Original Article

What Personal Experiences of CPAP Use Affect CPAP Adherence and Duration of CPAP Use in OSA Patients?

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Obstructive sleep apnea [OSA] is found in 12 to 18 million adults in the US. It leads to several cardiovascular diseases but can be treated with a continuous positive airway pressure [CPAP] machine. There is limited data on CPAP compliance in Thai or oriental OSA patients particularly on personal experiences on CPAP use. The present study aimed to evaluate personal experience factors associated with CPAP adherence and duration of use in Thai OSA patients. The present study enrolled OSA patients who had their own CPAP machine. All eligible patients were requested to fill out a self-reported questionnaire. The questionnaire comprised of eight parts; baseline characters, co-morbid diseases, CPAP features, feeling during CPAP use, side effects from CPAP, CPAP salesperson, knowledge on CPAP advantages, and overall CPAP experience evaluation. There were 44 OSA patients met the study criteria. There were three independent factors associated with CPAP adherence including feeling annoyed, fearing of mask off during the night, and high price. The adjusted odds ratio (95% CI) of these three factors were 0.168 (0.029, 0.965), 0.137 (0.028, 0.983), and 10.032 (1.062, 94.757). Only male sex and fearing of mask off during the night were significantly associated with CPAP use in hours; average 6.47 hours. The adjusted coefficients and *p*-values of both factors were 1.604 (*p*-value = 0.016) and -0.969 (*p*-value = 0.005). In conclusion, personal experience of CPAP use influenced CPAP adherence and duration of CPAP use in OSA patients.

Keywords: Price, Compliance, Patient experience

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Obstructive sleep apnea [OSA] is a common disease and found in 12 to 18 million adults in the US[1]. OSA is reported to be related with poor quality of life and several cardiovascular diseases such as hypertension, or coronary artery disease[2]. The diagnosis of OSA can be made by using a polysomnography with an evidence of apnea-hypopnea index [AHI] of more than or equal to five events/hour[1]. The most effective treatment for OSA is a continuous positive airway pressure [CPAP] machine. A meta-analysis found that CPAP improved sleepiness scale by 2 unit, reduced systolic blood pressure 2.4 points of weighted mean difference, reduced diastolic blood pressure blood pressure 1.3 points of weighted mean difference, and sleep-related quality of life[3].

Even though CPAP therapy is effective and beneficial, not all patients with OSA are able to use CPAP. A previous study found that only 46 to 83% of OSA patients were able to use CPAP[4]. There were several factors that may affect the CPAP use such as reimbursement insurance right or experience of CPAP use[5,6]. Only 50% of OSA patients were able to constantly and continuously use the CPAP[6]. Symptomatic improvement of daytime sleepiness was showed to be associated with CPAP adherence at one year of treatment (*p*-value <0.01)[6]. The previous research showed that patient factor was claimed to be under-researched particularly in regards of personal experience on CPAP thearpy[5]. Additionally, most studies were conducted in the Western countries and focused mainly on treatment outcomes. Therefore, this study aimed to evaluate personal experience of CPAP use in terms of management aspects on CPAP adherence in Thai OSA patients.

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Materials and Methods

The present study conducted at Sleep Clinic, Srinagarind Hospital: a university hospital of Khon

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Kaen University, Khon Kaen, Thailand. The study period was between March and April, 2018. The inclusion criteria were adult patients (age over 18 years), diagnosed as OSA by polysomnography, had their own CPAP machine, and willing to participate the study. We excluded patients with pregnancy or unable to read or understand Thai.

