



## Original Article

# Comparison of improvement in quality of life between continuous positive airway pressure and autotitrating positive airway pressure treatment for obstructive sleep apnea: A randomized crossover study

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## ABSTRACT

**Objectives:** Obstructive sleep apnea (OSA) is a sleep disorder with repeated nocturnal desaturation and sleep fragmentation. It can lead to poor quality of life. Our goal was to compare improvement in the quality of life of patients with OSA between those treated with continuous positive airway pressure (CPAP) and autotitrating positive airway pressure (APAP) for 3 months.

**Materials and Methods:** This was a prospective, randomized, crossover study. Study participants were patients with OSA randomized into the APAP or CPAP group, with crossover to the other group 3 months later. All patients received CPAP or APAP treatment for > 4 h/d. Each patient completed the Short Form 36 Health Survey (SF-36) before and after the 3-month CPAP and APAP treatment.

**Results:** The 19 patients had severe OSA [mean apnea–hypopnea index (AHI)  $59.7 \pm 23.9$ /h] and the mean optimal pressure of CPAP titration was  $8.7 \pm 1.5$  mmHg. The CPAP group had a higher mean pressure  $8.7 \pm 1.4$  mmHg as well as a lower AHI  $0.6 \pm 1.4$ /h than the APAP group. There was no difference in compliance between groups. Both groups had significant improvement in general health and vitality after treatment compared with before treatment. However, there were no significant differences in improvement in any component of the SF-36 between groups.

**Conclusion:** In our study, the CPAP patients had a higher pressure and lower AHI than the APAP patients. OSA patients preferred APAP. Both CPAP and APAP can improve general health and vitality in OSA patients.

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## 1. Introduction

Obstructive sleep apnea syndrome (OSA) involves recurrent upper airway collapse leading to repetitive episodes of hypoxemia and arousal during sleep [1]. Its clinical features include snoring, daytime sleepiness, and sleep fragmentation [2]. There is increasing evidence that poor sleep quality can lead to an inability to maintain daytime wakefulness and poor quality of life [3].

Continuous positive airway pressure (CPAP) and autotitrating positive airway pressure (APAP) are now standard treatments for patients with OSA, with good evidence that they improve cognitive function and quality of life [4,5]. Improvement in quality of life with short-term use of CPAP/APAP (from 6 weeks to 3 months) has been well reported in patients with good compliance to treatment in some studies [6]. However, the rate of discontinuing CPAP has ranged from 8% to 46% [7]. One meta-analysis showed that APAP improved compliance in OSA patients by 11 min/night [6]. To our knowledge, few studies have investigated the differences in quality of life with long-term use of CPAP/APAP. Our study investigated the compliance and improvement in quality of life over 6 months in OSA patients with good compliance to APAP/CPAP.

Conflict of interest: none.

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## 2. Materials and Methods

This prospective, randomized, crossover study enrolled 25 patients with moderate-to-severe OSA [apnea–hypopnea index (AHI)  $\geq 15$ /h] from the Sleep Center of Hualien Tzu Chi General Hospital, Hualien, Taiwan in 2012. The patients were randomly divided into the CPAP or APAP group for 3 months. After 3 months, the patients shifted to the alternative treatment for the following 3 months. All study participants completed Short Form 36 Health Survey (SF-36) questionnaires at baseline (before treatment) and at 3 months and 6 months after different positive airway pressure treatments. Patients younger than 20 years and those who were under treatment for anxiety and depression were excluded. The hospital's Institutional Review Board approved the study. The study had no external funding. All participants provided informed consent.

### 2.1. Polysomnography and CPAP titration study

All patients underwent one night of polysomnographic study (A10; Embla, Broomfield, CO, USA) at the Sleep Center. A CPAP titration study was performed on each patient with moderate-to-severe OSA (AHI  $\geq 15$ /h), with manual methods by H.M.W. The optimal CPAP pressure was defined as the pressure at which the AHI  $\leq 5$ /h during the CPAP titration study. Patients in the CPAP/APAP treatment group used the DeZire OminiPAP OP700 (MD Biomedical Inc., Taipei, Taiwan, R.O.C.).

