Catastrophizing is associated with pain-related disability in temporomandibular disorders

Cintia Regina Andrade SOUSA[a]
Ynara Bosco de Oliveira Lima ARSATI[a]
Ana Miriam VELLY[b]
Carlos Alberto Lima da SILVA[c]
Franco ARSATI[a]

[a]Universidade Estadual de Feira de Santana – UEFS, Department of Biological Sciences, Feira de Santana, BA, Brazil.

[b]McGill University, Faculty of Dentistry, Montreal, QC, Canada.

[c]Universidade Estadual de Feira de Santana – UEFS, Health Department, Feira de Santana, BA, Brazil.

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Corresponding Author:
Cintia Regina Andrade Sousa
E-mail: crasousa@uefs.br

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Abstract: This study aimed to evaluate the association of pain-related disability with biopsychosocial factors in temporomandibular disorders (TMD) patients. The study was carried out at the Orofacial Pain Outpatient Clinic of the State University of Feira de Santana, Bahia, from September 2018 to March 2020. The sociodemographic aspects, TMD subtypes, presence of pain-induced disability, pressure pain threshold, perceived stress, anxiety, depression, and catastrophizing were evaluated in 61 patients. The studied variables were compared between patients with and without pain-induced disability. Crude and adjusted logistic regression were performed to obtain estimates of odds ratios (OR) and 95% confidence intervals. With the exception of catastrophizing, there was no association between the biopsychosocial factors and pain-induced disability. The presence of catastrophizing increased the chance of having chronic pain-induced disability by 4.02 times. The results of this study indicate a strong association between pain catastrophizing and disability in individuals with chronic painful TMD.

Keywords: Temporomandibular Joint Disorders; Catastrophization; Chronic Pain.

Introduction

According to the National Institute of Dental and Craniofacial Research - Facial Pain,[1] temporomandibular disorders (TMD) are the second most common musculoskeletal disorder after chronic low back pain. About half to two-thirds of TMD patients seek professional care from dentists or physicians, and one-third of these patients continue to experience moderate to severe levels of pain and disability, regardless of the treatment received.[2-4] A previous systematic review concluded that the prevalence of TMD is approximately 31% in adults and the elderly and 11% in children and adolescents.[5]

TMD have a multifactorial etiology, involving physical and psychosocial aspects. This clinical condition is often associated with one or more risk factors, such as impact on the facial region, parafunctional oral habits, change in synovial fluid viscosity, joint hypermobility, hormonal fluctuations, genetic polymorphism, poor sleep quality, and psychosocial factors, such as stress, anxiety, depression, catastrophizing, and somatization.[6,7]

TMD is often associated with chronic pain with disability, influencing social behavior, psychological state, and quality of life.[8] Pain-induced disability in TMD patients has been shown to be associated with catastrophizing and depression,[9] which contribute to pain progression[9] and persistence.[6] In addition, the presence of highly disabling pain can also influence the effectiveness of treatment for patients with TMD. Manfredini et al.[10] demonstrated that in patients with temporomandibular joint osteoarthritis, treatment with intra-articular injection of hyaluronic acid presented the worst results precisely in patients with the highest levels of disability points. Given this, it is extremely important to better characterize TMD patients with pain-related disability, in order to determine the psychological and physical factors that may be associated and that, if present, must be addressed from the beginning of treatment to achieve therapeutic success. The aim of the present study was to evaluate the association of pain-related disability with biopsychosocial factors in TMD patients.

Methodology

Study design and sample

The present study was approved by the Ethics Committee in Research with Human Beings of the State University of Feira de Santana (CEP-UEFS) under protocol number 2.049.468. All participants signed the Free and Informed Consent Term, with all the information regarding the research. This cross-sectional study was carried out at the Orofacial Pain Clinics of the State University of Feira de Santana (Bahia, Brazil), which specializes in low-cost care for TMD and sees an average of 30 patients per month. Feira de Santana is the largest city in inland Bahia and has a Human Development Index (HDI) of 0.712.

