Prevalence of TMD and its impact on quality of life in male construction workers

Prevalência de DTM e impacto na qualidade de vida de trabalhadores na construção civil

DOI:10.34117/bjdv7n3-662

Recebimento dos originais: 08/02/2021
Aceitação para publicação: 01/03/2021

Samantha Schaffer Pugsley Baratto
DDS, MSc, PhD student
Serviço Social do Sindicato da Indústria da Construção Civil do Paraná
Endereço: Rua João Viana Seiler, 116, 80220-270, Curitiba, Paraná, Brasil
E-mail: samanthapugsley@gmail.com

Michelle Nascimento Meger
DDS, MSc, PhD student
Escola de Ciências da Saúde, Universidade Positivo
Endereço: Rua Professor Pedro Viriato Parigot de Souza, 5300, 80740-050, Curitiba, Paraná, Brasil
E-mail: michellemeger@hotmail.com

Vânia Camargo
DDS
Escola de Ciências da Saúde, Universidade Positivo
Endereço: Rua Professor Pedro Viriato Parigot de Souza, 5300, 80740-050, Curitiba, Paraná, Brasil
E-mail: cv.camargocania@gmail.com

Isabela Ribeiro Madalena
DDS, MSc, PhD
Departamento de Clínica Infantil, Faculdade de Odontologia de Ribeirão Preto, Universidade de São Paulo
Endereço: Avenida do Café, s/nº, 14040-904, Ribeirão Preto, São Paulo, Brasil
E-mail: isabelarmadalena@hotmail.com

Flares Baratto-Filho
DDS, MSc, PhD
Departamento de Odontologia, Universidade da Região de Joinville
Universidade do Tuiuti do Paraná
Endereço: Rua Paulo Malschitzki, s/n, 89219-710, Joinville, Santa Catarina, Brasil
E-mail: fbaratto1@gmail.com

Luiz Carlos Machado Miguel
DDS, MSc, PhD
Departamento de Odontologia, Universidade da Região de Joinville
Endereço: Rua Paulo Malschitzki, s/n, 89219-710, Joinville, Santa Catarina, Brasil
E-mail: lcmmiguel@gmail.com

Natanael Henrique Ribeiro Mattos
DDS, MSc, PhD
Universidade do Tuiuti do Paraná
Endereço: Rua Sydnei Antonio Rangel Santos, 238, 82010-330, Curitiba, Paraná, Brasil
E-mail: natanael.mattos@utp.br

Raul Konrad Teige Erzinger
DDS
Serviço Social do Sindicato da Indústria da Construção Civil do Paraná
Endereço: Rua João Viana Seiler, 116, 80220-270, Curitiba, Paraná, Brasil
E-mail: raul.odonto@hotmail.com

Erika Calvano Küchler
DDS, MSc, PhD
Departamento de Clínica Infantil, Faculdade de Odontologia de Ribeirão Preto, Universidade de São Paulo
Endereço: Avenida do Café, s/nº, 14040-904, Ribeirão Preto, São Paulo, Brasil
E-mail: erikacalvano@gmail.com

Aline Sebastiani
DDS, MSc, PhD
Departamento de Estomatologia, Faculdade de Odontologia, Universidade Federal do Paraná
Endereço: Avenida Prefeito Lothário Meissner, 632, 80210-170, Curitiba, Paraná, Brasil
E-mail: sebastiani.aline@gmail.com

Gisele Maria Correr Nolasco
DDS, MSc, PhD
Escola de Ciências da Saúde, Universidade Positivo
Endereço: Rua Professor Pedro Viriato Parigot de Souza, 5300, 80740-050, Curitiba, Paraná, Brasil
E-mail: gmcnolasco@gmail.com

