TMD by adding the Generalized Anxiety Disorder Questionnaire (GAD-7).[41] At the same time, the DC/TMD project enabled the substitution of the Patient Health Questionnaire (PHQ-9 and PHQ-15) with the RDC/TMD depression and somatization questionnaires (SCL-90-R) if continuity with legacy data is important for research purposes.[41]

The aims of this study were to examine the extent of depression, anxiety, somatization, and comorbidity between depression and anxiety in TMD patients, by adding the SCL-90-R self-report questionnaire for anxiety to the RDC/TMD. The data were explored in three ways: viewing the TMD study group as a whole (one-dimensional approach); comparing acute pain TMD patients to chronic pain TMD patients; and comparing chronic pain TMD patients according to their degree of disability as expressed by their GCPS score (multidimensional approach).

Materials and Methods

This retrospective study consisted of 400 consecutive patients who were seen in two orofacial pain clinics in Israel with a proposed diagnosis of TMD during the period between January and October 2003. Examination of patients was performed by either the senior author (SR), who was calibrated to the RDC/TMD examination protocol during her studies at the Oral Medicine graduate program, University of Washington, or the other senior staff members of the Orofacial Pain Clinic, School of Dental Medicine, Tel Aviv University. Calibration to the RDC/TMD protocol was performed between the senior author and the other examiners. The study was approved by the ethics committee for conducting studies on human subjects of the Tel Aviv University, under the Helsinki accord. Since this was a retrospective study taken from patients' medical records 10 years ago and was not a prospective study, and the study did not involve an invasive procedure, an ethics committee approval was considered to be sufficient with no further requirement for informed consent by the patients.

Included in the study were patients who met the diagnostic criteria for TMD according to the RDC/TMD.[15] Excluded from the study were patients who did not meet the criteria to receive an Axis I diagnosis of TMD according to the RDC/TMD (n = 20), patients younger than 18 years of age (n = 54), patients who were referred for bruxism only (n = 22), patients who did not fill out the questionnaire according to the specifications of the RDC/TMD (n = 39), and patients referred after trauma (n = 8). Patients who identified themselves as Israeli Arabs were excluded from the study due to the reported ethnic influence on Axis II results in TMD patients[42] (n = 50). As to the diverse ethnic origin of Israeli Jews, no association has been found between Axis II parameters and Ashkenazi or Sephardic origin of the Israeli-born patients, indicating cultural integration as far as Axis II parameters are concerned.[43] The final study population was 207 patients.

Prior to the clinical examination, the patients filled out the Hebrew version of the RDC/TMD questionnaire,[15] which had been translated to Hebrew and then back-translated to English to verify accuracy according to the International RDC/TMD consortium.[44] Accordingly, each patient received RDC/TMD Axis I and Axis II diagnoses. Calculation of Axis II diagnoses included levels of depression, somatization without pain items, anxiety, and GCPS.

In order to assess anxiety level, 10 items were added to the questionnaire. These 10 items were identical to the items appearing originally in the SCL-90-R questionnaire for assessing anxiety[45] (Table 1). The translation of these items to Hebrew was also

Table 1 Assessment of Anxiety Levels with the Use of the SCL-90-R[45]*

	In the last month, how much have you been distressed by….	Not at all	A little bit	Moderately	Quite a bit	Extremely
1	Nervousness or shaking inside	0	1	2	3	4
2	Trembling	0	1	2	3	4
3	Suddenly being scared for no reason	0	1	2	3	4
4	Feeling fearful	0	1	2	3	4
5	Heart pounding or racing	0	1	2	3	4
6	Feeling tense or keyed up	0	1	2	3	4
7	Spells of terror or panic	0	1	2	3	4
8	Feeling so restless you couldn't sit still	0	1	2	3	4
9	The feeling that something bad is going to happen to you	0	1	2	3	4
10	Thoughts and images of frightening nature	0	1	2	3	4

*Calculation of the anxiety scale score was performed by adding the item score for all items answered and dividing by the number of items answered. The cutoff point calculations as modified[15] for determining normal versus moderate or severe anxiety are: normal anxiety < 0.445, moderate anxiety 0.445 to < 1.100, and severe anxiety > 1.100.[45]
SCL-90-R = Symptom Checklist-90 Revised.

