



Relationship Between Chronic Pain and Sleep Quality in Patients with Temporomandibular Joint Dysfunction

Temporomandibular Eklem Disfonksiyonu Olan Hastalarda Kronik Ağrı ve Uyku Kalitesi İlişkisi

Ömer Ekici

Afyonkarahisar Health Sciences University Faculty of Dentistry, Department of Oral and Maxillofacial Surgery, Afyonkarahisar, Turkey

Abstract

Objective: Craniofacial pain and sleep are interrelated: Pain can cause sleep problems, and sleep problems can worsen pain. This study aimed to establish the relationship between chronic pain and sleep quality among patients with temporomandibular disorders (TMDs).

Materials and Methods: The study was carried out in patients with TMDs who sought care at the oral and maxillofacial surgery clinic of a faculty of dentistry. This study included a total of 337 patients diagnosed with TMD according to the Research diagnostic criteria for TMDs. TMD pain was evaluated using the graded chronic pain scale, and their sleep quality was assessed with the Pittsburgh Sleep Quality index (PSQI).

Results: The mean PQQI index score of all participants was 6.54. No significant difference was found between the PSQI scores in terms of sociodemographic variables. The sleep quality of the participants varied significantly according to the pain levels. This difference was observed both in total sleep quality scores and in each of the seven components of sleep quality ($p<0.001$ and $p<0.005$, respectively). In this study, sleep disturbance components with the highest scores were "sleep disturbances (1.5 ± 0.65)", "sleep latency (1.42 ± 0.86)" and "subjective sleep quality (1.21 ± 0.68)".

Conclusion: The findings of this study reveal that the quality of sleep decreased as the level of pain increased, that is, PSQI scores and all subcomponent scores are also increased. These findings indicate that physicians treating patients with TMD pain should investigate their quality of sleep.

Keywords: Orofacial pain, sleep quality, temporomandibular joint dysfunction

Öz

Amaç: Kraniofasial ağrı ve uyku birbiriyle ilişkilidir. Ağrı uyku sorunlarına neden olabilir, uyku sorunları ağrıyı kötüleştirebilir. Bu çalışmanın amacı, temporo-mandibular eklem bozukluğu olan hastalarda kronik ağrı ile uyku kalitesi arasındaki ilişkiyi belirlemektir.

Gereç ve Yöntem: Çalışma bir diş hekimliği fakültesi ağız ve çene cerrahisi kliniğine tedavi için başvuran Temporomandibular bozukluk (TMD) hastaları ile gerçekleştirilmiştir. TMD'ler için araştırma tanı kriterlerine (ATK/TMD) göre TME bozukluğu tanısı alan 337 hasta çalışmaya dahil edildi. Hastaların TMD ağrıları Dereceli Kronik Ağrı ölçeği ile, uyku kaliteleri Pittsburgh Uyku Kalitesi indeksi (PUKİ) ile değerlendirildi.

Bulgular: Tüm katılımcıların ortalama PUKİ puanı 6,54 idi. Katılımcıların PUKİ puanları arasında sosyodemografik değişkenler açısından anlamlı bir fark yoktu. Katılımcıların ağrı düzeylerine göre uyku kaliteleri önemli derecede değişti. Bu fark hem toplam uyku kalitesi puanlarında hem de uyku kalitesinin 7 bileşeninin her birinde gözlemlendi (sırasıyla $p<0,001$ ve $p<0,005$). Bu çalışmada, en yüksek uyku bozukluğu bileşenleri "uyku bozuklukları ($1,5\pm0,65$)", "uyku gecikmesi ($1,42\pm0,86$)" ve "öznel uyku kalitesi ($1,21\pm0,68$)" idi.

Sonuç: Çalışma bulgularına göre ağrı düzeyi arttıkça, uyku kalitesi azaldı yani toplam PUKİ puanları ve tüm alt bileşen puanları yükseldi. Bu bulgular, TMD ağrısı olan hastaları tedavi eden hekimlerin uyku kalitelerini araştırması gerektiğini göstermektedir.

Anahtar Kelimeler: Orofasial ağrı, uyku kalitesi, temporomandibular eklem disfonksiyonu

Introduction

Pain and sleep disorders are the most prevalent issues in the population, so it is no wonder that these two situations overlap (1). Nevertheless, the relationship between pain and sleep is not one-way (2). Painful conditions interfere with sleep, but sleep disturbances often contribute to the perception of pain

(3). The bidirectional relationship is especially relevant when patients have chronic pain situations. Research indicates sleep problems in 50-89% of patients with any form of chronic pain (4). Patients with chronic pain frequently experience poor sleep quality (SQ), which may include impaired sleep onset or maintenance, as well as impaired sleep with repeated arousals, or a combination of these issues (5).