All eligible patients were requested to fill out a self-reported questionnaire. The questionnaire comprised of eight parts; baseline characters, co-morbid diseases, CPAP features, feeling during CPAP use, side effects from CPAP, CPAP sales person, knowledge on CPAP advantages, and overall CPAP experience evaluation. In total, there were 81 items and distributed in eight parts as follows: 7, 7, 12, 14, 11, 10, 19, and 1. The overall CPAP experience was a 100-score system, while other parts except baseline characters and co-morbid diseases were a 5-level Likert scale with a maximum score of 5 (strongly agreed). A CPAP machine is composed of three parts; machine, corrugated CPAP tube, and CPAP mask. These three parts are connected as a closed-system to a patient. All patients were asked to response to all questions by their own personal experience. The personal experience was instructed in the first part of questionnaire indicating that personal experience is holistic interactive processes by cognition and emotion on CPAP treatment to summarize as pleasurable/un-pleasurable memories[7]. There two main outcomes in this study; regularity of CPAP use and average duration of CPAP use per night. Generally, it took approximately 15 minutes to complete the questionnaire. Eligible patients were able to finish or quit the study at any time.

Statistical analysis

Sample size calculation. A review found that the maximum adherence rate of CPAP in patients with OSA in literatures was 60%[8]. There is currently no compliant report from Thai OSA patients. From a clinical observation, the CPAP compliance rate in Thais was approximately 40%. With a confidence of 95% and power of 80%, the required sample size was 37 patients.

All eligible patients were categorized by regularity of CPAP use as regular CPAP use and no CPAP use. Patients who did not use or intermittently use CPAP was categorized as no CPAP use group, while those patients who use CPAP every night was considered as CPAP use group. Descriptive statistics were used to compare factors between both groups.

Factors associated with CPAP use were computed by using logistic regression analysis. Those factors with a *p*-value of less than 0.20 by univariate logistic regression analysis were subsequently put into the multivariate logistic regression analysis. A stepwise multivariate logistic regression analysis was used to create a final model. A Hosmer-Lemeshow Chi-square was used to evaluate a goodness of fit of the final model. Results were presented as odds ratios and 95% confidence interval [CI].

Another outcome, duration of CPAP use, was calculated in those who used CPAP regularly. Factors related with numbers of CPAP use in hours were executed by using linear regression analysis. All studied variables were computed by a univariate linear regression analysis. Those factors with a *p*-value of less than 0.20 were put in the multivariate linear regression analysis. A stepwise approach was used for multivariate linear regression analysis. An adjusted R square was used to evaluate the goodness of fit of the final model. Results were presented as coefficients and *p*-values. All statistical analyses were calculated by STATA software, version 10.1 (College Station, Texas, USA).

Results

There were 48 patients participated the study. Of those, four patients were excluded due to incomplete data information. In total, there were 44 patients in the analysis and categorized into two groups; regular CPAP users in 35 patients (79.55%) and no CPAP use in 9 patients (20.45%). An average (SD) use of CPAP for those with regular users was 6.47 (1.57) hours. Baseline characters and presence of co-morbid diseases were comparable in patients who regularly use CPAP (Table 1).

There were 12 factors with the *p*-value by a univariate logistic regression analysis of less than 0.20 in four categories including CPAP features (2 items), feeling during CPAP use (7 items), side effects from CPAP (1 item), and knowledge on CPAP advantages (2 itmes). After adjusted, there were three independent factors associated with regular CPAP use including feeling annoyed, fearing of mask off during the night, and high price (Table 2). The adjusted odds ratio (95% CI) of these three factors were 0.168 (0.029, 0.965), 0.137 (0.028, 0.983), and 10.032 (1.062, 94.757). The Hosmer-Lemeshow Chi-square was 4.95 (*p*-value =0.763).

Regarding duration of CPAP use (hours), there were 13 factors with significant correlation by a univariate linear regression analysis; four positive

Table 1. baseline characters and factors associated with continuous positive airway pressure (CPAP) use in obstructive sleep apnea patients

