Temporomandibular Disorders in a Young Adolescent Brazilian Population: Epidemiologic Characterization and Associated Factors

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Aims: To carry out an epidemiologic characterization of the most common subtypes of temporomandibular disorders (TMD) and to identify associated factors in a Brazilian sample of young adolescents. **Methods:** From a population of public schoolchildren (12 to 14 years of age), 3,117 students were randomly invited to participate in this study. TMD was assessed according to the Research Diagnostic Criteria for TMD (RDC/TMD) Axis I, in addition to some questions of the Axis II history questionnaire. The associated factors, ie, difficulty with concentration/attention, anger, sadness, anxiety, headache complaints, oral parafunctions, diurnal jaw clenching, tooth grinding at night, and parents not living together, were assessed based on the responses of the adolescents and their parents to structured questions. For the statistical analyses, descriptive statistics, chi-square tests, odds ratio, and logistic regression models were used, adopting a 95% confidence interval and 5% level of significance. **Results:** The sample consisted of 1,307 individuals (response rate of 41.9%), 56.8% (n = 742) girls. Overall, 397 (30.4%) adolescents presented with TMD, of whom 330 (25.2%) had painful TMD diagnoses. The majority of these had painful TMD of muscular origin (13.1%) and comprised chronic cases (14.9%). Girls presented higher frequencies of TMD overall, painful TMD, painful combined TMD, and chronic painful TMD diagnoses The final multivariate logistic regression model revealed that headache complaints (odds ratio 2.87; confidence intervals 2.21–3.72), oral parafunctions (2.08; 1.26–3.44), tooth grinding at night (2.05; 1.56–2.70), diurnal jaw clenching (1.96; 1.50–2.55), and parents not living together (1.38; 1.07–1.80) were the factors significantly associated with a TMD (overall) diagnosis. **Conclusion:** About 25% of the adolescents evaluated presented painful TMD, and the majority of these comprised muscular and chronic cases. Some factors, such as reports of headache complaints, oral parafunctions, tooth grinding at night, and parents not living together, were associated with this condition among young Brazilian adolescents. Special attention should be given to these factors among adolescents with TMD. *J Oral Facial Pain Headache 2015;29:242–249. doi: 10.11607/ofph.1262*

Keywords: *adolescents, epidemiology, prevalence, temporomandibular joint disorders*

Over the years, temporomandibular disorders (TMD) have been the focus of interest in many epidemiologic surveys. In general, high prevalence rates of TMD, varying from 21.5% to 51.8%, have been reported among adults.[1–4] Although there have been few studies of TMD in children and adolescents, the prevalence of TMD pain has been reported to be lower than in adult populations and to vary from 2% to 7%.[5–8] Two recent studies have shown prevalence rates of TMD signs and symptoms varying from 33.2% to 35.0%.[9,10]

Aside from the small number of epidemiologic studies about the TMD prevalence in children and adolescents, there is also a lack of information regarding associated factors. Some parafunctional activities, psychological factors, and structural factors have been suggested as possible risk factors for TMD in children and adolescents.[8,11–18]

TMD is a common condition in the adult population, but signs and symptoms of TMD may arise during adolescence and continue into

adulthood.[15,19–22] Therefore, to better control TMD signs and symptoms, as well as prevent the development of chronic pain related to TMD, it is important to clarify its characteristics and associated factors during childhood and adolescence. Thus, the aim of this study was to carry out an epidemiologic characterization of the most common subtypes of TMD and to identify associated factors in a Brazilian sample of young adolescents. It was hypothesized that TMD is a prevalent condition among Brazilian adolescents and is significantly associated with personality characteristics, headache complaints, and oral behaviors.

Materials and Methods

This study received full approval of the Research Ethics Committee of Faculdade de Odontologia de Araraquara, UNESP—Univ Estadual Paulista (Process #70/10).

Study Design

This was a cross-sectional study conducted on a large sample of adolescents (12 to 14 years of age) recruited in the city of Araraquara, São Paulo, Brazil.

