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Compliance in sleep apnoea therapy: influence of home care support and pressure mode

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ABSTRACT: Continuous positive airway pressure (CPAP) is an effective treatment for obstructive sleep apnoea syndrom (OSAS) but therapy adherence is often low. The hypothesis that CPAP-adherence and clinical outcomes can be improved by either using an autoadjusting-CPAP (APAP) device or an intensive support was tested.

A controlled parallel group study was performed with 100 newly diagnosed OSAS patients, randomised into 4 groups (n=25 each): standard or intensive support plus either APAP or CPAP. Intensive support included education and monthly home visits for 6 months. Clinical outcome was monitored by polysomnography at CPAP initiation and, after 3 and 9 months, compliance data were downloaded from the CPAP devices.

After 9 months, intensively supported patients returned for follow-up in 88 *versus* 68% in the standard-support-group. Daily usage (mean±SEM 5.7±0.2 for intensive support *versus* 4.6±0.4 h for standard support), percentage of days used (80.4±2.8 *versus* 57.0±5.9%) and proportion of individual sleep time (80.6±3.2 *versus* 64.9±6.2%) were also higher. There was no significant difference between APAP or CPAP, (daily usage 5.2±0.4 *versus* 5.1±0.3 h, percentage of days 67.9±5.0 *versus* 69.2±4.9%, proportion of sleep time 72.5±5.0% *versus* 72.1±5.2%, for APAP and CPAP) but retention rate was higher with CPAP.

In summary, intensive support after continuous positive airway pressure initiation, rather than the application of autoadjusting-continuous positive airway pressure, increased therapy adherence.

KEYWORDS: Continuous positive airway pressure, obstructive sleep apnoea syndrome, respiratory care, sleep apnoea diagnosis and treatment

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Obstructive sleep apnoea syndrome (OSAS) is a major public health burden, with a worldwide prevalence of 2–4% among the adult population [1]. OSAS is associated with excessive daytime sleepiness, cognitive dysfunction, impaired quality of life, hypertension and an increased cardiovascular morbidity and mortality [2]. Continuous positive airway pressure (CPAP) is an effective treatment for OSAS symptoms and also decreases cardiovascular morbidity and mortality [3–6].

However, the effectiveness of this symptomatic therapy mainly depends on regular use. The use/comfort of CPAP therapy may be limited by side effects, such as mucosal irritation, mask dislodgement, mask leak or difficulty in exhaling, which may critically impair compliance [7–12] or lead to discontinuation of therapy; 23% of patients quit CPAP within 5 yrs, most of them during the first year [13]. In other publications, discontinuation rates ranged from 8 [11] to 46% [14].

Most of the side-effects are associated with the airflow generated by the CPAP device and tend to worsen with higher pressures or airflow rates. The pressure required to achieve airway patency often varies throughout the night, *i.e.* it may be higher during REM sleep or in the supine position.

Autoadjusting-CPAP (APAP) devices were developed for continuous adjustment of pressure, which yields a lower mean pressure needed to achieve airway patency; pressure is increased when airflow limitations or an increase in upper airway resistance are identified, whereas pressure is decreased when the airway is open. However, no significant improvement of comfort and compliance has been demonstrated, while the clinical outcomes seem to be similar for both pressure modes [10, 15].

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Intensive patient support is usually aimed at early minimising adverse factors and focussing patients' awareness on the necessity of the treatment and the benefit eventually derived from it. The first few weeks seem to be crucial for patients' ability to cope with the disease and their acclimatisation to therapy [16, 17]; and thus for long-term compliance. Hence, most of the interventions studied were focussed on this period of time. Problems caused by mask, airflow or an increase in pressure can be addressed by re-adjustment of the interface and/or the CPAP device, whereas prejudice, embarrassment or technical problems in dealing with the equipment are a possible target to behavioural/educational measures. Investigators have used education about disease and therapy by different media [18, 19] and a closer monitoring by means of phone calls, letters [16] or telemedicine [20]. One study was based on home visits and could show an increase in the hours of use, with an improvement in subjective daytime symptoms and mood [18]; however, more reliable clinical outcome parameters regarding the disease severity, such as the apnoea/hypopnoea index (AHI), were not compared.

