Correlation between headache, cervical pain, and bruxism: retrospective study on TMD patients

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Abstract

Objectives. This study aims to establish whether headaches and cervical pain may have a positive association with bruxism in patients with temporomandibular disorders (tmd). In addition, possible correlations between these conditions and age, gender, and the circadian cycle are investigated.
Materials and methods. A retrospective observational study was conducted on tmd patients based on the analysis of standardized medical records for the diagnosis of temporomandibular disorders (tmd). The study examined 216 medical records of patients treated for tmd at the linares oral rehabilitation institute (chile) between february 2015 and august 2020. Age, gender, and selected data from the dc/tmd questionnaire were extracted from the medical records of the patients under review. The examined data were subjected to the chi-square test, the mann-whitney non-parametric test, and the kruskal-wallis test. All analyses used a 5% significance level.
Results. Of 216 tmd patient medical records reviewed, 125 were selected and included in the study (95 women aged 34.3 +/- 17.78 years; 30 men aged 28.3 +/- 18.26 years). 68% of the patients had probable sleep bruxism (sb), 85.6% had probable awake bruxism (ab), 64 64% had both. 34.4% of the patients experienced headaches, and 43.2% reported cervicalgia. Women showed more ab (p=0.03), secondary headaches (p=0.005), and myalgia of the masticatory muscles (p=0.04) than men. Younger patients showed a higher ab (p = 0.042). Patients with a high frequency of sb (more than 2-3 days per week) and with ab showed cervical pain (p=0.006 and p=0.000, respectively). In addition, patients with ab showed more

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headaches than the other groups (0.001), whereas patients without ab had a low frequency of myalgia (0.004).
Conclusions. Tmds encompass a range of conditions, both painful and non-painful, that affect the temporomandibular joint, the masticatory muscles, and other associated structures. Symptoms commonly include pain and dysfunction of the masticatory muscles, temporomandibular joints (tmj), and joint noises. Other reported symptoms include painful comorbid conditions such as headache and cervical pain. The results of this retrospective observational study suggest that in tmd patients, secondary headache and cervical pain are associated with bruxism, particularly with ab more than with sb. A significant association between ab and children, adolescents, and young adults was found. Women with tmd showed a greater tendency to ab, headaches, and cervical pain. In addition, a significant relationship was found between headache, cervicalgia, and myalgia.

Keywords: Sleep bruxism; Awake bruxism; Headache; Cervical pain; Temporomandibular disorders

Introduction

Temporomandibular disorders (TMDs) are a group of musculoskeletal disorders that involve the masticatory muscles and the temporomandibular joint (TMJ), most commonly resulting in chronic pain. They lead to abnormal, incomplete, or impaired function of the TMJ and/or muscles of mastication (1-3). The exact pathophysiology of TMDs is not yet fully understood, although several multifactorial models have been proposed (3). Regarding the etiology, whereas in the past the focus was on physical causes, an equally significant psychosocial factor has now been recognized. This has led to the acceptance of a multifactorial etiology of TMDs and the spread of the biopsychosocial model (4,5). TMD-related factors are numerous and involve genetic, environmental, social, cognitive, and behavioral aspects and habits (2,6-10). Signs and symptoms associated with TMD vary in their manifestation and often involve more than one component of the masticatory system: they commonly include pain, limited range of motion, and TMJ noises (11). Other reported symptoms include comorbid painful conditions such as headache and cervical pain, as well as psychosocial distress such as depression and anxiety. Some categories of TMD patients are bruxists. Bruxism is defined as a repetitive activity of the masticatory muscles characterized by clenching or grinding of the teeth and/or stiffening or thrusting of the mandible, causing forced contact between the biting surfaces of the maxillary and mandibular teeth (12). It has a multifactorial etiology with associated physiological, psychosocial, and external factors (13-15). Bruxism per se does not represent a pain syndrome, but rather should be considered as a behavior. Bruxism has two distinct circadian manifestations, each with a different definition, both of which involve the concept of muscular activity. For this reason, the international definition of bruxism includes two manifestations: unconscious bruxism during sleep, defined as ‘sleep bruxism’ (SB), and bruxism during wakefulness, defined as ‘awake bruxism’ (AB) (16). Specifically, SB is characterized by masticatory muscle activity that occurs mainly in the N1 phase of sleep (the light sleep phase), including short daytime naps, and may be rhythmic (phasic) or non-rhythmic (tonic). SB is associated with waking headache, and some studies have shown a possible effect on insomnia. AB is described as an activity of the masticatory muscles during wakefulness, characterized by repeated or prolonged contact of the antagonistic teeth and/or stiffening or pushing of the jaw (16). Clenching and grinding are observed in SB, whereas in AB, clenching appears to prevail (17). Furthermore, AB has been observed in comorbidity with secondary headaches more than sleep bruxism; SB would appear to be associated with myofascial pain, arthralgia, and some temporomandibular joint disorders (18). In general, risk factors for bruxism are controversial and poorly understood, while etiological factors can be classified as anatomical, psychosocial, and/or neuromuscular (19). The prevalence of bruxism in the general population ranges from 8 to 31.4 per cent (20). The prevalence is widespread among people under 40 years of age, especially in women, and decreases after the age of 65 (19). Bruxism may be considered a risk factor or a protective factor, and it need not be considered a disorder; however, in healthy individuals, it may represent a physiological state. Some evidence has been reported on the physiological task of bruxism, which may play a role in allostasis, adaptation, and feedback in the presence of stressors (21-23). Allostasis corresponds to the adaptive process that protects the organism by responding to stress, both internal and external, through the autonomic nervous system (ANS), the hypothalamic-pituitary-adrenal axis (HPA), and the immune system (24). The stomatognathic system is closely linked to the limbic system and the expression of emotions. In the presence of an experience perceived as stressful, masticatory activity and bruxism may serve as a stress relief valve, playing a role in stress adaptation (25). Due to the variety of symptoms and overlaps with other conditions, the diagnosis of bruxism requires careful evaluation that includes questionnaires, records of past bruxism episodes, and thorough examinations. To confirm the diagnosis of bruxism, there are two different methods: a non-instrumental method based on the patient’s description of symptoms, questionnaires, medical history and clinical examinations; and an instrumental method using electromyography (EMG) and polysomnography, which shows muscle activity during sleep and the absence of associated epileptic activity (12). There are three different levels of probability that a patient suffers from bruxism, depending on the diagnostic means employed. Diagnosis based on symptoms reported by the patient represents ‘possible bruxism’. In contrast, ‘probable bruxism’ is based on clinical examinations with/without a positive patient interview, and ‘definite bruxism’ is determined by

