

Anxiety and Depression in Adolescents and Their Relationship with Signs and Symptoms of Temporomandibular Disorders

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Purpose: Several clinical studies suggest that psychologic factors may play an important role in the etiology and maintenance of temporomandibular disorder (TMD) signs and symptoms. The goal of this study was to verify the prevalence of anxiety and depression in adolescents, and their relationship with signs and symptoms of TMD. **Materials and Methods:** The sample comprised 217 nonpatient adolescents between 12 and 18 years of age. The subjective symptoms and clinical signs of TMD were evaluated, respectively, using a self-report questionnaire and the Craniomandibular Index (CMI, which has 2 subscales), the Dysfunction Index, and the Palpation Index. The Hospital Anxiety and Depression Scale (HADS), a 14-item self-administered rating scale that was developed specifically to identify anxiety and depression in nonpsychiatric medical outpatients, assessed levels of anxiety and depression. **Results:** In the total sample, anxiety and depression were present in 16.58% and 26.71% of subjects, respectively, including all levels of HADS. The results showed that there were positive correlations between CMI and Palpation Index and anxiety (HADSa) ($P < .01$) but not with depression (HADSd). An association between the number of TMD subjective symptoms and HADSa/HADSd was found ($P < .01$). **Conclusion:** Anxiety and depression, although of mild intensity, are common in adolescents. In this study both HADSa and HADSd were associated with an increasing number of TMD subjective symptoms. However, only anxiety was correlated with clinical signs of TMD (CMI), primarily muscle tenderness (Palpation Index). *Int J Prosthodont 2005;18:347-352.*

Temporomandibular disorders (TMD) is an all-inclusive term referring to a heterogeneous group of psychophysiological disorders with the common characteristics of orofacial pain, masticatory dysfunction, or both.^{1,2} The etiology of TMD is considered to be mul-

tifactorial,²⁻⁴ but the relative importance of individual factors is still controversial. Psychosocial variables may play an important role in adaptation to pain and eventual recovery. TMD patients exhibit a variety of psychological and behavioral characteristics, including increased somatization, stress, anxiety, and depression.^{2,5}

Some investigations have examined the relationship between psychologic factors and TMD.⁶⁻¹¹ Studies of anxiety and depression in chronic pain patients have established that despite methodologic problems, there is evidence of greater prevalence of anxious and depressive symptoms in chronic pain populations than in controls.^{5,11,12} Since there is compelling evidence that chronic pain patients do not have a particular personality structure,^{13,14} it seems likely that anxiety and depression develop as sequelae to pain. Mood may, however, contribute to the endurance and impact of pain.¹⁵

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A small but clinically challenging population of children and adolescents become chronic pain patients who report not only pain, but also associated emotional distress and disability.¹⁶⁻¹⁸ A picture is developing of the adolescent with chronic pain who also reports general emotional distress and a heightened sense of vulnerability.¹⁹ Functional TMD is often accompanied by mental symptoms such as depression, anxiety, and/or somatization on various levels.

This investigation was conducted to verify the prevalence and relationship of anxious-depressive symptoms with signs and symptoms of TMD and gender in adolescents. Furthermore, this research sought to identify whether these psychologic variables were associated with the severity of this disorder.

Material and Methods

Sample

Two hundred seventeen nonpatient adolescents (120 girls/97 boys), aged between 12 and 18 years, were randomly selected from public schools in Piracicaba, Brazil. Those who had received any type of orthodontic treatment were excluded before selection. The Ethics Committee of Piracicaba Dental School approved the research. The parents/guardians and the adolescents were informed about the purpose of this research, and signed informed consents were obtained.

Prior to the examination of clinical signs and symptoms, a questionnaire was filled out; this included questions about each individual's general state of health, illness, diseases, oral hygiene, and occlusion characteristics. The questionnaire and the clinical examination were conducted in appropriate rooms in the Public Schools following calibration of two of the author examiners (LRB and LJP).

Subjective Symptoms Interview

A self-report questionnaire was used to assess subjective symptoms according to Riolo et al²⁰ regarding pain in the jaws when functioning (eg, chewing), unusually frequent headaches (more than once a week), stiffness/tiredness in the jaws, difficulty in jaw opening, grinding teeth, and sounds from the temporomandibular joints (TMJs). Each question could be answered with a "yes" or a "no."

Evaluation of Clinical Signs

The signs of TMD were assessed by the authors on 1 occasion according to the Craniomandibular Index (CMI), as described by Friction and Schiffman.²¹ The CMI has a 0 to 1 scale that measures tenderness and

dysfunction in the stomatognathic system and includes all currently recognized signs of TMD.^{21,22} It has 2 subscales: the Dysfunction Index (DI) and the Palpation Index (PI). The DI is designed to measure limitation in mandibular movement, pain and deviation in movement, TMJ noise, and TMJ tenderness. The PI measures the prevalence of muscle tenderness in the stomatognathic system. Thus, this index separates joint problems from muscle problems. The clinical examinations were conducted by two calibrated examiners ($Kappa = .936$).

