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SCIENTIFIC INVESTIGATIONS

Auto-adjusting Positive Airway Pressure Treatment for Sleep Apnea Diagnosed by Home Sleep Testing

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Study Objectives: Compare auto-adjusting positive airway pressure (APAP) treatment with positive airway pressure (PAP) titration by polysomnography (PSG) followed by CPAP treatment in patients diagnosed with obstructive sleep apnea (OSA) by home sleep apnea testing (HSAT).

Design: Prospective randomized treatment study.

Setting: Tertiary Veterans Administration Medical Center.

Participants: 156 patients diagnosed with OSA by HSAT (apnea-hypopnea index [AHI] ≥ 10/h) suitable for APAP treatment.

Interventions: APAP arm: Treatment with an APAP device, CPAP arm: PSG PAP titration followed by CPAP treatment.

Measurements: Mean PAP adherence, Epworth sleepiness scale (ESS), Functional Outcomes of Sleep Questionnaire (FOSQ).

Results: The mean (± SD) age, BMI, and diagnostic AHI (APAP: 28.6 ± 18.5, CPAP: 28.3 ± 16.0/h, p = NS) did not differ between the study arms. After 6 weeks of treatment, 84.6% of 78 patients started on APAP and 84.3% of 70 patients started on CPAP (8 declined treatment after the titration) were using PAP, p = NS. The 90% APAP and level of CPAP were similar (10.8 ± 3.1, 11.7 ± 2.5 cm H_2O, p = 0.07). The average nightly PAP use did not differ (APAP: 4.45 ± 2.3, CPAP: 4.0 ± 2.3 h, p = NS). The improvements in the ESS (APAP: −4.2 ± 4.7, CPAP: −3.7 ± 4.8, p = NS) and in the FOSQ (APAP: 2.6 ± 3.5, CPAP: 2.2 ± 3.7, p = NS) were not different.

Conclusions: Following diagnosis of OSA by HSAT, treatment with APAP results in equivalent PAP adherence and improvement in sleepiness compared to a PSG titration and CPAP treatment.

Commentary: A commentary on this article appears in this issue on page 1277.

Keywords: obstructive sleep apnea, home sleep testing, auto-adjusting positive airway pressure

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Home sleep apnea testing (HSAT), recording a limited number of channels usually not including sleep, is considered an acceptable alternative to polysomnography (PSG) for the diagnosis of obstructive sleep apnea (OSA) in patients with a high probability of having moderate to severe OSA without comorbidities that would degrade the utility of testing.[1] HSAT (also known as portable monitoring or home sleep testing) has become the predominant diagnostic approach for suspected OSA in some locales. As a high proportion of these studies will be positive, the clinician is faced with the challenge of starting patients on positive airway pressure (PAP) treatment. While the standard approach is a PAP titration using PSG followed by continuous positive airway pressure (CPAP) treatment (**Figure 1**, Pathway 1),[2-5] in some health care systems timely PSG is not available, and in others a PSG titration is not reimbursed by insurance providers if a patient has uncomplicated OSA. Rather than use PSG for PAP titration, one can perform unattended auto-titration at home using an auto-adjusting positive airway pressure (APAP) device for several nights (**Figure 1**, Pathway 2).[6-12] The 90th or 95th percentile pressure obtained from the device information download is chosen as the level of CPAP for chronic treatment. However, auto-titration has significant personnel and equipment costs as well as requiring additional patient visits to the sleep center. Proceeding with chronic treatment using an auto-adjusting positive airway device (APAP) avoids any type of titration following the diagnosis of OSA (**Figure 1**, Pathway 3). The approach of diagnosis by HSAT followed by treatment with an APAP device has been used at a number of Veterans Administration Hospitals where demand exceeds the capacity for PSG.

BRIEF SUMMARY

Current Knowledge/Study Rationale: Following diagnosis of obstructive sleep apnea by home sleep testing, one treatment option is to start the patient on an auto-adjusting positive airway pressure device without a preceding titration either by polysomnography or home auto-titration. The effectiveness of this approach needs to be documented.

