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Comparison of three ways to determine and deliver pressure during nasal CPAP therapy for Obstructive Sleep Apnoea

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Abstract

The simplest method of initiating and maintaining therapeutic continuous positive airways pressure (CPAP) therapy for obstructive sleep apnoea (OSA) is not established.

Methods: 98 people with OSA, requiring CPAP treatment (>10, >4% oxygen desaturation dips/hour of sleep study, and Epworth Sleepiness Score (ESS) >9) were randomized prospectively to three different methods of CPAP delivery for 6 months (Autoset Spirit, ResMed): A) autotitrating pressure throughout; B) autotitrating pressure for 1 week, followed by fixed pressure (95th centile) thereafter; and C) fixed pressure, determined by algorithm (based on neck size and dip rate). Patients and investigators were blind to group allocation. CPAP therapy was initiated mostly at home, following afternoon clinic training and induction. One week after initiation, the sleep nurses reviewed all patients routinely. Study assessments took place before CPAP therapy, at 1 and 6 months after, to assess ESS, maintenance of wakefulness test, 24-hour blood pressure, general health (SF-36) and sleep apnoea related quality of life (SAQLI). CPAP internal monitoring data were also collected.

Results: There were no significant differences in any of the outcome measures or CPAP monitoring data between the three groups. The 95th centile CPAP pressures delivered in the 6-month autotitration and the 1-week autotitration groups were higher than in the algorithm group, but the median pressures were lowest in the 6-month autotitration group.

Conclusions: The method of determining CPAP pressure for moderate to severe OSA treatment makes no significant difference to clinical outcome measures. This particular autotitrating CPAP machine shows no advantage in this setting over simpler methods of pressure determination.

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INTRODUCTION

Obstructive sleep apnoea (OSA) is a common condition, characterised by recurrent episodes of upper airway obstruction, apnoeas and arousals. The resulting sleep fragmentation causes excessive daytime sleepiness. Continuous positive airways pressure (CPAP) is a well-established, effective and evidence-based treatment for OSA[1]. The prescription of nasal CPAP for patients with OSA and associated daytime sleepiness is now a very common therapeutic intervention. The most effective and economic method of initiating CPAP therapy however is not established.

Traditionally, it has been recommended that technicians should titrate CPAP pressures overnight in patients with OSA, until most of the apnoeas and arousals are abolished, as measured by concurrent polysomnography [2]. The required pressure is then delivered by a simple 'fixed pressure' CPAP machine. Overnight titration is, however, time-consuming and labour intensive. Autotitrating machines, which adjust pressure according to inspiratory flow limitation, snoring and apnoeas, are as effective as polysomnography at performing overnight CPAP titration. They have been used to initiate CPAP treatment, either at home or in hospital [3-5]. The overnight results regarding airway pressure (usually the 95th centile), can be used to determine the effective level of CPAP required, then administered by a simpler fixed pressure machine. Alternatively, patients may use the autotitrating machines long-term [6,7]. Algorithm-based methods of determining a fixed CPAP pressure are also used. These predict the required CPAP pressure based on neck circumference/body mass index and oxygen desaturation/apnoea-hypopnoea index [8;9]. This approach has given comparable pressures and patient outcomes to autotitrating machines in the limited studies done so far [8]. It has also been reported that patients themselves can titrate their fixed CPAP pressure for comfort and perceived efficacy, with improvement in subjective and objective sleepiness, or the bed-partner can adjust the pressure until snoring is largely abolished [10; 11].

The cost implications for each method are different; as overnight technician supervised polysomnography and long-term autotitrating machines are more expensive than single night autotitration and algorithm methods of establishing CPAP. It is argued that methods may differ in their efficacy at controlling OSA and hence their ability to improve the patient's clinical symptoms.