ABSTRACT
Background: Temporomandibular joint disorder (TMD) can significantly affect the quality of life of individuals. However, evidence of TMD involvement and the extent of the impacts caused by it, in groups exposed to a stressful routine, are still scarce. Therefore, the aim of the present study was to evaluate the prevalence of TMD signs and symptoms and their impact on quality of life related to oral health in construction workers. Material and methods: This cross-sectional study included only male individuals. Illiterate workers and functional illiterate were excluded. The diagnosis of TMD was established according to the Research Diagnostic Criteria for TMD (RDC/TMD). The Oral Health Impact Profile questionnaire validated for Portuguese (OHIP-14) was used to assess the impact of TMD on oral health and quality of life. Descriptive analysis of TMD signs and symptoms was performed. Data related to the OHIP-14 questionnaire were compared using the Mann-Whitney U test. Pearson's correlation was also performed. The established alpha of this study was 5%. Results: 230 individuals were included. The mean age was 37.8 (SD=11) years. The most frequent TMD sign and the symptom was disc displacement, 86 (37.39%) of the individuals. OHIP-14 demonstrated a statistically significant difference when

compared to all TMD signs and symptoms (p<0.001). A weak correlation was observed between pain and OHIP-14 (r=0.366; p<0.0001). Conclusion: TMD affects oral health and quality of life for construction workers.

Key-words: Temporomandibular joint disorders, Oral health, Quality of life, Sickness impact profile.

RESUMO

Introdução: A disfunção da articulação temporomandibular (DTM) pode afetar significativamente a qualidade de vida dos indivíduos. No entanto, as evidências do envolvimento da DTM e a extensão dos impactos por ela causados, em grupos expostos a uma rotina estressante, ainda são escassas. Desta forma, o objetivo do presente estudo foi avaliar a prevalência de sinais e sintomas da DTM e seu impacto na qualidade de vida relacionada à saúde bucal em trabalhadores da construção civil. Material e métodos: Este estudo transversal incluiu apenas indivíduos do sexo masculino. Foram excluídos trabalhadores analfabetos e analfabetos funcionais. O diagnóstico de DTM foi estabelecido de acordo com o *Research Diagnostic Criteria for TMD* (RDC/TMD). O questionário *Oral Health Impact Profile* validado para o português (OHIP-14) foi utilizado para avaliar o impacto da DTM na saúde bucal e na qualidade de vida dos trabalhores. Foi realizada análise descritiva dos sinais e sintomas de DTM. Os dados relacionados ao questionário OHIP-14 foram comparados usando o teste U de Mann-Whitney. A correlação de Pearson também foi realizada. O alfa estabelecido neste estudo foi de 5%. Resultados: 230 indivíduos foram incluídos. A média de idade foi de 37,8 (DP = 11) anos. O sinal e sintoma de DTM mais frequente foi deslocamento de disco, 86 (37,39%) dos indivíduos. O OHIP-14 demonstrou diferença estatisticamente significativa quando comparado a todos os sinais e sintomas de DTM (p <0,001). Foi observada correlação fraca entre dor e OHIP-14 (r = 0,366; p <0,0001). Conclusão: a DTM afeta a saúde bucal e a qualidade de vida dos trabalhadores da construção.

Palavras-chave: Transtorno da articulação temporomandibular, Saúde bucal, Qualidade de vida, Perfil de impacto da doença.

1 INTRODUCTION

Temporomandibular joint disorder (TMD) is a complex pathological condition involving pain and dysfunction in the temporomandibular joint and in masticatory muscles. TMD has a multifactorial etiology. Health conditions, jaw parafunction, psychosocial alterations, deteriorating sleep quality and genetic polymorphisms are risk factors previous identified associated with TMD (Slade et al., 2016). The prevalence of TMD range from 5% to 50% according to the population's ethnicity, study design and diagnostic criteria used to assess TMD (Modi; Shaikh; Mude, 2012; Vojdani; Bahrani; Ghadiri, 2012).

There is some evidence that TMD impacts quality of life, affecting individuals in their daily lives, especially in work, school, sleep and food activities, due to pain, limited mouth opening and masticatory difficulties (Bitiniene et al., 2018). Psychobehavioral or

psychosocial factors, such as distress, anxiety, somatization, and depression are more commonly reported in TMD patients (Sójka et al., 2019). Depression seems to play an important role in the etiology and in the perpetuation of the condition (Selaimen et al., 2007).