Study Impact: The results of this study suggest that treatment with an auto-adjusting positive airway pressure device following diagnosis of obstructive sleep apnea by home sleep testing is an effective treatment option if patients are carefully selected based on clinical characteristics and findings from the home sleep test.

While the efficacy of diagnosis by HSAT and auto-titration followed by CPAP treatment (**Figure 1**, Pathway 2) as an alternative to PSG has been documented by a number of studies,[8-12] these findings may not generalize to the approach of simply starting a PAP naive patient on APAP treatment following a diagnosis by HSAT (**Figure 1**, Pathway 3). Auto-titration allows the patient to experience PAP at home for a short time before CPAP treatment is initiated. Important clinical information about PAP efficacy (device interrogation) and side effects experienced by the patient during the short trial may result in

Figure 1—Clinical pathways for starting positive airway pressure treatment following diagnosis of obstructive sleep apnea by home sleep apnea testing (HSAT).

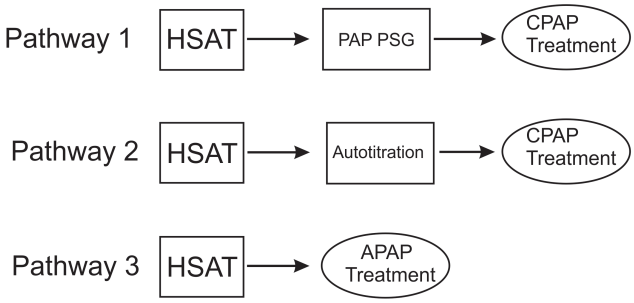
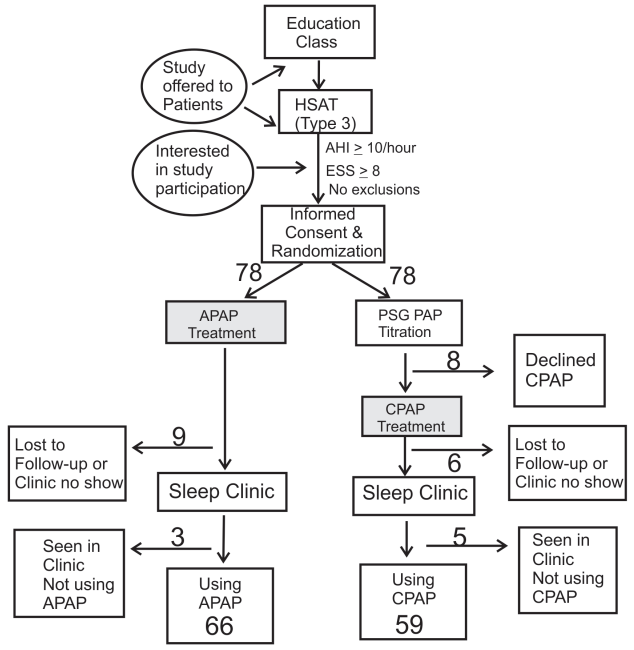


Figure 2—Summary of study design and patient flow.



The number of patients at each step of the study flow is shown.

interventions at the time the patient is started on chronic CPAP treatment that improve outcomes. Given the widespread use of APAP treatment following diagnosis of OSA by HSAT without a preceding short trial of PAP at home, it is important that the efficacy of this approach be documented.

We performed a prospective randomized trial of patients with a diagnosis of OSA by HSAT that compared a study arm of PAP titration with PSG followed by CPAP treatment (considered the standard) with a study arm consisting of APAP treatment (**Figure 1**, Pathway 1 versus Pathway 3). The primary outcome measures were PAP adherence and improvement in subjective daytime sleepiness and quality of life.

METHODS

The project was approved by the institutional review board of the University of Florida and the Human Studies Subcommittee of the Malcom Randall VAMC. The trial was registered with Clinical Trials.gov (NCT00988351).

