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SEÇÃO: ARTIGO

Depression, somatization, and sleep disorders as risk factors for temporomandibular disorders development: a population-based case-control study

Depressão, somatização e distúrbios do sono como fatores de risco para o desenvolvimento de disfunções temporomandibulares: um estudo de controle de casos baseado na população

Depresión, somatización y trastornos del sueño como factores de riesgo para el desarrollo de trastornos temporomandibulares: un estudio de casos y controles de base poblacional

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Abstract: The objective of this study was to determine the association between temporomandibular disorders (TMD) with depression, somatization and sleep disorders in the city of Maringá, Brazil. A total of 1,643 participants were selected from the Brazilian Unified Health System (SUS). Of these, the test group consisted of 84 participants who had moderate or severe limitations due to TMD pain and the control group consisted of 1,048 participants with no pain. There was a highly statistically significant difference ($p<0.001$) between cases and controls regarding depression (82.1 *versus* 37.4%), somatization (84.5 *versus* 31.4%), and sleep disorders (84.6 *versus* 36.4%), in moderate to severe levels. The levels of moderate to severe depression, somatization and sleep disorders were significantly higher in TMD subjects with high TMD pain disability. The risk of developing TMD increased 4 to 5 times when the individual has moderate to severe levels of depression, somatization, and sleep disorders.

Keywords: temporomandibular disorder, risk factors, predictors, sociodemographic characteristics

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Resumo: O objetivo deste estudo foi determinar a associação entre disfunções temporomandibulares (DTM) com depressão, somatização e distúrbios do sono na cidade de Maringá, Brasil. Foram selecionados 1.643 participantes atendidos no Sistema Único de Saúde (SUS). Desses, o grupo caso foi formado por 84 participantes que apresentaram limitações moderada ou grave devido à dor na DTM e o grupo controle foi formado por 1.048 participantes com ausência de dor. Verificou-se diferença estatisticamente significativa (p<0,001) entre casos e controles em relação à depressão (82,1 versus 37,4%), somatização (84,5 versus 31,4%) e distúrbios do sono (84,6 versus 36,4%), em níveis moderados a graves. Os níveis de depressão moderada a grave, somatização e distúrbios do sono foram significativamente mais altos em indivíduos com DTM com alta incapacidade devido à dor por DTM. O risco de desenvolver DTM aumentou quatro a cinco vezes quando o indivíduo apresenta níveis moderados a graves de depressão, somatização e distúrbios do sono.
Palavras-chave: disfunção temporomandibular, fatores de risco, preditores, características sociodemográficas

Resumen: El objetivo de este estudio fue determinar la asociación entre los trastornos temporomandibulares (TMD) con la depresión, la somatización y los trastornos del sueño en la ciudad de Maringá, Brasil. Un total de 1.643 participantes fueron seleccionados del Sistema Único de Salud (SUS) de Brasil. (SUS). De estos, el grupo de casos fue formado por 84 participantes que presentaban limitaciones moderadas o graves debido al dolor TMD y el grupo de control estaba formado por 1.048 participantes sin dolor. Hubo una diferencia estadísticamente significativa (p <0,001) entre casos y controles con respecto a depresión (82,1 frente a 37,4%), somatización (84,5 frente a 31,4%) y trastornos del sueño (84,6 frente a 36,4%), en niveles moderados a severos. Los niveles de depresión moderada a grave, somatización y trastornos del sueño fueron significativamente más altos en personas con TMD con alta discapacidad por dolor en TMD. El riesgo de desarrollar TMD aumenta de 4 a 5 veces cuando el individuo tiene niveles moderados a severos de depresión, somatización y trastornos del sueño.
Palabras clave: trastornos temporomandibulares, factores de riesgo, predictores, características sociodemográficas

Chronic pain is a worldwide health concern (Dueñas et al. 2016), since it may compromise social, personal and even professional aspects of life. Many studies have demonstrated the influence of psychological aspects, such as depression, anxiety and somatization (Carlson, 2008; Jeremic-Knezevic et al., 2018; Reis et al., 2019; Sheng et al., 2017), in chronic pain conditions, including orofacial pain (Alrashdan, & Alkhader, 2017; Bäck et al., 2020). Pain is the most common symptom of temporomandibular disorders (TMD), which might be originated from the temporomandibular joint (TMJ) and/or masticatory muscles, being the major reason for patients to seek treatment (Carrara et al., 2010).