No long-term studies (more than 12 weeks) have been performed to compare directly some of these different methods of CPAP initiation and to establish whether the clinical improvement is greater with any particular approach. The number of endpoints to establish equivalence has been limited. This study aimed therefore to randomise prospectively patients diagnosed recently with OSA to one of three different methods of CPAP therapy, to establish whether subjective and objective sleepiness, 24-hour blood pressure, self-reported health status, CPAP usage and extra calls to the sleep nurses were different between the groups over a six month period. A secondary aim of the study was to determine the differences in overall CPAP pressures administered between the three groups.

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METHODS

Subject selection

Subjects were identified through the outpatient Oxford Sleep Clinic, between January 2002 and March 2003. Subjects were eligible if they were aged 18-75 with excessive daytime sleepiness (Epworth Sleepiness Score >9) and proven OSA on a one-night respiratory polysomnography sleep study. These took place in hospital rooms that were decorated and furnished to resemble an ordinary bedroom. Subjects body movements, heart rate and pulse transit time (PTT) changes were recorded as measures of arousal from sleep. The PTT signal and body movements derived from video are robust markers of arousal [12]. Arterial oxygen saturation measurements, snoring and increases in the respiratory swing in PTT were used as markers of breathing pattern and respiratory effort (Win-Visi monitoring system, Stowood Scientific Instruments, Oxford UK). The PTT swing is a sensitive index of respiratory effort that accurately predicts change in pleural pressure and differentiates between central and obstructive apnoeas. The results of the sleep study were scored automatically, with manual review to ensure accuracy of the data. OSA was diagnosed from a review of all the data. The severity of the sleep apnoea was then quantified as the number of dips in oxygen saturation of greater than 4% for every hour of the study. This index is one of the best predictors of therapeutic response to nasal CPAP [12]. A recent study has also shown oximetry to be at least as good as conventional EEG-based polysomnography at predicting response to CPAP [13]. Subjects with more than 10 dips per hour in the arterial oxygen saturation (SaO_2) of > 4%, confirmed as being caused by upper airway obstruction, were eligible for inclusion in the study. All subjects were CPAP-naïve. Subjects were recruited up to the capacity of the study each week, with preference for more local residents, to reduce travelling times. Subjects were excluded if they had respiratory failure requiring urgent treatment, declined to participate or could not give written informed consent. Subjects were not excluded on the basis of other co-morbidities. 633 patients in total with OSA were commenced on CPAP in this time. There is no reason to believe the subjects selected for the study were not representative of the patients seen by our clinic. The Central Oxford Research Ethics Committee approved the study (C02.282). This study was independent of previous studies performed in our department.

Outcome measurements

Study assessments were made prior to commencement of CPAP, one month and six months after initiating CPAP therapy.

Sleepiness measures

Subjective sleepiness was measured by means of the Epworth Sleepiness Score (ESS), an eight point self-completed questionnaire assessment of the tendency to fall asleep during various daytime situations [14]. The higher the score (up to 24), the sleepier a person is. Objective sleepiness was measured by a modification of the Maintenance of Wakefulness test (OSLER), a behavioural sleep resistance challenge, where the patient is required to stay awake in a darkened sound protected room [15]. The time taken to repeatedly fail to respond to a visual signal is measured, hence the lower the score, the sleepier a person is [16;17]. Each subject completed a single OSLER test at the same time of day on each visit, after a quiet period of filling in questionnaires with the investigator (approximately 30

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minutes).

Self-reported health status

Subjects completed the Short Form-36 and Sleep Apnea Quality of Life Index (SAQLI) questionnaires. The SF-36 questionnaire has been used to measure decreased quality of life in several disorders, including OSA, and shows large improvements following CPAP therapy, especially the Energy and Vitality dimension, which we report here [18;1]. The SAQLI questionnaire is a disease specific quality of life measure, recording the key elements of sleep apnoea, which are important to patients. It has been used as a measure of outcome in clinical trials related to sleep apnoea [19]. The minimal important difference in the total SAQLI score measured in patients using CPAP for 4 weeks has been found to be approximately 1, a moderate difference is approximately 2, and a large difference is approximately 3 [20]. Scoring of the SAQLI was based on the manual by Flemons and Reimer [21].

