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In-person versus video instruction of patients with sleep apnoea in the use of continuous positive airway pressure (CPAP)

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ABSTRACT

INTRODUCTION. Instructing newly diagnosed sleep apnoea patients in the use of continuous positive airway pressure (CPAP) machines is time consuming for healthcare workers and patients alike. Our aim was to test the feasibility of video instruction as an alternative to physical attendance in the clinic.

METHODS. In this randomised controlled trial, we enrolled 120 patients who were randomised to either classic instruction by a nurse or video instruction at home. Both patients and doctors answered questionnaires at the time of inclusion. Follow-up was 1-3 months.

RESULTS. No significant difference was recorded between the two groups on any measured parameter.

CONCLUSIONS. Video instruction is feasible and should be considered as an alternative to physical attendance for the CPAP start-up.

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Challenging times call for creative solutions. As from the first months of 2020, healthcare professionals all over the world have been forced to prioritise medical resources and rethink guidelines on an unprecedented scale. The COVID-19 pandemic has brought considerable consequences for patients and health personnel alike; both directly for those who have become infected with the virus, but also indirectly as a range of treatment modalities have been suspended during the epidemic. One affected area is aerosol-producing and non-life-threatening examinations. Treatments such as these have been discontinued to avoid any unnecessary risk of spreading the infection.

Continuous positive airway pressure (CPAP) treatment and machine testing in the outpatient clinic produce aerosols. Personnel in close proximity or even just in the same room as an activated CPAP machine risk COVID-19 infection if the CPAP user is infected with COVID-19. As the virus may spread from asymptomatic carriers, a complete ban on CPAP instruction and fitting has been a necessary precaution at our centre. Additionally, a large percentage of the obstructive sleep apnoea (OSA) patients are overweight, of old age and suffer from comorbidities all of which place them at a high risk of a fatal outcome if infected with COVID-19 [1-3]. Thus, it is desirable to limit their number of contacts to the clinic to an absolute minimum.

In this article, we present a novel solution. Before the onset of the COVID-19 pandemic, we initiated a randomised controlled trial to investigate the quality of video instruction for newly diagnosed OSA patients. We believe that many patients are capable of using video instructions as an alternative to in-hospital instruction. Our aim was to assess whether a CPAP start-up by video instruction was as good as a standard instruction provided by a nurse, assessed by treatment adherence and effect after 1-3 months.