This study had a convenience sample. From June 2018 to March 2020, 116 participants with TMD were examined. Inclusion criteria were: being at least 18 years old and having TMD-associated pain for three months or more, which characterizes chronic pain.[11] Fifty-five patients were excluded due to the following exclusion criteria: dental pain, muscle pain caused by systemic diseases, recent history of trauma to the face and neck, and subjects under TMD management. Sixty-one patients were selected. TMD diagnosis and classification were performed using the DC/TMD (Axis I) and Symptom Questionnaire and Examination Form.[12] The DC/TMD was applied by trained researchers (undergraduate students in Dentistry) under the supervision of a specialist in TMD and Orofacial Pain (F.A.), with experience in performing this test. The diagnosis of each patient performed by each researcher on the team was checked by the specialist researcher and corrected when necessary. Participants were classified as having muscular (myalgia of the masticatory muscles), joint (arthralgia, intra-articular joint disorders and/or degenerative join disorders), or mixed TMD. Data collection was performed at the first consultation. Chronic pain-induced disability was measured by the Graded Chronic Pain Scale (GCPS).[13] This scale has the following degrees of classification according to pain intensity and disability.[12]

a. Grade 0: None (no pain);
b. Grade I: low intensity pain, without disability;
c. Grade II: high intensity pain, without disability;
d. Grade III: high intensity pain, with moderately limiting disability;
e. Grade IV: high intensity pain, with severely limiting disability.

The sample was divided into two groups depending on the presence or absence of disability. Participants with scores of I and II made up the no-disability group. Patients with scores III and IV made up the disability group. There was no patient with score zero, as one of the inclusion criteria was the presence of pain.

Data collection

To avoid measurement bias, data collection was performed by trained researchers. Sociodemographic aspects were investigated using an interview form. The pressure pain threshold (PPT) test was performed with an algometer, whose flat circular tip of 1 cm^2 is applied with a constant force of 0.5 $kgf/cm^2/s$ on the body of the muscle to be tested; when this pressure starts to cause pain, it was defined as the PPT. This test was performed bilaterally on the masticatory muscles (masseter and temporalis) and

on the right forearm. Each muscle was tested twice, with a 5-minute interval between tests. The mean of the two measurements of each muscle was used to determine the PPT.[14]

To assess the psychosocial factors, self-report instruments validated in the scientific literature were used. The evaluated psychological aspects were: perceived stress, depression, anxiety, and catastrophizing. Perceived stress in the previous month was determined using the Perceived Stress Questionnaire (PSQ) through the sum of scores obtained in the 14 items, whose answers are defined by a five-point scale: 0 (never) to 4 (always), with a total score that can vary from 0 to 56.[15] Depression was assessed using the Patient Health Questionnaire-9 (PHQ-9). It consists of nine items that assess the frequency of signs and symptoms of depression in a two-week period, with a four-point response scale — 0 (never) to 3 (almost every day) — and a score that ranges from 0 to 27.[16] Anxiety was measured using the "Generalized Anxiety Disorder" scale (GAD-7). It consists of seven items that assess the frequency of signs and symptoms of anxiety over a two-week period, with a four-point response scale: 0 (never) to 3 (almost every day). Its score ranges from 0 to 21.[17] Catastrophizing was assessed using the Pain Catastrophizing Scale (PCS). It consists of 13 items with a four-point response scale: from 0 (never) to 4 (always); its score ranges from 0 to 52. The PCS scale has three subscales that assess helplessness, rumination, and pain amplification.[18] Individuals who had scores of 30 or more after adding up all the scale items, were considered catastrophic. In the catastrophizing subscales, the cut-off points for rumination, amplification and helplessness were 11, 5, and 13, respectively.[19]

Statistical analysis

Data were tabulated and analyzed by the statistical program STATA 13.0. For categorical variables, the percentage of each category was determined. For continuous variables, measures of central tendency (mean and median) and dispersion (standard deviation and interquartile range) were determined. For comparison between groups, Student's "T", Mann Whitney U, Pearson's Chi-square or Fisher's exact tests were used, according to data characteristics. For quantitative variables, data normality was assessed using the Shapiro-Wilk test. Logistic regression was used to obtain odds ratio estimates and 95% confidence intervals, adjusted for confounding variables. The choice of variables to compose the regression model was based on the level of significance of the bivariate analyses (alpha = 0.05), and previous definition of associated factors found in the literature. To assess the quality of the model, the Hosmer and Lemeshow test was applied with a significance level of 10%. Further, we used the Cronbach's alpha to test the internal consistency of the data obtained with the psychosocial scales.

