Annals Journal of Dental and Medical Assisting
2025, Volume 5, Issue 1, Page No: 54-61

Available online at: www.tsdp.net

ISSN: 3062-3510

Original Article

Preliminary Evaluation of the Associations Between Sleep Bruxism, Self-Reported Pain and Headaches, Certain Health Factors, and General Health in Patients with Temporomandibular Disorders

Christina Maria Liebl[1*]

[1] Department of Prosthodontics, University of Heidelberg, Im Neuenheimer Feld 400, 69120 Heidelberg, Germany.

***E-mail** ✉ Liebel.mchristina@gamail.com

Received: 27 November 2024; **Revised:** 07 March 2025; **Accepted:** 11 March 2025

ABSTRACT

Temporomandibular disorders (TMD) represent a significant health concern, potentially affecting patients' quality of life, reducing work efficiency, and leading to absences or limitations in daily activities. Consequently, it is essential not only to apply accurate diagnostic and therapeutic approaches for individuals with TMD and/or sleep bruxism (SB) but also to examine how various medical and lifestyle factors influence the development of these conditions, as adjusting these factors could alleviate symptom severity. This preliminary study aimed to explore the associations between SB, self-reported pain and headaches, specific health factors, and overall health status in patients with TMD. The study involved 114 patients from the Outpatient Clinic for Temporomandibular Disorders in Wroclaw, Poland, who underwent single-night video-polysomnography (PSG). Participants completed questionnaires addressing their pain experiences, headaches, and health status, including the presence or history of conditions such as hypothyroidism, hypertension, cancer, diabetes, myocardial infarction, stroke, and gastroesophageal reflux disease (GERD). Information on lifestyle habits—including alcohol consumption, smoking, caffeine intake, and physical activity—was also collected. All data were subjected to statistical analysis. Among TMD patients, a history of cancer and GERD appeared to influence the perception of pain and headaches. Additionally, smoking was significantly correlated with both the presence and severity of SB. Certain lifestyle habits, health factors, and overall health conditions in TMD patients are linked to SB, as well as reported pain and headaches. However, these relationships warrant further investigation in studies with larger sample sizes.

Keywords: Sleep bruxism, Habits, TMD, Headache, General health

How to Cite This Article: Liebl MC. Preliminary Evaluation of the Associations Between Sleep Bruxism, Self-Reported Pain and Headaches, Certain Health Factors, and General Health in Patients with Temporomandibular Disorders. Ann J Dent Med Assist. 2025;5(1):54-61. https://doi.org/10.51847/2hZXCufKvJ

Introduction

Temporomandibular disorders (TMD) are a collection of conditions affecting the masticatory muscles and the temporomandibular joint (TMJ), commonly presenting with pain, limited jaw mobility, joint noises such as clicking or crepitus, myofascial discomfort, and headaches [1]. These disorders rank as the second most frequent cause of pain in the oral and facial region, following dental pain [2], and are also the second leading source of musculoskeletal discomfort after chronic low-back pain [1]. Prevalence estimates suggest that TMD affects 5–12% of the general population, with young adults exhibiting rates up to 30% [3]. In Poland, around 55.9% of individuals report at least one TMD symptom, with a higher prevalence observed in women [4].

Sleep bruxism (SB), classified under sleep-related movement disorders (SRMD) in the ICSD-3, involves repetitive jaw-muscle activity characterized by teeth clenching and/or grinding [5]. Worldwide, SB affects roughly 8–13% of the population [6].

Orofacial pain (OFP) refers to a broad spectrum of pain conditions, including dental, mucosal, musculoskeletal, neurovascular, and neuropathic origins [7]. Chronic OFP and headache are defined as pain occurring more than 15 days per month, lasting over 4 hours per day, and persisting for at least the past 3 months [8, 9].

This preliminary study aimed to investigate the links between SB, self-reported pain and headaches, selected health conditions, and general health characteristics in patients diagnosed with TMD.

