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Prevalence of signs and symptoms of temporomandibular disorders in college preparatory students: associations with emotional factors, parafunctional habits, and impact on quality of life

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Abstract *The aim of this study was to evaluate the prevalence of temporomandibular disorders (TMD) signs and symptoms, its correlation with gender, parafunctional habits, emotional stress, anxiety, and depression and its impact on oral health-related quality of life (OHRQL) in college preparatory students at public and private institutions in João Pessoa, Paraíba (PB). The sample consisted of 303 students. Presence of TMD symptoms was determined by an anamnesis questionnaire containing questions related to the presence of parafunctional habits and emotional stress. A simplified clinical evaluation protocol was used. Anxiety and depression were determined with the Hospital Anxiety and Depression (HAD) scale and the OHRQL using the short version contained in the Oral Health Impact Profile (OHIP-14). The Chi-square, Fisher Exact, Mann Whitney, and Kruskal-Wallis tests were performed. Presence of signs and symptoms of TMD was statistically associated ($p \leq 0,05$) with female gender, parafunctional habits, emotional stress, and anxiety, and represented greater impairment of the OHRQL. The physical pain domain was the most affected. The increased prevalence of signs and symptoms of TMD among college preparatory students indicates that there is a need for education and clarification among teachers and students to improve early diagnosis and to prevent the problem.*

Key words *Temporomandibular joint disorders, Adolescence, Habits, Anxiety, Quality of life*

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Introduction

The *American Academy of Orofacial Pain* (AAOP) defines temporomandibular disorder (TMD) as a group of painful and/or dysfunctional conditions related to the muscles of mastication, temporomandibular joints (TMJs), and related structures[1].

The major signs and symptoms related to these disorders are pain in the TMJ region and palpation of the muscles of mastication, ear pain and other otologic signs, joint noise, mandibular misalignment, limited mouth opening, tiredness and muscular fatigue, headaches, and dental wear[2-6].

TMD has a multifactorial etiology, including genetic and behavioral factors, direct and indirect trauma, psychological factors, and postural and parafunctional habits[2,7-9]. However, the effects of these etiological agents are controversial and remain not completely understood.

The biopsychosocial model has recently gained attention, promoting a wide discussion on the influence of emotional factors on the etiology of TMD[8-12]. Thus, emotional distress, stress, anxiety, and depression have been linked to the presence of the signs and symptoms of this disorder in several populations[9,11,13-15]. These factors, especially stress and anxiety, may cause muscular hyperactivity and the development of parafunctional habits, leading to microtraumas of the TMJ and muscular lesions[16-18].

Recent studies have also shown that the symptoms of TMD, especially pain, can increase the level of physical and mental harm, with negative effects on quality of life (QL)[19-23]. In addition, the literature has shown that the severity of TMD is reflected in the decrease in oral health-related quality of life (OHRQL)[23].

In this study, we address the presence of signs and symptoms of TMD in a population of college preparatory students, mainly adolescents in the last year of high school. According to Godoy et al.[24], this phase is often characterized as a period of confusion and ambiguity due to the youths' needs to begin to become part of the adult world and changes to their bodies, which affect their role in society. In addition, the college entrance exam, which is considered to be a competitive and stressful system for acceptance to Brazilian universities, may be reflected by increased social and familial pressure, anxiety, stress, and other emotional disorders closely related to a diagnosis of TMD[25,26].

In addition, several studies have investigated the prevalence of TMD and associated factors in children[3,7,14,27], adolescents[2,4,16], college students[9,15,18,23,28], adults[10,12,21,29] and elderly[30], however few information is available about college preparatory students, subjected to high psychosocial burden, including psychological and physical manifestations of stress and anxiety[24,26,31,32].

Thus, the aim of this study is to evaluate the presence of signs and symptoms of TMD, its correlation with gender, reports of parafunctional habits, emotional stress, anxiety, and depression and its effects on OHRQL in college preparatory students enrolled in their last year of high school or college entrance exam courses in João Pessoa, Paraíba (PB).

Materials and methods

This research was a non-probability cross-sectional study performed using college preparatory students in the third year of high school or taking college entrance exam preparation courses in public and private institutions in the city of João Pessoa (PB) in 2011. The sample consisted of 303 volunteers from both sexes, between 15 to 25 years of age, who agreed to participate in the study. Students who did not sign (or whose guardians did not sign) the consent form, students who had orthodontic treatment (attached or removable appliance), and students who had received treatments for TMD or other orofacial pain were excluded.