Results

The sample selection process is described in Figure. The distribution of patients according to the GCPS in groups with or without disability is described in Table 1. The no-disability group consisted of 33 individuals with a median age of 29 [23–44.5] years. The disability group consisted of 28 individuals with a median age of 33.5 [27–51] years. Regarding age, there were no statistically significant differences between the groups, using the Mann Whitney U test (p = 0.152). The descriptions of the other sociodemographic aspects analyzed are presented in Table 2. As for the prevalence of TMD subtypes, no participant had only joint TMD. The prevalence of muscular TMD in the disability group and no-disability group was 64.3% (n = 18) and 45.5% (n = 15), respectively. In turn, mixed TMD (muscular and joint) had a prevalence of 35.7% (n = 10) and 54.5% (n = 18) in the disability and no-disability groups, respectively, with no significant difference between them. There were no statistically significant differences between the groups regarding pain duration (36 months [18–102] for the no-disability group and 60 months [24–114] for the disability group; p = 0,283) and PPT test (Table 3). Regarding the Perceived Stress Scale, the results were: 26 [19.25–33.75] for the no-disability group and 30.50 [24.50–38.00] for the disability group, without statistically significant difference between the groups (p = 0.097). Table 4 shows the

distribution of the sample among the categories of depression, anxiety, and catastrophizing. The internal consistency of the data obtained with these instruments was evaluated by determining the Cronbach's alpha value. The results showed good (> 0.8) or excellent (> 0.9) internal consistency as follows: Depression - PHQ9 = 0.88; Anxiety - GAD7 = 0.83; Catastrophizing = 0.92; Disability - CPGS = 0.85; Perceived stress - PSS = 0.86. In the bivariate analysis, a statistically significant difference was found between the groups for catastrophizing and its subscales, with the relative frequency of these variables being higher in the group with disabilities. In the multivariate analysis, this association was also confirmed, where those who had catastrophizing were 4.02 times more likely to have chronic pain-induced disability (Table 5).

Discussion

The present study found differences in clinical and psychological aspects between patients with and without disabilities according to the GCPS classification. It was found that the presence of pain-induced disability was significantly associated with catastrophizing.

Based on the GCPS scores, higher relative frequencies of groups III (moderately limiting disability) and IV (severely limiting disability) were found in our sample compared to other studies;[20,21]

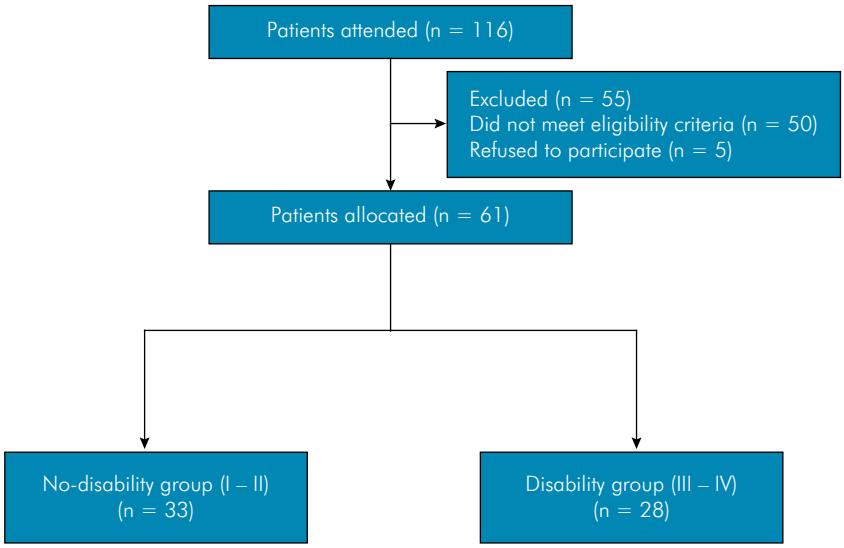

Figure. Sample selection flowchart.

Table 1. Distribution of patients into the categories of the graded chronic pain scale (GCPS) and in the no-disability group (I-II) and disability group (III-IV).

Graded chronic pain scale	Groups	n	%
No-Disability Group			
Low-intensity pain without disability	I	12	19.7
High-intensity pain without disability	II	21	34.4
Disability Group			
High-intensity pain with moderately limiting disability	III	13	21.3
High-intensity pain with severely limiting disability	IV	15	24.6
Total		61	100.0

Table 2. Distribution and comparison of sociodemographic aspects of patients with TMD with or without pain-induced disability.

