Sleep and Breathing
https://doi.org/10.1007/s11325-023-02831-2

SLEEP BREATHING PHYSIOLOGY AND DISORDERS • ORIGINAL ARTICLE

The impact of fibromyalgia syndrome on obstructive sleep apnea syndrome in terms of pain threshold, daytime symptoms, anxiety, depression, disease severity, and sleep quality: a polysomnographic study

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Received: 8 February 2023 / Revised: 30 March 2023 / Accepted: 7 April 2023

Abstract

Background Current studies have focused on the association of fibromyalgia syndrome (FMS) and obsctructive sleep apnea syndrome (OSAS). Results of these studies on the effect of this association have been inconsistent. The current study aimed to investigate the effect of FMS on OSAS regarding sleep quality, pressure pain threshold, fatigue, daytime symptoms, anxiety, and depression, and also to determine the relationship between OSAS severity and FMS.

Methods In a cross-sectional design, patients diagnosed with OSAS were evaluated in two groups comparing those with and those without FMS. Data on demographics, headache, morning fatigue, and chronic pain duration were collected. Questionnaires including the Fatigue Severity Scale (FSS), Fibromyalgia Impact Questionnaire (FIQ), Beck Depression Inventory (BDI), and Beck Anxiety Inventory (BAI) were completed. Pressure pain threshold, tender points, and polysomnographic data were recorded.

Results Of 69 patients, 27 were diagnosed with FMS + OSAS and 42 were diagnosed as OSAS only. Statistically significant differences were found between the two groups in VAS, pain duration, morning fatigue, headache, BAI, tender point count, FIQ and FSS scores, and algometer measurements. All polysomnografic data were compared, and no statistically significant differences were found between the two groups. There were no statistically significant differences in the algometer, BDI, BAI, FIQ, and FSS scores when analyzed according to the severity of OSAS.

Conclusion The findings suggest that FMS has no effect on polysomnographic parameters of OSAS. Headache, daytime fatigue, anxiety, depression, pain duration, and pain intensity are higher while the pressure pain threshold is lower when FMS is present. No correlation was found between OSAS severity and FMS, fatigue, pressure pain threshold, depression, and anxiety.

Clinical Trial Registration Number: NCT05367167/date: April 8, 2022.

Keywords Obstructive sleep apnea syndrome · Fibromyalgia syndrome · Polysomnography · Pain threshold · Fatigue

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Published online: 18 April 2023

Introduction

Obstructive sleep apnea syndrome (OSAS) is a symptomatic disease characterized by recurrent collapse of the upper airways. OSAS affects approximately one billion people worldwide [1]. Although OSAS is more common in men, it is reported that women have the same risk as men after menopause [2]. There are difficulties in the diagnosis of OSAS [2]. It is estimated that most patients with OSAS, especially females, are undiagnosed [2, 3]. The most frequently reported symptom of OSAS is snoring. Daytime symptoms are excessive sleepiness, fatigue, morning headaches, and waking up without feeling rested. OSAS may be associated with nonspecific symptoms such as sleep disturbance, depression, fatigue, and headache in females [3]. A systematic review recently reported that OSAS is associated with affective symptoms such as cognitive impairment, depression, and anxiety [4]. The pain threshold of patient with OSAS decreases secondary to sleep disturbance. A recent review recommended investigating OSAS in patients with chronic pain [5]. In many respects OSAS bears similarities to fibromyalgia syndrome (FMS), one of the common causes of chronic pain [6].

FMS is a disease characterized by chronic widespread pain, fatigue, and sleep disturbance [7, 8]. FMS is associated with comorbidities such as rheumatological diseases, psychiatric diseases, gastrointestinal diseases, cardiovascular diseases, cancer, and peripheral neuropathies [8]. The prevalence of FMS varies between communities and varies according to the diagnostic criteria used. The frequency of FMS is reported to vary between 0.7 and 9.3% [9]. According to the 2010 ACR FMS diagnostic criteria, the prevalence of FMS in the USA was reported to be 6.4% [7, 10]. It has been known that there are difficulties in the diagnosis of FMS, similar to the diagnosis of OSAS [2, 11, 12]. Recent studies have focused on the association between FMS and OSAS [6, 13, 14].

