Research Article

Evaluation of a Structured Follow-up in Patients with Obstructive Sleep Apnea Syndrome Receiving Continuous Positive Airway Pressure Therapy

Julia Ritter*, Katharina Geißler, Gerlind Schneider, and Orlando Guntinas-Lichius

Department of Otorhinolaryngology, Jena University Hospital, Germany

Abstract

Continuous positive airway pressure (CPAP) therapy is the most successful conservative therapy for obstructive sleep apnea syndrome (OSAS). However, CPAP adherence is dissatisfying. We analyzed the most common problems with CPAP therapy and evaluated if a structured follow-up program enhances its adherence.

In this retrospective clinical-effectiveness study all patients (n=237) with a newly adjusted CPAP therapy due to the diagnosis of mild to severe OSAS were investigated. We ascertained data of the standardized follow-up between 2011 and 2013. Follow-up took place every 1593.7 ± 77.4 CPAP operation hours.

79% fulfilled the criteria of CPAP adherence as measured by operation hours. There were no significant influences on CPAP adherence seen in patients' demographic, clinical and pharmacological characteristics. The most common problems of patients receiving a CPAP therapy were dryness of the mucous membranes (43.7%) and pressure marks (22.4%). Considering the changes in Epworth Sleepiness Scale there were no significant relations to CPAP adherence, whereas Pittsburgh sleep quality index significantly correlated with CPAP-adherence (r=-0.345; p<0.001). Apnea-hypopnea-index (AHI) at baseline, AHI difference, as well as satisfaction with our follow-up significantly correlated with CPAP adherence (r=0.185; p=0.032), whereas therapy pressure did not have any significant influence on CPAP adherence.

In conclusion, a structured and individually adapted follow-up is very important. In future, apart from control of therapy success, greater attention in the follow-up of CPAP therapy should be given to aspects of feedback, education, motivation and problem solution.

INTRODUCTION

Continuous positive airway pressure (CPAP) therapy, first introduced by Sullivan [1], is the most successful conservative treatment for obstructive sleep apnea syndrome (OSAS) [2,3]. Pneumatic splinting of the upper airways results in a reduction of respiratory disorder, snoring, daytime sleepiness und cardiovascular risk [2]. However, CPAP adherence is dissatisfying [3-7]. There are inconsistent results concerning the influence of factors such as age, sex or economic status, as well as clinical factors such as medication on CPAP adherence [8]. Social characteristics, as for instance marital status or employment level seem to have a significant influence CPAP adherence [9]. Problems emerging after initiation of CPAP therapy, such as skin abrasion caused by the mask or claustrophobia, also seem to influence CPAP adherence [10-12] and are much easier available for interventions. Because of all these problems, the Adult Obstructive Sleep Apnea Task Force of the American Academy of Sleep Medicine (ASSM) [13] gives recommendations for patient education and long-term management in patients receiving CPAP therapy. They point out the importance of a close follow-up, especially in the first few weeks of CPAP use, but underline a yearly long-term follow-up as optional [14]. De facto, follow-up is inconsistent for many patients in clinical routine. A large number of patients might not receive the required support in the approach to technical and medical issues of CPAP therapy. Due to that, long-term follow-up with the opportunities to offer education, a professional feedback, approaches for problem solutions and hence, increasing therapy motivation, must get an inherent feature of therapy. The objective of our work was to find out if a standardized follow-up model is able to increase CPAP adherence, as measured by operation hours, compared to the values given in literature. Besides, we analyzed the most common problems of patients receiving CPAP therapy to acquire basic approaches for problem solution as helpful tools in a structured follow-up.

