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The effect of CPAP treatment on pulmonary function, anxiety/depression and life quality in obstructive sleep apnea syndrome

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ABSTRACT

Aims: Obstructive sleep apnea syndrome (OSAS) is a condition commonly associated with excessive daytime sleepiness and neurophysiological dysfunction and increases cardiovascular and cerebrovascular morbidity and mortality. Exercise limitation was assessed with a 6 min walk test (6MWT) in previous studies and was associated with apnea hypopnea index (AHI), body-mass index (BMI), female gender, hypertension (HT), and low FVC values. There are few studies on the effect of CPAP treatment on these parameters. In our study; the aim of this study was to evaluate the changes in pulmonary function test (PFT), 6MWT, quality of life (SF-36) and hospital anxiety / depression scale with patients who should use CPAP because of OSAS.

Methods: Patients who presented to the Sleep Clinic of the Department of Pulmonology at Hacettepe University Faculty of Medicine between 17 October 2018 and 20 December 2018 were enrolled in the study. Individuals with a diagnosis of sleep apnea who met the indication criteria for positive airway pressure (PAP) therapy underwent titration under polysomnographic supervision, and an appropriate PAP device with optimal pressure settings was prescribed. Demographic characteristics, medical history, anthropometric measurements, and polysomnography (PSG) recordings were collected for all participants. Additionally, the Short Form-36 (SF-36) questionnaire, the Hospital Anxiety and Depression Scale (HADS), the 6MWT, and baseline morning spirometry were administered. After obtaining their PAP devices and using them for one month, patients were scheduled for routine follow-up, during which spirometry, the SF-36 questionnaire, HADS, and the 6MWT were reassessed.

Results: 18 patients were included in the study. These patients; 17% were female and 83% were male and the mean age was 46.9±9. The anxiety and depression scores were significantly decreased after one month of CPAP treatment. Before CPAP treatment; anxiety was found in 4 patients and depression was found in 8 patients. One month CPAP treatment; anxiety was present 2 patients and no depression was detected in any patient. In the evaluation of exercise capacity; there was a significant increase in walking distance after CPAP treatment (548.83±60.6, 579.33±54) (p: 0,007). CPAP treatment was significantly improved in subscales of quality of life in general health, physical function, vitality (energy), social function and mental health sub parameters. There was no significant change in spirometric measurements before and after CPAP treatment and titration. There was no significant change in spirometric measurements before and after CPAP treatment and titration. In the correlation analysis, a significant relationship was found between the change in 6MWT and the change in physical function, energy, mental health and anxiety score. At the same time, a significant correlation was found between anxiety and depression improvement and quality of life subscales.

Conclusion: The study demonstrated that even short-term PAP therapy may lead to improvements in several quality-of-life subdomains, anxiety and depression scores, and exercise capacity. Considering the findings of this study, multicenter investigations involving a larger cohort of patients with OSAS, comparing CPAP therapy with alternative treatment modalities and enabling more advanced analyses, would provide a more comprehensive understanding of CPAP-related changes in pulmonary function, quality of life, anxiety and depression, and exercise capacity.

Keywords: Sleep apnea, obstructive, exercise test, quality of life, pulmonary function tests, anxiety, depression, continuous positive airway pressure

INTRODUCTION

Obstructive sleep apnea syndrome (OSAS) is characterized by recurrent episodes of upper airway obstruction during sleep, often accompanied by a reduction in arterial oxygen saturation.[1] The major symptoms include excessive daytime sleepiness, witnessed apnea, and loud snoring.[2] Repeated apneic events result in hypoxemia and/or hypercapnia, which, through peripheral and central chemoreceptor mechanisms, lead to increased sympathetic activation, excessive daytime somnolence, cognitive dysfunction, predisposition to depression, and constitute a risk factor for several comorbidities, particularly cardiovascular diseases. The gold-standard treatment modality for OSAS is positive airway pressure (PAP) therapy.[3]