The primary aim of the present study was to test whether an intensive support of OSAS patients during the first 6 months of CPAP therapy can enhance CPAP adherence and improve clinical outcomes compared with standard support. In addition, the effectiveness and compliance of APAP and fixed-pressure therapy was compared. It is the first long-term interventional study, with 100 patients being followed over 9 months. A total of four different surrogate parameters for compliance and a set of clinical parameters, which allows for an estimation of cardiovascular impairment as well as sleep fragmentation and daytime somnolence, were used.

METHODS

Study design

A total of 100 patients (78 male and 22 female; mean$\pm$SD age 57$\pm$12 yrs; BMI 31$\pm$5 kg·m^{-2}) with newly diagnosed OSAS were enrolled (inclusion criteria: AHI $\geqslant$15, with or without corresponding daytime symptoms). Exclusion criteria were as follows: 1) any global respiratory failure; 2) central sleep apnoea syndrome; and 3) any severe mental or psychological impairment. Before enrolment, all patients gave their written informed consent and answered a questionnaire regarding daytime sleepiness (Epworth Sleepiness Scale (ESS)). The study was approved by the local ethic committee of the Albert Ludwigs University of Freiburg (Freiburg, Germany).

Patients underwent standard diagnostic overnight polysomnography using a Heinen and Löwenstein SIDAS (Heinen and Löwenstein, Herrsching, Germany) or Jaeger Sleeplab 1000 (Jaeger, Würzburg, Germany) polysomnography system. Sleep measurements during polysomnography included standard electroencephalography (EEG), electro-oculography (EOG) and electromyography (EMG). Nasal airflow and oxygen saturation were measured by thermistor and pulse oxymetry, respectively, and patients were monitored and recorded by infrared video camera. Respiratory effort was determined by thoracic and abdominal gauges. Following polysomnography, sleep stages and respiratory events were visually analysed and edited, page by page. The diagnostic night (DIAG) was followed directly by a second full-night polysomnography with CPAP therapy (THER_INI), during which the CPAP adjustment was performed by attended autotitration (pressure-limits 6-14 mbar). Thereafter, patients were allocated to following groups: 1) standard support and APAP therapy (n=25); 2) standard support and CPAP therapy (n=25); 3) intensive support and APAP therapy (n=25); and 4) intensive support and CPAP therapy (n=25). Fixed CPAP pressure was obtained choosing the pressure level with lowest RDI during the polysomnography. In all four groups a further polysomnographic monitoring and interview was performed after 3 months (3M) and 9 months (9M) of CPAP treatment.

The intensive support groups were further visited by specially trained members of the present authors' Sleep Laboratory of the Department of Pneumology at 1, 2, 4, 5 and 6 months after CPAP therapy (fig. 1). Intensive support included optimising the equipment such as mask fit, the use of moisturers as indicated and an early identification of patients with low compliance, as well as educational support and counselling.

CPAP units

The CPAP device used was the AutoSet Spirit (ResMed, Sydney, NSW, Australia) which allows for switching between the conventional CPAP and the autoadjusting pressure modes. Furthermore, data concerning compliance (days and hours used, total of days, *etc.*), clinical parameters (apnoeas and hypopnoeas) as well as pressure and air leakage can be recorded, stored for up to 365 days and downloaded.

Outcome measurements

Polysomnographic data were collected at the time of diagnosis and therapy initiation, and after 3 and 9 months. These data included the AHI (total number of apnoeas and hypopnoeas calculated, over the total sleep time), arousal index, oxygen desaturation index (ODI) and sleep profiles. Data stored in the AutoSet Spirit were downloaded after each polysomnography and during every home visit. The device records the total number of days, percentage of days used, total number of hours, daily usage in hours, air leakage episodes, pressure delivered, apnoea-hypopnoea index and mean duration of apnoeas. ESS-scores were also obtained at every encounter. Compliance data were obtained as follows: retention rate was calculated from the number of patients who returned for follow-up divided by the total number of patients; daily usage was calculated from the total number of hours divided by the total number of days used; the days the device was actually used were divided by the total number of days, in order to obtain the percentage; and the portion of individual sleep time spent with appropriate mask pressure was calculated from the daily usage in hours divided by patients' self-estimated sleep time, which they gave at the interview. Compliance parameters were set to zero when patients did not appear for their follow-up visit.