For sample size calculation, a prevalence ratio of 2% to 7% of TMD pain was considered, based on the international literature of TMD among adolescents.[5–8] The study was exploratory and the statistical planning ensured a sufficient number of participants with TMD. According to the Municipal and State Education Departments, there were 7,172 children enrolled in the city of Araraquara, distributed among 24 schools. Thus, the estimated sample would have 1,005 participants. Considering an absenteeism of 20%, the estimated final sample size was 1,257 individuals.

The adolescents were invited to participate in the research after a brief explanation about TMD and the aims of the study. They also received written instructions: a general presentation about the project, an educational folder about TMD, a sociodemographic questionnaire for parents about the family and the adolescent, and a form of free and informed consent for the parents or the legal guardian to sign. Overall, 3,117 letters were distributed and 1,307 healthy adolescents participated in the study (response rate of 41.9%).

Data Collection

Questionnaire for parents' and adolescents' interview. Through the questionnaire answered by the parents or legal guardians, assessments were made of the sociodemographic status, household income per month, educational level of the main financial contributor of the family, and the marital status of the adolescents' parents. Moreover, objective questions about the adolescents' personality and behavior were asked as follows (indicating answers should be "yes" or "no"):

- "Has your son's/daughter's teacher ever mentioned whether he/she presents any difficulty with concentration/attention during the class?"
- "Do you notice that your son/daughter is frequently angry?"
- "Do you notice that your son/daughter is frequently sad?"
- "Do you notice that your son/daughter is anxious?"

The adolescents' interview assessed gender, age, self-declared ethnicity, and menarche. Additionally, they answered the following questions (yes/no):

- "During the last 6 months have you had a problem with headaches or migraines?"
- "Do you usually bite your nails/pen/lips, chew gum, or lay your chin on your hands?"
- "During the day, do you grind your teeth or clench your jaw?"
- "Have you been told, or do you notice, that you grind your teeth or clench your jaw while sleeping?"

TMD Assessment. TMD diagnoses and classification were obtained using the Portuguese version of the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) Axis I,[23,24] which was applied to all participants. To facilitate the TMD diagnoses, some Axis II questions were also applied: #3 ("Have you had pain in the face, jaw, temple, in front of the ear, or in your ear in the past month?"), #4 ("How long ago did your facial pain begin for the first time?"), and #14 ("Have you ever had your jaw lock or catch so that it would not open all the way?"). Afterward, diagnostic categories were defined, as follows:

1. Considering TMD presence:
   –No TMD (absence of Group I, II, or III diagnoses)
   –TMD overall (any painful and/or nonpainful TMD diagnosis)
2. Considering painful TMD presence:
   –Nonpainful TMD (Group II or Group IIIc)
   –Painful TMD (Group I and/or Group IIIa/b)
3. Regarding painful structures involved:
   –Painful joint TMD (Group IIIa/b combined or not with Group II)
   –Painful muscular TMD (Group I combined or not with Group II or IIIc)
   –Painful combined TMD (Group I combined with Group IIIa/b, and/or Group II)

Table 1 Sample Sociodemographic Data

	Boys	Girls	Total	*P*
Study sample, n (%)	565 (43.2)	742 (56.8)	1,307 (100.0)	–
Mean age (SD), y	12.75 (0.733)	12.69 (0.684)	12.72 (0.706)	.121
Ethnicity, n (%)				
Caucasian	372 (65.8)	507 (68.3)	880 (67.3)	.519
Afro-Brazilians	30 (5.3)	43 (5.8)	73 (5.6)	
Mulattos	160 (28.3)	190 (25.6)	350 (26.8)	
Asians	2 (0.4)	2 (0.3)	4 (0.3)	
Household income per month, n (%)				
Lower than US$510	297 (52.3)	405 (54.6)	702 (53.7)	.503
Between US$510 and US$1,530	233 (41.2)	283 (38.1)	516 (39.5)	
Between US$1,530 and US$3,825	15 (2.7)	24 (3.2)	39 (3.0)	
Between US$3,825 and US$7,650	0 (0.0)	1 (0.1)	1 (0.1)	
Over US$7,650	0 (0.0)	0 (0.0)	0 (0.0)	
Did not answer	20 (3.5)	29 (3.9)	49 (3.7)	
Education level of the major financial contributor of the family, n (%)				
Never attended school	7 (1.2)	17 (2.3)	24 (1.8)	.592
Elementary school	244 (43.2)	320 (43.1)	564 (43.2)	
High school	265 (46.9)	348 (46.9)	613 (46.9)	
University	32 (5.7)	43 (5.8)	75 (5.7)	
Did not answer	17 (3.0)	14 (1.9)	31 (2.4)	
Adolescent's parents live together, n (%)				
Yes	342 (60.5)	453 (61.0)	795 (60.8)	.872
No	210 (37.2)	273 (36.8)	483 (37.0)	
Did not answer	13 (2.3)	16 (2.2)	29 (2.2)	

