DOI: https://doi.org/10.17921/2447-8938.2022v24n3p195-200

Are Stress Associated with Temporomandibular Dysfunction? A Cross-Sectional Study

O Estresse Está Associado à Disfunção Temporomandibular? Um Estudo Transversal

Jacinta da Conceição Cezerilo Pataca[a]; Luiz Alexandre Chisini[b]; Kauê Collares[c]; César Dalmolin Bergoli[a]

[a]Universidade Federal de Pelotas. RS, Brasil.
[b]Universidade Federal de Juiz de Fora. MG, Brasil.
[c]Universidade de Passo Fundo. RS, Brasil.
*E-mail: alexandrechisini@gmail.com

Abstract

Temporomandibular disorders are frequent in different segments of the population and harm the quality of life of individuals. The present sudy aimed to investigate the association between stress and temporomandibular dysfunction (TMD) in university students in Brazil. All incoming students at the Federal University of Pelotas were invited to participate in this cross-sectional study. A self-administered questionnaire was used with socioeconomic and oral health variables. TMD Fonseca questionnaire "Fonseca's anamnestic index" was used to identify the severity of symptoms of temporomandibular dysfunction. The same was elaborated in the form of Helkimo's anamnestic index. Stress was measured using a modified version of the Perceived Stress Scale and categorized into quartiles. Logistic multivariable regression models were used to analyze the associations of interest controlling for possible confounding variables. A backward stepwise procedure was used to select variables that should be kept in the final model. A total of 2,089 students answered the questionnaires and 82 (3.9%) were classified with the presence of TMD. Adjusted logistic regression shows that chance of presenting temporomandibular dysfunction was higher (OR=2.43; 95%CI=1.04-5.65) when the stress level increased. In conclusion, the mild degree of temporomandibular dysfunction was the most prevalent. Stress was associated with individuals with a higher prevalence of temporomandibular dysfunction.

Keywords: Temporomandibular Joint. Stress, Physiological. Students.

Resumo

As disfunções temporomandibulares são frequentes em diferentes segmentos da população e prejudicam a qualidade de vida dos indivíduos. O presente estudo teve como objetivo investigar a associação entre estresse e disfunção temporomandibular (DTM) em estudantes universitários no Brasil. Todos os alunos ingressantes da Universidade Federal de Pelotas foram convidados a participar deste estudo transversal. Foi utilizado um questionário autoaplicável com variáveis socioeconômicas e de saúde bucal. O questionário TMD Fonseca "Índice anamnésico de Fonseca" foi utilizado para identificar a gravidade dos sintomas da disfunção temporomandibular. O mesmo foi elaborado na forma de índice anamnésico de Helkimo. O estresse foi medido usando uma versão modificada da Perceived Stress Scale e categorizado em quartis. Modelos de regressão logística multivariada foram usados para analisar as associações de interesse controlando possíveis variáveis de confusão. Um procedimento de backward stepwise foi usado para selecionar as variáveis que deveriam ser mantidas no modelo final. Um total de 2.089 alunos responderam aos questionários e 82 (3,9%) foram classificados com presença de DTM. A regressão logística ajustada mostra que a chance de apresentar disfunção temporomandibular foi maior (OR=2,43; IC95%=1,04-5,65) quando o nível de estresse aumentou. Em conclusão, o grau leve de disfunção temporomandibular foi o mais prevalente. O estresse foi associado a indivíduos com maior prevalência de disfunção temporomandibular.

Palavras-chave*: Articulação Temporomandibular. Estresse Fisiológico. Estudante.*

1 Introduction

According to the American Academy of Orofacial Pain[1], temporomandibular dysfunction is a term designated to a subgroup of orofacial pain whose signs and symptoms include pain or discomfort in the temporomandibular joint, ears, chewing muscles on one or both sides, eyes, face, back, and neck. The etiology of temporomandibular dysfunction is multifactorial, being influenced by degenerative or traumatic lesions of the temporomandibular joint, muscle changes, psychological factors, skeletal problems, changes in occlusion, and parafunctional habits. All these problems can bring damage and disharmony to the entire stomatognathic system, leading to an imbalance of the temporomandibular joint[2]. Epidemiological studies show a higher prevalence of temporomandibular dysfunction in females compared to males[3] and an average of 40% to 60% of the population presents at least one detectable sign related to temporomandibular dysfunction, especially at the age of 20 to 40 years[4]. Usually, treatment is based on conservative therapy and should be proposed before any surgical procedure[4].