Blood pressure

Subjects were fitted with an ambulatory blood pressure monitor to wear for 24 hours as an outpatient during normal activities (TM2420, 2421, Takeda A&D, Japan). It was programmed for cuff inflation measurements every 30 minutes throughout the 24-hour period, including sleep time. By averaging the 48 readings a 24-hour mean systolic and diastolic pressure was obtained. A single mean blood pressure was calculated from this (one third of the systolic pressure plus two thirds of the diastolic pressure).

CPAP data

When the patients returned for repeat study assessments, their CPAP machines were downloaded to give the following data: usage (hours CPAP used per 24 hours, measured as mask-on time on nights worn and number of nights used); treatment pressure (over the time period during mask-on time, with 95th centile and median values); apnoea-hypopnoea index (AHI); mask leak (net airflow greater than the mask vent flow during mask-on time, with 95th centile and median values). A 95th centile leak of less than 0.4l/sec is considered acceptable.

CPAP administration

All CPAP was administered via identical machines (Autoset Spirit, ResMed). In most patients, CPAP was first used overnight at home, following an afternoon training and induction session. Six patients had CPAP initiated as hospital in-patients overnight, where they received their CPAP mode according to the study group to which they had been allocated. Both these methods of CPAP initiation are available in our centre, and are used according to availability.

One week after CPAP initiation, patients were routinely seen in the nurse-led CPAP clinic, by personnel not involved in the study assessments. At this point, the CPAP machines were downloaded to give usage, mask leak, pressure and apnoea-hypopnoea index (AHI) data. This data was available to the sleep nurses for all the patients, so they could give advice and make mask adjustments according to the leak data as necessary. All the patients in the group receiving autotitrating pressure for one week were converted

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to a fixed pressure determined from their 95th centile pressure over the preceding week. The nurses gave no information to the patients regarding their treatment group.

If the patients had problems after this one-week visit, they were instructed to telephone the sleep nurses for advice, as is standard practice in our unit. All these calls were logged. If any patients remained symptomatic from OSA with continued snoring, the nurses were advised to increase the fixed CPAP pressure, in accordance with their standard practice.

Study design

Patients attended for baseline tests prior to commencing CPAP therapy. Following the completion of their initial tests, patients were randomized to one of three CPAP treatment groups: A) autotitrating pressure for 6 months, B) autotitrating pressure for 1 week, followed by fixed pressure determined by the 95th centile pressure from the week's data, and C) fixed pressure, determined by an algorithm based on neck circumference and OSA severity, as previously described [22]. Balanced randomization was by means of a computer program (MINIM version 1.5, Evans S). The patients and the investigators carrying out the assessment studies were blinded to their group allocation. One month and six months after commencing CPAP, patients returned for further study assessments. Any patients who failed to attend their study visits were contacted by telephone to rearrange their appointment. If they could not be contacted or did not reply, they were sent a reminder letter. Based on our previous two way studies on the treatment of OSA, this study was powered such that 30 patients in each group would have an 80% chance at the 5% level of not missing a difference in ESS of 2.5 points between groups following treatment, a difference in MWT (OSLER) of 6 minutes between groups, or a difference in CPAP compliance of 1.4 hours per night [1;23].

Data analysis

ESS, MWT (OSLER), 24-hour BP, AHI, usage, pressure, leak and self-reported health status scores (SF-36, SAQLI) were compared between the three groups. Statistical analysis was by SPSS version 11.0. Non-parametric testing was performed using Kruskal-Wallis. Results are shown as median values (5th/95th centile). Standard errors of the differences for key outcome measures were also calculated to provide confidence intervals on these differences.

RESULTS

Patient characteristics

98 patients were recruited to the study and randomized following their first study visit. The three groups were well matched at baseline (table 1) and had moderate to severe OSA (median >4% SaO_2 dip rate 34.5 dips per hour, range 10.3-89.0 dips per hour).