P values according to the chi-square test.

4. Regarding the pain duration[25]:
   –Acute painful TMD (less than 6 months)
   –Chronic painful TMD (6 months or more)

Exclusion Criteria

Individuals complaining about toothache, recent facial or head trauma, or difficulty with cognition/communication did not participate in this study.

Pilot Study

A pilot study was conducted on a subsample of 77 adolescents to test-retest reliability of the adolescents' self-reports and the intraexaminer reproducibility of the RDC/TMD diagnostic criteria (kappa statistics). The volunteers' evaluation occurred twice in a 7-day interval.

The test-retest reliability for adolescents' self-reports to the questions mentioned above (adolescent interview) was, respectively, $\kappa = 0.688$, $\kappa = 0.490$, $\kappa = 0.690$, and $\kappa = 0.968$. The reproducibility for the RDC/TMD was $\kappa = 0.884$ for Group I (muscular disorders), $\kappa = 0.529$ for Group II (disc displacements), and $\kappa = 0.795$ for Group III (other joint conditions). Participants from the pilot study were included in the final sample.

Two different researchers conducted the interviews and the examinations. GF was responsible for the interviews and ALFM, a trained examiner, conducted the RDC/TMD physical examination. The two researchers worked in such a way that one did not know the outcome of the procedure performed by the other. They evaluated all adolescents at the schools.

Statistical Analysis

The sample was characterized by the use of descriptive statistics analyzing the sociodemographic data. Chi-square test with a significance level of 5% detected differences between boys and girls and between girls before and after menarche. The odds ratio (OR) with 95% confidence intervals (CI) and a significance level of 5% was used to calculate the association between the TMD diagnoses and sex. The univariate analyses showed significant associations between the studied factors and TMD diagnoses, acute and chronic painful TMD. The 13 variables first selected included ethnicity, sex, education of the major financial contributor of the family, household income per month, parents not living together, difficulties with concentration/attention, anger, sadness, anxiety, headache complaints, oral parafunctions, diurnal jaw clenching, and tooth grinding at night. Finally, the significant variables ($P < .10$) were put into a logistic regression model for a multivariate analysis.

Table 2 Frequencies and Odds Ratios of Diagnostic Categories for Boys and Girls

	Boys (n = 565)		Girls (n = 742)		Total (n = 1,307)			
Diagnostic category	n	%	n	%	n	%	OR (95% CI)	*P*
No TMD	411	72.7	499	67.3	910	69.6	Ref	–
TMD overall (painful + nonpainful TMD)	154	27.2	243	32.7	397	30.4	1.30 (1.02–1.65)	.0337*
Nonpainful TMD	29	5.1	38	5.1	67	5.2	1.08 (0.65–1.78)	.8638
Painful TMD	125	22.2	205	27.6	330	25.2	1.35 (1.04–1.75)	.0262*
Painful joint TMD	13	2.3	20	2.7	33	2.5	1.27 (0.62–2.58)	.6337
Painful muscular TMD	76	13.5	95	12.8	171	13.1	1.03 (0.74–1.43)	.9283
Painful combined TMD	36	6.4	90	12.1	126	9.6	2.06 (1.37–3.10)	.0006*
Acute painful TMD	58	10.3	77	10.4	135	10.3	1.09 (0.76–1.57)	.6985
Chronic painful TMD	67	11.9	128	17.2	195	14.9	1.57 (1.14–2.17)	.0073*

*Significance at $P < .05$; chi-square test.
OR = odds ratio; 95% CI = 95% confidence interval; Ref = reference values.

