

## Assessment of sleep quality in adolescents with temporomandibular disorders

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### Abstract

**Objectives:** To determine the frequency of temporomandibular disorders and investigate their relationship with sleep quality in 18 and 19-year-old adolescents.

**Methods:** Cross-sectional design; dysfunctions were diagnosed using the Research Diagnostic Criteria for Temporomandibular Disorders and sleep was assessed using the Pittsburgh Sleep Quality Index in 200 students. Data were analyzed by frequency distribution and using the chi-square test and Student's *t* test.

**Results:** 35.5% of adolescents had dysfunctions. The mean total score of adolescents with dysfunctions was 7.34 and 4.76 for adolescents without dysfunctions ( $p < 0.001$ ). 82% of the participants were free from dysfunctions. 17% of those with dysfunctions had good sleep quality.

**Conclusions:** The frequency of dysfunctions was elevated and dysfunctions were associated with poor sleep quality. The study design does not allow it to be determined whether poor sleep quality is a cause or a consequence of TMDs, which can be elucidated in future studies.

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### Introduction

The definition of temporomandibular disorders (TMDs) covers pain in muscles of mastication and/or the temporomandibular joint (TMJ), limited and asymmetrical movement and noises in the TMJ.<sup>1</sup> Prevalence is elevated, but varies depending on the population studied and the diagnostic criterion employed,<sup>2</sup> ranging from 9.8 to 74%.<sup>3</sup> The signs and symptoms of TMDs are common during adolescence, which is a phase that is characterized by intense physical, hormonal, emotional, social and cognitive changes.<sup>4</sup>

Temporomandibular disorders have multifactor etiology, and there are a large number of different associated factors. Malocclusion, parafunctional habits and psychosocial problems,<sup>2</sup> can cause hyperactivity of the muscles of mastication in people with low physiological tolerance, leading to the emergence of TMDs. The degree of tolerance<sup>1</sup> is in turn influenced by general health status, nutrition and quality of sleep.

It has been suggested that puberty is associated with high rates of sleep disorders and that these in turn may be

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related to adolescents' psychological or social problems.<sup>5</sup> Some of these disorders exhibit a tendency to recur within families, but no molecular basis has been identified for the majority of them.<sup>6</sup>

Recent studies indicate that there is an association between sleep disorders and TMDs. An elevated rate of sleep disorders was observed among patients with TMDs.<sup>7</sup> A study conducted in Italy found that a majority of a sample of patients with TMDs complained of poor sleep quality, although few of them met the criteria for diagnosis of a sleep disorder.<sup>8</sup> It is suggested that poor sleep could be an important indicator of a risk of developing TMDs.<sup>9,10</sup> Furthermore, increases in degree of TMD have been related to worsening sleep quality or vice versa.<sup>11</sup>

Sleep plays a vital role in health, and a lack of sleep can predispose people to emergence and maintenance of TMDs. The flip side is that pain, which is prevalent in TMD patients, can compromise sleep. This research was conducted in response to the need for studies that investigate this relationship using reliable diagnostic instruments and including control groups. The objectives of this study were to determine the frequency of TMDs and investigate their relationship with sleep quality in adolescent schoolchildren aged 18 or 19.

## Methodology

This was a cross-sectional study of 18 and 19-year-old adolescents at public and private schools in Belo Horizonte, MG, Brazil, and was approved by the Research Ethics Committee at the Universidade Federal de Minas Gerais (UFMG). Schools with 18 and 19-year-old students enrolled in Secondary Education and whose principals agreed to take part were selected for the study. The inclusion criteria were adolescents of the correct age enrolled in Secondary Education at one of these schools. Adolescents were excluded if they had severe comorbidities, syndromes, orofacial deformities or extensive dental losses that could interfere in the clinical assessment or change the results of the study.

A survey-type study was conducted of 333 students aged 18 or 19. Of these, 11 did not meet the inclusion criteria, 200 took part in the study and gave free and informed consent and 122 did not take part, primarily because they did not consent to participation.