Sleep disturbances are common in patients with FMS. Patients with FMS have shorter sleep duration, objectively lighter sleep, and decreased sleep quality and sleep efficiency [15]. A recent review suggested that there may be a relationship between OSAS and FMS and that patients with FMS should be evaluated for OSAS [6]. A multidisciplinary approach is beneficial in the management of FMS, including rheumatologists, physiatrists, and psychiatrists [16]. Additionally, the results of current studies recommend polysomnographic examination, especially in patients with FMS who have excessive daytime sleepiness [17]. Patients with FMS may benefit from OSAS evaluation and patients with OSAS may benefit from assessment for FMS [14].

In cases when OSAS is accompanied by chronic pain conditions such as FMS, it is important to examine the change in pain threshold [5]. Additionally, the importance of nocturnal hypoxemia and interrupted sleep on the pain threshold should be evaluated [15].

Results of recent studies are contradictory regarding the relationship between OSAS severity and coexistence of FMS [14, 17]. Clarification of this point may contribute to are of patients with OSAS. In particular it may be useful to determine which patients with OSAS should be investigated for fibromyalgia.

Investigators planned this study to investigate the effect of FMS on OSAS regarding sleep quality, pressure pain threshold, anxiety, depression, morning fatigue, daytime fatigue, headache, and chronic pain level. A secondary aim of this study was to determine the relationship between OSAS severity and FMS.

Material and methods

Study design

This cross-sectional study was conducted with patients between the ages of 18 and 60 who were diagnosed with obstructive sleep apnea syndrome between April 8, 2022 and November 28, 2022 in the sleep laboratory of the Chest Diseases Clinic and Physical Medicine and Rehabilitation Clinic.

Participants

Polysomnography was performed in patients who presented to the Sleep Laboratory with suspicion obstructive sleep apnea syndrome (OSAS) (i.e. STOP-Bang questionnaire > 2) [18, 19]. The patients were evaluated by a chest diseases specialist (NZ) who had 15 years of experience in the diagnosis and treatment of OSAS. Patients were diagnosed with OSAS according to the 2014 American Academy of Sleep Medicine diagnostic criteria [20]. Patients diagnosed with OSAS who agreed to participate in the study and did not meet the exclusion criteria were referred to the physical therapy and rehabilitation clinic. Exclusion criteria were pregnancy, morbid obesity (BMI > 40 kg/m2), inflammatory rheumatological diseases, and previous diagnosis of OSAS and therefore using a device for treatment of OSAS. All patients were examined by a physiatrist (BCK) with 9 years of experience in FMS and chronic pain. Patients were diagnosed with FMS according to the 2010 American College of Rheumatology diagnostic criteria [7]. Patients were categorized into an OSAS + FMS group and an OSAS only group.

Sample size calculation

The sample size for the t-test difference between the two groups was calculated using G*Power (V3.1.9.6) based on the main hypothesis of lower algometer values for the FMS + OSAS group compared to the OSAS group. The sample size was calculated as at least 64 individuals for the two groups, with 80% power and 5% margin of error, and an effect size of $d = 0.71$[14].

Outcome measurements

Data on age, gender, body mass index, headache, morning fatigue, and number of comorbid diseases of the patients were recorded.

In this study, the Fatigue Severity Scale was used to evaluate the fatigue levels of the participants. In this scale, 9 questions are asked about fatigue, physical functions, family and social life, and motivation, and participants give points between 1 and 7 for each question. High scores indicate an increased level of fatigue. Cultural adaptation, validity, and reliability of the scale were accomplished [21, 22].

Anxiety level was evaluated using the Beck Anxiety Inventory (BAI), a questionnaire containing 21 questions. High scores indicate an increased level of anxiety [23]. Beck Depression Inventory (BDI) was used to assess depression, failure, guilt, pessimism, self-criticism, suicidal ideation, feelings of worthlessness, loss of energy, sleep disturbances, and concentration problems [24]. Cultural adaptation, validity, and reliability of these two scales were previously accomplished.

The Fibromyalgia Impact Questionnaire (FIQ) was used to assess pain, functionality, mood, and physical impact associated with FMS. High FIQ scores report adverse health status due to FMS [25]. The cultural adaptation, validity, and reliability of the FIQ were previously studied [26]. In addition, all patient numbers of tender points were determined by physical examination. The tender point numbers of the patients were recorded according to The American College of Rheumatology 1990 FMS diagnostic criteria [27]. Accordingly, occiput, lower cervical region, trapezius, supraspinatus, second rib, lateral epicondyle, gluteal region, greater trochanter, and medial knee were palpated in physical examination. A force of approximately 4 kg was applied during digital palpation. The points that the patient said were painful on palpation were recorded.