MATERIALS AND METHODS

Patients

In this study we examined all 237 patients (61.05 ± 11.47 years old, 175 male) with a newly adjusted CPAP therapy due to

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the diagnosis of an OSAS in accordance to the guidelines of the German Sleep Society (DGSM) with differentiation according to severity. Briefly, these guidelines recommend CPAP therapy as standard therapy for moderate and severe OSAS, as well as for mild OSAS in special cases (cardiovascular risk factors, no opportunities for therapy alternatives). All patients received our structured follow-up in the period between June 2011 and May 2013. There were no exclusion criteria. The median follow-up was 33 months. The characteristics of the patient population are summarized in Table 1.

CPAP adjustment and follow-up

Figure 1 shows the follow-up algorithm. All patients received standard diagnostics for diagnosis of OSAS. Before CPAP adjustment, patients obtained information and education concerning OSAS and CPAP therapy in a special consultation. All patients attended our consultation hour for the first time four weeks after adjustment of CPAP therapy. Subsequently, the intervals for the next follow-up dates were determined depending on the patients' complaints:

a) In unproblematic cases, the next consultation followed after six months, later once a year and finally every two years; b) In patients with problems concerning CPAP therapy, which could not be solved during one consultation, as well as in patients with an insufficient CPAP adherence, individually adapted consultations were planned in more frequent intervals. As a standard, each consultation was performed by an otorhinolaryngologist specialized in sleep medicine together with a service technician for CPAP devices. Herein the proper functioning of the device was controlled. The operation hours of the CPAP device were checked and it was analyzed whether the adjusted pressure of the device in the upper airways was adequate to receive an apnea-hypopnea index (AHI) less than 10/h. Furthermore, technical, functional and medical issues of CPAP therapy were discussed with the objective of problem solving. The consistent follow-up intervals were also thought to increase the patients' motivation to continue therapy, despite initial difficulties. Moreover, the follow-up was convenient for adapting or modifying therapy in time, if necessary, or for finding indications for further medical interventions. In selected cases it was necessary to indicate a therapy control by polysomnography in the sleep laboratory with the opportunity to adapt therapy pressure.

Data acquisition

A retrospective data analysis of all 237 patients was performed. The clinical experiments conformed to the principles outlined by the Declaration of Helsinki.

We used the AHI as a value for the severity of OSAS and therapy success. For correlation analyses we used the percentage gap between AHI at baseline and at follow-up. We used operation hours as a value for CPAP adherence. Furthermore, the influence of therapy pressure on CPAP adherence was examined. The demographic and clinical parameters, such as age, gender, body mass index and medication were assessed. The Charlson Comorbidity Index was used as marker for the severity of accompanying illnesses [15]. Furthermore, questionnaires were used for the capture of quality of life and sleep in patients

Table 1: Clinical and demographic characteristics of the patient population.

Follow up (in months)	
Median	33
Maximum	168
Minimum	1
Consultation hours per year	
Median	1.7
Mean ± SD	1.75 ± 0.48
Demographic characteristics	
Total, n	237
Female, n	62
Male, n	175
Mean ± SD age (in years)	61.1 ± 11.5
Youngest/ oldest patient (in years)	26/ 88
Participation in Questionnaires, n	174
Employed persons, n	74
Unemployed/ retired persons, n	100
Clinical characteristics	
Severity of OSAS	
mild, n	23
moderate, n	98
severe, n	102
Therapy pressure (in mbar)	
Median	8.0
Mean ± SD	8.17 ± 0.99
< 8, n	43
= 8, n	117
> 8, n	56
Body mass index (BMI) ± SD	30.4 ± 8.1
Charlson Comorbidity Index ± SD	1.2 ± 1.1
Pharmacological characteristics	
No medication, n	65
Antihypertensives, n	138
Antidiabetics, n	27
Permanent usage of analgetics, n	10
Antidepressants, n	21
Others, n	136

receiving CPAP therapy (Epworth Sleepiness Scale [ESS] [16] and Pittsburgh Sleep Quality Index [17]), as well as surveys about satisfaction with CPAP therapy and follow-up by mail. 174 of 237 patients (return rate: 73.4%) took part in that survey.