Materials and Methods

Participants

The study protocol was approved by the Ethics Committee of Wroclaw Medical University, Poland (KB-794/2019). All participants provided informed consent and were briefed on the study's objectives. The research followed the ethical standards outlined in the Declaration of Helsinki.

Patients attending the Outpatient Clinic for Temporomandibular Disorders underwent a single-night video-polysomnography (PSG) assessment. They also completed structured interviews regarding their medical history, including conditions such as hypothyroidism, hypertension, cancer, diabetes, myocardial infarction, stroke, and gastroesophageal reflux disease (GERD). Lifestyle factors—including alcohol use, smoking habits, caffeine consumption, and physical activity—were recorded.

Inclusion criteria

Eligible participants were adults over 18 years old with OFP or headaches, assessed using the Graded Chronic Pain Scale (GCPS), Headache Impact Test-6 (HIT-6), Migraine Disability Assessment (MIDAS), short-form McGill Pain Questionnaire (SF-MPQ), and the TMD pain screener. All participants had to provide consent to participate.

Exclusion criteria

Patients were excluded if they had drug or medication dependence, used drugs affecting the nervous or muscular systems, suffered from severe systemic or mental disorders (including major cognitive impairments or active cancer), had less than 4 hours of PSG-recorded sleep, were pregnant, had untreated sleep apnea, or declined participation.

Video-Polysomnography

Bruxism intensity was quantified using the bruxism episode index (BEI), representing the number of bruxism events per hour of sleep. Classification followed AASM ICSD-3 guidelines: BEI < 2 indicated negligible SB, 2–4 indicated mild to moderate SB, and >4 indicated severe SB [10].

Pain assessment

Pain severity was evaluated through validated questionnaires, including the SF-MPQ [11], GCPS [12], MIDAS [13], HIT-6 [14], and TMD pain screener [15].

Health and lifestyle questionnaire

Participants completed a comprehensive questionnaire covering ten domains: personal medical history, family medical history, current medications, dietary habits, alcohol intake, smoking, caffeine consumption, physical activity, and demographic details.

Database

Participants' medical histories, questionnaire responses, and PSG results were compiled into a database using Microsoft Excel (Microsoft Corporation, Redmond, USA). The data entries were subsequently analyzed using statistical methods.

Statistical analysis

Relationships between variables were examined using the Mann–Whitney U test. This non-parametric test was selected due to the non-normal distribution of the data. Correlations with a p-value below 0.05 were considered statistically significant. All analyses were performed using Statistica™, version 13.1 (StatSoft, Krakow, Poland). The required sample size (N) was estimated using the power.cor function from the genefu package (https://rdrr.io/bioc/genefu/man/power.cor.html).

Results

Study sample characteristics

Age and gender

The study included 114 adult participants, comprising 72 women and 42 men, resulting in a female-to-male ratio of 1.71:1. All participants were Caucasian, ranging in age from 21 to 71 years, with a mean age of 37.67 years.

Reported pain

Pain intensity was assessed through four independent questionnaires, and the results are summarized in **Table 1**.

Table 1. Levels of pain severity and the bruxism episode index (BEI) values according to gender

Variable		Examined women	Examined men
GCPS	grade 0	8.54	33.34
	grade 1	56.95	54.76
	grade 2a, 2b	19.44	7.14
	grade 3	12.50	4.76
	grade 4	2.57	0.00
HIT-6	no or little impact	43.11	64.29
	slight impact	8.33	16.67
	significant impact	5.56	11.90
	severe impact	43.00	7.14
MIDAS	grade I	42.86	63.63
	grade II	19.05	9.10
	grade III	14.29	18.17
	grade IV	23.80	9.10
SF-MPQ	total value ≤5	59.72	64.91
	total value >5	40.28	35.09
TMD pain screener	total value ≤3	34.43	53.41
	total value >3	65.57	46.59
BEI	>2	25.00	13.89
	2–4	31.25	13.89
	>4	43.75	72.22

Data presented as percentage (%).
GCPS – Graded Chronic Pain Scale; HIT-6 – Headache Impact Test-6; MIDAS – Migraine Disability Assessment; SF-MPQ – short-form McGill Pain Questionnaire; TMD pain screener – temporomandibular disorder pain screener.