METHODS

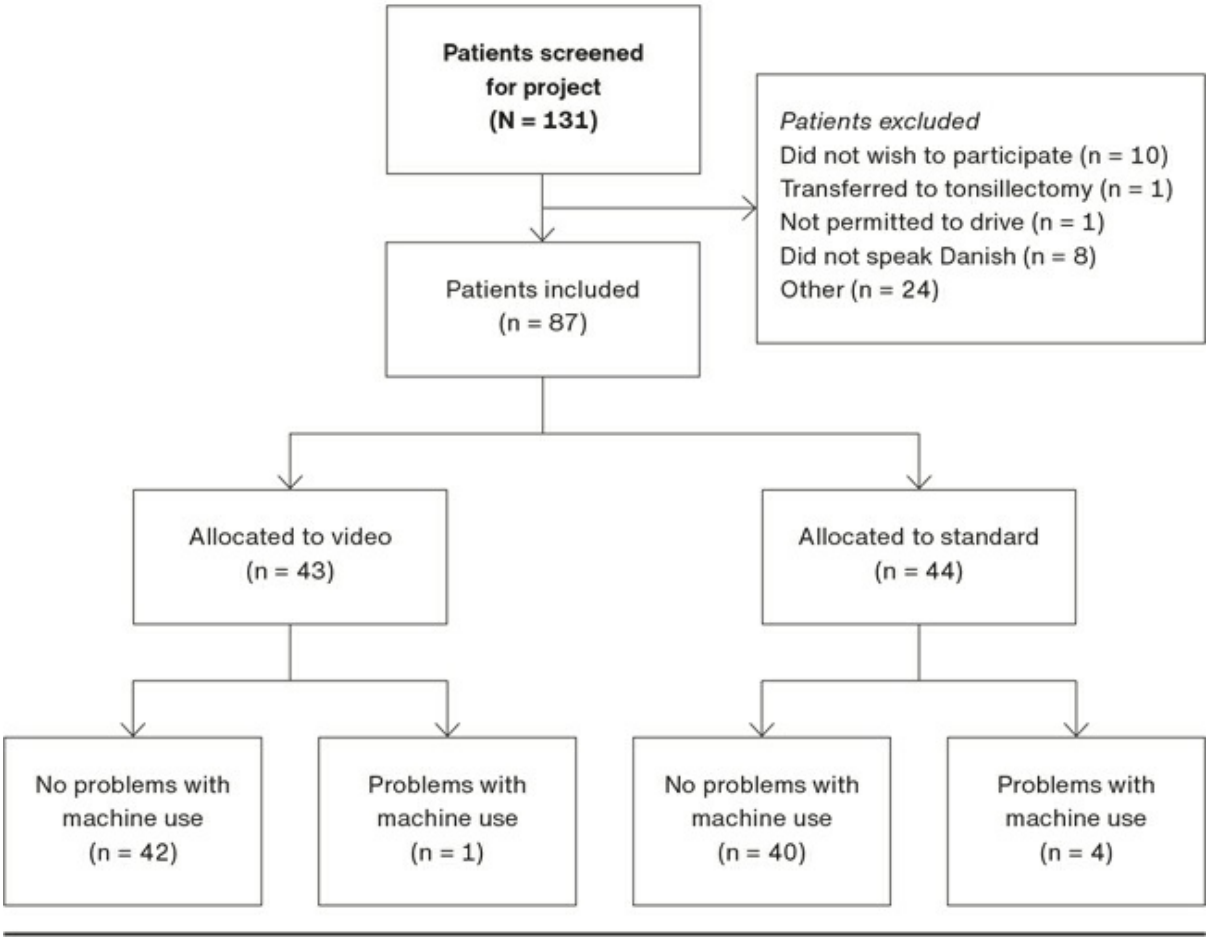
Design

We conducted a randomised controlled trial at Regional Hospital Silkeborg, Jutland, Denmark. Enrolment was discontinued due to the COVID-19 pandemic after registration of 120 patients. The study was approved by the Danish National Committee on Health Research Ethics (case number 1-10-72-193-19), and data collection and storage were approved by the Central Denmark Region. The study protocol was approved by clinicaltrials.gov (NCT number 15022020).

Participants

All patients referred to home sleep apnoea testing (HSAT) and subsequent CPAP treatment or directly for CPAP treatment were enrolled in the study. Our centre receives referrals from general practitioners, other departments and private practicing ear-, nose- and throat specialists. The patients referred from the general practitioners had a HSAT performed in a home setting. Patients referred from ear-, nose- and throat specialists already had complete HSAT reports. Those who were found not to benefit from CPAP were registered, but not randomized (please see the flow chart in **Figure 1**). Baseline questionnaire data were entered into a redcap database directly on an iPad by the patients upon arrival. Subsequently, all patients underwent the same preliminary examination and assessment by an ear-, nose- and throat physician.

FIGURE 1 Flow chart.



Recruitment was initiated on 18 February 2020 and completed on 12 March 2020. The exclusion criteria were cognitive disabilities, hearing disability, prior CPAP use, poor Danish language skills and driving ban due to the OSA diagnosis. Participant information was sent to all patients before their first visit to the clinic. The baseline questionnaire covered age, sex, gender, the Major Depression Inventory Test, the Insomnia Severity Index, educational level (calculated in accordance with the International Standard Classification of Education) and motivation for CPAP on a 0-100 *visual analogue scale* (VAS) (**Table 1**). The baseline Apnoea-Hypopnoea Index (AHI), the Friedman score, the Epworth Sleepiness Scale (ESS) and the quality of the cardio-respiratory monitoring were also registered by the ear-, nose- and throat physician. Consent to participate was obtained after a thorough explanation of the study.

TABLE 1 Descriptive statistics: the basic statistics for the patients in the two groups.

