Two months follow up of auto-CPAP treatment in patients with obstructive sleep apnoea

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Abstract

Background—**Continuous positive airway pressure (CPAP) with fixed mask pressure is the current standard treatment for obstructive sleep apnoea (OSA). Auto-CPAP devices apply at any time the minimally required pressure to normalise breathing and may improve patient comfort and compliance. We present an open descriptive study of auto-CPAP treatment at home in patients previously managed with conventional CPAP.**

Methods—**Fifteen patients with obstructive sleep apnoea (OSA), previously treated for at least one year with standard CPAP, were followed prospectively for a two month period on auto-CPAP. Outcome measures were both subjective evaluation by the patients and objective (polysomnographic) data obtained at one and two months of follow up.**

Results—**The Epworth sleepiness score did not change significantly between baseline and follow up after one and two months and no systematic changes in CPAP related side effects were reported. Compared with the baseline polysomnographic values without treatment, a significant improvement in both respiratory and sleep parameters was observed during auto-CPAP. These results were not significantly different from those obtained with standard CPAP. A significant correlation was found between the effective CPAP pressure (Peff) and the amount of time spent below Peff during auto-CPAP treatment ($r = 0.6$, $p = 0.01$).**

Conclusion—**Long term auto-CPAP treatment in these patients with severe OSA appears to provide comparable efficacy to that of standard CPAP treatment.**

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Obstructive sleep apnoea syndrome (OSA) is a disorder characterised by intermittent closure of the upper airway during sleep resulting in sleep fragmentation and night time hypoxaemia. Among the different treatment modalities currently available, continuous positive airway pressure (CPAP) is the most efficient and most widely used. The pressure required to normalise breathing during sleep, the effective pressure (Peff), is determined by several factors such as the degree of respiratory effort developed during obstructive apnoeas, upper airway anat-

omy, and the apnoea/hypopnoea index which remain relatively constant in otherwise untreated patients.[1 2] Intra-patient variability of Peff can be attributed to alcohol consumption, a change of body position, or transient upper airway obstruction.[3 4] Auto-CPAP devices were designed to reduce expenditure from hospital admissions and technicians (no CPAP titration night required) and to improve the outcome of CPAP therapy and treatment compliance.[5] Most auto-CPAP studies performed to date have been carried out in the sleep laboratory and have aimed to compare the efficacy of auto-CPAP with standard CPAP treatment or to investigate the feasibility of auto-CPAP for CPAP titration.[6] To date only one study has compared conventional CPAP with auto-CPAP at home.[7] We report the results of a two month follow up of auto-CPAP treatment in 15 patients with OSA previously treated with standard CPAP. Both subjective perceptions by the patients and polysomnographic data are discussed.

Methods

This prospective study was performed in 15 randomly selected patients with OSA who had been treated for at least one year with CPAP at a fixed mask pressure (standard CPAP) at the Sleep Disorders Unit of the Antwerp University Hospital. All patients gave written informed consent.

Each participant underwent four complete polysomnographic tests which were performed and scored as previously described.[8] Patients did not stop CPAP treatment prior to the baseline polysomnographic test which was carried out during the first night of the study (night 1; without CPAP) and followed by a polysomnographic test with auto-CPAP (night 2). Thereafter the patients were instructed to continue with the auto-CPAP device for the next two months at home. After this period a polysomnographic reading with auto-CPAP (night 3) was followed by a polysomnographic reading with standard CPAP (night 4). During night 4 mask pressure was fixed at the level that resulted in elimination of respiratory events and snoring during non-REM and REM sleep as used for standard CPAP treatment before the start of the study (Peff).

For this study we used the REM+ Auto device (Version 1.6, Sefam, Villers Les Nancy, France). This device adapts mask pressure after detection of respiratory pauses or acoustic vibrations. The pressure range was set from 5 to 15 cm H_2O. Data on effective CPAP use and the amount of time spent at different levels of

Table 1 Sleep and respiratory parameters during polysomnographic tests at baseline (night 1), during the first night on auto-CPAP (night 2), after two months of auto-CPAP treatment night 3 (with auto-CPAP) and night 4 (with standard CPAP)

Parameter	Night 1 (baseline)	Night 2 (auto-CPAP)	Night 3 (auto-CPAP)	Night 4 (standard CPAP)
TST (%)	288.5 (266.5 to 330)	428.0 (368.5 to 450.5)	375.5 (319.5 to 430.5)	344.5 (313.0 to 406.0)
NREM (min)	273.5 (216.5 to 314.0)	316.5 (281.0 to 349.5)	290.0 (243.0 to 319.0)	283.5 (261.5 to 321.0)
REM (min)	26.0 (18.5 to 40.0)	101.5 (84.0 to 111.0)	77.0 (56.5 to 101.0)	83.5 (58.5 to 99.0)
Arousal index (no./h)	27.4 (21.8 to 42.6)	8.4 (5.4 to 12.8)	10.0 (5.9 to 13.9)	9.2 (5.99 to 14.6)
RDI (events/h)	65.8 (48.6 to 80.3)	2.1 (0.9 to 3.2)	2.5 (1.0 to 5.6)	1.5 (0.9 to 2.9)
Sao_2 non-REM (%)	93.0 (92.0 to 93.0)	93.0 (93.0 to 94.0)	94.0 (93.0 to 94.0)	94.0 (93.0 to 94.0)
Sao_2 REM (%)	93.0 (91.0 to 93.0)	93.0 (92.0 to 94.0)	93.5 (93.0 to 94.0)	94.0 (93.0 to 94.0)
Snoring time (min)	79.6 (37.6 to 193.3)	16.5 (5.9 to 53.1)	15.6 (7.2 to 29.7)	12.1 (0 to 42.0)
Nasal pressure (cm H_2O)	—	5.4 (4.5 to 7.3)	5.4 (5.1 to 6.9)	8.0 (5.0 to 8.0)