Patients with OSAS frequently experience reductions in daily activity levels due to excessive sleepiness, fatigue, and often increased body weight. Nocturnal hypoxemia impairs skeletal muscle oxidative metabolism, resulting in reduced exercise capacity compared to healthy individuals. Studies have shown that exercise limitation is independent of body composition and is primarily associated with the severity of sleep disturbance.[4] In the literature, exercise limitation has been demonstrated using cardiopulmonary exercise testing (CPET), and regular PAP therapy has been shown to lead to significant improvement in exercise performance.[5]

In this study, we aimed to evaluate the effects of PAP therapy on functional capacity, exercise capacity, and emotional status in patients diagnosed with OSAS. Functional capacity was assessed using the pulmonary function test (PFT), exercise capacity with the six-minute walk test (6MWT), and emotional state using the Hospital Anxiety and Depression Scale (HADS) and the Short Form-36 (SF-36) quality of life questionnaire. Although similar studies exist in the literature, no previous research has evaluated these three parameters simultaneously.

METHODS

Ethics

Ethical approval for this study was obtained from the Hacettepe University Clinical Researches Ethics Committee (Date: 17.10.2018, Decision No: 2018118-21 (KA-I80107)) and the Turkish Medicines and Medical Devices Agency. All procedures performed in this study were conducted in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Declaration of Helsinki and its later amendments. Written informed consent was obtained from all participants prior to enrollment.

This prospective observational study was conducted at the Department of Pulmonary Medicine, Hacettepe University Faculty of Medicine, Sleep Disorders Outpatient Clinic, between October 17 and December 20, 2018.

Study Population

A total of 52 patients who underwent polysomnography (PSG) and were diagnosed with OSAS requiring PAP therapy, based on the 2012 American Academy of Sleep Medicine (AASM) scoring criteria, were initially enrolled. The Apnea–Hypopnea Index (AHI), expressed as the number of apnea and hypopnea events per hour, was used to determine OSAS severity:

- Mild OSAS: AHI 5–15/hour
- Moderate OSAS: AHI 15–30/hour
- Severe OSAS: AHI>30/hour

The indication for PAP therapy was determined by a multidisciplinary sleep council comprising specialists in neurology, otorhinolaryngology, pulmonary medicine, and dentistry. Eligible patients underwent overnight PSG with titration to determine the optimal therapeutic pressure.

Before hospitalization, patients' demographic characteristics, medical histories, height, weight, and PSG data were recorded. Baseline assessments included the SF-36 quality of life questionnaire, HADS, 6MWT, and PFT. During titration nights, PSG recordings were performed under technician supervision using a 55-channel system (Alice 6). Pressure titration was adjusted according to apneic and hypopneic events, and optimal PAP pressure was determined based on AASM 2012 scoring rules.

Patients were prescribed PAP devices at the determined pressure and instructed to use them for one month. At follow-up, PFT, HADS, SF-36, and 6MWT were repeated. Device data were downloaded to assess average nightly usage duration, mask leakage, and residual AHI.

Inclusion Criteria

- Age ≥18 years
- Diagnosis of OSAS confirmed by PSG with PAP therapy indication
- Absence of known chronic pulmonary disease (COPD, asthma, bronchiectasis, lung cancer, etc.)
- Voluntary participation with informed consent

Exclusion Criteria

- Pregnancy
- Obesity hypoventilation syndrome
- Psychiatric disorders
- Contraindications to PFT or 6MWT, including:
- Unstable angina
- Myocardial infarction within the previous month
- Active endocarditis, myocarditis, or pericarditis
- Uncontrolled arrhythmia with hemodynamic compromise
- Syncope history
- Severe symptomatic aortic stenosis
- Uncontrolled heart failure
- Acute pulmonary embolism or infarction
- Lower extremity thrombus
- Suspected aortic dissection
- Pulmonary edema
- Uncontrolled asthma
- Resting oxygen saturation ≤85% on room air
- Acute respiratory failure
- Acute non-cardiopulmonary illness affecting exercise performance (e.g., infection, renal failure, thyrotoxicosis)
- Mental impairment preventing cooperation