The Visual Analog Scale (VAS) was used to assess the intensity of diffuse body pain. VAS consists of a 10-point Likert scale. The patient is asked to give a score between 0 and 10 for pain, with 0 points being "no pain" and 10 points being "unbearable pain." High scores report increased pain intensity [28].

Pressure-pain threshold measurement was made with an algometer device (Baseline © Dolorimeter 66 lb/30 kg, NY, USA). The measurements were made by a physiatrist (BCK) with an algometer device from the right trapezius region, while the participants were in a sitting position. In the presence of an active trigger point that may cause a difference in the algometric measurement in the right trapezius region, the left trapezius muscle was used. Pressure was applied to the upper trapezius area of the patient with an algometer. When the feeling of pressure turned into a feeling of pain, the numerical value on the algometer was recorded.The measurement was made three times from the same area. In the analysis of the data, the average of the three measurements was used as the algorithmic measurement result.

In the sleep laboratory, polysomnographic measurements were made with the Alice 6 device (Philips Respironics, Murrysville, PA, USA). The minimum acceptable time for polysomnographic measurements was 4 h. Total sleep time (min), sleep latency (min), sleep efficiency (%), REM (min), number of apneas, number of hypopneas, apnea hypopnea index (AHI), rem AHI, supine AHI, non-supine AHI, oxygen desaturation index, and mean saturation oxygen values were recorded. Rem AHI values were used to identify patients with REM-dependent OSAS.

According to the AHI, patients were graded as mild (5 to 14.9), moderate (15 to 29.9), and severe (30 or more severe).

Ethical approval

Ethical approval was obtained from the university ethics committee before starting the study (approval number: KAEK 2022–07/69). Additionally, this study was registered at Clinicaltrials.gov after ethical approval, before enrolling the first patient in the study (number: NCT05367167 date: April 8, 2022). The study was organized in accordance with the Helsinki declaration, and informed voluntary consent was obtained from all participants before starting the study.

Statistical analysis

The IBM SPSS 27.0 Windows package program was used to analyze the obtained data statistically. Whether the variables showed a normal distribution was analyzed with the Kolmogorov–Smirnov test. An independent sample t-test was performed between the two group comparisons when the variables were normally distributed. Mann–Whitney U and Kruskal–wallis tests were used when parametric data were not normally distributed and nonparametric data were compared. Comparisons of categorical data were made with the chi-square test. $P < 0.05$ was considered significant for all tests.

Results

Of 69 patients included in the study, 27 were diagnosed with FMS + OSAS and 42 of them were OSAS only. Of the patients, 31 (45%) were female and 38 (55%) were male. Of the FMS + OSAS group 63% were female while 33% of the OSAS only group were female. The mean age of the patients included in the study was 57.1 ± 7.6 and mean BMI was 32.2 ± 4.7. There was no significant difference between the two groups in terms of age, BMI, and number of comorbid diseases. When symptoms of the patients were compared, a statistically significant difference was found between the two groups in VAS scores, chronic pain duration, morning fatigue, headache, BAI scores, tender point count FIQ and FSS scores, and algometer measurements (Table 1). The values of 17 female patients in the FMS + OSAS group and 14 female patients in the OSAS group were compared as a subgroup. VAS scores ($p < 0.001$), BDI values ($p = 0.047$), BAI values ($p < 0.001$), FIQ scores ($p < 0.001$), and FSS scores ($p < 0.001$) were higher in the FMS + OSAS group. Algometer scores ($p < 0.001$) were lower in the FMS + OSAS group. In polysomnographic parameters, no differences were found between these two groups.

Additionally, no statistical differences were found between the severity of OSAS, REM-dependent OSAS, and supine OSAS, in which OSAS diagnoses were compared between the two groups (Table 1).

Polysomnographic data of the FMS + OSAS group and OSAS group were compared. There were no statistically significant differences between the two groups in terms of total sleep time, sleep latency, sleep efficiency, REM, number of apneas and hypopneas, AHI, REM AHI, supine AHI,

