



## THE INTENSITY OF SELF-REPORTED PAIN IN UNDERGRADUATE STUDENTS WITH TEMPOROMANDIBULAR DISORDER AND SYMPTOMS OF DEPRESSION: A CASE-CONTROL STUDY

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### ABSTRACT

**Objective:** To analyze the possible association of self-reported painful spots on the face between undergraduate students with temporomandibular disorder and depression.

**Methods:** Analytical, cross-sectional, case-control study with 763 students from the Faculty of Sciences and Technology of Maranhão. Thirty students were diagnosed with severe TMD (case group), which were matched by age and sex in a proportion of 1:2 with the control group: people without TMD diagnosis and without symptoms of depression. The case group and the control group were submitted to analysis of the painful spots in the muscles and joints through the RDC/TMD axis I.

**Results:** Of the 30 people with severe TMD, 63.3% presented myofascial TMD diagnosis and 36.7% of joint TMD. There was no significant difference ( $p > 0.05$ ) regarding the sex and the age between the case and control groups. However, it was observed a significant difference ( $p < 0.05$ ) in the painful symptoms, location of the pain, presence of articular noises and pain on palpation in the muscles and adjacent structures evaluated.

**Conclusion:** It was concluded that there is a greater risk of developing musculoskeletal pain in TMD carriers with depressive symptoms when compared to individuals without TMD diagnosis and depressive symptoms.

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### INTRODUCTION

Temporomandibular disorder (TMD) can be caused by a defect in one or both joints. Any problem that prevents this system composed of muscles, bones and joints of "working in harmony" can result in this disorder (Jerjes *et al.*, 2008). People with TMD usually present muscular alterations, articular noises, headache and earache, hearing loss, dizziness, tinnitus and articular compression, tension in the tympanic

cord nerve and disc perforation (PovedaRoda *et al.*, 2007; Figueiredo *et al.*, 2009). Researches show that most of symptoms of TMD are observed from 20 years to 40 years old, and the its prevalence varies between 8% and 15% in the female and 3% to 10% in the male. Women are the one that most seeks treatment in comparison to the men on a scale of one man in every four women, and it is not clear the reason of this phenomenon since it is suspected that the TMD affects both female and male (Jerjes *et al.*, 2008; Concórdia *et al.*, 2014). Compared with other clinical conditions, these disorders are commonly associated with anxiety, depression, stressful life events, psychological trauma and their carriers are more likely to have an increase in the rate of current

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psychiatric disorders and throughout life. In the literature, a significant impact of the psycho-emotional factor is reported, comparable to the impact of other factors related to physical health, such as systemic diseases, malocclusion, tooth loss, trauma and microtraumas (Bavia *et al.*, 2016). Psychological factors are related to the process of perception of local pain and may imply the predisposition, initiation and perpetuation of TMD. There is an important aspect of this disorder in the psychological alterations as exacerbation of this disorder and they are commonly observed in patients with chronic pain, especially depression (Resende *et al.*, 2013). In this context, this study aimed to analyze causal association of self-reported painful spots in the face between TMD and depression symptoms carriers when compared to healthy individuals.

## MATERIAL AND METHODS

**Study design:** This is an analytical, cross-sectional, case-control study with a quantitative approach.

**Study Location:** The study was carried out at the Faculty of Sciences and Technology of Maranhão (FACEMA), in the city of Caxias - MA, from February 2015 to December 2016. Caxias is located in the interior of Maranhão state, in the Northeast region of Brazil. It is the fifth largest city of the state, with a population of 155,202 inhabitants and an area of 5,223,981 km<sup>2</sup>, and it is one of the largest economic centers of the state due to its great performance in the Industry sectors and an important political, cultural and populational center of the state (IBGE, 2010).