The stability of the temporomandibular joint is essential for the proper functioning of the stomatognathic apparatus because once it can perform complex movements associated with the action of the masticatory muscles, its correct functioning makes it possible to perform stomatognathic functions, such as: chewing, swallowing, and speech[5]. The

literature has shown that stress can play an important role in the prevalence of temporomandibular dysfunction and this occurs through complex interrelationships in the central nervous system. Interaction between the limbic system and the center of motor activity allows the transformation of an emotional and cognitive process that in the area of the stomatognathic system manifests itself as an increase in muscle tone. The muscle tension that accompanies stressful emotional conditions is an important etiological factor for many dysfunctional and painful problems. Besides, stress-induced muscle dysfunction may secondarily produce changes in the temporomandibular joint, resulting in changes in joint biomechanics, microtrauma to joint capsules and meniscus, and changes in pain perception[6,7].

Among the populations most affected by stress, university students are among the most affected[8]. This portion of the population is subject to several distinct emotional issues such as being away from family, living with other colleagues, frustration, fears, anguish, etc. Thus, the environment that would contribute to the building of knowledge and be the basis for their professional training experiences sometimes becomes the trigger for pathological disorders, and students may develop feelings of disability concerning the activities required during their professional training. These changes can increase the risk of stress development and in parallel several other diseases related to their presence. Also, this portion of the population is sometimes poorly studied and left out of specific health policies and programs. Therefore, this work aims to evaluate the prevalence of Temporomandibular Dysfunction in students at the Federal University of Pelotas as well as to evaluate the association of this disease with stress.

2 Materials and Methods

2.1 Study Design

This is a cross-sectional observational study, aligned with a longitudinal cohort study that aimed to accompany university students throughout their academic lives. This multidisciplinary study assessed the health environment, and psychosocial and behavioral issues of university students. The data used in this study are part of the first data collection conducted in 2016. Full details concerning the methods of the present study have been published previously[9-12].

This study was reported according to the STROBE guide (Reinforcement Reporting of Observation Studies in Epidemiology) for cross-sectional studies.

2.2 Sample size and power of the study

The minimum sample size required was estimated using the 6.0 EpiInfo software (Centers for Disease Control and Prevention, Atlanta, USA), where the estimated number of participants in the first half of 2015 (3000 students) and a prevalence of 50% (unknown) for the variables of interest were considered, the margin of error of the study was 1.8 percentage points within a 95% confidence interval. For the association analysis, this sample size is sufficient to detect a prevalence ratio of 1.4, considering an exposure prevalence of 50%, the prevalence of the outcome in exposed individuals of 5%, power of 80%, and $\alpha = 5\%$.

2.3 Data Collection

The fieldwork team was composed of undergraduate and graduate students of the School of Dentistry and all members of EpiBucal (Study Group in Oral Health Epidemiology). The entire team was submitted to a 4-hour theoretical training with a presentation of the research instruments, study logistics with discussion, and clarification of possible doubts. The application of the questionnaires took place in the classrooms after prior authorization from the collegiate and teacher responsible for the discipline. The questionnaire was self-managed.

2.4 Population and sample

All regular university students who entered the Federal University of Pelotas in 2016 were considered eligible for this study. The students were located by a list sent by their respective academic units. Those who were unable to complete the questionnaire and those without regular enrolment with the institution were excluded from the sample. The questionnaire was applied before classes with the authorization of the teachers of each course.