Pulmonary Function Test (PFT)

After recording patients' height, weight, and age, they were allowed to rest for 15 minutes before testing. Spirometry was performed using a portable device (Medwelt SP10). Parameters measured included forced vital capacity (FVC), forced expiratory volume in one second (FEV_1), peak expiratory flow (PEF), and mid-expiratory flow rate (FEF25–75%). All values were expressed as percentages of predicted values based on patient demographics. Pulmonary function testing was performed in accordance with the American

Thoracic Society/European Respiratory Society (ATS/ERS) criteria.

Six-Minute Walk Test (6MWT)

Before the test, patients rested for 15 minutes. Baseline blood pressure, heart rate, oxygen saturation, and dyspnea score were recorded. The test was conducted in a 30-meter corridor under supervision, during which patients were instructed to walk at the fastest pace possible for six minutes. Fatigue, dyspnea, and oxygen saturation were continuously monitored. The test was terminated early if severe dyspnea, dizziness, pallor, or a marked drop in oxygen saturation occurred. After six minutes, vital signs and perceived dyspnea were reassessed, and total distance walked was recorded and adjusted for age, sex, height, and body weight. 6MWT was performed in accordance with the ATS/ERS criteria.

Quality of Life Assessment (SF-36)

The SF-36 questionnaire, consisting of 36 items, evaluates eight health-related quality-of-life domains: physical functioning (10 items), role limitations due to physical problems (4 items), role limitations due to emotional problems (3 items), social functioning (2 items), mental health (5 items), vitality (4 items), bodily pain (2 items), and general health perceptions (5 items). Each domain is scored from 0 (worst) to 100 (best). Based on the established normative data and discriminative characteristics of the SF-36 in the Turkish population, the questionnaire was administered to patients diagnosed with sleep apnea before and after one month of CPAP treatment use.[6] The test was administered face-to-face by directing the questions to the patient, and the responses provided were recorded.

Hospital Anxiety and Depression Scale (HADS)

HADS is a 14-item self-report instrument used to evaluate the risk and severity of anxiety and depression. Odd-numbered items assess anxiety, and even-numbered items assess depression. Scores ≥10 on the anxiety subscale and ≥7 on the depression subscale indicate a high risk for each condition. The Turkish validity and reliability study of the HADS was used as a reference, and the scale was administered to patients diagnosed with sleep apnea both before PAP therapy and after the first month of treatment.[7] The test was administered face-to-face by directing the questions to the patient, and the responses provided were recorded.

Statistical Analysis

All data analyses were performed using IBM SPSS Statistics for Windows, Version 22.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean±standard deviation (SD) for normally distributed data, or as median [minimum–maximum] and 25^{th}–75^{th} percentiles for non-normally distributed data. Categorical variables were presented as numbers and percentages. Normality was tested with the one-sample Kolmogorov–Smirnov test. Paired-sample t-tests were used for normally distributed paired data; the Wilcoxon signed-rank test for non-normally distributed data; and McNemar's test for categorical paired comparisons (e.g., anxiety presence before vs. after therapy). Correlations between variables were assessed using Pearson's correlation coefficient. p-value of <0.05 was considered statistically significant.

RESULTS

This study was conducted at the Department of Pulmonary Medicine, Hacettepe University Faculty of Medicine, between October 17 and December 20, 2018. During this period, 52 patients diagnosed with moderate or severe OSAS who required PAP therapy underwent overnight PSG with titration in the sleep laboratory. However, after applying the exclusion criteria, the study was completed with 18 eligible volunteer patients (**Figure**).