10.59987/ads/2025.2. 139-148

instrumental tests (5;12). The coexistence of bruxism, temporomandibular disorders (TMD), and headache is a common finding in patients. However, there is conflicting evidence as to whether this association is simply the result of their high prevalence or whether there is an actual causal relationship (11). A headache is defined as pain located in the head, above the orbitomeatal line and/or nuchal ridge. Headaches can be classified as primary, when they are not caused or attributed to another disorder, or as secondary when they are the result of an underlying condition (11). Secondary headaches are considered a symptom rather than a disease. However, they still exhibit specific signs and symptoms, which may be related to temporomandibular disorders or cervicalgia due to their neuroanatomical mechanism (26, 27). In the latter case, headache attributed to cervical dysfunction is defined as non-traumatic pathology of any cervical structure, including bones, muscles, or other soft tissues. (26). Altered neuromuscular control of the cervical region may contribute to the sensitivity associated with cervical pain and its relationship with orofacial pain (28,29). All relationships between cervical and stomatognathic structures can be explained by the functional neuroanatomical activities between related structures, in which the trigeminal nerve, accessory nerve, and cervical plexus are involved (30). The relationship that exists between the different anatomical areas innervated by the different branches of the nerves listed, especially that between the trigeminal nerve and the cervical nerves, can generate a phenomenon known as referred pain, which can cause a headache secondary to TMD or cervical disorders. The pathophysiological mechanism of cervicogenic headache, for example, is attributable to the trigeminal-cervical nucleus, where both afferents from the trigeminal nerve and afferents from cervical segments C1-C3 converge. This convergence makes head pain of cervical origin possible (30,31). Although the mechanisms explaining this pain are not yet fully understood, the convergence of these nerves helps explain the onset of pain referred to neck structures in patients with orofacial pain, supporting the relationship between bruxism and TMD-associated pain, as well as the onset of headache (32,33). This may explain why dysfunction and pain felt in the face may be associated with the neck and vice versa. Furthermore, the masticatory motor activity associated with active mandibular movement, such as mouth opening, chewing, and talking, interacts with neck muscle activity (34). Some studies have experimentally demonstrated that clenching and grinding increase the contraction of neck muscles, indicating an additional neuromuscular interaction between the two muscle groups that can be explained by complex neurophysiological interactions (35, 36). The relationship between headache, cervical pain, and bruxism in TMD patients has not yet been established in the literature. Equally, the potential relationship between these conditions and age, gender, and circadian cycle has not yet been established. Based on these considerations, to understand the possible correlations of these conditions, a retrospective observational study was conducted on medical records standardized according to the 'Diagnostic Criteria for Temporomandibular Disorders' (DC/TMD) of TMD patients.

Materials and methods

A retrospective cross-sectional observational study was conducted. Between February 2015 and August 2020, 216 TMD patients treated at the 'Oral Rehabilitation Institute - Linares' were considered. Study participants signed informed consent, and the Helsinki agreements were followed—this project was approved by the Universidad de los Andes Research Committee. Medical records of patients with TMD diagnosed by an experienced practitioner following the criteria of the 'Diagnostic Criteria for Temporomandibular Disorders' (DC/TMD) (5) were considered. Patients with systemic diseases affecting musculoskeletal activity, patients with chronic pain, and patients with mental and cognitive disorders were excluded. From the medical records of the test patients, the following data were considered: sex and age; questions 3 to 7 of the questionnaire 'Diagnostic Criteria for Temporomandibular Disorders' (DC/TMD); questions 1, 3, 4 or 5 on oral behavior and habits of the DC/TMD questionnaire (questions were sub-classified according to frequency as high or low frequency); clinical results of items E1a, E 1b, E4, E5 and E9, as well as the reporting of pain in the cervical muscles indicated on the drawing/pain map or issued in the comments (Figures 1-3). Two researchers (GB and RF) extracted the data from the DC/TMD files. They entered them into an Excel® file according to the variables considered: gender, age, probable bruxism (sleep, wakefulness and frequency), cervical pain or discomfort, myalgia of the masticatory muscles (12 muscle bundles considered: posterior temporal, median, right and left anterior; masseter at the origin, body and intersection of right and left), arthralgia, headache secondary to TMD. All data were analyzed and entered into summary tables.

SB was defined by question 1 of the Behavior and Oral Habits Questionnaire, and examination no. 9 was positive. The low frequency of SB was defined as less than 3 nights per month, as indicated in question 1 of the 'Behavior and Oral Habits Questionnaire', and an exam result of No. 9. High SB frequency was defined through question 1 of the Behavior and Oral Habits Questionnaire with more than 3 nights per week, plus exam No. 9 positive. AB was defined by questions 3, 4, or 5 of the Behavior and Oral Habits Questionnaire, and exam No. 9 was positive. The low frequency of AB was defined with questions 3, 4, or 5 of the Behavior and Oral Habits Questionnaire, with the answer 'a little of the time' or 'some of the time', plus exam No. 9 positive. The high frequency of AB was defined through question No. 3, 4 or 5 of the Behavior and Oral Habits Questionnaire with the answer 'most of the time' or 'all of the time' ('most of the time' or 'all of the time'), plus exam No. 9 positive.

Regarding statistical analysis of the collected data, descriptive statistics were conducted. To assess qualitative variables, the 'chi-square test' and 'posterior residual analysis' were applied. To compare quantitative