In concordance with the requirements and criteria established by Resolution num. 196/96 of the National Health Council (NHC), the project was presented to the Research Ethics Committee (REC) of the Lauro Wanderley University Hospital at the Federal University of Paraíba (UFPB).

Data collection

Permission slips were provided in duplicate to 10 high schools (five private and five public), together with a copy of the research study. Institutions were selected by convenience from all of the high schools and pre-entrance exam courses in the city of João Pessoa (PB). Permission to perform the study was given in only three private and three public institutions.

Questionnaires were given during the break between classes, which varied between 20 and 30 minutes, during both sessions (morning and afternoon), depending on the availability of each school.

A majority of the institutions were visited more than once due to both the limited time

to conduct the surveys and the inclusion in the study of minors whose participation was dependent on the consent form being signed by their legal guardians.

Evaluation of the presence of TMD symptoms and parafunctional habits

A self-reporting questionnaire containing objective questions on the presence of parafunctional habits and the "DMF anamnestic index" from Fonseca et al.[33] was used to evaluate the severity of the TMD and the need for treatment.

The DMF index consisted of 10 questions related to symptoms of TMD, with three possible answers for each question: "yes," "no," or "occasionally," which were assigned values of 10, 0, and 5, respectively. The sum of the values for the responses allowed the population to be classified according to the severity of the TMD, based on the reported symptoms: absent (0-15), mild (20-40), moderate (45-65), or severe (70-100). The data from the DMF anamnesis index also allowed the sample to be classified by need for treatment, based on the TMD symptoms reported, as: "no need for treatment" (absent or mild TMD) and "treatment needed" (moderate to severe TMD).

For parafunctional habits, the volunteers were asked to indicate the habits that they performed most often on a multiple-choice question containing options previously selected from the literature[4,16,34]. Participants were informed that they could mark more than one option.

Evaluation for the presence of clinical signs of TMD

Two previously calibrated examiners, with inter and intra-examiner Kappa coefficients of 0.82 and 0.95, respectively, performed the simplified clinical exam on the youths in rooms selected by the institutions. The evaluation was performed with the students sitting in a chair with a backrest with an erect back, legs and feet parallel and firmly placed on the ground under ambient light. Examiners also used proper personal protection equipment (gloves, masks, protective eyewear, and protective clothing).

The following parameters were evaluated:

Muscular sensitivity: the masseter (lower, middle, and upper thirds) and temporal (anterior, middle and posterior thirds) muscles were palpated with a pressure of approximately 1.0 kg/cm^2 [23,35], and the resistive protrusion method was used to analyze the lateral pterygoid. A total of seven sites were analyzed by palpation on each side (three temporal, three masseter, and one lateral pterygoid), resulting in 14 muscular palpation sites per volunteer. Pain was quantified using objective values in which "0" indicated no pain, "1" tenderness was reported by the volunteer, "2" tenderness with physical manifestations, and "3" tenderness with evasion by the volunteer[23,35].

Joint sensitivity: Lateral palpation of the TMJ was performed with the volunteer at rest, and posterior palpation of the TMJ was palpated with maximum opening. Both were conducted with a pressure of approximately 0.5 kg/cm^2 [23,35]. Pain was quantified using objective values, as described above[23,35].

Joint Noise: The volunteers were asked to open and close their mouths three times. The examiner's index fingers were positioned over the TMJs, allowing the evaluation of presence/absence of clicking or crepitus (grinding sound during mandibular movement) to be detected. The presence of TMJ noise was considered when they were reproducible in at least two of three movements[23,35].

Active mouth opening: With the patient in maximum opening, the distance between the edges of the upper and lower middle incisors was measured, in millimeters (mm), using a caliper (NSK, Nippon Sokutei, Japan). In addition, the vertical overlap was also measured by vertical superposition of the upper incisors on the lower, with the volunteer in maximal intercuspation, using a caliper. The sum of the two measurements (opening and vertical overlay) provided the active mouth opening of each volunteer. The size of the active mouth opening was classified as restricted opening (< 40 mm), normal opening (40-59 mm), or hypermobility (more than 60 mm)[23,35].

