

REVIEWS

Strategies to improve continuous positive airway pressure compliance: A review

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Abstract

Continuous positive airway pressure (CPAP) is the gold standard of treatment for patients diagnosed with significant Obstructive Sleep Apnea (OSA). Although CPAP is highly effective in preventing the repetitive upper airway collapses in OSA, compliance to treatment is poor, which in turn leads to poorer health outcomes. In this study an extensive review of the literature was completed using the Cochrane library, CINAHL, PubMed and Embase databases. The research objective of this study was to determine the efficacy of interventions designed to increase compliance with CPAP. The themes that were found to be effective in increasing compliance with CPAP were increased patient education and intensive patient support. Improvements in CPAP compliance will positive impact patients, patient's families and the health care system. In conclusion, the evidence points to the necessity of implementation of an intensive patient education and patient support program for all OSA patients.

Key words

Obstructive Sleep Apnea (OSA), Continuous positive airway pressure (CPAP), Compliance, Adherence, Adult, Education, Sleep Apnea

Introduction

Obstructive sleep apnea (OSA) is a common sleep disorder that requires lifetime care. OSA is characterized by repetitive obstructive airway closures during sleep, which are associated with fragmented sleep and oxygen desaturations ^[1]. OSA has been shown to negatively impact health. Untreated OSA is associated with an increased risk of cardiovascular and cerebrovascular diseases ^[3]. Excessive daytime sleepiness, a consequence of the sleep fragmentation from airway closures, has been shown to adversely impact quality of life. Moreover, OSA has been shown to be associated with impaired cognition, memory, mood alterations as well as decreased occupational and functional capacity ^[4].

Continuous Positive Airway Pressure (CPAP) is a highly effective treatment for OSA. CPAP delivers constant positive pressure to the airway through a mask, splinting the airway open throughout the night, eliminating breathing disruptions ^[2]. CPAP is currently the first line treatment for patients with moderate to severe sleep apnea ^[1]. Despite its effectiveness, compliance with the treatment plan is poor ^[2]. Medicare defines CPAP compliance as 70% usage over four hours per night in any given thirty-day period ^[5]. Education and follow up are extremely important for all patients with chronic diseases; however, it is paramount for patients with OSA, as it can be challenging to adapt to using CPAP, limiting compliance.

CPAP patients face various obstacles that may lead to noncompliance, ranging from lack of adequate understanding about the diagnosis to physical discomfort from CPAP.

Significance of the problem

It is estimated that 24% of the United States population has a diagnosis of OSA, however only about 4% carry the diagnosis^[3]. The OSA population is growing exponentially each year, a consequence of increased public awareness and provider education about OSA^[3,6]. Although CPAP is an extremely effective treatment for OSA, compliance is a critical problem and is widely recognized as a significant limiting factor in successful treatment^[4]. Research shows that 30%-50% of patients diagnosed with OSA reject CPAP immediately and approximately 80% of OSA patients are noncompliant within a year after starting CPAP therapy^[7]. Noncompliance with CPAP significantly reduces the overall effectiveness of treatment of OSA, leaving these patients at an increased risk for comorbid conditions, impaired daily functioning and decreased quality of life^[2].

OSA has a significant impact on patients and their families as well as society as a whole if not treated properly. Untreated, it leaves patients with a three-fold increase in risk for hypertension, diabetes mellitus and stroke^[6]. Patients are also at an increased risk for ischemic heart disease, cardiac arrhythmia, congestive heart failure, peripheral vascular disease and valvular cardiac disease^[8]. Patients with untreated OSA often experience excessive daytime sleepiness, impaired cognition and memory, decreased functional and occupational capacity as well as mood alterations, which significantly decreases quality of life^[3,6]. Besides affecting the patients quality of life and health outcomes, it has been shown that untreated OSA patients have up to two times greater health care costs than similar individuals without OSA^[9].