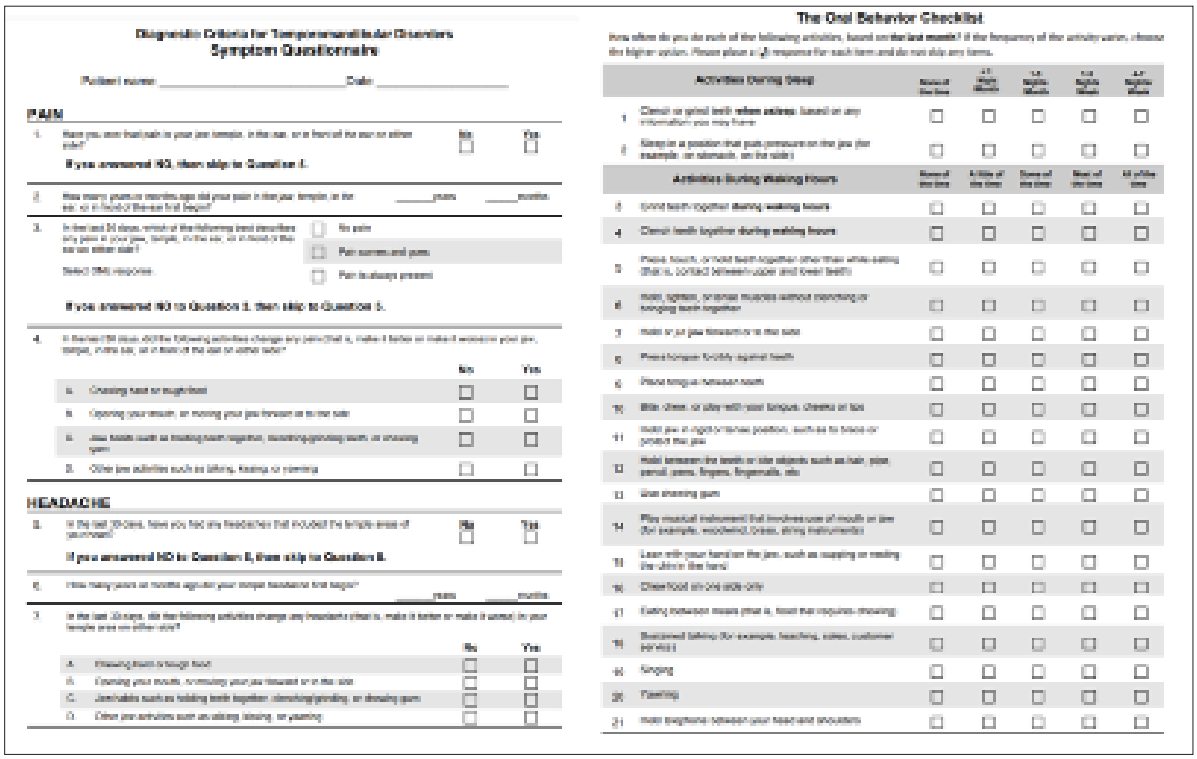

Figure 1. Questions 3 to 7 from the DC/TMD questionnaire. Questions 1, 3, 4, or 5 of the DC/TMD questionnaire about behavior and oral habits.

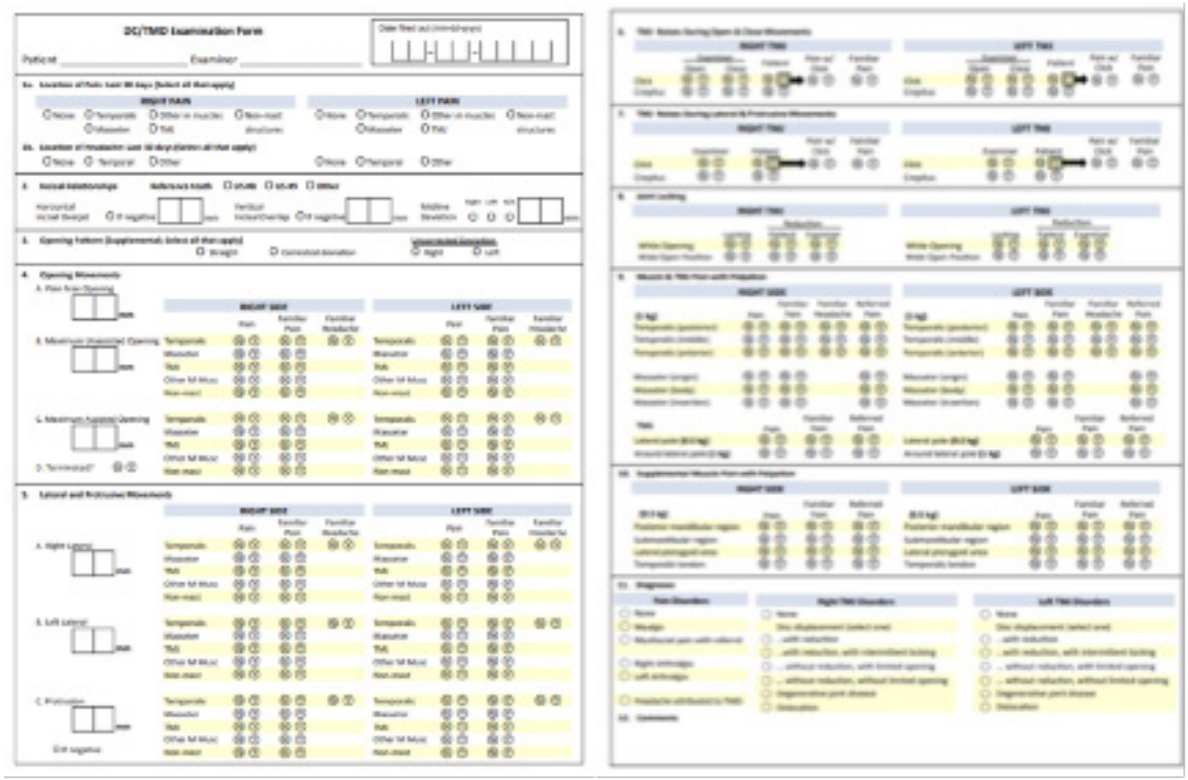

Figure 2. Clinical findings from item E1a, E 1b, E4, E5, and E9.

10.59987/ads/2025.2. 139-148

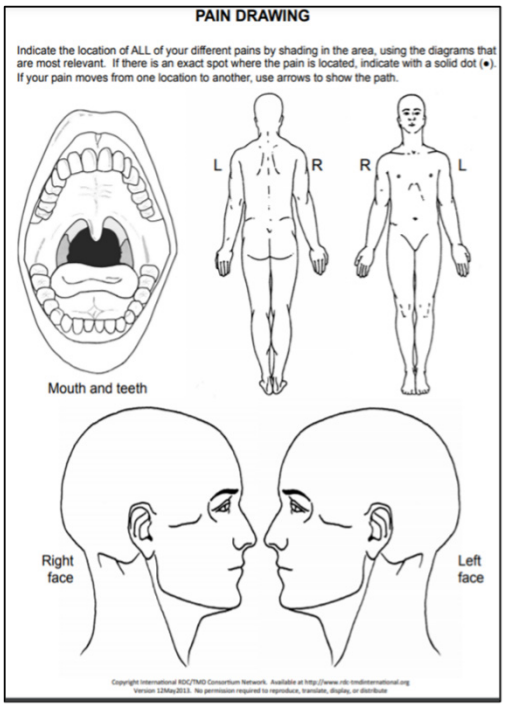

Figure 3. A report of pain in the cervical muscles is defined in the drawing of pain.

variables between two populations, the 'Mann-Whitney non-parametric test' was performed. To compare more than two populations, the 'Kruskal-Wallis test' was applied. SPSS was used. All analyses used a 5% significance level.

