RESEARCH ARTICLE / *Araştırma Makalesi*

The Effect of Bruxism on the Severity of OSAS in Patients with OSAS and Headache

Baş Ağrısı Olan OUAS'lı Hastalarda Bruksizmin OUAS Şiddetine Etkisi

Figen Yavlal[1], Sena Boncuk Ulaş[2], Yeşim Güzey Aras[3]

[1] Medicana International Istanbul Hospital , Department of Neurology, Istanbul, Türkiye
[2] Edirne Keşan State Hospital, Department of Neurology, Edirne, Türkiye
[3] Sakarya University Training and Researche Hospital department of Neurology, Sakarya ,Türkiye

Yazışma Adresi / *Correspondence:*
Figen Yavlal

Iğdır Dr. Nevruz Erez Devlet Hastanesi, Radyoloji Departmanı, Pir Sultan Abdal Mah. Melekli Yolu Cd. 76000 Iğdır Merkez/Iğdır, Türkiye
T: **+90 554 549 73 86** E-mail **: fgnyvll@gmail.com**

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Orcid ve Mail Adresleri
Figen Yavlal https://orcid.org/0000 0002 6710 511X, fgnyvll@gmail.com
Sena Boncuk Ulaş https://orcid.org/0000-0002-0076-9405, senaboncuk@gmail.com
Yeşim Güzey Aras https://orcid.org/0000-0002-2000-8056, yesimguzeyaras@hotmail.com

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Abstract

Introduction	Morning headaches have been associated with sleep-related breathing disorders and Sleep Bruxism (SB). The present study aims to investigate the relationship between SB, primary headaches and the severity of Obstructive Sleep Apnea Syndrome (OSAS) in patients presenting with morning headaches and a prediagnosis of OSAS.
Materials and Methods	The study included 480 patients who prediagnosis of OSAS and morning headache complaints, and were diagnosed with primary headache according to the International Classification of Headache Disorders (ICHD). Age, gender, Body Mass Index (BMI), headache type, presence of SB, OSAS stage according to Apnea-Hypopnea Index (AHI), and presence of hypoxia were recorded. Patients were then divided into 2 groups of SB (-) and SB (+), and both groups were compared in terms of headache.
Results	In the classification according to headache types, 31.5% of the patients were classified as migraine, 41.9% as tension-type headache (TTH), 2.1% as cluster, and 24.6% as other types of headache. While 76% of the patients had no SB, 24% had SB. The rate TTH was significantly ($p<0.05$) higher in the group with SB than in the group without SB. Severe OSAS and high BMI were significantly higher in the SB group compared to the non-SB group ($p <0.05$).
Conclusion	PSG should be performed to make a differential diagnosis of sleep-related disorders in patients presenting with a morning headache. Obesity, severe OSAS, TTH, hypoxemia are common in patients with sleep bruxism. SB, headache, and sleep-disordered breathing share common risk factors or common pathophysiology without specific cause-and-effect relationship.
Keywords	: sleep bruxism; obstructive sleep apnea syndrome; headache

