

Clinical presentations and co-morbid factors of patients with myofascial pain or myalgia of masticatory muscles

Goli Chamani DDS, MSc¹, Elham Abbaszadeh DDS, MSc²,
Mohammad Reza Zarei DDS, MSc³, Robert L. Merrill Jr DDS⁴,
Maryam Rad DDS, MSc, PhD⁵

Original Article

Abstract

BACKGROUND AND AIM: This study was aimed to investigate the clinical presentations and frequencies of co-morbid factors in patients with myofascial pain or myalgia of masticatory muscles.

METHODS: In this retrospective study, the data were obtained from the documents of the patients with myalgia or myofascial pain of the masticatory muscles who were conceded to Kerman Orofacial Pain Clinic, Kerman, Iran. Their clinical presentations and frequencies of possible related comorbid factors were evaluated. The chi-square test, Fisher's exact test, and t-test were used for comparing the distribution of variables. Analysis of variance (ANOVA) and Tukey's honestly significant difference (HSD) test were also used for comparisons between groups. A P-value ≤ 0.05 was considered statistically significant.

RESULTS: Patients with masticatory muscle myalgia or myofascial pain consisted of 296 individuals, 258 women (87.7%) and 38 men (12.3%) with an average age of 34.00 ± 11.75 years (range: 15-75 years). Temporomandibular disorder (TMD) occurred in 259 (87.5%) patients and 262 (88.5%) subjects had headache. A total of 178 individuals (60.1%) reported pain in three parts of the body and 155 subjects (52.4%) had insomnia. Bruxism, other oral para-functional habits, and poor head and neck postures were found in 156 (52.7%), 167 (56.4%), and 80 (27.0%) subjects, respectively. The frequency of moderate to severe depression and moderate anxiety was 22.0% of our study population.

CONCLUSION: This study stated that the frequency of masticatory muscle pain (MMP) was high in patients with TMD, headache, and psychological disorders and accompanied with insomnia, oral parafunction, and bodily pain.

KEYWORDS: Myofascial Pain; Myalgia; Masticatory Muscles; Temporomandibular Joint Disorders; Headache

Citation: Chamani G, Abbaszadeh E, Zarei MR, Merrill Jr RL, Rad M. **Clinical presentations and co-morbid factors of patients with myofascial pain or myalgia of masticatory muscles.** J Oral Health Oral Epidemiol 2019; 8(4): 190-7.

As muscle tenderness and muscle pain are the most frequent signs and symptoms of temporomandibular disorders (TMDs), examination of them is one of the main methods in orofacial pain clinic to establish an appropriate diagnosis and treatment.¹ The total prevalence of myofascial pain is about 46.0%,

but it could be as much as 85.0%.² Etiology of masticatory myofascial pain (MMP) is complex and poorly understood.³ The most common type of chronic pain that referred to dentists is TMD.⁴ Concept of chronic pain is different from acute pain. Chronic pains in various parts of the body are related to each others. They are not distinct entities. They

1- Professor, Department of Oral Medicine and Orofacial Pain, School of Dentistry, Kerman University of Medical Sciences, Kerman, Iran

2- Assistant Professor, Department of Oral Medicine and Orofacial Pain, School of Dentistry, Kerman University of Medical Sciences, Kerman, Iran

3- Associate Professor, Department of Oral Medicine and Orofacial Pain, School of Dentistry, Kerman University of Medical Sciences, Kerman, Iran

4- Professor, Director of Orofacial Pain Program, UCLA School of Dentistry, Los Angeles, California, USA

5- Oral and Dental Diseases Research Center AND Kerman Social Determinants on Oral Health Research Center, Kerman University of Medical Sciences, Kerman, Iran

Correspondence to: Elham Abbaszadeh DDS, MSc

Email: elham_abbaszadeh27@yahoo.com

have common etiologies. TMD is a chronic pain condition that can occur in association with some other chronic pain conditions like headache and pain in the neck, shoulder, and back areas.⁵

Myofascial pain syndrome (MPS) features have not been investigated completely with regard to these associations. This study proposed to describe and analyze the relationship between MPS and TMD, primary headaches, chronic widespread pain, general health and psychological status, sleep, oral habits, and posture in the individuals with myofascial pain or myalgia of masticatory muscles. This study has been conducted to determine the frequency of clinical presentations and comorbid factors in patients with myofascial pain or myalgia of masticatory muscles.