Table 1—Inclusion and exclusion criteria.

Inclusion Criteria
1. AHI ≥ 10/hour by limited channel sleep testing and ESS ≥ 8/24
2. Residence within 200 miles of the hospital
3. Ability to understand directions
4. Age > 18 years

Exclusion Criteria
1. Prior CPAP treatment
2. Shift work
3. Unstable depression or psychosis
4. History of medical non-adherence
5. Moderate to severe COPD
6. Uncontrolled hypertension
7. Uncontrolled restless legs syndrome
8. Known or suspected narcolepsy
9. Use of supplemental oxygen
10. Severe congestive heart failure
11. Uncontrolled hypertension
12. Use of nightly narcotics
13. Hypoventilation
14. Neuromuscular weakness
15. Sleep duration < 4 hours per night
16. Low baseline SaO_2 on HSAT (SaO_2 ≤ 88% for ≥ 15 minutes in the absence of apneas or hypopneas)
17. Central apnea index > 5/hour on HSAT

Inclusion criteria (**Table 1**) included an age > 18 years, apnea-hypopnea index (AHI) ≥ 10/h, an Epworth Sleepiness Scale[13] (ESS) score ≥ 8, residence within 200 miles of the hospital, and ability to understand directions. Complete medical records of all patients were reviewed (computerized medical record) as part of their routine clinical evaluation for suspected sleep apnea. Exclusion criteria (**Table 1**) included prior CPAP treatment, shift work, unstable depression or psychosis, history of medical non-adherence, moderate to severe chronic obstructive pulmonary disease, uncontrolled hypertension, uncontrolled restless legs syndrome, known or suspected narcolepsy, use of daytime supplemental oxygen, severe congestive heart failure, use of nightly narcotics, known hypoventilation, a neuromuscular disorder, and a reported sleep duration < 4 h night. If the HSAT showed a low baseline arterial oxygen saturation (≤ 88% for ≥ 15 min in the absence of apnea or hypopnea) or a central apnea index > 5/h, patients were also excluded.

The study design is illustrated in **Figure 2**. At the Malcom Randall VAMC all patients undergoing evaluation for suspected OSA attended an education and evaluation class before sleep testing. Patients routinely complete an Epworth Sleepiness Scale[13] and a screening sleep questionnaire. In approximately one-third of the classes, patients were given information about the study, and those interested in participating gave written permission to be contacted after their HSAT. HSAT was performed using a type III device (Embletta, Embla, Aurora, CO) that monitored nasal pressure, chest and abdominal movements with respiratory inductance plethysmography, body position, and arterial oxygen saturation. HSAT was part of the routine clinical management and not part of the research study. Hypopnea was defined as ≥ 30% decrease in the nasal pressure signal associated with ≥ 4% arterial oxygen desaturation. There was

a complete review of the medical record and sleep questionnaire prior to reading the HSAT studies as part of routine clinical care. Those patients who expressed a desire to be contacted about the study and who met the inclusion and exclusion criteria were contacted and informed of the diagnostic study results as well as additional details about the research study. Patients who chose to participate signed an informed consent and were randomized to one of two study arms. The method of randomization was by opening sequential envelopes prepared by the research service. The patients in both study arms completed a Functional Outcomes of Sleep Questionnaire (FOSQ)[14] after signing the informed consent.

In the PSG-CPAP arm, patients underwent an attended PSG PAP titration. Following the CPAP titration, patients in this study arm were started on CPAP based on the results of the titration. In the auto-titrating positive airway pressure (APAP) treatment arm patients were setup on an APAP device for chronic treatment. In both arms the patients were contacted one week after setup and interventions were performed for problems with PAP treatment. In both arms, patients returned for a clinic visit after 6 to 8 weeks of treatment and the PAP device was downloaded to determine objective adherence.