Sociodemographic aspects	No-disability group		Disability group		p-value
	n = 33	%	n = 28	%	
Sex					
Male	6	18.2	2	7.1	0.269
Female	27	81.8	26	92.9	
Marital status					
Married	12	36.4	13	46.4	
Single	20	60.6	12	42.9	0.275
Widower	1	3.0	1	3.6	0.957
Separated / Divorced	0	0.0	2	7.1	
Education					
Primary	4	12.1	3	10.7	
Middle school	16	48.5	17	60.7	0.678
College	12	36.4	6	21.4	0.657
Master's / Doctorate	1	3.0	2	7.1	0.497
Labor activity[a]					
Yes	13	39.4	13	48.1	0.496
No	20	60.6	14	51.9	
Income[a]					
Less than 1 salary	7	21.2	4	14.8	
Between 1 and 3 salaries	19	57.6	18	66.7	0.475
More than 3 salaries	7	21.2	5	18.5	0.795

[a]data skipped.

Table 3. Values for the pressure pain threshold test (in kgf).

Variable	No-disability group	Disability group	p-value
Right masseter [a]	1.2 [1.0–1.6]	1.0 [0.7–1.4]	0.148 [c]
Left masseter [a]	1.3 [0.9–1.7]	1.0 [1.0–1.3]	0.085 [c]
Right forearm [a]	2.8 [2.3–3.6]	2.7 [2.0–3.4]	0.258 [c]
Right temporal [b]	1.78 ± 0.61	1.46 ± 0.62	0.052 [d]
Left temporal [b]	1.61 ± 0.59	1.44 ± 0.62	0.288 [d]

[a]values of median and interquartile range; [b]values of mean and standard deviation; [c]Mann-Whitney test; [d]Student´s t test.

this difference can be attributed to selection bias and the smaller sample size of this study.

In our study sample, there was a predominance of women and the mean age was compatible with findings from other studies.[22,23] It is important to emphasize that in the present study the age range analyzed was from 18 to 71 years, not including some age groups. If we consider that the third quartile was 48.2 years, we verify that most of the participants in this study were adult women of reproductive age. Regarding TMD subtype, the patients in our sample presented only muscular TMD (disability group vs no-disability group; 64.3% vs 45.5%) or mixed TMD (35.7% vs 54.5%), with no statistical difference between groups. We selected patients with the most diverse subtypes of painful TMD because our objective was to evaluate the association of pain-related disability with biopsychosocial factors

Table 4. Distribution and association of psychological aspects of patients with TMD with and without pain-induced disability.

Psychological aspects	No-disability		Disability		p-value	95%CI
	n = 33	%	n = 28	%		
Depression						
Yes	23	69.7	22	78.6	0.432	0.50–5.13
No	10	30.3	6	21.4		
Anxiety						
Yes	29	87.9	25	89.3	1	0.23–5.63
No	4	12.1	3	10.7		
Catastrophizing						
Yes	8	24.2	16	57.1	0.009	1.40–12.43
No	25	75.8	12	42.9		
Catastrophizing (subscales)						
Rumination						
Yes	9	30.0	21	70.0	<0.001	2.54–25.22
No	24	77.4	7	22.6		
Amplification						
Yes	19	45.2	23	54.8	0.044	1.03–11.12
No	14	73.7	5	26.3		
Helplessness						
Yes	7	29.2	17	70.8	0.002	1.86–17.73
No	26	70.3	11	29.7		

Table 5. Crude (OR) and adjusted (ORa) odds ratios of the variables in the logistic regression model.

Disability	OR	95%CI	p-value	OR_a	95%CI	p- value
Sex						
Male	1 (reference)			-	-	-
Female	2.89	0.53–15.63	0.218			
Neck pain						
No	1 (reference)			-	-	-
Yes	2.30	0.69–7.70	0.177			
Headache						
No	1 (reference)			1 (reference)		
Yes	4.16	0.80–21.53	0.089	3.40	0.60–19.19	0.166
Diagnosis						
Muscular	1 (reference)			1 (reference)		
Mixed	0.68	0.41–1.14	0.144	0.57	0.32–1.02	0.060
Depression						
No	1 (reference)			-	-	-
Yes	1.59	0.50–5.13	0.434			
Catastrophizing						
No	1 (reference)			1 (reference)		
Yes	4.17	1.40–12.43	0.010	4.02	1.22–13.26	0.022

in TMD patients. Therefore, the most important thing was that our sample included patients with or without disability, regardless of TMD subtype. Furthermore, it has been shown that TMD subtypes does not correlate with pain-induced disability.[21]