Results

The medical records of 216 patients were considered and analyzed. All patients required a specialist visit for TMD (31.2+/- 17.4 years, 160 women and 56 men) between February 2015 and August 2020. Of all medical records, 75 corresponded to emergencies without a DC/TMD protocol, and 16 records were incomplete. Based on the selection criteria, 125 medical records were included: 95 women, with a mean age of 34.3 ± 17.78 years; 30 men, with a mean age of 28.3 ± 18.26 years. In terms of age, the sample of patients included in the study consisted of 23 children (18.4%), 32 adolescent-young adults (25.6%), 57 adults (45.2%), 11 elderly patients (8.8%), and 2 very elderly patients (1.6%). The distribution of the sample by gender and age is shown in Table 1. Regarding the relationship between bruxism, gender, and age, 80 patients were diagnosed with both types of bruxism (64%), 64 women and 16 men. 85 patients presented with probable SB, 67 women (78.8%) and 18 men (21.2%). A total of 107

Table 1. Total distribution of the sample by sex and age.

	Women		Men	
	N	%	N	%
Child (0-15 ys)	16	16.8	7	23.3
Adolescents-young adults (16-25)	21	22.1	11	36.8
Adult (26-60)	48	50.7	9	30.0
Elderly (61-70)	9	9.4	2	6.6
Senior (>71)	1	1.0	1	3.3
Total	95	100	30	100

Table 2. Prevalence of awake and sleep bruxism by frequency and gender.

	Sleep bruxism						Awake Bruxism					
	Women		Men		Total		Women		Men		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Low frequency	16	23.9	6	33.3	22	25.9	46	54.1	16	72.7	62	57.9
High frequency	51	76.1	12	66.7	63	74.1	39	45.9	6	28.3	45	42.1
Total	67	78.8	18	21.2	85	100	85	78.8	22	21.2	107	100

Table 3. Association between sex, awake bruxism, headaches, and myalgia.

	Awake bruxism (%)			Headache (%)		Myalgia (%)	
	NO	Low frequency	High frequency	NO	YES	NO	YES
Men	27.7	53.3	41.1	86.7	13.3	43.3	56.7
Women	10.5	48.4	20.0	58.9	41.1	24.2	75.8

Table 4. Association between age and awake bruxism.

patients presented with probable AB, comprising 85 women (79.4%) and 22 men (20.6%). The frequency of both types of bruxism is shown in Table 2. Women with TMD showed a greater tendency to AB (P=0.03). No difference was observed between SB and gender (P=0.414) (Table 3). A significant association (P = 0.042) was found between AB and the following age groups: childhood, adolescence, and young adulthood (Table 4). No differences were observed regarding SB. Regarding the relationship between headache and gender, 43 patients were diagnosed with a secondary headache due to TMD, 39 women (90.6%) and 4 men (9.4%). 41.1% of the total number of women and 13.3% of the total number of men presented with headaches due to TMD. Women with TMD showed a greater tendency to present with headaches due to TMD (0.005) (Table 3). Concerning the relationship between pain in the masticatory muscles and gender, women with TMD showed a greater tendency to present with myalgia of the masticatory muscles (P=0.04) than men (Table 3). Regarding the relationship between cervical pain and gender, 54 TMD patients presented with cervical pain (43.2%), 45 women (83.3%), and 9 men (16.7%). 47.4% of the total number of women and 30% of the total number of men presented with neck pain. Women with TMD showed a greater tendency to present with neck pain (P=0.094). However, there was no statistically significant difference in neck pain between genders (P = 0.094) (Table 3). Concerning the relationship between bruxism, cervical pain, and headache: regarding SB, patients with a high frequency of SB showed more cervical pain (P=0.006), whereas cervicalgia was significantly lower in non-bruxer patients. No other associations were found for the different variables (Table 4). Regarding AB, patients with a high frequency of AB showed more cervical pain than the other group, whereas the non-bruxers patients did not present much cervical pain (P=0.000). Furthermore, a high relationship was found between AB and headache (P=0.001). Finally, patients with both types of bruxism (SB and AB) showed more cervical pain and myalgia of the masticatory muscles than non-bruxer patients (P=0.005 and P=0.004, respectively) (Table 4).

Discussion

This research aims to investigate whether there is a correlation between secondary headache, cervical pain, and bruxism in patients with TMD. Additionally, the potential relationship between these conditions and age, gender, and the circadian cycle is explored. The relationship between TMD and bruxism is a widely debated topic in the literature and has been treated in numerous research studies. Bruxism, when it exceeds the protective behavior attributable to allostasis, is capable of generating muscular overload, especially in the masticatory muscles, with consequent fatigue of these muscles due to their prolonged contraction. This fatigue could be associated with the development of myofascial pain, arthralgia, and joint pathology. However, there are conflicting opinions on the subject (18). Equally, there are few studies on the circadian manifestations of bruxism (SB and AB) and the possible correlation with TMDs. A recent study from 2017 shows that in patients without bruxism, the risk of TMD is low, in patients with SB, it increases slightly, and in subjects with AB, there is an increased risk of presenting TMD (32). The study concludes that the two types of bruxism are not independent of each other, but appear to interact with each other by an additive mechanism (32). Furthermore, another study points out that bruxism is associated with myofascial pain, arthralgia, and joint pathology such as disc displacement and joint noises, justifying the increased risk of TMD (18). As with bruxism and TMD, the possible correlation between bruxism and headache may also be related to allostatic overload, with bruxism associated with symptoms such as myofascial pain or secondary headache (25). However, the relationship between bruxism and headaches is lacking in quality studies. A 2001 study found that the absence of headaches is often accompanied by the absence of bruxism (37), but did not reach a definitive conclusion regarding the relationship between the two conditions. In 2018, studies on bruxism, pain, and headache found that patients with TMD and AB are more likely to have headaches (38). This is because AB is characterized by a greater number of isometric contractions than isotonic contractions, i.e., contractions in which continuous muscle tension predominates and without changes in muscle length, resulting in the muscles being more fatigued (38). Therefore, a relationship between AB and headache, as with cervicalgia, is more likely. The main results of our study suggest that in patients with TMD, secondary headache and cervical pain are associated with bruxism, especially with AB. Furthermore, a significant relationship was found between these two symptoms and myalgia (diagnosed by DC/TMD). This suggests that pain of the masticatory muscles may be related to secondary headaches and cervical pain. Furthermore, AB showed a high comorbidity with secondary headaches, cervical pain, and myalgia, unlike SB. This finding may confirm that the two types of bruxism are distinct entities, one conscious and the other unconscious, with different etiology and pathophysiology (15, 39, 40). Furthermore, AB has been associated with different parafunctional habits such as nail biting, gum chewing, lingual interposition, object biting, etc., probably related to stress and anxiety (41-43). The etiology of bruxism remains poorly understood. There is moderate evidence that psychosocial factors such as stress, mood, anxiety, nervousness, and feelings of sadness are associated with bruxism, as are caffeine, alcohol, and smoking. In children, exposure to second-hand smoke was associated with SB, as were sleep disturbances in both children and adolescents. AB has been associated with psychosocial factors, smoking, orofacial pain, and joint noise. Stress and anxiety are described as the main risk factors for AB, while for SB, common risk factors are psychoactive substance use and sleep disorders such as sleep apnea. Although the above associations have been published, establishing causality is extremely challenging (16). Recent studies have developed new theories suggesting that bruxism