Data are presented as median values (95% confidence interval). For each parameter a significant difference (p<0.05) was found between night 1 and night 2. No significant differences were found between nights 3 and 4.
TST = total sleep time; RDI = respiratory disturbance index.

nasal pressure were downloaded from the device after one and two months of treatment.

A questionnaire and the Epworth sleepiness scale were used to evaluate symptoms and CPAP related side effects.

Data are presented as median values with 95% confidence intervals (CI). Statistical analysis was performed using StatSoft software package (Version 5, 1996) and statistical significance assumed at p<0.05. The effectiveness of auto-CPAP in treating OSA was assessed by comparison of night 1 (baseline) with night 2 (auto-CPAP) using the Wilcoxon matched pairs test. The results from night 3 (auto-CPAP) and night 4 (standard CPAP) were analysed by the Wilcoxon matched pairs test to compare auto-CPAP with standard CPAP treatment.

Results
Fifteen obese (BMI 31.6 (95% CI 28.4 to 35.7) kg/m^2) middle aged patients (55.0 (95% CI 44 to 59) years) with severe OSA (respiratory disturbance index (RDI) 65.8 (95% CI 48.6 to 80.3) events/hour) agreed to participate. The effective CPAP pressure required to eliminate apnoeas, hypopnoeas, and snoring in non-REM and REM sleep was 8.0 (95% CI 5 to 8) cm H_2O.

There was no significant change in the Epworth sleepiness score on auto-CPAP, values being 6.0 (95% CI 4.0 to 7.0) at baseline, 4.0 (95% CI 2.0 to 7.0) at one month follow up, and 5.0 (95% CI 3.0 to 11.0) at two months follow up. One patient reported an increase in snoring while on auto-CPAP. After one and two months of auto-CPAP four patients complained of an increase in daytime fatigue or excessive daytime sleepiness and disturbed sleep.

Sleep and respiratory parameters during polysomnography at baseline, during the first night on auto-CPAP, and after two months of auto-CPAP are shown in table 1. During the first night on auto-CPAP (night 2) a significant increase in stage III–IV non-REM sleep, a decrease in the arousal index, and a significant decrease in both apnoeas and hypopnoeas was observed compared with baseline. Auto-CPAP resulted in a significant reduction but no complete elimination of snoring. There was no significant difference in any of the sleep or respiratory parameters between both treatment modalities after two months of auto-CPAP treatment.

The mean pressure during auto-CPAP treatment was 5.2 (95% CI 4.9 to 6.8) cm H_2O in the hospital and 5.6 (95% CI 5.3 to 7.1) cm H_2O at home. The difference between Peff and the mean mask pressure during auto-CPAP in hospital or at home was not statistically significant. Spearman rank correlation analysis revealed a significant correlation between the effective CPAP pressure and the percentage of time spent below Peff during auto-CPAP treatment (r = 0.6, p = 0.01). Effective auto-CPAP use during the first month was 6.3 (95% CI 5.1 to 6.7) hours/night and 6.1 (95% CI 5.2 to 6.8) hours/night during the second month of auto-CPAP.

Discussion
We have shown that patients with severe OSA can be efficiently treated with auto-CPAP (REM+ Auto, version 1.6) and that the improvement in sleep related breathing disturbances and daytime function obtained is comparable to that which can be obtained with standard CPAP.[9] No major differences in pressure related side effects were reported and treatment compliance was well above the minimal acceptable level.[10]

Although not statistically significant, a trend towards a lower mean pressure during auto-CPAP treatment was observed compared with standard CPAP. In addition, a significant correlation between Peff and the percentage of time spent below Peff was observed. The latter implies that, in particular, those patients requiring high levels of nasal pressure to normalise breathing spent more time below this level during auto-CPAP treatment.

It has been suggested previously that auto-CPAP would reduce pressure related side effects because the mean mask pressure would be lower than with standard CPAP.[5] On the other hand, it is not unlikely that a low nasal pressure may result in the persistence of flow limitation and subsequent arousals from sleep which in turn may compromise treatment efficacy. This might explain why four of our patients reported an increase in daytime sleepiness while using an auto-CPAP device that does not respond to flow limitation (REM+ Auto, version 1.6).

In conclusion, both objective polysomnographic data and subjective reports from

patients suggest that the auto-CPAP is an effective long term treatment for patients with severe OSA.

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