### 2.2. Data collection

Patient information obtained included age, sex, body mass index (BMI), Epworth sleepiness scale (ESS) score, and polysomnographic profiles. All study participants also completed the SF-36 at baseline (before treatment) and at 3 months and 6 months after the different treatments. The compliance data, including number of hours used, number of days used, and mean pressure of the CPAP/APAP, as well as the AHI under PAP treatment were recorded by the smart card from the CPAP/APAP equipment.

### 2.3. Statistical analysis

Analysis was performed using the SPSS version 14.0 (SPSS Inc., Chicago, IL, USA). *Post hoc* analysis was applied to compare the order effects of the SF-36 pre- and post-treatment with APAP/CPAP. Statistical significance was set at  $p < 0.05$ .

## 3. Results

Six of the 25 enrolled OSA patients (24%; 3 received APAP first and 3 received CPAP first) withdrew during the 1<sup>st</sup> month due to intolerance to CPAP/APAP. Nineteen patients (76%; male/female, 18/1) completed all 6 months of treatment. All of the enrolled OSA patients used CPAP/APAP for  $> 4$  h/d, as well as  $> 70\%$  of the studied days. Patients who were enrolled initially in either the CPAP or APAP group did not change their compliance during the following 3-month treatment with CPAP/APAP.

The mean age of the studied patients was  $46.2 \pm 16.5$  years, mean body mass index was  $30.2 \pm 4.6$  kg/m<sup>2</sup>, and mean ESS score was  $9.6 \pm 5.0$ . Polysomnographic data from the 19 patients showed a mean AHI of  $59.7 \pm 23.9$ /h, with a mean arousal index of  $43.4 \pm 20.4$ /h and mean oxygen desaturation index of  $52.5 \pm 39.6$ /h. The mean CPAP pressure defined by the CPAP titration pressure study was  $8.7 \pm 1.5$  mmHg (Table 1).

**Table 1**

Demographic and polysomnographic data.

n (M/F)	19 (18/1)
Age (y)	46.2 $\pm$ 16.5
BMI (kg/m <sup>2</sup> )	30.2 $\pm$ 4.6
NC (cm)	40.6 $\pm$ 2.8
ESS	9.6 $\pm$ 5.0
AHI (/h)	59.7 $\pm$ 23.9
TST (min)	343.0 $\pm$ 71.0
SE (%)	81.8 $\pm$ 16.0
N1 (%)	43.9 $\pm$ 20.2
N2 (%)	31.6 $\pm$ 17.4
N3 (%)	5.9 $\pm$ 8.3
REM (%)	18.6 $\pm$ 7.5
AI (/h)	43.4 $\pm$ 20.4
ODI (/h)	52.5 $\pm$ 39.6
CPAPP (mmHg)	8.7 $\pm$ 1.5

Data are shown as mean  $\pm$  standard deviation.

AHI = apnea–hypopnea index; AI = arousal index; BMI = body mass index; CPAPP = pressure defined by continuous positive airway pressure titration; ESS = Epworth sleepiness scale; N1 = NREM stage 1; N2 = NREM stage 2; N3 = NREM stage 3; NC = neck circumference; ODI = oxygen desaturation index; REM = rapid eye movement stage; SE = sleep efficacy; TST = total sleep time.

### 3.1. Compliance

The APAP group had a nonsignificant increase in hours using treatment per day ( $0.3 \pm 1.2$  h/d, 17 minutes) compared with the CPAP group. The mean pressure during CPAP was 1.2 mmHg higher and the AHI was significantly lower by 1.8/h than in the APAP group although both treatment groups had an AHI  $< 5$ /h during treatment (Table 2).

### 3.2. Quality of life

Eight components of the SF-36 were collected in the studied group. There were significant improvements in the scores for general health (GH) and vitality (VT) after CPAP and APAP treatment compared with pretreatment. However, these two components did not show significant differences between groups (Table 3). Compared with pretreatment, GH scores improved a mean 15.1 points in the CPAP group and 12.5 points in APAP group, and VT scores improved 14.7 points in CPAP group and 14.5 points in APAP group. Improvements in both GH and VT on the SF-36 did not have significant correlations with improvement in the AHI.

## 4. Discussion

In the present randomized, crossover study, CPAP and APAP equally improved quality of life after 3 months treatment in OSA patients, as shown by the GH and VT scores on the SF-36. APAP was

**Table 2**

Compliances between autotitrating positive airway pressure (APAP) and continuous positive airway pressure (CPAP) treatment of obstructive sleep apnea (OSA) patients.