Jaw movement alterations: The volunteers were asked to open and close their mouths three times, allowing the presence or absence of mandibular deviations (the mandible deviates during opening but returns to the midline when opened completely) or deflections (when the mandible is off the midline through maximal opening). The presence of jaw movement alterations was defined when they were reproducible in at least two of three movements[23,35].

The presence of clinical signs allowed the volunteers classification as follows:

Signs of muscular TMD: two or more sites of muscular sensitivity;

Signs of articular TMD: two or more sites of TMJ alterations (joint pain, joint noise, restricted

mouth opening or mandibular hypermobility, or altered movement);

Signs of mixed muscular and articular TMD: the presence of two or more sites with muscular pain and simultaneous joint signs.

Analysis of the presence of anxiety, depression, and emotional stress

The *Hospital Anxiety and Depression* (HAD) scale, translated into and validated in Portuguese, was used to evaluate the frequency of anxiety and depression[36]. The scale includes 14 items, seven that address anxiety (HADS-A) and seven that address depression (HADS-D). Each of these items can receive 0 to 3 points, resulting in a maximum score of 21 points for each subscale. The total scores in each subscale are classified using the following cutoffs: no anxiety from 0 to 8 and anxiety ≥ 9; no depression 0 to 8 and depression ≥ 9.

The volunteers also responded, in the same questionnaire, to a question related to the presence/absence of emotional stress and indicated their stress level on an Analog Visual Scale (AVS) from 0 to 10.

Oral Health-Related Quality of Life Analysis

OHRQL was measured using the *Oral Health Impact Profile* (OHIP), in a shortened and validated Portuguese version (OHIP-14)[37,38]. The questionnaire consists of 14 questions, two for each of the seven survey dimension. Each question has five possible answers: never, rarely, sometimes, often, and always for 0, 1, 2, 3, and 4 points, respectively. The sum of the ordinal responses gives the total OHIP-14 score, which can range from 0 to 56, with higher scores indicating a larger negative impact for oral health[37,38].

The OHIP-14 comprises seven areas of oral health with two questions for each area (functional limitation, physical pain, psychological discomfort, physical impairment, psychological impairment, social impairment, and disability). The points from each of the seven OHIP-14 areas can range from 0 to 8 points, with higher scores representing more harm.

Data analysis

The data were recorded and tabulated in the Statistical Package for Social Sciences (SPSS), version 22.0, and analyzed by descriptive and by inferential statistics. Frequencies and percentages were used for descriptive analysis, and the following non-parametric tests were used for inferential statistical analysis: Chi-square, Fisher exact, and significance calculations for identifying correlations between the variables. For the OHIP-14 scores, the Kolmogorov-Smirnov normality test showed that the data were not normally distributed; thus, the non-parametric Mann-Whitney and Kruskal-Wallis tests were used to compare the means of the OHIP-14 scores in the different groups analyzed. For all statistical tests, a 95% confidence interval and a 5% ($p < 0.05$) significance level were adopted.

Results

Sample characterization

A total of 303 students were evaluated in this study. From this sample, most were female (69%), between 15 to 19 years of age (93.1%), and from public schools (74.6%). Based on the DMF index, some level of TMD was identified in 89.8% of the participants, of which 50.2% had mild TMD, 33.0% moderate and only 6.6% severe. 39.6% of volunteers exhibited an active need for treatment (moderate and severe TMD). The TMD severity and need for treatment were determined by the DMF index according to the TMD symptoms reported. However, the physical exam showed the presence of clinical TMD signs in 56.4% of the sample. 31.0% showed clinical signs of articular TMD, 11.2% signs of muscular TMD and 14.2% combined signals of articular and muscular TMD.

Parafunctional habits were highly prevalent (95.4%), but the variables of emotional stress, anxiety, and depression were found in 82.5%, 40.3%, and 10.6% of the analyzed population, respectively.

Factors associated with the presence of signs and symptoms of TMD

Table 1 shows that the presence of TMD symptoms (DMF index) was statistically correlated with female gender ($p < 0.001$), reported parafunctional habits ($p < 0.001$), reported emotional stress ($p < 0.001$), and anxiety ($p < 0.001$). There was no statistically significant association between TMD symptoms and the type of educational institution or the presence of depression. The "treatment need" (DMF index,

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Table 1. Association between the presence of TMD symptoms (DMF index) and the variables gender, type of educational institution, presence of parafunctional habits , stress report, presence of anxiety and depression.

