Correlation Between Physical and Psychosocial Findings in a Population of Temporomandibular Disorder Patients

Giancarlo De la Torre Canales, DDS, MSc, PhD
Bauru Orofacial Pain Group, Bauru School of Dentistry, São Paulo University, São Paulo, Brazil.

Leonardo Rigoldi Bonjardim, DDS, MSc, PhD
Rodrigo Lorenzi Poluha, DDS, MSc
Flávia Fonseca Carvalho Soares, DDS, MSc
Bauru Orofacial Pain Group, Bauru School of Dentistry, São Paulo University, São Paulo, Brazil.

Luca Guarda-Nardini, DDS, MSc, PhD
Department of Maxillofacial Surgery, University of Padova, Padova, Italy.

Paulo Rodrigues Conti, DDS, MSc, PhD
Bauru Orofacial Pain Group, Bauru School of Dentistry, São Paulo University, São Paulo, Brazil.

Daniele Manfredini, DDS, MSc, PhD
School of Dentistry, University of Siena, Siena, Italy.

Purpose: To assess the correlation between RDC/TMD Axis I and Axis II diagnoses and whether pain could mediate a possible correlation between these two variables. ***Materials and Methods:*** Data of both RDC/TMD axes were collected from 737 consecutive patients who sought TMD advice at the University of Padova, Italy. A descriptive analysis was used to report the frequencies of Axis I and II diagnoses, and Spearman test was performed to assess the correlation between the axes. Subsequently, the sample was divided into two groups (painful vs nonpainful TMD). Frequencies were reported using descriptive analysis, and chi-square test was used to compare groups. The painful TMD group was then divided based on the level of pain-related impairment (low = Groups I and II; high = Groups III and IV). Then, frequencies of depression and somatization were reported using descriptive analysis for each disability group, and chi-square test was used to compare groups. ***Results:*** No correlation levels were found between Axis I and any of the Axis II findings (Graded Chronic Pain Scale, depression, and somatization). The painful TMD group presented higher levels of depression and somatization ($P < .05$). Comparisons of depression and somatization frequencies between pain-impairment groups showed a significantly higher prevalence of abnormal scores for the severe pain-impairment group. ***Conclusion:*** There is no correlation between specific Axis I and Axis II findings. The presence of pain, independent of the muscle or joint location, is correlated with Axis II findings, and higher levels of pain-related impairment are associated with the most severe scores of depression and somatization.
Int J Prosthodont 2020;33:155–159. doi: 10.11607/ijp.5847

The definition of "pain" according to the International Association for the Study of Pain (IASP) emphasizes the emotional and psychologic features of pain experience along with the biologic component.[1] Hence, pain is not just a biologic phenomenon but the result of an interaction among psychologic, social, environmental, and biologic factors. Such a concept is the basis of the so-called biopsychosocial model of pain,[2] which highlights the role of emotional and behavioral aspects. Of the pain-related conditions of dental interest associated with psychologic factors, temporomandibular disorders (TMD) have received increasing attention over the past few decades.[3]

TMD are a group of musculoskeletal disorders affecting the temporomandibular joints (TMJs), the jaw muscles, and associated structures.[4] Diagnosis should be based on history taking, clinical examination, and imaging integration.[5] In addition, the standardized Research Diagnostic Criteria for TMD (RDC/TMD) encompasses a psychosocial evaluation.[4]

Correspondence to:
Dr Giancarlo De la Torre Canales
Department of Prosthodontics
Bauru School of Dentistry
University of São Paulo
Al. Octávio Pinheiro Brisola, 9-75
CEP 17012-901 Bauru, SP, Brazil
Email: giank_28@hotmail.com

Submitted February 21, 2018;
accepted October 1, 2019.