	CPAP	APAP
mP (mmHg)	8.7 $\pm$ 1.4 *	7.5 $\pm$ 1.6
Hours	5.8 $\pm$ 1.2	6.3 $\pm$ 1.5
Days used	50.1 $\pm$ 5.5	49.6 $\pm$ 6.1
AHI	0.6 $\pm$ 1.4 *	2.4 $\pm$ 1.8

Data are shown as mean  $\pm$  standard deviation.

\* $p < 0.05$  compared to APAP group.

AHI = apnea–hypopnea index; mP = mean pressure during 90% of positive airway pressure treatment.

**Table 3**

Comparison of quality of life with SF-36 measurements before and after autotitrating positive airway pressure (APAP) and continuous positive airway pressure (CPAP) treatment of obstructive sleep apnea (OSA) patients.

	Before treatment	CPAP	APAP
PF	85.5 ± 11.9	84.2 ± 16.8	83.9 ± 15.6
RP	59.2 ± 39.3	77.6 ± 34.2	81.6 ± 29.9
BP	74.9 ± 14.6	74.4 ± 17.2	82.9 ± 18.6
GH	49.5 ± 17.1 <sup>b,c</sup>	64.6 ± 18.0 <sup>a</sup>	62.2 ± 18.4 <sup>a</sup>
VT	49.7 ± 17.0 <sup>b,c</sup>	64.4 ± 17.7 <sup>a</sup>	64.2 ± 17.0 <sup>a</sup>
SF	76.9 ± 17.3	75.0 ± 19.1	80.3 ± 18.8
RE	57.9 ± 41.3	73.7 ± 39.4	71.9 ± 43.4
MH	61.3 ± 11.9	66.5 ± 12.9	68.0 ± 12.9

Data are shown as mean ± standard deviation.

BP = bodily pain; GH = General health; MH = mental health; PF = physical functioning; RE = role-emotional; RP = role-physical; SF = social functioning; VT = vitality.

<sup>a</sup>  $p < 0.05$  compared to OSA patients before treatment.

<sup>b</sup>  $p < 0.05$  compared to OSA patients under CPAP treatment for 3 months.

<sup>c</sup>  $p < 0.05$  compared to OSA patients under APAP treatment for 3 months.

used for 17 min/d more than CPAP, which was not significant, but CPAP had significantly better effects in minimizing the AHI in OSA patients because of a higher mean pressure during positive airway pressure treatment. Initial use of CPAP or APAP did not affect further use of CPAP and APAP after 1 month of treatment.

Most previous studies showed no difference between the use of APAP or CPAP, but some showed better compliance with APAP. In a meta-analysis [6], OSA patients who used APAP had a statistically significant difference of 11 minutes use per night. The clinical significance of improvement in compliance with APAP was unclear in the previous report. Similarly, those who used APAP in our study could tolerate it for about 17 minutes longer at night than CPAP, but this was not significant, probably because of the small number of patients. Although CPAP had a higher mean pressure overnight, the effect of a minimized AHI was better with CPAP than APAP in our study.

Quality of life is often assessed in OSA patients. In the Sleep Heart Health Study [8], patients with mild to moderate OSA had reduced vitality, while a poorer quality of life was noted in patients with severe OSA. Daytime sleepiness has been associated with poor quality of life in OSA patients. In another study, depression, lower arterial oxygen saturation during sleep and higher ESS scores were associated with poor quality of life [9]. In the meta-analysis [6],

there were no significant differences in quality of life measures between APAP and CPAP treatment. Improvements in vitality, mental health, and physical health were seen in the SF-36 of OSA patients who had been treated for 1 month to 6 weeks [9]. In the present study, there were no differences in improvement on the SF-36 between the CPAP and APAP groups, and the main improvements were seen in VT and GH in treated patients. Improvements in both VT and GH were greater than the minimally important clinical differences (an increase of > 5 in the score for each component). To our knowledge, our study had the longest follow-up period in crossover studies of OSA patients. However, the study had limitations due to the small number of patients studied. Power analysis calculation showed that 28 patients were needed to compare the two groups. Larger sample sizes study should be used in future studies.

In conclusion, CPAP had a higher pressure and lower AHI than APAP. OSA patients preferred to use APAP. Both CPAP and APAP can improve GH and VT in OSA patients.

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