Variables	TMD symptoms (DMF index)					p
	Absent		Present		Total	
	n	%	n	%	%	
Gender						
Female	11	3.6	198	65.3	69.0	< **0.001**
Male	20	6.6	74	24.4	31.0	
Educational institution						
Private	4	1.3	73	24.1	25.4	0.065*
Public	27	8.9	199	65.7	74.6	
Parafunctional habits						
No	7	2.3	7	2.3	4.6	< **0.001**
Yes	24	7.9	265	87.5	95.4	
Presence/report of stress						
No	17	5.6	36	11.9	17.5	< **0.001**
Yes	14	4.6	236	77.9	82.5	
Anxiety						
No	31	10.2	150	49.5	59.7	< **0.001***
Yes	0	0	122	40.3	40.3	
Depression						
No	29	9.6	242	79.9	89.4	0.337*
Yes	2	0.7	30	9.9	10.6	

Chi-square test. *Fisher Exact Test Statistically significant, $p < 0.05$.

based on the symptoms of TMD reported) was statistically associated with the female gender ($p < 0.001$), reported parafunctional habits ($p = 0.039$), reported emotional stress ($p < 0.001$), anxiety ($p < 0.001$), and depression ($p < 0.001$) (Table 2). However, the presence of clinical signs of TMD following the physical exam was only associated with female gender ($p < 0.001$) and anxiety ($p < 0.001$) (Table 3).

When the symptoms of TMD (DMF index) was compared to each type of parafunctional habit, we found a statistically significant association with the following habits: chewing gum ($p = 0.027$); clenching teeth ($p = 0.020$); resting your chin on your hand ($p = 0.002$); biting the tongue ($p = 0.014$); biting lips ($p = 0.008$); unilateral chewing ($p = 0.008$); lateral sleeping ($p = 0.003$); and chewing ice and/or lollipops ($p = 0.039$) (Table 4).

Impact of TMD on oral health-related quality of life

Table 5 shows that volunteers with TMD symptoms (DMF index) had a statistically higher OHIP-14 score than volunteers without symptoms ($p < 0.001$), suggesting a negative impact on OHRQL. The average OHIP-14 score was statistically higher in the group of volunteers needing treatment than in the group not needing treatment ($p < 0.001$), and the more severe the TMD (DMF index) was, the larger the impact on OHRQL.

Regarding the physical exam, volunteers with clinical signs of articular, muscular, or mixed TMD had higher OHIP-14 scores than volunteers with no signs of TMD, but this difference was only significant for those with mixed signs of articular and muscular TMD ($p = 0.01$) (Table 4). Of the OHIP-14 seven domains, physical pain was the domain that presented the highest impact on the groups with clinical signs of articular ($p = 0.033$), muscular ($p = 0.019$), and mixed ($p < 0.001$) TMD.

Discussion

In this study it was proposed to evaluate the prevalence of signs and symptoms of TMD and its associated factors in a sample of students in the last year of high school and that would be submitted to the college entrance examination. The

Table 2. Association between the "treatment need" (DMF index) and the variables gender, type of educational institution, presence of parafunctional habits , stress report, presence of anxiety and depression.

Variables	Need for TMD treatment (DMF index)					
	Absent		Present		Total	p
	n	%	n	%	%	
Gender						
Female	107	35.3	102	33.7	69.0	< **0.001**
Male	76	25.1	18	5.9	31.0	
Educational institution						
Private	43	14.2	34	11.2	25.4	0.344
Public	140	46.2	86	28.4	74.6	
Parafunctional habits						
No	12	4.0	2	0.7	4.7	**0.039***
Yes	171	56.4	118	38.9	95.3	
Presence/report of stress						
No	44	14.5	9	3.0	17.5	< **0.001**
Yes	139	45.9	111	36.6	82.5	
Anxiety						
No	136	44.8	45	14.9	59.7	< **0.001**
Yes	47	15.5	75	24.8	40.3	
Depression						
No	175	57.8	96	31.7	89.5	< **0.001**
Yes	8	2.6	24	7.9	10.5	

Chi-square test. *Fisher Exact Test Statistically significant, $p < 0.05$.