Epworth sleepiness scale

ESS is a questionnaire for grading the disposition for falling asleep at daytime in eight predefined, typical situations at a scale between 0 and 3 for assessing daytime sleepiness [16]. The score can vary between 0 and 24 points. Higher values correspond to a worse quality of sleep. The test was performed twice in each patient (before starting therapy and in May 2013, after time of their particular follow-up).

Pittsburgh sleep quality index

Pittsburgh Sleep Quality Index (PSQI) is a valid test for assessing quality of sleep in between the last four weeks. Eighteen questions for self-assessment of sleep quality, sleeping times, latency of falling asleep, sleep duration, sleep medication and daytime sleepiness are summarized in 7 components, which are then added for a total value, varying between 0 and 21 points. Higher values correspond to a worse quality of sleep [17].The test was performed once in each patient in May 2013.
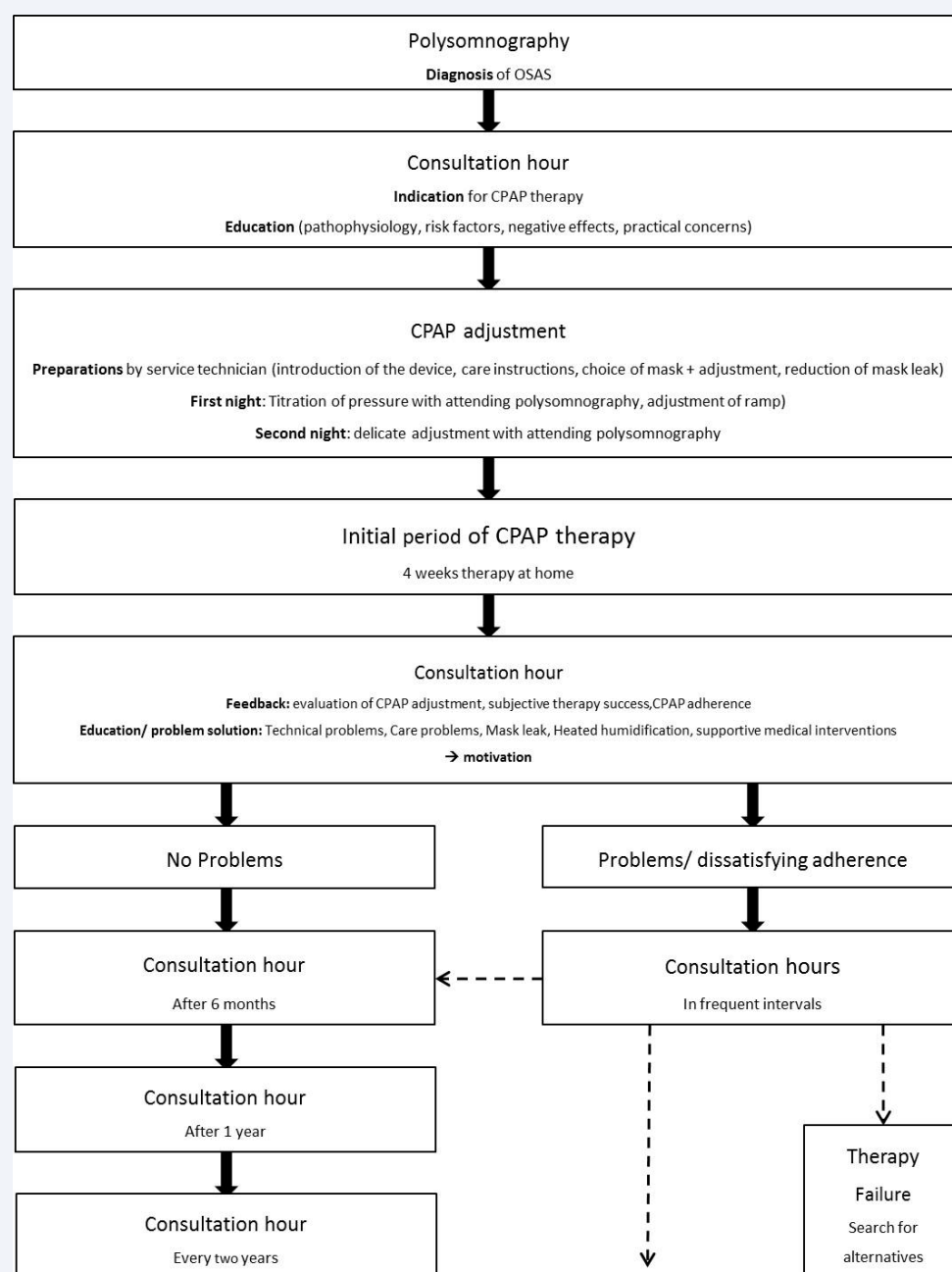
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Figure 1