The instrument "Research Diagnostic Criteria for “Temporomandibular Disorders" (RDC/TMD) is the most used in TMD researches since its publication in 1992 by Dworkin and LeResche (Dworkin; LeResche, 1992). This tool aims to perform a physical diagnosis and identify other relevant characteristics of the patient that may influence the condition. The RDC/TMD consists of a self-administered questionnaire with 31 questions and a clinical examination form with 10 items, as well as the specifications of the clinical examination and diagnostic criteria that allow to classify each case according to the patient's physical condition (Axis I) and psychological conditions (Axis II). Axis I classify individuals into three categories: Myofacial pain, disc displacement and joint inflammation. While Axis II classify patients according to the chronic pain, degree of depression, nonspecific physical symptoms including and excluding pain. The RDC/TMD is a diagnostic system used worldwide (Wiese et al., 2008), but was initially proposed in English language and subsequently validated for the Portuguese language. The version was considered valid and with reproducible results for Brazilians.

The Oral Health Impact Profile (OHIP) is an instrument used to measure the perception of the social impact of oral disorders on the well-being of patients. It was developed by Slade and Spencer in Australia in 1994, and the original version of the questionnaire had 49 questions. Latter, Slade conducted a study to validate the simplified version, OHIP-14 with only 14 questions, keeping the original concept of the instrument. The questionnaire is subdivided into 7 subscales: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability and handicap in carrying out daily activities. These segments are based on the conceptual model of oral health (Miettinen; Lahti; Sipilä, 2012). Currently, it is one of the most widely used international indicators as it presents acceptable reliability and validity to measure quality of life related to oral health. OHIP-14 is a relevant instrument that allows individuals to self-report the impact of oral health on quality of life (OHQoL) (Gabardo; Moysés; Moysés, 2013).

Several studies showed that females are more affected by TMD and they have received more attention in the investigations of risk factors associated with TMD (Johansson et al., 2003; Suvinen et al., 2005; Louca Jounger et al., 2017). However, males

are also affected by this condition and investigations in specific risk groups, such workers in stressful jobs, are necessary. Therefore, in this study we evaluated the prevalence of the signs and symptoms of TMD in male construction workers and evaluate TMD impacts oral-related quality of life.

2 MATERIAL AND METHODS

This project was approved by the local Human Research Ethics Committees (number # 2.802.708 CAAE # 94262618.4.0000.0093). This cross-sectional study was performed in the Dental Clinic of the Social Service of the Civil Construction Industry Union of the Paraná State (SECONCI-PR), located in the south of Brazil. SECONCI-PR is a non-profit organization, linked to the Employer's Union of the Civil Construction Industry of Paraná, which represents companies in the sector. The organization promotes health and safety at work for the construction workers of the city of Curitiba (capital of Paraná state) and its metropolitan region.

The construction workers were consecutively included from 2018 to 2019. During the initial appointment, the patient was invited to participate in the study. Only manual workers from the construction site were invited. All included patients signed the Informed Consent Form. Illiterate workers and functional illiterates, those who were unable to understand and express themselves in written form, were excluded. Females were not included.

The examiner (an experience dentist) was trained and calibrated for TMD diagnosis according to the criteria of Axis I of the Research Diagnostic Criteria for TMD (RDC/TMD). This axis diagnoses individuals about three groups of disorders: myofascial pain, disc displacements and inflammatory conditions. The myofascial pain could be with or without mouth opening limitation. Disc displacements are evaluated for each side, and could be with or without reduction. Inflammatory conditions were also considered by side, classified in arthralgia, osteoarthritis and osteoarthrosis. To compare TMD with OHIP-14 values we classified the individuals according to the presence or absence of some diagnose in each group, on at least one side.

Axis II was filled by the worker and aimed to measure the intensity of pain and the levels of depressive symptoms. It classifies the chronic pain in a grade from 0 to IV, that correspond to: 0 - low incapacity; I - low intensity, II - high intensity, III - moderate limitation and IV - severe limitation. Depression, Nonspecific Physical Symptoms Including Pain (NPSIP) and Nonspecific Physical Symptoms Excluding Pain (NPSEP).

They were dichotomized by the presence or absence of these conditions to compare with OHIP-14 values. When the individuals were diagnosed with grade 0, it was considered absence of chronical pain, when they have grade I or more it was considered the presence. For variables Depression, NPSIP and NPSEP, when they presented the diagnose regular, it was considered absence, and, when they presented moderate or severe diagnose, were considered the presence of the conditions.