performed from the original English version and then back-translated to English to verify accuracy according to the International RDC/TMD consortium.[44]

In the first stage, levels of depression, anxiety, somatization, and comorbidity were assessed in the study group as a whole (n = 207). In the second stage, levels of depression, anxiety, somatization, and comorbidity in chronic pain TMD patients (chrTMD) were calculated and compared to a group of acute pain TMD patients (acuteTMD). The chrTMD group was defined by excluding from the group those patients who did not report pain (characteristic pain intensity [CPI] = 0, GCPS = 0, n = 19) and further excluding patients who reported a pain duration of less than 3 months (n = 49). The final chrTMD study population was 139. The acute pain group included those who reported symptoms of less than 3 months duration (n = 64); excluded from this group were those who did not report pain (CPI = 0, GCPS = 0, n = 15). The final acuteTMD group was 49.

In the third stage, levels of depression, anxiety, somatization, and comorbidity were examined in the chrTMD group according to their dysfunction level as defined by the GCPS: The chrTMD group (n = 139) was divided into three subgroups according to their GCPS score. The first subgroup showed a GCPS score = 1 (n = 46, 33.1%) (GCPS1); the second subgroup showed a GCPS score = 2 (n = 65, 46.8%) (GCPS2); and the third subgroup showed a GCPS score = 3 or 4 (n = 28, 20.1%) (GCPS3&4). Levels of depression, anxiety, somatization and comorbidity were calculated for each subgroup.

Statistical Analysis

Continuous variables were reported as mean and standard deviation (SD), and categorical variables as frequencies and proportions. Spearman correlation was used to assess the level of correlation between Axis II diagnoses according to the RDC/TMD (depression, anxiety, and somatization pain items excluded). Fisher's exact test or Pearson chi-square test was used to compare the categorical variables between the groups. The Mann-Whitney test or Kruskal-Wallis test was used to compare continuous non-normal distributed variables and ordinal variables between groups. Normally distributed continuous variables were compared using a *t* test. Normal distribution of continuous variables was evaluated using the Kolmogorov-Smirnov test. $P < .05$ was considered as statistically significant. The Statistical Package for the Social Sciences (SPSS 21.0, SPSS Inc) was used for statistical analysis.

Results

General Characteristics

Demographic and socioeconomic data of the study group are presented in Table 2 and compared to other studies in the United States[16,46] and Sweden.[16]

Axis II Results

Axis II results as to GCPS, depression, anxiety, and somatization pain items excluded are presented in Table 2 and compared to the US and Swedish studies.[16,46] Overall, when demographic, available socioeconomic data, and Axis I and Axis II diagnoses were compared, the US, Swedish, and Israeli study populations were very similar. Thus it may be appropriate to state that the current study population represented a normal clinical TMD population from a specialty center. In the first stage when the group study was examined as a whole, depression and anxiety received similar scores for all three levels: (44.0%/45.9% for normal depression/anxiety, 33.3%/29.5% for moderate depression/anxiety, and 22.7%/24.6% for severe depression/anxiety). Spearman correlation coefficients were 0.786 between depression and

Table 2 Demographic Data, Socioeconomic Data, and Axis I and Axis II Diagnoses According to the RDC/TMD in the Current Study Compared to Available Data from Studies in the US[16,46] and Sweden[16]