	Video (N = 43)	Standard (N = 44)	Overall (N = 87)	p-value[a]
Sex, n (%)				0.4488
Male	28 (65.1)	32 (72.7)	60 (69.0)	
Female	15 (34.9)	12 (27.3)	27 (31.0)	
BMI, kg/m²				0.7995
Mean ± SD	31.8 ± 6.90	32.2 ± 6.99	32.0 ± 6.91	
Median (min.-max)	30.8 (19.8-49.9)	31.2 (18.8-55.8)	30.9 (18.8-55.8)	
Missing, n (%)	2 (4.7)	1 (2.3)	3 (3.4)	
Insomnia Severity Index				0.002875
Mean ± SD	12.4 ± 4.82	15.7 ± 5.23	14.1 ± 5.29	
Median (min.-max)	12.0 (3.00-22.0)	15.0 (5.00-25.0)	14.0 (3.00-25.0)	
Missing, n (%)	2 (4.7)	1 (2.3)	3 (3.4)	
Depression score				0.2879
Mean ± SD	15.4 ± 11.2)	18.1 ± 11.8)	16.8 ± 11.5	
Median (min.-max)	12.0 (0-42.0)	15.0 (2.00-48.0)	13.0 (0-48.0)	
Missing, n (%)	2 (4.7)	2 (4.5)	4 (4.6)	
Epworth Sleepiness Scale				0.7139
Mean ± SD	9.81 ± 4.56	9.44 ± 4.65	9.62 ± 4.58	
Median (min.-max)	10.0 (0-19.0)	9.00 (2.00-19.0)	10.0 (0-19.0)	
Missing, n (%)	1 (2.3)	1 (2.3)	2 (2.3)	
AHI before CPAP				0.1816
Mean ± SD	38.9 ± 26.6	31.5 ± 24.6	35.1 ± 25.7	
Median (min.-max)	29.0 (7.90-125)	21.2 (4.70-95.7)	24.3 (4.70-125)	
ODI before CPAP				0.2075
Mean ± SD	32.5 (21.2)	26.5 (22.4)	29.4 (21.9)	
Median (min.-max)	26.3 (3.00-87.0)	19.6 (5.00-97.2)	22.0 (3.00-97.2)	
Missing, n (%)	1 (2.3)	1 (2.3)	2 (2.3)	
Education, n (%)				0.8006
Craftsman	11 (25.6)	17 (38.6)	28 (32.2)	
Short: 1-3 yrs	16 (37.2)	10 (22.7)	26 (29.9)	
Intermediate: 3-4 yrs	8 (18.6)	6 (13.6)	14 (16.1)	
Long: 4-6 yrs	3 (7.0)	3 (6.8)	6 (6.9)	
PhD/doctorate/lector	0	0	0	
Primary school	3 (7.0)	6 (13.6)	9 (10.3)	
Missing	2 (4.7)	2 (4.5)	4 (4.6)	
Motivation VAS 0-100				0.4497
Mean ± SD	79.8 ± 21.7	83.3 ± 18.1	81.5 ± 20.0	
Median (min.-max)	88.0 (0-100)	90.0 (31.0-100)	89.0 (0-100)	
Missing, n (%)	4 (9.3)	6 (13.6)	10 (11.5)	
Friedman tonsil staging, n (%)				-
Grade 0	10 (23.3)	9 (20.5)	19 (21.8)	
Grade I	19 (44.2)	23 (52.3)	42 (48.3)	
Grade II	8 (18.6)	8 (18.2)	16 (18.4)	
Grade III	6 (14.0)	4 (9.1)	10 (11.5)	
Grade IV	0	0	0	
Friedman tongue staging, n (%)				-
Grade I	9 (20.9)	3 (6.8)	12 (13.8)	
Grade IIa	5 (11.6)	7 (15.9)	12 (13.8)	
Grade IIb	11 (25.6)	11 (25.0)	22 (25.3)	
Grade III	15 (34.9)	19 (43.2)	34 (39.1)	
Grade IV	3 (7.0)	4 (9.1)	7 (8.0)	

AHI = Apnoea-Hypopnoea Index; CPAP = continuous positive airway pressure; ODI = oxygen desaturation index; SD = standard deviation; VAS = visual analogue scale.
a) The p-values are calculated for the differences between the two groups. Comparative analyses were not performed for Friedmann tonsil staging and Friedmann tongue staging due to a low number of patients in the subgroups.

Randomisation

An investigator not involved in patient treatment prepared randomisation envelopes and a randomisation code. The randomisation was sealed in numbered opaque envelopes. Consenting and participating patients were randomly assigned to the video instruction group (VIG) or the nurse instruction group (NIG).

Procedures

In the VIG, all CPAP machines were pre-set for regular start-up. Thus, the CPAP machines were handed to the patient in a closed bag without any display of the equipment. Based on a quick assessment, a mask was chosen

by the nurse. The patients were then given a password-protected link to an online instruction video, and the nurse checked if the patients were able to access the video. In addition to the link, the patients in the VIG were given a pamphlet with the following text (translated into English language): “Please watch the video from beginning to end. If you have any trouble with one of the steps, the timeline will show you where you can find the explanation again”. In addition to the timeline, the pamphlet included pictures of the masks correctly fitted in anterior and lateral view. The video was seven minutes long and provided a brief review of illness and treatment, instruction on assembling and adapting the equipment and answered the most frequently asked questions. **https://vimeo.com/388696944 (link to video in Danish language)**.