Assessment of satisfaction with CPAP therapy and follow-up

For detection of the subjective satisfaction with CPAP therapy a questionnaire was developed with five questions to assess snoring, daytime sleepiness, quality of life with CPAP therapy, motivation for therapy and the most common problems with CPAP therapy (Table 2). On a scale between 0 and 10 the value "10" represented the highest possible satisfaction with therapy. Moreover, there are four questions for assessing satisfaction with follow-up to experience more about the importance of the follow-up for CPAP adherence. On a scale between 0 and 6 the value "6" represented the highest possible satisfaction with follow-up. Additionally, we wanted to determine, whether problems with

the therapy could be solved within our follow-up consultations (table 3). For that reason we defined scores (high values reflect high satisfaction) as shown in Table 2 and 3.

Assessment of operation hours of CPAP therapy

Operation hours were partially read from the patients' devices, partially patients had to be asked to provide information about their average operation hours, because some of the devices were too old (in approximately 50 percent). It was documented how many hours per night and how many nights per week CPAP therapy were used. 204 of 237 patients (86.1%) took part in that survey. We compared our results to the data of former investigations [5,6]. Predominantly, a value of >4 hours per night

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Table 2: Evaluation of CPAP therapy.		
Question	**Score**	**n**
Since I receive CPAP therapy, my snoring has ...		
... improved obviously.	2	148
... not changed considerably.	1	8
... impaired obviously.	0	0
Since I receive CPAP therapy, my daytime sleepiness has ...		
... improved obviously.	2	104
... not changed considerably.	1	58
... impaired obviously.	0	1
Since I receive CPAP therapy, my quality of life has ...		
... improved obviously.	2	101
... not changed considerably.	1	60
... impaired obviously.	0	1
Did you ever have the feeling, you would like to abandon therapy?		
... No, I managed therapy from the beginning.	2[1]	93
... Yes, at the beginning. Later I got used to it.	1[1]	55
... Yes. But with the help of the follow-up I attempted continuing therapy, despite initial difficulties. Now, I get along better.	1[1]	25
	0	3
... Yes, I'd preferably abandon therapy.	0	3
... Yes, I abandoned this way of therapy for myself.		
Concerning CPAP therapy I had the following problems:		
Dryness of the mucous membranes	1[2]	76
Pressure marks	2[3]	39
Volume/ Light of the device		30
Infections of the upper airways		29
Upsetting the partner		29
Difficulties in sleeping through		20
Conjunctivitis		18
Skin irritation		16
Difficulties in falling asleep		16
Difficulties in service		9
Claustrophobia		8
No problems	0	80
[1] Maximum 2 points attainable (only one equal value counts)		
[2] Maximum 3 different problems mentioned		
[3] More than 3 different problems mentioned		

on 7 days a week had been regarded as CPAP adherence [6]. There are strongly deviating results concerning the amount of long-term non-responders to CPAP therapy, varying from 29 to 83% [4,6].