Table 1 Axis I Diagnoses in the Study Population

Axis I Grade	Patients, n (%)
–	13 (1.7)
Ia	396 (52.5)
Ib	119 (15.8)
IIa	220 (29.1)
IIb	30 (4.0)
IIc	51 (6.8)
IIIa	256 (33.9)
IIIb	85 (11.3)

Table 2 Combined Axis I Diagnoses in the Study Population

Axis I Grade(s)	Patients, n (%)
0	13 (1.7)
I	138 (18.3)
II	94 (12.5)
III	135 (17.9)
I + II	71 (9.4)
I + III	228 (15.6)
II + III	112 (14.8)
I + II + III	73 (9.7)

The RDC/TMD classification was based on the biopsychosocial model of pain[4] and is constituted by two axes: Axis I for physical evaluation, and Axis II for psychosocial assessment. The latter allows an evaluation of pain-related impairment and levels of depression and somatization in TMD patients.[4] The updated version, called the Diagnostic Criteria for TMD (DC/TMD),[6] widened the usefulness of these instruments to the clinical setting, thanks to a refinement of Axis I (ie, physical) algorithms and the addition of some Axis II measures. Nonetheless, the core features of the original Axis II, used for more than 20 years, are still useful tools for sharing epidemiologic data among the different research groups, as well as for characterizing behavioral features in clinical settings.

Despite the wide diffusion of the RDC/TMD in the research setting, little information is available on the correlation between physical diagnoses drawn from Axis I and psychosocial findings based on Axis II. Such an evaluation could be helpful to identify clinical predictors of high pain-related disability. Therefore, the aim of the present investigation was to assess the correlation between Axis I and Axis II diagnoses and whether pain could mediate a possible correlation between these two variables.

MATERIALS AND METHODS

Data were collected from 737 consecutive patients (587 women, 150 men; mean age: 39.3 years) who sought TMD advice at the Department of Maxillofacial Surgery, University of Padova, Italy, at their first appointments, from 2012 to 2014. Patients aged younger than 18 years, as well as individuals with rheumatic or psychiatric disorders, were excluded.

Participants underwent thorough history taking and assessment in accordance with both RDC/TMD Axis (RDC/TMD Consortium Network) Italian version protocols to receive TMD diagnoses. Briefly, the RDC/TMD Axis I is an examination form whose findings correspond to the 10 items of the evaluation protocol for orofacial anatomical elements, and the RDC/TMD Axis II Questionnaire consists of 31 items divided into sociodemographic, socioeconomic, psychologic (depression and somatization subscales), psychosocial (graded chronic pain severity [pain intensity and disability]), and patient-related signs and symptoms, as well as the limitation scale on mandibular function. Patients were assessed by two examiners (D.M.; L.G.), who collected all RDC/TMD data and assigned one or more of the following Axis I diagnoses by agreement: muscle disorders (Group I); disc displacement (Group II); and arthralgia, osteoarthritis, or osteoarthrosis (Group III). Axis II assessment was based on scores of the following instruments: Graded Chronic Pain Scale (GCPS), which allows the rating of pain-related impairment based on five degrees of severity, and Symptoms Checklist-90-Revised (SCL-90R), which measures the levels of depression (SCL-DEP) and somatization (SCL-SOM) and categorizes scores as normal, moderate, or severe. The frequencies of Axis I diagnoses, and scores of Axis II data were reported by descriptive analysis. Spearman test was performed to assess the correlation between Axis I and II data.

Subsequently, a division of the sample into painful TMD and nonpainful TMD groups was performed, with the aim of describing the prevalence of depression and somatization in both groups. Frequencies were reported using descriptive analysis, and chi-square test was used to compare the two groups (ie, painful vs nonpainful TMDs). The painful TMD group was then divided based on the level of pain-related impairment, as assessed with the GCPS scale (ie, low = I, II; high = III, IV). Then, frequencies of depression and somatization were reported by descriptive analysis for each disability group, and chi-square test was used to compare the differences between these groups.

All patients gave their written informed consent to the clinical diagnostic procedures undertaken during the investigation, and the study protocol was approved by the University of Padova's Institutional Review Board.

RESULTS

Regarding RDC/TMD Axis I diagnoses, Group I disorders (muscle disorders) were diagnosed in 515 participants (68.3%), Group II disorders (disc displacement) in 301 (42.9%), and Group III disorders (arthralgia, osteoarthritis, and osteoarthrosis) in 341 (45.2%) (Table 1). About half of the patients received multiple Axis I diagnoses (Table 2).