Table 3. Association between the presence of clinical signs of TMD (simplified clinical exam protocol) and the variables: gender, type of educational institution, presence of parafunctional habits, stress report, presence of anxiety and depression.

Variables	Clinical signs of TMD (simplified clinical exam protocol)					
	Absent		Present		Total	p
	n	%	n	%	%	
Gender						
Female	77	25.4	132	43.6	69.0	< **0.001**
Male	55	18.2	39	12.2	31.0	
Teaching institution						
Private	32	10.6	45	14.8	25.4	0.681
Public	100	33.0	126	41.6	74.6	
Parafunctional habits						
No	10	3.3	5	1.7	5.0	0.064
Yes	122	40.3	166	54.4	95.0	
Presence/report of stress						
No	24	7.9	29	9.6	17.5	0.781
Yes	108	35.6	142	36.9	82.6	
Anxiety						
No	97	32.0	91	30.0	62.0	< **0.001**
Yes	35	11.6	80	26.4	38.0	
Depression						
No	120	39.6	153	50.5	90.1	0.678
Yes	12	4.0	18	5.9	9.9	

Chi-square test. Statistically significant, $p < 0.05$.

Table 4. Association of the presence of TMD symptoms with each parafunctional habit.

Variables	TMD symptoms (DMF index)					p
	Absent		Present		Total	
	n	%	n	%	%	
Types of parafunctional habits						
Grinding teeth						
No	29	9.6	235	77.6	87.1	0.204*
Yes	2	0.7	37	12.2	12.9	
Clenching teeth						
No	28	9.2	197	65.0	74.3	**0.020***
Yes	3	1.0	75	24.8	25.7	
Biting nails						
No	18	5.9	163	53.8	59.7	0.841
Yes	13	4.3	109	36.0	40.3	
Chewing on objects (e.g., pencil)						
No	19	6.3	155	51.2	57.4	0.646
Yes	12	4.0	117	38.6	42.6	
Chewing gum						
No	22	7.3	136	44.9	52.1	**0.027**
Yes	9	3.0	136	44.9	47.9	
Biting cheeks						
No	25	8.3	192	63.4	71.6	0.239
Yes	6	2.0	80	26.4	28.4	
Sucking a finger						
No	31	10.2	264	87.1	97.4	0.417*
Yes	0	0	8	2.6	2.6	
Resting your chin on your hand						
No	25	8.3	139	45.9	54.1	**0.002**
Yes	6	2.0	133	43.9	45.9	
Biting the tongue						
No	31	10.2	235	77.6	87.8	**0.014***
Yes	0	0	37	12.2	12.2	
Biting lips						
No	22	7.3	125	41.3	48.5	**0.008**
Yes	9	3.0	147	48.5	51.5	
Unilateral chewing						
No	30	9.9	214	70.6	80.5	**0.008***
Yes	1	0.3	58	19.1	19.5	
Lateral sleep position						
No	24	7.9	135	44.6	52.5	**0.003**
Yes	7	2.3	137	45.2	47.5	
Chewing ice and/or lollipops						
No	22	7.3	140	46.2	53.5	**0.039**
Yes	9	3.0	132	43.6	46.5	

Chi-square test. *Fisher Exact Test. Statistically significant, $p < 0.05$

choice of this specific group is justified by the absence of further studies related to TMD in this specific sample, demonstrably subjected to high emotional burden, including anxiety, anguish, restlessness and stress[26,31,32]. Furthermore, recent studies have shown that these emotional factors may be closely related to the diagnosis and progression of TMD[9,11,13-15].

Table 5. Statistical comparisons between OHIP-14 scores for the presence of TMD symptoms (DMF index), severity of TMD (DMF index), need for treatment (DMF index) and clinical signs of TMD (simplified clinical examination protocol).

TMD Classification	Mean OHIP-14 ± SD	p
TMD symptoms (DMF index)		
Absent	5.42 ± 4.581	< **0.001***
Present	11.65 ± 8.482	
Need for treatment (DMF index)		
Absent	8.02 ± 6.531	< **0.001***
Present	15.53 ± 8.855	
Severity of TMD (DMF index)		
No TMD	5.42 ± 4.581	**0.019****
Mild TMD	8.60 ± 6.745	
Moderate TMD	14.54 ± 8.474	< **0.001****
Severe TMD	20.45 ± 9.512	< **0.001****
Clinical signs of TMD (simplified clinical examination protocol)		
No TMD	9.98 ± 8.046	0.320**
Clinical signs of articular TMD	10.52 ± 8.421	
Clinical signs of muscular TMD	12.26 ± 8.743	0.127**
Clinical signs of mixed articular and muscular TMD	14.30 ± 8.348	**0.01****

SD = Standard deviation. * Statistically significant ($p < 0.05$) (Mann-Whitney test). ** Statistically significant ($p < 0.05$) (Kruskal-Wallis test).

