Temporomandibular Disorders and Associated Factors in Brazilian Teenagers: A Cross-Sectional Study

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Purpose: This study aimed to assess the prevalence of temporomandibular disorders (TMD) and associated variables among adolescents from 16 to 18 years of age in their senior year of high school in the city of Recife, Pernambuco, Brazil, in 2005. ***Materials and Methods:*** The studied variables were gender, self-esteem and nervous behavior, type of occlusion, and use of orthodontic appliances. In this cross-sectional study, the nonpatient population comprised 410 adolescents attending private and state schools. The data collection was conducted using 2 questionnaires, the first of which was used to evaluate the prevalence of TMD and the second to assess self-esteem. A clinical examination was conducted for the occlusion aspect of the evaluation. ***Results:*** The prevalence of TMD was 16.3% in the study group and there was no statistical difference between occlusions judged as normal or as malocclusions ($P = .1148$). There was a statistically significant association between students who had previously undergone orthodontic treatment and TMD ($P = .0033$, odds ratio: 3.08). The students classified in the low self-esteem group showed a significant increase in TMD ($P = .0140$). The group that classified themselves as nervous also showed an increase ($P = .0034$), with a higher prevalence also found in females ($P = .0021$). ***Conclusions:*** This study suggests that low self-esteem and gender may be more frequently related than dental factors to TMD in adolescents. *Int J Prosthodont 2007;20:599–605.*

Temporomandibular disorders (TMD) is an all-inclusive term referring to a heterogeneous group of psychophysiologic disorders with the common characteristics of orofacial pain, masticatory dysfunction, or both.[1] Carlsson[2] reported that 93% of the general population showed some kind of TMD, with 5% to 13% of the patients exhibiting clinically significant symptoms such as pain or severe dysfunction. Epidemiologic studies have shown that TMD is common in adolescents.[3] In Japan, the signs and symptoms of TMD were evaluated in 160 students aged 12 to 14 years and 480 students aged 15 to 17 years in a 2-year follow-up study. It was found that 31% of the 12-to-14-year-old students and 39.6% of those aged 15 to 17 years presented 1 or several signs of TMD.[4]

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Even though no clear causal relationship between TMD and a particular risk factor has been identified, several factors have been reported to be associated with TMD. MacNamara et al[5] reported that some morphologic malocclusions could increase the risk of TMD. Malocclusion has been associated with morphologic changes in the temporomandibular joint (TMJ), particularly when combined with age. This evidence supports the belief that longer exposure to malocclusion may be associated with more extensive TMJ changes.[6] According to this theory, functional and morphologic malocclusion causes TMD, and the achievement of an ideal occlusion through orthodontic or occlusal adjustment should eliminate pain and dysfunction.[7] On the other hand, orthodontic therapy as a possible TMD etiologic factor has been the subject of controversy, especially after a lawsuit in which orthodontic treatment was considered the main cause of pain.[8] The deleterious effects of orthodontic mechanics in the stomatognathic system are said to result from a new occlusal design.[9,10]

In children and adolescents, investigations have shown a significant association between emotional factors and signs and symptoms of TMD.[11–14]

Adolescence is characterized by young people's need to become part of the adult world. It has in fact often been characterized as a time of confusion and ambiguity.[15] The existential conflicts inherent in this period of human development and the social pressure concerning the choice of profession may affect self-esteem.

It is therefore important that children and adolescents with recurrent pains be carefully evaluated and offered access to treatment to prevent the development of long-term pain, emotional problems, or disabilities in adulthood.

Thus, this study aimed to evaluate TMD in preuniversity adolescents and its relationship with self-esteem, malocclusion, and orthodontic treatment.

Materials and Methods

Subjects in this study were from public and private schools in Recife, Pernambuco, Brazil. Both the subjects and the schools were randomly selected. The study comprised 486 teenagers, of whom 280 (57.6%) were from private schools and 206 (42.4%) were from public schools. The subjects were aged between 17 and 18 years and were preparing for admission to university. The study was approved by the Ethics Committee of the University of Pernambuco. The parents or guardians and adolescents were informed about the purpose of study and signed the informed consent document. The study was carried out over a 2-month period. The clinical examinations were conducted by a single calibrated examiner. For calibration purposes, 45 subjects were examined and reexamined after a 1-week interval (kappa = 0.933).

The adolescents were given a self-esteem questionnaire, a self-report questionnaire of TMD and state of emotion, a clinical TMD examination, and an intraoral occlusion examination.