The reduced version of the Oral Health Impact Profile questionnaire validated for Portuguese (OHIP-14) was used. The questionnaire consists of 14 questions, two from each of the seven domains of the instrument (functional limitation, physical pain, psychological discomfort, physical disability, psychological disability and handicap). There are 5 possible answers for each question: never, seldom, sometimes, repeatedly and always, which are graded as zero, one, two, three and four points, respectively. The combined ordinal responses produce a total score (OHIP-total) that can vary from 0 to 56. Higher scores indicate a greater negative impact on OHQoL. The score in each domain ranges from 0 to 18 and higher scores indicates greater impairment.

Data were submitted to statistical analysis, there was performed a descriptive analysis about the frequencies of TMD signs and symptoms. The normality distribution of numerical variable was analyzed by Shapiro-Wilk test. The OHIP-14 data was presented as median (minimum and maximum) and the OHIP-14 total scale and domains were compared with RDC-TMD diagnoses using Mann-Whitney U test. A Pearson correlation test was also performed. The statistical significance was determined for values with probability over 95% (alpha = 0.05). All analyses were performed using the Prism 8 software (Graph Pad Software Inc., San Diego, California, United States of America).

3 RESULTS

Seven individuals did not complete the questionnaire or were not clinically examined. Thus, a total of 230 male patients were included. The age ranged from 18 to 77 years and the mean age was 37.8 (standard deviation 11.0) years.

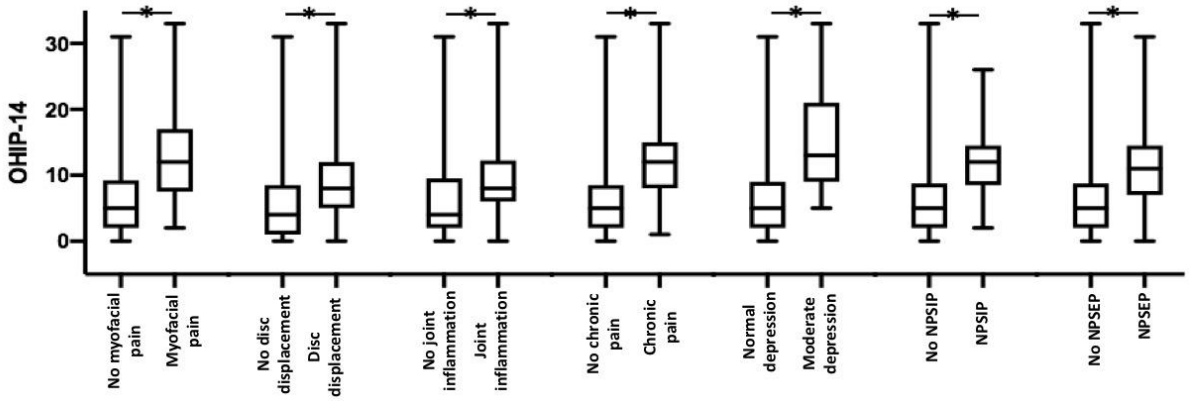
The frequency of the signs and symptoms of TMD is presented the in Table 1. Among the patients that reported pain, the mean pain intensity was 48.4 (± 19.9).

Table 1. Characteristics of the sample according to the signs and symptoms of TMD (RDC/TMD axis I and II)

Signs and symptoms	*n*	*%*
Myofacial pain	20	8.70
Disc displacement	86	37.39
Inflammatory disorders	56	24.35
Chronic Pain	33	14.35
Depression		
Normal	207	91.19
Mild	19	8.37
Severe	1	0.44
Nonspecific physical symptoms including pain		
Normal	202	88.60
Mild	26	11.40
Severe	0	0
Nonspecific physical symptoms excluding pain		
Normal	196	85.96
Mild	32	14.04
Severe	0	0

The distribution of OHIP-14 (Total) according to the absence or presence of TMD signs and symptoms are shown in Figure 1. There was a statistically significant difference in all comparisons ($p<0.001$).

