Anxiety and depression associated with pain and discomfort of temporomandibular disorders

Ansiedade e depressão associados à dor e desconforto das desordens temporomandibulares

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ABSTRACT

BACKGROUND AND OBJECTIVES: The etiology of temporomandibular disorders includes local and systemic factors, with an emphasis on the occlusal condition, trauma, parafunctional activities, and emotional stress, deriving signs of anxiety and depression. These, in turn, are more likely to develop in the university population, due to the changes required when entering university and the demand for good performance. This study aimed to evaluate the correlation between anxiety and depression symptoms and the existence of symptoms associated with temporomandibular disorders in university students.
METHODS: An epidemiological, randomized, and cross-sectional clinical study conducted with 100 university students. The Research Diagnostic Criteria for Temporomandibular Disorders: Axis II and the Hospital Anxiety and Depression Scale questionnaires were applied. For the statistical analysis, the Chi-square tests and the Logistic regression model were used.
RESULTS: The results of the present study consisted of responses from 79 women and 21 men, with a mean age of 19 years. The following associations were observed: general health status and depression; anxiety and pain in the face/ clicking; habit of grinding/clenching teeth when sleeping, and a "yes" answer to anxiety; discomfort with your teeth and depression; state of anguished/worried about all anxiety issues; depression and thoughts about death, difficulty in breathing and feeling discouraged about the future.
CONCLUSION: From the data obtained, it was possible to conclude that the presence of symptoms related to anxiety and depression interfere with the painful symptoms of temporomandibular disorders in the addressed population.
Keywords: Signs and symptoms, Psychological stress, Temporomandibular joint disorders.

RESUMO

JUSTIFICATIVA E OBJETIVOS: A etiologia das disfunções temporomandibulares engloba fatores locais e sistêmicos, destacando-se a condição oclusal, trauma, atividades parafuncionais e estresse emocional, derivando-se os sinais de ansiedade e de depressão. Esses, por sua vez, apresentam maior propensão em se desenvolver na população universitária devido às mudanças exigidas ao ingressar na universidade e a cobrança por um bom desempenho. O objetivo deste estudo foi avaliar a correlação de sintomas de ansiedade e de depressão e a existência de sintomas associados às disfunções temporomandibulares em estudantes universitários.
MÉTODOS: Realizou-se um estudo clínico epidemiológico, aleatório e transversal, cuja amostra foi constituída por 100 estudantes universitários, aos quais foram aplicados os questionários *Research Diagnostic Criteria for Temporomandibular Disorders*: Eixo II e o *Hospital Anxiety and Depression Scale*. Para a análise estatística foram utilizados os testes Qui-quadrado e o Modelo de regressão logística.
RESULTADOS: Os resultados do presente estudo foram constituídos pelas respostas de 79 mulheres e 21 homens, com média de idade de 19 anos. Foram observadas as seguintes associações: estado de saúde geral e depressão, ansiedade e dor na face/estalos, hábito de ranger/apertar os dentes ao dormir, e resposta "sim" para ansiedade, desconforto com seus dentes e depressão; estado de angustiado/preocupado com todas as questões de ansiedade; depressão e pensamentos sobre morte, dificuldade em respirar e sentir-se desanimado sobre o futuro.
CONCLUSÃO: A partir dos dados obtidos foi possível concluir que a presença de sintomas relativos à ansiedade e depressão interferem nos sintomas dolorosos das disfunções temporomandibulares da população abordada.
Descritores: Estresse psicológico, Sinais e sintomas, Transtornos da articulação temporomandibular.

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INTRODUCTION

Temporomandibular dysfunctions (TMJ) are composed of muscle and temporomandibular joint (TMJ) disorders. About 40 or 60% of the population presents some kind of sign or

symptom related to TMD. Most individuals that suffer from TMD are between 20 and 40 years old. The prevalence of TMD in women is three to nine times more than compared to men[1,2].

The etiology of the disorders was multifactorial and complex, including local and systemic factors; most causes are related to occlusal condition, trauma, emotional stress, profound pain stimulus and parafunctional activities. The symptoms include pain or discomfort in the TMJ, in the ears and facial muscles, presence of clicking, crackling and limited amplitude of movement[3]. Although the condition is systemic and said to be indirect, the appearance of TMD symptoms are strongly related to emotional stress and signs of anxiety and depression[2,4-8].