10.59987/ads/2025.2. 139-148

may be related to the central neurotransmitter action system of the nervous system and to genetic polymorphism (gen HTR2A), particularly associated with the serotonergic pathway (44). Bruxism can lead to dental tissue damage, complications to prosthetic restorations, tongue and cheek injuries, disturbances in salivary quantity and composition, increased tooth mobility, gingival recessions, as well as increased masticatory muscle activity, hypertrophy of the masticatory muscles (especially the masseter), craniofacial pain, and joint stiffness (45,46). Regarding muscle activity, it is known that muscle contraction resulting from parafunctional habits and prolonged clenching, such as isometric contraction, generates high stress, decreased perfusion, hypoxia, and muscle fatigue, which can cause orofacial pain and/or myalgia (47-49). This may justify the results obtained in this study, in which AB was associated with myalgia and secondary headache. Regarding grinding, its relationship with masticatory and neck muscles, as well as behavior, remains unclear. Grinding is a dynamic process with a specific physical action that may generate isotonic and asymmetrical muscle contractions. Some of them might generate musculoskeletal fatigue (36,50). Presumably, high neck muscle fatigue is induced by the activation of prolonged vertical forces during 'clenching' and 'grinding' (36). This reinforces the comorbidity between bruxism, especially AB, and cervical pain. This pathological coexistence has also been described in many other studies (41-55). Another issue concerns the lack of correlation between cervicalgia, headache, and SB. Bruxism, as previously explained, should be considered a behavior that may have a protective role but can prove harmful when associated with one or more negative conditions (56). Masticatory activity, including bruxism, may attenuate stress-induced psychosomatic disorders through negative feedback from the limbic system (25). This concept is directly related to the concept of allostasis and adaptation, which protects the body by responding to internal and external stress through the autonomic nervous system, hypothalamic-pituitary-adrenal axis, and the immune system (24). The protective role associated with bruxism activity is particularly associated with SB. About sex differences, a correlation has tended to be observed between AB, secondary headache, and myalgia in women. Epidemiological evidence indicates a higher frequency and severity of TMD in women than in men, probably due to hormonal behavior, anatomical features, psychosocial factors, and immune regulation (57-61). Regarding age, the study results reveal a significant association between AB and the younger patient groups. In the children's group, many cases of low-frequency AB were found, whereas the prevalence of high-frequency AB increased in the young adult group. Older people do not present AB. Regarding the early age stages, bruxism is a common phenomenon during the deciduous and mixed dentition stages and has been linked to the need for balanced occlusion (62). This situation could fall under the umbrella of allostasis, as the process of changing the type of dentition can be considered a source of stress. Therefore, while bruxism in very young patients may be based on the process of allostasis and adaptation, in young adults, the stressors are probably related to early life situations. Regarding the main focus of this research, the relationship between headaches and bruxism in TMD patients proved to be positive. TMD patients with AB showed a higher tendency to develop secondary headaches than TMD patients with SB or without bruxism. Some studies justify these findings and postulate that bruxistic activity, especially AB, could develop hyperactivity of the lateral masseter and lateral pterygoid muscles, generating myalgias and muscle spasms, resulting in secondary headaches (63,64). Explanations for the association between bruxism and headache include peripheral and central sensitization, as well as a possible overload of the stomatognathic system. The common denominator is therefore the overuse of the masticatory muscles, which could lead to muscular symptoms (11). In contrast, cervicalgia has been observed in patients with both types of bruxism (AB and SB), which confirms the close neuroanatomical connection between cervical and masticatory structures, based on the neurophysiological relationship between the trigeminal system and the neuromuscular control of the neck. It follows from these considerations that TMDs should not be considered as an isolated entity of the stomatognathic system, since, due to their multifactorial etiology, risk factors and associated signs/symptoms, they often present with co-morbidities such as headache, cervical disorders, as well as bruxism, depression and anxiety, and more. These not only interact with TMD but also with each other, as in the case of the association between bruxism, AB, and/or SB, and headache. Therefore, the suggestion is to consider TMD as an entity affecting the suprascapular unit, in which, due to the neurophysiology and the close interrelationship between the neuroanatomical structures, a dysfunction of different areas of this unit can occur, with signs, symptoms and types of pain that can be traced back to muscular and articular pathology. Although this study provides numerous concepts and information, it also presents several situations that introduce bias, including a non-probabilistic sample, a reduced sample size, temporal ambiguity in the sample, and an information bias related to cervicalgia.

Conclusions

TMDs encompass a range of conditions, both painful and non-painful, that affect the temporomandibular joint, the masticatory muscles, and other associated structures. Symptoms commonly include pain and dysfunction of the masticatory muscles, temporomandibular joints (TMJ), and joint noises. Other reported symptoms include comorbid painful conditions such as headache and cervical pain. In TMD patients, the coexistence of bruxism, headache, and cervicalgia is a common condition. Bruxism is not a pain syndrome, but should be understood as a behavior that may occur during sleep or wakefulness, with a potentially protective or harmful role. Due to the variety of symptoms and overlap with other conditions,

the diagnosis of bruxism requires careful evaluation that includes questionnaires, records of past bruxism episodes, and dedicated instrumental examinations. The results of this retrospective study suggest that in TMD patients, secondary headache and cervical pain are associated with bruxism, particularly with AB more than with SB. A significant association was found between AB and specific age groups, specifically childhood, adolescence, and young adulthood. Women with TMD showed a greater tendency to present with AB, headaches, and cervical pain. In addition, a significant relationship was found between headache, cervicalgia, and myalgia.