Address for Correspondence/Yazışma Adresi: Ömer Ekici MD, Afyonkarahisar Health Sciences University Faculty of Dentistry, Department of Oral and Maxillofacial Surgery, Afyonkarahisar, Turkey **Phone:** +90 507 217 92 75 **E-mail:** dromerekici@hotmail.com **ORCID-ID:** orcid.org/0000-0002-7902-9601

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According to the American Academy of Orofacial Pain, temporo-mandibular disorders (TMDs) are described as a group of disorders including masticatory muscles, the temporomandibular joint (TMJ), and related structures (6). Typical clinical symptoms of TMD include idiopathic and episodic orofacial musculoskeletal pain and/or TMJ sounds (e.g. clicking, cracking, and crepitation) and/or restricted jaw movements (7). The etiology of TMD is complex, multifactorial, and coherent with the biopsychosocial model of the disease (8), and frequently present with jaw pain, headache, toothache, earache, facial pain or fullness or pressure on the face (9). TMDs are the main cause of non-dental orofacial pain. After chronic low back pain, the TMD is the second most prevalent musculoskeletal pain (10).

Patients with TMDs, particularly those with chronic pain, have often complained about sleep disorders (11-13). Up to 90% of patients with TMD usually experience poor SQ (14). Up to 70 percent of patients with TMD meet at least one criterion for a sleep disorder and 43 percent meet two or more criteria (15). In a recent systematic review study, it was reported that there is a relationship between painful TMD and SQ, and the presence of pain can strongly affect SQ in TMD patients (16). In chronic TMD patients, the relationship between chronic pain and sleep disturbances is not yet well known though substantial evidence exists (17). Assessing the quality of sleep can lead to successful therapies for many TMD patients. The objective of this study is therefore to establish the relationship between chronic pain and SQ among patients with TMD.

Materials and Methods

The study was carried out TMD patients who sought care at the Department of Oral and Maxillofacial Surgery Faculty of Dentistry in Afyonkarahisar Health Sciences University, from October 1, 2019, to April 30, 2020. This research was approved by the Ethics Committee of the Faculty of Medicine, Afyonkarahisar University of Health Sciences Turkey (2019/10-317) and was conducted according to principles of the Declaration of Helsinki. Written informed consent was obtained from all patients. The clinical examination and diagnosis of TMD were made on the basis of the Research Diagnostic Criteria for TMD (RDC/TMD) (10). A single calibrated oral and maxillofacial surgeon examined all patients and conducted all questionnaires and tests to patients. TMD pain of patients was assessed with the Graded Chronic Pain scale (GCPS) and their SQ was assessed with the Pittsburgh Sleep Quality index (PSQI).

GCPS

Chronic pain was assessed using the GCPS as it was defined in the literature (18). GCPS has two indicators: Pain intensity and disability degree. Pain intensity determined by Visual Analog scales (VAS) (current pain intensity, maximum pain intensity, and average pain intensity in prior 6 months/3). Degree of disability, determined by quantifying the number of disability days and the degree of disability obtained from the sum of the VAS scores (how the disability affects patients' daily, recreational and work activities). The values are measured

from 0 to 4 (grade 0: No pain in prior 6 months, grade I: Low intensity (pain intensity <50), low disability, grade II: High intensity (pain intensity >50), low disability, grade III: High disability, moderately limiting, grade IV: High disability, severely limiting).

PSQI

The PSQI is a short, easy-to-use questionnaire used to gather information on SQ. PSQI offers a combination of quantitative and qualitative sleep information (19). By the answers obtained from the person, seven components are evaluated: subjective quality of sleep, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction (20). A point range from 0 to 3 is obtained for each component, with a higher score that indicates poorer SQ. The questionnaire is scored from 0 to 21 points. If the total of the scores more five points, the patient has bad sleeping patterns or sleep disorders. Individuals can thus be graded as having the following: good sleep (0-4 scores), poor sleep (5-10 scores), and the occurrence of chronic sleep disturbance (>10 scores).