Furthermore, when relating the etiology of the disorder and its incidence, there is a connection between the development of TMD and individuals that are under emotional stress, as it can be can be the case with college students[4,9]. Due to life changes when entering college, the pressure for good performance and other hardships, this group is more inclined to develop psychological conditions, like anxiety and depression[10,11]. The aim of the present study is to evaluate the correlation between symptoms of anxiety and depression and the presence of symptoms related to TMD in college students.

METHODS

The present work is a randomized, cross-sectional, clinic epidemiological study in which 100 college students participated. The recruitment was done through a calling on social networks and class rooms.

The inclusion criteria were individuals from both sexes, older than 18 years old and enrolled in one of the graduation courses from UNIFAL-MG.

After all due explanations, individuals who met the criteria were invited to participate after signing the Free and Informed Consent Term (FICT). All participants were evaluated for the presence of symptoms related to TMD by the means of the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD): Axis II questionnaire[12,13]. The Hospital Anxiety and Depression Scale (HADS) was applied for the evaluation of anxiety and depression symptoms[14]. After the questionnaires were applied. The data was charted for the comparative statistical analysis as follows.

The answers for the anxiety (HADS-A) and depression (HADS-D) items were used for the evaluation of the frequency of anxiety and depression. For both HADS subscales, the following dichotomization and cutting points14 were adopted: zero for no anxiety or depression, from a total of zero to 8 points; and 1 as presence of anxiety and depression, from a total of ≥9 points. The research also evaluated all possible variations of the RDC axis II and considered those that could be related to the HADS subscales. These factors were divided in the following categories: general/oral health state and demographic data, face/oral habits pain and occlusion, and state of distress or worry. The categories answers to some of these

variables were grouped and/or dichotomized as zero=no and 1=yes, so as to synthesize the test information's and strength. For the first category, data over the general and oral health state (great, good, regular, bad or terrible), gender, skin color or ethnicity, excluding answers with specific race were collected. Considering the facial pain/oral habits and occlusion factors, individuals answered "no" or "yes" to the following questions: having felt pain in the face in places like the jaw, on the sides of the head, in front of the ear, or in the ear during the last four weeks; hearing cracks when chewing, opening or closing the mouth; having noticed (themselves or through someone near) gnashing or squeezing of the teeth while sleeping; and feeling discomfort or difference in the way the teeth touch each other.

The evaluation of the state of distress and worry for the last four weeks included information as: loss of sexual interest or pleasure, feeling chest or heart "tightness", having thoughts about death, feeling lonely or sad, breathing difficulty, feeling "something stuck inside the throat", and feeling discouraged about the future, all present in RDC's question 20. The answers for the items were grouped for "no" or "not at all"; or "yes", "somewhat", "moderately" and "plenty"; excluding the presence of the "extremely" answer.

The project was sponsored by the Ethics and Research Committee involving human beings (CEP/UNIFAL-MG), approved under number 2.816.052.

Statistical analysis

Statistical analysis of the answers was performed, and the Chi-square test was used to assess the association between the HADS subscales results for each relevant variable of the study. As for the value of $p<0.05$, there was a significant statistical difference. The logistic regression model was estimated to assess the dependence between the HADS scale and the study variables, which were considered individually significant in the Chi-square test ($p<0.05$). Odds ratios (OR) were estimated to measure this dependency.

RESULTS

The final sample consisted of 100 individuals, 79 females and 21 males, with an average age of 19 years old. Regarding general and oral health state, only an association between the general health state and HADS-D ($x^2=5.991$; $p=0.000$) was observed. No statistically significant ($p>0.05$) association for the remaining variables was observed.

Regarding anxiety (HADS-A) and the facial/oral habits pain and occlusion factors, association between facial pain during the last four weeks and ($x^2=3.841$; $p=0.044$) (Table 1) was verified. Clicking while chewing, opening or closing the mouth ($x^2=3.841$; $p=0.036$) was also verified, having 47 individuals heard clicking, in contrast to 19 individuals that didn't.

Also, from the 56 individuals which affirmed having the habit of gnashing/squeezing the teeth while sleeping, 42 presented "yes" for HADS-A, in comparison to 24 from 44 individuals that affirmed "not" having the habit of gnashing/squeezing

the teeth while sleeping (x^2=3.841; p=0.032). There was no evidence of association between the same variables (facial pain during the last four weeks, hearing clicking while chewing, opening or closing the mouth, and gnashing/squeezing teeth while sleeping) and HADS-D (p>0.05) (Table 1).

However, as for feeling of discomfort with the way the teeth touch each other, an association with HADS-D only was verified. In that case, from the 35 individuals that felt discomfort with their teeth, 17 presented affirmative state of depression, a larger percentage than the 17 from the 65 individuals that answered ''no'' (x^2=3.841; p=0.024) (Table 1).