Hospital Anxiety and Depression Scale

The level of anxiety and depression was self-rated by the Hospital Anxiety and Depression Scale (HADS). HADS consists of 7 items for depression (HADSd) and 7 items for anxiety (HADSa). The scale originated in the study of Zigmond and Snaith,²³ and a Portuguese version was validated by Botega et al.²⁴ The main characteristic of HADS is that items covering somatic symptoms of anxiety and depression have been eliminated. By defining cutoff values, the HADS subscales can give an indication of mental disorder: 0 to 7 = normal; 8 to 10 = mild; 11 to 14 = moderate; and 15 to 21 = severe disorder.²³ HADS has been extensively tested and has well-established psychometric properties.²⁵

Statistical Analysis

Data were computerized and the SAS package (version 8.2; SAS Institute) was used for their analysis. The presence of anxiety and depression in both genders was calculated by percentage and the Chi-square test. Correlation between CMI, PI, DI, and HADSa and HADSd was tested using the Spearman correlation. Associations between the number of symptoms and HADSa and HADSd were calculated using the Mantel-Haenszel Chi-square test. The significance level was set at $P < .05$ for all analyses.

Results

Table 1 shows that ages 12 to 14 were most prevalent in the studied sample, and the number of males and females were similar in all age groups. Maximum, minimum, and mean values for CMI, PI, and DI in both genders are expressed in Table 2. The mean scores for the indexes were low, because the majority of the adolescents did not show significant signs and symptoms; this decreased the total mean. In fact, there was no statistical difference between genders (Mann-Whitney, $P > .06$). However, in Table 2 it can be seen that some subjects presented with high scores. The distribution of anxiety and depression in both genders is presented in Table 3 and Table 4, respectively. Anxiety was more

Table 1 Age and Gender Distribution (n = 217)

| | Age (y) | | | | | | | | | | | | | | | |
|--------|---------|-------|----|-------|----|-------|----|------|----|------|----|------|----|------|-------|------|
| | 12 | | 13 | | 14 | | 15 | | 16 | | 17 | | 18 | | Total | |
| | n | (%) | n | (%) | n | (%) | n | (%) | n | (%) | n | (%) | n | (%) | n | (%) |
| Female | 38 | 17.51 | 47 | 21.65 | 24 | 11.05 | 4 | 1.84 | 1 | 0.46 | 4 | 1.84 | 2 | 3.68 | 120 | 55.3 |
| Male | 38 | 17.51 | 28 | 12.9 | 18 | 8.29 | 4 | 1.84 | 1 | 0.46 | 3 | 1.38 | 5 | 2.30 | 97 | 44.7 |
| Total | 76 | 35.02 | 75 | 34.56 | 42 | 19.35 | 8 | 3.68 | 2 | 0.92 | 7 | 3.22 | 7 | 3.22 | 217 | 100 |

Table 2 Maximum, Minimum, and Mean Values for DI, PI, and CMI

| Scale | Boys | | Girls | |
|-------|-------|---------|-------|----------|
| | Mean | Range | Mean | Range |
| DI | 0.083 | 0–0.214 | 0.097 | 0–0.428 |
| PI | 0.056 | 0–0.477 | 0.087 | 0–0.8181 |
| CMI | 0.075 | 0–0.582 | 0.093 | 0–0.532 |

Table 4 Gender Distribution According to Level of Depression (HADSd)

| Depression level | Boys | | Girls | | Total | |
|--------------------|------|------|-------|------|-------|-------|
| | n | (%) | n | % | n | (%) |
| Free of depression | 73 | 75.3 | 86 | 71.6 | 159 | 73.2 |
| Mild | 20 | 20.6 | 17 | 14.1 | 37 | 17.04 |
| Moderate | 4* | 4.1 | 15* | 13.3 | 20 | 9.21 |
| Severe | 0 | 0 | 1 | 0.83 | 1 | 0.46 |

*P < .05.