In the present study, sample consisted mainly of female students from public schools. These results are due to the lack of responses for permission to collect data and negativity in some private institutions. Add to this the better reception among female volunteers, and it was difficult to obtain a balanced sample for gender and type of teaching institution.

The prevalence of symptoms and clinical signs of TMD were determined in this study by the "DMF index"[34] and simplified clinical examination[2,4,16,23]. The DMF index sorts the volunteers in categories based on the severity of TMD symptoms and the absence/presence of treatment need, but does not provide diagnostic classification[39]. Another limitation arises from its scoring system, since if three affirmative responses are attributed to questions about headache, cervical pain and perception of emotional tension, the volunteer will be classified as mild DTM carrier, and these symptoms may occur an isolated manner, without any relation to this dysfunction[39].

However, the DMF index brings some advantages such as simplicity, speed of aplication and low cost, enabling it use in epidemiological studies, for plotting population profiles, for patients screening or, in the assessment of quality of life[23,39,40], being used in several studies to evaluate the prevalence of TMD symptoms[18,41-43]. Campos et al.[40] suggested the suppression of some of the DMF index questions, which would increase its reliability. However, the removal of this questions would make the instrument very similar to the AAOP questionnaire, would not allow the classification of the severity of symptoms of TMD. Besides, the validity trial of the modified index was not yet performed. Thus, we decided to use the DMF index in its original version.

The simplified clinical examination protocol[2,4,16,23,35] allows the evaluation of the presence of joint, muscle or mixed TMD clinical signs. This clinical evaluation protocol is quick and simple, allowing its use in studies with larger samples, complementing the information of anamnesis questionnaire[33]. However, it does not provide a standardized diagnostic classification for TMD. Currently, the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD), and its most recent version, the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) are the "gold–standard" instruments available in the literature for TMD evaluation, providing an accurate diagnosis this dysfunction[44]. However, RDC/TMD is a complex instrument, making its use difficult in large samples, and the calibration of examiners is time-con-

suming. In this study, all evaluations were conducted with students during the interval between classes. This is a short period, around 20-30 minutes, which would difficult the application of the RDC/TMD. Furthermore, the DC/TMD was not yet translated or validated for Portuguese, which difficult it use in research in Brazil. The difficulty in establishing an "ideal" protocol of epidemiological evaluation of TMD can be confirmed by the absence of representative data of TMD prevalence in the Brazilian population, since, until this moment, no TMD protocol exam has yet been included in the National Oral Health Survey - the "SB Brasil", performed in 2003 and 2010.

Considering the facts previously described and the limitations of the instruments used in this study, a high prevalence of clinical signs and symptoms of TMD by the anamnestic DMF index (89.8%) and the physical exam (56.4%) was observed. In addition, a large portion of this population showed an active "treatment need" (39.6%). It is noteworthy that the need for treatment was based on reported symptoms[33] rather than the diagnosis of TMD. The prevalence of the signs and symptoms of TMD in adolescents varies widely due to individual differences, sample variability (heterogeneous age groups, sample size, and selection criteria), and different evaluation methods[27,45]. Thus, epidemiological studies in children have found a TMD prevalence between 21-74%[4,16,28]. In this study, the age range varied between 15-25 years of age, including adolescents and young adults. Indeed, the latter group had a higher prevalence of TMD signs and symptoms[5,41,43], supporting the results found.

The majority of volunteers had mild TMD (50.2%), and only 6.6% had severe TMD. It is noteworthy that the severity of TMD was based on symptoms reported[33] by volunteers. A higher percentage of individuals with mild TMD was also observed by Medeiros et al.[18], Pedroni et al.[41], Oliveira et al.[42] e Bonjardim et al.[43]. Considering the clinical exam protocol, the clinical signs of articular TMD were most prevalent (31%), followed by signs of mixed articular and muscular TMD (14.2%) and muscular TMD (11.2%). Consistent with our results, epidemiological studies have shown a prevalence of joint sounds in approximately 23-47% and joint pain in 16-45% of children and adolescents[2,4,5,24]. Furthermore, muscular sensitivity to palpation was recorded in 23-43% of this population[2,4,16].