Regarding the association between the state of distress or worry in the last four weeks and HADS-A, there was a statistically significant association for all variables assessed: loss of sexual interest or pleasure (x^2=3.841; p=0.004), feeling "tightness" in the chest or heart (x^2=3.841; p=0.009), having thoughts about death (x^2=3.841; p=0.000), feeling lonely (x^2=3.841; p=0.008), feeling sad (x^2=3.841; p=0.005), breathing difficulty (x^2=3.841; p<0.0001), feeling "something stuck inside the throat" (x^2=3.841; p=0.001), feeling discouraged about the future (x^2=3.841; p<0.0001) (Table 2). In addition, evaluating the association between the state of distress or worry in the last four weeks and HADS-D one can see the influence of the state of depression on having thoughts about death (x^2=3.841; p<0.0001), feeling lonely (x^2=3.841; p=0.009), feeling sad (x^2=3.841; p=0.043), breathing difficulty (x^2=3.841; p=0.001), and feeling discouraged about the future (x^2=3.841; p=0.008) (Table 2).

Table 1. Association between facial/oral habits pain and occlusion evaluated by the RDC in relation to the HADS (n=100)

| | HADS-A | | | | | | | HADS-D | | | | | | |
| | No | | Yes | | Total | | | No | | Yes | | Total | | |
	n	%	n	%	n	%	p-value[†]	n	%	n	%[a]	n	%	p-value[†]
Facial pain during the last four weeks	19	45.2	23	54.8	42	42.0	0.044[*]	27	64.3	15	35.7	42	42.0	0.758 [ns]
No	15	25.9	43	74.1	58	58.0		39	67.2	19	32.8	58	58.0	
Yes														
Hearing clicking while chewing, opening or closing the mouth														
No	17	47.2	19	52.8	36	36.0	0.036[*]	24	66.7	12	33.3	36	36.0	0.916 [ns]
Yes	17	26.6	47	73.4	64	64.0		42	65.6	22	34.4	64	64.0	
Gnashing/squeezing teeth while sleeping														
No	20	45.5	24	54.5	44	44.0	0.032[*]	29	65.9	15	34.1	44	44.0	0.986 [ns]
Yes	14	25.0	42	75.0	56	56.0		37	66.1	19	33.9	56	56.0	
Feeling discomfort with the way the teeth touch each other														
No	25	38.5	40	61.5	65	65.0	0.199 [ns]	48	73.8	17	26.2	65	65.0	0.024[*]
Yes	9	25.7	26	74.3	35	35.0		18	51.4	17	48.6	35	35.0	
Total	34	34.0	66	66.0	100	100.0		66	66.0	34	34.0	100	100.0	

HADS = Hospital Anxiety and Depression; [a]Values expressed as percentage in line; [b] Values expressed as percentage.
[†]Chi-square test; [ns]Not significant; p>0.05; [*]Significant; p<0.05.

Table 2. Association between the state of distress or worry during the last four weeks evaluated by the RDC in relation to the HADS (n=100)

| | HADS-A | | | | | | | HADS-D | | | | | | |
| | No | | Yes | | Total | | | No | | Yes | | Total | | |
	n	%[a]	n	%[a]	n	%[b]	p-value[†]	n	%[a]	n	%[a]	n	%[b]	p-value[†]
Loss of sexual interest or pleasure							0.004*							0.058 [ns]
No	27	45.0	33	55.0	60	60.0		44	73.3	16	26.7	60	60.0	
Yes	7	17.5	33	82.5	40	40.0		22	55.0	18	45.0	40	40.0	
Feeling "tightness" in the chest or heart														
No	20	48.8	21	51.2	41	41.0	0.009*	29	70.7	12	29.3	41	41.0	0.405 [ns]
Yes	14	23.7	45	76.3	59	59.0		37	62.7	22	37.3	59	59.0	
Having thoughts about death														
No	28	48.3	30	51.7	58	58.0	0.000*	49	84.5	9	15.5	58	58.0	<0.0001*
Yes	6	14.3	36	85.7	42	42.0		17	40.5	25	59.5	42	42.0	

Continue...