As for Axis II, most patients were rated as Grade I or II in the GCPS

Table 3 Axis II Diagnoses in the Study Population

Axis II Grades	Patients, %
GCPS	
0	15.4
I	34.2
II	31.7
III	12.6
IV	6.1
SCL-DEP	
Normal	43.1
Moderate	15
Severe	41.9
SCL-SOM	
Normal	25.8
Moderate	27
Severe	47.2

GCPS = Graded Chronic Pain Scale (I, II = low intensity; III, IV = high intensity); SCL-DEP = Symptom Checklist-90-Revised for Depression; SCL-SOM = Symptom Checklist-90-Revised for Somatization.

(65.9%), with 31.7% having low disability but high-intensity pain-related impairment. Only 18.7% were rated as Grade III or IV, with 6.1% presenting severely limiting high-disability pain-related impairment (Grade IV). The SCL-DEP and SCL-SOM scales rated 56.9% and 74.2% of patients, respectively, with abnormal values. In particular, 41.9% and 47.2% of them presented severe levels of depression and somatization (Table 3). Correlation levels performed between Axis I and Axis II were not significant for any of the Axis II findings (ie, GCPS, SCL-DEP, and SOM scores). Notwithstanding, a significant correlation was found between Axis II instruments ($P < .05$) (Table 4).

Painful and nonpainful TMD were reported in 587 (81%) and 137 (19%) patients, respectively. Concerning the SCL-DEP and SCL-SOM scores within the two groups, a significantly higher frequency of abnormal scores was found for the painful TMD group ($P < .001$) (Table 5). In particular, 49.2% (37.6% severe and 11.6% moderate) and 63.7% (42.7% severe, 21% moderate) of the patients presented abnormal values for the depression and somatization scales, respectively. Comparisons of SCL-DEP and SCL-SOM frequencies between pain-impairment groups showed a significantly higher prevalence of abnormal scores for the severe pain-impairment group (Table 6).

Table 4 Correlations Between Axis I and Axis II Findings

Correlations	Spearman ρ	*P*
Axis I/GCPS	0.034	.358
Axis I/depression	0.068	.067
Axis I/somatization	0.020	.584
GCPS/depression	0.219	.05
GCPS/somatization	0.298	.05
Depression/somatization	0.517	.05

GCPS = Graded Chronic Pain Scale.

Table 5 Comparisons of Depression (SCL-DEP) and Somatization (SCL-SOM) Between Painful (n = 587) and Nonpainful (n = 137) TMD Patients

	Painful TMD, n (%)*	Nonpainful TMD, n (%)
SCL-DEP		
Normal	231 (31.9)*	73 (10.1)
Moderate	84 (11.6)*	26 (3.6)
Severe	272 (37.6)*	38 (5.2)
SCL-SOM		
Normal	126 (17.4)*	52 (7.2)
Moderate	152 (21)*	45 (6.2)
Severe	309 (42.7)*	40 (5.5)

Chi-square test.
*$P < .001$ for comparison between TMD groups.

Table 6 Comparisons of Depression (SCL-DEP) and Somatization (SCL-SOM) According to Degree of Pain Impairment (Low vs Severe) in Painful TMD Patients

	Low, n (%)	Severe, n (%)	Total, n (%)
SCL-DEP			
Normal	206 (35.1)	25 (4.3)	231 (39.35)
Moderate	70 (11.9)	14 (2.4)	84 (14.31)
Severe	187 (31.9)	85 (14.5)*	272 (46.33)*
Total, n	463	124	587
SCL-SOM			
Normal	118 (20.1)	8 (1.4)	126 (21.46)
Moderate	139 (23.7)	13 (2.2)	152 (25.89)
Severe	206 (35.1)*	103 (17.5)*	309 (52.64)*
Total, n	463	124	587

*$P < .001$ between depression and somatization levels.