Öz

Amaç	*Sabah baş ağrıları, uyku ile ilişkili solunum bozuklukları ve Uyku Bruksizmi (UB) ile ilişkilendirilmiştir. Bu çalışmanın amacı, sabah baş ağrıları ile başvuran ve Obstrüktif Uyku Apne Sendromu (OUAS) ön tanısı olan hastalarda UB, primer baş ağrıları ve OUAS şiddeti arasındaki ilişkinin araştırılmasıdır.*
Yöntem ve Gereçler	*Çalışmaya OUAS ön tanılı olan sabah baş ağrısı yaşayan ve Uluslararası Baş Ağrısı Bozuklukları Sınıflandırmasına (ICHD) göre primer baş ağrısı tanısı alan 480 hasta dahil edildi. Yaş, cinsiyet, Beden Kitle İndeksi (VKİ), baş ağrısı tipi, SB varlığı, Apne-Hipopne İndeksi'ne (AHİ) göre OUAS evresi ve hipoksi varlığı kaydedildi. Hastalar daha sonra SB (-) ve SB (+) olarak 2 gruba ayrıldı ve her iki grup baş ağrısı açısından karşılaştırıldı.*
Bulgular	*Baş ağrısı tiplerine göre yapılan sınıflamada hastaların %31,5'i migren, %41,9'u gerilim tipi baş ağrısı (GTBA), %2,1'i küme, %24,6'sı diğer baş ağrısı tipleri olarak sınıflandırıldı. Hastaların %76'sında SB yokken, %24'ünde SB vardı. SB olan grupta GTBA oranı SB olmayan gruba göre anlamlı olarak ($p<0,05$) daha yüksekti. Şiddetli OUAS ve yüksek VKİ, SB grubunda, SB olmayan gruba göre anlamlı olarak daha yüksekti ($p <0,05$).*
Sonuç	*Sabah baş ağrısı ile başvuran hastalarda uyku ile ilişkili bozuklukların ayırıcı tanısını yapmak için PSG yapılmalıdır. Uyku bruksizmi olan hastalarda obezite, şiddetli OUAS, GTBA, hipoksemi sık görülür. SB, baş ağrısı ve uykuda solunum bozukluğu, spesifik neden-sonuç ilişkisi olmaksızın ortak risk faktörlerini veya ortak patofizyolojiyi paylaşır.*
Anahtar Kelimeler	*uyku bruksizmi; obstrüktif uyku apne sendromu; başağrısı*

INTRODUCTION

Sleep disorders are common in patients presenting to neurology clinics with refractory headaches. Many sleep disorders, especially insomnia and OSAS, can be seen with accompanying headaches. OSAS is a recurrent, partial or complete airway obstruction during sleep. Headache is present in 30% to 70% of patients with OSAS and often has features of tension-type headache (TTH), migraine, or chronic migraine, especially in the morning. Sleep-related headaches can also be treated by treating sleep disorders.[1,2] The most common headaches are tension-type headaches and migraine.[3] The pathophysiology of TTH and migraine is complex and multifactorial. In TTH, sensitization of the pain pathways is facilitated, resulting in sensitization of the trigeminocervical nucleus, whereas, in migraine, pain is associated with abnormal neuronal excitability, cortical spreading depression, and central sensitization of trigeminovascular pain.[4,5] However, previous studies have shown that dysfunction of the masticatory and cervical muscles is associated with an increased prevalence of headaches in both types of pain.[6,7]

SB can be defined as the activity of masticatory muscles during sleep. It is not considered a movement disorder or sleep disorder in healthy individuals. Previous studies have shown that SB can cause both TTH and migraine headaches during the day.[6,8,9] SB has also been frequently associated with sleep-disordered breathing, snoring, and OSAS, in particular.[10,11] The coexistence of SB and morning headache suggests the presence of sleep-disordered breathing. Moreover, SB, headache, and sleep-disordered breathing may also coexist due to common risk factors or common pathophysiology.[12,13] The presence of sleep-disordered breathing and SB should be investigated especially in patients presenting with a morning headache. This study aims to investigate the relationship between SB and primary headaches in patients presenting with morning headaches and a prediagnosis of OSAS.

MATERIALS and METHODS

The study included patients who were admitted to the sleep outpatient clinic of the Neurology Clinic of Medicana International Istanbul Hospital with a prediagnosis of OSAS and complaints of morning headache and were diagnosed with primary headache according to the International Classification of Headache Disorders (ICHD). For the study, the files of 512 patients who presented with morning headaches and underwent PSG between October 15, and December 15, 2022, were retrospectively reviewed. Thirty-two patients were excluded from the study because of headaches due to secondary causes, and the study was completed with the remaining 480 patients. All patients included in the study were the first time application to the neurology outpatient clinic with headache complaints and did not receive any specific treatment for headaches. Approval was obtained from the Sakarya University Faculty of Medicine Non-Interventional Ethics Committee with approval no: E-71522473-050.01.04-17132-252 and the date 05.10.2022.