Severity of sleep bruxism

The distribution of bruxism episode index (BEI) values by gender is presented in **Table 1**.

Selected health factors, general health conditions, and lifestyle habits

Within the study group, 2 participants (1.75%) reported hypothyroidism, while arterial hypertension was present in 5 patients (4.39%), all of whom indicated they were on regular medication and maintained controlled blood pressure. Four participants (3.51%) had a history of cancer, and 3 individuals (2.63%) were being treated for diabetes. No cases of previous myocardial infarction or stroke were reported. Gastroesophageal reflux disease (GERD) was reported by 33 participants, accounting for 28.95% of the group. Regarding lifestyle habits, 42 participants (36.84%) consumed alcohol, with 5 (4.39%) reporting regular intake and 37 (32.46%) drinking occasionally. Cigarette smoking was reported by 12 participants (10.53%). Coffee consumption was noted in 26 participants (22.8%), with 20 individuals (17.54%) drinking coffee regularly and 6 (5.26%) occasionally. Physical activity was reported by 64 participants (56.14%), but only 11 (9.65%) exercised daily. Nineteen participants (16.67%) engaged in physical activity 3–4 times per week, 28 (24.56%) exercised 1–2 times per week, and 6 participants (5.26%) reported exercising less than once per week.

Relationship between health factors, lifestyle, and reported pain

Associations between the environmental and health-related factors and patients' self-reported pain levels, assessed via the GCPS, MIDAS, HIT-6, SF-MPQ questionnaires, and the TMD pain screener, were evaluated using the Mann–Whitney U test **(Table 2)**.

Table 2. Summary of the statistical relationships between the intensity of pain and bruxism and the general health of patients, as well as the factors influencing their health

Variables	Sum of ranks group I	Sum of ranks group II	U	Z	p-value	Z corrected	p-value
GCPS & hypothyroidism	3,252.500	752.500	551.500	−0.34190	0.732	−0.34337	0.731
HIT-6 & hypothyroidism	2,999.000	829.000	443.000	−1.36405	0.173	−1.36629	0.172
MIDAS & hypothyroidism	2,614.000	707.000	403.000	−1.11247	0.266	−1.13166	0.258
SF-MPQ & hypothyroidism	3,253.500	841.500	478.500	−1.19254	0.233	−1.21936	0.223
TMD pain screener & hypothyroidism	2,965.000	690.000	480.000	−0.51299	0.608	−0.51867	0.604
GCPS & arterial hypertension	3,434.500	570.500	431.500	−0.36037	0.719	−0.36192	0.717
HIT-6 & arterial hypertension	3,344.500	483.500	417.500	0.00000	1.000	0.00000	1.000
MIDAS & arterial hypertension	2,907.000	414.000	348.000	0.50319	0.615	0.51187	0.609
SF-MPQ & arterial hypertension	3,389.000	706.000	308.000	−1.89318	0.058	−1.93576	0.053
TMD pain screener & arterial hypertension	3,106.500	548.500	405.500	−0.40387	0.686	−0.40834	0.683
GCPS & cancer	3,758.500	246.500	103.500	−1.30699	0.191	−1.31260	0.189