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Table 1 Median (5^{th}/95^{th} centile) baseline characteristics of patients entering the study according to subsequent group allocation

	A: 6 months autotitration (n=31)	B: 1 week autotitration (n=33)	C: Algorithm (n=34)	p value between groups
Age	48.0 (33.0/66.6)	43.0 (33.5/65.0)	46.5 (33.8/68.0)	0.6
M:F	27:4	28:5	28:6	
Neck size (cm)	45.7 (39.5/53.0)	45.7 (37.7/50.1)	44.5 (35.6/53.3)	0.7
4% SaO_2 dip rate per hour	36.8 (12.0/64.9)	33.4 (11.9/82.0)	33.0 (12.7/78.0)	0.9
ESS	16.0 (10.6/23.0)	17.0 (10.4/22.6)	16.5 (10.5/22.3)	0.7
MWT (mins)	19.4 (1.4/40.0)	19.5 (2.9/40)	15.7 (2.1/40)	0.8
24 hour mean BP	95.8 (77.0/122.0)	95.2 (77.3/118.3)	96.2 (75.0/120.7)	0.9
SAQLI score	3.9 (1.7/6.0)	3.1 (1.5/5.8)	3.5 (1.9/6.1)	0.4

ESS = Epworth Sleepiness Score, MWT = maintenance of wakefulness test, SaO_2 = oxygen saturation, SAQLI = Sleep Apnea Quality of Life Index

The trial outline is shown in figure 1. Data were available 1 month after CPAP initiation on 92 patients and at 6 months on 86 patients. 6 patients did not attend at one month; 2 of these patients did however attend at 6 months. Nine patients did not attend at 6 months. No data was entered for those who did not attend. Two patients stopped using their CPAP after 1 month, one because he could not tolerate it, and one because he had lost weight and was no longer symptomatic from OSA. Both of these patients were in the group receiving 1 week of autotitration. These patients did not return at 6 months. Four patients were found to be not using their CPAP at their 6 month follow up because they felt better; their ESS and OSLER scores had also improved. Three of these were in the algorithm group and 1 was in the 1-week autotitration group.

Outcome measures: ESS, MWT, SF-36, SAQLI

There was a highly significant improvement in all outcome scores in all the groups following treatment with CPAP. There was no significant difference between the groups in any of the outcome measures, as shown in table 2. The standard errors of the difference between groups for ESS, MWT and BP were 1.1, 2.8 (minutes) and 4.4 (mmHg) respectively.

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Table 2 Median (5^{th}/95^{th} centile) outcome measures of the three groups at 1 and 6 months