The age, gender, and Body Mass Index (BMI) of the patients were recorded. Patients were grouped as underweight for BMI <19 kg/m², normal for BMI <25 kg/m², preobese (overweight) for 25 kg/m2≤ BMI<30 kg/m², Class I obese for 30 kg/m2≤ BMI<35 kg/m², Class II obese for 35 kg/m2≤ BMI<40 kg/m², and Class III obese for 40 kg/m² ≤ BMI, according to the classification made by the World Health Organization. The patients were divided into 4 groups: migraine, TTH, cluster, and other primary headaches according to ICHD criteria. PSG data were then examined. Two Alice® Sleepware, Philips Respironics, PA, USA (Philips Respironics) software diagnostic devices were used for PSG data collection. PSG examination included brain activity measurement by electroencephalography (EEG) (recorded from F3-A2, C3-A2, F4-A1, C4-A1, O1-A2, O2-A1 channels placed according to the international 10-20 system), bilateral eye movements by electrooculography, submental muscle and bilateral tibialis anterior muscle activity by electromyography, airflow

with a thermistor and nasal cannula, chest and abdominal respiratory movements with plethysmography, lying position with position sensors, snoring with laryngeal microphone, oxygen saturation (SpO2) with finger oximetry, heart rhythm with one-lead electrocardiography, and video recordings were made with an infrared camera.

PSG recordings were scored according to the 2018 American Academy of Sleep Medicine version 2.5 PSG scoring criteria.[14] PSG recordings were scored in 30-second epochs with Somnologica 3.3.2 software (Flaga Inc). Sleep recordings were examined in 30-second epochs and staged according to the guideline criteria published by the American Academy of Sleep Medicine (AASM). According to AASM criteria, hypopnea was defined as a ≥ 30% decrease in flow from baseline for at least 10 s with associated oxygen desaturation or associated stimulation. Apnea was defined as a ≥90% decrease in airflow for at least 10 seconds. AHI was obtained by dividing the sum of the number of apneas and hypopneas by the sleep duration in hours. Patients with AHI ≥5 were considered to have OSAS and patients with AHI 5-15 were grouped as mild, 16-30 as moderate, and >30 as severe OSAS.[15] Sleep stages were scored as N1, N2, N3, and REM sleep.

In the scoring, those with SB were also identified according to AASM international diagnostic criteria.[16] For bruxism, EMG activity lasting more than 2 seconds recorded with electrodes placed on the masseter muscles at 2 cm intervals during routine PSG was considered bruxism. According to the scoring, the patients were divided into two groups SB (+) and SB (-), and the two groups were compared with each other.

Statistical Analysis

Mean, standard deviation, median, minimum, maximum, frequency, and ratio values were used in the descriptive statistics of the data. The distribution of the variables was measured by the Kolmogorov-Smirnov test. Mann-Whitney u test was used in the analysis of quantitative independent data. The Chi-square test was used in the analysis of qualitative independent data, and the Fischer test was used when chi-square test conditions were not met. SPSS 28.0 program was used in the analyses.

RESULTS

The study included 480 patients. The mean age of the patients was 42.2±10.6 years. Of the patients, 58% were male, and 41.9% were female. According to BMI, 0.6% of the patients were classified as underweight, 20.6% as normal, 40% as overweight, 26.7% as Class I obesity, 9.4% as Class II obesity, and 2.7% as Class III obesity. The mean BMI was 29.0±5.0. According to AHI scores, 3.1% of the patients were classified as normal, 26.5% as mild, 32.9% as moderate, and 37.5% as severe OSAS. In the classification according to headache types, 31.5% of the patients were classified as migraine, 41.9% as tension-type, 2.1% as cluster, and 24.6% as other types of headache. In terms of the presence of hypoxia, 63.3% of the patients were classified as normal, 23.1% as hypoxia-prone, and 13.5% as hypoxia. While 76% of the patients were SB (-), 24% were SB (+) (Table 1).