Statistical evaluation

For evaluation of the data we used the analysis software SPSS 17.0 for Windows (SPSS inc., Chicago, Illinois, USA). Descriptive statistics were used to describe the basic data as mean value ± standard deviation. To examine differences of the parameters before therapy and at follow-up, we used the Wilcoxon signed-rank test for two paired samples. For capturing the potential relationships between different factors we performed correlation analyses using Pearson correlation coefficient. A level of p≤0.05 was accepted to be significant.

RESULTS

Objective therapy success

Objective therapy success was defined by AHI. The AHI at baseline, which was ascertained by polysomnography before therapy, was 40.3 ± 19.5/h. With continuous therapy the AHI decreased significantly (5.6 ± 8.5/h (p<0.001)). Table 4 shows more details and classification of OSAS according to severity. Patients with a severe OSAS had a significantly higher therapy pressure (r=0.239; p<0.001), but also a significantly greater therapy success (r=0.146; p=0.035). A high therapy pressure resulted in a higher reduction of AHI with continuous therapy (r=0.151; p=0.031). Objective therapy success was associated with a reduction of snoring (r=-0.322; p<0.001), but not with quality of life (r=-0.151; p=0.066) or daytime sleepiness (r=-0.009; p=0.910).

Subjective therapy success

Epworth Sleepiness Scale: The ESS value at baseline was 7.9 ± 4.4, at follow-up it did not decrease significantly (7.2 ± 3.6; p=0.082). ESS at baseline showed a significant correlation to AHI at baseline (r=0.271; p=0.006). ESS during therapy significantly correlated to AHI at follow-up (r=0.158; p=0.046). Neither ESS

Table 3: Evaluation of follow-up.		
Question	**Score**	**n**
I take part in the regular follow-up, ...		
... because my doctor tells me, I have to.	0	18
... to address my problems with CPAP therapy.	1[1]	70
... to check the functionality of my device and the effect of therapy routinely.	1[1]	137
Are you satisfied with the intervals of the follow-up dates?		
... The intervals are right/ I would like to come more often.	2	109
... The intervals are too short, I'd like to come less often.	1	46
... I'd preferably come to the follow-up dates no more.	0	10
Could your problems with therapy be solved in the frame of the follow-up dates?		
... I never had any problems	2[2]	44
... Problems could be solved completely.	1[2]	21
... Problems could be solved partially.	2[2]	56
... Problems could not be solved.	0	36
How would you assess the importance of a structured follow-up concerning CPAP therapy?		
... It's not necessary.	0	9
... The follow-up dates helped me persevering CPAP therapy.	1[1]	50
... In the follow-up dates I receive a feedback for the success of my therapy.	1[1]	67
... Problems could be cleared up, so it was easier to continue CPAP therapy.	1[1]	58
... without follow-up I would have abandoned CPAP therapy.	1[1]	13
[1] Maximum 1 point attainable (only one equal value counts)		
[2] Maximum 2 points attainable (only one equal value counts)		

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baseline value (r=0.345; p=0.594), nor ESS at follow-up (r=0,451; p=0.054) showed any significant relations to CPAP adherence.

Pittsburgh Sleep Quality Index: 49.4% of the patients receiving CPAP therapy showed a PSQI value above the cut-off value of 5 (average: 5.9 ± 3.0). For PSQI we could find a statistically significant correlation with objective therapy success (r=-0.174; p=0,033). Furthermore, PSQI significantly correlated with CPAP adherence (r=-0.345; p<0.001).

Satisfaction with CPAP therapy: Satisfaction with therapy was 7.9 ± 1.4. There was a significant correlation between satisfaction with therapy and sleeping duration (r=0.207; p=0.009), as well as latency of falling asleep (r=-0.234; p=0.003). Satisfaction with therapy also significantly correlated with therapy success, as measured by AHI difference (r=0.233; p=0.005). Therapy pressure did not have any significant influence on satisfaction with therapy (r=-0.072; p=0.383). Table 2 shows how patients assessed development of snoring, daytime sleepiness and quality of life at follow-up and the most common problems with CPAP therapy.