There are some studies evaluating the multifactorial etiology of TMD, which includes not only physical, but also psychological factors (Furquim et al., 2015; Kim, Kim et al., 2012; Penlington, & Ohrbach, 2020). Prevalence of disability, depression and somatization related to severe pain measured by the research diagnostic criteria for temporomandibular disorders (RDC/TMD) Axis II have been reported to be 16.9%, 21.4%, and 28.5%, respectively (Manfredini et al., 2010). In one populational study (N=1,149), the authors found that the higher the disability, the higher the depression and somatization levels. Other studies have shown that patients with chronic TMD, or with more than one TMD condition, have increased levels of depression and somatization (Ćelić et al., 2011; Canales et al., 2019). Biopsychosocial factors have been associated to painful TMD; however, there is no agreement of whether depression and anxiety are predisposing, precipitating, or perpetuating factors (Dougall et al., 2012; Fernandes et al., 2012).

Another aspect related to TMD is sleep. Patients with a sleep disorders have demonstrated higher chronic pain intensity (Mathias et al., 2018; Sierwald et al., 2015), and there has been articles suggesting that depression as well as sleep quality should be considered in the TMD prognosis (Ekici, 2020; Natu et al., 2018; Selaimen et al., 2006). In addition, obstructive sleep apnea hypopnea syndrome (OSAS), characterized by partial or total airway obstruction during sleep, may lead to high morbidity rates and even death (Pack et al., 2008). Prevalence of sleep disturbances in patients with chronic pain is higher, ranging from 50 to 89% (Merrill, 2010), and many chronic pain patients complain of having insomnia, tiredness, excessive daytime sleep or fatigue (Fernandes et al., 2012). In addition, individuals with TMD show lower level of pain threshold, sleep quality and anxiety as compared to healthy subjects (Daher et al., 2018).

One of the problems with the literature at the present time is the fact that the studies reported

above were from clinical populations seeking treatment for TMD, which did not assess the different levels of exposure for psychological factors as well as the TMD disability level. Therefore, the objective of this population-based case-control study was to determine the association between high disability temporomandibular disorders (TMD) *versus* different exposure levels of depression, non-specific physical symptoms (i.e. somatization) and sleep disorders in the city of Maringá, Brazil.

Materials and methods

Study population, inclusion and exclusion criteria and study protocol

The study population was recruited from the local public health service of the city of Maringá, Paraná State in Brazil. This case-control study was carried out from august 2011 until March 2012 (Progiante et al., 2015).

Patients from both sexes, ranging from 18-65 years of age, who were registered in the Brazilian Government Ministry of Health Unified Health System (SUS) in the city of Maringá, were included. Based on clinical history, patients with chronic pain; patients with acute periodontal disease, caries or periapical pathologies; patients users of anti-ammoniac medications in addition to paracetamol, anxiolytics, anticonvulsants, opioids, or drug users; and patients presenting with systemic and/or mental disorders that may have influenced the clinical examination or diagnosis of TMD were excluded. After the anamnesis, the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) Axis II and the Sleep Assessment Questionnaire (SAQ®) questionnaires were applied to the entire sample, regardless of the presence or absence of TMD.

The single clinical examiner was blinded to the self-completion questionnaires and was instructed not to question the patients about TMD or related variables. The database was part of a data collection from a previous publication by this research group, where a more detailed description of the study protocol and data collection can be also found (Progiante et al., 2015).

Research questionnaires

Structured and standardized questionnaires and clinical examination protocols, validated in the Portuguese language, were used. The RDC/TMD Axis II (http://www.rdc-tmdinternational.org/TMDAssessmentDiagnosis/RDC-TMD/Translations/Portuguese(Brazil).aspx) was used to assess both TMD pain level and disability, socioeconomic and demographic variables, and psychological variables (i.e. depression and non-specific physical symptoms – somatization). Pain items were excluded from the analysis because it will obviously show a very high correlation with TMD Axis II classification. Subjects underwent a self-completing questionnaire in Axis II for the classification of pain intensity and disability: the Graded Chronic Pain Severity (GCPS). The GCPS divides TMD patients into 4 levels of pain and disability: a) Grade 0 - absence of pain in the last 6 months, b) Grade I - low intensity pain, c) Grade II - high intensity pain, c) Grade III - moderate functional limitation, and d) Grade IV - severe functional limitation (Dworkin & LeResche, 1992). Subjects with a GCPS = III and IV were considered TMD patients due to the high disability, while those with a GCPS = 0 were considered controls. Subjects with a GCPS = I and II were excluded due to the low disability.