Table 6 Association Between Number of Subjective Symptoms and Anxiety (HADSa)

| No. of symptoms | Free of anxiety | | Mild | | Moderate | | Severe | |
|-----------------|-----------------|-------|------|------|----------|------|--------|------|
| | n | (%) | n | (%) | n | (%) | n | (%) |
| 0 | 89 | 41.01 | 13 | 5.99 | 6 | 2.76 | 0 | 0 |
| 1 | 40 | 18.43 | 14 | 6.45 | 7 | 3.23 | 0 | 0 |
| 2 | 21 | 9.68 | 3 | 1.38 | 4 | 1.84 | 1 | 0.46 |
| 3 | 8 | 3.69 | 6 | 2.76 | 2 | 0.92 | 0 | 0 |
| 4 | 1 | 0.46 | 1 | 0.46 | 1 | 0.46 | 0 | 0 |

P = .0013.

prevalent in boys (24.7%) than in girls (9.83%) ($P < .05$), and the degree “mild” was the most prevalent in both genders. According to HADSd, depression was found in 27.4% of girls and in 24.7% of boys, with no statistically significant difference ($P > .05$). Mild depression was predominant in boys, whereas in girls the “mild” and “moderate” degrees were most common. There was a significant difference in depression severity between genders, since the percentage of girls presenting with a moderate degree was significantly higher than boys (13.3% and 4.1%, respectively). The majority of subjects presenting anxiety and depression were

Table 3 Gender Distribution According to Level of Anxiety (HADSa)

| Anxiety level | Boys | | Girls | | Total | |
|-----------------|------|------|-------|------|-------|-------|
| | n | (%) | n | % | n | (%) |
| Free of anxiety | 73 | 75.3 | 108 | 90 | 181 | 83.4 |
| Mild | 22* | 22.7 | 11* | 9 | 33 | 15.20 |
| Moderate | 1 | 1.03 | 1 | 0.83 | 2 | 0.92 |
| Severe | 1 | 1.03 | 0 | 0 | 1 | 0.46 |

*P < .05.

Table 5 Correlations Between CMI, DI, PI, and HADSa/HADSd (r value)

| | HADSa | HADSd |
|-----|----------|----------|
| DI | 0.08299 | -0.00898 |
| PI | 0.25448* | 0.03251 |
| CMI | 0.28093† | 0.00283 |

*P < .0002; †P < .0001.

Table 7 Association Between Number of Subjective Symptoms and Depression (HADSd)

| No. of symptoms | Free of depression | | Mild | | Moderate | | Severe | |
|-----------------|--------------------|-------|------|------|----------|------|--------|------|
| | n | (%) | n | (%) | n | (%) | n | (%) |
| 0 | 94 | 43.32 | 13 | 5.99 | 1 | 0.46 | 0 | 0 |
| 1 | 51 | 23.50 | 10 | 4.61 | 0 | 0 | 0 | 0 |
| 2 | 23 | 10.60 | 5 | 2.30 | 0 | 0 | 1 | 0.46 |
| 3 | 11 | 5.07 | 4 | 1.84 | 1 | 0.46 | 0 | 0 |
| 4 | 2 | 0.92 | 1 | 0.46 | 0 | 0 | 0 | 0 |

P = .0232.

classified as mild according to HADS. The correlation coefficients for CMI, PI, DI, and HADSa and HADSd are expressed in Table 5. A significant correlation was found between CMI/PI scores and anxiety ($P < .01$), but this correlation was not found for depressive symptoms. Thus, the correlation with anxiety was significant for muscle tenderness. The Mantel-Haenszel Chi-square test was used to examine the association among HADSa and HADSd and the number of subjective symptoms of TMD (Tables 6 and 7). The results showed that the number of subjective TMD symptoms was associated with anxiety and depression ($P < .01$). It

showed that subjects with a greater number of subjective TMD symptoms could present with more anxiety and depression symptoms.

Discussion

This study evaluated the presence of anxiety and depression in adolescents and the relationship of these characteristics with signs and symptoms of TMD. The HADS was chosen to assess anxiety and depression symptoms. The method used is considered an easy-to-use, self-reporting questionnaire to detect anxiety and depression in medical outpatients in either a nonpsychiatric hospital setting or in the general population.^{25,26} It has been extensively researched and validated, and findings have demonstrated good sensitivity, specificity, and correlation between HADS, other questionnaires, and structured interviews used to diagnose depression and anxiety disorders.²⁷⁻²⁹