Factors	CPAP use n = 35	No CPAP use n = 9	*p*-value
Baseline characters			
Age, years	52.68 (13.71)	57.33 (10.21)	0.852
Male sex, n (%)	19 (55.88)	3 (33.33)	0.281
Body mass index, kg/m^2	31.90 (7.84)	27.72 (4.91)	0.919
College education or higher, n (%)	22 (62.86)	6 (66.67)	0.999
Government officer, n (%)	9 (25.71)	1 (11.11)	0.659
Income over 500 USD/month, n (%)	22 (68.75)	6 (75.00)	0.999
Reimbursement, n (%)	24 (68.57)	8 (88.89)	0.405
Co-morbid diseases			
Hypertension, n (%)	22 (62.86)	8 (88.89)	0.233
Diabetes, n (%)	11 (31.43)	3 (33.33)	0.999
Congestive heart failure, n (%)	1 (2.86)	0	0.999
Cardiac arrhythmia, n (%)	3 (8.57)	1 (11.11)	0.999
Coronary artery disease, n (%)	1 (2.86)	0	0.999
Stroke, n (%)	3 (8.57)	1 (11.11)	0.999
GERD, n (%)	11 (31.43)	2 (22.22)	0.703
CPAP features*			
Length of CPAP tube	3.86 (0.72)	3.44 (0.73)	0.167
High price	3.71 (1.19)	3.00 (0.93)	0.071
Feeling during CPAP use*			
Fear of electrical shock by CPAP	2.18 (1.10)	3.22 (0.97)	0.017
Fear that CPAP stops working while wearing	2.33 (1.19)	3.22 (1.09)	0.048
CPAP causes insomnia	2.15 (1.21)	2.78 (0.83)	0.073
Feeling worried during CPAP use	2.09 (0.91)	2.78 (1.09)	0.082
Fearing of mask off during the night	2.36 (1.11)	3.11 (1.67)	0.111
Feeling annoyed during CPAP use	2.26 (1.16)	2.75 (0.71)	0.179
Feeling tightness during CPAP use	2.26 (1.05)	2.75 (0.71)	0.200
Side effects from CPAP*			
Mask leakage during CPAP use	2.50 (1.05)	2.00 (0.87)	0.156
CPAP salesperson**			
Salesperson gives enough information	4.00 (0.98)	4.13 (0.83)	0.857
Knowledge on CPAP advantages*			
No apnea during sleep	4.13 (0.81)	3.62 (0.91)	0.145
Refreshed sleep	3.79 (0.84)	4.22 (0.67)	0.168
Overall	81.90 (12.99)	91.00 (7.63)	0.035

1 USD is approximately 30 Baht; reimbursement: insurance right for CPAP reimbursement
* Factors with a *p*-value by a univariate logistic regression analysis of less than 0.20, ** Lowest *p*-value by a univariate logistic regression analysis in the category, *,** used a five-level Likert scale; data presented as mean (SD) unless indicated otherwise

correlation and nine negative correlation (Table 3). After adjusted, only male sex and fearing of mask off during the night were significantly associated with CPAP use in hours. The adjusted coefficients and *p*-values of both factors were 1.604 (*p*-value = 0.016) and -0.969 (*p*-value = 0.005). The final model has the adjusted R square of 0.3031.

Discussion

A previous study from UK showed that personal experience on CPAP use was one of the main factor associated with CPAP adherence. High CPAP compliance was related to strong internal locus of control, less belief in powerful others, and greater health value[9]. In the present study, conducted in all Thai

Table 2. Factors associated with continuous positive airway pressure use by logistic regression analysis

Factors	Unadjusted odds ratio (95% confidence interval)	Adjusted odds ratio (95% confidence interval)
Feeling annoyed during CPAP use	0.667 (0.328, 1.358)	0.168 (0.029, 0.965)
Fearing of mask off during the night	0.534 (0.277, 1.030)	0.137 (0.028, 0.983)
High price	1.678 (0.853, 3.300)	10.032 (1.062, 94.757)
Age, years	0.997 (0.942, 1.056)	0.857 (0.720, 1.019)
Body mass index, kg/m^2	0.961 (0.876, 1.054)	0.864 (0.718, 1.039)
Refreshed sleep	0.489 (0.176, 1.357)	0.364 (0.080, 1.648)

Table 3. Significant factors associated with continuous positive airway pressure use (hours) in obstructive sleep apnea patients by univariate linear regression analysis