In the present study, female gender was strongly associated with the presence of symptoms and clinical signs of TMD (DMF index and simplified clinical examination), as with "treatment need" (DMF index). A higher prevalence of TMD in females has been widely reported in the literature[2,4,5,28,45], but the reasons for this prevalence remain controversial. Factors such as increased sensitivity to pain, the increased prevalence of emotional stress, anxiety, or depression, physiological differences (hormonal differences), differences in muscular structure, and increased preoccupation and treatment seeking[1,9,41] in females have all been proposed. Conversely, studies on children have not shown significant differences between genders for the signs and symptoms of TMD[14,34], reinforcing the possible role of hormones in the development of this disorders, considering that these studies were conducted on prepubescent children who were therefore not influenced by reproductive hormones[14].

The report of parafunctional habits was statistically associated with the presence of TMD symptoms and the "treatment need" (DMF index). In addition, the habits of clenching teeth, chewing gum, resting chin on hand, biting the tongue, biting lips, lateral sleep position, and chewing ice/lollipops were associated with the presence of this disorder symptoms (DMF index). Similar to this results, several studies have shown a positive association between parafunctional habits and the presence of signs and symptoms of TMD[4,18,45,46]. Other studies, however, have contested this association[34,47,48]. The results of this study suggest that parafunctional habits may be important associated factors to TMD occurrence and progression, but further examination, relating each habit to specific diagnosis of this dysfunction is necessary for better understanding of their participation in the etiology of the different subgroups of TMD. It is noteworthy that, in the present study, bruxism and clenching habits were self-reported by the students[2,4,16,34]. This type of evaluation carries a limitation that is inherent in it: its natural subjectivity, considering that most of the deleterious habits are unconscious, which means that the patient is not always aware of their presence. This factors can cause risks of over or underestimate the real prevalence of this condition[49]. The literature considers the polysomnography exam as the "gold standard" for the diagnose of sleep bruxism and clenching, however is a suitable technique only for small samples due to high cost and limited availability[49], which compromises its use in larger samples studies, as the present one.

When emotional factors were analyzed, it was observed an elevated prevalence of self reported

emotional stress (82.5%) and anxiety (40.3%). Depression was present in 10.6% of the sample. These results are in agreement with previous studies which have also demonstrated elevated prevalence of emotional factors in this population[24,26,32,33]. Guhur et al.[26] assert that the moment of college entrance examination usually coincides with the turbulent period of life that is adolescence, and the professional decision usually generates anxiety. In addition, factors such as family interference, social pressure and the absence of a realistic view about certain areas of knowledge or professions may contribute to elevate the emotional tension and anxiety[26,32,33]. The low prevalence of depression reflects the greater role of tension and stress events in the evaluated sample, as demonstrated in previous studies[24,26,32,33]. It is noteworthy that in this study the evaluation of the presence of emotional stress was determined from an objective question related to their presence/absence directed to volunteers. This data should be analyzed with caution, since that emotional tension is subjective by nature. This type of evaluation was choosen due to the absence of more specific and precise instruments to evaluate this emotional component.

Several studies have shown a significant association between different emotional factors and the presence of signs and symptoms of TMD[9,11,13,14]. In this study, the report of emotional stress was statistically associated with the presence of TMD symptoms and the need for treatment (DMF index). These findings were consistent with other studies performed in various populations[17,28]. It is believed that stress can affect biological processes related to the transmission and perception of pain, promoting chronic muscular hyperactivity, which in turn can damage the TMJ and related structures, in addition to contributing to the creation and evolution of parafunctional habits[8,50].

Several studies have also shown a significant correlation between anxiety and depression and the presence of signs and symptoms of TMD[11,12,15,28,29]. Corroborating these results, data showed that anxiety was statistically associated with the presence of TMD signs and symptoms (DMF index or simplified clinical examination) and the need for treatment (DMF index). Similarly, Karibe et al.[45] showed a significant correlation between anxiety and the presence of TMD symptoms in a population of Japanese children and adolescents.