PSG PAP Titration and CPAP Treatment

The PAP titration was performed using standard techniques according to the guidelines of the American Academy of Sleep Medicine.[2,5,15] Monitoring included the recording of frontal, central, and occipital EEG derivations, left and right electrooculographic derivations, chin EMG derivations, ECG, the PAP device flow signal, chest and abdominal respiratory inductance plethysmography effort belts, pulse oximetry, left and right anterior tibial EMG, and PAP device pressure and leak signals. Signals were recorded by digital polysomnography with synchronized video/audio recording (Comet Amplifier, Grass Technologies, Warwick RI). Patients were allowed to try multiple mask interfaces prior to the study and to practice breathing on low levels of pressure before the sleep study. Heated humidity was routinely used. CPAP was titrated with the goal of finding an effective pressure (apnea-hypopnea index [AHI] $\leq$ 10/h) in all body positions and sleep stages if possible. The quality of CPAP titrations was graded as follows: optimal (AHI $\leq$ 5/h, supine REM sleep on the treatment pressure), good (AHI < 10/h, REM sleep on the treatment pressure), adequate (AHI < 10/h, supine NREM on the treatment pressure), or inadequate if none of these criteria were met. If the titration was inadequate patients were given the option of a repeat PSG titration study. Based on the titration, patients were started on CPAP (Philips-Respironics REM star Pro with flexible pressure) with heated humidity. The devices contained a data card to record adherence and also provided an estimate of the residual AHI.

At the time of CPAP setup, patients were trained on the use of the CPAP device and again given a choice of mask interface from a variety of nasal, nasal pillow, and oronasal interfaces. The patients practiced placing the mask and starting the CPAP device. They were given an opportunity to breathe on the device with the chosen interface. If they found the interface to be uncomfortable, a change of the interface was allowed. Patients were trained on use of the humidifier and cleaning of mask and humidifier chamber. The CPAP devices had the ability to deliver flexible pressure and patients were instructed on the use of this comfort option as well as use of the ramp option. PAP setup was performed by the clinical CPAP respiratory therapist staff as per routine procedure at our institution.

APAP Treatment

Patients randomized to this study arm underwent training on the use of an APAP device (Philips-Respironics REMstar Auto with heated humidification) with a pressure range set to 4 to 18 cm H_2O. If the patient felt that the starting pressure was inadequate the lower limit of the range was set to 6 or 8 cm H_2O for patient comfort. All devices had a data card and had AHI estimation and flexible pressure capability. Patients received the same education, mask fitting, and PAP practice as those who were setup on CPAP as per routine procedure at our institution.

Follow-up (Both Study Arms)

All patients had a PAP hotline number to call with concerns. Patients were called one week after starting treatment to determine adherence and identify problems. In the CPAP group if pressure intolerance or a sensation of inadequate pressure was a problem the patient was mailed a memory card resetting the pressure slightly lower or higher as needed. The patient also had the option of coming to the hospital for pressure adjustment. Patients could also receive an alternative interface by mail or come to the sleep center for mask adjustment if needed. In the APAP group, the lower pressure limit could be increased or the upper pressure limit decreased to improve patient comfort. A card was mailed to the patient allowing the device to be reset or the patient could come to the sleep center for pressure adjustments. A change in mask interface was also possible if indicated.

Clinic Visit

Patients were seen in clinic after being on treatment for 6 to 8 weeks. They completed an ESS and the FOSQ. The PAP satisfaction questionnaire (Appendix) was also completed. The device data card information was transferred to a computer and data analyzed by a computer program (Encore, Respironics). Available information included the days the device was used and the average nightly use. A residual AHI estimate and the 90% pressure (APAP devices) were also obtained from the machine data.