Before data collection, a mapping of all academic units belonging to the university and their respective coordinators was performed. As a first step, all academic units were contacted by e-mail, with a letter of approval from the Ethics Committee, a letter of authorization from the university's dean to conduct the research, and requesting the recommendation of a professor of the course in question to conduct the data collection in his classroom. In the cases of absence in the return via e-mail, the research team personally contacted the coordinators of the academic units. Thus, all academic units were informed about the study for their proper authorization and accomplishment. An initial visit was conducted by supervisors in all courses of the University where authorization was obtained from the coordinators of each undergraduate course. Students were invited to participate in the study by a member of the fieldwork team who explained the objectives and methodology of the work as well as its ethical implications. In addition, the students received the informed consent form of the study, and those who agreed to sign it were part of the sample. Students who were unable to self-complete the questionnaire were excluded from the sample, as were students entering another school year and special students.

2.5 Study variables

2.5.1 Independent variables

Demographic characteristics including gender, age, and

nationality were collected. Family income was collected categorically in reais - BRL: (a) up to 500.00; b) 5, 001.00 up to 1,000.00; c) 1, 001.00 up to 2,500.00; d) 2, 501.00 up to 5000.00; e) 5, 001.00 up to 10,000.00; and f) more than 10,001.00) and classified into three categories: a) ≤ 1,000.00; b) to 1, 001.00 5, 000.00 and c) ≥ 5, 001.00. Oral health conditions were investigated through self-reporting measures. Gum bleeding was estimated by the question: "Do your gums bleed when brushing your teeth? ". (No, sometimes, and always). The dental caries experiment was verified using the question: (Yes or No) "Do you actually have or have you ever had any teeth affected by dental caries? ".

The stress level was measured using a modified version of the Perceived Stress Scale (PSS), validated for Portuguese by Reis, Hymn. This questionnaire is composed of ten questions related to last month, reflecting events and situations, four positive and six negative questions. Each question presents five options on a Likert scale, varying from 1 = never; 2 = almost never; 3 = a few times; 4= less common; and 5 = very often. Scores for positive questions are reversed-marked and negative scores are usually scored, so the whole range from 0 to 40 points on the scale. A higher score indicates higher tension.

2.5.2 Variable outcome - Temporomandibular dysfunction

The outcome variable was evaluated using the "Fonseca anamnestic index"[13]. It is an instrument that identifies the severity of symptoms of temporomandibular dysfunction.

It was elaborated in the form of Helkimo's anamnestic index and is one of the few instruments available in Portuguese to characterize the severity of symptoms of temporomandibular dysfunction. It was previously tested in patients with temporomandibular dysfunction and showed a 95% correlation with Helkimo's clinical index. There are ten questions in total, in which each of the questions in Fonseca's questionnaire is possible three answers (yes, no, and sometimes) for which three scores are pre-established (10, 0, and 5, respectively). The sum of the points awarded gives an anamnestic index that allows volunteers to be classified by symptom severity: no TMD (0 to 15 points), mild TMD (20 to 45 points), moderate TMD (50 to 65), and severe TMD (70 to 100 points).

2.6 Statistical methods

The collected data was double-typed and confronted in a database created in the EpiData 3.1 software. The analyses were performed in the Stata 16.0 software (Stata Corporation, College Station, TX, USA). The relative and absolute frequencies of the variables of interest were calculated and their 95% confidence intervals were estimated. The analysis of associations between variables was first performed using the Chi-square test (categorical variables) and the Chi-square of linear tendency (ordinal categorical variables). Logistic multivariable regression models were used to analyze the associations of interest controlling for possible confounding variables. A backward stepwise procedure was used to select variables that should be kept in the final model. Only variables with p≤0.250 were maintained in the final model All analyses considered a value of α =5%.

Ethical aspects

The institution (UFPel) and the Ethics and Research Committee of the Faculty of Medicine of the UFPel approved this study under protocol 49449415.2.0000.5317. All participants were previously informed about the study and the confidentiality of data.