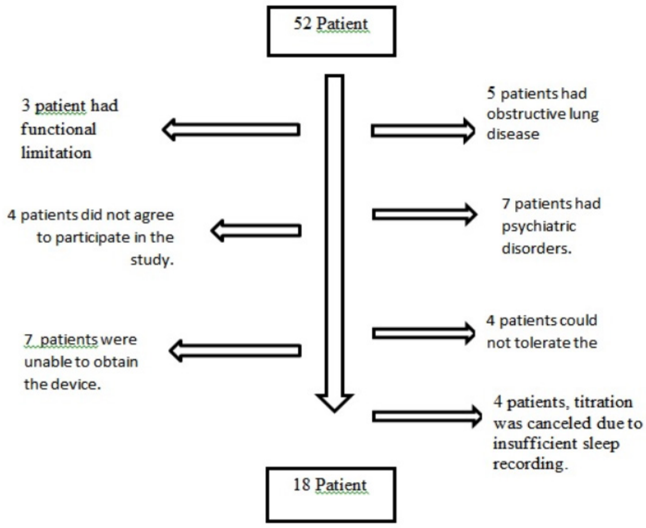

Figure. The patient selection and exclusion process in the study has been illustrated schematically

Patient Characteristics

The demographic and clinical characteristics of the study group are summarized in **Table 1**. The mean age was 46.9±9.0 years, and 83.3% (n=15) of participants were male. Six patients (33.3%) were current smokers, 5 (27.8%) were former smokers, and 7 (38.9%) had never smoked. The median smoking history was 15 pack-years (range: 5-60).

Table 1. Demographic and clinical characteristics of the study population

Sex (n=18)	**n (%)**
Female	3(16.7)
Male	15(83.3)
Age±SD (years)	46.94±9.03
Smoking status (n=18)	
Current smoker	6 (33.3)
Former smoker	5 (27.8)
Never smoked	7 (38.9)
Smoking (pack-years)	15 (5-60)*
Comorbid diseases	
Hypertension	5 (27.8)
Diabetes mellitus	3 (16.7)
Venous thromboembolism	1 (5.6)
Pulmonary hypertension	1 (5.6)
Epilepsy	2 (11.1)
None	3 (16.7)

SD: Standard deviation. Median, minimum, and maximum values are provided

Comorbidities included hypertension (HT) in 5 patients (27.8%), diabetes mellitus in 3 (16.7%), venous thromboembolism in 1 (5.6%), pulmonary HT in 1 (5.6%), and epilepsy in 2 (11.1%). Three patients (16.7%) had no comorbid disease.

Baseline body composition parameters are presented in **Table 2**. The mean body-mass index (BMI) was 31.2±4.1 kg/m^2, indicating that half of the participants were overweight and half were obese. The mean neck circumference was 41.5±2.9 cm, and mean abdominal circumference was 111.2±8.8 cm.

Table 2. Baseline anthropometric measurements of the study population

Body measurements (n=18)	Mean±SD	Median (25-75 per)
Weight (kg)	93.28±12.8	94.5 (80-99.5)
Height (cm)	173.11±9.5	173.5 (167-178.5)
BMI (kg/m^2)	31.16±4.1	30.41 (27.64-34.80)
Neck circumference (cm)	41.5±2.9	41.5 (40-43)
Abdominal circumference (cm)	111.22±8.8	110.5 (105.2-116

BMI: Body-mass index, Per: Percentile, SD: Standard deviation

Polysomnographic and Titration Findings

Polysomnographic parameters and titration results are shown in **Table 3**. Among the patients, 11% (n=2) were classified as having moderate OSAS and 89% (n=16) as severe OSAS.

The mean AHI during diagnostic PSG was 55.3±21.5 events/hour, which decreased to 6.98±6.5 events/hour during PAP titration (p<0.001). Minimum and mean oxygen saturations increased significantly after titration (p<0.001 for both). The duration of sleep spent with oxygen saturation below 90% decreased significantly after titration (p<0.001).

The lowest heart rate significantly increased during titration (p<0.001), while the highest heart rate significantly decreased (p=0.001). Total sleep time and sleep stage percentages did not differ significantly between the diagnostic and titration PSG recordings.