The global negative self-evaluation (GSE)[16] was used to evaluate psychologic status. GSE was constructed for use with all students irrespective of age. The GSE scale consists of the following items: *(1)* At times I think I am no good at all; *(2)* I feel I do not have much to be proud of; *(3)* I certainly feel useless at times; *(4)* All in all, I am inclined to feel I am a failure; *(5)* I would like to change many things about myself; *(6)* I have often wanted to be someone else. To classify self-esteem, each question had 6 answers that scored from 1 to 6, and the sum was divided by 6. Results ranging from 2.7 to 6 indicated a low self-esteem. A high score indicates a high level of negative self-evaluation.

The subjects were examined in habitual occlusion. Occlusion was classified as either normal occlusion or malocclusion (Angle Class I, Class II, or Class III[17]). Normal occlusion was classified based on 4 of the 6 keys defined by Andrews[18]: bilateral anteroposterior molar Class I; bilateral canine Class I; overjet (2 to 3 mm); no spacing or crowding; deep bite 2 to 3 mm; and no teeth rotation. Malocclusion was classified when the subject had Class II or Class III malocclusion or had one of the following problems: space anomalies (spacing $>$ 2 mm and/or crowding $>$ 2 mm), maxillary overjet $>$ 6 mm, mandibular overjet $>$ 0 mm, deep bite ($>$ 5 mm), open bite ($<$ 0 mm), or posterior crossbite ($>$ 2 mm).

There was no attempt to assess the reason why adolescents had orthodontic treatment or whether there were any TMD symptoms prior to treatment. The subjects were only asked whether they or not they had been treated.

The subjects were asked to answer an anamnestic questionnaire based on the Helkimo index and validated for Portuguese by Fonseca et al,[19] at a 5% level of significance. The questionnaire had 10 questions about the presence of the most common TMD symptoms: *(1)* Do you have difficulty opening your mouth? *(2)* Do you have difficulty moving or using your jaw? *(3)* Do you have tenderness or muscular pain when chewing? *(4)* Do you have frequent headaches? *(5)* Do you have neckaches and/or shoulder pain? *(6)* Do you have pain in or around the ears? *(7)* Are you aware of noises in your jaw joints? *(8)* Do you consider your bite "normal"? *(9)* Do you use only one side of your mouth to chew? *(10)* Do you consider yourself a nervous person? In an analogic scale from 0 to 10, 0 stands for "not nervous" and 10 for "very nervous." The answer "Yes" = 10 points, "Sometimes" = 5 points, and "No" = 0 points. The sum of the scores for the 10 responses was used to classify the students in 4 categories: 0 to 20 points = TMD free; 21 to 30 points = mild TMD; 31 to 40 points = moderate TMD; 41 or more points = severe TMD.

The presence of noise and joint pain was detected during TMJ palpation performed bilaterally. Palpation was performed at a standardized pressure of approximately 1,500 g calibrated with an algometer according to Conti et al.[20] This was performed by the same examiner using the middle finger, with soft but firm pressure maintained for 2 seconds. A painful sensation was detected by the adolescent's response. There was no attempt to differentiate the levels of pain, only the presence or absence of symptoms.

To avoid examiner bias during the occlusal analysis and muscle palpation, results of the anamnestic scoring were not available to the examiner before the clinical examination.

Statistical Analysis

The chi-square test and Fisher exact test were used for analysis of differences between variables, and bivariate logistical regression was used to identify the asso-

Table 1 Association Between TMD and Gender, Self-esteem, and State of Emotion

Variable	TMD		No TMD		Total			
	n	%	n	%	n	%	*P**	OR[2] (95% CI)[†]
Gender								
Male	14	9.1	140	90.9	154	100.0	.0021	1.00
Female	53	20.7	203	79.3	256	100.0		2.61 (1.39–4.89)
Total	67	16.3	343	83.7	410	100.0		
Self-esteem[‡]								
Low	28	23.3	92	76.7	120	100.0	.0140	1.96 (1.14–3.38)
High	38	13.4	245	86.6	283	100.0		1.00
Total	66	16.4	337	83.6	403	100.0		
State of emotion								
Yes	43	21.9	153	78.1	196	100.0	.0034	2.22 (1.29–3.83)
No	24	11.2	190	88.8	214	100.0		1.00
Total	67	16.3	343	83.7	410	100.0		

*Pearson chi-square test.
[†]OR was extracted from positive cases and line 1.00 was the base. The interval for OR excludes the 1.00 value.
[‡]Seven cases had no information available related to self-esteem.

ciated factors, observing the odds ratio (OR) and confidence intervals (CI) of 95%. A multivariate logistic regression model was constructed in which only those variables that had statistical significance were taken into account ($P < .20$). A dichotomic test was preformed for the dependent variable. The level of probability chosen was 20%, which aimed to avoid the exclusion of important variables from the regression model. A *P* value of .15 to .20 has been highly recommended.[21] The interval for OR excludes the 1.00 value.