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Conflicts of Interest

The authors declare that they have no conflicts of interest.

References

1. Dworkin SF. Research Diagnostic criteria for Temporomandibular Disorders: current status & future relevance. J Oral Rehabil. 2010 Oct;37(10):734-43. doi: 10.1111/j.1365-2842.2010.02090.x. Epub 2010 May 31. PMID: 20529171.
2. De Leeuw R; Klasser GD. Orofacial pain: guidelines for assessment, diagnosis, and management. Fifth edition. Quintessence Publishing Co, Inc; 2013.
3. List T, Jensen RH. Temporomandibular disorders: Old ideas and new concepts. Cephalalgia. 2017 Jun;37(7):692-704. doi: 10.1177/0333102416686302. Epub 2017 Jan 9. PMID: 28068790.
4. Ohrbach R, Dworkin SF. The Evolution of TMD Diagnosis: Past, Present, Future. J Dent Res. 2016 Sep;95(10):1093-101. Doi: 10.1177/0022034516653922. Epub 2016 Jun 16. PMID: 27313164; PMCID: PMC5004241.
5. Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet JP, List T, Svensson P, Gonzalez Y, Lobbezoo F, Michelotti A, Brooks SL, Ceusters W, Drangsholt M, Ettlin D, Gaul C, Goldberg LJ, Haythornthwaite JA, Hollender L, Jensen R, John MT, De Laat A, de Leeuw R, Maixner W, van der Meulen M, Murray GM, Nixdorf DR, Palla S, Petersson A, Pionchon P, Smith B, Visscher CM, Zakrzewska J, Dworkin SF; International RDC/TMD Consortium Network, International association for Dental Research; Orofacial Pain Special Interest Group, International Association for the Study of Pain. 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 Winter;28(1):6-27. doi: 10.11607/jop.1151. PMID: 24482784; PMCID: PMC4478082.
6. Liu F, Steinkeler A. Epidemiology, diagnosis, and treatment of temporomandibular disorders. Dent Clin North Am. 2013 Jul;57(3):465-79. Doi: 10.1016/j.cden.2013.04.006. PMID: 23809304.
7. Chang TH, Yuh DY, Wu YT, Cheng WC, Lin FG, Shieh YS, et al. The association between temporomandibular disorders and joint hypermobility syndrome: a nationwide population-based study. Clin Oral Investig. 2015;19(8):2123-32. doi: 10.1007/s00784-015-1422-7. Epub 2015 Feb 17. PMID: 25687768.
8. 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(5):749-56. doi: 10.1007/s00784-010-0444-4. Epub 2010 Jul 14. PMID: 20628773.
9. 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(10):765-72. doi: 10.1016/j.jdent.2010.06.007. Epub 2010 Jun 25. PMID: 20600559.
10. Van Selms MK, Lobbezoo F, Visscher CM, Naeije M. Myofascial temporomandibular disorder pain, parafunctions and psychological stress. J Oral Rehabil. 2008;35(1):45-52. doi: 10.1111/j.1365-2842.2007.01795.x. PMID: 18190360.
11. Voß LC, Basedau H, Svensson P, May A. Bruxism, temporomandibular disorders, and headache: a narrative review of correlations and causalities. Pain. 2024 Nov 1;165(11):2409-2418. doi: 10.1097/j.pain.0000000000003277. Epub 2024 Jun 18. PMID: 38888745.
12. Lobbezoo F, Ahlberg J, Raphael KG, Wetselaar P, Glaros AG, Kato T, Santiago V, Winocur E, De Laat A, De Leeuw R, Koyano K, Lavigne GJ, Svensson P, Manfredini D. International consensus on the assessment of bruxism: Report of a work in progress. J Oral Rehabil. 2018 Nov;45(11):837-844. doi: 10.1111/joor.12663. Epub 2018 Jun 21. PMID: 29926505; PMCID: PMC6287494.
13. Lavigne GJ, Guitard F, Rompré PH, Montplaisir JY. Variability in sleep bruxism activity over time. J Sleep Res. 2001 Sep;10(3):237-44. doi: 10.1046/j.1365-2869.2001.00261.x. PMID: 11696077.
14. Sateia MJ. International classification of sleep disorders-third edition: highlights and modifications. Chest. 2014 Nov;146(5):1387-1394. doi: 10.1378/chest.14-0970. PMID: 25367475.
15. Lobbezoo F, Ahlberg J, Glaros AG, Kato T, Koyano K, Lavigne GJ, de Leeuw R, Manfredini D, Svensson P, Winocur E. Bruxism defined and graded: an international consensus. J Oral Rehabil. 2013 Jan;40(1):2-4. doi: 10.1111/joor.12011. Epub 2012 Nov 4. PMID: 23121262.
16. Goldstein G, DeSantis L, Goodacre C. Bruxism: Best Evidence Consensus Statement. J Prosthodont. 2021 Apr;30(S1):91-101. doi: 10.1111/jopr.13308. PMID: 33331675.
17. Bracci A, Lobbezoo F, Colonna A, Bender S, Conti PCR, Emodi-Perlman A, Häggman-Henrikson B, Klasser GD, Michelotti A, Lavigne GJ, Svensson P, Ahlberg J, Manfredini D. Research routes on awake bruxism metrics: Implications of the updated bruxism definition and evaluation strategies. J Oral Rehabil. 2024 Jan;51(1):150-161. doi: 10.1111/joor.13514. Epub 2023 Jun 16. PMID: 37191494.
18. Jiménez-Silva A, Peña-Durán C, Tobar-Reyes J, Frugone-Zambra R. Sleep and awake bruxism in adults and its relationship with temporomandibular disorders: A systematic review from 2003 to 2014. Acta Odontol Scand. 2017 Jan;75(1):36-58. doi: 10.1080/00016357.2016.1247465. Epub 2016 Oct 31. PMID: 27796166.
19. Piekartz HV, Rösner C, Batz A, Hall T, Ballenberger N. Bruxism, temporomandibular dysfunction and cervical impairments in females - Results from an observational study. Musculoskelet Sci Pract. 2020 Feb;45:102073. doi: 10.1016/j.msksp.2019.102073. Epub 2019 Oct 28. PMID: 31678819.
20. Manfredini D, Winocur E, Guarda-Nardini L, Paesani D, Lobbezoo F. Epidemiology of bruxism in adults: a systematic review of the literature. J Orofac Pain. 2013 Spring;27(2):99-110. doi: 10.11607/jop.921. PMID: 23630682.
21. McEwen BS. Stress, adaptation, and disease. Allostasis and allostatic load. Ann. N.Y. Acad. Sci. 1998 May 1;840:33-44. Doi: 10.1111/j.1749-6632.1998.tb09546.x. PMID: 9629234.
22. McEwen BS. Sex, stress, and the hippocampus: allostasis, allostatic load, and the aging process. Neurobiol Aging 2002; (23):921-939. doi: 10.1016/s0197-4580(02)00027-1. PMID: 12392796.
23. Goldstein DS, McEwen BS. Allostasis, homeostasis, and the nature of stress. Stress 2002; (5):55-58. doi: 10.1080/102538902900012345. PMID: 12171767.
24. McEwen BS, Seeman T. Protective and damaging effects of mediators of stress: elaborating and testing the