In addition to negatively affecting the patient, untreated OSA often causes family members to suffer as well. Untreated it has been shown to have a significant effect on the patient's bed partner. As previously reported^[3,6] untreated OSA has a negative effect on the patient's bed partner's health status, sleep quality, daytime alertness, mood, overall quality of life as well as his/her personal relationship with the patient. Patients with untreated OSA are three to seven times more likely to have motor vehicle accidents and injuries than patients without the diagnosis, costing up to 16 billion dollars per year^[10]. It has been estimated^[6] that patients with untreated OSA are two to three times more likely to have an occupational injury or accident, which further contributes to decreased occupational productivity and increased health costs.

Untreated sleep apnea also affects the health care system as a whole. As previously reported^[9] studies have calculated that the health related cost burden of untreated sleep apnea in the United States is approximately 3.4 billion dollars per year. These astronomical costs are typically a result of more frequent practitioner visits, increased hospitalizations, and development of comorbid conditions^[9].

Improvement of CPAP compliance will positively impact patients, patient's families, communities and the health care system as a whole. By improving CPAP compliance, patients will decrease their risk of comorbid conditions associated with untreated OSA^[6]. Patient's quality of life, cognitive function as well as occupational function will also improve, as daytime symptoms improve when effectively treated by CPAP^[3,6]. Moreover, research has shown that the patient's bed partner's quality of sleep, quality of life, health status, as well as relationship with the patient improves when a patient is compliant with CPAP^[3,6]. With increased CPAP compliance, patients will experience less daytime sleepiness, reducing their increased risk of accidents and poor job performance, which in turn has benefits for the community. It has been estimated that 567,000 collisions and 980 fatalities annually could be avoided by effective CPAP treatment^[10]. Importantly, research has shown that effectively treating OSA will decrease health care system costs as it reduces follow up care required for comorbidities associated with untreated OSA^[9]. It becomes extremely important to evaluate what interventions are most effective in increasing CPAP compliance among adult patients diagnosed with OSA.

Search strategy

The research objective of this search was to determine the efficacy of interventions designed to increase compliance with CPAP. Many mechanical, psychological and educational interventions have been proposed to increase CPAP compliance in patients diagnosed with OSA. Searches were carried out in the Cochrane Library, CINAHL, PubMed and Embase databases. The PICO (population, intervention, comparison, and outcome) format was used to choose the search terms as it helps to focus on certain key concepts^[11]. The PICO format helps to narrow down the key concepts of the question, and choose search terms based off of the key concepts^[11]. The search terms that were used were “Obstructive Sleep Apnea”, “Continuous Positive Airway Pressure”, “Noncompliance” and “Nonadherence”.

After combining the four main searches together a total of 8,618 articles were produced. The search was then restricted to the English language and duplicates were eliminated, which produced 6,269 articles. After restricting the articles to the English language, a title review on the remaining articles was carried out. The inclusion criteria consisted of articles that focused on the evaluation of interventions to improve CPAP compliance in adult patients who were diagnosed with OSA. Exclusion criteria included articles that discuss AutoCPAP, Bi-Level Positive Airway Pressure (BiPAP), Auto Servo Ventilation (ASV), Mandibular Advancement Devices, weight loss as well as ENT surgical procedures as primary treatments for OSA. Articles that focused on patients under the age of 18 were excluded, as the patient population being assessed was adults. After performing the title review of the articles to evaluate if they met inclusion or exclusion criteria 191 articles were kept. The abstract of each article was read and reviewed to see if it met all inclusion criteria, and at the end of the abstract review 76 articles were kept. Each of the 76 articles were read in full to further review if each individual article met the inclusion criteria and if it helped to assess interventions to improve CPAP compliance. After the article review, 28 articles were left for evaluation (see Figure 1).