Results

The anamnestic data from the TMD questionnaire revealed that 16.3% of the sample presented TMD and 83.7% were free of TMD. This analysis comprised 410 subjects aged 16 to 18 years, of whom 154 (37.6%) were males and 256 (62.4%) were females.

When comparing the prevalence of TMD between genders, there was a statistically significant difference ($P = .0021$, OR = 2.61). TMD was associated with psychologic variables—self-esteem and reported state of emotion—which showed statistically significant associations ($P = .0140$, OR = 1.96; $P = .0034$, OR = 2.22, respectively) (Table 1). Adolescents with low self-esteem had a higher prevalence of TMD than those with high self-esteem.

Thirty-five subjects had been previously exposed to orthodontic treatment (8.5%). Orthodontic treatment, when associated with TMD, showed a statistically significant association (Table 2). The prevalence of TMD symptoms was higher in orthodontically treated adolescents than in untreated ones. Regarding occlusal factors, 5% had anterior open bite, 5% had posterior crossbite, 49.8% presented normal occlusion, and 50.2% had some kind of malocclusion. No statistical differences were found in the association of TMD with malocclusion or normal occlusion (Table 2).

During the clinical examination, joint noises were detected in 27.3% of the subjects. During the palpation procedures, 21.5% of the subjects presented TMJ tenderness. The association between joint noises, joint tenderness, and TMD was statistically significant (Table 3).

Discussion

TMD are frequently encountered and may be regarded as a challenge for the health team. In the present study, 16.3% of nonpatient adolescents were diagnosed with a TMD, a figure comparable to previous studies. Deng et al[22] reported a prevalence of 17.9% among Chinese adolescents, while in Japan, Motegi et al[23] reported a 12.2% occurrence in children and adolescents aged between 6 and 18 years in a cross-sectional study. Morinushi et al[24] found a higher number of TMD signs and symptoms among 160 Japanese students aged 12 to 14 years and 480 students aged 15 to 17 years during a 2-year follow-up observation period, and 39.6% of the students aged 15 to 17 years presented one or several TMD signs/symptoms. This corroborates the results from other studies.[13,20,25,26] A lower prevalence of TMD of 8.4% was reported in Israel by Katz and Heft.[27] List et al[28] reported a prevalence of only 7% in Swiss adolescents. Nilsson et al[29] observed a prevalence of 4.2%. The statistical differences between the various studies are probably the result of different indices and evaluation techniques employed.

The prevalence of TMD in the present study was higher in females than in males ($P = .0021$), which is in agreement with earlier studies.[28–31] Although this gen-

Table 2 Association Between TMD and Type of Occlusion, Orthodontic Treatment, Anterior Open Bite, and Posterior Crossbite

	TMD		No TMD		Total			
Variable	n	%	n	%	n	%	*P**	OR[2] (95% CI)
Type of occlusion								
Normal	6	30.0	14	70.0	20	100.0	.1148*	2.31 (0.85–6.25)
Malocclusion	61	15.6	329	84.4	390	100.0		1.00
Total	67	16.3	343	83.7	410	100.0		
Orthodontic treatment								
No	40	12.9	269	87.1	309	100.0	.0033**	1.00
Yes	11	31.4	24	68.6	35	100.0		3.08 (1.40–6.77)†
Total	67	16.3	343	83.7	410	100.0		
Anterior open bite								
Yes	4	18.2	18	81.8	22	100.0	.7688*	1.14 (0.38–3.50)
No	63	16.2	325	83.8	388	100.0		1.00
Total	67	16.3	343	83.7	410	100.0		
Posterior crossbite								
Yes	6	27.3	16	72.7	22	100.0	.2293*	2.01 (0.76–5.34)
No	61	15.7	327	84.3	388	100.0		1.00
Total	67	16.3	343	83.7	410	100.0		
Joint noises								
Yes	30	26.8	82	73.2	112	100.0	.0005**	2.58 (1.50–4.44)†
No	37	12.4	261	87.6	298	100.0		1.00
Total	67	16.3	343	83.7	410	100.0		
Joint tenderness								
Yes	38	43.2	50	56.8	88	100.0	< .0001**	7.68 (4.35–13.56)†
No	29	9.0	293	91.0	322	100.0		1.00
Total	67	16.3	343	83.7	410	100.0		

*Fisher exact test; **Pearson chi-square test.
†The interval for OR excludes the 1.00 value.