Sleep Assessment Questionnaire (SAQ®) was used to evaluate the presence and level of sleep disorders. The Sleep Assessment Questionnaire (SAQ©) is a 17-item validated against polysomnography questionnaire that is used to screen for sleep disorders in epidemiological studies (Cronbach's alpha correlation=0.7) (Cesta et al., 1996). The five factors that were identified in the SAQ© were the following: (i) non-restorative sleep, (ii) insomnia, (iii) sleep apnea, (iv) daytime sleepiness, and (v) restlessness. The SAQ is scored in the following manner: a) never=0 point, rarely=1 point, sometimes=2 points, frequently=3 points, always=4 points, and don't know=0. The higher the sum of the scores (scores 0 to 68), the worse the sleep quality (Unger, 2004).

Statistical analysis and sample size calculation

In order to estimate a representative sample of the population, a statistical analysis with a 95% confidence interval was performed, taking into account that the prevalence of TMD is 5% in the population, with a margin of error of 1.5%, which reached an initial sample of 805 individuals. After that, it was considered a ratio of 8:1 between exposed/unexposed subjects, and it was added 30% to compensate for losses, which resulted in a final sample of 1,775 subjects (Jekel et al.,2006).

Data analysis was performed with STATA 11.0. The Pearson's Chi-Square test, the Student's t test, and the Linear Trend test were used for categorical and continuous outcome variables data analysis. The alpha error (type I) was 5% ($P<0.05$), and the beta error (type II) was 20% (power = 80%). For correlation assessment, Logistic Regression tests (odds ratio – OR and adjusted OR) were used ($p < 0.05$) (Jekel et al., 2006).

Results

A total of 1,643 patients were evaluated, and 1,132 were selected for analysis based on their GCPS scores. Initially, 84 subjects with GCPS = III or IV (i.e. moderate or severe functional limitation due to TMD pain) were selected for the test (TMD) group; in addition, 1,048 subjects with GCPS = 0 (i.e. absence of TMD pain in the last 6 months) were selected to be the asymptomatic (control) group. Finally, 511 subjects with GCPS = I and II (low and high intensity pain) were excluded.

Social and demographic description of both groups are shown in Table 1. There were significantly more women than men in the TMD group than in the control group (81% against 59.8%, respectively). Regarding age distribution, both groups were young adults between the ages of 20 to 49 years old; however, a significantly higher proportion was found for the TMD group when compared to the control group (89.2% versus 83%, respectively). No difference between TMD and non-TMD groups were found for marital status, and about half of both groups were married. Both groups were predominantly Caucasian, but the proportion in the control group was significantly higher than the TMD group (71.5% versus 53.6%, respectively). Conversely, significantly higher proportions were found for both the black/black mixed and Asian/native populations combined in the TMD group than in the control group (46.4% versus 28.6%, respectively).

Table 1 – Social and demographic description between high disability TMD cases (the Graded Chronic Pain Severity - GCPS = III or IV) versus controls (GCPS = 0) of our sample extracted from the population of the City of Maringá users of the Brazilian Public Health System (SUS), N=1,643

Variables	TMD Group (N = 84) %	Control Group (no pain) (N = 1,048) %	P-value
Gender			
Female	81.0	59.8	< 0.001 *
Male	19.0	40.2	
Age Group			
< 20 years old	2.4	9.5	
20-29 years old	20.2	38.2	
30-39 years old	45.2	28.6	< 0.001 ǂ
40-49 years old	23.8	16.2	
50-59 years old	4.8	7.3	
≥ 60 years old	3.6	0.1	

Marital Status			
Married	59.5	47.9	NS *
Single	16.7	44.0	
Divorced/Widowed	23.8	8.1	
Ethnicity			
Caucasian	53.6	71.5	< 0.01 *
Black/Black Mixed	39.3	23.4	
Asian or Native	7.1	5.2	
Family Income (Brazilian Reais)			
High (≥ 3,000,00)	8.3	13.5	
High Medium (1,000,00 – 2,999.00)	25.0	38.0	< 0.001 ǂ
Low Medium (500.00 – 999.00)	39.3	37.0	
Low (< 500.00)	27.4	11.5	
Educational Level			
Complete Post-Secondary Certificate/Diploma	13.1	25.8	
Incomplete Post-Secondary Certificate/Diploma	14.3	25.5	< 0.001 ǂ
Complete High School	32.1	31.4	
Incomplete High School	15.5	9.1	
Elementary School	25.0	8.3	