HIT-6 & cancer	3,606.000	222.000	36.000	−2.08196	0.037	−2.08538	0.037*
MIDAS & cancer	3,113.000	208.000	32.000	−2.11316	0.035	−2.14961	0.032*
SF-MPQ & cancer	3,837.000	258.000	96.000	−1.47822	0.139	−1.51146	0.131
TMD pain screener & cancer	3,453.000	202.000	132.000	−0.61220	0.540	−0.61898	0.536
GCPS & diabetes	3,573.000	82.000	76.000	1.10746	0.268	1.11199	0.266
HIT-6 & diabetes	3,333.000	153.000	93.000	−0.64653	0.518	−0.64754	0.517
MIDAS & diabetes	3,033.500	126.500	107.500	−0.15390	0.878	−0.15676	0.875
SF-MPQ & diabetes	3,601.000	140.000	115.000	−0.21182	0.832	−0.21635	0.829
TMD pain screener & diabetes	3,418.000	68.000	62.000	1.40286	0.161	1.41895	0.156
GCPS & GERD	2,392.500	1,177.500	616.500	2.05615	0.040	2.06392	0.039*
HIT-6 & GERD	2,074.000	1,329.000	696.000	−0.80385	0.421	−0.80509	0.421
MIDAS & GERD	1,923.500	1,236.500	648.500	−0.77299	0.440	−0.78738	0.431
SF-MPQ & GERD	2,354.000	1,301.000	740.000	1.05955	0.289	1.08076	0.280
TMD pain screener & GERD	2,135.000	1,268.000	740.000	0.56560	0.572	0.57190	0.567
GCPS & alcohol consumption	2,920.500	907.500	574.500	−0.72942	0.466	−0.73271	0.464
HIT-6 & alcohol consumption	2,731.500	923.500	453.500	−1.60271	0.109	−1.60509	0.108
MIDAS & alcohol consumption	2,494.000	827.000	414.000	−1.50189	0.133	−1.52780	0.127
SF-MPQ & alcohol consumption	2,973.500	942.500	627.500	−0.51776	0.605	−0.52806	0.597
TMD pain screener & alcohol consumption	2,787.500	867.500	576.500	−0.52743	0.598	−0.53327	0.594
GCPS & smoking	3,401.000	427.000	349.000	1.23707	0.216	1.24265	0.214
HIT-6 & smoking	3,235.500	419.500	341.500	1.21160	0.226	1.21341	0.225
MIDAS & smoking	3,013.500	307.500	252.500	1.46438	0.143	1.48964	0.136
SF-MPQ & smoking	3,516.000	400.000	322.000	1.62323	0.105	1.65550	0.098
TMD pain screener & smoking	3,268.000	387.000	321.000	1.11943	0.263	1.13183	0.258
GCPS & caffeine use	3,102.000	726.000	516.000	1.54848	0.122	1.55546	0.120
HIT-6 & caffeine use	2,785.000	870.000	507.000	−1.02724	0.304	−1.02877	0.304
MIDAS & caffeine use	2,431.500	889.500	478.500	−1.22604	0.220	−1.24719	0.212
SF-MPQ & caffeine use	3,130.500	785.500	575.500	1.03552	0.300	1.05611	0.291
TMD pain screener & caffeine use	2,828.500	826.500	617.500	−0.09494	0.924	−0.09660	0.924
GCPS & physical activity	1,203.500	2,624.500	544.500	1.83835	0.066	1.84578	0.065
HIT-6 & physical activity	1,105.000	2,550.000	597.000	1.14252	0.253	1.14422	0.253
MIDAS & physical activity	855.000	2,385.000	555.000	0.49444	0.621	0.50330	0.615
SF-MPQ & physical activity	1,186.000	2,730.000	585.000	1.53847	0.124	1.57219	0.116
TMD pain screener & physical activity	833.500	2,736.500	591.500	0.27264	0.785	0.27571	0.783
BEI & hypothyroidism	2,936.500	633.5000	513.500	0.04088	0.967	0.04088	0.967
BEI & arterial hypertension	3,141.500	428.500	366.500	−0.04144	0.967	−0.04144	0.967
BEI & cancer	3,436.000	134.000	124.000	0.74565	0.456	0.74576	0.456
BEI & diabetes	–	–	0.000	0.00000	1.000	0.00000	1.000
BEI & GERD	1,818.500	1,341.500	690.500	−0.60919	0.542	−0.60927	0.542
BEI & alcohol consumption	2,731.500	671.500	518.500	0.38319	0.702	0.38325	0.702
BEI & smoking	2,769.500	633.500	213.500	−2.40143	0.016	−2.40181	0.016*
BEI & caffeine use	2,654.000	749.000	559.000	0.42862	0.668	0.42868	0.668

BEI & physical activity	767.500	2,635.500	536.500	−1.09956	0.272	−1.09971	0.271

GERD – gastroesophageal reflux disease; * statistically significant (Mann–Whitney U test with the continuity correction).