Methods

This retrospective cross-sectional study was approved by the Dental and Oral Diseases Research Center of Kerman University of Medical Sciences, Kerman, Iran (ethics code of this research: IR.KMU.REC.1393.462). The data were gathered from all records of the patients with the main complaint of craniofacial pain who were accepted in the Orofacial Pain Clinic in Kerman School of Dentistry, Kerman University of Medical Sciences from July 2014 to July 2016. The sampling method was census. The evaluation of charts and data collection was done by a 3rd year resident that was trained in this field. We obtained data that were recorded in the charts of patients who had myalgia or myofascial pain of the masticatory muscles. Additionally, the clinical presentations of patients, frequency of related comorbid factors, bodily pain, sleep disturbance, smoking habits, poor postures, oral parafunctional habits, and psychological status were also assessed.⁶⁻⁸

The data were recorded by a checklist in a questionnaire format which consisted of 8 main domains including: 1. demographic characteristics and general health status,

2. clinical presentations, 3. bodily pain, 4. sleep disturbance, 5. smoking habits, 6. poor postures, 7. oral parafunctional habits, and 8. psychological status.

The evaluation of TMD and headache problems was based upon documented self-report and clinical examinations. The applied clinical protocol was based on the American Academy of Orofacial Pain (AAOP) classification, using the Diagnostic Criteria for TMDs (DC/TMD).^{9,10}

Assessment of headache was based on the International Classification for Headache Disorders-3rd edition (beta version), 2013 (ICHD-3-β).¹¹ For assessment of bodily pain, we assessed pain from three parts of the body including neck, low back, and abdomen.^{6,8}

Insomnia assessment was done based on American Academy of Sleep Medicine (AASM) definition. Insomnia, according to the AASM definition, is a subjective complaint of problem with falling and staying asleep despite ample opportunity for sleep.¹² Patients with bad head and neck position for a long period of time (few hours) during their routine activities were regarded to have bad posture. Oral parafunction was evaluated via a checklist and oral examination. Also, the standardized Persian version of Beck Depression Inventory (BDI)¹³ and Beck Anxiety Inventory (BAI)¹⁴ were used for evaluation of psychological status of patients.

Descriptive statistics were used to describe the basic features of the data in this study using SPSS software (version 21, IBM Corporation, Armonk, NY, USA). Chi-square test and Fisher's exact test were used to compare two non-numerical variables and t-test was used for continuous variables. Analysis of variance (ANOVA) and Tukey's honestly significant difference (HSD) test were performed to compare the groups. A P-value of < 0.05 was considered statistically significant.

Results

In all, 336 charts were evaluated. 40 patients were excluded from our study because their chief complaints were not related to muscle

pain. These patients were as follows: 14 subjects with trigeminal neuralgia (TN), 17 patients with burning mouth syndrome (BMS), 3 individuals with cluster headache (CH), and 6 patients with trigeminal neuropathy. The final study sample consisted of 296 individuals with myofascial pain or myalgia of the masticatory muscles. Of these individuals, 258 were women (87.7%) and 38 were men (12.3%) with a mean age of 34.00 ± 11.75 years (range: 15-75 years).