*Note: * Pearson's Chi Square, ǂ Linear-by-Linear Association*

Regarding economic status, the majority of both TMD and control groups were predominantly from the middle class with medium income (64.3% versus 75%, respectively), but the TMD group had a higher proportion of low income (27.4% versus 11.5%) and lower proportion of high income (8.3% versus 13.5%) populations than the control group; all findings were significant. Significant differences were found also in educational level, where the TMD group had a significantly lower proportion of subjects with post-secondary education (i.e. certificate/diploma or complete post-secondary) as compared to controls (27.4% versus 51.3%, respectively). In summary, except for marital status, gender, age, ethnicity, family income and educational level were significantly different between TMD versus non-TMD groups.

In Table 2, according to the RDC/TMD Axis II findings, as a consequence of our inclusion criteria of GCPS = III and IV, most TMD subjects had moderate limitation due to pain most as compared to severe (85.7% versus 14.3%, respectively), but with a very low mean number of days lost due to the disability. The mean pain intensity was moderate (i.e. 7.3 on a 10-point scale). Therefore, the profile of our sample were TMD subjects with moderate pain limitation and intensity, but with low impact on daily work. Controls were asymptomatic (GCPS = 0).

Table 2 – Prevalence of the Research Diagnostic Criteria for Temporomandibular Disorders (RDC - Axis I and II) for pain intensity, frequency and limitation between high disability TMD cases (the Graded Chronic Pain Severity - GCPS = III or IV) versus controls (GCPS = 0) extracted from the population of the City of Maringá users of the Brazilian Public Health System (SUS), N=1,643

Variables	TMD Group (N = 84)		Control Group (no pain) (N = 1,048)		P-value
	%	Mean (SD)	%	Mean (SD)	
Graded Chronic Pain Severity - GCPS					
Grade 0 = sem dor nos últimos 6 meses	0.0		100.0		
Grade I = low intensity	0.0		0.0		< 0.001 ǂ
Grade II = high intensity	0.0		0.0		
Grade III = moderately limiting	85.7		0.0		
Grade IV = severely limiting	14.3		0.0		
Disability Points (DP) (scores from 0 to 6):					
No disability = 0 points	0.1				
Mild = 1 to 2 points	7.1		NC		NC
Moderate = 3 to 4 points	23.8				
Severe = 5 to 6 points	69.0				
Disability Days (scores 0 to 60):		1.0 (0.83)		NC	NC
Characteristic Pain Intensity (CPI) (scores from 0 to 100):		73.69 (18.80)		NC	NC
Muscle Disorders					
No Pain	27.4		87.6		
Myofascial Pain (MFP)	45.2		7.8		< 0.001 *
Myofascial Pain with Limited Opening (MFP limited)	27.4		4.6		

*Note: * Pearson's Chi Squar; ǂ Linear-by-Linear Association;* § *Student's t-test; NC: non-computed*

Information regarding depression and non-specific physical symptoms (i.e. somatization) excluding pain items measured by the RDC/TMD Axis II, and data regarding sleep quality measured by the SAQ®, are shown in Table 3. Depression was present as a moderate to severe condition in 82.1% of the TMD and in 37.4% of the control group ($p<0.001$). Normal depression levels in the TMD group was only 17.9% against 62.7% in control group. The same happened to the moderate to severe non-specific physical symptoms (somatization) level with pain items excluded. Subjects with TMD had significantly higher prevalence of somatization than non-TMD subjects (84.5% vs. 31.4%, respectively). Conversely, normal somatization was present in only 15.5% on TMD subjects against 68.6% of controls. Similarly, moderate to severe levels of the SAQ® was significantly higher in the TMD group, and the scores showed that 84.6% of TMD subjects suffered from moderate to severe sleep disorders against 36.4% in the control group (Table 3). On the other hand, 15.4% of TMD subjects had low to mild sleep disorders against 63.3% of non-TMD subjects.