Subjects who were free of anxiety and depression comprised the majority of the sample (Tables 2 and 3). However, 16.58% and 26.71% presented with anxiety and depression respectively, predominantly of mild intensity. These results show that there is evidence of psychologic disturbances in the general adolescent population, as verified also by Wight et al.³⁰ Anxiety and depressive disorders have been found in children and adolescents, with the ratio ranging from 5.7% to 17.7%³¹ for anxiety and from 3% to 40%^{32,33} for depression, corroborating the present results. In this study, 15.2% and 1.38% of subjects presented with mild and moderate/severe anxiety symptoms, respectively. Since these results could be explained by the age of the sample, it may be that such anxiety symptoms might not yet be affecting their quality of life. With regard to depressive symptoms, moderate/severe depressive symptoms were found in 9.67% of the subjects; this is in agreement with Rushton et al,³⁴ who found that over 9% of 13,568 adolescents reported moderate to severe depressive symptoms. In the present study, the majority of the symptoms were mild; nevertheless, girls presented more moderate depression than boys. The larger number of adolescents in this sample who were age 12 to 14 suggests that the difference between genders could be a result of biologic variables (eg, hormonal characteristics), as maturation in girls typically occurs earlier than in boys. However, it is necessary to consider that adolescents experience many developmental challenges as they strive to separate from their parents, become independent, and establish their own identities. This period of biopsychosocial maturation creates the conditions for people experiencing a greater sense of hopelessness and despair than when they were younger.³⁵ List et al⁶ verified in adolescents with TMD a higher degree

of stress and behavior problems than healthy individuals. The TMD group also reported more somatic complaints and sought health care more frequently compared to controls. Thus, it appears that adolescents suffering from TMD pain seem to be more sensitive and more somatically focused than their healthy peers.

The debate is ongoing regarding the possible predisposing, triggering, and/or worsening role played by some psychological disorders in TMD subjects.^{5,36} There are also numerous reports of greater levels of depression and anxiety in persons presenting temporomandibular complaints as compared to normal controls.^{5-7,10,37-39}

TMD patients are more emotionally reactive to environmental challenge than normal subjects,³⁹ and approximately one third of the persons seeking treatment for TMD were experiencing depression.^{40,41} A significant correlation was found between CMI/PI and anxiety (HADSa) but not DI and anxiety; however, the same results were not found for depression (HADSd). Because the subjects examined were not seeking treatment, most of them probably did not present great evidence of clinical signs of TMD, which was found by the low mean CMI score of 0.085, on a scale of 0 to 1, and their lives were not yet affected. Although the mean CMI score was low, there were some high scores in both genders for CMI, PI, and DI, as presented in Table 2. In addition, the scores for CMI and PI were greater than those for DI in both genders, meaning that muscle tenderness could be the factor in determining the difference.

Therefore, individuals with high CMI and PI scores also had the highest HADSa scores, showing that these score indexes, especially those that involve muscle tenderness, tend to be enhanced in anxious subjects. It was found that the frequency of muscle groups painful to palpation increased in proportion to the frequency of reported anxiety symptoms. Such observations are in keeping with the hypothesized link between psychologic factors and muscular activity in the facial area, as myofascial pain patients have shown the highest prevalence of both mood and anxiety psychopathology when compared with TMD-free, disc displacement, and joint disorder subjects.^{5,9,42}

Furthermore, anxiety may be an important factor in the perception of pain, and anxious subjects may increase attention to pain, thereby amplifying their perceived intensity. This evidence was confirmed by other studies,^{7,11,43-45} which indicated that anxiety is related to increased pain reports in clinical settings. In addition, the evaluation of the psychologic dimension of muscle tenderness and its associated disability could provide valuable information for the adequate management of these patients and for assessing treatment outcome. Nevertheless, the results of this re-

search are in accordance with a number of studies that also suggest that the association between myofascial pain and anxiety disorders is stronger than the association between pain and depression.^{46–50}

Furthermore, these results determined a significant association between anxiety/depression and the number of symptoms, as shown in Tables 6 and 7, suggesting that as the number of subjective symptoms increases, the same happens with the proportion of individuals presenting anxiety and depression complaints; this corroborates the findings of Sipila et al.⁵¹ Such associations might be explained by the fact that TMD symptoms and orofacial pain could have a psychosocial impact on the adolescent's quality of life, as is the case in adult populations.⁵² The number of non-specific pain conditions reported may be a predictor of psychosocial problems, depression, and somatization.⁵³ It has been observed that small elevations in anxiety, depression, and somatization have been consistently identified in TMD patients.⁵⁴ Although there is no consensus regarding the percentage of TMD patients in whom psychologic factors play a role, it is clear that such factors need to be taken into account, along with structural indicators, to properly diagnose and plan management strategies.

It was concluded that the signs and symptoms of TMD could be present in adolescents and psychologic variables may be related. However, these conclusions must be interpreted with caution, given the inherent shortcomings of correlation studies of this nature. Limitations include the selection protocol employed and the possible influence of gender on the recorded results. Additionally the known fluctuation in signs and symptoms of musculoskeletal disorders in a time-dependent context might have been better addressed by carrying out repeated clinical recordings. Nonetheless, the observed outcomes suggest the importance of recognizing the merits of psychologic screening of adolescents with a confirmed diagnosis of a TMD, where indicated.

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