TMD occurred in 87.5% (259) of patients. The most common symptom of TMD (93.4%, 242 subjects) was pain in temporomandibular joint (TMJ), jaw, ear, or temporal and preauricular areas. TMJ sounds and limitation of mouth opening were other common symptoms reported by 32.0% (83 subjects) and 26.6% (69 subjects) of patients with TMD, respectively. The majority of patients had two or more symptoms. Most of the patients with TMD (70.5%) had chronic pain (> 3 months), while 29.5% were suffering from acute pain (< 3 months) at the time of their first visit. The most common TMD sign was tenderness of the lateral pole of the condyle (83.0%), clicking (41.0%), deviation (28.1%), deflection (27.4%), and crepitus (8.1%). Among the study population, 69 patients (23.3%) had a history of trauma to the head and TMJ and 3 patients had experienced whiplash trauma.

Arthralgia (71.4%) and myofascial pain (63.7%) were the most prevalent TMDs (Table 1).

Table 1. Frequency of various types of temporomandibular disorders (TMDs)

Disorder	n (%)
Arthralgia	185 (71.4)
Myofascial pain	165 (63.7)
Headache attributed to TMD	105 (40.5)
Disk displacement with reduction	106 (41.0)
Myalgia	97 (37.4)
Subluxation	9 (3.4)
Disk displacement without reduction	6 (2.3)
Muscle splinting	3 (1.1)
Two or more than two diagnoses of TMD	136 (52.5)

TMD: Temporomandibular disorder

Headache was present in 262 (88.5%) subjects of sample (Table 2). Migraine without

aura was the most frequent headache among patients. In 176 (67.1%) patients with headache, palpation of masticatory muscles replicated the headache. Palpation of temporalis and sternocleidomastoid muscles replicated the headache in 151 (57.6%) and 126 (48.0%) patients, respectively. Some of the patients (67 subjects) had more than one type of headache. The number of patients with chronic headache was 190 (72.8%) and 27.2% of the patients had acute headache.

Table 2. Types of headache among patients with myofascial pain or myalgia of the masticatory muscles

Diagnosis	n (%)
Migraine	195 (74.4)
Migraine without aura (1.1)	139 (53.0)
Migraine with aura (1.2)	47 (17.9)
Retinal migraine (1.2.4)	8 (3.0)
Abdominal migraine (1.6.1.2)	1 (0.3)
TTH	104 (39.6)
MOH	39 (14.8)
Migraine	29 (11.0)
TTH	10 (3.8)
CDH	9 (3.4)
Migraine	7 (2.6)
TTH	2 (0.7)
CGH	4 (1.5)
Two or more than two diagnoses of headache	67 (25.5)

TTH: Tension-type headache; MOH: Medication overuse headache; CDH: Chronic daily headache; CGH: Cervicogenic headache

A total of 156 (52.7%) patients had a history of different kinds of jaw parafunction, including clenching or bruxism whether it was nocturnal or diurnal. Signs and symptoms of bruxism are shown in table 3. Attrition was the most frequent sign. A total of 167 patients (56.4%) had oral habits other than bruxism.

Table 3. Frequency of signs and symptoms of bruxism in patients with myofascial pain or myalgia of masticatory muscles

Sign and symptom of bruxism	n (%)
Attrition	243 (82.0)
Cheek ridging	221 (74.7)
Tongue ridging	221 (74.7)
Generalized tooth sensitivity	14 (4.7)
Tooth chipping	6 (2.0)
Abfraction	2 (0.7)
Two or more than two signs of bruxism	229 (77.3)

Table 4. Psychological status of patients with myofascial pain or myalgia of masticatory muscles

Depression status		Anxiety status	
BDI score	Frequency of different levels of depression among patients [n (%)]	BAI score	Frequency of different levels of anxiety among patients [n (%)]
0-9	Normal [89 (37.0)]	0-21	Very low anxiety [166 (69.1)]
10-15	Mild depression [52 (21.5)]	22-35	Moderate anxiety [53 (22.0)]
16-19	Mild to moderate depression [25 (10.3)]	> 35	Severe anxiety [20 (8.3)]
20-29	Moderate to severe depression [53 (22.0)]		
30-63	Severe depression [21 (8.7)]		

BDI: Beck Depression Inventory; BAI: Beck Anxiety Inventory

The BDI and BAI forms were completed in only 240 patients due to illiteracy, advanced age, or cognitive problems. The scores and interpretations of these inventories are demonstrated in table 4.