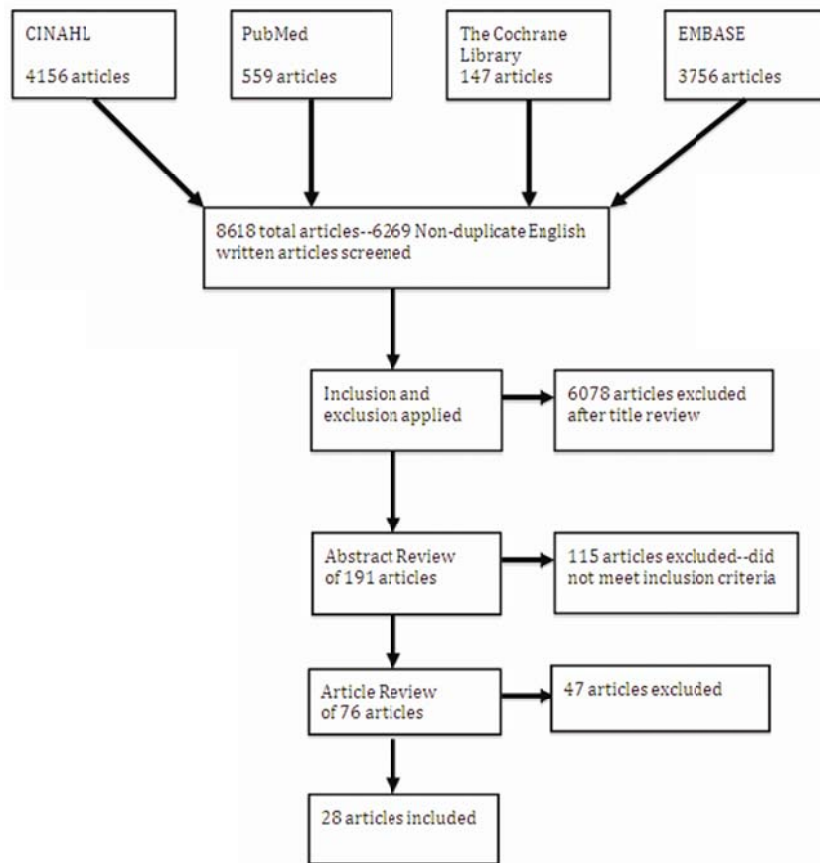


Figure 1. PRISMA diagram

Table 1. Johns Hopkins Nursing Evidenced-based Practice Individual Evidence Summary Tool

EBP Question: What is the most effective intervention to increase CPAP compliance among adult OSA patients?