Table 3 – Prevalence for depression and somatization (Research Diagnostic Criteria for Temporomandibular Disorders - RDC/DTM, Axis II) and for sleep disorders (Sleep Assessment Questionnaire - SAQ) between TMD cases (Graded Chronic Pain Severity - GCPS) versus controls (GCPS = 0) extracted from the population of the City of Maringá users of the Brazilian Public Health System (SUS), N=1,643

Variables	Test-Group (TMD) N = 84		Control Group (no pain) N = 1,048		P-value
	%	Mean (SD)	%	Mean (SD)	
Depression (including vegetative symptoms) (scores from 0 to 4):		1.3 (0.72)		0.51 (0.47)	< 0.001 §
Depression (including vegetative symptoms) (scores from 0 to 4):					
Normal (<0.535)	17.9		62.7		< 0.001 ǂ
Moderate (from 0.535 to <1.105)	25.0		25.9		
Severe (1.105+)	57.1		11.5		
Non-specific Physical Symptoms (pain items excluded) RDC/TMD Axis II (scores from 0 to 4):		1.06 (0.76)		0.3 (0.3)	< 0.001 §
Non-specific Physical Symptoms (pain items excluded) RDC/TMD Axis II (scores from 0 to 4):					
Normal (<0.428)	15.5		68.6		< 0.001 ǂ
Moderate (from 0.428 to <0.857)	27.4		20.5		
Severe (0.857+)	57.1		10.9		
Sleep Assessment Questionnaire (scores from 0 to 68):		(N = 72) 26.33 (10.14)		(N = 962) 15.26 (8.28)	< 0.05 §
Sleep Assessment Questionnaire (scores from 0 to 68):					
Low (≤ P25%, scores 0-10)	7.7		33.3		< 0.001 ǂ
Mild (>P25% - P50%, scores 11-16)	7.7		30.3		
Moderate (>P50% - P75%, scores 17-23)	27.7		24.5		
Severe (> P75%, scores 24-68)	56.9		11.9		

Note: Pearson's Chi Square, ǂ Linear-by-Linear Association, § *Student's t-test*

In the adjusted stratified logistic regression analysis (adjusted odds ratio - OR) controlling for ethnicity, marital status, family income, educational level, age and gender; severe levels of depression, somatization and sleep disorders increased the risk of developing TMD in 25.70, 19.00, and 25.74 times, respectively (Table 4). Moderate levels of depression, somatization and sleep disorders also increased the risk of developing TMD in 4.02, 4.34, and 4.49 times, respectively. Therefore, the higher the level of depression, somatization and sleep disorders, the higher the risk of developing TMD, particularly in the severe levels.

Table 4 – Unadjusted and adjusted analysis using logistic regression (odds ratio - OR) for depression and somatization (Research Diagnostic Criteria - RDC/DTM, Axis II) as well as for sleep (Sleep Assessment Questionnaire - SAQ®) between TMD cases (Graded Chronic Pain Severity - GCPS = III or IV) versus controls (Chronic Pain Grade = 0) extracted from the population of the City of Maringá (Brazil) users of the Brazilian Public Health System (SUS), N=1,643

Variables	Unadjusted analysis			Adjusted analysis		
	OR	95% CI	P-value	OR	95% CI	P-value
Sleep Assessement Questionnaire:*						
Low (≤ P25%)	1			1		
Mild (>P25% - P50%)	0.93	(0.25 – 3.35)	< 0.001	1.13	(0.28 – 4.50)	< 0.001
Moderate (>P50% - P75%)	3.91	(1.33 – 11.49)		4.49	(1.37 – 14.71)	
Severe (> P75%)	17.94	(6.35 – 50.65)		25.74	(7.73 – 85.61)	
Depression (including vegetative symptoms)*						
Normal (<0.535)	1		<0.001	1		< 0.001
Moderate (0.535 to <1.105)	2.94	(1.36 – 6.32)		4.02	(1.75 – 9.26)	
Severe (1.105+)	19.41	(9.37 – 40.21)		25.70	(10.82 – 61.02)	
Non-specific Physical Symptoms (pain items excluded)*						
Normal (<0.428)	1		<0.001	1		< 0.001
Moderate (0.428 to <0.857)	4.89	(2.21 – 10.78)		4.34	(1.89 – 9.97)	
Severe (0.857+)	19.84	(9.46 – 41.57)		19.00	(8.52 – 42.36)	

Note: Adjustment for ethnicity, marital status, family income, educational level, age and gender.

Table 5 shows that the best predictors of TMD development in the backward logistic regression analysis were: a) moderate and severe levels of depression (OR = 2.77 and 5.54, respectively), b) lower educational level (i.e. incomplete high school or complete elementary school, OR = 5.12), and c) moderate and severe levels of sleep disorders (i.e. OR = 2.66 and 9.38, respectively).