DISCUSSION

The results of the present study showed that most patients (68.3%) received a diagnosis of muscle disorders. Also, most of them had low pain-related impairment (ie, GCPS Grade I or II, 65.9%), and just a minority (6.1%) presented severely limiting, high-disability, pain-related impairment (Grade IV). Likewise, 41.9% and 47.2% of patients presented severe levels of depression and somatization, respectively. Interestingly, no correlation was

found between Axis I and II findings; notwithstanding, the severe pain-impairment group presented a significantly higher frequency of severe scores of depression and somatization.

The frequencies of the different Axis I diagnoses described in this investigation are similar to literature studies of the same design. The frequency of muscle disorders diagnosis (68.3%) is in line with values described in the early RDC/TMD publication on Swedish and U.S. patients (76%),[7] while it is higher than in Asian patients (31%).[8] Along with social and ethical factors, these differences could be explained by the possible overestimation of muscle disorders based on the protocol, which included palpation of poorly reliable muscles (ie, lateral pterygoid and temporalis tendon areas). The updated DC/TMD could bring a more valid approach to myofascial pain diagnosis by also minimizing potential false positives (postexercise tenderness, fatigue). As for joint disorders, the frequency of Group II diagnoses in the present investigation (42.9%) is in line with the average literature report in patient populations (41.1%),[9] with disc displacement with reduction being the most common diagnosis (29.1%). More specifically, the literature on disc displacements showed a partial variability of findings, with most studies reporting disc displacement with reduction in about one-third of the sample[7,10,11] and a lower frequency in Asian populations.[12] Group III inflammatory-degenerative joint disorders (45.2%) and arthralgia (33.9%) were the most common diagnoses (33.9%), in line with the averages reported in the literature of 30.1% and 34.2%,[9] respectively.

The present study is one of the few investigations focusing on the description of the entire spectrum of symptoms included in the Axis II evaluation. Available literature on GCPS scores reported a 6.3% to 11.2% frequency of high intensity, moderately limiting pain, and a 3.1% to 5.7% frequency of high-intensity, severely limiting pain,[13–16] which is in line with the present study. Even though the aforementioned studies presented different strategies of patient recruitment as well as cultural attitudes toward treatment-seeking behavior, the absence of relevant cross-population differences confirms that only a small percentage of patients present high-disability pain-related impairment with negative influences on their daily activities. As for the SCL-90R scores, moderate to severe levels of depression and somatization were detected in 56.9% and 74.2%, respectively, which are also similar to data from the literature.[8,16] Therefore, it can be confirmed that the association between TMD and psychosocial factors is part of a more complex pain-psychopathology association, including at least symptoms of depression and somatization.[16]

The main goal of this study was to assess a possible correlation between Axis I and II diagnoses, given the paucity of available information on this issue. Although Manfredini et al (2011)[17] already partly addressed this topic, the authors assessed only the correlation of Axis I diagnoses with GCPS scores and suggested that treatment-seeking behavior was the best predictor for high pain-related impairment, independent of the Axis I diagnosis. Similarly, no correlation was found between Axis I findings and GCPS scores in the present investigation in an enlarged sample. In addition, the lack of correlation with Axis I findings was also shown for depression and somatization scores. On the other hand, a correlation was found between Axis II assessment tools, which is also in line with Manfredini et al.[18] Overall, these findings suggest that none of the Axis I (ie, physical) diagnoses are specifically correlated with psychosocial findings and that, in turn, different psychologic symptoms are reciprocally linked to each other.

Considering that TMD are pain-related conditions associated with psychologic factors, and since no correlation was found between physical and psychosocial diagnoses, the role of pain in this scenario was worthy of exploration. In particular, an assessment of the correlation between Axis II findings and Axis I diagnoses depending on the presence of pain was performed. The null hypothesis was that painful TMD patients would not present higher prevalence of psychosocial impairment than nonpainful TMD patients.