A total of 178 individuals (60.1%) reported bodily pain: low back in 41.2% (122), neck in 35.1% (104), and abdomen in 19.9% (59) of the subjects. A total of 27.0% of sample (80 subjects) had poor posture during their daily activities and 155 subjects (52.4%) had insomnia. In this study, 21 individuals (7.1%) were smoker and 7 patients used alcohol. Use of energy drink was reported by 10 patients.

The study sample was further classified into three groups including 225 (76.0%) subjects with TMD and headache, 34 (11.5%) subjects with TMD without headache, and 37 (12.5%) subjects with headache without TMD. This study showed that there was a significantly higher frequency of insomnia in patients who had TMD and headache together compared to patients who had TMD or headache alone ($P = 0.010$). Analysis of BDI and BAI scores in the three groups of patients showed that the level of anxiety was significantly higher in patients who had only headache ($P = 0.020$) compared to those who had TMD alone. We evaluated the association of headaches with bodily pain, insomnia, bruxism, oral parafunctional habits, poor posture, trauma, and smoking. There was a statistically significant association between headache with insomnia ($P = 0.004$). Our study showed a statistically significant high value of anxiety among patients with insomnia. Additionally, the value of depression was significantly high in patients with headache ($P = 0.030$), insomnia

($P = 0.0001$), poor posture ($P = 0.030$), and bruxism and oral habits ($P = 0.040$). In this study, there was no association between sleep problems with bodily pain, poor posture, and bruxism and oral habits. Our study showed that there was a marginal significant relationship between headache and gender; it is possible that if the number of men was more than this in our study population, the relationship would be significant. We also analyzed the relationship between trauma and clicking and it was statistically insignificant ($P = 0.700$). There was not also any statistically significant relationship between poor posture and bodily pain ($P = 0.600$).

The patients' medical histories showed that cardiovascular disease (CVD) was the most frequent health problem (37.0%) and palpitation was the most common cardiovascular complaint (23.3%). Other more frequent health problems were peptic ulcers, anemia, hypertension (HTN), and thyroid diseases.

Discussion

In this study, we assessed the frequency of clinical presentations and co-morbid factors of patients with myofascial pain or myalgia of masticatory muscles. The main finding of study was that patients with myofascial pain or myalgia had significantly more subtypes of TMD, headaches, bodily pain, sleep disturbances, poor posture, oral habits, depression, and anxiety. TMD occurred in 87.5% (259) of patients. Headache occurred in 262 (88.5%) subjects. A total of 178 individuals (60.1%) reported bodily pain.

The sample of the study was populated primarily by women ($n = 258, 87.7\%$), which is

consistent with other studies that report a higher prevalence of TMD and headache disorders in women.^{4,15} Interestingly, studies in the general population usually report much smaller differences between men and women compared to studies in clinical samples. It has been suggested that women tend to feel their pain as more intense, frequent, and continuous than men.¹⁶ This suggestion may explain the higher frequency of seeking care for women in the present study.