Date: 12/10/12

Reference #	Author & Date	Evidence Type	Sample, Sample Size, & Setting	Study findings that help answer the EBP question	Limitations	Evidence Level & Quality
37	Smith, I. (2009)	Systematic Review	24 RCT studies	-Auto CPAP did not increase compliance when compared to CPAP -No significant difference between BiPAP and CPAP compliance -No significance in compliance with the addition of humidification -Intensive support (including home visits) increase CPAP compliance -CBT and education increased CPAP compliance	-Not all studies had the same methods for recording compliance -Not all studies had the same diagnostic criteria for OSA	Level I Grade A
23	Damjanovic, D. (2009)	RCT	100 newly diagnosed OSA patients—setting-G ermany	-There was no difference in compliance between the CPAP group and the Auto CPAP group -Intensive support (Visit at 1, 2, 4 & 5 months—mask fitting, education and counseling given at each visit)increased CPAP compliance compared to the standard support group (visit at 3 & 9 months)	-Study was only 9 months long	Level I Grade-A
22	Chervin, R. (1997)	RCT	-33 subjects that were new CPAP users-- Setting-Sleep Disorders Clinic in Michigan.	-The written group (educational pamphlets on symptoms, treatment and diagnosis of OSA as well as on CPAP and remedies for CPAP problems) had significant increase in compliance -Telephone encounter group did not show significant improvement in compliance, potentially due to small sample size	-Unequal sample size between groups -Follow up was 2 months	Level I Grade A
30	Massie, C. (1999)	RCT	-38 newly diagnosed OSA patients-- Setting-2 suburban community-based sleep centers	-Small increase in compliance was noted in heated humidification patients as opposed to no humidity use -No difference in compliance between patients who used heated or passive humidity -Patient had increased satisfaction with humidification and less side effects from CPAP	-Small sample size -8 week follow up period	Level I Grade A
28	Hoy, C. (1999)	RCT	-80 OSA patients— Setting-Sleep Center in Edinburgh, U.K.	-Intensive support and education increased CPAP compliance (diagnosis explained by MD, 20 min educational video, mask fitting, Call on day 2 and 21, office visit at 1,3 and 6 months, home visit at day 7, 14, and 28 and 4 months, and additional education given at home -Self referred group had higher compliance then partner referred group did	-6 month trial	Level I Grade A
40	Sparrow, D. (2010)	RCT	-250 newly diagnosed OSA patients— Setting-2 Boston Medical Centers	-TLC-CPAP group has 30% higher CPAP compliance at 12 months (telephone encounters were built around motivational interviewing to give feedback and provide counseling, as well as address barriers and poor self-efficacy—Patients called weekly for a month and monthly for the next year	-Patients enrolling in study may have been more inclined to adhere to treatment	Level I Grade A
39	Smith, C. (2006)	RCT	-19 previously noncompliant CPAP patients— Setting-n/a	-The Telehealth group (3 sessions in week 1, and 1 session weekly for 11 weeks over the phone to assess mask fit, describe how to manage CPAP barriers, reinforce the consequences of noncompliance and emphasize benefits of CPAP) had increased CPAP compliance then the control group (discussed benefits of vitamin replacement at same intervals as intervention group)	-Small sample size -Short follow up period of 12 weeks	Level I Grade A
18	Ballard, R. (2007)	RCT	204 previously noncompliant CPAP patients—n/a	-Phase 1—24% of patients were compliant after the first phase of treatment (mask change, addition of humidification, and saline rinses were moderately helpful with compliance)—(education improved compliance the most) -Phase 2—after 90 days 28% of patients who were previously noncompliant with CPAP become compliance after switch to Bi-level	-As these patients had used CPAP in the past it is possible they may have been able to perceive a change in pressure waveform	Level I Grade A
24	DeMolles, D. (2004)	RCT	30 patients newly diagnosed with OSA— Setting-Home Care Company in Massachusetts	-TLC increased CPAP usage and decreased overall sleepiness in patients (modeled on Hoy et al personal intensive intervention—TLC calls and monitors self-reported behavior, gives education and behavioral reinforcement for target health related behaviors)	-Small Sample size -Patients had overall less severe apnea -Patients started out with low ESS scores	Level I Grade B
33	Richards, D. (2007)	RCT	100 patients diagnosed with OSA— Setting-Sleep Center in Australia	-CBT group (2-1 hour sessions 1 week apart-PowerPoint on normal sleep, daytime/nighttime consequences of OSA and effectiveness of CPAP, patients encouraged to handle machine and mask during visit, 15 minute video with people discussing their experience with CPAP, booklet with general OSA and CPAP information) showed increased acceptance, usage and adherence to CPAP	-Participants from a high socioeconomic area in Australia -Poor statistical tests chosen to evaluate data	Level I Grade B
25	Fox, N. (2012)	RCT	75 patients diagnosed with OSA— Setting-Sleep Disorders Program in British Columbia, Canada	-Telemedicine group (standard care + web modem that sent compliance information to a database daily-coordinator reviewed data on each patient daily and if compliance was low specific intervention was put into action immediately, patients had a 4-6 week follow up and a 3 months follow up) had increased CPAP compliance at 3 months then standard care group	-Small sample size -Only patients with an ESS >11 were included -Only moderate to severe OSA cases were included	Level I Grade B
37	Smith, C. (2009)	RCT	-97 patients with moderate to severe OSA— Setting-University of Kansas Sleep Lab	-Increased CPAP compliance in the Intervention group (music based audio tape with repeated step by step instructions which guide arrangement of CPAP equipment, nightly bedtime CPAP procedure and relax them to sleep-in addition to an educational handout on OSA and CPAP) at 1 month -No difference in the 3 or 6 month follow ups	-High attrition rate in the intervention and in the standard group -Poor choice of statistical evaluation	Level I Grade B
42	Trupp, R. (2011)	RCT	-70 patients with OSA and cardiovascular disease— Setting-Ohio Sleep Center	-Negative framed outcomes (highlighted consequences if CPAP is not worn) led to increased CPAP compliance then positive framed outcomes (benefits of CPAP)	-Only patients with OSA and cardiovascular disease were included -High attrition rate	Level I Grade B

(Table 1 continued on page 66.)