As expected, splitting the study sample into painful and nonpainful TMD groups showed a significantly higher frequency of depression and somatization in the painful TMD group. These findings confirm that pain, independent of an Axis I diagnosis, could be the relevant factor associated with Axis II scores. The cross-sectional nature and the lack of a control group (patients without TMD) are the main limitations of this investigation and do not allow any speculation on the direction of the cause-and-effect relationship, if any. On the other hand, observations that psychologic therapies aiming to reduce pain intensity may be useful in the clinical setting may suggest that psychosocial impairment cannot be viewed as only the consequence of pain.[19,20] Therefore, the present results and findings reported by Manfredini et al[17] suggest that Axis II findings are related to the complex pain experience rather than to pain location.

In addition, the results showed that the higher the degree of pain-related impairment, the higher the levels of severe depression and somatization. These findings confirm that assessing the levels of pain-related disability is of particular importance as a potential marker of a broad spectrum of psychologic symptoms that may influence the clinical decision-making process and the therapeutic outcome.

From a clinical viewpoint, studies have suggested that patients with low impairment seem to benefit even from a "simple" cognitive-behavioral therapy regimen,

while patients presenting severe impairment are the worst treatment responders.[21,22] The comprehensive assessment of psychosocial factors could facilitate the selection of an appropriate treatment via the identification of proper outcome predictors. The clinical implications of this investigation are related to the deriving recommendation for a thorough assessment of Axis II profiles to avoid crippling the biopsychosocial model of pain. Indeed, the degree of pain-related impairment may explain a treatment-seeking behavior in the clinical setting, thus representing a key treatment target that is not related to any specific Axis I diagnosis.

CONCLUSIONS

Based on the present findings, it can be concluded that there is no correlation between specific Axis I diagnoses and Axis II findings. The presence of pain, independent of the muscle or joint location, is correlated with Axis II findings, and higher levels of pain-related impairment are associated with the most severe depression and somatization scores.

ACKNOWLEDGMENTS

Fundação de Amparo à Pesquisa do Estado de São Paulo – FAPESP (number 2017/21674-0). The authors declare that they have no conflicts of interest.