	A: 6 months autotitration	B: 1 week autotitration	C: Algorithm	p value between groups
ESS				
Pre CPAP	16.0 (10.6/23.0)	17.0 (10.4/22.6)	16.5 (10.5/22.3)	0.7
1 month	7.0 (1.0/12.0)	7.0 (0/15.4)	6 .0 (1.0/19.8)	0.9
6 months	6.0 (0.45/13.8)	5.0 (0/15.5)	5.0 (0.5/12.5)	0.8
MWT (mins)				
Pre CPAP	19.4 (1.4/40.0)	19.5 (2.9/40)	15.7 (2.1/40)	0.8
1 month	40.0 (5.1/40.0)	40.0 (5.5/40.0)	31.3 (3.1/40)	0.1
6 months	40.0 (11.6/40.0)	40.0 (14.5/40)	40.0 (2.2/40)	0.2
Mean BP (mmHg)				
Pre CPAP	95.8 (77.0/122.0)	95.2 (77.3/118.3)	96.2 (75.0/120.6)	0.9
1 month	93.3 (73.0/115.0)	93.3 (78.0/108.0)	96.4 (84.0/115.0)	0.4
6 months	99.6 (77.3/119.0)	96.7 (82.7/119.0)	96.4 (73.3/114.3)	0.5
SF-36 PCS				
Pre CPAP	62.5 (17.2/93.2)	65.7 (25.2/90.0)	62.6 (25.9/92.5)	0.6
1 month	79.7 (35.1/95.4)	81.7 (33.1/94.5)	81.3 (30.5/98.7)	0.8
6 months	78.8 (20.0/96.2)	85.2 (26.6/95.3)	83.3 (40.9/98.3)	0.5
SF-36 MCS				
Pre CPAP	57.2 (19.8/87.5)	56.8 (26.0/89.4)	56.6 (16.6/88.7)	0.9
1 month	77.7 (32.5/93.6)	82.3 (39.7/94.0)	81.8 (24.4/97.6)	0.9
6 months	79.3 (30.5/94.1)	81.5 (27.8/95.0)	82.7 (35.4/95.4)	0.9
SF-36 EV				
Pre CPAP	25.0 (6.0/74.0)	30.0 (0/78.0)	27.5 (3.8/72.5)	0.9
1 month	65.0 (30.0/87.5)	60.0 (24.0/90.0)	60.0 (23.3/100.0)	0.9
6 months	67.5 (19.0/82.8)	67.5 (35.0/94.9)	60.0 (42.0/94.0)	1.0
SAQLI change				
1 month	1.4 (-3.2/4.3)	1.5 (-4.0/4.5)	0.8 (-5.4/3.7)	0.2
6 months	1.6 (-4.8/4.3)	1.5 (-5.6/4.7)	1.4 (-5.2/3.4)	0.7

ESS = Epworth Sleepiness Score, MWT = maintenance of wakefulness test, PCS = physical component summary, MCS = mental component summary, EV = energy and vitality dimension, SAQLI = Sleep Apnea Quality of Life Index

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CPAP data: usage, mask leak, airway pressure

Table 3 shows the CPAP data downloaded from the machines from all the groups. The data shown are taken from the preceding 28 days at both the one month and six month points, in order to reflect the recent past. There was no significant difference between the three groups in terms of the hours of CPAP use per night worn, the percentage of nights used, the mask leak, or the AHI. The standard error of the difference between groups for CPAP use per night was 0.41 hours.

The median and 95th centile pressures shown were CPAP machine-generated. There was a significant difference in the delivered CPAP pressures between the groups. The algorithm and the 1-week autotitrating groups both had fixed pressures delivered and so each of their median and 95th centile pressures are the same. As the 6-month autotitration group received varying pressures, the median and 95th centile pressures are different. At 1 month and at 6 months, the 95th centile CPAP pressures delivered in the 6-month autotitration and the 1-week autotitration groups were significantly higher than those delivered in the algorithm group. The median pressures were however lowest in the 6-month autotitration group. Only one patient, who was in the 1-week autotitrating group, had his CPAP pressure increased by the sleep nurses due to residual snoring.

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Table 3 Downloadable CPAP data at 1 and 6 months. Median (5^{th}/95^{th} percentile) figures of all subjects from preceding month

	A: 6 months autotitration	B: 1 week autotitration	C: Algorithm	p value between groups
Median pressure ($cm H_20$)				
1 month	9.5 (6.4/12.8)	11.1 (8.2/14.3)	9.8 (7.7/13.0)	0.001
6 months	9.7 (6.4/11.7)	11.5 (3.2/14.3)	10.0 (7.8/12.5)	<0.0001
95^{th} centile pressure ($cm H_20$)				
1 month	10.8 (8.7/15.8)	11.1 (8.9/14.3)	9.8 (7.7/13.0)	0.001
6 months	11.6 (9.1/14.6)	11.5 (3.2/14.3)	10.0 (7.8/12.5)	<0.0001
Hours used per night worn				
1 month	5.3 (0/7.3)	4.3 (0/7.12)	4.7 (0/8.3)	0.27
6 months	5.49 (0/7.5)	4.9 (0/7.2)	4.0 (0/8.3)	0.23
% nights used				
1 month	96.9(31.3-100)	98.4 (51-100)	96.6 (47-100)	0.68
6 months	100 (5-100)	98.3 (61-100)	92.6 (33-100)	0.21
AHI				
1 month	5.8 (0.4-17.3)	4.2 (1.2-12.6)	4.4 (0.5-23.5)	0.4
6 months	5.2 (1.5-13.2)	3.6 (0.5-15.9)	3.8 (0.7-26.1)	0.3
Median leak (l/sec)				
1 month	0.02 (0/0.5)	0.05 (0/0.2)	0.04 (0/0.3)	1.0
6 months	0.03 (0/0.3)	0.05 (0/0.3)	0.04 (0/0.3)	0.9
95^{th} centile leak (l/sec)				
1 month	0.2 (0/1.5)	0.3 (0/0.7)	0.3 (0/0.8)	0.2
6 months	0.2 (0/1.5)	0.3 (0/0.7)	0.3 (0/0.8)	0.4