Analysis

The demographics, AHI, lowest SaO_2, and the pre-treatment ESS and FOSQ were compared between groups using the unpaired t-test (Analyze-it Software, Ltd, Leeds, UK). The time from the diagnostic study to the start of PAP therapy in both arms was also compared. The percentages of patients using PAP at 6 weeks (defined as PAP use $\geq$ 0.5 h/night) were compared (χ^2 analysis). Of the patients considered to be using PAP at 6 to 8 week clinic visit, the average nightly use (all nights, averaging in zero for nights not used), the residual AHI, and level of CPAP versus 90% pressure were compared using the unpaired t-test. The pre and post ESS and FOSQ were compared using the analysis of variance with repeated measures with a mixed design (MedCalc Software, Belgium). The repeated measures were pre and post treatment results and the group (APAP

Table 2—Demographics and pre-treatment characteristics of patients.

	All Participants after Randomization			Participants Using CPAP at Clinic Visit		
	APAP Arm (pre-treatment)	PSG-CPAP (pre-treatment)	p	APAP (pre-treatment)	PSG-CPAP (pre-treatment)	p
N	78	78		66	59	NS
Age (years)	57.7 ± 12.1	59.7 ± 12.6	NS	57.1 ± 11.9	60.1 ± 11.6	NS
BMI (kg/m^2)	34.2 ± 5.8	34.9 ± 6.0	NS	34.1 ± 5.7	35.5 ± 5.6	NS
M/F	73/5	72/6		64/2	55/4	
AHI (/hour)	28.6 ± 18.5	28.3 ± 16.0	NS	28.8 ± 18.9	31.4 ± 18.3	NS
Low SaO_2 (%)	78.9 ± 11.2	79.9 ± 6.6	NS	79.0 ± 11.7	77.6 ± 14.9	NS
ESS*	15.2 ± 4.4	14.3 ± 4.6	NS	15.2 ± 4.4	14.5 ± 4.7	NS
FOSQ*	12.7 ± 3.7	13.6 ± 3.5	NS	12.6 ± 3.4	13.3 ± 3.5	NS

Values are means ± SD. * Values prior to treatment. ESS, Epworth Sleepiness Scale; FOSQ, Functional Outcomes of Sleep Questionnaire; APAP, auto-adjusting positive airway pressure; PSG-CPAP, positive airway pressure titration with polysomnography followed by CPAP treatment; M/F, male/female.

Table 3—Comparison of data at clinic visit.

	APAP	CPAP	APAP versus CPAP
PAP setups (#.)	78	70	
Using CPAP at clinic visit	66	59	
% Using CPAP (of those started on PAP)	84.6	84.3	p = NS
90% pressure/CPAP pressure (cm H_2O)	10.8 ± 3.1	11.7 ± 2.5	p = 0.07
Average nightly use (h)	4.45 ± 2.3	4.0 ± 2.3	p = 0.26
Residual AHI (#/h)	5.5 ± 4.7	4.9 ± 4.9	p = 0.49
Post treatment ESS	11.0 ± 5.1*	10.8 ± 3.5*	
Change ESS	−4.2 ± 4.7	−3.7 ± 4.8	p = 0.15
Post treatment FOSQ	15.2 ± 3.2*	15.5 ± 3.4*	
Change FOSQ	2.6 ± 3.5	2.2 ± 3.7	p = 0.33
PAP satisfaction	11.8 ± 2.3	10.7 ± 3.1	p = 0.03

ESS, Epworth Sleepiness Scale; FOSQ, Functional Outcomes of Sleep Questionnaire; PAP satisfaction (see Appendix). * $p < 0.001$ pre versus post (see Table 2 for pre value).

versus CPAP) was the non-repeated factor. A p value < 0.05 was considered statistically significant. Results are displayed as the mean ± SD unless otherwise specified. A non-inferiority analysis was performed with Study Size 2.0 software (Creostat HB, Frolunda, Sweden) to determine the non-inferiority limit (APAP no worse than PSG/CPAP) for a power of 0.8 with a level of significance of 0.05 using the number of subjects and the standard deviation of the average daily PAP use.[16]