REFERENCES

1. Merskey H, Bogduk N (eds). Classification of Chronic Pain, ed 2. Seattle: IASP, 1994.
2. Loeser JD, Fordyce WE. Chronic pain. In: Carr JE, Dengerink HA (eds). Behavioral Science in the Practice of Medicine. New York: Elsevier, 1983:331–346.
3. Laskin DM, Greene CS. Diagnostic methods for temporomandibular disorders: What we have learned in two decades. Anesth Prog 1990; 37:66–71.
4. Dworkin SF, LeResche L. Research diagnostic criteria for temporomandibular disorders: Review, criteria, examinations and specifications, critique. J Craniomandib Disord 1992;6:301–355.
5. Ahmad M, Schiffman EL. Temporomandibular joint disorders and orofacial pain. Dent Clin North Am 2016;60:105–124.
6. Schiffman E, Ohrbach R, Truelove E, et al. Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for Clinical and Research Applications: Recommendations of the International RDC/TMD Consortium Network and Orofacial Pain Special Interest Group. J Oral Facial Pain Headache 2014;28:6–27.
7. List T, Dworkin SF. Comparing TMD diagnoses and clinical findings at Swedish and US TMD centers using Research Diagnostic Criteria for Temporomandibular Disorders. J Orofac Pain 1996;10:240–253.
8. Yap AU, Dworkin SF, Chua EK, List T, Tan KB, Tan HH. Prevalence of temporomandibular disorder subtypes, psychologic distress, and psychosocial dysfunction in Asian patients. J Orofac Pain 2003;17:21–28.
9. Manfredini D, Guarda-Nardini L, Winocur E, Piccotti F, Ahlberg J, Lobbezoo F. Research Diagnostic Criteria for Temporomandibular Disorders: A systematic review of Axis I epidemiologic findings. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2011;112:453–462.
10. Winocur E, Steinkeller-Dekel M, Reiter S, Eli I. A retrospective analysis of temporomandibular findings among Israeli-born patients based on the RDC/TMD. J Oral Rehabil 2009;36:11–17.
11. Manfredini D, Chiappe G, Bosco M. Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) Axis I diagnoses in an Italian patient population. J Oral Rehabil 2006;33:551–558.
12. Yap AU, Tan KB, Chua EK, Tan HH. Depression and somatization in patients with temporomandibular disorders. J Prosthet Dent 2002;88: 479–484.
13. John MT, Reissmann DR, Schierz O, Wassell RW. Oral health-related quality of life in patients with temporomandibular disorders. J Orofac Pain 2007;21:46–54.
14. Ohrbach R, Turner JA, Sherman JJ, et al. The Research Diagnostic Criteria for Temporomandibular Disorders. IV: Evaluation of psychometric properties of the Axis II measures. J Orofac Pain 2010;24:48–62.
15. Manfredini D, Winocur E, Ahlberg J, Guarda-Nardini L, Lobbezoo F. Psychosocial impairment in temporomandibular disorders patients. RDC/TMD Axis II findings from a multicentre study. J Dent 2010;38:765–772.
16. Canales GT, Guarda-Nardini L, Rizzatti-Barbosa CM, Conti PCR, Manfredini D. Distribution of depression, somatization and pain-related impairment in patients with chronic temporomandibular disorders. J Appl Oral Sci 2019;27:e20180210.
17. Manfredini D, Ahlberg J, Winocur E, Guarda-Nardini L, Lobbezoo F. Correlation of RDC/TMD Axis I diagnoses and Axis II pain-related disability. A multicenter study. Clin Oral Investig 2011;15:749–756.
18. Manfredini D, Borella L, Favero L, Ferronato G, Guarda-Nardini L. Chronic pain severity and depression/somatization levels in TMD patients. Int J Prosthodont 2010;23:529–534.
19. Aggarwal VR, Macfarlane GJ, Farragher TM, McBeth J. Risk factors for onset of chronic oro-facial pain—Results of the North Cheshire orofacial pain prospective population study. Pain 2010;149:354–359.
20. Kindler S, Samietz S, Houshmand M, et al. Depressive and anxiety symptoms as risk factors for temporomandibular joint pain: A prospective cohort study in the general population. J Pain 2012;13:1188–1197.
21. Kurita K, Westesson PL, Yuasa H, Toyama M, Machida J, Ogi N. Natural course of untreated symptomatic temporomandibular joint disc displacement without reduction. J Dent Res 1998;77:361–365.
22. Manfredini D, Favero L, Del Giudice A, Masiero S, Stellini E, Guarda-Nardini L. Axis II psychosocial findings predict effectiveness of TMJ hyaluronic acid injections. Int J Oral Maxillofac Surg 2013;42:364–368.

Literature Abstract

Effect of Ibuprofen on the Efficacy of Inferior Alveolar Nerve Block in Patients with Irreversible Pulpitis: A Meta-Analysis

The aim of this study was to compare the effect of preventive ibuprofen administration to placebo on the efficacy of inferior alveolar nerve block in patients with irreversible pulpitis. A search was performed in the PubMed, Scopus, Web of Science, LILACS, BBO, Cochrane Library, and SIGLE databases, as well as gray literature. Risk of bias was evaluated through the Cochrane Collaboration tool. The quality of the evidence was assessed using the GRADE approach. Only seven studies were eligible for meta-analysis. Administering ibuprofen before anesthesia increased the success rate of injectable anesthesia (RR = 1.79; 95% confidence interval CI)1.32 to 2.42; *P* = .0002), even in cases of symptomatic irreversible pulpitis (RR = 1.55; 95% CI 1.05 to 2.29; *P* = .03). The intensity of pain was lower for ibuprofen (standardized difference in means = –3.73; 95% CI –6.43 to –1.04; *P* = .007). The results suggest that ibuprofen as premedication is beneficial for the success of inferior alveolar nerve block.

de Geus JL, Wambier LM, Boing TF, Loguercio AD, Reis A. *Aust Endod J* 2019;45:246–258. **References:** 46. **Reprints:** Juliana de Geus, ju_degeus@hotmail.com —*Ray Scott, USA*