Figure 1. Distribution of OHIP-14 (Total) according to the absence or presence of TMD signs and symptoms. NPSIP means nonspecific physical symptoms including pain. NPSEP means nonspecific physical symptoms excluding pain.



Statistical comparison of TMD signs and symptoms according to each domain of OHIP-14 is presented in the Table 2.

In the Pearson correlation test, only a weak correlation was observed between pain and OHIP-14 ($r=0.366$; $p<0.0001$).

Table 2. Comparison of OHIP-14 domains according to the subgroups RDC/TMD axis I and II.

	D1	p-value	D2	p-value	D3	p-value	D4	p-value	D5	p-value	D6	p-value	D7	p-value
Myofacial pain														
No	0 (0-6)	0.122	0 (0-7)	**0.004**	3 (0-8)	**0.0005**	1 (0-8)	**0.007**	4 (0-7)	**<0.0001**	0 (0-5)	**<0.0001**	0 (0-5)	**0.005**
Yes	0 (0-4)		2 (0-6)		4 (1.5-8)		4 (1-7)		2.2 (0-6)		2 (0-4)		0 (0-6)	
Disc displacement														
No	0 (0-6)	0.911	0 (0-7)	**0.020**	1 (0-8)	**<0.0001**	0 (0-8)	**0.037**	1 (0-6)	**0.0005**	0 (0-5)	**<0.0001**	0 (0-4)	0.201
Yes	0 (0-6)		0 (0.5-6)		2 (0-8)		0 (0-8)		2 (0-6)		1 (0-4)		0 (0-6)	
Joint inflammation														
No	0 (0-6)	0.345	0 (0-7)	**0.005**	1 (0-8)	**0.001**	0 (0-8)	**0.018**	1 (0-6)	**0.002**	0 (0-4)	**<0.0001**	0 (0-5)	0.198
Yes	0 (0-4)		1 (0-6)		3 (0-8)		0 (0-8)		2 (0-6)		1 (0-5)		0 (0-6)	
Chronic Pain														
No	0 (0-6)	**0.039**	0 (0-7)	**0.0008**	2 (0-8)	**<0.0001**	0 (0-8)	**0.0005**	1 (0-6)	**<0.0001**	0 (0-5)	**<0.0001**	0 (0-5)	**0.044**
Yes	0 (0-4)		2 (0-4)		4 (0-8)		1 (0-7)		3 (0-6)		1 (0-4)		0 (0-6)	
Depression[#]														
Normal	0 (0-6)	**0.022**	0 (0-6)	**0.120**	2 (0-8)	**<0.0001**	0 (0-8)	**0.0005**	1 (0-6)	**<0.0001**	0 (0-5)	**<0.0001**	0 (0-5)	**0.020**
Moderate	0 (0-6)		1 (0-1)		4 (0-8)		1.5 (0-7)		3 (0-6)		2 (0-4)		0 (0-5)	
NPSIP														
No	0 (0-6)	0.075	0 (0-7)	**<0.0001**	2 (0-8)	**0.005**	0 (0-8)	**0.0001**	1 (0-6)	**0.0001**	0 (0-5)	**0.001**	0 (0-6)	**0.042**
Yes	0 (0-4)		2 (0-6)		3 (0-8)		2 (0-6)		3 (0-6)		1 (0-4)		0 (0-3)	
NPSEP														
No	0 (0-6)	0.976	0 (0-7)	**0.030**	2 (0-8)	**0.021**	0 (0-8)	**0.001**	1 (0-6)	**0.0001**	0 (0-5)	**0.002**	0 (0-6)	**0.005**
Yes	0 (0-4)		1 (0-6)		3 (0-8)		1 (0-8)		3 (0-6)		1 (0-4)		0 (0-5)	

Note: D1 means Functional limitation; D2 means physical pain; D3 means physiological discomfort; D4 means physical disability; D5 means physiological disability; D6 means handicap; and D7 means social disability.
Bold form indicates statistical significance difference.
[#]Only one case was identified with severe depression and was excluded from this analysis.