RESULTS

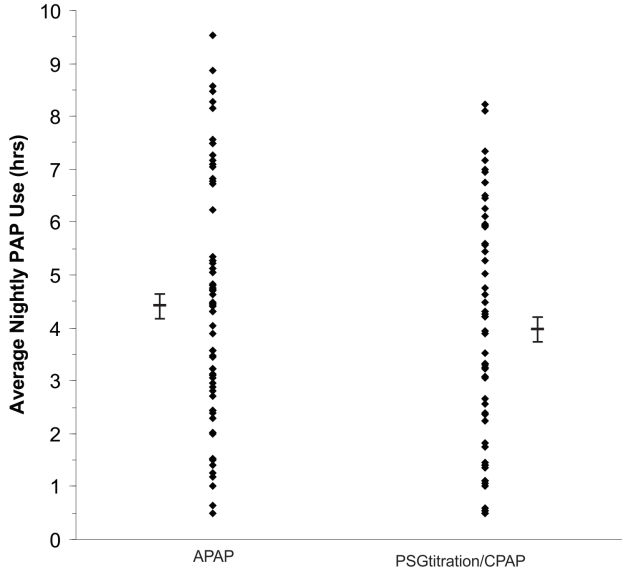
During the duration of the study 3,075 patients attended the education and evaluation classes and 1,100 were informed about the study and given a chance to express interest in participation. Of the 240 patients expressing an interest in study participation, only 156 met inclusion and exclusion criteria and signed a consent (65%). Of the 84 patients not enrolled 39.3% had an AHI < 10/h, 20% had an ESS < 8, 10.7% had central apneas, 9.5% had an uncontrolled psychiatric disorder, 3.6% were taking potent narcotics, and 7.1% had various exclusions such as a low baseline sleeping SaO_2. Another 9.5% of patients met inclusion and exclusion criteria but were not enrolled due to scheduling issues. The demographic and *pre-treatment* ESS and FOSQ values for patients randomized to each arm and those using PAP at the clinic visit are shown in **Table 2**. The patients were well matched for age, BMI, AHI, and low SaO_2, and ESS. The patients in both groups were obese and had moderate-to-severe sleep apnea. The ESS data showed that the patients had severe sleepiness on average. Eight patients in the PSG/CPAP arm declined CPAP treatment following the CPAP titration. Therefore, more patients were setup on APAP (N = 78) than CPAP (N = 70). Of the 78 PSG PAP titrations, 43 were optimal, 20 were good, 9 were acceptable, and 6 were unsatisfactory. Of the 6 patients having an unsatisfactory titration 4 could not tolerate CPAP and 2 had treatment-emergent central apneas. All of these patients were offered a repeat titration but declined. These patients and another 2 with good titrations declined being setup on CPAP treatment.

The results of the clinic visit are shown in **Table 3**. The average 90% APAP pressure was slightly lower than the CPAP pressure (p = 0.07). The difference was < 1 cm H_2O and is unlikely to be clinically significant. The average nightly use was slightly higher in the APAP study arm (**Figure 3**). However, the mean difference was relatively small and not statistically significant. When we chose a non-inferiority limit of 0.55 h (APAP adherence is no worse than 0.55 h less than PAP-PSG/CPAP adherence), a level of significance of 0.05 and used the mean difference and standard deviations found in our study, we

calculated the power of our study to be 0.80. A smaller difference in hours of adherence would be unlikely to have clinical significance. Thus, the study had reasonable power to establish that the APAP study arm was not inferior to the PSG titration/CPAP treatment arm.

The residual AHI values in both groups were very similar and low. The PAP satisfaction was slightly higher in the APAP arm ($p < 0.05$). The pre-treatment values of the ESS and FOSQ are shown in **Table 2** and the post-treatment values in **Table 3**. There was a significant improvement in both the Epworth Sleepiness Scale and FOSQ in both treatment arms ($p < 0.001$). However, the improvement in ESS and FOSQ following therapy did not differ between the treatment arms (**Table 3**). That is, the mixed design analysis of variance for repeated measures found the pre-post treatment condition was significant and the interaction (pre-post versus group) was not significant. The time from the diagnostic study to PAP setup was 50.4 ± 37.8 days in the APAP treatment group and 77.6 ± 33.2 days in the PSG titration/CPAP treatment group ($p < 0.001$).