Statistical Analysis

The data were analyzed with the Statistical Package for the Social Sciences (SPSS-version 22) program. Descriptive statistics was used for categorical variables and frequency calculations were expressed as percentage. Chi-square test was used for crosstabulations. One-Way ANOVA and Kruskal-Wallis test were used for comparison of mean values. The mean difference was considered significant at the 0.05 level.

Results

The sociodemographic characteristics and PSQI scores of patients with TMDs participating in the study are given in Table 1. The majority of the 337 participants (82.8%) were women. When the age range of the participants was examined, the majority of the participants were young people and middle age group. Approximately half of the participants (47.8%) were married. Only 8.6% of the participants had undergraduate and postgraduate education. When the Body Mass index (BMI) was examined, approximately half of the participants (52.2%) were at normal weight, while 41.3% were overweight. The average PSQI index score of all participants was 6.54. Also, 76.3% of the participants had bruxism. There was no significant difference between the PSQI scores of the participants in terms of all sociodemographic variables (age, gender, marital status, education status, BMI, and bruxism).

In the study, patients' chronic pain states related to TMJ were evaluated using the GCPS. According to this assessment, 13.1% of patients had grade 0, 33.5% had grade 1, 43.6% had grade 2, 9.8% had grade 3 pain. There was no participant with grade 4 pain rating. When SQ is evaluated using the PSQI, 43.6% of the participants had good SQ (0-5 points), 43.3% had poor SQ (6-10 points) and 13.1% had chronic sleep disorder (11-21 points).

The relationship between the participants' chronic pain level and SQ is included in the cross chi square table (Table 2). In the

Demographic data	n	%	PSQI Mean \pm SDs	P
Gender				
Female	279	82.8	6.65 \pm 3.47	0.145
Male	58	17.2	6.01 \pm 2.87	
Age				
<20 years old	75	22.3	6.82 \pm 2.84	0.061
20-29 years old	99	29.4	5.95 \pm 1.97	
30-39 years old	83	24.6	6.27 \pm 3.91	
40-49 years old	49	9.2	7.61 \pm 4.86	
50 and over age	31	11.8	6.74 \pm 3.54	
Marital status				
Married	161	47.8	6.67 \pm 3.55	0.347
Single	157	46.6	6.54 \pm 3.00	
Divorced	19	5.6	5.47 \pm 4.70	
Education status				
Primary school	90	26.7	6.20 \pm 3.43	0.175
Secondary school	104	30.9	6.51 \pm 3.38	
High school	114	33.8	7.01 \pm 3.27	
Faculty	27	8	5.59 \pm 3.60	
Graduate	2	0.6	9.00 \pm 0.00	
BMI				
<18.5 kg/m ² (weak)	22	6.5	5.54 \pm 2.50	0.067
18.5-24.9 kg/m ² (normal)	176	52.2	6.91 \pm 3.52	
25-29.9 kg/m ² (overweight)	106	31.5	5.96 \pm 2.98	
>30 kg/m ² (obese)	33	9.8	7.09 \pm 4.03	
Bruxism				
Yes	257	76.3	6.67 \pm 3.40	0.187
No	80	23.7	6.11 \pm 3.29	
Total	337	100	6.54 \pm 3.38	

PSQI: Pittsburgh Sleep Quality index, SDs: Standard deviations, BMI: Body Mass index

Graded Chronic Pain scale			Sleep quality			Total
			Poor sleep (6-10 point)	Good sleep (0-5 point)	Chronic sleep disorder (10< point)	
Grade	0.00	Number (n)	26	18	0	44
		% within grade	59.1%	40.9%	0.0%	100.0%
		% of total	7.7%	5.3%	0.0%	13.1%
	1.00	Number (n)	58	49	6	113
		% within grade	51.3%	43.4%	5.3%	100.0%
		% of total	17.2%	14.5%	1.8%	33.5%
	2.00	Number (n)	58	65	24	147
		% within grade	39.5%	44.2%	16.3%	100.0%
		% of total	17.2%	19.3%	7.1%	43.6%
	3.00	Number (n)	5	14	14	33
		% within grade	15.2%	42.4%	42.4%	100.0%
		% of total	1.5%	4.2%	4.2%	9.8%
Total		Number (n)	147	146	44	337
		% within grade	43.6%	43.3%	13.1%	100.0%
		% of total	43.6%	43.3%	13.1%	100.0%

study, it was clearly seen that SQ deteriorated in parallel with the increase in the degree of pain of the participants. When Table 2 is examined, the rate of those who have good SQ is 59.1% in grade 0, it decreases to 51.3% in grade 1, 39.5% in grade 2 and 15.2% in grade 3. Similarly, while there were no participants with chronic sleep disorders in grade 0, the rate of those with chronic sleep disorders in grade 1 was 5.3%, 16.3% in grade 2 and 42.4% in grade 3.