Table 2. Association between the state of distress or worry during the last four weeks evaluated by the RDC in relation to the HADS (n=100) – continuation

	HADS-A							HADS-D						
	No		Yes		Total			No		Yes		Total		
	n	%[a]	n	%[a]	n	%[b]	p-value[†]	n	%[a]	n	%[a]	n	%[b]	p-value[†]
Feeling lonely														
No	16	53.3	14	46.7	30	30.0	0.008*	26	86.7	4	13.3	30	30.0	0.009*
Yes	18	25.7	52	74.3	70	70.0		40	57.1	30	42.9	70	70.0	
Feeling sad														
No	13	59.1	9	40.9	22	22.00	0.005*	19	86.4	3	13.6	22	22.0	0.043*
Yes	21	26.9	57	73.1	78	78.00		47	60.3	31	39.7	78	78.0	
Breathing difficulty														
No	31	49.2	32	50.8	63	63.0	<0.0001*	49	77.8	14	22.2	63	63.0	
Yes	3	8.1	34	91.9	37	37.0		17	45.9	20	54.1	37	37.0	0.001*
Feeling "something stuck inside the throat"														
No	23	53.5	20	46.5	43	43.0	0.000 *	33	76.7	10	23.3	43	43.0	0.049 ns
Yes	11	19.3	46	80.7	57	57.0		33	57.9	24	42.1	57	57.0	
Feeling discouraged about the future														
No	16	69.6	7	30.4	23	23.0	<0.0001*	21	91.3	2	8.7	23	23.00	0.008*
Yes	18	23.4	59	76.6	77	77.0		45	58.4	32	41.6	77	77.00	
Total	34	34.0	66	66.0	100	100.0		66	66.0	34	34.0	100	100.0	

HADS = Hospital Anxiety and Depression; [a]Values expressed as percentage in line; [b] Values expressed as percentage.
[†]Chi-square test; [ns]Not significant; p>0.05; *Significant; p<0.05.

The odds ratio was estimated by the logistic regression model for the statistically significant variables associated with the HADS scale (Table 3). Among the variables, only breathing difficulty increases the chance of anxiety by 8,5 times, with significant statistical difference (p=0.002); and feeling discouraged increases significantly by 5.4 times (p=0.003). Regarding the variable ''having thoughts about death'', an increase of 5.9 times the chance for depression is estimated, with statistically significant difference (p=0.019); and

feeling uncomfortable increases the chance by 3.8 times, statistically significant (p=0.001). Moreover, there was some influence of good general health in relation to the reference: terrible/regular/bad reduces in approximately 89% (1-0.109) the chance for depression with significant statistical difference (p=0,001). Great general health, in relation to the reference, is estimated to reduce in approximately 69% (1-0.312) the chance for depression, although with no significant statistical difference (p=0.204) (Table 3).

Table 3. Logistic regression between study variables and HADS considering 2 models (n=100)

Variables [≠]	HADS (zero FOR NO and 1 FOR YES)					
	HADS-A [‡]			HADS-D [‡]		
	OR [CI 95%]	ES (SE)	p-value	OR [CI 95%]	ES (SE)	p-value
(Intercept)	0,317	-1,149 (0,494)	0,020*	0,576	-0,552 (0,602)	0,359 ns
Breathing difficulty						
No	1 [Reference]					
Yes	8,467 [2,264;31,662]	2,136 (0,673)	0,002*	-	-	-
Feeling discouraged about the future						
No	1 [Reference]					
Yes	5,422 [1,793;16,399]	1,691 (0,565)	0,003*	-	-	-
General health						
Terrible/regular/bad				1 [Reference]		
Good	-	-	-	0,109 [0,030;0,397]	-2,212 (0,658)	0,001*
Great	-	-	-	0,312 [0,052;1,885]	-1,165 (0,918)	0,204 ns

Continue...

Table 3. Logistic regression between study variables and HADS considering 2 models (n=100) – continuation

Variables *	HADS (zero FOR NO and 1 FOR YES)					
	HADS-A ‡			HADS-D ‡		
	OR [CI 95%]	ES (SE)	p-value	OR [CI 95%]	ES (SE)	p-value
Feeling discomfort with the way the teeth touch each other						
No				1 [Reference]		
Yes	-	-	-	3,780 [1,239;11,528]	1,330 (0,569)	0,019*
Having thoughts about death						
No				1 [Reference]		
Yes	-	-	-	5,858 [2,042;16,800]	1,768 (0,538)	0,001*

ES = estimate; OR - odds ratio; SE = standard error; CI = confidence interval; p (probability value); * List of all variables considered in a step by step interactive procedure, ‡Only variables statistically significant after procedure, ns Not significant p>0.05; *Significant; p<0.05.