In the NIG, a new appointment was scheduled for hand out and instruction. At this appointment, a nurse demonstrated equipment assembly, and the patient had the mask fitted by the nurse. During a 45-minute session, the nurse went through the same topics as the video, i.e. maintenance and use of the equipment and adaptation to the CPAP machine.

In May 2020, we emailed a questionnaire to all participants. Non-responders were called by the nursing staff who then completed the questionnaires on the phone in collaboration with participants.

Preliminary testing of the video

The video was recorded on an iPhone XS and edited in Apple iMovie by the authors. The video was tested on friends and relatives before final changes were made in collaboration with experienced nurses who had both handed out equipment and been involved in follow-up with CPAP patients.

Statistical analysis

Analysis was performed as intention to treat and we measured satisfaction by a survey completed after a mean 185 days (range: 105-427 days). Between-group differences for continuous variables were compared using t-test or Mann-Whitney, as appropriate. Differences in proportions between categorical variables were tested using the Chi-squared test. Logistic regression was used to test for effects of variables on the outcome between groups. We considered the following variables in the univariate logistic model: treatment group, sex, BMI, ESS and Depression Anxiety Stress Scale scores. A multivariate model included variables from the univariate model with p values < 0.1. Statistical analysis was performed in R. A value of $p < 0.05$ was considered significant for all statistical analyses.

Power analysis

With equal numbers of participants in the two groups, an alpha level of 5% and a power of 90% were calculated. The non-inferiority margin was set at 0.2 and true mean response rates at 75% and 80% in the VIG versus NIG. Powered for non-inferiority, the sample size was calculated to be 48 patients in each of the treatment arms.

Trial registration: clinicaltrials.gov (NCT number 15022020).

RESULTS

A total of 131 patients were screened for eligibility. Ten did not want to participate, one was referred for tonsillectomy, one had received a driving ban and eight lacked Danish language skills. Thus, a total of 24 patients were not candidates for CPAP treatment. The remaining 87 were enrolled in the study (Figure 1). Age and gender were evenly distributed between the two groups. We found no statistical differences regarding ESS score ($p = 0.71$), depression score ($p = 0.29$), baseline AHI ($p = 0.18$) or motivation ($p = 0.45$). Insomnia was the only parameter found to be significantly different between the two groups ($p = 0.003$).

Our primary endpoint was whether the patients could make the machine work or not; 86.0% in the VIG and

79.5% NIG answered yes. No statistical difference was recorded between the two groups (p = 0.10). The next section of the survey focused on our secondary outcome measures (**Table 2**). 16.3% in the VIG and 31.8% in the NIG contacted the department in the follow-up period due to CPAP difficulties. This difference was statistically insignificant (p = 0.12). 73.6% of the population experienced "an effect" of the treatment. More than 50% in either group experienced an effect on sleepiness. Again, the two groups were without statistical difference (p = 0.59). Overall, a trend towards a better outcome was observed in the VIG. This was insignificant for all parameters, though.

TABLE 2 Descriptive statistics: the outcome and p-values on follow-up in the two groups.

	Video (N = 43)	Standard (N = 44)	Overall (N = 87)	p-value[a]
Could you make the machine work properly?				0.1047
Yes, n (%)	37 (86.0)	35 (79.5)	72 (82.8)	
No, n (%)	1 (2.3)	5 (11.4)	6 (6.9)	
Missing, n (%)	5 (11.6)	4 (9.1)	9 (10.3)	
In what areas do you experience an effect of the treatment?				
Sleep, n (%):				0.5915
Yes	27 (62.8)	23 (52.3)	50 (57.5)	
No	16 (37.2)	21 (47.7)	37 (42.5)	
Concentration, n (%):				0.8624
Yes	11 (25.6)	9 (20.5)	20 (23.0)	
No	32 (74.4)	35 (79.5)	67 (77.0)	
Irritability, n (%):				0.2229
Yes	6 (14.0)	13 (29.5)	19 (21.8)	
No	37 (86.0)	31 (70.5)	68 (78.2)	
Memory, n (%):				1
Yes	6 (14.0)	7 (15.9)	13 (14.9)	
No	37 (86.0)	37 (84.1)	74 (85.1)	
No effect, n (%):				0.5847
Yes	9 (20.9)	14 (31.8)	23 (26.4)	
No	34 (79.1)	30 (68.2)	64 (73.6)	
Would you recommend the way you were instructed to others?				0.5448
Yes, n (%)	33 (76.7)	31 (70.5)	64 (73.6)	
No, n (%)	5 (11.6)	8 (18.2)	13 (14.9)	
Missing, n (%)	5 (11.6)	5 (11.4)	10 (11.5)	
How satisfied are you with CPAP treatment?				0.3171
0-100 VAS, mean ± SD	77.9 ± 22.9	65.6 ± 33.2	71.8 ± 29.0	
Have you changed your mask since start-up?				0.4977
Yes, n (%)	14 (32.6)	18 (40.9)	32 (36.8)	
No, n (%)	24 (55.8)	22 (50.0)	46 (52.9)	
Missing, n (%)	5 (11.6)	4 (9.1)	9 (10.3)	
Have you had any extra contacts to the clinic since start-up?				0.1245
Yes, n (%)	7 (16.3)	14 (31.8)	21 (24.1)	
No, n (%)	31 (72.1)	25 (56.8)	56 (64.4)	
Missing, n (%)	5 (11.6)	5 (11.4)	10 (11.5)	