Table 1. (Continued.)

Reference #	Author & Date	Evidence Type	Sample, Sample Size, & Setting	Study findings that help answer the EBP question	Limitations	Evidence Level & Quality
34	Roecklein, K. (2010)	RCT	-30 patients diagnosed with OSA— Setting-n/a	-No significant difference was noted between groups -If adequate size potential for personal feedback to improve CPAP compliance in low socioeconomic class African Americans	-Small sample size -Results not generalizable -No concrete outcomes	Level I Grade C
41	Stepnowsky, C. (2007)	RCT	-45 newly diagnosed OSA patients— Setting—VA Health Care System in San Diego	-Tele-monitored care (look at compliance and efficacy data, data was summarized and color coded patients based on compliance data-action was taken if needed) increases compliance in CPAP	-CPAP therapists not blinded to treatment groups	Level I Grade C
44	Wiese, H. (2005)	RCT	-93 patients diagnosed with OSA— Setting-University of Kentucky Sleep Center	-Video group (15 min video education and specific information on OSA) increased compliance-Video group had increased CPAP compliance	-High attrition rate in both groups -Poor statistical testing chosen	Level I Grade C
27	Golay, A. (2006)	Quasi-experimental	-35 patients diagnosed with OSA— Setting-Pulmonary service at a hospital in Geneva	-Improvement in compliance with educational session (patients were admitted for 36 hours for education which included sessions on understanding OSA, how to use CPAP, benefits of CPAP, life with CPAP, obstacles for CPAP and a round table with spouses)	-Small sample size -Not generalizable for all patient populations	Level II Grade B
26	Fuchs, F. (2010)	Quasi-experimental	-475 patients diagnosed with OSA and using CPAP— Setting-Sleep center in Germany	-Education program group (120 min lecture emphasizing effects of OSA and benefits of CPAP, ways to decrease CPAP side effects, self support meetings and booklet summarizing information given during session) increased CPAP compliance	-High attrition rate -CPAP compliance was self-report	Level II Grade B
21	Cartwright, R. (2008)	Quasi-Experimental	-10 men diagnosed with OSA who were married— Setting-Rush University	-Compliance with CPAP in married men is related to the frequency with which his partner sleeps with him during his initial home treatment	-Small sample size -Only married men included in study -Not generalizable	Level II Grade C
29	Likar, L. (1997)	Retrospective Chart Review	-73 patients diagnosed with OSA— Setting outpatient clinic at a Veterans Affairs Medical Center	-Group educational sessions (2 hour CPAP clinic to review data and review CPAP equipment, instructed by NP about OSA and CPAP and viewed an educational video on CPAP) improved CPAP compliance	-Lack of true control group due to nature of design of study	Level III Grade A
31	Pamidi, S. (2012)	Retrospective Chart Review	-403 patients with OSA— Setting-Chicago Sleep Disorders Center	-Patients who met with a sleep specialist (discuss OSA, describe PSG process, discuss pathophysiology of OSA and consequences of untreated OSA, discussed importance of compliance) prior to having a sleep study had increased CPAP compliance than those who met with PCP	-What was discussed during PCP visit was not documented	Level III Grade A
36	Silva, R. (2007)	Retrospective Chart Review	-1481 patients referred to have a CPAP titration— Setting Sleep Institute/AFIP	-Orientation session with a sleep technician (describing what OSA is, discussed consequences of untreated OSA, how to treat OSA and a mask desensitization session) prior to CPAP titration night led to increase CPAP acceptance	-Retrospective study not a RCT	Level III Grade A
19	Baron, K. (2012)	Observational Study	-31 men diagnosed with OSA who were living with their wives for over 1 year— Setting-University of Utah	-Collaboration with wife led to increased compliance with CPAP	-Small sample size -Sample only included married men	Level III Grade B
35	Russo-Magno, P. (2001)	Retrospective Chart Review	-33 older male patients diagnosed with OSA— Setting-Veterans Affairs Medical Center	-Patients who attended group sessions (discussed diagnosis of OSA and use of CPAP, mailed reminders of education and support sessions, symptomatic patients given proper interventions needed) had increased compliance to CPAP	-Small sample size -Sample only included older males	Level III Grade B
20	Bollig, S. (2010)	Literature Review by a provider	N/A	-Improving CPAP compliance is a multi-layered approach. Intensive behavioral interventions and intensive patient education can improve CPAP compliance -Change to Auto-CPAP or BiPAP has shown some improvement of compliance in some subsets	-Did not specify articles that were reviewed	Level V Grade B
32	Pruitt, B. (2009)	Literature Review	N/A	-Early and ongoing education, good experience with CPAP titration, immediate individual follow up, monitoring compliance and efficacy, long term support and trouble shooting, mask fit and choice of interface, nasal steroids/antihistamines, humidification, and group support have all been shown to increase CPAP compliance	-Did not review high level literature -Overall summary of interventions data not presented	Level V Grade C
17	Anstead, M. (1998)	Literature Review	N/A	-Patient education and close patient follow up have been shown to increase CPAP compliance	-Not specific in articles that were included in literature review	Level V Grade B
43	Wickwire, E. (2012)	Literature Review	N/A	-Cognitive Behavioral Therapy has been shown to increase CPAP compliance	-Limit of studies reviewed	Level V Grade B