DISCUSSION

The average age of the studied sample was similar to another study[15] and belonged to the variation presented in similar works[4,16,17]. However, there was a great difference between genders with the predominance of 79% females.

Regarding the relation between the aspects of general and oral health, gender and skin color or race and the presence of signs and symptoms of depression represented by the HADS-D, only general health generated statistically significant association. There was no statistically significant association with p>0,05 for oral health, gender and skin color or race. The results dispute other studies that associate oral health state and the development of TMD to depression. Nevertheless, as the RDC questionnaire's Axis I was not applied, the identification of individuals suffering from TMD and the correlation to gender could not be executed. In other works, the proportion of afflicted women reaches three to nine times more than men[1,2,9].

Other similar studies results could also be related to the subjected country, as well as quality and style of life. Another aspect that can interfere is the age of the sample, which could present more or less propensity to the development of depression and anxiety symptoms, as well as development of symptoms associated with TMD for other reasons[4-6].

On the other hand, relating signs and symptoms of anxiety, represented by HADS-A, and factors related to TMD symptoms, the present study established statistically significant association for facial pain during the last four weeks, hearing clicking when chewing, opening or closing the mouth and the habits of gnashing/squeezing the teeth while sleeping.

Such association was also confirmed by other authors[4-6,16,17]. A possible explanation for the association between TMD and facial pain would be that these aches are related to excessive muscular activity. Excessive tension, in turn, can result in a constant teeth pressing, which leads to an alteration of the local circulation in the muscles and to the ionic change between cellular membranes, as well as accumulation of lactic acid and pyruvic acids, contributing to the stimulation of pain receptors. Besides, the presence of noise in the TMJ could be due to the incorrect

positioning of the joint cartilage, which moves the upper jaw's head when the mouth is open, resulting in clicking[1].

For the affirmative state of depression, represented by the HADS-D, factors like facial pain during the last four weeks, hearing clicking while chewing, opening or closing the mouth, and gnashing/squeezing the teeth while sleeping did not show statistically significant association. Only a relation to feeling discomfort with the way the teeth touch each other was found, on the opposite hand of results obtained in other works that presented association between cases of depression and its direct influence on the development of TMD symptomatology[4,18].

Moreover, the results obtained in the present study confirmed the data assessed by other authors[10-12,19], which presented the main symptoms related to the development of anxiety and depression in Brazilian college students. The present study verified the following associations for anxiety: loss of sexual interest or pleasure, feeling "tightness" in the chest or heart, having thoughts about death, feeling lonely, feeling sad, breathing difficulty, feeling "something stuck inside the throat", feeling discouraged about the future; for depression: having thoughts about death, feeling lonely, feeling sad, breathing difficulty, and feeling discouraged about the future.

The mechanism of the stress response is the triggering of neurochemical mechanisms with the with the conduction via neuroendocrine pathways. Therefore, first, through the hormonal release of noradrenaline and adrenaline, an initial discharge of the sympathetic nervous system occurs. The adrenaline aims to increase the function of vital organs and determining the body's general alert state. Increased heart rate, dilated pupils, increased blood pressure and constriction of blood vessels in the skin and extremities are the results of this mechanism. In addition, the individual under stress is also typically tense due to increased muscle contraction in the shoulder and neck regions, in addition to fast and superficial breathing, as well as the symptoms presented in the study[7,19,20].

Regarding the propensity to develop depression and anxiety, according to the study, the symptoms of "breathing difficulty" and "feeling discouraged" increased the chances of developing anxiety. As for depression, the factors that were influenced were "thoughts about

death" and "feeling uncomfortable". Another work[11], also using college students, showed that a good health condition or self-esteem can help prevent the development of depression. In the present study, the participants' self-assessment of general health indicated that a good general health is capable of reducing by 89% the chance of developing depression, with significant statistical difference. Thus, it should be noted that although the study did not use the RDC/TMD Axis I questionnaire that would allow the quantification and identification of individuals with TMD; this study acted by qualifying and correlating the most prevalent TMD-related signs and symptoms in the addressed population, correlating those most prevalent for the presence and development of anxiety or depression in a specific manner. It's also important to notice a lack of studies about this subject in the literature, since most studies that address the issue do not present the specific factors and symptoms of anxiety and depression related to the development of TMD, but its identification related to more generic factors.

CONCLUSION

Symptoms related to anxiety and depression interfered on the symptomatology of the temporomandibular dysfunction on the college students that participated in the research. Furthermore, the studied population presented high propensity to development of anxiety/depression, which can influence the development of symptoms related to TMD.

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