CPAP adherence

CPAP adherence was defined by operation hours of CPAP therapy. The results are shown in Table 5. Demographic, clinical and pharmacological characteristics, such as age (p=0.355), gender (p=0.088), body mass index (p=0.064), Charlson Comorbidity Index (p=0.893) and medication (p=0.583) had no significant influences on CPAP adherence. There were no correlations with daytime sleepiness (p=0.556) or snoring at baseline (p=0.887). CPAP adherence was significantly higher, the more severe OSAS was at baseline (r=0.180; p=0.013) and the more successful therapy was, as measured by AHI (r=0.197; p=0.007).

Follow-up

Follow-up took place every 1593.7 ± 77.4 CPAP operation hours. The median account of consultation hours in our sample was 1.7 per year. Patients with a better CPAP adherence, as measured by operation hours, embraced follow-up less frequent (r=-0.174; p=0,013). The less satisfied patients were with CPAP therapy, the more frequent they attended the consultation hours (r=-0.275; p<0.001).

Satisfaction with follow-up was 4.7 ± 1.2. Table 3 gives an overview about the patients' answers concerning satisfaction with follow-up. . Satisfaction with follow-up significantly correlated with PSQI (r=-0.176; p=0.033) and CPAP adherence (r=0.185; p=0.032).

Influencing factors

Age: On average, younger patients needed a higher therapy pressure than older people (r=0.159; p=0.020). Besides that, the patients' age did not show any significant correlations to the parameters of objective therapy success (p=0.271) or CPAP adherence (p=0.355).

: BMI was significantly higher in patients with a high baseline value for AHI (r=0.332; p<0.001). Patients with a lower BMI attended our consultation hours more often (r=-0.162; p=0.038).

No significant correlations could be shown for ESS (r=0.168; p=0.160), PSQI (r=0.013; p=0.870), satisfaction with therapy (r=0.090; p=0.263) and follow-up (r=-0.053; p=0.524).

Charlson Comorbidity Index: A higher Charlson Comorbidity Index was significantly associated with more problems concerning CPAP therapy as reported by the patients (r=0.276; p<0.001).

Medication: Patients taking antihypertensive drugs had significantly more problems with CPAP therapy (r=0.189; p=0.015). In contrast, patients taking antidepressants had significantly more consultation hours per year than patients that did not (r=0.185; p=0.005). Other long-term medication, such as antidiabetic drugs, showed no further significant influences.

Gender: Women attended consultations significantly more often per year than men (r=0.203; p=0.002). Men had a significant higher therapy pressure than women (r=-0.157; p=0.022). Besides that, there were no verifiable gender-specific differences.

Employment status: Employed OSAS patients tend to have less problems with CPAP therapy than unemployed or retired OSAS patients (r=-0.150; p=0.054). In contrast, CPAP adherence was significantly better in unemployed or retired OSAS patients (r=-0.203; p=0.012).

Table 4: Changes of AHI and severity level of OSAS during therapy.

	Baseline value	Follow-up
AHI ± SD (/h)	40.3 ± 19.5	5.6 ± 8.5
Maximum (/h)	106.5	56.0
Minimum (/h)	10.7	0.0
Severity level of OSAS		
Severe OSAS, n	102	4
Moderate OSAS, n	98	9
Mild OSAS, n	23	17
No OSAS, n	0	185
Unknown[1], n	14	22

[1] concerns patients with no documented baseline AHI value and patients with older devices from which reading AHI value is not possible/ AHI at follow-up was not documented

Table 5: Operation hours of the CPAP device and CPAP adherence.