Statistical analysis

All variables were tested for normal distribution and equal variance. Data are presented as mean$\pm$SEM. For all experiments, the statistical significance of differences between samples was calculated using ANOVA, Bonferroni comparison tests. A p-value <0.05 was considered to be significant.

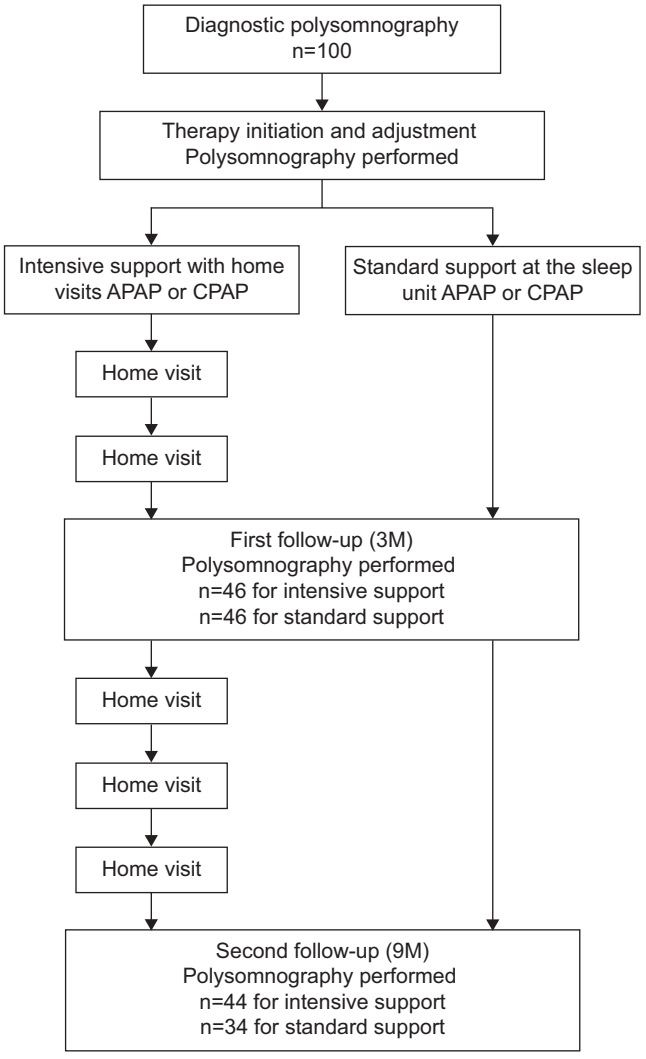

FIGURE 1. Schematic of the support protocols and course of the study. A total of 100 patients with newly diagnosed obstructive sleep apnoea syndrome were included and 78 completed the study. Home visits were, from top, at months 1, 2, 4, 5 and 6 after diagnostic polysomnography. CPAP: continuous positive airway pressure; APAP: autoadjusting CPAP; 3M: follow-up at 3 months; 9M: follow-up at 9 months.

RESULTS

Patient characteristics

Patient characteristics were similar in all four groups (table 1) and basic data such as BMI did not significantly change in the course of the study.

Intensive support significantly enhanced adherence to CPAP therapy, compared with standard support

After 9 months of therapy, 88% of the intensively supported patients returned for follow-up but only 68% of the patients receiving standard support. As shown in table 2, patients in the intensive support arm had used their CPAP device significantly more often (80.4±2.8% of days) between the two follow-ups. After nine months of CPAP treatment, usage was also higher (5.7±0.2 h) in terms of absolute duration as well as related to patients' individual sleep time (80.6±3.2%) compared with the standard support arm (57.0±5.9%, $p<0.001$; 4.6±0.4 h, $p<0.05$; 64.2±6.2% $p<0.05$, respectively).

Intensive versus standard support: clinical outcomes

Indices of disease severity (AHI, ODI, arousal index) showed no difference between the different support groups at baseline but were significantly decreased at the start of the therapy and remained low (table 3). ESS-scores were different at baseline, formally indicating a higher mean daytime sleepiness in the intensive support group. After 9 months however, no difference could be detected between the two groups.