**Subjects:** The study involved 763 students selected by a probabilistic sampling process, in which the elements of the population were ordered and the choice of the sample elements was performed randomly. The sample size was calculated considering a prevalence of TMD in undergraduate students of 28% (Goyatá *et al.*, 2010). Of a total 2392 students enrolled in all courses offered by FACEMA, with a margin of error of 3% and a confidence level of 95%, the total number of students was estimated in 760 students already considering a loss of 10%. Undergraduate students aged between 18 and 45 years old were included. Individuals with systemic problems such as fibromyalgia, arthritis, whose symptoms could be confused with TMD, those who were undergoing orthodontic treatment or who had undergone recent surgery in the orofacial region, individuals with neurological disorders, pregnant women and those who reported continuous use of anti-inflammatory drugs in the last 6 months were excluded. The authors guaranteed the secrecy of the participants, the confidentiality of the collected data and anonymity as well as freedom to refuse to participate of the research, without prejudice of their treatment. The interview was conducted only after the clarification and agreement of the participants, and after signing the Informed Consent Form, following the precepts of the Resolution nº 446 of December 12, 2012 of the National Health Council. The study was approved by the Research Ethics Committee of the Federal University of Maranhão (UFMA) under opinion number 1,121,984.

**Data Collection:** For the description of the prevalence of TMD among undergraduate students, it was used the Anamnestic Index of Fonseca *et al.* (1994), a Brazilian instrument, consolidated in the literature, used as a tool for the detection of TMD signs and symptoms, composed by 10 questions with the possibility of three answers: "yes", which

equals 10 points; "Sometimes", equivalent to 5 points; and "no", whose score is zero. The questions assessed the presence of pain in the temporomandibular joints, in the neck, pain when chewing, headache, difficulties of mandibular movement, articular noises, parafunctional habits (teeth clenching and grinding), perception of malocclusion and sensation of emotional stress. By the sum of the points, the Index can classify participants into categories of symptom severity, such as without TMD (0 to 15 points), mild TMD (20 to 40 points), moderate TMD (45 to 65 points) and severe TMD (70 to 100 points). The Research Diagnostic Criteria for Temporomandibular (RDC/TMD) Axis II was self-applied for the evaluation of the emotional state of participants. This index contains 31 questions, distributed in 4 dimensions, among them the level of depression. It is a method of clinical diagnosis, already validated and used in researches with several population groups (Lee *et al.*, 2013; Berni *et al.*, 2015; Dantas *et al.*, 2015; Al-Khotani *et al.*, 2016). Regarding the degree of symptoms of depression, the participants were classified as normal (score <0.535), moderate depression (score >0.535 and <1.105), and severe depression (score >1.105) (Reiter *et al.*, 2015). Subsequently, the RDC/TMD Axis I was applied by a single trained researcher, to diagnose the subjects classified as severe TMD on Fonseca's Anamnestic Index regarding: masticatory muscle disorders, disc displacement and inflammatory or degenerative TMJ disease. Eight cases of inflammatory or degenerative TMJ disease were excluded, and 30 subjects were included. The case group was thus defined: students with any of a TMD or disc displacement according to the RDC/TMD axis I and symptoms of depression (30). The control group: students without symptoms of TMD and depression, matched by sex and age, in the proportion of 1 case for 2 controls (60).

In order to analyze the painful spots in the muscles and joints, the RDC/TMD axis I was applied in both groups in the following locations: temporal (posterior, middle and anterior), masseter origin, masseter body and masseter insertion, posterior mandibular region (styloid and anterior digastric), submandibular region (medial pterygoid, anterior digastric, supra-hyoid), lateral pterygoid region and temporal tendon beyond articular palpation (lateral pole and posterior insertion). All palpations were carried out according to the RDC/TMD recommendations and guidelines. The students also answered a questionnaire about the economic profile proposed by the Brazilian Association of Research Companies<sup>15</sup>, which assesses the purchasing power of a family through the possession of television, radio, refrigerator, washing machine, and level of education of the head of family. Subsequently, all items were scored and classified according to the final result. The level of education of the head of the family is worth from 0 to 8 points, the other points are obtained by the quantity of consumer durables. The sum of the 23 indicators allows to classify the individuals into 07 classes: A1 (42-46 points), A2 (35-41 points), B1 (29-34 points), B2 (23-28 points), C1 (18-22 points), C2 (14-17 points), D (8-13 points) and E (0-7 points) (ABEP, 2015).