Telephone calls to sleep nurses

There was no difference between the groups in terms of the number of extra calls or extra visits made to the sleep nurses because of CPAP problems (median 0 calls/visits per group, range 0-3 calls/visits).

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DISCUSSION

We report the results of a double blind randomized trial of three different methods of determining and delivering the pressure during CPAP therapy for OSA. The three methodologies selected were chosen to represent those commonly used in clinical practice currently: that is A) long-term autotitrating pressure, B) autotitration for 1 week with long term fixed pressure thereafter, and C) an algorithm method of pressure determination. We opted to use a one-week autotitration in the second group as there is evidence that a one night titration is unreliable, due to the considerable variation in night-to-night CPAP requirements [22]. We did not have a titration polysomnography group, as a recent study has established the outcomes to be no different to those having a one-night autotitration [24;25]. The study directly compared the outcomes of the three groups over a 6 month time period and looked at a comprehensive range of relevant outcome measures. We found therapeutic CPAP was provided equally well by all three methods of CPAP initiation. The improvements in ESS and MWT are consistent with those found in other studies of patients with OSA being commenced on CPAP treatment [1;24;26]. The patients were followed up for 6 months after CPAP initiation, so information regarding longer-term outcomes, including CPAP pressures and compliance was available. The three groups were no different in terms of subjective and objective measures of sleepiness, 24 hour BP, usage, AHI and mask leak. Self-reported health status, measured by the SF-36 and SAQLI improved in all three groups, with no significant difference between them. SAQLI scores at 6 months had risen by a mean of 1.5. These figures are a little larger than those found in a recent study of CPAP in 288 patients with varying severities of OSA; mean increases of 0.87 in the SAQLI score were found one month after treatment[13].

We noted that the CPAP pressures varied significantly between the groups. The median pressure in the 1-week autotitration group was significantly higher than the other two groups, reflecting the fact it was based on the 95th centile pressure after one week. The median pressure was lowest in the 6-month autotitration group, although its 95th centile pressure was higher than that of the algorithm group. Despite the differences in pressure, the outcome measures between the three groups were no different, suggesting that the lower pressure delivered in the 6-month autotitration and algorithm groups is adequate to improve the AHI and reduce symptoms.

Although this study was not powered to look at changes in blood pressure with CPAP treatment, we noted that expected falls blood pressure occurred following CPAP at one month (borderline significance); however blood pressure returned to baseline levels at 6 months. There were no significant differences in blood pressure change between the three groups. A previous randomized controlled trial in OSA showed a significant fall in blood pressure following one month CPAP, but there have not been controlled studies examining the longer term effect of CPAP on blood pressure [27]. We do not have information from this study regarding pre-existing hypertension or whether the patients were taking anti-hypertensive therapy.

The autotitration CPAP machines used in this study cost about 30% more than a simple fixed pressure CPAP machine. Since this study shows that long or short-term

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autotitration confers no clinical advantage over fixed pressure determined by an algorithm, it can be concluded that algorithm methods of CPAP initiation probably represent an effective and economic option in the treatment of moderate to severe OSA. As the algorithm method of initiating CPAP avoids the need for CPAP titration, this represents a further economic advantage to this approach.