At the one-month follow-up after initiation of PAP therapy, device-derived data were examined. Thirteen patients had devices with data-recording capability. The mean AHI among these patients was 2.3 events/hour. One patient exhibited a mean AHI of 15.3 events/hour, necessitating an increase of 2 cmH$_2$O in the device pressure. It was also noted that 50% of the patients (n=9) demonstrated PAP adherence exceeding 80%.

Quality of Life Assessment

Comparison of pre- and post-PAP therapy SF-36 subscale scores is shown in **Table 4**. Significant improvements were observed in physical functioning (p=0.009), general health (p=0.005), vitality (p=0.003), social functioning (p=0.007), and mental health (p=0.007) domains after one month of PAP therapy. No statistically significant changes were detected in role limitations due to physical problems, bodily pain, or role limitations due to emotional problems. Subgroup analysis of patients with ≥80% PAP adherence (n=9, 50%) revealed no significant differences in SF-36 subscale scores compared with the overall cohort.

Table 4. Comparison of SF-36 quality-of-life subscales before and after PAP therapy

SF-36 subscales	Pre-PAP	Post-PAP	p value
Physical functioning	80.28±14.29	89.72±11.04	0.009
Role limitations due to physical health	69.44±41.62	81.94±30.68	0.156
Pain	79.17±19.93	86.94±17.81	0.084
General health	56.67±26.12	67.5±23.21	0.005
Vitality (energy)	49.72±29.33	69.44±20.71	0.003
Social functioning	75±26.08	93.05±14.36	0.007
Role limitations due to emotional problems	70.37±35.96	79.63±28.33	0.298
Mental health	69.33±26.53	82.89±12.63	0.007

SF-36: Short Form Quality of Life, PAP: Positive airway pressure

Anxiety and Depression

According to the HADS assessment, the mean anxiety score decreased significantly from 8.33±5.6 before PAP therapy to 4.44±3.7 after one month (p=0.003).

Table 3. Comparison of polysomnographic and PAP titration parameters

Polysomnography characteristics			Polisomnography+titration		p value
	Mean±SD	Median (25-75 per.)	Mean±SD	Median (25-75 per.)	
Apnea–Hypopnea Index	55.29±21.5	52.55 (42.77-65.9	6.98±6.5	5.5 (1.45-11.1)	<0.001
Total sleep time (min)	358.96±35.3	357.15 (331.7-392.97)	324.47±96	331.7 (260.7-408.8)	0.186
Sleep efficiency (%)	85.23±8.8	87.35 (78.95-91.82)	69.63±16.7	73.4 (59-81.3)	0.002
Lowest oxygen saturation (%)	76.05±10.2	80 (72.75-82.5)	87.38±5.1	88.5 (85.5-91)	<0.001
Mean oxygen saturation (%)	92.9±1.6	93.15 (91.55-94.1)	94.55±1.6	94.5 (93-95.2)	<0.001
REM(%)	13.8±5.1	15.46 (8.95-17.97)	15.16±7.8	15.96 (9.62-21.62)	0.621
Stage 1 sleep (%)	8.92±4.6	9.44 (5.1-11.78)	7.53±6.5	4.55 (1.92-13.03)	0.533
Stage 2 sleep (%)	61.04±12.2	57.34 (52.72-62.69)	65.84±12.1	65.88 (60.18-69.59)	0.291
Stage 3 sleep (%)	16.23±8.8	18.65 (9.31-23.04)	11.16±8.8	8.84 (5.46-17.68)	0.058
Sleep latency (min)	4.73±8.1	2.03 (1.45-5)	16.85±15.6	9.96 (5.11-26.67)	0.011
Time spent with SpO$_2$ <% 90 (%)	21.91±17.6	17.34 (3.72-36.53)	1.06±2.3	0.14 (0.02-0.86)	<0.001
Mean heart rate (beats/min)	68.41±6.6	66.05 (65.1-72.85)	67.63±8.4	66.5 (61-73)	0.481
Lowest heart rate (beats/min)	40.33±14.2	40.2 (25.45-53.5)	55.55±7.2	54 (49-59.2)	<0.001
Highest heart rate (beats/min)	118.46±26.7	112.5 (91.5-148)	90.94±12.3	86.5 (82-100.7)	0.001