Figure 3—The average nightly PAP adherence in hours for patients in the auto-adjusting positive airway pressure (APAP) arm and the PAP titration by polysomnography followed by CPAP treatment study arm.



The mean ± SEM for each group is also illustrated. Adherence was slightly higher in the APAP arm, but the difference was not statistically significant.

DISCUSSION

The main findings of the study are that APAP treatment of carefully selected patients diagnosed with OSA by HSAT resulted in PAP adherence and clinical improvement equivalent to that from the standard approach of a PSG PAP titration followed by CPAP treatment. In our study the adherence in the APAP group was slightly but not statistically significantly higher. In several meta-analysis of studies comparing CPAP and APAP adherence, there was either no or a small but clinically insignificant advantage to APAP.[17-20] The average nightly PAP use at the first clinic visit in our study for both study arms was certainly lower than desired. However, our nightly adherence values are comparable to those found in a study by Kuna et al. of a VA population similar to the one we studied.[11] The patient population treated at VA Medical centers is challenging due to the high percentage of comorbid conditions including depression and the post-traumatic stress syndrome.[21] In both treatment arms subjective sleepiness (ESS) and the quality of life (FOSQ) improved significantly after treatment. However, the improvements in subjective sleepiness (ESS) and quality of life did not differ between our treatment arms. On the other hand there was a slightly higher satisfaction with APAP than CPAP treatment. The difference, while statistically significant, is unlikely to be clinically significant.

Patients with the APAP study arm were started on treatment about 1 month sooner following diagnosis. One of the potential benefits of APAP treatment following HSAT diagnosis is that treatment is not delayed by the need to complete a PAP titration. This potential advantage may be irrelevant if PAP titration can be scheduled in a timely manner. It is unknown if the delay of one month in starting PAP treatment in the PSG titration - CPAP arm compared to the APAP treatment arm in our study had clinical significance. For example, this could have affected patient satisfaction or dropout rate. It is possible that the slightly lower PAP satisfaction and slightly higher dropout rate in the PSG-titration CPAP arm was due to the longer delay in treatment initiation. In both study arms, the mean delay in starting treatment was longer than desired. PAP was initiated by clinical CPAP respiratory therapists, and setup was often delayed based on both patient availability and PAP setup appointment availability.

Our study has a number of limitations. First, the results of a study based on a middle-aged and older predominantly male veteran population with symptomatic sleep apnea (average ESS approximately 15 and 14, **Table 2**) may not generalize to other patient populations (including those who are not sleepy). Studies comparing clinical pathways in populations that are not sleepy are needed.

Our patients were carefully selected and a complete medical history of each patient was available for review in the VA electronic medical record. Of note, only 22% of patients offered study participation expressed interest in the study. It is possible that a "volunteer bias" with selection of more motivated patients could have affected our results. While there is always some concern about selection bias, once enrolled the randomization resulted in two study groups very equivalent in age, BMI, apnea severity, and sleepiness. While only 66% of patients expressing interest in the study were enrolled, the largest exclusions were a low AHI or absence of subjective sleepiness.

One of the exclusions in our study was medical non-adherence. The patient's problem list in the medical record and current progress notes from the primary care provider were reviewed to determine if the patient had a history of medical non-adherence including repeated failure to attend scheduled clinic appointments or documented non-adherence to prescription medications. It is possible that excluding patients with non-adherence affected our results.

The durable medical equipment services including PAP setup and troubleshooting were provided directly by skilled

VA respiratory therapists. Interfaces could be replaced without regard to cost. Patients in the private sector may not have the benefit of a setup by skilled therapists who provide systematic education and have the patients try the chosen mask under pressure at the time of setup. On the other hand, our patients were not subject to loss of their equipment if their adherence was inadequate as is common in the non-VA sector for patients covered by Medicare or private insurance carriers.