3 Results and Discussion

A total of 3,237 students were eligible to study and a total of 2089 (64.5%) answered the questionnaires. Losses were due to students that did not found in the respective classes for 4 consecutive visits. Refusals corresponded to 1.4% (N= 29). Of the total, 82 were classified with the presence of temporomandibular dysfunction, as they presented scores corresponding to moderate (50-65 points) or severe (70-100 points) dysfunction.

The variables gender, quality of life-related to oral health, self-perception of oral health, and stress level influenced the presence of dysfunction (Table 1). After the analysis adjusted through the logistic regression test (Table 2) it was possible to observe that women (OR = 3.22, 95% CI: [1.8 – 5.2]), people with a high impact of oral health on quality of life (OR = 2.33, 95% CI: [1.04 – 2.88]), people with a low perception of oral health (OR = 1.75, 95% CI: [1.07 – 2.88]) and people with high levels of stress (OR = 2.43, 95% CI: [1.04 – 5.65]) had a higher chance of having the presence of temporomandibular dysfunction.

Table 1 - Description of the sample variables with the presence of temporomandibular dysfunction

Temporomandibular Dysfunction		
Variable / Category	**N (%)**	**p**
Sex		<0.001
Male	18 (1.89)	
Female	63 (5.83)	
Age		0.486
16-18	8 (2.63)	
18-24	56 (4.13)	
25-34	11 (5.13)	
More than 34	7 (4.00)	
Family Income		0.194
Less than 1000	16 (5.81)	
Between 1000 and 5000	37 (3.51)	
Greater than 5000	13 (3.42)	
Maternal education		0.289
Incomplete high school	21 (4.51)	
Complete high school	5 (1.91)	
Elementary school	26 (4.00)	
Tertiary education	29 (4.41)	
OHIP-14		<0.001

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No impact	22 (1.91)	
With impact	51 (6.11)	
Self-perception of oral health		<0.001
Good	43 (2.91)	
Bad	29 (6.61)	
Experience of caries		0.317
Yes	22 (3.41)	
No	60 (4.31)	
Last visit to the dentist		0.387
Less than 1 year	52 (3.72)	
More than 1 year	29 (4.61)	
Stress		<0.001
PSS from 0-11	8 (1.51)	
PSS from 12-16	16 (2.82)	
PSS from 17-21	23 (4.73)	
PSS from 22-40	35 (8.00)	

OHIP-14: Oral Health Impact Profile-14; PSS: Perceived Stress Scale
Source: Resource data.

Table 2 - Analysis of adjusted* variables and their odds ratio values for individuals with temporomandibular dysfunction after the logistic regression test

Temporomandibular Dysfunction		
Variable / Category	**OR (CI 95%)**	**p-value**
Sex		<0.001
Female	3.2 (1.8-5.2)	
OHIP-14		0.003
With impact	2.33 (1.04-4.05)	
Self-perception of oral health		0.028
Bad	1.75(1.07-2.88)	
Stress		0.010
PSS from 22-40	2.43 (1.04-5.65)	

* adjusted by age, family income, maternal education, caries experience and last visit to the dentist. OHIP-14: Oral Health Impact Profile-14; PSS: Perceived Stress Scale
Source: Resource data.

The highest level of stress increases 2.4 the odds of temporomandibular disorder in students, being more prevalent in women. Temporomandibular disorders are frequent in different segments of the population and harm the quality of life of individuals[14]. They present a multifactorial etiopathogenic, in which factors such as trauma, anatomical considerations, pathophysiological factors, and psychosocial issues, of which stress is the most evident alteration[4]. In other words, the current trend is to believe that there are several interconnections of triggering factors and thus consider that the temporomandibular dysfunction is not a consequence of a single factor, but their association[15].

By evaluating temporomandibular dysfunction by gender, a higher prevalence in women could be verified. The reasons why women are more affected than men remain controversial and some factors have been suggested, such as a higher female perception of painful stimuli, higher prevalence of psychological disorders, physiological differences such as hormonal variations, structural differences in muscle and the connective tissue or simply a greater health concern, leading to a greater search for prevention and treatment[16,17].