Table 1 Comparison of FMS + OSAS group and OSAS group data

	FMS + OSAS ($n = 27$)	OSAS ($n = 42$)	p value
Gender			0.016*
Female	17 (63)	14 (33)	
Male	10 (37)	28 (74)	
Age	55.4 ± 6.6	58.2 ± 8.1	0.287
BMI (kg/m^2)	31.8 ± 5.0	32.6 ± 4.5	0.299
Tender point count	9.1 ± 2.1	3.0 ± 3.8	< 0.001*
VAS score	6.2 ± 1.4	1.8 ± 1.6	< 0.001*
Algometer (Newton)	31.2 ± 12.6	62.9 ± 29.0	< 0.001*
BDI score	16.5 ± 6.8	11.7 ± 7.8	0.014*
BAI score	18.3 ± 8.6	7.3 ± 6.7	< 0.001*
FIQ score	54.6 ± 14.9	23.6 ± 15.3	< 0.001*
FSS score	47.2 ± 12.4	24.0 ± 21.6	< 0.001*
Chronic pain duration (year)	5.2 ± 4.7	2.7 ± 4.3	< 0.001*
Comorbid disease (number)	1.2 ± 1.1	1.6 ± 1.3	0.318
Morning fatigue *n* (%)			< 0.001*
Yes	27 (100)	29 (69)	
No	-	13 (31)	
Headache *n* (%)			0.002*
Yes	241 (78)	17 (41)	
No	6 (22)	25 (60)	
Severity of OSAS *n* (%)			0.586
Mild	4 (15)	5 (12)	
Moderate	11 (41)	13 (31)	
Severe	12 (44)	24 (57)	
REM-dependent OSAS *n* (%)			0.128
Yes	23 (85)	29 (69)	
No	4 (15)	13 (31)	
Supine OSAS *n* (%)			0.278
Yes	22 (83)	38 (90)	
No	5 (19)	4 (10)	

BMI, body mass index; *VAS*, Visual Analog Scale; *BDI*, Beck Depression Inventory; *BAS*, Beck Anxiety Inventory; *FSS*, Fatigue Severity Scale; *FIQ*, Fibramiyalgia Impact Questionnaire. *$p < 0.05$

non-supine AHI, oxygen desaturation index, and the mean saturation oxygen values (Table 2).

The patients were divided according to the severity of OSAS as mild, moderate, and severe. There were no statistically significant differences between the algometer, BDI, BAI, FIQ, and FSS scores and the severity of OSAS when analyzed according to the three groups of severity of OSAS (Table 3).

Discussion

The results of this study suggest that FMS accompanying OSAS does not cause a difference in polysomnographic data. Koseoglu et al. previously reported that fibromyalgia accompanying OSAS had no effect on polysomnographic parameters. Our findings support the results of the Koseoglu study [14]. We found that headache, daytime fatigue, and morning fatigue were more common when OSAS was accompanied by FMS. Additionally, patients with FMS accompanied by OSAS had a lower pressure pain threshold and higher pain intensity.

Table 2 Comparison of polysomnographic data of FMS + OSAS group and OSAS group

	FMS + OSAS	OSAS	*p* value
Total record time (h)	7.2 ± 0.8	7.2 ± 0.7	0.839
Total sleep time (min)	380.8 ± 65.3	348.7 ± 67.5	0.090
Sleep latency (min)	24.4 ± 31.8	42.6 ± 46.1	0.063
Sleep efficiency (%)	79.5 ± 10.0	72.6 ± 19.4	0.233
REM (min)	32.3 ± 27.2	49.4 ± 85.9	0.499
Number of apneas	49.2 ± 44.1	63.1 ± 59.2	0.956
Number of hypopneas	118.4 ± 79.3	122.5 ± 95.2	0.606
AHI	30.8 ± 17.1	36.4 ± 19.8	0.290
Rem AHI	18.3 ± 23.7	27.8 ± 25.3	0.216
Supine AHI	45.8 ± 28.1	35.4 ± 28.0	0.112
Non-supine AHI	18.8 ± 16.0	18.8 ± 25.5	0.484
Oxygen desaturation index	24.1 ± 19.4	34.3 ± 33.4	0.605
Mean saturation oxygen	93.2 ± 2.4	91.5 ± 6.0	0.389

AHI, apnea hypopnea index

These patients had more tender points and a longer duration of chronic pain. Terzi et al. reported that the pressure pain threshold was significantly lower in patients with OSAS compared to a healthy control group. When OSAS was accompanied by FMS, there was a significant decrease in pressure pain threshold compared to the group with only OSAS [29]. The results of current study support these findings also.