Table 1: Demographic Data, BMI, AHI, Headache Type, Presence of Hypoxia and Bruxism

		Min-Max	Median	Avg.±SD/n-%	
Age		18.0-59.0	43.0	42.2±10.6	
Gender	Male			279	58.1%
	Female			201	41.9%
BMI		17.1-44.5	28.7	29.0±5.0	
Classification According to BMI	Underweight			3	0.6%
	Normal			99	20.6%
	Overweight			192	40.0%
	Class I Obesity			128	26.7%
	Class II Obesity			45	9.4%
	Class III Obesity			13	2.7%
Minimum Oxygen Saturation					
AHI Index		54.0-99.0	91.0	90.3±6.0	
Classification According to AHI	Normal	1.1-101.1	22.6	15	3.1%
	Mild OSAS			127	26.5%
	Moderate OSAS			158	32.9%
	Severe OSAS			180	37.5%
Headache Type	Migraine			151	31.5%
	Tension Type			201	41.9%
	Cluster			10	2.1%
	Other			118	24.6%
Presence of Hypoxia	Normal			304	63.3%
	Hypoxemia Tendency			111	23.1%
	Hypoxemia			65	13.5%
Bruxism (SB)	No			365	76.0%
	Yes			115	24.0%

Min: Minimum, Max: Maximum, Avg: Average, SD: Standard Deviation, BMI: Body Mass Index, AHI: Apnea Hypopnea Index, OSAS: Obstructive Sleep Apnea Syndrome, SB: Sleep Bruxism

The ages of the patients did not differ significantly between the SB (-) and (+) groups ($p > 0.05$). The proportion of male patients was significantly ($p < 0.05$) higher in the SB (+) group than in the SB (-) group. The mean BMI value was 30.9±5.1 in the SB (+) group, and 28.4±4.9 in the SB (-) group, which was significantly ($p < 0.05$) higher in the SB (+) group. In OSAS staging according to AHI, normal and mild OSAS were significantly higher in the SB (-) group, while severe OSAS was significantly ($p < 0.05$) higher in the SB (+) group compared to the SB (-) group. The rate of tension-type headache was 58.3% in the SB (+) group, and 36.7% in the SB (-) group, and it was significantly ($p<0.05$) higher in the SB (+) group. The migraine rate was 35.3% in the SB (-) group and 19.1% in the SB (+) group and was significantly ($p<0.05$) higher in the SB (-) group. The rate of the tendency to hypoxemia was 31.3%, and the rate of hypoxia was 30.4% in the SB (+) group, while the same rates were 20.5% and 8.2% in the SB (-) group, respectively,

and were significantly ($p < 0.05$) higher in the SB (+) group (Table 2).

Table 2: Comparison of Sleep Bruxism (+) and (-) groups in terms of BMI, AHI, Headache Type, and Hypoxia Presence

		SB (-)			SB (+)			p
		Avg.±SD/n-%		Median	Avg.±SD/n-%		Median	
		41.7 ± 10.7		42.0	43.8 ± 10.3		45.0	0.063
Gender	Male	200	54.8%		79	68.7%		**0.000** m
	Female	165	45.2%		36	31.3%		
		28.4 ± 4.9		28.3	30.9 ± 5.1		30.9	**0.000** m
Classification According to BMI								
Underweight		3	0.8%		0	0.0%		**0.000** m
Normal		83	22.7%		16	13.9%		
Overweight		159	43.6%		33	28.7%		
Class I Obesity		82	22.5%		46	40.0%		
Class II Obesity		31	8.5%		14	12.2%		
Class III Obesity		7	1.9%		6	5.2%		
Minimum SO_2		91.6 ± 4.6		92.0	86.2 ± 7.9		87.0	**0.000** m
AHI Index		24.3 ± 16.8		18.7	43.2 ± 21.7		42.2	**0.000** m
Classification According to AHI								
Normal		15	4.1%		0	0.0%		**0.000** m
Mild OSAS		120	32.9%		7	6.1%		
Moderate OSAS		121	33.2%		37	32.2%		
Severe OSAS		109	29.9%		71	61.7%		
Headache Type								
Migraine		129	35.3%		22	19.1%		**0.000** m
Tension Type		134	36.7%		67	58.3%		
Cluster		9	2.5%		1	0.9%		
Other		93	25.5%		25	21.7%		
Presence of Hypoxia								
Normal		260	71.2%		44	38.3%		**0.000** m
Hypoxemia Tendency		75	20.5%		36	31.3%		
Hypoxemia		30	8.2%		35	30.4%		

m Mann-Whitney u test / X^2 Chi-square test
SB: Sleep Bruxism, Avg: Average, SD: Standard Deviation, BMI: Body Mass Index, AHI: Apnea Hypopnea Index, OSAS: Obstructive Sleep Apnea Syndrome