**Statistical analysis:** Data were organized and tabulated using Microsoft Excel 2010 version for Windows and statistical analysis was performed using IBM SPSS 18.0 version (IBM Corp., Armonk, United States). The univariate analysis are presented as absolute (N) and relative (%) frequency measurements and means/standard deviation (SD). For the bivariate analysis of the data, Pearson's Chi-square test (X<sup>2</sup>)

was used, with an estimate of effect measured by odds ratio (OR) and confidence intervals of 95% (95% CI). The null hypothesis was rejected as the value of  $p < 0.05$ . For the multivariate model (logistic regression), crude and adjusted odds ratio (OR) and respective confidence intervals of 95% (95% CI) were estimated. Independent variables that reached a value of  $p < 0.05$  in the bivariate analysis were selected for the multivariate model. For all the analyses under study a significance of 95% was considered.

## RESULTS

Of the 763 participants, 63.7% (486) were female, 61.7% (471) were 22 years of age or older and 49.3% (376) belonged to economic classes C1 and C2. The prevalence of symptoms of TMD in the current study was 63.8% (487). Of these participants, 37.2% (CI 33.8-40.7) were classified as mild TMD. Regarding the presence of symptoms of depression, 47.6% (363) of them presented some degree of symptoms of this condition, 4.98% (38) with severe TMD. There was a statistically significant association between sex ( $p < 0.001$ ), age group ( $p = 0.29$ ) and depression ( $p < 0.001$ ) with TMD (Table 1). The responses to the Fonseca's Anamnestic Index showed that the main complaint of the participants is emotional tension (34.2%), followed by fatigue or pain when chewing (27.5%) and frequent headache (27.5%) (Table 2).

When comparing the risks of developing TMD, women had 1.87 times greater chance to present moderate TMD and 2.25 times greater chance of developing severe TMD. Participants over 22 years had a 1.51 times greater chance of developing mild TMD. Those who presented symptoms of moderate depression had a 5.11 times greater chance of developing severe TMD. Those who presented symptoms of severe depression had a 12.51 times greater chance of developing severe TMD (Table 3). The diagnostic evaluation of TMD according to the RDC/TMD concluded that of the 30 subjects, 19 had a diagnosis of myofascial TMD (63.3%) and 11 had a diagnosis of articular TMD (36.7%). The group of the 30 students who match the criteria for inclusion in the cases diagnosed with TMD and depression had an average age of 22 years, 15 individuals younger than 22 years and 15 individuals aged 23 years or older; 23 were female. The average age of the control group, composed by 60 participants without symptoms of TMD and depression, was 22 years old, with 31 individuals aged 23 years or older and 42 were female. There was no significant difference ( $p > 0.05$ ) regarding sex and age between the case and control groups (Table 4). In the evaluation of the painful symptoms, 29 individuals reported facial pain (90.6%), 18 of them reported muscle pain (94.7%), 13 presented muscle pain on the left side (86.7%) and 12 in the joint (100%) and 21 presented articular noises (67.7%).

**Table 1. Socio-demographic and clinical profile of the undergraduate students according to the diagnosis of temporomandibular disorder. Caxias - MA, 2017**

Variables	Without TMD		Mild TMD		Moderate TMD		Severe TMD		Total		P*
	N	%	N	%	N	%	N	%	N	%	
Sex											<0.001
Male	127	45.8	97	35.0	42	15.2	11	4.0	277	36.3	
Female	149	30.7	187	38.5	112	23.0	38	7.8	486	63.7	
Age											0.029
< 22 years	93	31.8	128	43.8	53	18.2	18	6.2	292	38.3	
≥ 22 years	183	38.9	156	33.1	101	21.4	31	6.6	471	61.7	
Economic class											0.452
A1 e A2	11	45.8	08	33.3	03	12.5	02	8.3	24	3.1	
B1 e B2	97	35.0	112	40.4	57	20.6	11	4.0	277	36.3	
C1 e C2	142	37.8	132	37.2	21	24.4	07	8.1	376	49.3	
D e E	26	30.2	32	37.2	21	24.4	07	8.1	86	11.3	
Depression											<0.001
Without	199	49.8	137	34.2	53	13.2	11	2.8	400	52.4	
Moderate	45	27.6	68	41.7	37	22.7	13	8.0	163	21.4	
Severe	32	16.0	79	39.5	64	32.0	25	12.5	200	26.2	
Total	276	36.2	284	37.2	154	20.2	49	6.4	763	100.0	

Source: Research data, 2017.