Table 3 Results of Univariate Analyses for TMD (overall)

		95% CI		
Variable	Odds ratio	LL	UL	*P*
Non-white	1.02	0.79	1.31	.878
Female sex	1.30	1.02	1.65	.033*
Education level of the major financial contributor of the family				
Never frequented school	1.06	0.36	3.06	.921
Elementary school	1.45	0.83	2.53	.194
High school	1.39	0.80	2.43	.247
Household income per month				
Less than US$510	1.99	0.90	4.38	.089*
Between US$510 and $1,530	1.45	0.65	3.22	.366
Parents not living together	1.40	1.10	1.79	.006*
Difficulties with concentration/attention	1.34	1.04	1.72	.025*
Anger	1.55	1.22	1.96	< .001*
Sadness	1.17	0.87	1.59	.306
Anxiety	1.46	1.09	1.96	.012*
Headache complaints	3.42	2.67	4.28	< .001*
Oral parafunctions	2.85	1.77	4.6	< .001*
Diurnal jaw clenching	2.36	1.84	3.01	< .001*
Tooth grinding at night	2.23	1.73	2.87	< .001*

*Variables selected for the logistic regression model ($P < .10$).
CI = confidence interval; LL = lower limit; UL = upper limit.

Results

Table 1 describes the sample sociodemographic data. The majority of the participants were Caucasian (67.3%; n = 880) and female (56.8%; n = 742), of whom 80.7% (n = 599) had experienced menarche. The mean age of the total sample was 12.72 (0.706 SD) years. There were no statistical differences between boys and girls or between girls before and after menarche regarding age and ethnicity. The same applied to household income per month, educational level of the main financial contributor, and parents living together. The analysis excluded the absence of answers.

Overall, 397 (30.4%) adolescents presented with TMD, of which 25.2% were painful and 5.2% nonpainful TMD diagnoses. The majority of the TMD pain diagnoses were of muscular origin (13.1%). Overall, 10.3% of participants presented with acute painful TMD, whereas 14.9% presented with chronic painful TMD. The differences observed between boys and girls are shown in Table 2. Girls presented higher frequencies of TMD overall, painful TMD, painful combined TMD, and chronic painful TMD diagnoses. No significant differences were observed between girls before and after menarche.

Tables 3 and 4 present the results of the univariate analyses, taking the adolescents with no TMD as reference for comparisons (n = 910). Table 5 presents the final multivariate logistic regression model, demonstrating that parents not living together, diurnal jaw clenching, tooth grinding at night, oral parafunctions,

Table 4 Results of Univariate Analyses for Acute and Chronic Painful TMD

	Acute painful TMD				Chronic painful TMD			
	Odds	95% CI			Odds	95% CI		
Variable	ratio	LL	UL	*P*	ratio	LL	UL	*P*
Non-white	1.04	0.85	1.27	.725	0.96	0.80	1.14	.604
Female sex	1.09	0.76	1.58	.631	1.57	1.14	2.17	.006*
Education level of the major financial contributor of the family								
Never attended school	3.17	0.42	24.12	.266	0.86	0.22	3.44	.836
Elementary school	4.71	1.12	19.79	.034*	1.14	0.57	2.26	.712
High school	4.28	1.02	17.97	.047*	1.12	0.57	2.22	.747
Household income per month								
Less than US$510	1.38	0.48	4.01	.552	1.96	0.68	5.66	.213
Between US$510 and $1,530	0.87	0.29	2.57	.795	1.44	0.49	4.19	.508
Parents not living together	1.60	1.11	2.31	.013*	1.19	0.86	1.64	.299
Difficulties with concentration/attention	1.54	1.06	2.25	.024*	1.38	1.00	1.92	.053*
Anger	1.67	1.16	2.40	.006*	1.51	1.10	2.06	.010*
Sadness	1.26	0.80	1.98	.312	1.18	0.80	1.76	.404
Anxiety	1.46	0.92	2.32	.106	1.83	1.21	2.79	.004*
Headache complaints	3.86	2.61	5.69	< .001*	5.98	4.16	8.58	< .001*
Oral parafunctions	1.80	0.94	3.42	.075*	5.02	2.18	11.55	< .001*
Diurnal jaw clenching	2.10	1.45	3.03	< .001*	3.42	2.49	4.70	< .001*
Tooth grinding at night	2.51	1.73	3.65	< .001*	2.58	1.87	3.56	< .001*