PAP: Positive airway pressure, SD: Standart deviation, Per: Percentile, Min: Minute (Paired-Sample T test and non parametric Wilcoxon's signed-rank test)

Similarly, the mean depression score decreased from 6.11±3.9 to 2.89±3.0 (p=0.001). Before treatment, 44% of patients (n=8) met the HADS criteria for depression, whereas no patients were classified as depressed after PAP therapy.

Pulmonary Function and Exercise Capacity

Pre-and post-treatment pulmonary function and exercise parameters are presented in **Table 5**. A significant increase in six-minute walk distance (6MWD) was observed following PAP therapy (548.8±60.6 m vs. 579.3±54 m, p=0.007).

Table 5. Pulmonary function and exercise performance before and after PAP therapy

	Pre-PAP	Post-PAP	p value
6MWT (meter)	548.83±60.6	579.33±54	0.007
FVC (%)	101.05±20.1	93.69±28.3	0.131
FEV1 (%)	98.05±18.1	95.33±17	0.074
FEV1/FVC	79.76±6.3	79.96±5.5	0.771
PEF (%)	98.55±17.6	100±19.7	0.659
FEF25/75 (%)	87.33±25.6	85.05±24.6	0.433

6MWT: 6 minute walk test, PAP: Positive airway pressure, FVC: Forced vital capacity, FEV1: Forced expiratory volume in one second, PEF: Peak expiratory flow, orced expiratory flow between 25% and 75% of forced vital capacity

No significant changes were found in spirometric parameters (FVC, FEV_1, FEV_1/FVC, PEF, or FEF25–75).

Correlation Analysis

Correlation analysis demonstrated significant relationships between:

- Age and post-treatment changes in physical functioning, physical role limitation, general health, vitality, mental health, and anxiety scores (p<0.05);
- BMI and post-treatment changes in physical functioning (p<0.05);
- Change in 6MWD and improvements in physical functioning, vitality, mental health, and anxiety (p<0.05);
- PAP usage percentage and changes in pain and anxiety scores (p<0.05);
- AHI during diagnostic PSG and post-treatment emotional role limitation scores (p<0.05);
- Duration of oxygen saturation >90% during PSG and corresponding emotional role limitation improvement (p<0.05).

DISCUSSION

In our study, it was found that in patients with moderate to severe OSAS who required PAP therapy, a one-month period of PAP treatment significantly improved exercise capacity according to the 6MWT results, without notable changes in body composition parameters. PAP therapy also led to improvements in anxiety, depression, and several subscales of quality of life, and these improvements were shown to be interrelated. No significant changes were observed in spirometric measurements after PAP treatment.

Several risk factors have been associated with obstructive sleep apnea, including male sex, increased body weight, tobacco use, and advanced age.[8] OSAS is known to occur more frequently in men than in women. The Turkish Adult Population Epidemiology of Sleep (TAPES) study conducted in 2012 similarly demonstrated a higher prevalence of OSAS among men.[9] In that study, the mean age of 5.021 participants was 40.7±15.1 years. In our study, the male-to-female ratio was 5:1, and the mean age was 46.9±9 years, which is consistent with findings reported in the literature.