TMD: temporomandibular disorder, A1 and A2: upper class, B1 and B2: upper middle class, C1 and C2: middle class, D and E: lower class (based on Brazil's Economy Classification Criteria). \*Pearson's chi-square test

**Table 2. Responses of the participants to the Fonseca's Anamnestic Index. Caxias - MA, 2017**

Questions	No		Sometimes		Yes	
	N	%	N	%	N	%
Difficulty to open your mouth wide?	590	77.3	127	16.6	46	6.0
Difficulty to move your jaw to the sides?	612	80.2	106	13.9	45	5.9
Are you tired/achy when you chew?	423	37.0	261	35.5	210	27.5
Do you often have headaches?	282	37.0	271	35.5	210	27.5
Do you feel pain in the neck or torticollis?	329	43.1	289	37.9	145	19.0
Do you have pain in the ear or in the temporomandibular joints?	535	70.1	161	21.1	67	8.8
Have you ever noticed if you have TMJ noises when you chew or when you open your mouth?	494	64.7	155	20.3	114	14.9
Have you ever noticed if you have a habit like squeezing or grinding your teeth?	457	59.9	159	20.8	147	19.3
Do you feel that your teeth do not articulate well?	490	64.2	157	20.6	116	15.2
Do you consider yourself a tense (nervous) person?	197	25.8	305	40.0	261	34.2

Source: Research data, 2017.

TMJ: temporomandibular joint.

**Table 3. Multinomial logistic regression model for the influence of sociodemographic characteristics and depression in the diagnosis of temporomandibular disorder in undergraduate students. Caxias - MA, 2017**

Variables	Mild TMD	Moderate TMD	Severe TMD
	OR (CI95%)	OR (CI95%)	OR (CI95%)
Sex			
Male	1.0	1.0	1.0
Female	1.40 (0.98-1.99)	1.87 (1.20-2.93)**	2.25 (1.07-4.71)*
Age			
≥ 22 years	1.0	1.0	1.0
< 22 years	1.51 (1.06-2.15)*	0.93 (0.60-1.44)	0.98 (0.51-1.91)
Depression <sup>†</sup>			
Without	1.0	1.0	1.0
Moderate	2.08 (1.34-3.23)***	3.05 (1.79-5.21)***	5.11 (2.14-12.21)***
Severe	3.37 (2.11-5.40)***	6.82 (4.03-11.55)***	12.51 (5.58-28.08)***

Source: Research data, 2017.

CI95%: 95% confidence interval, <sup>†</sup>adjusted to sex and age in the model; OR: odds ratio. Data compared to the category: without TMD.

\*p&lt;0.05; \*\*p&lt;0.01; \*\*\*p&lt;0.001

**Table 4. Comparative result of the case and control groups for the variables sex and age. Caxias – MA, 2017**

Variables	Groups				Total	P*
	Case (n=30)		Control (n=60)			
	N	%	N	%		
Sex						0.506
Male	07	28.0	18	72.0	25	27.8
Female	23	35.4	42	64.6	65	72.2
Age						0.881
< 22 years	15	34.1	29	65.9	44	48.9
≥23 years	15	32.6	31	67.4	46	51.1
Total	30	33.3	60	66.7	90	100.0

Source: Data research, 2017.