Operation hours	
Hours per night ± SD	6.1 ± 2.4
Nights per week ± SD	6.2 ± 2.1
Hours per week ± SD	41.4 ± 17.4
Sleeping time (hours per night) ± SD	6.6 ± 1.2
Operation hours related to sleeping time (%)	92.2
CPAP adherence	
Operation hours of at least 5 on 5 days	
n	157
%	78.5
Operation hours of at least 4 on 7 days	
n	158
%	79.0
No operation hours (therapy abandoned)	
n	16
%	8.0

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Characteristics of Sleep: Patients with a low latency of falling asleep had less problems with CPAP therapy (r=0.283; p<0.001). Satisfaction with therapy was significantly better in patients who had a briefer latency of falling asleep (r=-0.234; p=0.003). Patients with a shorter sleeping duration had obviously more problems with CPAP therapy (r=-0.171; p=0.028) and were more dissatisfied with CPAP therapy (r=0.207; p=0.009).

DISCUSSION

In this study the influence of a structured and individually adapted follow-up on CPAP adherence in all 237 patients with a newly adjusted CPAP therapy due to the diagnosis of mild to severe OSAS was determined. Therapy success was defined by AHI, CPAP adherence by operation hours and satisfaction with therapy and follow-up by different questionnaires. Contemporary, worldwide guidelines for the follow-up of patients with OSAS receiving a CPAP therapy are inconsistent and worded in general terms. The Adult Obstructive Sleep Apnea Task Force of the American Academy of Sleep Medicine (AASM) gives recommendations concerning patients' education and long-term management for patients treated with CPAP [13]. Here, the focus is on a continuous follow-up for the first weeks of CPAP use, whereas long-term follow-up is not a standard, but rather an option [14].

On the other hand, long-term CPAP adherence, ranging from 17-71% in literature, is dissatisfying [3-7]. Former studies

Table 6: CPAP adherence in the current study compared to former investigations.

Criteriafor CPAP adherence	CPAP adherence (%)		
	Weaver et al. 2008	McArdle et al. 1999	Currentstudy
>4 hours on 7 days	17-71	-	79
5 hours on 5 days	-	<70	78.5

Table 7: Solution approaches for the most common problems with CPAP therapy.

Problem	Solution approaches
Dryness of the mucous membranes, infections of the upper airways, conjunctivitis	Care advices (saline or cortisone-containing nose-sprays, nasal douche etc.), heated humidification, change of mask type/ mask size, reduction of the inferior nasal turbinates by CO2-Laser or surgery, septal surgery, functional septorhinoplasty
Pressure marks, skin irritation	Change of mask size/ mask type, adjustment of the tie, individually manufactured mask insets, skin care
Difficulties in service	Re-education, special education
Upsetting the partner	Education of the partner
Claustrophobia	Change of the mask type (open mask, nasal plugs)
Difficulties in falling asleep	Adjusting ramp function
Non-adherence from not determinable reasons or insoluble problems	Finding alternatives by the means of DISE (drug-induced sleep endoscopy): surgery of the tonsils, base of the tongue or the soft palate, nitinol stents for the splinting of the nasopharyngeal and upper oropharyngeal region, upper-airway stimulation devices

showed the positive effects of a follow-up including mask optimization, heated humidification, topical nasal therapy, and sleep apnea education on CPAP adherence [18]. In our investigations, patients receiving a structured follow-up (with due regard to the criteria: 4 operation hours on 7 days), showed an obviously higher long-term CPAP adherence of 79%. An overview about CPAP adherence in the current study compared to former investigations is given in Table 6.