Obesity is another major risk factor for OSAS and is defined as a significant contributor to the development of respiratory disorders such as snoring and sleep apnea.[10] Young et al.[11] reported that 58% of OSAS cases were associated with a BMI≥25 kg/m². In a 2019 study, Kandasamy et al.[8] investigated the efficacy of CPAP therapy in 175 OSAS patients and found that 29.7% were overweight and 59.4% were obese, supporting previous research showing that OSAS prevalence is approximately four times higher in obese individuals. In Turkiye, the TAPES study showed that among 5.021 patients, 34.3% were overweight, 15.6% were obese, and 6.6% were morbidly obese.[9] Consistent with these findings, in our study, half of the patients were overweight and the other half obese, with a mean BMI of 31.2 kg/m². Mean neck and abdominal circumferences were also above normal limits. After one month of PAP therapy, no significant change was observed in BMI. Weight loss occurred only in patients who had made substantial lifestyle changes, while one patient with concomitant pulmonary HT and right heart failure experienced weight gain due to fluid retention. These findings suggest that long-term weight reduction programs may be an important intervention strategy for OSAS. PAP therapy alone may not be sufficient for weight loss; however, since our study evaluated short-term results, definitive conclusions cannot be drawn.

The relationship between smoking and OSAS has been evaluated in several previous studies. Multiple cross-sectional epidemiological studies have reported a significant association between smoking and both snoring and sleep apnea. In the Northern European Respiratory Health Study, even individuals who had never smoked but were exposed to passive smoking had a 1.6-fold increased risk of snoring (95% CI, 1.2–2.1), even after adjusting for BMI, age, and sex.[12] Wetter et al.[13] reported a dose-response relationship between smoking and OSAS severity, with more severe symptoms in heavy smokers, and that these symptoms improved after smoking cessation. In our study, 33% of patients were current smokers, 28% were former smokers, and 39% had never smoked. According to 2016 national data, 39.5% of the adult population in Turkiye were daily tobacco users;[14] therefore, the smoking rate in our cohort was lower than the national average.

Cholidou et al.[15] evaluated changes in 6MWT performance after six months of CPAP treatment in OSAS patients and reported a statistically significant increase after therapy. Previous studies have similarly demonstrated beneficial effects of CPAP therapy on exercise performance in OSAS patients.[16,17] Consistent with the literature, in our study, the 6MWT distance significantly increased after CPAP therapy compared with baseline (p=0.007). This improvement can be explained by the normalization of the baroreflex mechanism, which controls heart rate and is impaired in OSAS patients.[18] Saad et al.[19] reported that reduced baseline FEV_1 in severe OSAS cases was associated with a 29.7 m decrease in 6MWT distance. However, studies on this topic remain limited. Contrary to these findings, although the 6MWT distance significantly improved in our study, spirometric parameters did not show a significant change before and after CPAP treatment. Tapan et al.[20] reported that although not statistically significant, CPAP therapy improved exercise capacity and respiratory muscle strength, enhanced quality of life, and contributed to blood pressure regulation, with minor improvement only in FEV_1. In contrast, Bonay et al.[21] reported that long-term CPAP use in OSAS patients led to decreases in FEV_1 and FEF25–75 values, possibly due to airway irritation and inflammation caused by chronic CPAP exposure. Our study did not evaluate long-term outcomes, and no significant positive or negative changes in spirometric parameters were observed after one month of CPAP therapy. Similarly, there were no significant changes in PFT results between pre/post-night measurements during titration nights. One of the reasons for the absence of significant changes in PFT results may be the short duration of therapy, which might have been insufficient for a measurable physiological response. Additionally, the patients had only recently initiated device use, and their daily usage times were relatively limited. More definitive conclusions may be obtained with a larger sample size and increased daily usage hours.

Depression has been reported in approximately 30% of patients with OSAS,[22] which negatively affects family life, social interactions, and work performance, ultimately impairing quality of life.[23,24] The relationship between psychiatric disorders and OSAS has recently been attributed to a complex feedback mechanism involving biological, metabolic, and neurological dysregulation, which contributes to psychiatric disorders, sleep fragmentation, and cardiovascular and metabolic diseases.[25] In a Turkish study conducted in 2016, Çelik et al.[26] evaluated depression and anxiety levels using the HADS before and at three months of CPAP therapy and found statistically significant improvements in both parameters. Similarly, Gupta et al.,[25] in a systematic review and meta-analysis of 33 studies, reported moderate improvements in depression, anxiety, and quality of life following CPAP treatment, but these benefits were not observed in patients with poor adherence. In our study, anxiety scores decreased significantly after CPAP treatment ($p=0.003$), and there was a statistically significant correlation between CPAP adherence and anxiety score improvement ($p=0.046$). Depression scores also decreased significantly after CPAP therapy ($p=0.001$). These findings support the beneficial effects of CPAP therapy on depressive and anxiety symptoms in OSAS patients, even within a short one-month treatment period.