**Table 5. Comparative result of the case and control groups for the variables facial pain, location and presence of articular noises. Caxias – MA, 2017**

Variables	Groups				Total	P*
	Case (n=30)		Control (n=60)			
	N	%	N	%		
Facialpain						<0.001
No	01	1.7	57	98.3	58	64.4
Yes	29	90.6	03	9.4	32	35.6
Locationtotheright						<0.001
Withoutpain	01	1.7	59	98.3	60	66.7
Muscle	18	94.7	01	5.3	19	21.1
Joint	11	100.0	-	-	11	12.2
Locationtotheleft						<0.001
Withoutpain	05	7.9	58	92.1	63	70.0
Muscle	13	86.7	02	13.3	15	16.7
Joint	12	100.0	-	100.0	12	13.3
Articular noises in themouthopening						<0.001
Absent	09	15.3	50	84.7	59	65.6
Present	21	67.7	10	32.3	31	34.4

Source: Research data, 2017.

There was a significant difference between the presence of facial pain ( $p < 0.001$ ), location of pain ( $p < 0.001$ ) and presence of articular noises ( $p < 0.001$ ) between the case group and the control group (Table 5). There was also a significant difference ( $p < 0.05$ ) in the pain and palpation in the muscles: right posterior temporal, right middle temporal, left middle temporal, right anterior temporal, left anterior temporal, right superior masseter, left superior masseter, right middle masseter, right inferior masseter, left inferior masseter, right posterior mandibular region, left posterior mandibular region, right submandibular region, left submandibular, right lateral pterygoid region, left lateral pterygoid region, right tendon temporal region, and left tendon temporal region, when compared the case group with the control group.

There was also a significant difference ( $p < 0.05$ ) between the case and control groups regarding the pain on articular palpation on the right lateral pole, left lateral pole, right posterior ligament and on the left posterior ligament. The odds ratio values (OR) regarding the intensity of pain in the muscles and structures evaluated are shown in the Table 6.

## DISCUSSION

In this study, the prevalence of symptoms of TMD among undergraduate students was high (63.8%), similar to other studies (Dantas *et al.*, 2015; Al-Khotani *et al.*, 2016; Pinto *et al.*, 2017). Although many patients do not complain of any TMD-related symptoms, studies suggest that 40-60% of the individuals in the general population have some type of

**Table 6. Comparative result of the case and control groups for the variables pain on palpation of orofacial structures, odds ratio and P value. Caxias – MA, 2017**