Many studies evaluated the frequencies of TMD and headache, but the results of these studies are not necessarily comparable to each other because of the different diagnostic criteria, methodology, and study groups. Our results showed a reciprocal relation between headache and TMD, that is compatible with results of papers demonstrating the relationship between TMD and headaches.^{4,17,18}

Many studies found a higher prevalence of masticatory muscle tenderness and TMJ pain in patients with headache.¹⁹⁻²¹ Several studies have demonstrated that headache and TMD are comorbid diseases, that is, the presence of one increases the frequency of the other.²² Some studies have shown that the larger the number of signs/symptoms of TMD, the higher the frequency of migraine or tension-type headache (TTH). In addition, they show that the treatment of TMD facilitates the treatment of headaches.²³ Melo et al. suggested that the severity of TMD was higher in patients with headache than general population.¹⁵ Graff-Radford showed that TMD impacted the headache because of the same innervations with the trigeminal nerve.²⁴ Bevilaqua-Grossi et al. showed that TMD could change the episodic headache to chronic.²⁵ Goncalves et al. wrote that TMD symptoms were higher in patients with migraine, TTH, and chronic daily headache (CDH), especially for migraine.¹⁷ These findings suggest that at least some of the headaches in the present study may be TMD-related, considering the neck and stomatognathic systems during evaluating and treating patients with headache disorders.

A strong association between TMD pain and other painful conditions has been found. In our study, 60.1% of subjects had bodily pain in at least three other parts of the body. Our results are in line with earlier findings in samples of patients with TMD and population-based studies. Wiesinger et al. showed the associations between back pain and musculoskeletal disorders.²⁶ Nilsson et al. demonstrated that neck pain and back pain were relevant to TMD pain.⁸ Bodily pain has been declared as one of the risk factors for the chronic TMD pain.²⁷ Lim et al.⁶ showed that subjects with TMD experienced more muscle, joint, back, chest, abdominal, and menstrual pain compared to those subjects without TMD.

In our study, 52.4% of the patients had insomnia and there was a significant relationship between headache and insomnia. Human experimental studies have found that pain and sleep disturbance have a reciprocal and bidirectional relation.²⁸ Sleep disorders are prevalent in patients with TMD²⁹ and recent studies have concluded that sleep disturbance is a predisposing factor for TMD.⁷ Lindroth et al. showed that the sleep status of patients with MMP was poorer, compared to patients with intracapsular pain.³⁰

Approximately, one quarter (27.0%) of subjects had poor head and neck posture during daily activities. Studies have shown a correlation between TMDs and poor head and neck posture. Frequently, patients with TMD show changes in the center of gravity of their bodies³¹ and anterior displacement of the head.³² Shortening of the posterior cervical extensor and sternocleidomastoid muscles are seen in patients with TMD.³³

In the study of Karibe et al., head-forward posture was significantly more frequent in the subjects with TMD than in the controls.³⁴

Patients with TMD may improve their symptoms after posture correction via instructions.

In the present study, 52.7% of subjects were conscious of having bruxism. Clinical signs of bruxism were found in most of

patients (82.0%), suggesting that some patients may not be aware of their parafunction. When parafunctional forces are more than the physiologic sufferance of the masticatory system, clinical signs and symptoms of TMD such as pain in TMJ or masticatory muscles are manifested.³⁵ Methodologically, assessing bruxism is difficult. Only polysomnography (PSG) in a sleep laboratory can confirm sleep bruxism.³⁶ Several recent studies have revealed significant associations between bruxism and signs and symptoms of TMD.³⁷⁻³⁹ Michelotti et al. stated that daytime clenching/grinding was a risk factor for myofascial pain and disc displacement.⁴⁰

We also have considered other oral parafunctional habits including gum chewing, lip, cheek, nail, or pen chewing, unusual jaw or tongue movements, and unilateral chewing in our study. More than half of the patients (54.6%) had oral habits; gum chewing and lip chewing were the most frequent oral habits in our study population. Gavish et al. discovered the associations of intensive gum chewing and crushing ice with muscle sensitivity and joint noises and also found a positive relation between unusual jaw movement, catching the jaw, and joint disturbances.⁴¹ Glaros et al. showed that patients with headache had more oral parafunctional behaviors.⁴²

We found that the associations between bruxism, oral habits, and anxiety were statistically significant. Pain is affected by physiological and psychological variables.⁷ In our study, 22.0% of the subjects had moderate to severe depression and moderate anxiety. There was a statistically significant relationship between headache and anxiety. Headache had a marginally significant association with depression. We also found a statistically significant association between

insomnia, depression, and anxiety. Many studies showed that patients with myofascial pain and different types of headache experienced more intensive symptoms of anxiety.^{43,44}

A number of studies have described an association between general health conditions and orofacial pain.^{45,46} The most frequent medical conditions among our patients were CVD (37.0%) and palpitation representing 62.7% of these subjects. It is possible that higher level of anxiety in our patients compared to general population made this discrepancy.