APAP versus CPAP: clinical outcomes

The two modes were equally effective in reducing respiratory disturbances. AHI was decreased from 41.8±20.9 to 7.4±3.8 (for APAP) and 45.5±22.4 to 11.4±9.2 (for CPAP) in the first night of CPAP treatment ($p<0.001$). There was a further reduction of the AHI in the long term but at no time, could a significant difference between the groups be observed. Daytime sleepiness was reduced significantly throughout the time in both groups but the CPAP group showed higher ESS Scores (table 4).

APAP versus CPAP: mean pressure and compliance

Mean positive airway pressure (P_{mean}) was 1.0–1.2 cmH_2O higher in CPAP, 9.2±1.3 cmH_2O at THER_INI and 9.4±1.1 cmH_2O (3M and 9M) *versus* 8.8±1.6 cmH_2O at THER_INI, 8.2±2.0 cmH_2O (3M), and 8.4±1.5 cmH_2O (9M), $p<0.001$ (table 5). However, no differences in therapy adherence could be observed; there was an overall decrease in compliance in both pressure groups in the long term, in terms of the percentage of days used as well as daily usage. APAP-patients used their device for a similar proportion of their individual sleep time as CPAP patients (see table 2).

Mean air-leakage was mainly constant in both groups with a slight decrease in the APAP group (table 5). Changes and differences between the groups were not statistically significant although values tended to be higher in the CPAP group.

DISCUSSION

This controlled parallel group trial shows that an intensive support, especially during the first few months from therapy initiation can enhance long-term adherence to CPAP in obstructive sleep apnoea for up to 20%, whereas the use of APAP had no such effect. It is the first home-based interventional study to follow 100 patients over 9 months, using several different parameters for compliance and clinical outcome.

Overall compliance was high in continuing users in both groups, with >75% of days used and a mean nightly usage of over 5 h. Comparable data on CPAP adherence have been published before. PIETERS *et al*. [21] reported on a mean use of 5±1.8 $h \cdot night^{-1}$, remaining stable for 2 yrs. KRIBBS *et al.* [14] found an utilisation rate of 66% of the days monitored. A recent study by SUCENA *et al*. [13] showed an increase in compliance in continuing users in the long term with 5.35 h after 1 yr and 6.55 h after 10 yrs. 23% of patients quit CPAP within 5 yrs, most of them during the first year.

In the present study, the most evident effect of the intervention was a lower drop-out rate among patients who had received an intensive support, where compliance data were monitored

TABLE 1 Patient characteristics

	CPAP		APAP	
	Intensive support	Standard support	Intensive support	Standard support
Sex M/F n	20/5	17/8	21/4	20/5
Age yrs	59.4±2.1	57.6±2.1	54.9±2.9	57.8±2.0
Height cm	172.3±2.1	171.6±2.0	172.0±1.9	174.6±1.9
Weight kg	90.5±3.6	92.1±3.4	93.9±3.7	94.1±3.3
BMI kg·m^{-2}	30.5±1.2	31.2±1.0	31.8±1.2	30.8±0.8

Data are presented as mean±SEM, unless otherwise stated. CPAP: continuous positive airway pressure; APAP: autoadjusting CPAP; M: male; F: female; BMI: body mass index.

closely and therapy problems could be addressed immediately. 88% of these returned for follow-up after 9 months *versus* 68% of patients receiving standard support, which means that more patients were kept from discontinuing their therapy by the intervention performed. This suggests that the general acceptance of CPAP as a key aspect of therapy efficiency is an important, clear-cut and perhaps more-promising target for specific interventions.

Mean daily usage, the percentage of days used and the proportion of individual sleep time spent with adequate mask pressure were higher for up to 20% in the intensive support group, when analysed on an intention-to-treat basis. However, a possible limitation of these data might be a conservative missing value imputation, which could increase the statistical error.

Notably, even the ''standard support'' applied to the control group was more intensive than common support at the sleep unit with an explanation about the disease and its possible sequels, a thorough introduction to the device and equipment, and a brief diurnal CPAP trial before the second polysomnography. This effect may account for part of the high overall compliance, compared with literature [14] and has already caused difficulties in observing differences in several interventional CPAP trials [18, 22–24].