Variables	Groups				Total		OR (CI95%)	P*
	Case (n=30)		Control (n=60)		N	%		
	N	%	N	%				
Pain on palpation in the right posterior temporal								
Absent	21	27.6	55	72.4	76	100.0	1	0.028
Mild	07	63.6	04	36.4	11	100.0	4.26 (1.14-15.97)	
Moderate to Severe	02	66.7	01	33.3	03	100.0	4.21 (0.40-48.46)	
Pain on palpation in the left posterior temporal								0.296
Absent	22	29.7	52	70.3	74	100.0	1	
Mild	06	50.0	06	50.0	12	100.0	2.25 (0.66-7.69)	
Moderate to Severe	02	50.0	02	50.0	04	100.0	2.01 (0.30-15.50)	
Pain on palpation in the right middle temporal								<0.001
Absent	15	21.4	55	78.6	70	100.0	-	
Mild	07	58.3	05	41.7	12	100.0	-	
Moderate to Severe	08	100.0	-	-	08	100.0	-	
Pain on palpation in the left middle temporal								<0.001
Absent	15	21.7	54	78.3	69	100.0	1	
Mild	09	69.2	04	30.8	13	100.0	6.0 (1.70-21.58)	
Moderate to Severe	06	75.0	02	25.0	08	100.0	7.25 (1.36-38.50)	
Pain on palpation in the right anterior temporal								<0.001
Absent	10	15.6	54	84.4	64	100.0	-	
Mild	10	62.5	6	37.5	16	100.0	-	
Moderate to Severe	10	100.0	-	-	10	100.0	-	
Pain on palpation in the left anterior temporal								<0.001
Absent	6	10.5	51	89.5	57	100.0	1	
Mild	14	63.6	08	36.4	22	100.0	5.69 (2.02-16.0)	
Moderate to Severe	10	90.9	01	9.1	11	100.0	29.5 (3.55-45.01)	
Pain on palpation in the right superior masseter								<0.001
Absent	12	19.0	51	81.0	63	100.0	1	
Mild	07	53.8	06	46.2	13	100.0	2.74 (0.83-9.05)	
Moderate to Severe	11	78.6	03	21.4	14	100.0	11.0 (2.77-43.64)	
Pain on palpation in the left superior masseter								<0.001
Absent	09	16.4	46	83.6	55	100.0	1	
Mild	04	28.6	10	71.4	14	100.0	0.76 (0.22-2.69)	
Moderate to Severe	17	81.0	04	19.0	21	100.0	18.31 (5.27-63.59)	
Pain on palpation in the right middle masseter								<0.001
Absent	08	15.1	45	84.9	53	100.0	1	
Mild	07	36.8	12	63.2	19	100.0	1.22 (0.42-3.50)	
Moderate to Severe	15	83.3	03	16.7	18	100.0	19.0 (4.87-74.31)	
Pain on palpation in the left middle masseter								<0.001
Absent	05	9.6	47	90.4	52	100.0	1	
Mild	04	30.8	09	69.2	13	100.0	0.87 (0.24-3.01)	
Moderate to Severe	21	84.0	04	16.0	25	100.0	32.67 (9.08-117.5)	
Pain on palpation in the right inferior masseter								<0.001
Absent	07	12.1	51	87.9	58	100.0	1	
Mild	09	56.2	07	43.8	16	100.0	3.24 (1.07-9.84)	
Moderate to Severe	14	87.5	02	12.5	16	100.0	25.37 (5.21-123.4)	
Pain on palpation in the left inferior masseter								<0.001
Absent	09	15.8	48	84.2	57	100.0	1	
Mild	06	35.3	11	64.7	17	100.0	1.11 (0.37-3.37)	
Moderate to Severe	15	93.8	01	6.2	16	100.0	59.0 (7.2-482.0)	
Pain on palpation in the right posterior mandibular region								<0.001
Absent	02	4.7	41	95.3	43	100.0	1	
Mild	10	45.5	12	54.5	22	100.0	2.00 (0.74-5.37)	
Moderate to Severe	18	72.0	07	28.0	25	100.0	11.36 (3.88-33.26)	
Pain on palpation in the left posterior mandibular region								<0.001
Absent	02	48.8	40	95.2	42	100.0	1	
Mild	04	20.0	16	80.0	20	100.0	0.42 (0.13-1.40)	
Moderate to Severe	24	85.7	04	14.3	28	100.0	56.0 (14.50-216.6)	
Pain on palpation in the right submandibular region								<0.001
Absent	09	15.5	49	84.5	58	100.0	1	
Mild	04	33.3	08	66.7	12	100.0	1.00 (0.27-3.63)	
Moderate to Severe	17	85.0	03	15.0	20	100.0	24.85 (6.33-97.6)	
Pain on palpation in the left submandibular region								<0.001
Absent	05	9.4	48	90.6	53	100.0	1	
Mild	07	46.7	08	53.3	15	100.0	1.98 (0.64-6.10)	
Moderate to Severe	18	81.8	04	18.2	22	100.0	21.0 (6.02-73.30)	
Articular pain on palpation in the right lateral pole								<0.001
Absent	05	9.6	47	90.4	52	100.0	1	
Mild	08	42.1	11	57.9	19	100.0	1.62 (0.57-4.58)	
Moderate to Severe	17	89.5	02	10.5	19	100.0	37.92 (7.78-184.8)	