concepts of allostasis and allostatic load. Ann NY Acad Sci 1999; (896): 30-47. Doi: 10.1111/j.1749-6632.1999.tb08103.x. PMID: 10681886.
25. Sato S, Slavicek R. Allostasis and dentistry. J Cranio Mand Func 2009;1(4):283–294.
26. Headache Classification Committee of the International Headache Society (IHS) The International Classification of Headache Disorders, 3rd edition. Cephalalgia. 2018 Jan;38(1):1-211. doi: 10.1177/0333102417738202. PMID: 29368949.
27. Ballegaard V, Thede-Schmidt-Hansen P, Svensson P, Jensen R. Are headache and temporomandibular disorders related? A blinded study. Cephalalgia. 2008 Aug;28(8):832-41. doi: 10.1111/j.1468-2982.2008.01597.x. Epub 2008 May 21. PMID: 18498400.
28. Armijo-Olivo S, Rappoport K, Fuentes J, Gadotti IC, Major PW, Warren S, Thie NM, Magee DJ. Head and cervical posture in patients with temporomandibular disorders. J Orofac Pain. 2011 Summer;25(3):199-209. PMID: 21837287.
29. Armijo-Olivo S, Silvestre RA, Fuentes JP, da Costa BR, Major PW, Warren S, Thie NM, Magee DJ. Patients with temporomandibular disorders have increased fatigability of the cervical extensor muscles. Clin J Pain. 2012 Jan;28(1):55-64. doi: 10.1097/AJP.0b013e31822019f2. PMID: 21677569.
30. Armijo-Olivo S, Magee D. Cervical musculoskeletal impairments and temporomandibular disorders. J Oral Maxillofac Res. 2013 Jan 1;3(4):e4. doi: 10.5037/jomr.2012.3404. PMID: 24422022; PMCID: PMC3886095.
31. Bogduk N. Cervicogenic headache: anatomic basis and pathophysiologic mechanisms. Curr Pain Headache Rep. 2001 Aug;5(4):382-6. doi: 10.1007/s11916-001-0029-7. PMID: 11403743.
32. Reissmann DR, John MT, Aigner A, Schön G, Sierwald I, Schiffman EL. Interaction Between Awake and Sleep Bruxism Is Associated with Increased Presence of Painful Temporomandibular Disorder. J Oral Facial Pain Headache. 2017 Fall;31(4):299–305. doi: 10.11607/ofph . 1885. Epub 2017 Oct 3. PMID: 28973051; PMCID: PMC6762034.
33. Olivo SA, Fuentes J, Major PW, Warren S, Thie NM, Magee DJ. The association between neck disability and jaw disability. J Oral Rehabil. 2010 Sep;37(9):670-9. doi: 10.1111/j.1365-2842.2010.02098.x. Epub 2010 May 27. PMID: 20524969.
34. Häggman-Henrikson B, Nordh E, Eriksson PO. Increased sternocleidomastoid, but not trapezius, muscle activity in response to increased chewing load. Eur J Oral Sci. 2013 Oct;121(5):443-9. doi: 10.1111/eos.12066. Epub 2013 Jun 26. PMID: 24028592.
35. Giannakopoulos NN, Schindler HJ, Rammelsberg P, Eberhard L, Schmitter M, Hellmann D. Co-activation of jaw and neck muscles during submaximum clenching in the supine position. Arch Oral Biol. 2013 Dec;58(12):1751-60. doi: 10.1016/j.archoralbio.2013.09.002. Epub 2013 Sep 20. PMID: 24200301.
36. Giannakopoulos NN, Schindler HJ, Hellmann D. Co-contraction behaviour of masticatory and neck muscles during tooth grinding. J Oral Rehabil. 2018 Jul;45(7):504-511. doi: 10.1111/joor.12646. Epub 2018 May 30. PMID: 29761534.
37. Ciancaglini R, Radaelli G. The relationship between headache and symptoms of temporomandibular disorder in the general population. J Dent. 2001 Feb;29(2):93-8. doi: 10.1016/s0300-5712(00)00042-7. PMID: 11239582.
38. Sierwald I, John MT, Schierz O, et al. Association of temporomandibular disorder pain with awake and sleep bruxism in adults. J Orofac Orthop. 2015;76(4):305-317. doi: 10.1007/s00056-015-0293-5. PMID: 26123732.
39. Winocur E, Uziel N, Lisha T, Goldsmith C, Eli I. Self-reported bruxism - associations with perceived stress, motivation for control, dental anxiety and gagging. J Oral Rehabil. 2011 Jan;38(1):3-11. doi: 10.1111/j.1365-2842.2010.02118.x. PMID: 20557433.
40. Sateia MJ. International classification of sleep disorders-third edition: highlights and modifications. Chest. 2014 Nov;146(5):1387-1394. doi: 10.1378/chest.14-0970. PMID: 25367475.
41. Carra MC HN, Morton P, Rompré PH, Papadakis A, Remise C, et al. Prevalence and risk factors of sleep bruxism and wake-time tooth clenching in a 7- to 17-year-old population. Eur J Oral Sci. 2011;119(5):386-94. doi: 10.1111/j.1600-0722.2011.00846.x. Epub 2011 Aug 12. PMID: 21896056.
42. Emodi-Perlman A EI, Friedman-Rubin P, Goldsmith C, Reiter S, Winocur E. Bruxism, oral parafunctions, anamnestic and clinical findings of temporomandibular disorders in children. J Oral Rehabil. 2012;39(2):126-35). doi: 10.1111/j.1365-2842.2011.02254.x. Epub 2011 Sep 15. PMID: 21916926.
43. Koutris M LF, Naeije M, Wang K, Svensson P, Arendt-Nielsen L, et al. Effects of intense chewing exercises on the masticatory sensory-motor system. J Dent Res. 2009;88(7):658-62. doi: 10.1177/0022034509338573. PMID: 19641154.
44. Oporto GH 5th, Bornhardt T, Iturriaga V, Salazar LA. Genetic polymorphisms in the serotonergic system are associated with circadian manifestations of bruxism. J Oral Rehabil. 2016 Nov;43(11):805-812. doi: 10.1111/joor.12436. Epub 2016 Sep 20. PMID: 27611726.
45. Murali RV, Rangarajan P, Mounissamy A. Bruxism: Conceptual discussion and review. J Pharm Bioallied Sci. 2015 Apr;7(Suppl 1):S265-70. Doi: 10.4103/0975-7406.155948. PMID: 26015729; PMCID: PMC4439689.
46. Carra MC, Huynh N, Lavigne G. Sleep bruxism: a comprehensive overview for the dental clinician interested in sleep medicine. Dent Clin North Am. 2012 Apr;56(2):387-413. doi: 10.1016/j.cden.2012.01.003. PMID: 22480810.
47. Yamasaki K, Harada S, Higuchi I, Osame M, Ito G. Fatigue and damage to the masseter muscle by prolonged low-frequency stimulation in the rat. Arch Oral Biol. 2005 Dec;50(12):1005-13. doi: 10.1016/j.archoralbio.2005.05.001. Epub 2005 Jun 8. PMID: 15949787.
48. Delcanho RE, Kim YJ, Clark GT. Haemodynamic changes induced by submaximal isometric contraction in painful and non-painful human masseter using near-infra-red spectroscopy. Arch Oral Biol. 1996 Jun;41(6):585-96. doi: 10.1016/0003-9969(96)00009-x. PMID: 8937650.
49. Suzuki S, Castrillon EE, Arima T, Kitagawa Y, Svensson P. Blood oxygenation of masseter muscle during sustained elevated muscle activity in healthy participants. J Oral Rehabil. 2016 Dec;43(12):900-910. doi: 10.1111/joor.12450. Epub 2016 Nov 10. PMID: 27743403.
50. Christensen LV, Mohamed SE. Contractile activity of the masseter muscle in experimental clenching and grinding of the teeth in man. J Oral Rehabil. 1984 Mar;11(2):191-9. doi: 10.1111/j.1365-2842.1984.tb00568.x. PMID: 6585527.
51. De Laat A, Meuleman H, Stevens A, Verbeke G. Correlation between cervical spine and temporomandibular disorders. Clin Oral Investig. 1998 Jun;2(2):54-7. doi: 10.1007/s007840050045. PMID: 15490776.
52. Visscher CM, Lobbezoo F, de Boer W, van der Zaag J, Naeije M. Prevalence of cervical spinal pain in craniomandibular pain patients. Eur J Oral Sci. 2001 Apr;109(2):76-80. doi: 10.1034/j.1600-0722.2001.00996.x. PMID: 11347659.
53. Giannakopoulos NN, Hellmann D, Schmitter M, Krüger B, Hauser T, Schindler HJ. Neuromuscular interaction of jaw and neck muscles during jaw clenching. J Orofac Pain. 2013 Winter;27(1):61-71. doi: 10.11607/jop.915. PMID: 23424721.
54. Ferrario VF, Tartaglia GM, Galletta A, Grassi GP, Sforza C. The influence of occlusion on jaw and neck muscle activity: a surface EMG study in healthy young adults. J Oral Rehabil. 2006 May;33(5):341-8. doi: 10.1111/j.1365-2842.2005.01558.x. PMID: 16629892.
55. Hellmann D, Giannakopoulos NN, Schmitter M, Lenz J, Schindler HJ. Anterior and posterior neck muscle activation during a variety of biting tasks. Eur J Oral Sci. 2012 Aug;120(4):326-34. doi: 10.1111/j.1600-0722.2012.00969.x. Epub 2012 Jun 25. PMID: 22813223.
56. Raphael KG SV, Lobbezoo F. Is bruxism a disorder or a behavior? Rethinking the international consensus on defining and grading of bruxism. J Oral Rehabil. 2016;