No significant associations were found between participants' reported pain levels and hypothyroidism, hypertension, diabetes, alcohol consumption, smoking, caffeine intake, or physical activity ($p > 0.05$).

However, a significant correlation emerged between pain and a history of cancer. Specifically, higher scores were recorded in the HIT-6 ($p = 0.037$) and MIDAS ($p = 0.032$) questionnaires for patients with a previous cancer diagnosis, while no significant differences were observed in GCPS, SF-MPQ, or the TMD pain screener ($p > 0.05$).

Additionally, gastroesophageal reflux disease (GERD) was associated with increased pain intensity and disability, as indicated by the GCPS ($p = 0.039$). Patients with GERD reported greater pain and functional limitations compared to those without the condition. No significant correlations were detected between GERD and HIT-6, MIDAS, SF-MPQ, or the TMD pain screener ($p > 0.05$).

Health factors, lifestyle, and sleep bruxism

The relationships between SB severity and various health and lifestyle factors—hypothyroidism, hypertension, cancer, diabetes, GERD, alcohol consumption, smoking, caffeine intake, and physical activity—were evaluated using the Mann–Whitney U test **(Table 2)**. Among these, only smoking showed a statistically significant association with SB ($p = 0.016$). Within the subgroup of smokers, one participant (8.33%) had a BEI < 2, another (8.33%) had BEI between 2–4, while the majority (10 participants; 83.33%) demonstrated severe bruxism (BEI > 4).

Discussion

According to Østensjø *et al.*, factors such as female sex, urban living, severe menstrual pain, and frequent headaches contribute to painful TMD [16]. Women not only experience TMD more frequently but also report higher pain intensity [16]. These findings align with our results, as women made up the majority of our sample and reported higher pain levels and greater disability than men. Østensjø *et al.* also suggested that regular physical activity may help alleviate pain [16], and several studies support the pain-reducing effects of consistent exercise [17]. In our cohort, physical activity did not reach statistical significance in relation to reported pain, though it had a slightly stronger effect on GCPS scores ($p = 0.065$) than on SB ($p = 0.271$).

The OPPERA project (Orofacial Pain: Prospective Evaluation and Risk Assessment), launched in 2006, identified poor general health, comorbidities, sleep disturbances, and smoking as risk factors for developing painful TMD [18].

Grozdinska *et al.* examined 119 women, including 52 with Hashimoto's thyroiditis and 67 healthy controls, and found a significantly higher prevalence of TMD in the thyroid disorder group [19]. Muscle pain and stiffness were reported by 45 participants (86.5%) in the study group, and 33 participants (63.5%) exhibited disk displacement with repositioning [19]. Their results indicated that muscle-related TMD is more frequent among patients with Hashimoto's thyroiditis than in healthy controls ($p < 0.001$) [19].

In contrast, our study did not demonstrate a significant relationship between reported pain or SB and thyroid disorders. However, only two participants had hypothyroidism, which limits the reliability of any conclusions regarding this association.

Miettinen *et al.* analyzed a cohort of 8,678 participants (148 women and 8,530 men) using questionnaires to assess TMD symptoms, health behaviors, and demographic background. Their findings indicated that women exhibited a higher prevalence of nearly all TMD symptoms, except for TMJ clicking [20]. Smoking was significantly correlated with TMD symptoms, excluding TMJ clicking, while alcohol consumption at least once per week was associated with facial pain, TMJ pain, and TMJ clicking. Use of snuff was linked specifically to facial pain [20]. These findings align with Sanders *et al.*, who reported that smoking was associated with TMD in women, primarily during young adulthood [21]. In contrast, Wänman observed no relationship between smoking and TMD signs or symptoms in adults aged 30–65 years [22].