Earlier studies investigated the potential influence of social, epidemiological and medical factors on long-term CPAP adherence, which is a quite important aspect for estimating presumable therapy success prior to therapy und to construct a risk profile for potential non-responders [12]. In the present study, patients with a higher Charlson Comorbidity Index, as well as patients taking antihypertensive drugs, had significantly more problems with CPAP therapy. However, CPAP adherence was the same, compared to less comorbid patients. Therapy pressure did not seem to influence CPAP adherence, as well. There were no significant differences concerning CPAP adherence in the parameters gender, age, BMI or intake of antidiabetics and antidepressants. Our study population showed a remarkably low value for baseline ESS (7.9 ± 4.4) with no significant decrease at follow-up (7.2 ± 3.6; p=0.082). This fact implicates, that the level of suffering induced by OSAS in our study population seems to be low. A low level of suffering induced by OSAS would be conceivable to be a reason for a bad therapy adherence, because disadvantages und discomfort caused by CPAP therapy predominates in the eyes of the patients. A low ESS at baseline is an imaginable risk factor for bad CPAP adherence.

In our study, the latency of falling asleep was shown to be an important factor for satisfaction with therapy and CPAP adherence. This fact should be emphasized more in the future and patients with a poor CPAP adherence should be interviewed about it pointedly. Contrary to earlier studies [1] CPAP adherence did not correlate to daytime sleepiness or snoring at baseline in our study.

Nevertheless, it is difficult to derive a distinct risk profile from the epidemiological, social and clinical characteristics for patients with a poor CPAP adherence. Therefore, we need a shift of attention to CPAP-specific problems and how to find solutions in order to improve CPAP adherence. Already former studies drew attention to the influence of CPAP-specific problems on CPAP adherence, such as irritations of the skin or claustrophobia [10-12].

A way to realize the highest possible problem control is a structured follow-up with a widespread and long-term character. This follow-up should be close-meshed at the beginning of CPAP use, because especially the initial experience with CPAP therapy seems to be very important for long-term adherence [19].

We conclude, that our pattern of a structured, but individually adapted follow-up is able to raise therapy adherence in OSAS patients receiving a CPAP therapy. As the four main issues of our follow up, we formulated patients' education, feedback, problem solution and motivation.

Education allows patients to understand the functioning of CPAP therapy, as well as the matters of handling, especially in additional devices like heated humidification. A comprehensive education before starting CPAP therapy is important to raise

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the understanding for their disorder and the consequences of missing treatment, which is particularly relevant in asymptomatic patients without daytime sleepiness, or without cardiovascular diseases. Education has to be repeated individually during follow-up.

Feedback is important for the patients to achieve an overview of the success of their therapy by checking the data of their device (AHI, therapy hours etc.). Moreover, this is also a tool for the physician to assess therapy success and adherence objectively.

By means of medical and technical assistance and control, problems can be solved step by step and misunderstandings can be cleared up, that otherwise would have led to an abandonment of therapy. Solution approaches for the most common problems that were applied in our patients, are resumed in Table 7.

Continuous controls, starting immediately after the beginning of CPAP therapy very close-meshed often improve patients' motivation to continue therapy and getting the opportunity to get used to it, in spite of initial problems. The fact, that 13 patients (8.2%) in our study reported to have had completely abandoned CPAP therapy without follow-up, reveals the importance of motivation. An unsatisfying result in our study is that 58.6% of the patients answered that their problems could not or just partially be solved within the frame of our follow-up. We have to realize, that the problem solution approaches that we offer in our follow-up (Table 7), have to be extended. Because the opportunities of problem solution are strongly dependent on the experience of the otorhinolaryngologist and the service technician, a steady further education concerning sleep medicine and innovations in therapy is unalterable.

A limiting factor in our study is that the operation hours, as a marker for CPAP adherence, could not be analyzed in all of the patients' devices, because some of the devices were too old. Therefore, approximately 50 percent of the values result from anamnestic elicitation, where we had to bank on patients' statements. This may lead to a falsely positive estimation of our results and impairs specificity of our investigation.

CONCLUSIONS

A structured and individually adapted follow-up seems to be an important factor to raise CPAP adherence. The contents of follow-up, particularly the long-term follow-up, should be determined and defined in the guidelines in a more precise way. In future, apart from control of therapy success, aspects of feedback, education, motivation and problem solution should be given a greater attention in the follow-up of CPAP therapy.

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