DISCUSSION

Sleep disorders are common but overlooked health problems in the community. OSAS occurs in 3% of the middle-aged population. The prevalence of sleep apnea headache in this population is 12-18%, while morning headache with symptoms similar to sleep apnea headache occurs in 5-8% of the general population. Headache disorders and sleep disorders have a well-established comorbid relationship.[17,18] Although headaches in obstructive sleep apnea patients may appear to be a non-specific symptom, the types of headaches in obstructive sleep apnea have characteristics of tension-type headache, migraine, or chronic migraine, often reported in the morning. In this study, 41.9% of the patients whose PSG results were compatible with OSAS had TTH, 31.5% had migraine, 2.1% had cluster headaches, and 24.6% had other primary headaches. The physiopathology of morning headaches in obstructive sleep apnea patients is not fully understood. The headache may be the result of recurrent obstructive respiratory events associated with oxygen desaturation and sleep fragmentation. The role of nocturnal hypoxemia is controversial, and a slight association with sleep architecture parameters has been found.[2,19] However, our patients, especially the group of patients with sleep bruxism was more prone to hypoxemia. In the same group, higher AHI increased nocturnal hypoxemia, and SB also contributed to this increase.

According to the International Classification of Sleep Disorders (ICSD-3), SB causes sleep quality deterioration and sleep disturbance.[16] SB is defined as rhythmic or non-rhythmic masticatory muscle activity that occurs in the masticatory muscles during sleep. In addition to sleep disturbances, symptoms such as hypertrophy of the masseter and temporal muscles, tooth wear, tenderness of the jaw muscles, pain on palpation, and morning headache are frequently seen in these patients.[8] Although many studies have demonstrated the relationship between SB and headaches, most of these studies have not classified headaches. De Luca Canto et al. reported that TTH and migraine are also associated with SB.6 However, unlike the literature, while the frequency of TTH was higher in the SB (+) group, migraine was more common in the SB (-) group in our study. Although the pathophysiology of TTH and migraine is complex and multifactorial, previous studies suggest that dysfunctions of masticatory and cervical muscles are associated with an increased prevalence of these disorders.[7]

SB has been frequently associated with sleep-disordered breathing, especially snoring, and obstructive sleep apnea.[10,11,20,21] In our study, the frequency of severe OSAS was significantly higher in the SB (+) group compared to the SB (-) group. In parallel with this, BMI values were statistically higher in the SB (+) group compared to the SB (-) group. We believe that the high incidence of severe OSAS in the SB (+) group may be related to its high incidence in males, and the high number of male patients in this group. In conclusion, sleep-disordered breathing was found to be significantly higher in subjects with morning headaches, and the presence of TTH, obesity, and severe OSAS was found to be higher in those with SB (+) in our study, consistent with the literature. We believe that the relationship between SB, headache, and sleep-disordered breathing may arise due to common risk factors or common pathophysiology without a specific cause-and-effect relationship. However, further studies with a larger number of patients are needed to demonstrate the relationship between these disorders.

Study Limitations

The biggest limitation of our study is that although the number of patients included in the study was high, the number of patients with sleep bruxism was low; and these data stays limited in reflecting the general population. Again, due to the retrospective nature of the study, patients were evaluated only based on medical records and polysomnography data, and it was not sufficient to evaluate the long-term treatment and outcome of all patients. Since the polysomnography examination, for which we obtained

the main data of our study, is expensive and difficult to apply, the study was planned retrospectively. Therefore, more accurate results can be obtained with a prospective study.

There are no conflicts of interest.

Written informed consent was obtained from patients who participated in this study.

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The study was approved by the Clinical Studies Ethical Committe of Sakarya University Training and Research Hospital by the decision no E-71522473-050.01.04-17132-252 and date 05.10.2022

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