Another common problem in interventional CPAP trials is that not specific interventions but rather ''packages'' [25] are studied, so that the most relevant measure cannot be identified distinctively. HOY *et al.* [18] used an intensive education, a 3-night CPAP trial and home nursing. They reported a 40% higher CPAP use with intensive support, sustained for over six months, in terms of usage in h·night^{-1}. Percentage of days or other parameters of usage were not monitored. JEAN WIESE *et al.* [19] showed a higher retention rate for 1-month follow-up after video education with 72.9 *versus* 48.9% in the control group. CHERVIN *et al.* [16] and colleagues performed education, telephone calls and letters. The present study shows the effectiveness of regular home visits in the first 6 months from therapy initiation. It could not be clarified, in this study, whether the higher frequency of encounters or the home setting led to a higher adherence to CPAP. A combination of home visits at therapy initiation for a shorter period than in the present study, followed by more frequent follow-ups at the sleep units, might be a feasible alternative strategy.

Other measures, such as optimising mask-fit and educational support, were provided to patients in both groups, as mentioned above, although more frequently to the intensive support group. This may also have led to higher material costs in some patients of that group, contributing, alternatively, to

TABLE 2 Compliance data intensive *versus* standard support and continuous positive airway pressure (CPAP) *versus* autoadjusting CPAP (APAP)

	Intensive support		Standard support		APAP		CPAP	
	3M	9M	3M	9M	3M	9M	3M	9M
Daily usage h	5.5±0.2	5.7±0.2	5.4±0.3	4.6±0.4*	5.4±0.2	5.2±0.4	5.4±0.3	5.1±0.3
Percentage of days %	82.7±2.7	80.4±2.8	68.7±4.6*	57.0±5.9**	76.0±3.9	67.9±5.0	75.0±4.1	69.2±4.9
Hours used/sleep time	79.6±5.4	80.6±3.2	75.7±4.1	64.2±6.2*	73.4±3.1	72.5±5.0	81.4±5.8	72.1±5.2

Data are presented as mean±SEM. Merged data (CPAP plus APAP or intensive plus standard support). Daily usage was calculated from the total of hours (counter of CPAP device) divided by the total number of days used; percentage of days was calculated as the number of days used divided by the total number of days; and hours used/sleep time was calculated as daily usage in hours divided by patients' self-estimated sleep time given during interview. 3M: follow-up at 3 months; 9M: follow-up at 9 months. *: $p<0.05$; and **: $p<0.01$ between groups at the same time-point.

TABLE 3 Clinical outcomes of intensive *versus* standard support

	Intensive support				Standard support			
	DIAG	THER_INI	3M	9M	DIAG	THER_INI	3M	9M
AHI	43.8±3.6	10.2±1.3**	5.6±0.7**	3.5±0.8**	43.6±3.4	8.5±0.9**	6.0±1.0**	5.9±1.6**
ODI	38.5±4.0	4.3±0.7**	3.1±0.5**	3.3±0.9**	38.7±3.5	4.1±0.7**	3.2±0.7**	4.7±1.2**
ArI	33.9±2.9	16.7±1.5**	14.6±1.4**	12.3±1.5**	31.1±3.5	14.4±1.8**	14.2±1.5**	14.0±1.4**
ESS	10.1±0.6		7.8±0.7	6.6±0.7**	7.4±0.8*		5.5±0.6*	5.8±0.6

Data are presented as mean±SEM. Merged group data (continuous positive airway pressure (CPAP) plus autoadjusting CPAP). DIAG: diagnostic polysomnography; THER_INI: therapy initiation; 3M: follow-up at 3 months; 9M: follow-up at 9 months; AHI: apnoea/hypopnoea index; ODI: oxygen desaturation index; ArI: arousal index; ESS: Epworth Sleepiness Scale. *: $p<0.05$ between groups at the same time-point; **: $p<0.01$ compared with DIAG, same group.

their acclimatisation to CPAP. This suggests that, even if inferior to psycho-educational measures, mechanical interventions in terms of equipment optimisation (humidifiers, different interfaces, *etc.*) at therapy initiation should also be employed when necessary, in order to prevent impairment of CPAP adherence.

In the present authors' experience, increased mask discomfort and equipment requirements, resulting in frequent interface change at therapy initiation, are the manifestation of difficulties in acclimatisation to CPAP and coping, in some patients. Intensive support, addressing the underlying problems and helping the patient to achieve a positive ''cost–benefit calculation'', despite all discomfort, will help to reduce these material costs. These savings, however, could be allocated to personal costs again.