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Articular pain on palpation in the left lateral pole									<0.001
Absent	02	4.4	43	95.6	45	100.0	1		
Mild	10	40.0	15	60.0	25	100.0	1.50 (0.57-3.90)		
Moderate to Severe	18	90.0	02	10.0	20	100.0	43.5 (8.89-212.3)		
Articular pain on palpation in the right posterior ligament									<0.001
Absent	09	15.8	48	84.2	57	100.0	1		
Mild	10	58.8	07	41.2	17	100.0	3.79 (1.27-11.31)		
Moderate to Severe	11	68.8	05	31.2	16	100.0	6.37 (1.96-20.70)		
Articular pain on palpation in the left posterior ligament									<0.001
Absent	10	16.9	49	83.1	59	100.0	1		
Mild	01	14.3	06	85.7	07	100.0	0.31 (0.36-2.70)		
Moderate to Severe	19	79.2	05	20.8	24	100.0	19.0 (5.84-61.78)		
Muscle pain on palpation in the right lateral pterygoid region									<0.001
Absent	01	4.3	22	95.7	23	100.0	1		
Mild	01	7.7	12	92.3	13	100.0	0.14 (0.02-1.18)		
Moderate to Severe	28	51.9	26	48.1	54	100.0	18.31 (4.00-83.93)		
Muscle pain on palpation in the left lateral pterygoid region									<0.001
Absent	-	-	18	100.0	18	100.0	-		
Mild	-	-	17	100.0	17	100.0	-		
Moderate to Severe	30	54.5	25	45.5	55	100.0	-		
Muscle pain on palpation in the right temporal tendon region									<0.001
Absent	02	6.5	29	93.5	31	100.0	1		
Mild	03	21.4	11	78.6	14	100.0	0.50 (0.13-1.93)		
Moderate to Severe	25	55.6	20	44.4	45	100.0	10.0 (3.33-30.04)		
Muscle pain on palpation in the left temporal tendon region									<0.001
Absent	02	8.0	23	92.0	25	100.0	1		
Mild	02	10.5	17	89.5	19	100.0	0.18 (0.04-0.84)		
Moderate to Severe	26	56.5	20	43.5	46	100.0	16.44 (4.97-54.21)		

Source: Research data, 2017.

temporomandibular disorder. The possible explanation for this fact is the presence of subclinical signs that are not reported as symptoms (Bortolotto *et al.*, 2013). Regarding the degree of symptoms of TMD, the mild degree was the most frequent (37.7%), corroborating previous studies carried out on undergraduate students, which observed a higher prevalence of mild TMD (Pinto *et al.*, 2017; Silva *et al.*, 2012; Habib *et al.*, 2014). Both men and women had a higher prevalence of mild TMD (35% and 38.5% respectively), and these findings were in agreement with other studies (Cabral *et al.*, 2016; Oliveira *et al.*, 2016). This higher prevalence in female sex is due to the fact that women seek treatment more frequently, so they are more attentive and careful with their health than male individuals, as well as having a greater perception to the painful stimulus (Berni *et al.*, 2015; Cabral *et al.*, 2016).

According to Minghelli *et al.* (2014), there is greater ligament laxity in women, which is related to estrogen level, making these tissues less able to stand functional pressure, leading to TMD. Symptoms of depression were present in 47.6% of the participants, corroborating other studies that found a similar prevalence of depressive symptoms in undergraduate students (Jadoon *et al.*, 2010; Araneda *et al.*, 2013). In the transition from high school to university, these young people face relational (establishing new connections), academic (adapting to a different model of evaluation and learning), vocational (establishing a career identity) challenges, among others. Dealing with these challenges, there are several aspects that can be perceived as stressors, regardless of the level that the student is in (beginning, middle or end of the course), such as excessive academic tasks, lack of motivation for studies and the chosen career, the existence of conflicts with colleagues and teachers, the presentation of works, difficulties in the acquisition of materials and books, among others (Brandtner and Bardagi, 2009). Fonseca *et al.* (2008) explain that some young people find it difficult to internalize the notion of responsibility, indispensable to personal and social life, sometimes being pressured to achieve their own goals.