In the present study, non-significant differences in sociodemographic variables were found between the groups with and without pain-related disability. Similar results were found by Kotiranta et al.[24], as the patients with and without disability did not differ in terms of age, sex, marital status, and education, but patients with pain-induced disability were absent from work due to health problems more frequently. In this study, it was shown that TMD patients with pain-related disability have significantly more catastrophic thoughts, including rumination, magnification, and helplessness, compared to patients without disability. Another important result from the present study is that the presence of catastrophizing increases the chance of having chronic pain-induced disability by 4.02 times. Regarding the catastrophizing subscales, magnification ("I worry that something serious may happen") and rumination ("I can't stop thinking about how much it hurts") may be related to primary appraisal processes in which individuals may focus on and exaggerate the threat value of a painful stimuli. Helplessness ("There is nothing I can do to reduce the intensity of the pain") may be related to secondary appraisal processes in which individuals negatively evaluate their ability to deal effectively with pain[19]. The association between catastrophizing and disability has been shown in other studies with patients with chronic pain. Sullivan et al.[25] showed that catastrophizing was associated with disability, independent of the levels of depression and anxiety, in a sample of individuals who had sustained soft-tissue injuries to the neck, shoulders, or back following work or motor vehicle accidents. High levels of pain catastrophizing increased the risk of pain and disability in patients with chronic low back pain.[26]

Willassen et al.[27] demonstrated that catastrophizing is a better predictor of TMD development than anxiety, depression, and PPT (algometry). The finding by Kotiranta et al.[24] corroborates our study, in which catastrophizing was significantly more common among TMD patients with disability due to chronic pain compared to groups without disability. Reiter et al.[6] found no association between disability and catastrophizing in TMD patients. Velly et al.[9] demonstrated that both catastrophizing and depression contribute to the progression of chronic pain and disability in patients with TMD. More recently, the same group demonstrated that patients with chronic TMD with clinically relevant pain are more likely to have catastrophic thoughts (OR = 2.70, 95%CI = 1.55–4.68) than patients with painful acute TMD. These authors also found, through multivariate analysis, statistically significant odds ratios for all catastrophic subscales, such as rumination (OR = 2.45, 95%CI = 1.36–4.41), amplification (OR = 2.41 , 95%CI = 1.38–4.23), and helplessness (OR = 3.37, 95%CI = 1.87–4.23), regardless of age, sex, depression, and anxiety.[28] According to Buenaver et al.,[29] catastrophizing plays a central role in disability and pain duration in patients with chronic pain.

It has been suggested that individuals with catastrophizing thoughts develop greater fear of performing movements, increasing pain-related disability.[30] According to Niederstrasser et al.,[31] catastrophizing can promote a nociceptive pain response even in the absence of a noxious stimulus. Some studies suggested that catastrophizing may play a facilitating role in the nociceptive response[32] or may negatively alter the endogenous modulation of pain.[33] Another hypothesis to explain how catastrophic thoughts can negatively influence the painful experience was demonstrated by Quartana et al.[34] These authors quantified salivary cortisol levels before and after the application of the PPT test in the masseter muscles in healthy people or TMD patients, with or without catastrophizing. Although the painful sensation was similar between healthy people and TMD patients, an increase in cortisol secretion was observed after the nociceptive test precisely in the most catastrophic individuals. These results suggest an abnormal adrenocortical response to pain in individuals with catastrophizing thoughts, which may increase their vulnerability to develop chronic pain and maintain or increase the pain experience.

This study had some limitations. First, this was a cross-sectional study, and it was not possible to establish a cause-and-effect relationship between catastrophizing and disability in patients with chronic painful TMD. Second, it used a convenience sample, which may lead to selection bias. Third, memory bias may have occurred when completing the instruments used for data collection. However, the strengths of this study were the standardization of data collection, the use of validated instruments translated into Portuguese, and the nullification of the effect of confounding variables by using multivariate analysis through logistic regression.

From a clinical point of view, knowing that catastrophizing is associated with pain-related disability is important in order to provide a more comprehensive care to these patients.

Conclusion

The results of this study indicate a strong association between pain catastrophizing and disability in individuals with chronic painful TMD.

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