CPAP = continuous positive airway pressure; SD = standard deviation; VAS = visual analogue scale.

DISCUSSION

This study is the first ever to evaluate the use of instructional videos as an introduction to the use of CPAP. Our findings suggest that patients are fully capable of initiating the treatment themselves with the aid of video instruction. At follow-up, no differences were found between the two groups on any parameter. We assess that the significant p value found between insomnia groups was due to multiple testing and therefore not a factor that we would consider relevant to the results.

Currently, most available online videos are educational, but none of them explain the step-by-step start-up of CPAP as classified by Singh et al.'s review of the available videos [4]. Video education has previously been described by &;Gagliano [5] as good and often more effective than traditional methods of patient education in terms of recalling recently acquired knowledge. Video solutions have been attempted previously as a way of increasing adherence. This was done with good effect [6-8], but never as a solitary solution for CPAP instruction. Though dealing with cancer patient education, &;Gysels et al. [9] found that for dissemination of knowledge, a videotape was superior to the same information given verbally, and the combination of videotape and verbal &;discussion was no better than videotape alone. These findings were confirmed by a large systematic review and practice guideline recommendation by Friedman et al. [10] who found that &;videotapes may be an effective teaching strategy in delivering patient education. They further noted that &;verbal instruction should be used only in conjunction with other teaching methods and that &;the use of multiple teaching strategies was a sound option in patient education. In our setting, all of the above teaching methods were included: initial verbal explanation of the disease by a doctor, a video explanation at home and, finally, a pamphlet about the mask-fitting procedure.

This study has some limitations. Originally, we scheduled a follow-up session with a trained nurse after one month of CPAP use. The nurse was to register AHI and ESS, and the patients were to complete a follow-up questionnaire including questions detailing any difficulty with assembly, trouble with the mask and mask exchange, and the participants' overall satisfaction with the treatment on a 1-10 VAS. AHI, days of use and average hours of use per night are registered on the CPAP machine. We had planned to collect these data to calculate compliance as an objective measure of success or failure. Again, the COVID-19-pandemic led to a change of plans since we were permitted to turn on CPAP machines in the clinic. Thus, we had to use the less objective option of a follow-up questionnaire alone.

In our opinion, the use of video instruction should not be restricted to the present COVID-19-era. The technical skills of the general population are rapidly increasing; this leads us to believe that many patients are capable of using video instructions as an alternative to attending an instructive session at the hospital. From the patient's point of view, time spent at hospital means time lost at work or time spent with family or on spare time activities. Additionally, available time and patient care are currently under pressure due to an increasing number of elderly patients and a "high demand" for quick access to the healthcare system. A number of patients receive a driving ban when they are diagnosed with OSA. Video instruction may potentially provide a fast-track solution for this subgroup. This is of both socio-economic and personal benefit.

Video instruction ensures thorough and easily repeatable information in a comfortable setting of the patient's own choice. Video instruction will give the opportunity to recapitulate and pause, relieving a potentially stressful situation. Video instruction also gives the opportunity to process information with relatives or friends. Even so, we are aware that video instruction is not the optimal solution for everyone. We suggest that video instruction should be an offer to those who believe that they can manage the start-up themselves. Future studies will show if, e.g., age, Body Mass Index, history of insomnia or other factors can predict what patients to prioritise in order to ensure optimal compliance.

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