Sleep was assessed using a validated Brazilian Portuguese translation of the Pittsburgh Sleep Quality Index,<sup>12</sup> which was developed to assess subjective sleep quality over the previous month. The scale is self-administrated, comprises 19 questions and has 89.6% sensitivity and 86.5% specificity. Scores greater than or equal to 5 classify sleep quality as poor. The higher the score the greater the degree to which sleep quality is compromised.<sup>13</sup>

The Research Diagnosis Criteria for Temporomandibular disorders (RDC/TMD) use a multi-axis approach: Axis I assesses the clinical conditions of TMDs and offers better diagnostic classifications for research; Axis II assesses chronic pain and depression.<sup>14</sup> Axis I, translated by the International RDC/TMD Consortium's English-Portuguese team<sup>15</sup>, was used to diagnose TMDs in this study. Diagnoses are related to items that are part of the examination, and which are specified in detail, and on the presence of the following principal signs and symptoms: patient complains of pain and there are areas of muscle that are sensitive to palpation; limitations to and/or deviations of jaw opening; joint sounds compatible with displacement of the TMJ articular disc; joint pain, sensitivity and/or crepitus during jaw movement.

The investigator was capacitated to undertake the examinations through a combination of theoretical discussion and training on the RDC/TMD with a specialist in TMD. Twelve adolescent students were recruited from a non-participating school and assessed using the RDC/TMD. These 12 adolescents were diagnosed according to the RDC/TMD and then reassessed 15 days later by the same examiner. The intra-examiner kappa index was 0.867, which indicates excellent agreement between the two assessments.

Interviews and clinical examinations were conducted in rooms provided by the schools, with the subject sitting in front of the examiner. Adolescents were referred to the Centro Universitário Newton Paiva for treatment when required. Students self-administered the PSQI under supervision by an auxiliary who had been trained in advance by the examiner, was blind to the TMD diagnoses and was also responsible for adding up the scores.

Data were analyzed using SPSS for Windows 18.0. The chi-square test was used to analyze qualitative variables to a 95% confidence level. Student's *t* test was used to compare mean PSQI scores.

## Results

A total of 35.5% of the adolescents assessed were diagnosed with some type of TMD and 16.5% of them had myofascial pain, arthralgia or osteoarthritis of the TMJ, or a combination of these diagnoses. Table 1 lists data for the sample relating to age, sex, TMD diagnoses and classification of sleep quality.

Sleep quality was poor in 41% of the adolescents. The mean total score was 5.7 (SD 2.7), the median was 5 and the range was 0 to 14. There was a significant difference between mean scores for subjects with and without TMDs ( $p < 0.001$ ) (Table 1).

There was an association between TMDs and female sex. The odds ratio was 2.73 for a 95% confidence interval, varying from 1.50 to 4.98 times (Table 2).

**Table 1** - Characteristics of the sample in terms of sex, age, sleep quality and diagnoses of TMD

Variable	n	%	Mean score*
<b>Sex</b>			
Female	95	47.5	6.5
Male	105	52.5	4.9
Total	200	100.0	
<b>Age</b>			
18 years	148	74.0	-
19 years	52	26.0	-
Total	200	100.0	
<b>TMD prevalence</b>			
Absent	129	64.5	4.3
Present	71	35.5	7.3
Total	200	100.0	
<b>Sleep quality</b>			
Good	118	59.0	-
Poor	82	41.0	-
Total	200	100.0	
<b>TMD<sup>†</sup> diagnosis groups</b>			
Group 1	15	21.1	-
Group 2	35	49.3	-
Group 3	15	21.1	-
Groups 1 and 2	2	2.8	-
Groups 1 and 3	1	1.4	-
Groups 2 and 3	2	2.8	-
Groups 1, 2 and 3	1	1.4	-
Total	71	100.0	

TMD = temporomandibular disorders.