Table 3 shows the average scores of the participants' SQ and SQ components. When PSQI SQ mean scores are examined, it is seen that the grade 0 group is 4.95, the grade 1 group is 5.73, the grade 2 group is 6.98 and the grade 3 group is 9.45. According to ANOVA and Kruskal-Wallis tests, there was a significant difference between the participants' pain levels and SQ. This difference was observed both in total SQ scores and in each of the 7 components of SQ. As seen in Table 3, as the pain level increased, SQ decreased, that is, PSQI scores and all subcomponent scores also increased. In the present study, the highest scores in components of PSQI were "sleep disturbances (1.5±0.65)", "sleep latency (1.42±0.86)", and "subjective SQ (1.21±0.68)".

Discussion

Adequate sleep is essential for healthy overall functioning. Poor sleep affects the perception of pain, too. Any painful condition will eventually interfere with sleep and affect mood, energy, etc. (21). The literature indicates a bidirectional correlation between pain and poor sleep (1). Poor sleep exacerbates pain, while greater pain adversely affects sleep (22). Sleep-wake patterns and quality of sleep can in a variety of ways affect orofacial pain (23). Pain-related awakening seen in approximately one-third of patients with craniofacial pain and is associated with severity of pain (24). This study investigated the association between chronic pain and SQ by using a chronic pain and sleep questionnaire in patients with TMJ disorders and by performing clinical examinations in a large number of patients.

Pain is a complicated experience that covers cognitive and emotional dimensions, which are perhaps the most common and disabling symptoms in medicine (25).

Although some evidence of this is available, the connection between chronic pain and sleep disturbance is not yet well explained. Chronic pain patients have poorer sleep than controls in terms of sleep duration, quality of sleep, and post-sleep awakenings (26). Fifty to seventy percent of patients with chronic pain report sleep interruption, with most of these patients citing pain as the primary cause of sleep disruption (4). Approximately one-third of patients with chronic craniofacial pain and pain-related associations experience pain-related awakening (24). Seventy-seven percent of the orofacial pain population reported a decrease in SQ after their pain started (15). In an earlier PSG-based study comparing chronic-pain patients to healthy people, the chronic-pain group had more awakenings during the night than the control group. In addition, the chronic pain group reported substantially greater difficulty in beginning sleep than in the control group (2,27). Fifty to seventy percent of chronic pain patients state that pain as the primary cause of sleep disruption (24).

TMD is a common musculoskeletal disease that affects 5-12% of the population and is frequently related to TMJ sounds, mandibular motion dysfunction, and pain in masticatory muscles and/or the preauricular region (10,28). Pain is the main symptom for most TMDs and also the main reason patients seek treatment (29). TMD may follow a chronic course in the event of persistent or recurrent pain (30). In this study, 86.9% of the patients suffered from chronic pain associated with the TMJ. Like all chronic pain patients, TMD patients with chronic pain experience sleep deprivation (31,32). Pain can also cause stress and anxiety and indirectly impair SQ. It has been reported that negative emotional states such as stress, anxiety, and depression can seriously impair SQ in TMD patients (33). Research has consistently shown that more than 50 percent of TMD patients experience poor SQ (17). Similar to the literature, 56.4% of TMD patients were found to have poor SQ. While the rate of patients with chronic sleep disorders was 13.1% in all patients, this rate was 42.4% in grade 3 group. In this study, there was a direct association between pain level and SQ. The increase in pain level caused a significant deterioration in all sub-components of SQ and total SQ. Especially in grade 3 patients, a significant deterioration was observed in both total

Table 3. Comparison of sleep quality according to chronic pain conditions of the participants