It has been reported that intermittent hypoxia causes an increase in pain sensitivity by affecting the pain transmission process and pain transmission in patients with OSAS [30]. According to the results of this study, no relationship was found between OSAS severity and pressure pain threshold. Similar to this study, pressure pain threshold in patients with OSAS was evaluated in another study using an algometer. A decrease in mean nighttime oxygen saturation (SaO2) was associated with a decrease in the pressure pain threshold [29]. The results of a clinical trial showed that a decrease in pressure pain threshold measurements with an algometer was associated with an increase in sleep latency. Researchers interpreted these findings to indicate that patients had difficulty falling asleep as the pain threshold decreased [14]. According to the current study, fibromyalgia accompanying OSAS did not cause a difference in polysomnographic parameters, including sleep latency. On the other hand, although there was no difference in polysomnographic data, pain-related parameters and fatigue were more common when FMS accompanied OSAS. A prior study reported that the association of OSAS and FMS is frequent, especially in elderly patients [13]. However, in the current study, no significant relationship was found between age and the presence of FMS in patients with OSAS. In addition, female gender was significantly higher in the group with FMS. In clinical practice, it may be useful to evaluate for FMS, regardless of the severity of OSAS, particularly in female patients with OSAS and in any patients with severe pain and fatigue.

There may be a two-way relationship between OSAS and affective disorders such as anxiety and depression [31]. Likewise, it is known that anxiety and depression are more common in patients with FMS [32]. Current studies have continued to explore the effect of anxiety and depression on chronic pain [33]. A prior study reported that there is no significant difference in Beck depression scores in patients with OSAS

Table 3 Comparison of groups according to severity of OSAS

Severity of OSAS	Mild (*n* = 9)	Moderate (*n* = 24)	Severe (*n* = 36)	*p* value
Algometer (Newton)	59.1 ± 26.6	51.7 ± 30.9	47.5 ± 27.5	0.180
BDI	9.2 ± 6.9	13.0 ± 8.8	15.1 ± 6.9	0.137
BAI	7.9 ± 7.3	11.3 ± 8.1	12.7 ± 10.2	0.376
FSS	24.6 ± 17.5	34.7 ± 22.3	34.0 ± 22.2	0.247
FIQ	290 ± 19.6	39.0 ± 21.6	35.2 ± 20.7	0.430

BDI, Beck Depression Inventory; *BAI*, Beck Anxiety Inventory; *FSS*, Fatigue Severity Scale; *FIQ*, Fibramiyalgia Impact Questionnaire

compared to healthy adults, and that FMS accompanying OSAS has no effect on depression scores [29]. According to the findings of study, anxiety and depression levels of the patients were significantly higher when OSAS was accompanied by FMS.

Reported that there is no relationship between OSAS severity and FMS [14]. According to the results of the current study, no relationships were found between OSAS severity and fatigue, fibromyalgia severity, pressure pain threshold, depression, and anxiety. This suggests that there is no relationship between OSAS severity and patients' pain threshold, affect, and fatigue in clinical practice. However, it has been reported that there is a correlation between the AHI score and the severity of FMS [17] showing that there is no consensus on the relationship between OSAS severity and FMS Clinical studies with larger sample sizes are needed.

Limitations

A significant limitation of the study design was that it was performed in a single center with a relatively small sample size. While interpreting the data of the study, it should be kept in mind that the sample includes both male and female genders. Additionally, the cross-sectional design precludes conclusions regarding causality. Also, psychiatric diseases that may affect fatigue and depression levels were not questioned and excluded in the study. The results of our study may be useful for clinicians dealing with OSAS and FMS in their approach to these diseases, which are intertwined due to similarity of symptoms. The results of this study may lay the groundwork for other prospective interventional studies on the coexistence of OSAS and FMS.

Conclusion

FMS has no impact on polysomnographic parameters of OSAS. However, especially when FMS accompanies OSAS, headache, morning fatigue, daytime fatigue, anxiety, depression, chronic pain duration, and pain intensity are higher and pressure pain threshold is lower. No correlation was found between OSAS severity and FMS, fatigue, pressure pain threshold, depression, and anxiety. The results of this study suggest that OSAS patients with chronic pain, fatigue, and high anxiety and depression levels should also be evaluated for FMS, regardless of the severity of OSAS.

Acknowledgements The authors would like to thank all participants.

Author contribution Research concept and design: BCK, FT; collection and assembly of data: NZ, BCK; data analysis and interpretation; TS: writing the article;:BCK, TS: critical revision of the article: NZ, FT; final approval of the article: BCK.

Data availability The data of this study are available from the corresponding author upon request.

Declarations

Ethical approval Ethical approval was obtained from the university ethics committee (approval number: KAEK 2022–07/69). This study was registered at Clinicaltrials.gov (Clinical Trial Registration Number: NCT05367167/date: April 8, 2022). The study was organized in accordance with the 1964 Helsinki declaration, and informed voluntary consent was obtained from all participants before starting the study.

Conflict of interest The authors declare no competing interests.

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