\* The differences between mean scores are statistically significant for sex and for TMD prevalence (*t* test  $p < 0.001$  in both cases), with higher scores among females and those diagnosed with a TMD.

† Group 1: muscle diagnoses; Group 2: displaced disc diagnoses; Group 3: arthralgia, arthritis and arthrosis diagnoses.

**Table 2** - Bivariate analyses of presence of TMD against sleep quality and sex

	TMD diagnoses		p*
	Absent (n)	Present (n)	
<b>Sleep quality</b>			
Good	106	12	
Poor	23	59	
Total	129	71	< 0.001
<b>Sex</b>			
Female	50	45	
Male	79	26	
Total	129	71	0.001

TMD = temporomandibular disorders.

\* Chi-square test.

The chi-square test indicated an association between TMD and sleep quality ( $p < 0.001$ ) (Table 2). Sleep quality was classified as good by 82% of participants free from TMDs, and by just 17% of those who had TMDs.

## Discussion

Many epidemiological studies have attempted to determine the prevalence of TMDs in different populations. However, the lack of uniformity in terms of methodology makes it difficult to make trustworthy comparisons. In this study, at least one type of TMD was observed in 35.5% of participants. Other studies that have investigated the prevalence of TMDs in adolescent populations found results that differ in magnitude.<sup>2,4</sup> However, all authors report something in common: high prevalence of TMDs, which demonstrates the need to investigate them in adolescents.

People who are diagnosed with myofascial pain, arthralgia and osteoarthritis of the TMJs all suffer from pain. In this study, 16.5% of participants reported this symptom, which can have serious consequences, such as increased analgesic medication consumption, restriction of daily activities, increased numbers of visits to healthcare professionals, absence from school activities, psychosocial problems<sup>4</sup> and sleep disorders.<sup>7</sup>

Another factor observed here was an association between TMDs and female sex. Female adolescents were 2.73 times more likely to have a TMD than male adolescents, which is in line with the results of other investigations.<sup>2,4</sup> This increased incidence can be explained by structural differences in the TMJs of women.<sup>2</sup>

This study investigated the association between sleep quality and TMDs and found a robust relationship between the condition and poor quality sleep, which agrees with almost all of the studies analyzed<sup>7,9-11</sup> and partially disagrees with one study, which used a different instrument to assess sleep.<sup>8</sup>

In this study sleep was investigated subjectively using the PSQI, which does not diagnosis sleep disorders, but, among other applications, indicates sleep quality on the basis of an overall assessment of the previous month. Diagnosis of sleep disorders is dependent on a supplementary test – polysomnography – which provides an objective assessment of sleep.<sup>13</sup> However, this test requires the appropriate physical infrastructure, specialized human resources and a significant financial investment, which makes its use in studies of schoolchildren problematic.

There were significant losses from the study sample. Detailed clinical assessment of the students required a lot of time and was conducted between lessons, in order to avoid compromising the children's education. This may be the cause of a high percentage of the refusals to take part, opening up the possibility of selection bias in the

sample, which could have presented a false picture of the prevalence of TMDs. Nevertheless, the principal objective was to recruit two subsets that could be used to compare sleep quality. Although this level of refusal results in a convenience sample, the number of subjects recruited had sufficient power to define the study objectives, considering the effect size, which demanded a minimum of six adolescents per subset (significance level = 5%, test power = 80%). Furthermore, the sample maintained criteria by which the characteristics relevant to study variables could be controlled.

The results allow for the conclusion that TMD frequency is elevated among the adolescents studied. There was a significant difference between sexes, with female adolescents having a greater likelihood of TMDs.

The prevalence of poor sleep quality was elevated and a relationship was observed between sleep problems and TMDs. However, the cross-sectional study design means that it cannot be determined whether poor sleep quality is a cause or a consequence of TMDs, although this can be elucidated in future studies.

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