There were some limitations in the present study: 1. it was a cross-sectional study with no control group, 2. evaluation of psychological status was not possible for all of the patients, and 3. some data were collected from checklist and data relied on patients' memory and self-reporting.

Conclusion

In the present study, the frequency of masticatory muscles tenderness was high in TMD and headache disorders. Identification of common clinical presentations and comorbid factors of patients with myofascial pain or myalgia of the masticatory muscles may have a major impact on future diagnosis and treatment strategies. In addition, this would help clarify the importance of an interdisciplinary effort between different specialties, e.g., orofacial pain specialists, psychologists, and neurologists.

Conflict of Interests

Authors have no conflict of interest.

Acknowledgments

This work was supported by Kerman Oral and Dental Diseases Research Center, Kerman University of Medical Sciences.

References

1. Silveira A, Gadotti IC, Armijo-Olivo S, Biasotto-Gonzalez DA, Magee D. Jaw dysfunction is associated with neck disability and muscle tenderness in subjects with and without chronic temporomandibular disorders. *Biomed Res Int* 2015; 2015: 512792.

2. Fleckenstein J, Zaps D, Ruger LJ, Lehmeyer L, Freiberg F, Lang PM, et al. Discrepancy between prevalence and perceived effectiveness of treatment methods in myofascial pain syndrome: Results of a cross-sectional, nationwide survey. *BMC Musculoskelet Disord* 2010; 11: 32.
3. Suvinen TI, Reade PC, Kempainen P, Kononen M, Dworkin SF. Review of aetiological concepts of temporomandibular pain disorders: towards a biopsychosocial model for integration of physical disorder factors with psychological and psychosocial illness impact factors. *Eur J Pain* 2005; 9(6): 613-33.
4. Franco AL, Goncalves DA, Castanharo SM, Speciali JG, Bigal ME, Camparis CM. Migraine is the most prevalent primary headache in individuals with temporomandibular disorders. *J Orofac Pain* 2010; 24(3): 287-92.
5. Auvenshine RC. Temporomandibular disorders: Associated features. *Dent Clin North Am* 2007; 51(1): 105-27.
6. Lim PF, Smith S, Bhalang K, Slade GD, Maixner W. Development of temporomandibular disorders is associated with greater bodily pain experience. *Clin J Pain* 2010; 26(2): 116-20.
7. Lei J, Liu MQ, Yap AU, Fu KY. Sleep disturbance and psychologic distress: Prevalence and risk indicators for temporomandibular disorders in a Chinese population. *J Oral Facial Pain Headache* 2015; 29(1): 24-30.
8. Nilsson IM, List T, Drangsholt M. Headache and co-morbid pains associated with TMD pain in adolescents. *J Dent Res* 2013; 92(9): 802-7.
9. de Leeuw R. Orofacial pain: Guidelines for assessment, diagnosis, and management. 4th ed. New Malden, Surrey, UK: Quintessence Publishing; 2008.
10. Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet JP, 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(1): 6-27.
11. Headache Classification Committee of the International Headache Society (IHS). The International Classification of Headache Disorders, 3rd edition (beta version). *Cephalalgia* 2013; 33(9): 629-808.
12. Schutte-Rodin S, Broch L, Buysse D, Dorsey C, Sateia M. Clinical guideline for the evaluation and management of chronic insomnia in adults. *J Clin Sleep Med* 2008; 4(5): 487-504.