*Variables selected for the logistic regression model ($P < .10$).
CI = confidence interval; LL = lower limit; UL = upper limit.

Table 5 Results of Multivariate Analyses for Diagnosis of TMD (overall), Painful Acute TMD, and Painful Chronic TMD

Variables from the final logistic regression model	Coef	SE	Coef/SE	Odds ratio	95% CI LL	95% CI UL	*P*
TMD (overall)							
Intercept	–2.64	0.27					< .001
Parents not living together	0.32	0.13	2.46	1.38	1.07	1.80	.015
Diurnal jaw clenching	0.67	0.13	5.15	1.96	1.50	2.55	< .001
Tooth grinding at night	0.72	0.14	5.14	2.05	1.56	2.70	< .001
Oral parafunctions	0.73	0.26	2.81	2.08	1.26	3.44	.004
Headache complaints	1.05	0.13	8.08	2.87	2.21	3.72	< .001
Acute painful TMD							
Intercept	–3.26	0.21					< .001
Parents not living together	0.50	0.20	2.50	1.65	1.12	2.42	.011
Diurnal jaw clenching	0.62	0.20	3.10	1.87	1.26	2.77	.002
Tooth grinding at night	0.89	0.20	4.45	2.43	1.64	3.61	< .001
Headache complaints	1.21	0.21	5.76	3.34	2.23	5.00	< .001
Chronic painful TMD							
Intercept	–4.33	0.46					< .001
Tooth grinding at night	0.77	0.18	4.28	2.16	1.52	3.07	< .001
Diurnal jaw clenching	0.94	0.17	5.53	2.56	1.82	3.59	< .001
Oral parafunctions	1.34	0.44	3.05	3.81	1.61	9.05	.002
Headache complaints	1.57	0.19	8.26	4.82	3.32	7.00	< .001

Coef = coefficient; SE = standard error; CI = confidence interval; LL = lower limit; UL = upper limit.

and headache complaints were significantly associated with the presence of TMD (overall). The factors significantly associated with acute painful TMD were parents not living together, diurnal jaw clenching, tooth grinding at night, and headache complaints. For chronic painful TMD, the significant factors were tooth grinding at night, diurnal jaw clenching, oral parafunctions, and headache complaints.

Discussion

This study found a 25.2% prevalence rate of painful TMD and identified some associated factors in a 12- to 14-year-old adolescent sample. The nonpainful TMD diagnoses had a low prevalence rate (5.2%). Headache complaints, diurnal jaw clenching, teeth grinding at night, oral parafunctions, and parents not

living together showed a significant association with TMD overall.

Conclusive information about the general prevalence of TMD and its associated features is still difficult to find because published results for both adults and adolescents vary substantially according to research methodologies, population characteristics, and data-collection procedures.[26] Some previous studies have used screening questions for assessing TMD pain among adolescents and have found a prevalence rate of 4.2%[7] and an annual incidence of 2.9%.[6] Other studies that used the RDC/TMD also reported low prevalence rates of TMD pain: 4%[8] and 7%.[5] The age range of the participants has varied among the studies, which also makes it difficult to compare their outcomes.[5–7,10,27,28]

The explanation given to adolescents about the aims of the research and TMD during the invitation procedure was a requirement of the Research Ethics Committee and might have caused a bias that must be taken into account, considering the high prevalence rate of TMD pain (25.2%) in the study. It is not possible to affirm whether the subjects were casually interested in participating or whether they did so because they had previously noticed the symptoms mentioned by the researchers (eg, headaches, joint sounds, facial pain, and limitation of movements).