Regarding sleep bruxism, Castroflorio *et al.* reported that smoking, more than alcohol consumption, influences the occurrence of SB [23]. Our study supports this observation: the Mann–Whitney U test confirmed a significant association between smoking and SB ($p = 0.016$). However, no statistically significant relationship was observed between smoking and reported pain ($p > 0.05$). Similarly, alcohol consumption, whether occasional or regular, did not appear to influence pain intensity ($p > 0.05$) or SB occurrence ($p > 0.05$). Coffee intake also showed no significant effect on pain severity or on the frequency and intensity of SB ($p > 0.05$), contrasting with Frosztega *et al.*, who identified habitual coffee consumption as a risk factor for increased SB intensity [24].

Our findings further suggest that GERD may contribute to increased pain in TMD patients ($p = 0.039$). This is consistent with Li *et al.*, who reported an association between symptomatic GERD and chronic TMD pain [25]. Previous studies indicate that esophageal acidification can increase masticatory muscle activity, promoting teeth clenching or grinding during sleep [26] and elevating muscle activity during waking hours [27]. Additionally, Nota *et al.* highlighted a significant link between GERD and bruxism, particularly awake bruxism [28].

Kanclerska *et al.* emphasize the dentist's role in diagnosis and patient care, noting that dental screening is particularly important for patients with hypertension and SB symptoms. Their research showed that nonapneic hypertensive individuals exhibited higher SB intensity, altered sleep patterns, increased snoring, and lower mean oxygen saturation compared to normotensive subjects [29]. Martynowicz *et al.* evaluated SB intensity in 70 adults (35 hypertensive and 35 normotensive) using portable home cardiorespiratory polygraphy, finding significantly higher BEI values in hypertensive patients [30, 31]. In our study, no statistically significant association was observed between arterial hypertension and reported pain or SB. However, the small number of hypertensive participants limits the reliability of these findings, especially in the absence of a control group.

This study has several limitations, which should guide future research. The small sample size for participants with hypothyroidism, hypertension, cancer, diabetes, GERD, myocardial infarction, or stroke restricts the statistical power to detect associations. The absence of a control group is another limitation. Additionally, pain severity and TMD status were assessed using questionnaires, which may introduce subjective bias. The use of PSG for bruxism assessment and sleep quality analysis is a strength of the study; however, recordings were conducted on the first night in the hospital without an adaptation night, introducing a potential interpretation bias. Therefore, these results should be regarded as preliminary.

Conclusions

Certain lifestyle habits, health conditions, and general health factors in patients with TMD appear to be associated with sleep bruxism, as well as reported pain and headaches. Nevertheless, these relationships require further investigation in larger study populations.

Acknowledgments: None

Conflict of Interest: None

Financial Support: None

Ethics Statement: None

References

1. Osiewicz MA, Lobbezoo F, Loster BW, Loster JE, Manfredini D. Frequency of temporomandibular disorders diagnoses based on RDC/TMD in a Polish patient population. Cranio. 2018;36(5):304–10. doi:10.1080/08869634.2017.1361052
2. Rodgrigues Conti PC, Pinto-Fiamengui LM, Cunha CO, de Castro Ferreira Conti AC, Orofacial pain and temporomandibular disorders: The impact on oral health and quality of life. Braz Oral Res. 2012;26(Suppl 1):120–3. doi:10.1590/s1806-83242012000700018
3. Loster JE, Osiewicz MA, Groch M, Ryniewicz W, Wieczorek A. The prevalence of TMD in Polish young adults. J Prosthodont. 2017;26(4):284–8. doi:10.1111/jopr.12414
4. Wieckiewicz M, Grychowska N, Wojciechowski K, Pelc A, Augustyniak M, Sleboda A, et al. Prevalence and correlation between TMD based on RDC/TMD diagnoses, oral parafunctions and psychoemotional stress in Polish university students. Biomed Res Int. 2014;2014:472346. doi: 10.1155/2014/472346. PMID: 25121100; PMCID: PMC4119893.
5. Lobbezoo F, Ahlberg J, Raphael KG, Wetselaar P, Glaros AG, Kato T, et al. International consensus on the assessment of bruxism: Report of a work in progress. J Oral Rehabil. 2018;45(11):837-44. doi: 10.1111/joor.12663. PMID: 29926505; PMCID: PMC6287494.
6. Lavigne GJ, Khoury S, Abe S, Yamaguchi T, Raphael K. Bruxism physiology and pathology: An overview for clinicians. J Oral Rehabil. 2008;35(7):476–94. doi:10.1111/j.1365-2842.2008.01881.x
7. Seweryn P, Orzeszek SM, Waliszewska-Prosół M, Jenča A, Osiewicz M, Paradowska-Stolarz A, et al. Relationship between pain severity, satisfaction with life and the quality of sleep in Polish adults with temporomandibular disorders. Dent Med Probl. 2023;60(4):609-17. doi: 10.17219/dmp/171894. PMID: 37873974.
8. Cigdem Karacay B, Sahbaz T. Investigation of the relationship between probable sleep bruxism, awake bruxism and temporomandibular disorders using the Diagnostic Criteria for