Increased sleep fragmentation and reduced sleep quality have been associated with excessive daytime sleepiness, impaired quality of life, and negative health outcomes. Coman et al.[27] demonstrated significant improvements in quality of life after three months of CPAP therapy. Similarly, Irer et al.[28] reported improvements in all SF-36 subdomains after three months of treatment. Our findings are consistent with these results, indicating that CPAP therapy improves quality of life by reducing apneic events. Using the SF-36 questionnaire, we observed significant improvements in physical functioning, vitality, social functioning, general health, and mental health after one month of therapy, while changes in physical role limitation, bodily pain, and emotional role limitation were not statistically significant. Subgroup analysis of patients with ≥80% CPAP adherence yielded similar results. In patients with <80% adherence, only the vitality subscale showed significant improvement after treatment. This finding suggests that regular CPAP use may contribute to improvements in quality-of-life subscales, although the small sample size limits definitive conclusions.

In our correlation analysis, a significant relationship was found between improvement in emotional role limitation and baseline AHI. Finn et al. reported that AHI values were significantly correlated with five SF-36 domains; mental health, social functioning, physical role, physical functioning, vitality, and general health indicating that higher AHI levels were associated with poorer scores.[29] The findings of our study and others suggest that various aspects of quality of life are adversely affected by higher AHI values in OSAS patients. Moreover, our results demonstrated interrelationships between anxiety, depression, and quality-of-life subscales.

Limitations

The main limitation of our study is the small sample size, which was primarily due to patient noncompliance with therapy, inability to obtain the PAP device, or preference for alternative treatments. Additionally, only short-term (one-month) outcomes were evaluated, and long-term effects could not be assessed. Another limitation is that only CPAP and BiPAP users were included; therefore, the results could not be compared with other treatment modalities or untreated patients. Furthermore, social, familial, and personal factors independent of the disease, which may influence depression, anxiety, and quality of life, were not evaluated and may have affected the outcomes.

The strengths of our study include the simultaneous evaluation of multiple parameters, providing a comprehensive overview of the physiological, psychological, and functional challenges experienced by OSAS patients. The study demonstrated that significant improvement can be achieved even with short-term therapy. Our findings highlight that overall health and well-being should be evaluated through combined parameters, as they are interconnected.

CONCLUSION

As a result, this study demonstrated that even short-term PAP therapy can significantly improve several subdomains of quality of life, reduce anxiety and depression levels, and enhance exercise capacity in patients with OSAS. Future multicenter studies with larger patient populations and longer follow-up periods are warranted to compare CPAP with alternative treatment modalities and to further elucidate its impact on pulmonary function, quality of life, and emotional well-being.

ETHICAL DECLARATIONS

Ethics Committee Approval

Ethical approval for this study was obtained from the Hacettepe University Clinical Researches Ethics Committee (Date: 17.10.2018, Decision No: 2018118-21 (KA-I80107)).

Informed Consent

Written informed consent was obtained from all individual participants prior to their inclusion in the study. Participants were fully informed about the study's aims, procedures, potential risks and benefits, and their rights—including the right to withdraw at any time without consequence. All participants voluntarily signed a written informed consent form.

Peer Review Process

This manuscript was subject to external peer review.

Conflict of Interest

The authors declare no conflicts of interest related to this study.

Financial Disclosure

The authors received no financial support for the conduct or publication of this research.

Author Contributions

All authors contributed significantly to the study's conception, design, data acquisition, analysis, and interpretation. All authors reviewed and approved the final version of the manuscript.

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