Table 3 Logistic Regression Results

	OR (95% CI)		
Variable	Observed (bivariate analysis)	Adjusted (logistic regression)	*P*
Constant			< .001
Gender			
Male	1.00	1.00	.029
Female	2.61 (1.39–4.89)	2.26 (1.09–4.70)	
State of emotion			
Yes	2.22 (1.29–3.83)	2.58 (1.38–4.82)	.003
No	1.00	1.00	
Joint noises			
Yes	2.58 (1.50–4.44)	1.66 (0.88–3.12)	.115
No	1.00	1.00	
Joint tenderness			
Yes	7.68 (4.35–13.56)	8.01 (4.25–15.04)	< .001
No	1.00	1.00	

der difference has never been compellingly explained, Rieder et al[32] reported that women are more health-conscious and seek medical and dental attention more readily than men, while other authors have suggested that women have a higher degree of psychosomatic disease[33,34] and consider life events more stressful than men.[35] Other studies[22,25,27] found no gender differences.

The etiology of TMD is regarded as multifactorial. Factors predisposing to the development of TMD may be divided into systemic, psychologic, and structural malocclusion and other types of occlusal or morphologic discrepancies.[1,5,36] The association between morphologic and functional occlusal disorders in TMD patients has been investigated in many studies,[11,22,31,37] and it

remains a controversial issue. Egermark et al,[38] in a prospective investigation evaluating 402 randomly selected subjects, found signs and symptoms of TMD and associated variables and reported that occlusal factors were not strongly associated with TMD signs and symptoms. In the present study, no statistical differences were detected in TMD between the normal occlusion and malocclusion groups. The similarity in TMD prevalence does not support the role of occlusal factors as a risk factor for the development of this disorder, and other authors[20,37,39–44] have found similar results. However, in other studies,[11,25,31,45–47] malocclusions such as Angle Class II including large overjet, Class III, crossbite, and open bite have been associated with TMD.

There is scientific evidence that orthodontic treatment causes TMD. There is a considerable fluctuation in the signs and symptoms of TMD in adolescents, which reduces the chances of establishing clear associations between orthodontic treatment and TMD.[3,4] Several studies[38,43,48,49] reported no difference in the prevalence of TMD symptoms between untreated and orthodontically treated patients. Egermark et al[44] is also of the opinion that orthodontic treatment in childhood does not entail an increased risk for the development of either signs or symptoms of TMD later in life. However, in this study, the prevalence of TMD symptoms was higher in orthodontically treated adolescents than in the untreated young subjects ($P = .0033$, OR = 3.08). This finding indicates that patients who had received orthodontic treatment were more affected by TMD than those who had not been orthodontic patients, corroborating earlier studies.[25,50]

A number of studies[11,36,51] have shown that TMD is more commonly associated with psychologic factors. In children and adolescents, investigations have shown a significant association between emotional factors and signs and symptoms of TMD.[11–14] The present study supports the results of those who found an association between TMD and psychologic factors. The results showed a statistically significant association between adolescents with low self-esteem and signs and symptoms of TMD ($P < .05$). These results are in disagreement with those of Mohlin et al,[43] who demonstrated the complex nature of the etiology of TMD with the finding that non-TMD women had the lowest levels of self-esteem. Emotional stress is a major complaint nowadays, which can affect general health as well as predispose to and cause muscle contractions and parafunctional habits, increasing the risk of TMD symptoms.

Other studies should be developed using the examination and questionnaire used in this study with patients before and after the admission test to a university to obtain a better correlation between psychologic factors and TMD. The severity of the malocclusion and postorthodontic treatment results should also be considered.

Conclusion

Within the limitations of this study's research design, it appears that factors such as low self-esteem, emotional state, and gender are more frequently related to TMD than dental factors or previous orthodontic treatment.

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