Table 5 – Backward step logistic regression analysis (odds ratio - OR) for predictors of high disability temporomandibular disorders (Graded Chronic Pain Severity - GCPS = III or IV) symptoms among the population of the City of Maringá (Brazil) users of the Brazilian Public Health System (SUS), N = 1,643

Variable*	Adjusted Odds Ratio (OR)	Adjusted 95% CI	Adjusted P-value
Educational level			
Complete post-secondary certificate/diploma or incomplete post-secondary certificate/diploma	1		< 0.01
Complete high school	1.67	(0.70 – 3.97)	
Incomplete high school or complete elementary school	5.12	(1.94 – 13.48)	
Sleep Assessment Questionnaire			
Low (≤ P25%, scores 0-10)	1		
Mild (>P25% - P50%, scores 11-16)	0.67	(0.17 – 2.68)	< 0.01
Moderate (>P50% - P75%, scores 17-23)	2.66	(0.83 – 8.47)	
Severe (> P75%, scores 24-68)	9.38	(2.83 – 31.05)	
Depression (including vegetative symptoms) *			
Normal (<0.535)	1		< 0.001
Moderate (from 0.535 to <1.105)	2.77	(1.12 – 6.80)	
Severe (1.105+)	5.54	(2.07 – 14.79)	

Note: Variables removed from the model: ethnicity, marital status, and family income, age and gender.*

Discussion

In contrast with the literature, this is the first study which showed the correlation between different levels of exposure between depression, non-specific physical symptoms (i.e. somatization) without pain items, and sleep disorders against high disability TMD in a population-based (i.e. subjects not seeking treatment for TMD) case--control study. The levels of correlation (i.e. OR) showed in our results for the severe cases greatly outnumber the results found in the literature reported above, demonstrating that psychosocial factors (i.e. depression, somatization and sleep disorders) might increase the risk of developing TMD in patients with high disability in approximately 20 to 30 times. Future studies should also assess different levels of psychological variables in high disability TMD patients, particularly in randomized controlled clinical trials, considering that it might have an impact in the TMD management success rate.

In this study, similar to the literature, depressive patients showed high levels of somatization (Penna et al., 2009; Sherman et al., 2004; Canales et al., 2019), and major depressive episodes were significantly higher in TMD group when compared to controls (Penna et al., 2009; Canales et al., 2019). In an experimental pain model study, greater levels of depression and somatization were found in the TMD group (Sherman et al., 2004). Depression, anxiety, and somatization increase the risk of developing chronic orofacial pain in 3.1, 2.5, and 1.9 times, respectively (Aggarwal et al., 2010). In contradiction, one study found a lower risk (i.e. 1.4 times) of depressed mood patients for developing TMD (Nishiyama et al., 2012).

Specifically, for TMD, the prevalence of sleep disorders was found in one study to be 83.3% against 50% in non-TMD population, increasing in 5 times the risk of developing the disease (Selaimen et al., 2006). On the other hand, sleep alone has increased the risk of evoking pain only in 1.8 times (Aggarwal et al., 2010). Our study showed that severe sleep disorders increased the risk of developing TMD in more than 25 times even controlling for confounders (Table 4), and it was the major predictor of TMD in the logistic regression analysis, increasing in more than 9 times the risk of the disease (Table 5).The neurobiology of the interaction between sleep and pain has already been described in a review paper, where the lack of sleep facilitates pain sensitivity (Lavigne, & Sessle, 2016). Similar to depression and somatization, our results for sleep were much higher than previously described, probably due to the sleep severity and pain disability levels assessed.

According to this study, the levels of moderate to severe depression, somatization and sleep disorders were significantly higher in TMD subjects with high TMD pain disability. In addition, the risk of developing TMD with high disability due to pain is 4 to 5 times higher when the individual has moderate to severe levels of depression, somatization, and sleep disorders as compared to low or mild cases. Therefore, assessment and management of depression, somatization, and sleep has been shown in this study necessary when treating patients with high disability TMD pain, because they might have an impact in the TMD management success. This is in line with a systematic review which shows the effectiveness of combined biomedical and psychological interventions (i.e., incorporating selfmanagement approaches) on longterm outcomes in the management of chronic orofacial pain, particularly TMD (Aggarwal et al., 2019). Other study reveals that psychological treatments (Barker et al., 2018), as a cognitive behavioral therapy, are more successful in the long term for high TMD pain disability than traditional dental treatments using intra oral splints (Dworkin et al., 2002).We suggest that psychological screening should be included both in the routine assessment and management of individuals with TMD and in the decision on when psychology services referral might be required (Penlington, & Ohrbach, 2020).

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