Additional savings could be achieved by the delay of definite purchase of CPAP devices by health insurers until proper assessment of patient compliance.

Therapy efficiency should be monitored closely, using data storage in CPAP devices and personal supervision. This will help to identify patients at risk of abandoning CPAP and to intervene, if necessary. Therefore, current considerations to simplify treatment and follow-up to save money in the short term cannot be supported from this ''compliance'' point of view.

As to the measurement techniques applied, the set of different parameters used in the present study allows for a more-detailed analysis of different usage patterns and, therefore, yields a closer description of compliance as a construct.

Clinical outcome parameters, *i.e.* the AHI, as well as ESS Scores tended to decrease continuously. This suggests some curative aspects of CPAP in the long term because the values used were measured at defined time points, which are not directly influenced by usage rates. Mean values over time could help in detecting a true continuous improvement. One possible explanation for such an effect is the reduction of mucosal oedema by minimising vibrational trauma, which is known to account for upper airway collapsibility, in part [26]. Another possible explanation is a reduction in sleep fragmentation, reflected by a further decrease in the arousal-index in the present study; sleep fragmentation is known to increase upper airway collapsibility [27, 28]. A decrease in daytime somnolence may also be due to a better acclimatisation to CPAP and therefore less sleep fragmentation. The BMI did not change significantly in the course of the study, so weight loss cannot explain the improvements noticed in this case.

The reduction of the AHI appeared to be stronger with intensive support. Here, a direct effect of the intensive support must be postulated, rather than a statistical one, through a higher compliance. In the present authors' opinion, optimising the equipment, such as mask fit, minimising side-effects such as rhinorrhoea by the use of humidifiers, an early identification of patients with low compliance and again a better acclimatisation

TABLE 4 Clinical outcomes of continuous positive airway pressure (CPAP) *versus* autoadjusting CPAP (APAP)

	APAP				CPAP			
	DIAG	THER_INI	3M	9M	DIAG	THER_INI	3M	9M
AHI	41.8±3.5	7.4±0.6**	4.8±0.7**	3.6±0.8**	45.5±3.6	11.4±1.5**	6.7±0.9**	5.4±1.4**
ODI	35.6±3.9	3.4±0.7**	2.1±0.3**	2.9±0.7**	41.1±3.8	5.0±0.7**	4.1±0.7**	4.8±1.3**
ArI	30.6±3.3	13.9±1.6**	12.3±1.3**	12.9±1.5**	34.5±3.1	17.3±1.6**	16.4±1.4**	13.2±1.5**
ESS	8.5±0.8		6.4±0.7	5.9±0.7*	9.3±0.7		7.0±0.7*	6.6±0.7*

Data are presented as mean±SEM. Merged group data (intensive plus standard support). DIAG: diagnostic polysomnography; THER_INI: therapy initiation; 3M: follow-up at 3 months; 9M: follow-up at 9 months; AHI: apnoea/hypopnoea index; ODI: oxygen desaturation index; ArI: arousal index; ESS: Epworth Sleepiness Scale. *: $p<0.05$ and **: $p<0.01$, both compared with DIAG, same group.

TABLE 5 Mean pressure and air leakage of continuous positive airway pressure (CPAP) and autoadjusting CPAP (APAP)

	APAP			CPAP		
	THER_INI	3M	9M	THER_INI	3M	9M
P_{mean}	8.8±0.3	8.2±0.3	8.4±0.3	9.2±0.2	9.4±0.2**	9.4±0.2**
Leakage	0.27 (0.03)	0.26 (0.04)	0.29 (0.03)	0.28 (0.04)	0.35 (0.04)	0.36 (0.04)

Data are presented as mean±SEM or mean (95th percentile). Merged group data (intensive plus standard support). THER_INI: therapy initiation; 3M: follow-up at 3 months; 9M: follow-up at 9 months; P_{mean}: mean positive airway pressure. **: $p<0.01$ between groups at the same time-point.

to CPAP accounted for a better quality and effectiveness of therapy, and in terms of clinical outcome. ESS mean values at baseline were significantly different, showing a possible bias for compliance outcome. However, they were comparatively low in both groups, indicating that overall symptom severity was not as evident as the high RDI would have suggested. Additionally, they decreased in the same manner in both groups. Therefore, even if slightly increased or normal ESS values were considered to influence CPAP therapy adherence [11], this did not influence compliance outcomes in the current study.