Temporomandibular Disorders (DC/TMD). Dent Med Probl. 2023;60(4):601–8. doi:10.17219/dmp/158926

9. Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet JP, et al. 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;28(1):6-27. doi: 10.11607/jop.1151. PMID: 24482784; PMCID: PMC4478082.
10. Smardz J, Martynowicz H, Wojakowska A, Winocur-Arias O, Michalek-Zrabkowska M, Mazur G, et al. A polysomnographic study on the relationship between sleep bruxism intensity and sleep quality. Cranio. 2022;40(2):107-12. doi: 10.1080/08869634.2020.1716466. PMID: 31969083.
11. Melzack R, Katz J. The McGill pain questionnaire: Appraisal and current status. In: Turk DC, Melzack R, eds. Handbook of Pain Assessment. 2nd ed. New York, NY: Guilford Press; 2001:35–52.
12. Von Korff M, DeBar LL, Krebs EE, Kerns RD, Deyo RA, Keefe FJ. Graded Chronic Pain Scale revised: Mild, bothersome, and high-impact chronic pain. Pain. 2020;161(3):651-61. doi:10.1097/j.pain.0000000000001758
13. Yang M, Rendas-Baum R, Varon SF, Kosinski M. Validation of the Headache Impact Test (HIT-6™) across episodic and chronic migraine. Cephalalgia. 2011;31(3):357–67. doi:10.1177/0333102410379890
14. Stewart WF, Lipton RB, Kolodner KB, Sawyer J, Lee C, Liberman JN. Validity of the Migraine Disability Assessment (MIDAS) score in comparison to a diary-based measure in a population sample of migraine sufferers. Pain. 2000;88(1):41–52. doi:10.1016/S0304-3959(00)00305-5
15. Gonzalez YM, Schiffman E, Gordon SM, Seago B, Truelove EL, Slade G, et al. Development of a brief and effective temporomandibular disorder pain screening questionnaire: reliability and validity. J Am Dent Assoc. 2011 Oct;142(10):1183-91. doi: 10.14219/jada.archive.2011.0088. PMID: 21965492; PMCID: PMC4527600.
16. Østensjø V, Moen K, Storesund T, Rosén A. Prevalence of painful temporomandibular disorders and correlation to lifestyle factors among adolescents in Norway. Pain Res Manag. 2017;2017:2164825. doi:10.1155/2017/2164825
17. Fernandes G, Jennings F, Nery Cabral MV, Pirozzi Buosi AL, Natour J. Swimming improves pain and functional capacity of patients with fibromyalgia: A randomized controlled trial. Arch Phys Med Rehabil. 2016;97(8):1269–1275. doi:10.1016/j.apmr.2016.01.026
18. Slade GD, Ohrbach R, Greenspan JD, Fillingim RB, Bair E, Sanders AE, et al. Painful Temporomandibular Disorder: Decade of Discovery from OPPERA Studies. J Dent Res. 2016;95(10):1084-92. doi: 10.1177/0022034516653743. PMID: 27339423; PMCID: PMC5004239.
19. Grozdinska A, Hofmann E, Schmid M, Hirschfelder U. Prevalence of temporomandibular disorders in patients with Hashimoto thyroiditis. J Orofac Orthop. 2018;79(4):277–288. doi:10.1007/s00056-018-0140-6
20. Miettinen O, Anttonen V, Patinen P, Päkkilä J, Tjäderhane L, Sipilä K. Prevalence of temporomandibular disorder symptoms and their association with alcohol and smoking habits. J Oral Facial Pain Headache. 2017;31(31):30–36. doi:10.11607/ofph.1595
21. Sanders AE, Maixner W, Nackley AG, Diatchenko L, By K, Miller VE, et al. Excess risk of temporomandibular disorder associated with cigarette smoking in young adults. J Pain. 2012;13(1):21-31. doi: 10.1016/j.jpain.2011.08.003. PMID: 22036516; PMCID: PMC3249502.
22. Wänman A. Temporomandibular disorders among smokers and nonsmokers: A longitudinal cohort study. J Orofac Pain. 2005;19(3):209–217. PMID:16106714.
23. Castroflorio T, Bargellini A, Rossini G, Cugliari G, Deregibus A. Sleep bruxism and related risk factors in adults: A systematic literature review. Arch Oral Biol. 2017;83:25–32. doi:10.1016/j.archoralbio.2017.07.002
24. Frosztega W, Wieckiewicz M, Nowacki D, Poreba R, Lachowicz G, Mazur G, et al. The effect of coffee and black tea consumption on sleep bruxism intensity based on polysomnographic examination. Heliyon. 2023;9(5):e16212. doi: 10.1016/j.heliyon.2023.e16212. PMID: 37229165; PMCID: PMC10205497.