The depression results showed a significant correlation only with the "treatment need". According to Fonseca et al.[33], patients who are needing treatment represents an increased severity of TMD symptoms, making therapeutic intervention necessary. This result may suggest that depression plays a significant role in the progression and severity of this disorder, corroborating several studies in the literature[10,12,15,28,29,50]. However, in light of the limitations of this study design, it is difficult to determine whether depression was responsible for the development of more severe TMD or whether it is caused by the symptoms of the disorder.

When we analyzed the QL data, we observed that volunteers with the signs and symptoms of TMD (DMF index or simplified clinical examination protocol) presented higher OHIP-14 scores than volunteers without signs and symptoms, suggesting that this disorder negatively impacts the OHRQL. These results are consistent with several other studies that showed significantly higher OHIP-14 scores in patients with TMD than in asymptomatic individuals[19,21,23].

The DMF index data showed that volunteers needing treatment had higher OHIP-14 scores than patients who did not need treatment; furthermore, as the severity of TMD signs and symptoms increased (determined by reported symptoms), greater was the impact on OHRQL, which is consistent with previous studies[21-23]. A study performed on university students showed that the main complaint by volunteers with severe TMD is pain, which plays a significant role in psychosocial behavior and QL[23]. A recent systematic review also showed strong evidence that pain negatively impacts OHRQL in TMD patients[22].

When results from the simplified clinical examination protocol were evaluated, volunteers with a clinical sign of TMD had OHIP-14 scores that were statistically higher than those of patients without clinical signs, with the highest scores belonging to the group with signs of both articular and muscular TMD, followed by the group with signs of muscular TMD. These data support the claim that individuals with both articular and muscular signs presented an increased severity of TMD[23] and thus have a more severely impacted QL[21,22,51]. The higher OHIP-14 scores in the group with signs of muscular TMD is supported by the clinical observation that these individuals had more painful symptoms than individuals with clinical signs of articular TMD[19,22,51].

Regarding the seven OHIP-14 domains, physical pain was the most affected in groups with clinical signs of articular, muscular, and mixed

TMD. Similarly, several studies have also shown an increased harm in the physical pain domain in several populations, reinforcing the role of pain in the QL of individuals with TMD[21-23,51].

The data in this study presented a high prevalence of TMD signs and symptoms in college preparatory students, with a large portion in need of treatment. In addition, the negative impact of this disorder on OHRQL was evident. Among the associated factors, female gender, parafunction, and anxiety played a great role. These data indicate the need teachers and students being informed about TMDs signs and symptons and its possible link to parafunctional habits and emotional factors to improve early detection and to prevent the problem, which directly affects prognosis and the efficacy of treatment.

The elevated prevalence of self-reported emotional stress and anxiety, observed in this study reinforces the evidence of great emotional burden of which the college preparatory students are submitted, and these were statistically associated with the presence of signs and symptoms of TMD, which can suggest that this population is submitted to important risk factors for the development and progression of this disorder. Guhur et al.[26] states that there is a necessity for vocational guidance service and psychological counseling to adolescents in schools, so that they can go through this period of difficult choices. Finally, it is also suggested to include other health professionals in these services such as dentists and physicians, allowing the early diagnose and management of conditions that can be aggravated or initiated during this period, as TMD.

In addition, these data, in addition to numerous other studies, which have shown high prevalence of TMD in different age ranges[3,7,9,12,15,21,23,27,30], suggests the need for "Temporomandibular Dysfunction and Orofacial Pain" services into the public health service, especially into the Centro de Especialidades Odontológicas – CEO (Centers of Dental Specialists). Treatment centers for TMD patients financially supported by the Sistema Único de Sáude (Brazilian National Health System) are scarse, and generally restricted to training centers and/or research institutions (universities or dental schools). The inclusion of this knowledge area may improve the access to comprehensive dental care to a larger portion of the population that suffers from the signs and symptoms of this disorder, preventing more severe complications and improving their quality of life.

Collaborations

MR Paulino and VG Moreira participated in the study conception and design, collected and analyzed data, and reviewed the manuscript; GA Lemos, PLP Silva and PRF Bonan contributed to the statistical analysis, interpretation of the data, and manuscript review. AUD Batista supervised all the project phases, from conception and design to data collection, data analysis, and writing and revising the final manuscript. All of the authors read the final manuscript and approved the final version.

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