A study by Le Resche et al.[18] found clinical variations in pain intensity in women with temporomandibular dysfunction during the menstrual cycle. The authors cited in their study that the highest pain values coincided with the period of higher estrogen concentrations. Therefore, the greater flaccidity of connective and muscle tissues, and the estrogen levels in this gender, explain the reason why these issues have a lower capacity to withstand functional pressure leading to temporomandibular dysfunction. However, unlike the studies mentioned above, the study by Tosato[19] found no statistically significant difference between the male and female genders.

In the present study, the age group with the highest temporomandibular dysfunction was 18 to 24 years old, according to the results obtained by Bezerra et al.[20], who carried out a study to verify the prevalence of temporomandibular dysfunction in children between three and seven years of age and college students between 17 and 38 years of age; and realized that the presence of the symptoms of the temporomandibular dysfunction became more frequent among college students. Another study reported differences in the occurrence of temporomandibular dysfunction according to age groups, stating that there is no satisfactory explanation in the literature for this fact[21]. These differences were confirmed when it was observed that for Pimentel et al.[22] the age group most affected by temporomandibular dysfunction was 30 to 59 years.

In this study, the frequency of temporomandibular dysfunction was higher in the group with the highest score on the stress scale. The results of this study reinforce the assumption that there is an association between temporomandibular dysfunction and stress, although the association between psychological factors and temporomandibular dysfunction is inconsistent in the literature, there is biological plausibility for this association, according to Kindler et al.[23], psychological factors may initiate muscle hyperactivity, followed by biomechanical changes and consequently pain. They may also produce neurotransmitters, serotonin imbalance, and catecholamines, inducing pain. However, the high prevalence of n temporomandibular impact in college students is usually related to emotional stress[19]. Therefore, as undergraduate students, stress may have been an etiologic and predisposing factor, influencing the increase of emotional stress and, consequently, causing the n temporomandibular impact.

The high frequency of the temporomandibular dysfunction associated with the stress crisis found in this study was also following the findings of Manfredi et al.[24], in which they evaluated 455 university students and concluded that 90.9% of the individuals with temporomandibular dysfunction had a high level of stress, which explains the influence of this factor on the development of the temporomandibular dysfunction.

Probably, the level of stress perceived in this sample was raised by the fact that the research was done in the first months that they entered college, so many students, recently left the shelter of their families, the comfort of their homes, cities, and

began to experience situations perhaps different from what was usual, such as: Living with people of different lifestyles and social level, thus arising responsibilities that require some maturity in financial self-administration, self-administration of the house, time, grades and attendance in undergraduate classes.

It should be considered that students in all educational institutions experience, at various levels of intensity, stress during the learning process and depend on the reality in which they live, because fluctuations in the intensity of stress may occur during the school years. However, it was observed that the chances of presenting the temporomandibular were higher as the level of stress increased, however, since this is a cross-sectional study, it is difficult to establish a temporal relationship between the events and it is not possible to affirm a cause-effect relationship between them.

The results of this study showed that the chance of presenting temporomandibular dysfunction was 75% higher among individuals who reported poor self-perception of oral health, and it was also positively associated with those who reported that oral health influences quality of life. Chronic pain is directly related to the state of the individual's quality of life, since it generates effects not only on the body, but also on the psychological state and social coexistence, which must be carefully evaluated, and most of the time require therapeutic and multi-professional treatments to control or reverse the condition, studies show that chronic pain has been one of the deep causes of disturbance in the quality of life since it often does not affect only one organ, but can radiate to other parts of the body or even to the whole body, causing a decrease in concentration, psychic changes, and impoverishment of social relationships[4].

4 Conclusion

The results of the study reiterate the significance of temporomandibular dysfunction in the impairment of quality of life, possibly due to pain and the intensity and duration of its symptoms. Based on the results of this study was found an association between stress factors and the presence of temporomandibular dysfunction, as well as an association between sex and the presence of this dysfunction. Thus, it is possible to conclude that female patients with stress conditions should receive special attention for the diagnosis and treatment of the dysfunction, thus trying to minimize possible harmful actions.

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