Our study was designed to compare two commonly used clinical pathways to initiate PAP treatment following a diagnosis of OSA by HSAT. However, our pathways differed based on the presence or absence of a titration as well as the treatment device utilized (CPAP versus APAP). In general studies have not shown a significant clinical advantage to APAP versus CPAP treatment in patient's initially undergoing a CPAP titration.[19,20] We are not aware of a study comparing APAP treatment with or without an initial attended CPAP titration. There could be an advantage to using APAP set with a narrow range around the optimal CPAP level determined by a titration. For example, if the titration suggested CPAP of 12 cm H_2O was the optimal pressure, APAP treatment with a pressure range of 10 to 14 cm H_2O could be used. A study comparing APAP treatment with and without a preceding CPAP titration might provide clinically useful information.

We only compared adherence over the initial six weeks of treatment. It is possible that monitoring adherence over a longer interval may have resulted in different findings. However, studies have shown that short-term adherence is predictive of long-term adherence.[22-25] Our choice of a short period of evaluation was to avoid a large number of patients lost to follow-up.

Treatment with APAP devices without a titration has a number of limitations. Treatment efficacy is often assessed by the device determined residual AHI at follow-up. The device determined residual AHI can differ from that obtained from PSG,[26,27] and arterial oxygen saturation on treatment is not known unless oximetry is performed while patients use APAP.[12] A study by Denotti et al. found a surprising amount of residual sleep disordered breathing in patients being treated with APAP.[28] The APAP titration algorithms do vary between manufacturers. It is possible that the results of our study would not generalize to populations using other APAP devices. In any case, there is always some uncertainty about adequacy of the APAP treatment without a prior PSG titration. On the other hand, a low residual AHI on a PAP device download usually is consistent with adequate treatment.[26] As the average residual AHI in the APAP group was slightly higher than the PSG-titration CPAP group ($p = 0.49$), there is a concern that APAP slightly undertitrated patients compared to in-lab PAP titrations. We reviewed the data and found that only 5 of 66 patients in the APAP group and 4 of 59 patients in the PSG-titration CPAP group had a residual AHI greater than 10/hour. The AHI by both CPAP and APAP devices in our study used the same event detection algorithm. Thus, based on the residual AHI, treatment with APAP was equally as successful as treatment with CPAP.

A PAP PSG titration allows patients to trial a number of interfaces and if a mask interface is uncomfortable it can be changed during the titration. In contrast, if a patient is started on APAP treatment and the mask interface is found to be problematic, there is often a time delay before a replacement interface is available. Using a correct interface is important, as studies have shown that APAP devices may not perform well with high leak, and the high leak is associated with poor adherence.[29] In our study, the mask interface could be changed as needed without financial restraints. A change of interface may not be possible or timely in the private sector.

In summary, our results suggest that APAP treatment of patients diagnosed with moderate to severe OSA by HSAT can result in equivalent PAP adherence and improvement in subjective sleepiness and quality of life compared to an approach using a PAP PSG titration followed by CPAP treatment if patients are carefully selected. Selection criteria should focus on a patient population likely to be successfully treated by APAP. Careful and timely follow-up is needed to ensure efficacious treatment as well as adequate adherence. Any patient not experiencing clinical improvement after APAP treatment without a PAP titration should undergo careful re-evaluation and an attended PAP titration if clinically indicated.[6]

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APPENDIX

PAP Satisfaction Questionnaire

	Dissatisfied		Undecided		Very pleased
How do you feel about PAP treatment in general?	1	2	3	4	5
How do you feel about improvement in your symptoms?	1	2	3	4	5
	PAP Less effective		Undecided		PAP more effective
How do you feel regarding control of your daytime sleepiness compared to the way you felt before starting PAP?	1	2	3	4	5