As shown in Table 1, the summary of the evidence that was reviewed.

Summary of the evidence

Out of the 28 articles that were evaluated, fifteen were randomized control trials and one was a systematic review of randomized control trials, which according to the Johns Hopkins pyramid of evidence, is the highest level of evidence ^[12]. Three articles evaluated were quasi-experimental which according to the Johns Hopkins pyramid of evidence is level 2 evidence ^[12]. Of the articles evaluated, five were observational studies and the final four were literature reviews by providers, which categorizes them into evidence levels three and five respectively ^[12]. Each of the articles was graded individually for quality. The grading definitions used for all articles were from the Johns Hopkins Nursing Evidence-Based Practice Research Evidence Appraisal grading tool. Grade A articles had consistent results, sufficient sample size, adequate control, definitive conclusions, and consistent recommendations based on extensive literature review that includes thoughtful reference to scientific evidence ^[12]. Grade B articles had reasonably consistent results, sufficient sample size, some control, and fairly definitive conclusions, reasonable consistent recommendations on fairly comprehensive literature review that includes some reference to scientific evidence ^[12]. Grade C articles had little evidence with inconsistent results, insufficient sample size, and firm conclusions can't be drawn from the article ^[12]. Grade C articles were kept if they were valuable to help answer which interventions are most effective in improving CPAP compliance.

The Consort 2010 Checklist was used to grade the quality of each randomized control trial that was evaluated ^[13]. Out of the fifteen studies, seven articles were grade A, five were grade B and three were grade C. The Critical Appraisal Skills Programme (CASP) grading tool was used to evaluate the systematic review, which was a Grade A ^[14]. The TREND Statement Checklist, which stands for Transparent Reporting of Evaluations With Nonrandomized Designs, was used to evaluate the three quasi-experimental articles ^[15]. Two articles were grade B and one article was grade C, these articles were lower in quality however were helpful in answering the proposed research question which is why they were retained. The observational studies were evaluated with the Strobe Statement Checklist ^[16]. These articles had overall high quality with 4 being grade A and one being Grade B. The four literature reviews were graded with The Johns Hopkins Nursing Evidence-Based Practice Non-Research Evidence Appraisal Tool, three were Grade B and one was grade C ^[12]. Although these articles are low in strength and quality, they were kept, as they were helpful in answering the research question. The overall strength of the evidence that was included was moderate to high as most of the articles evaluated were evidence levels one or two. The overall quality of the articles evaluated was moderate to high as most articles were either grade A or grade B evidence (see Table 1).