13. Ghassemzadeh H, Mojtabai R, Karamghadiri N, Ebrahimkhani N. Psychometric properties of a Persian-language version of the Beck Depression Inventory--Second edition: BDI-II-PERSIAN. *Depress Anxiety* 2005; 21(4): 185-92.
14. Kaviani H, Mousavi AS. Psychometric properties of the Persian version of Beck Anxiety Inventory (BAI). *Tehran Univ Med J* 2008; 66(2): 136-40. [In Persian].
15. Melo CE, Oliveira JL, Jesus AC, Maia ML, de Santana JC, Andrade LS, et al. Temporomandibular disorders dysfunction in headache patients. *Med Oral Patol Oral Cir Bucal* 2012; 17(6): e1042-e1046.
16. Cairns BE. The influence of gender and sex steroids on craniofacial nociception. *Headache* 2007; 47(2): 319-24.
17. Goncalves DA, Bigal ME, Jales LC, Camparis CM, Speciali JG. Headache and symptoms of temporomandibular disorder: An epidemiological study. *Headache* 2010; 50(2): 231-41.
18. Tchivileva IE, Ohrbach R, Fillingim RB, Greenspan JD, Maixner W, Slade GD. Temporal change in headache and its contribution to the risk of developing first-onset temporomandibular disorder in the Orofacial Pain: Prospective Evaluation and Risk Assessment (OPPERA) study. *Pain* 2017; 158(1): 120-9.
19. Cady RJ, Glenn JR, Smith KM, Durham PL. Calcitonin gene-related peptide promotes cellular changes in trigeminal neurons and glia implicated in peripheral and central sensitization. *Mol Pain* 2011; 7: 94.
20. Stuginski-Barbosa J, Macedo HR, Bigal ME, Speciali JG. Signs of temporomandibular disorders in migraine patients: A prospective, controlled study. *Clin J Pain* 2010; 26(5): 418-21.
21. Liljestrom MR, Le Bell Y, Anttila P, Aromaa M, Jamsa T, Metsahonkala L, et al. Headache children with temporomandibular disorders have several types of pain and other symptoms. *Cephalalgia* 2005; 25(11): 1054-60.
22. Goncalves MC, Florencio LL, Chaves TC, Speciali JG, Bigal ME, Bevilacqua-Grossi D. Do women with migraine have higher prevalence of temporomandibular disorders? *Braz J Phys Ther* 2013; 17(1): 64-8.
23. Goncalves DA, Camparis CM, Franco AL, Fernandes G, Speciali JG, Bigal ME. How to investigate and treat: migraine in patients with temporomandibular disorders. *Curr Pain Headache Rep* 2012; 16(4): 359-64.
24. Graff-Radford SB. Temporomandibular disorders and headache. *Dent Clin North Am* 2007; 51(1): 129-44.
25. Bevilacqua-Grossi D, Lipton RB, Napchan U, Grosberg B, Ashina S, Bigal ME. Temporomandibular disorders and cutaneous allodynia are associated in individuals with migraine. *Cephalalgia* 2010; 30(4): 425-32.
26. Wiesinger B, Malaker H, Englund E, Wanman A. Back pain in relation to musculoskeletal disorders in the jaw-face: A matched case-control study. *Pain* 2007; 131(3): 311-9.
27. Macfarlane TV, Blinkhorn AS, Davies RM, Kincey J, Worthington HV. Predictors of outcome for orofacial pain in the general population: A four-year follow-up study. *J Dent Res* 2004; 83(9): 712-7.
28. Moldofsky H. The significance of the sleeping-waking brain for the understanding of widespread musculoskeletal pain and fatigue in fibromyalgia syndrome and allied syndromes. *Joint Bone Spine* 2008; 75(4): 397-402.
29. Yatani H, Studts J, Cordova M, Carlson CR, Okeson JP. Comparison of sleep quality and clinical and psychologic