	Total (n=337)	Grade 0 (n=44)	Grade 1 (n=113)	Grade 2 (n=147)	Grade 3 (n=33)	-
PSQI	Mean ± SDs	Mean ± SDs	Mean ± SDs	Mean ± SDs	Mean ± SDs	p
1. Subjective sleep quality	1.21±0.68	0.72±0.58 ^a	1.23±0.69 ^b	1.27±0.62 ^b	1.48±0.75 ^b	0.000
2. Sleep latency	1.42±0.86	1.11±0.75 ^a	1.39±0.81 ^{ab}	1.42±0.93 ^b	1.90±0.67 ^c	0.001
3. Sleep duration	0.57±0.91	0.29±0.79 ^a	0.53±0.81 ^{ab}	0.59±0.88 ^{ab}	1.00 ±1.32 ^b	0.009
4. Sleep efficiency	0.61±0.83	0.45±0.72 ^a	0.34±0.57 ^a	0.73±0.87 ^b	1.24±1.03 ^c	0.000
5. Sleep disturbances	1.5±0.65	1.45±0.69 ^a	1.35±0.56 ^a	1.57±0.69 ^b	1.75±0.56 ^{bc}	0.004
6. Use of sleep medication	0.18±0.57	0.06±0.25 ^a	0.03±0.26 ^a	0.27±0.66 ^b	0.45±0.97 ^b	0.000
7. Daytime dysfunction	1.01±0.86	0.90±0.93	0.79±0.76	1.06±0.83	1.66±0.85	0.000
PSQI global score	6.54±3.38	4.95±2.05 ^a	5.73±2.60 ^a	6.98±3.54 ^b	9.45±4.25 ^c	0.000

In each line, different superscripts indicate statistically significant difference between groups (p<0.005), PSQI: Pittsburgh Sleep Quality index, SDs: Standard deviations, In each line, different superscripts (a,b,c) indicate statistically significant difference between groups (p<0.005)

SQ and all sub-components of SQ compared to other groups. It has been shown that insomnias related to chronic pain are frequently phenotypically similar to primary insomnia (34). Likewise, delayed sleep onset, disturbed sleep, frequent awakenings, and non-restorative sleep are the most common sleep-associated symptoms of pain sufferers (35). In patients with TMD, insomnia is the most common sleep disorder and changes in the severity of insomnia contribute to an increase in TMD pain (36). TMD patients normally do not wake from sleep, but pain-related waking has been documented by up to 24% of patients with a high muscle tenderness score (24). Myofascial pain patients registered substantially poorer sleep than controls and those with TMJ pain in TMDs (13). In the study of Sener and Güler, the PSQI components that were most affected by TMDs were subjective SQ, sleep latency, sleep disturbance, and habitual sleep efficiency (37). Similarly, sleep disturbance, sleep latency, and subjective SQ were the highest sleep disturbance components on the PSQI scale in this study.

Study Limitations

The main limitations of this study are related to its subjectivity because although a large number of patients were included, the results could be subjective, as the questionnaire was used instead of PSG. PSG is the gold standard for sleep architecture assessment and can be used to objectively diagnose sleep pathophysiology (38) but it is a rather expensive tool and applicable in small populations. Sleep-questionnaire-based research has the advantages of less time and less cost needed to collect data on their sleeping properties compared to PSG (39). Also, participants' habits such as bruxism were entirely based on their own self-reports. Sleep bruxism can be diagnosed through patient reports and clinical interviews, clinical examinations, intraoral appliances, or muscle activity recordings. According to the last international consensus, the diagnosis of bruxism made by self-report is classified as potential bruxism (40). The diagnosis of bruxism was made by a professional clinician on the basis of clinical diagnostic criteria for sleep bruxism, as defined by the American Academy of Sleep Medicine (41). Sleep laboratory evaluation is needed to establish a definitive diagnosis of sleep bruxism, but it is costly and inaccessible for large samples. This research is important in studying the quality of the sleep and the relationship with chronic pain by using a questionnaire and performing clinical examinations to a large number of TMJ patients.

Conclusion

The results of this study clearly revealed the relationship between TMJ chronic pain and sleep disorders. SQ is strongly associated with TMJ pain. TMD patients with chronic pain suffer from sleep deprivation like other chronic-pain patients. These results imply that clinicians treating patients with TMD should examine their SQ. Assessing SQ and disturbances should be part of the routine diagnostic workup for TMD patients with chronic pain. The management of patients with chronic TMD pain problems and sleep disturbances should be based on a

systematic, multidisciplinary team plan that addresses all of the variables.

Ethics

Ethics Committee Approval: This research was approved by the Ethics Committee of the Faculty of Medicine, Afyonkarahisar Health Sciences University (2019/10-317) and was conducted according to principles of the Declaration of Helsinki.

Informed Consent: Written informed consent was obtained from all patients

Peer-review: Internally peer-reviewed.

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