After the evidence was graded the articles of higher impact were the articles that were used to guide the synthesis of the evidence. The randomized control trials and the systematic review were the highest impact articles that were reviewed. The quantitative articles had a larger impact in the synthesis of data than the qualitative articles did. Despite this, most articles that were reviewed had similar conclusions of interventions that are successful in improving CPAP compliance.

Synthesis of the evidence

The data was synthesized by first evaluating the quantitative data. The quantitative data had two overwhelming themes of interventions that have been shown to improve CPAP compliance. A third theme was noted in the qualitative data however in the quantitative data this intervention was found to be controversial which is why it was not concluded in the recommendations. After evaluating both the quantitative and qualitative data the same themes emerged which is how the data was synthesized and recommendations were made.

After the evaluation of each article three overall themes were identified in improving CPAP compliance in adults diagnosed with OSA: increased patient education, intensive patient support and spousal collaboration. These have been shown to be helpful in improving CPAP compliance. The delivery of intensive patient education was looked at in many different ways. Patient education was provided in the form of group sessions, office visits, written literature, telephone

encounters, videos as well as in presentations, all of which were shown to increase CPAP compliance. Although the method of delivering patient education differed among articles, the core information portrayed in each education method was similar. Within each method of communicating patient education information there were three parts: the diagnosis of OSA, the treatment of OSA and remedies to CPAP problems that patients may experience. Education was given on the definition and pathophysiology of OSA. The procedure to diagnose OSA was also highlighted. Side effects and consequences of untreated OSA were communicated to patients at length. The consequences of untreated OSA that were targeted included health risks as well as personal costs. The purpose and definition of CPAP was then highlighted. Finally, remedies to common CPAP problems were discussed at length. Overall, the evidence showed a strong link to intensive patient education and increased CPAP compliance.

The next theme of improving CPAP compliance was intensive patient support. Intensive patient support has been studied in many different ways however common themes emerged from the literature. Intensive patient support can vary in types including frequent office visits with the sleep provider, telemonitoring and phone conversations if patients have decreased compliance or frequent home visits. Each type of intensive support had similar activities that were performed during these sessions. CPAP compliance review was a part of the session, so the patient was able to monitor their progress and adherence with CPAP. The CPAP compliance report typically included hours per night mask was worn, amount of time there was mask leak and how effectively the patient's OSA is being treated by their CPAP. The clinician providing the patient support would then be able to give each patient feedback and motivation based on the compliance report generated. The presence of any side effects with CPAP was also addressed, and the clinician helped the patient remedy the issue. Equipment review was performed to ensure the patient had up to date supplies and replacements were ordered as needed. Finally, a mask fitting was performed as well to ensure that the patient was comfortable with the mask and that they were using and wearing the mask correctly. Overall intensive support was shown to moderately increase CPAP compliance.

Studies assessing the effect of spousal involvement on improving patient CPAP compliance have been controversial. Studies have looked at many different types of spousal involvement and its relationship to CPAP compliance. Spousal involvement in the form of support and collaboration has been noted to increase CPAP compliance in patients. Spousal support can range from a spouse encouraging the patient to use CPAP nightly to helping their spouse to clean the machine and equipment appropriately. Spousal collaboration has also been shown to increase CPAP compliance. Collaboration had the most effect when CPAP patients were having difficulties with their CPAP, and the spouse and patient work together to solve the problem. Studies have shown that spousal support and collaboration can help improve CPAP compliance however the data remains unclear in any other type of spousal involvement.

Practice change

Recent studies have revealed compliance with CPAP is not optimal, as noncompliance with CPAP significantly reduces the overall effectiveness of treatment of OSA; these patients are at risk for comorbid health conditions^[7]. Improvement of CPAP compliance will positively impact patients, patient's families, communities and the health care system as a whole. Interventions to improve CPAP compliance are essential. From the three main interventions patient education had the most consistent, highest level, and highest quality of evidence, which demonstrated it, improves CPAP compliance (see Table 2). Of the articles evaluated seven of the level one articles, two of the level two, four of the level three, and three of the level five articles showed that increased education increases patient compliance with CPAP. Of the articles demonstrating that intensive patient education increased CPAP compliance, the overall strength and quality of those articles were moderate to high.