4 DISCUSSION

There is a lack in the literature of studies focusing in the evaluation of TMD and its impact in the OHQoL of construction workers. Some professions can potentially be triggering factors related to TMD, especially those that generate more stress in their professional daily practice and construction workers are among of them. The literature already showed an association between TMD and professions that require greater muscular effort (Donnarumma et al., 2010), like in our study. We found that 71.9% of the workers presented at least one sign or symptom of TMD. The incidence of TMD varies depending on the studied population (John et al., 2007). According to Reiter et al. (Reiter et al., 2015), the prevalence among the studies is often related with the social context, ethnic origin, culture, and personality traits. It is also possible that the fact that the diagnosis of TMD is based on the identification of at least one sign or symptom also contributes to the variation in the prevalence among the studies.

In a study performed in metallurgists (97% males) with a mean age of 34.5 years, the joint crepitation was diagnosed in 17.8% of 460 workers (Barros et al., 2012). Another study evaluating metallurgical and mechanical workers, also with a predominantly male population and a mean age of 31.3 years, identified myofascial pain in 17.2% of 480 workers (Lacerda; Traebert; Zambenedetti, 2008). In our sample, 38.3% of the workers presented disk displacement, this is similar with the prevalence observed in professional karate-do and mixed martial arts fighters (Bonotto et al., 2016). However, it is important to mention that disc displacements are a common condition in the general population, usually followed by pain or impaired mandibular function (Amaral et al., 2013).

Chronic pain was observed in 14% of the population. Previous studies also identified similar prevalence of chronic pain in workers (Manfredini et al., 2010; Olivo et al., 2010). However, it is important to highlight that studies including women may present different results, once females present more myofascial pain than males (Johansson et al., 2003; Suvinen et al., 2005; Louca Jounger et al., 2017). A longitudinal study observed that the prevalence of chronic TMD is higher in women than in men, although the prevalence of acute TMD is similar between genders (Slade et al., 2016). Therefore, we decided to exclude females from our study, once they are the minority in the construction field.

The OHIP-14 is known as a precise, valid and reliable instrument for assessing OHQoL among adult populations. Therefore, we used this instrument in the present study in order to identify if signs and symptoms of TMD impacts the OHQoL in Brazilian

construction workers. We were able to note that all evaluated sings and symptoms of TMD have a negative impact in the total OHIP-14.

A systematic review assessing 12 articles published between year 2006 and 2016 that evaluated quality of life in patients with TMD. The authors observed that OHIP-14 was one of the most used instruments to assess quality of life among the studies. In their systematic review, they concluded that TMD impact negatively quality of life (Bitiniene et al., 2018). In this systematic review four studies used OHIP-14 (Miettinen; Lahti; Sipilä, 2012; Blanco Aguilera et al., 2014; Pereira et al., 2009; Lemos et al., 2015) and only one did not observe an association between TMD and OHQoL (Miettinen; Lahti; Sipilä, 2012). The other 3 studies concluded that TMD patients have lower quality of life (Blanco Aguilera et al., 2014; Pereira et al., 2009; Lemos et al., 2015). In our study signs and symptoms of TMD were also associated with almost all the OHIP-14 domains, demonstrating that TMD negatively impact OHQoL.

In conclusion, TMD impacts OHQoL by multiple ways, including physical, depression and somatization traits. Additionally, our findings emphasize the importance of early and effective diagnoses and treatment of TMD in construction workers.

CONFLICTS OF INTEREST

There are no conflicts of interest.

REFERENCES

Amaral RO, Damasceno NN, de Souza LA, Devito KL. Magnetic resonance images of patients with temporomandibular disorders: prevalence and correlation between disk morphology and displacement. Eur J Radiol 2013;82:990-4.

Barros ACM, Schmidt CM, Marote IAA, Queluz DP. Profile of oral health workers in the metallurgical industry. Odonto 2012;20:73-87.

Bitiniene D, Zamaliauskiene R, Kubilius R, Leketas M, Gailius T, Smirnovaite K. Quality of life in patients with temporomandibular disorders. A systematic review. Stomatologija 2018;20:3-9.

Blanco-Aguilera A, Blanco-Hungría A, Biedma-Velázquez L, Serrano-Del-Rosal R, González-López L, Blanco-Aguilera E, et al. Application of an oral health-related quality of life questionnaire in primary care patients with orofacial pain and temporomandibular disorders. Med Oral Patol Oral Cir Bucal 2014;19:e127-135.