Our overall results can be compared with those from a recent large multi-centre 12 week study by Masa et al, where 360 patients with OSA were randomized to receive CPAP by either conventional overnight polysomnographic titration to determine a fixed pressure, one night of home autotitration to determine a fixed pressure, or an algorithm-derived pressure with subsequent adjustment if symptoms continued [24]. There was no long-term autotitration group. There were no significant differences between the groups at 12 weeks in terms of ESS, AHI, SF-36 or CPAP usage. This study did not however provide any objective measures of sleepiness, and it could therefore be argued that the data is subjective only. Differences may only emerge after the first 3 months of CPAP use and other valid endpoints, such as blood pressure, SAQLI scores and mask leak were not measured.

A further study, from Hukins, gave patients with OSA 2 months of both fixed pressure CPAP and 2 months of autotitrating CPAP in a single blind crossover trial [25]. Both groups had diagnostic and treatment polysomnography to determine their required mask pressures, prior to commencing CPAP. The main outcome measures were subjective sleepiness (ESS) and self-reported health status (SF-36); there were no significant differences in these between the two groups after treatment. Average nightly usage was similar between the treatment groups. These results are essentially the same as those of our study. Those receiving CPAP via the autotitrating mode reported significantly fewer side effects, as measured by visual analogue scales, compared to those receiving fixed pressure CPAP ($p=0.02$). The numbers of patients studied was smaller (46 completed the study) than our study, and no objective measures of outcome such as MWT or blood pressure were used. Visual analogue scales have not been widely reported as an outcome measure of OSA and they have not been compared to the validated SAQLI measure of self-reported health status specific to OSA, which specifically takes account of side effects of treatment and overall impact on quality of life in the calculation of its final score.

A meta-analysis of all the randomized trials comparing autotitrating CPAP to fixed pressure CPAP has been completed [28]. This looked at 9 studies, totaling 282 patients, and showed no significant advantage of autotitrating CPAP over fixed pressure CPAP, based on the outcome measures of AHI, ESS and CPAP usage. All the studies determined the fixed CPAP pressure following a titration polysomnography. Mean pressure was lower in the autotitrating groups (2.2cm H_2O) than in the fixed pressure CPAP groups. Our results are not directly comparable due to our different methods of establishing the fixed CPAP pressure, but we found the median pressure at 6 months in the autotitrating group to be comparable to the algorithm determined pressure group and lower than the median pressure in the 1-week autotitration group.

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The results of all these studies, along with our own, show that long-term autotitrating CPAP has no clinical advantage over fixed pressure CPAP in patients with moderate to severe OSA. Results may be different in a group of patients with milder OSA. It has been argued that there maybe specific sub-groups of patients in whom autotitrating CPAP is more efficacious. A study by Massie et al showed that in those patients requiring CPAP pressures of >10cm H_20 on initial treatment polysomnography, their compliance was greater with autotitrating CPAP than fixed pressure CPAP (average of 35 minutes more per night, p=0.005) [29]. Overall, 95th centile pressures were lower with the autotitrating machine (9.2 vs. 10.9 cm H_20, p=<0.001). Some components of the SF-36 showed a significant improvement in the autotitration group compared to the fixed CPAP group, but improvements in ESS were no different between the two groups. We performed a sub-group analysis on the quarter of patients receiving the highest pressures in each group in our study and found no significant difference between groups in their CPAP usage.

In conclusion, we have shown little or no difference in several clinically relevant outcomes between patients given any of three different CPAP methods to treat their OSA. Long-term autotitrating CPAP with the Autoset Spirit does not provide any advantage that we detected over fixed pressures. A simple algorithm approach to defining the fixed pressure required is no worse than a fixed pressure established following a week with an autotitrating CPAP machine.