The clinical significance of these improvements remains unclear. A decrease in the AHI may well reflect amelioration of disease severity and hence its cardiovascular sequels through CPAP, as has been reported [3, 6]. HOY *et al.* [18] also demonstrated a reduction in sleepiness, better mood and improvements in reaction time. However, these parameters mainly pertain to quality-of-life issues. Parameters more related to intermittent hypoxia and its sequels, such as the AHI, were not discussed. Therefore, more studies on long-term cardiovascular outcomes, also considering costs arising from an increased morbidity, mortality and occupational injuries are needed to confirm relevant benefits from a higher therapy adherence and an intensive support, respectively. A consistent definition of effective CPAP use, in terms of usage in $h \cdot night^{-1}$, percentage of days *etc*., is still lacking; ''how much is enough?'' [29] still remains an important question.

Secondly, APAP and CPAP were compared. P_{mean} was about 1 cmH_2O lower after 3 and 9 months, as has been reported for APAP previously: TESCHLER *et al*. [30] found a 23% reduction in APAP compared with CPAP.

Variation of pressure in the APAP device did not cause higher air-leaks or more arousals during sleep, *i.e.* the Arousal-Index was similar in both groups. However, the association between arousals and single pressure changes was not analysed. FUCHS *et al.* [31] found that an average of 20% of microarousals (MA) were preceded by a significant change in pressure (at least 0.5 mbar within 30 s.) delivered by APAP but the relative amount of ''pressure-associated MA'' was not significant in most individuals [31].

The lower P_{mean} among APAP patients did not lead to a higher compliance or therapy adherence, respectively. Patients used their device for more than 5 $h \cdot day^{-1}$ and for about 75% of the days during the first 3 months in both groups, retention rate was even lower under APAP.

In their comparison between APAP and CPAP, RANDERATH *et al*. [15] also found no difference in compliance despite a lower P_{mean} under APAP. The duration of use was 5.25 $h \cdot day^{-1}$. However, 75% of the patients preferred APAP for long-term treatment at home. KONERMANN *et al.* [32] found a higher amount of $nights \cdot week^{-1}$ with nasal CPAP use for >4 h with APAP, after 6 months of therapy but without a significant difference in daily use. The authors themselves state that the slightly higher patient compliance with the self-adjusting device needs further confirmation, which could not be supported by the present study. Additionally, in a recent meta-analysis by AYAS *et al.* [33] a similar patient adherence for APAP and CPAP was found. The specific reasons for subjective preference of APAP remain unclear. The effective reduction in P_{mean} is a possible explanation but it has to be questioned whether patients have registered this reduction directly; the possibility would increase with a greater inter-individual variability of pressure throughout the night. An indirect benefit by the reduction of pressure- or airflow-associated side-effects can be assumed as a factor of influence but these questions were not evaluated in the current study, so far.

As to the clinical outcomes, both CPAP and APAP were equally effective in reducing the AHI, compared with the AHI at diagnosis, with an even further decrease in the long term. Concurrently, daytime sleepiness was reported to decrease significantly.

Autoadjusting continuous positive airway pressure as a mechanical type of intervention, showed no relevant impact on compliance or clinical outcomes in the therapy of obstructive sleep apnoeas syndrome compared with continuous positive airway pressure. Therefore, a switch to autoadjusting continuous positive airway pressure devices, which are more expensive currently, cannot be recommended in general, but to a more-selected group of patients might benefit from an automatic adjustment of pressure. As a result, more-precise differential indications for the use of autoadjusting continuous positive airway pressure need to be identified. Furthermore, even the use of autoadjusting continuous positive airway pressure for unattended therapy initiation at home needs to be questioned because the setting at the time of diagnosis and start of therapy (sleep unit or patients' home) also has shown to be a predictor of long-term compliance [34, 35]. However, some costs may be reduced by using autoadjusting continuous positive airway pressure for attended autotitration for determination of fixed continuous positive airway pressure.

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