The students with symptoms of depression face it as something triggered by a set of problems arising from suffering, loneliness, prejudice and the fact that they present symptoms of depression, gives them a representation of themselves as sad, lonely and unmotivated, who need help to confront this problem. When distributed according to the degrees of symptoms of depression, it was noticed that more than half (52.4%) of participants presented normal conditions. When analyzing the presence of symptoms of depression, it was observed that the majority of students presented symptoms of severe depression (26.2%), which differs from previous studies, that found a higher prevalence of symptoms of moderate depression (Lee *et al.*, 2013; Iqbal *et al.*, 2015). Of the 30 patients with severe TMD and depression evaluated, 63.3% presented myofascial TMD diagnosis, which according to the literature, there is a greater association between myofascial TMD and depression (Habib *et al.*, 2014; Minghelli *et al.*, 2014). Findings of the current study show that there is a greater risk of developing moderate to severe pain in the muscles and structures involved in the TMD when compared to the control group, mainly in masticatory muscles: masseter, styloid and anterior digastric. According to Tosato *et al.* (2015), masseter is a muscle susceptible to stress, resulting from the release of the hormone cortisol, which results in a greater severity of TMD symptoms, especially in this muscle.

The myogenic TMD has been associated with depression in other studies, such as Klasser *et al.* (2014), who carried out a cross-sectional study on 274 TMD patients and observed an association between myogenic TMD and depression. Dougall *et al.* (2012) investigated 207 TMD patients and concluded that patients with severe TMD had more disabling pain and also had significantly higher symptoms of depression. The findings of these studies substantiate data found in the present study, since the risk of developing moderate to severe pain in the joint region between individuals with TMD and depression compared with those without symptoms is 37.92 times higher from moderate to severe pain on the right lateral pole and 43.5 times greater risk of moderate to severe pain on the left lateral pole between participants with TMD and depression. Negative

emotions can contribute to the occurrence of pain, in this context, whenever the damage is unpredictable, pain plays an important role of alertness in the detection of risk situations to preserve tissue integrity, being used as a means of tissue monitoring, but in situations of eminent risk there is hypoalgesia as a defense mechanism. However, patients who are constantly subjected to negative emotions desensitize the tonsils, which, unlike healthy individuals, result in hyperalgesia (Al-Khotani *et al.*, 2016; Larner, 2013; Furquim *et al.*, 2015). However, the study by Guarda-Nardini *et al.* (2012) evaluated the behavior of chronic pain in 110 patients with TMD and suggested an evidence that psychopathology does not depend on the location of TMD, but patients with myofascial pain presented higher scores for psychological disorders, including depression with patients with articular pain. An explanation for the increased pain sensation may be due to the fact that depression exacerbates masticatory muscle tension, leading to teeth clenching, which in turn leads to an increase in the release of pro-inflammatory cytokines, followed by a sensitization reaction and resulting in pain (Al-Khotani *et al.*, 2016; Tosato *et al.*, 2015).

The majority of the participants evaluated (67.7%) presented articular noises during mouth opening. Similar findings of presence of articular noises were found by Machado *et al.* (2010), with a prevalence of 70% in a study carried out on 20 Speech Therapy students with an average age of 22 years. These data raise the hypothesis of greater articular erosion in this population, because although they are young people, they already have significant signs of articular noises. Articular noises are considered the most common sign of TMD, and are more frequent and more severe in older populations. This study has as limitation the methodological design that does not allow to know if the undergraduate students presented the temporomandibular disorder before or after the depressive symptomatology, however, it is highlighted as advantages the use of the RDC/TMD questionnaire, considered gold standard for diagnosis of TMD as well as the use of the Fonseca's Anamnestic Index. Another advantage to consider in this study is the way of pairing between the case group and the control group, in the 2:1 ratio between controls and cases, increasing the power of the study. The clinical implications of this study fit into the secondary prevention of the patient with pain. The health professional must to identify the patient's characteristics that can predispose him to the development of chronic pain and, thus, to perform an early intervention, advocating a multi professional approach. The findings of this study showed a significant difference in pain on palpation in muscles and articular structures related to TMD when compared the case group with the control group. It was also found that the risks of developing moderate to severe pain are higher in the muscles between individuals with TMD and depression when compared with healthy individuals, concluding that there is a greater risk of developing musculoskeletal pain in people with TMD and depressive symptoms when compared to people without diagnosis of TMD and depressive symptoms.

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