	Current study (n = 207)	US study (n = 261)	Swedish study (n = 82)
Males:females	1:3.2	1:5.0	1:3.6
Average age (y)	38.3	39	41.1
Mean education level	13.6 ± 2.7	"At least moderately well educated"	"At least moderately well educated"
Married	42.3%	68%	No data available
Single	41.5%	No data available	No data available
Divorced	5.6%	No data available	No data available
Widowed	3.5%	No data available	No data available
Very low combined income	8.5%	See below*	No data available
Low combined income	10.5%	No data available	No data available
Average combined income	55.6%	No data available	No data available
High combined income	9.2%	No data available	No data available
Very high combined income	None	No data available	No data available
Employed	63.4%	No data available	No data available
Unemployed	8%	No data available	No data available
Patients reporting pain	90.8%	95%	83%
Average duration of pain (y)	2.58 ± 3.80	8.3	5.7
Mean pain intensity	4.9 ± 2.9	4.0 ± 2.2	4.6 ± 2.2
Axis I, group 1 (muscle disorders)[15]			
Myofascial pain without limited opening	48.3%	46%	50%
Myofascial pain with limited opening	25.6%	30%	26%
Joints receiving group 2 diagnoses[15‡]	45.9%	47.5%†	67.0%
Joints receiving group 3 diagnoses[15§]	47.3%	88.0%†	58.0%†
Depression			
Level 1	44%	54.3%†	49%†
Level 2	33.3%	26%†	33%†
Level 3	22.7%	18.7%†	18%
Anxiety			
Level 1	45.9%	Not evaluated	Not evaluated
Level 2	29.5%	Not evaluated	Not evaluated
Level 3	24.6%	Not evaluated	Not evaluated
Somatization pain items excluded			
Level 1	36.7%	37%†	39%†
Level 2	24.6%	32%	33%†
Level 3	38.6%	31%†	28%
GCPS 0	8.7%	5.5%†	14%†
GCPS 1	29%	34.5%†	35%†
GCPS 2	46.4%	39%†	37%†
GCPS 3	10.1%	15%†	11%†
GCPS 4	5.8%	6%†	3%†

*The only data available on income were that patients were less likely to have household income greater than $35,000, which at the time the study took place represented probably moderate income according to the RDC/TMD questionnaire.
†The numerical value was estimated with the use of a ruler and calculated by the rule of three.[16]
‡Group 2: Disc displacement with reduction, disc displacement without reduction with/without limited opening.
§Group 3: Arthralgia, osteoarthritis, osteoarthrosis.
GCPS = Graded Chronic Pain Scale.

anxiety ($P < .001$), 0.644 between anxiety and somatization ($P < .001$), and 0.689 between depression and somatization ($P < .001$). Depression and anxiety cross-tabulation results are presented in Table 3; 78.7% of those who scored severe on the depression scale also scored severe on the anxiety scale, 72.5% of those who scored severe on the anxiety scale also scored severe on the depression scale, and 17.9% of the study population scored severe on both anxiety and depression scales (Fig 1). Comorbidity between severe anxiety, depression, and somatization is presented in Fig 1.

In the second stage, levels of depression, anxiety, and somatization, and the extent of comorbidity in chrTMD patients (n = 139) were calculated and compared to the levels in acuteTMD patients (n = 49). Initially, both were compared as to demographic and socioeconomic data and Axis I and Axis II diagnoses. In the case of Axis I diagnoses, statistically significant differences were found between the two groups

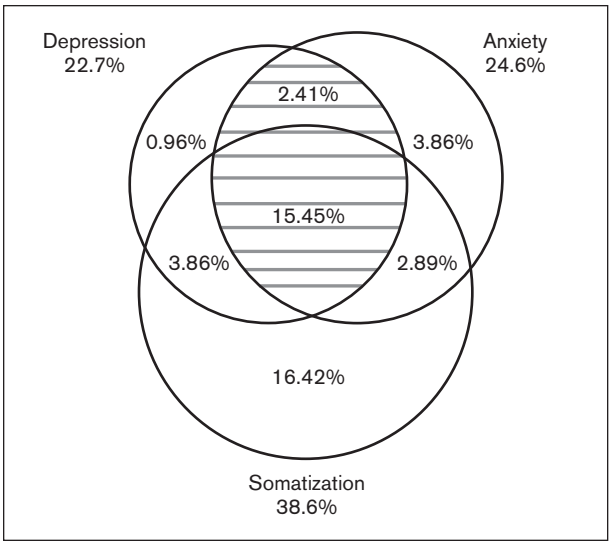

Fig 1 Overlap (comorbidity) of severe depression, severe anxiety, and severe somatization as a percentage of the total sample of 207 TMD patients. Highlighted is the percentage of patients (17.9%) who scored severe on both anxiety and depression scales.