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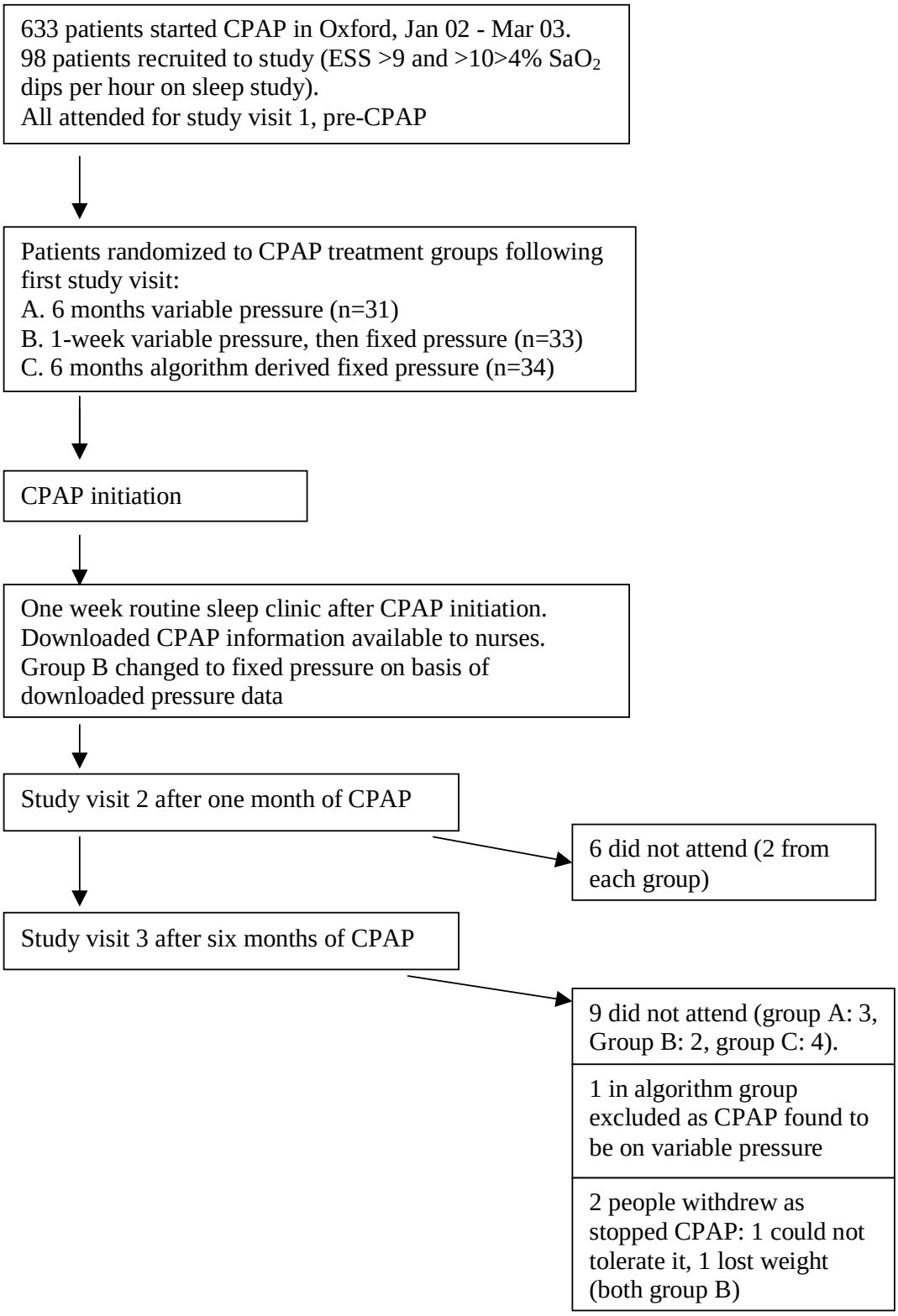
Figure 1 Trial outline



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