Bonotto D, Namba EL, Veiga DM, Wandembruck F, Mussi F, Cunali PA, et al. Professional karate-do and mixed martial arts fighters present with a high prevalence of temporomandibular disorders. Dent Traumatol 2016;32:281-5.

Donnarumma MDC, Muzilli CA, Ferreira C, Nemr K. Temporomandibular disorders: signs, symptoms and multidisciplinary approach. Rev CEFAC 2010;12:788-794.

Dworkin SF, LeResche L. Research diagnostic criteria for temporomandibular disorders: review, criteria, examinations and specifications, critique. J Craniomandib Disord 1992;6:301-55.

Gabardo MC, Moysés ST, Moysés SJ. Self-rating of oral health according to the Oral Health Impact Profile and associated factors: a systematic review. Rev Panam Salud Publica 2013;33:439-445.

Johansson A, Unell L, Carlsson GE, Söderfeldt B, Halling A. Gender difference in symptoms related to temporomandibular disorders in a population of 50-year-old subjects. J Orofac Pain 2003;17:29-35.

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.

Lacerda JT, Traebert J, Zambenedetti ML. Orofacial pain and absenteeism in workers of the metallurgic and mechanics industry. Saude soc 2008;17:182-191.

Lemos GA, Paulino MR, Forte FDS, Beltrão RTS, Batista AUD. Influence of temporomandibular disorder presence and severity on oral health-related quality of life. Rev dor 2015;16:10-14.

Louca Jounger S, Christidis N, Svensson P, List T, Ernberg M. Increased levels of intramuscular cytokines in patients with jaw muscle pain. J Headache Pain 2017;18:30.

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.

Miettinen O, Lahti S, Sipilä K. Psychosocial aspects of temporomandibular disorders and oral health-related quality-of-life. Acta Odontol Scand 2012;70:331-336.

Modi P, Shaikh SS, Munde A. A cross sectional study of prevalence of temporomandibular disorders in university students. Int J Sci Res Publ 2012;2:1-3.

Olivo SA, Fuentes J, Major PW, Warren S, Thie NM, Magee DJ. The association between neck disability and jaw disability. J Oral Rehabil 2010;37:670-679.

Pereira TC, Brasolotto AG, Conti PC, Berretin-Felix G. Temporomandibular disorders, voice and oral quality of life in women. J Appl Oral Sci 2009;17:50-56.

Reiter S, Emodi-Perlman A, Goldsmith C, Friedman-Rubin P, Winocur E. Comorbidity between depression and anxiety in patients with temporomandibular disorders according to the research diagnostic criteria for temporomandibular disorders. J Oral Facial Pain Headach. 2015;29:135-143.

Selaimen C, Brilhante DP, Grossi ML, Grossi PK. Depression and neuropsychological testing in patients with temporomandibular disorders. Cien Saude Colet 2007;12:1629-1639.

Slade GD, Ohrbach R, Greenspan JD, Fillingim RB, Bair E, Sanderse AE, et al. Painful temporomandibular disorder: Decade of discovery from OPPERA studies. J Dent Res 2016;95:1084-1092.

Sójka A, Stelcer B, Roy M, Mojs E, Pryliński M. Is there a relationship between psychological factors and TMD? Brain Behav 2019;9:e01360.

Suvinen TI, Reade PC, Hanes KR, Könönen M, Kemppainen P. Temporomandibular disorder subtypes according to self-reported physical and psychosocial variables in female patients: a re-evaluation. J Oral Rehabil 2005;32:166-173.

Vojdani M, Bahrani F, Ghadiri P. The study of relationship between reported temporomandibular symptoms and clinical dysfunction index among university students in Shiraz. Dent Res J (Isfahan) 2012;9:221-225.

Wiese M, Wenzel A, Hintze H, Petersson A, Knutsson K, Bakkee M, et al. Osseous changes and condyle position in TMJ tomograms: impact of RDC/TMD clinical diagnoses on agreement between expected and actual findings. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2008;106:e52-e63.