In agreement with previous studies,[5,9,11,29] painful muscular TMD was the most frequent diagnosis. The low prevalence of nonpainful TMD diagnoses (5.2%) corroborates a previous report of 5% of disc displacement in 12- to 16-year-old adolescents[16] but contrasts with other studies in which TMJ sounds were the most frequent symptom of TMD in adolescents.[9,10,12,17,28,30,31]

The univariate analysis showed associations between sex and TMD, ie, girls presented higher frequencies of TMD overall, painful TMD, painful combined TMD, and painful chronic TMD diagnoses. However, in the multivariate analysis, these associations disappeared. Significant associations between sex and painful TMD have been reported in other studies involving adolescents,[6,8,13,32,33] but this was not observed in this study. The present results are in agreement with a previous Brazilian study, which observed associations between TMD and female gender but not with menarche.[8] As the age of the present sample was limited (12 to 14 years of age), girls may have been assessed around a similar pubertal stage, irrespective of their menarche.[33] The risk of developing pain seems to be increased by the presence of reproductive hormones during puberty in girls.[33] However, up to the present time, there is still a lack of evidence to show how sex hormones can affect sensory processing in the trigeminal system, especially during adolescence, although recent studies have shown that sensory function and reflex responses in the trigeminal region differed depending on sex and age in adults.[34,35] In the future, these different physiologic responses should be investigated among children and adolescents.

Pain is known to be a complex phenomenon that can be influenced by biological, behavioral, and sociocultural factors.[5] A multifactorial etiology for TMD is assumed, and this highlights the importance of identifying and studying possible associated factors.[36]

The association between TMD and headaches in adolescents has been demonstrated previously.[5,9–11,13,19,31,37–39] As mentioned in a recent study,[37] it is difficult to detect the reason for the cited association. It is known that TMD can be a cause of secondary headaches[40] but may also be a comorbidity of some primary headaches[41–43] among adolescents as well as adults.[44] Nevertheless, no predictable relationship between these conditions has yet been established.[32]

As in other studies,[17,22,27] oral parafunctions presented significant associations with TMD in the present study. Adolescence involves extensive psychosocial changes,[6] and oral parafunctions may increase during puberty because there is an increase in life stressor events.[30] The reports of diurnal jaw clenching and tooth grinding at night that were also associated with TMD diagnoses corroborate the findings from previous studies.[31,45,46]

The present study also showed that having parents who do not live together was significantly associated with adolescents having TMD; this association may arise because of increased emotional stress. As recently observed in the OPPERA (Orofacial Pain: Prospective Evaluation and Risk Assessment) Cohort Study, several psychological variables have predicted the increased risk of first onset of TMD, and these variables included somatic symptoms, psychosocial stress, and affective distress among adults.[47]

The important strengths of the present study included the relatively large sample size and the methodology for assessing TMD. The assessment was conducted by a single trained examiner using the RDC/TMD Axis I.[24] This instrument has also been reliably used in other studies with adolescents.[8,16,48–50] The authors carefully selected a small age range (12 to 14 years of age) in order to homogenize the sample regarding the subjects' hormonal maturity and body development. The study did have some limitations. The person responsible for conducting the RDC/TMD evaluations was not calibrated against a gold standard RDC/TMD examiner, and the assessment of the associated factors was based only on self-reports. The authors were also aware of the limited sample representativeness once only public schools were selected to participate in the present study.

As TMD is a fluctuating disorder, there is a need for high-quality longitudinal studies to better examine the etiologies and mechanisms underlying these associations in children and adolescents.[8,51] The vast majority of studies have a cross-sectional design, and this constitutes a limitation for determining cause and effect relationships.[36] As previously suggested, reliable assessment of etiologic factors for TMD pain in childhood and adolescence could help to prevent these disorders in adulthood.[6] Moreover, the identification of associated factors is important, as exposure to various factors together may act synergistically.[14] There is a need for a broader approach to TMD in adolescents, since the factors significantly associated with this condition in the present study can be easily identified during a simple anamnesis procedure. Health professionals and parents should be aware of these potential associations.

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