Table 3 Depression and Anxiety Cross-Tabulation Results (n = 207)

Depression	Anxiety		
	Level 1 (n = 95)	Level 2 (n = 61)	Level 3 (n = 51)
Level 1 (n = 91)			
No. of patients	78	13	0
Within depression (%)	85.7	14.3	0.0
Within anxiety (%)	82.1	21.3	0.0
Level 2 (n = 69)			
No. of patients	16	39	14
Within depression (%)	23.2	56.5	20.3
Within anxiety (%)	16.8	63.9	27.5
Level 3 (n = 47)			
No. of patients	1	9	37
Within depression (%)	2.1	19.1	78.7
Within anxiety (%)	1.1	14.8	72.5

Table 4 Comparison of Levels of Depression, Anxiety, and Somatization in Acute Pain TMD Patients (acuteTMD) Compared to Chronic Pain TMD Patients (chrTMD)

	acuteTMD (n = 49)	chrTMD (n = 139)
Depression		
Level 1 (n = 83)		
No.	29	54
%	34.9	65.1
Level 2 (n = 63)		
No.	13	50
%	20.6	79.4
Level 3 (n = 42)		
No.	7	35
%	16.7	83.3
Anxiety		
Level 1 (n = 83)		
No.	27	58
%	31.8	68.2
Level 2 (n = 63)		
No.	14	42
%	25.0	75.0
Level 3 (n = 42)		
No.	8	39
%	17.0	83.0
Somatization		
Level 1 (n = 67)		
No.	24	43
%	35.8	64.2
Level 2 (n = 46)		
No.	9	37
%	19.6	80.4
Level 3 (n = 42)		
No.	16	59
%	21.3	78.7

in the proportion of three diagnoses: myofascial pain without limited opening (P = .008), myofascial pain with limited opening (P = .022), and arthralgia (P = .015). There were no statistically significant differences between the two groups as to gender (P = .55), mean age (P = .644), employment (P = .282), marital status (P = .663), income (P = .278), education level (P = .970), missing work days (P = .726), points for disability days (P = .832), points for disability score (P = .330), disability score (P = .073), CPI (P = .736), and GCPS (P = .880). Thereafter, the distribution of levels of depression and anxiety in these two groups was calculated and is presented in Table 4. Significant differences between the distribution across the two groups were found for depression only (P = .043, Pearson chi-square) and not for anxiety levels (P = .177, Pearson chi-square) or somatization (P = .075, Pearson chi-square). Comorbidity between depression, anxiety, and somatization in the acuteTMD and chrTMD groups is presented in Table 5. There were no statistically significant differences between the two groups as to comorbidity between depression and anxiety and vice versa (ie, the percentage of patients scoring severe on depression and also scoring severe on anxiety versus the percentage of patients scoring severe on anxiety and also scoring severe on depression) (P = .155, P = .215, respectively), between depression and somatization and vice versa (P = .782, P = .568, respectively), and between anxiety and somatization and vice versa (P = 1.0, P = .573, respectively).

In the third stage, the chrTMD group was divided into three subgroups according to their GCPS scores. There were no statistically significant differences between the three subgroups as to gender (P = .929), mean age (P = .281), education level (P = .594), employment (P = .059), marital status (P = .061), and income (P = .249). As to Axis I

Table 5 Comorbidity Between Depression, Anxiety, and Somatization in acuteTMD, chrTMD, GCPS1, GCPS2, and GCPS3&4 Subgroups

Comorbidity between	AcuteTMD (n = 49)	chrTMD (n = 139)	GCPS1 (n = 46)	GCPS2 (n = 65)	GCPS3&4 (n = 28)
Depression and anxiety	57.1%	82.9%	100%	82.4%	75.0%
Anxiety and depression	50.0%	74.4%	60%	77.8%	81.8%
Depression and somatization	100%	82.9%	100%	76.5%	83.3%
Somatization and depression	43.8%	49.2%	42.9%	44.8%	62.5%
Anxiety and somatization	75.0%	74.4%	80.0%	72.2%	72.7%
Somatization and anxiety	37.5%	49.2%	57.1%	44.8%	50.0%

Table 6 Comparison of Levels of Depression, Anxiety, and Somatization in GCPS1, GCPS2, and GCPS3&4 Subgroups