The evidence points to the necessity of the implementation of an intensive patient education program for all OSA patients. The education should start at the time the diagnosis of OSA is made, by thoroughly discussing the definition and pathophysiology of OSA. The complications of untreated OSA should be explained at length to the patient and the personalized treatment choices are to be discussed thoroughly with the patient. The definition and purpose of CPAP should

be explained in great detail to each patient. The education should highlight the benefits of CPAP as well as ways to eliminate potential CPAP side effects that patients may experience. When the patient returns after their diagnostic and treatment sleep study to review their results, the same education points should be reviewed. It should be emphasized that the patient should call the clinic with any problems or concerns with CPAP usage. Based on the evidence, each visit should review the definition of OSA, complications of untreated OSA, purpose of CPAP, benefits of CPAP and ways to eliminate potential CPAP side effects. As research has shown that intensive education is the most effective way to address the problem of CPAP noncompliance, it is imperative that there be a practice change implemented to reflect this.

Table 2. Johns Hopkins Nursing Evidenced-based Practice Synthesis and Recommendations Tool

EBP Practice Question: What is the most effective intervention to increase CPAP compliance among adult OSA patients?

Date: 12/10/12

Category (Level Type)	Total Number of Sources/Level	Overall Quality Rating	Synthesis of Findings Evidence That Answers the EBP Question
Level I			
Experimental study Randomized Controlled Trial (RCT) Systematic review of RCTs with or without meta analysis	16	A-8, B-5, C-3 Overall-A/B	-Increased patient education has been shown to increase CPAP compliance. Education includes information on OSA diagnosis, symptoms and treatment as well as information on CPAP and remedies for CPAP issues. -Intensive patient support with frequent home visits focusing on patient education has increased CPAP compliance.
Level II			
Quasi-experimental studies Systematic review of a combination of RCTs and quasi-experimental studies, or quasi-experimental studies only, with or without meta-analysis	3	A-0, B-2, C-1 Overall-B	-Intensive patient education has been shown to increase CPAP compliance. Education includes information on OSA diagnosis, symptoms and treatment as well as information on CPAP and remedies for CPAP issues.
Level III			
·Non-experimental study ·Systematic review of a combination of RCTs, quasi-experimental and non-experimental studies, or non-experimental studies only, with or without meta-analysis ·Qualitative study or systematic review of qualitative studies, with or without meta-synthesis	5	A-4, B-1, C-0 Overall-A	-Intensive patient education including information on diagnosis of OSA, consequences of untreated OSA, treatment options for OSA, and a CPAP review improved CPAP compliance -Collaboration between the patient and his wife leads to increased compliance with CPAP
Level IV			
Opinion of respected authorities and/or reports of nationally recognized expert committees/consensus panels based on scientific evidence	0	N/A	N/A
Level V			
Evidence obtained from literature reviews, quality improvement, program evaluation, financial analysis, or case reports Opinion of nationally recognized expert(s) based on experiential evidence	4	A-0, B-3, C-1 Overall-B	-Improving CPAP compliance is a multi-layered approach. Intensive CBT and patient education have been shown to increase CPAP compliance

Recommendations Based on Evidence Synthesis and Selected Translation Pathway

There is compelling evidence, which shows increased and intensive patient education can improve CPAP compliance in adults diagnosed with OSA. Patient education includes information on diagnosis of OSA, symptoms of OSA, treatment of OSA, complications that result from untreated OSA, information on CPAP, remedies for potential complications with CPAP usage.

As shown in Table 2, the synthesis of the evidence that was reviewed.

Conclusion

In conclusion, CPAP is highly effective in treating OSA, however compliance is often suboptimal leaving these patients at risk for comorbid conditions, increased health care costs, negative effects on their families as well as the health care system as a whole. The evidence demonstrated that the most effective way to improve CPAP compliance is with patient education as well as patient support. To improve CPAP compliance interventions such as, increased education and patient support, are essential to implement in order to effectively treat patients diagnosed with OSA.

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