25. Li Y, Fang M, Niu L, Fan Y, Liu Y, Long Y, et al. Associations among gastroesophageal reflux disease, mental disorders, sleep and chronic temporomandibular disorder: a case-control study. CMAJ. 2019;191(33):E909-15. doi: 10.1503/cmaj.181535. PMID: 31427355; PMCID: PMC6699946.
26. Ohmure H, Oikawa K, Kanematsu K, Saito Y, Yamamoto T, Nagahama H, et al. Influence of experimental esophageal acidification on sleep bruxism: A randomized trial. J Dent Res. 2011;90(5):665–71. doi:10.1177/0022034510393516
27. Ohmure H, Sakoguchi Y, Nagayama K, Numata M, Tsubouchi H, Miyawaki S. Influence of experimental oesophageal acidification on masseter muscle activity, cervicofacial behaviour and autonomic nervous activity in wakefulness. J Oral Rehabil. 2014;41(6):423–31. doi:10.1111/joor.12159
28. Nota A, Pittari L, Paggi M, Abati S, Tecco S. Correlation between bruxism and gastroesophageal reflux disorder and their effects on tooth wear. A systematic review. J Clin Med. 2022;11(4):1107. doi:10.3390/jcm11041107
29. Kanclerska J, Wieckiewicz M, Poreba R, Szymanska-Chabowska A, Gac P, Wojakowska A, et al. Polysomnographic Evaluation of Sleep Bruxism Intensity and Sleep Architecture in Nonapneic Hypertensives: A Prospective, Observational Study. J Clin Med. 2022 May 31;11(11):3113. doi: 10.3390/jcm11113113. PMID: 35683499; PMCID: PMC9181472.
30. Martynowicz H, Dymczyk P, Dominiak M, Kazubowska K, Skomro R, Poreba R, et al. Evaluation of Intensity of Sleep Bruxism in Arterial Hypertension. J Clin Med. 2018;7(10):327. doi: 10.3390/jcm7100327. PMID: 30301160; PMCID: PMC6210463.
31. Smardz J, Martynowicz H, Wojakowska A, Michalek-Zrabkowska M, Mazur G, Wieczorek T, et al. The meaning of the masticatory muscle tonic-type electromyographic pathway correlated with sleep bruxism and sleep-related breathing disorders - A polysomnographic study. Sleep Med. 2020;68:131-7. doi: 10.1016/j.sleep.2019.08.025. Epub 2019 Oct 2. PMID: 32035303.