	GCPS1 (n = 46)	GCPS2 (n = 65)	GCPS3&4 (n = 28)
Depression			
Level 1 (n = 54)			
No.	26	23	5
%	48.1	42.6	9.3
Level 2 (n = 50)			
No.	14	25	11
%	28.0	50.0	22.0
Level 3 (n = 35)			
No.	6	17	12
%	17.1	48.6	34.3
Anxiety			
Level 1 (n = 58)			
No.	26	24	8
%	44.8	41.4	13.8
Level 2 (n = 42)			
No.	10	23	9
%	23.8	54.8	21.4
Level 3 (n = 39)			
No.	10	18	11
%	25.6	46.2	28.2
Somatization			
Level 1 (n = 43)			
No.	23	14	6
%	53.5	32.6	14.0
Level 2 (n = 37)			
No.	9	22	6
%	24.3	59.5	16.2
Level 3 (n = 59)			
No.	14	29	16
%	23.7	49.2	27.1

diagnoses, the only statistically significant difference was in myofascial pain with limited opening diagnosis (P = .035). Levels of depression, anxiety, and somatization were calculated for each subgroup and are presented in Table 6. Results show that the proportion of severe depression, anxiety, and somatization increased as the GCPS score increased (r_s = .313, P < .001; r_s = .206, P = .015; r_s = .25, P = .003, respectively). However, differences between the subgroups were found to be statistically significant only for depression (P = .008) and somatization (P = .009). Comorbidity between depression, anxiety, and somatization in these three subgroups is presented in Table 5. There were no statistically significant differences between the three subgroups as to comorbidity between depression and anxiety and vice versa (P = .414, P = .469, respectively), between depression and somatization and vice versa (P = .421, P = .454, respectively), and between anxiety and somatization and vice versa (P = .893, P = .443, respectively).

Discussion

The finding of comorbidity between depression and anxiety is well acknowledged both in primary care and chronic pain patients. Studies indicate that the added morbidity of depression and anxiety with chronic pain is strongly associated with more severe pain, greater disability, and poorer health-related quality of life.[8] Löwe et al[47] assessed depression, anxiety, somatization, and functional impairment in primary care patients. Of the total sample of 2,091 patients, 6.6% scored severe on the depression scale, 8.0% scored severe on the anxiety scale, and 9.5% scored severe on the somatization scale. A majority (51.5%) of the patients who scored severe on the depression scale also scored severe on the anxiety scale. A large proportion (41.2%) of the patients who scored severe on the anxiety scale also scored severe on the depression scale. Similar rates of depression (11.3%), anxiety (8.3%), and comorbidity were reported in primary care patients in Qatar[4] and in other western populations.[48,49] In Israel, the prevalence of current depression in primary care varied considerably across studies: 1.6% to 5.9% for major depression, 1.1% to 5.4% for minor depression, and 14.3% to 24% for depressive symptoms.[50] In a recent study in Israel, higher rates of depression and anxiety compared to other countries were reported (GAD = 15.5%, current depressive episode [CDE] = 19.4%). However, similar rates of comorbidity compared to other countries were reported. (More than 60% of patients with GAD and 50% of patients with CDE had comorbidity with another diagnosis.[51]) When these findings in primary general care patients are compared to the findings of the current study, a higher percentage of

severe depression, severe anxiety, and severe somatization (22.7%, 24.6%, and 38.6%, respectively) were reported in TMD patients when the SCL-90-R was used. Indeed, studies have reported higher levels of depression and anxiety in TMD patients as compared to normal controls.[22,52–54]

Similar higher rates of depression and anxiety as compared to primary general care population clinics were reported in other chronic pain conditions; Thieme et al[55] reported that 32.2% of patients with fibromyalgia exhibited symptom characteristics of anxiety disorders, and 34.8% showed characteristics of mood disorders. Marks et al[56] reported that 27.3% of inflammatory bowel syndrome patients were diagnosed with depressive disorders only and 40.1% with anxiety disorders only. In another study of chronic pain patients, the most prevalent disorders were major depressive disorder (49.1%) and GAD (21.3%).[57] Bair et al[8] reported that 20% of chronic low back, hip, or knee pain patients had pain and depression. Thus, overall, the prevalence of depression and anxiety in various chronic pain conditions may be at least two to three times higher than their prevalence in primary general care clinics. Comorbidity rates were also higher in TMD patients as compared to primary general care patients: In the current study, 17.9% of the study population scored severe on both anxiety and depression scales. Similar higher rates of comorbidity were reported in other studies: Yap et al[11] reported a significant and positive correlation (r = 0.74) between depression and somatization in Asian TMD patients. In comparing several chronic pain conditions, Marks et al[56] reported that 32.6% of patients with irritable bowel syndrome had both depressive and anxiety disorders. Bair et al[8] reported that 23% of chronic lower back, hip, or knee patients experienced pain, depression, and anxiety.