(43):791-798. doi: 10.1111/joor.12413. Epub 2016 Jun 10. PMID: 27283599; PMCID: PMC5538376.
57. Mazzetto MO, Rodrigues CA, Magri LV, Melchior MO, Paiva G. Severity of TMD related to age, sex, and electromyographic analysis. Braz Dent J. 2014 Jan-Feb;25(1):54-8. doi: 10.1590/0103-6440201302310. PMID: 24789293.
58. Giefing-Kröll C, Berger P, Lepperdinger G, Grubeck-Loebenstein B. How sex and age affect immune responses, susceptibility to infections, and response to vaccination. Aging Cell. 2015 Jun;14(3):309-21. doi: 10.1111/acel.12326. Epub 2015 Feb 26. PMID: 25720438; PMCID: PMC4406660.
59. Kopp S. Neuroendocrine, immune, and local responses related to temporomandibular disorders. J Orofac Pain. 2001 Winter;15(1):9-28. PMID: 11889652.
60. 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 Aug;33(8):551-8. doi: 10.1111/j.1365-2842.2006.01600.x. PMID: 16856952.
61. Nomura K, Vitti M, Oliveira AS, Chaves TC, Semprini M, Siéssere S, Hallak JE, Regalo SC. Use of the Fonseca's questionnaire to assess the prevalence and severity of temporomandibular disorders in Brazilian dental undergraduates. Braz Dent J. 2007;18(2):163-7. Doi: 10.1590/s0103-64402007000200015. PMID: 17982559.
62. Goldstein RE, Auclair Clark W. The clinical management of awake bruxism. J Am Dent Assoc. 2017 Jun;148(6):387-391. doi: 10.1016/j.adaj.2017.03.005. PMID: 28550845.
63. Troeltzsch M TM, Cronin RJ, Brodine AH, Frankenberger R, Messlinger K. Prevalence and association of headaches, temporomandibular joint disorders, and occlusal interferences. J Prosthet Dent. 2011;105(6):410-417. doi: 10.1016/S0022-3913(11)60084-X. PMID: 21640243.
64. Glaros AG, Tabacchi KN, Glass EG. Effect of parafunctional clenching on TMD pain. J Orofac Pain. 1998 Spring;12(2):145-52. PMID: 9656892.

10.59987/ads/2025.2. 139-148