- characteristics in patients with temporomandibular disorders. *J Orofac Pain* 2002; 16(3): 221-8.
30. Lindroth JE, Schmidt JE, Carlson CR. A comparison between masticatory muscle pain patients and intracapsular pain patients on behavioral and psychosocial domains. *J Orofac Pain* 2002; 16(4): 277-83.
 31. Ishii H. A study on the relationships between imbalance of stomatognathic function and asymmetry of craniofacial morphology, and the center of gravity of the upright posture. *Osaka Daigaku Shigaku Zasshi* 1990; 35(2): 517-56. [In Japanese].
 32. Olmos SR, Kritz-Silverstein D, Halligan W, Silverstein ST. The effect of condyle fossa relationships on head posture. *Cranio* 2005; 23(1): 48-52.
 33. Cuccia A, Caradonna C. The relationship between the stomatognathic system and body posture. *Clinics (Sao Paulo)* 2009; 64(1): 61-6.
 34. Karibe H, Shimazu K, Okamoto A, Kawakami T, Kato Y, Warita-Naoi S. Prevalence and association of self-reported anxiety, pain, and oral parafunctional habits with temporomandibular disorders in Japanese children and adolescents: A cross-sectional survey. *BMC Oral Health* 2015; 15: 8.
 35. Lobbezoo F, Lavigne GJ. Do bruxism and temporomandibular disorders have a cause-and-effect relationship? *J Orofac Pain* 1997; 11(1): 15-23.
 36. Kato T, Thie NM, Huynh N, Miyawaki S, Lavigne GJ. Topical review: Sleep bruxism and the role of peripheral sensory influences. *J Orofac Pain* 2003; 17(3): 191-213.
 37. Carlsson GE, Egermark I, Magnusson T. Predictors of bruxism, other oral parafunctions, and tooth wear over a 20-year follow-up period. *J Orofac Pain* 2003; 17(1): 50-7.
 38. Manfredini D, Cantini E, Romagnoli M, Bosco M. Prevalence of bruxism in patients with different research diagnostic criteria for temporomandibular disorders (RDC/TMD) diagnoses. *Cranio* 2003; 21(4): 279-85.
 39. Ahlberg J, Savolainen A, Rantala M, Lindholm H, Kononen M. Reported bruxism and biopsychosocial symptoms: a longitudinal study. *Community Dent Oral Epidemiol* 2004; 32(4): 307-11.
 40. Michelotti A, Cioffi I, Festa P, Scala G, Farella M. Oral parafunctions as risk factors for diagnostic TMD subgroups. *J Oral Rehabil* 2010; 37(3): 157-62.
 41. Gavish A, Halachmi M, Winocur E, Gazit E. Oral habits and their association with signs and symptoms of temporomandibular disorders in adolescent girls. *J Oral Rehabil* 2000; 27(1): 22-32.
 42. Glaros AG, Hanson AH, Ryen CC. Headache and oral parafunctional behaviors. *Appl Psychophysiol Biofeedback* 2014; 39(1): 59-66.
 43. Carlson CR, Reid KI, Curran SL, Studts J, Okeson JP, Falace D, et al. Psychological and physiological parameters of masticatory muscle pain. *Pain* 1998; 76(3): 297-307.
 44. Atasoy HT, Atasoy N, Unal AE, Emre U, Sumer M. Psychiatric comorbidity in medication overuse headache patients with pre-existing headache type of episodic tension-type headache. *Eur J Pain* 2005; 9(3): 285-91.
 45. Franco AL, Runho GH, Siqueira JT, Camparis CM. Medical conditions and body pain in patients presenting orofacial pain. *Arq Neuropsiquiatr* 2012; 70(5): 348-51.
 46. Worthington HV, MacFarlane T. Association between orofacial pain and other symptoms: a population-based study. *Oral Biosciences and Medicine* 2004; 1(1):45-54.