However, in collecting all the relevant data on physical (Axis I) and psychosocial (Axis II) parameters according to the biopsychosocial model in TMD and in other chronic pain patients, the question is how to integrate this data in a meaningful way. As expressed by Turk and Rudy,[58] a multidimensional assessment may be viewed as uniaxial if it only considers medical, psychosocial, or behavioral information separately. Therefore, in the present study, evaluations of the degree of depression, anxiety, somatization, and comorbidity were explored in three ways: viewing the TMD study group as a whole with a one-dimensional approach, comparing acute pain TMD patients to chronic pain TMD patients, and comparing degree of disability as expressed by GCPS scores with a multidimensional approach in chronic pain TMD patients. Depression rates were significantly higher in chronic pain TMD patients as compared to acute pain TMD patients, supporting previous findings in TMD patients.[12] Depression and somatization rates were also significantly higher in TMD patients with higher disability as expressed by the GCPS, again supporting previous TMD findings.[23] However, statistically significant differences in both comorbidity and anxiety levels were not shown with any of the two approaches. These results support some of the studies on TMD and anxiety, which suggest that anxiety may play a less significant role in chronic TMD patients than depression and somatization.[26,28,34,59]

Nevertheless, it should always be kept in mind that, whether using the RDC/TMD[15] or the DC/TMD,[41] assessment of depression, somatization, and anxiety is performed by using self-report questionnaires. These instruments were not initially intended for reaching a psychiatric diagnosis of depression, anxiety, or somatization, but to assess psychological distress levels.[60] The process of self-answering a questionnaire may affect the validity of self-report data; social context, ethnicity,[42] culture, personal characteristics, intelligence level, and other factors might affect the validity of self-report data.[61] In addition, comparison between studies that used different diagnostic instruments with different sensitivity and specificity is problematic and may account for differences reported. In recent studies, poor diagnostic efficacy was found for most of the subscales of the SCL-90-R.[62,63] Ohrbach et al[64] evaluated the psychological properties of the Axis II measures of the RDC/TMD (SCL-90-R). Their findings show that if a TMD patient scores moderate-severe depression on the appropriate SCL-90-R scale, there is approximately a 19% probability that the patient will meet the criteria for depression or dysthymia diagnosis if he or she suffers from acute TMD and a 48% chance if the problem is chronic. In contrast to these results, others using the PHQ-9, PHQ-15, and GAD-7 have reported that the majority of patients with a score of 15 or greater (reflecting severe levels of depression, anxiety, or somatization) met the diagnostic criteria for a DSM-IV depressive, anxiety, or somatoform disorder.[47,65–67] Bair et al[8] used the GAD-7 for evaluating anxiety. Thieme et al[55] used a structured clinical interview of DSM-IV to assess Axis I and II disorders. While the current study used the GCPS for identifying subgroups according to their disability levels, other studies used the scores of the West Haven-Yale Multidimensional Pain Inventory.[55]

In conclusion, similar to other chronic pain conditions, higher rates of severe depression, anxiety, somatization, and comorbidity were reported by using the SCL-90-R in TMD patients as compared to existing comorbidity studies in primary general care patients. Statistically significant differences were found between subgroups of TMD patients as to depression and somatization levels, while no statistically

significant differences were found as to anxiety levels and comorbidity between TMD subgroups examined. Thus, multidimensional assessment enabled discrimination between the relative contribution of depression, anxiety, somatization, and comorbidity in subgroups of TMD patients. The finding of no statistically significant differences between subgroups of TMD patients as to anxiety and comorbidity supports several previous studies on TMD and anxiety that suggest a less significant role for anxiety in chronic TMD patients as compared to depression and somatization. Future studies that compare the new DC/TMD self-report questionnaires replacing the SCL-90-R (PHQ-9, PHQ-15, and GAD-7) and the SCL-90-R self-report questionnaire in the same TMD population may assist in further supporting the present findings, or may alternatively suggest that the findings are biased and inflated by the type of self-report questionnaire used and/or other relevant factors.

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