Factors	Unadjusted coefficients	*p*-value
Positive correlations		
Male sex	1.138	0.049
CPAP makes good blood pressure	1.069	0.046
CPAP size is appropriate for your bedroom	0.916	0.011
CPAP is safe	0.876	0.019
Negative correlations		
Government officer	-1.692	0.043
CPAP pressure is too high	-0.729	0.012
Feeling worried during CPAP use	-0.676	0.030
Fearing of mask off during the night	-0.651	0.008
Feeling itchy during CPAP use	-0.649	0.014
Feeling that mask is heavy	-0.617	0.016
Feeling disordered during CPAP use	-0.608	0.009
Feeling annoyed during CPAP use	-0.569	0.022
Feeling weird during CPAP use	-0.522	0.029

OSA patients, also found that personal experiences may associate with CPAP adherence but in a negative way. If patients felt annoyed with the CPAP or anxious of mask off while wearing the CPAP mask at night, the compliance was reduced by 83.2% and 86.3% (Table 2). Another unbelievable finding is that patients who bought expensive CPAP machine tended to use CPAP regularly by 10 times (Table 2). Also, note that non-CPAP users had overall CPAP experience score significantly higher than the CPAP user group (Table 2). These results may indicate that overall satisfaction may not related to adherence or compliance of CPAP in OSA patients.

As previously reported[3], CPAP improved sleep quality and should improve sleep duration. However, a study from Japan found that CPAP may increase sleep time for 33 minutes but only for those OSA patients with baseline shorter and more fragmented sleep[10]. In the present study, we did not evaluate baseline sleep condition of the patients but we found that male sex may be more compliant with CPAP than female and increase sleep with CPAP use by 1.60 hour. A study from France found that men with OSA were more likely to have more severe OSA than female. As previous reported, high AHI or more severe disease had a coefficient of 1.019 to be adhere with the CPAP[9]. Additionally, female patients were more anxious and depressed than male subject[10]. The anxiety and depression scores of female OSA patients were significantly higher than male patients (3.9 vs. 2.4 and 3.0 vs. 1.8; *p*-value <0.001 for both scores). These anxiousness or depression may increase risk of fearing of mask off while wearing CPAP which had negative correlation with duration of CPAP use (adjusted coefficient of -0.969).

There were some limitations in the present

study. First, some variables were not studied such as duration of CPAP use. Second, the percentage of CPAP users in this study may be higher than it should be. Some OSA patients who were unable to use CPAP did not attend the Sleep clinic anymore. Third, the present study focused only on personal experience on CPAP use. Other possible factors affect CPAP use should be studied in Thai population in the future such as family factor, physician factor, or treatment factors[5]. Further studies on these issues may be needed to confirm the results of the present study.

In conclusion, personal experience of CPAP use influenced CPAP adherence and duration of CPAP use in OSA patients.

What is already known on this topic?

Factors that may affect the CPAP adherence in obstructive sleep apnea patients in the Western countries included reimbursement insurance right or experience of CPAP use.

What this study adds?

Personal experiences affect CPAP adherence and duration of CPAP use in Thai patients with obstructive sleep apnea. Factors associated with CPAP adherence including feeling annoyed, fearing of mask off during the night, and high price. The duration of CPAP use was associated with male sex and fearing of mask off during the night.

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Potential conflicts of interest

The authors declare no conflict of interest.

References

1. Young T, Palta M, Dempsey J, Peppard PE, Nieto FJ, Hla KM. Burden of sleep apnea: rationale, design, and major findings of the Wisconsin Sleep Cohort study. WMJ 2009;108:246-9.
2. Piepoli MF, Hoes AW, Agewall S, Albus C, Brotons C, Catapano AL, et al. 2016 European Guidelines on cardiovascular disease prevention in clinical practice: The Sixth Joint Task Force of the European Society of Cardiology and Other Societies on Cardiovascular Disease Prevention in Clinical Practice (constituted by representatives of 10 societies and by invited experts)Developed with the special contribution of the European Association for Cardiovascular Prevention & Rehabilitation (EACPR). Eur Heart J 2016;37:2315-81.
3. Jonas DE, Amick HR, Feltner C, Weber RP, Arvanitis M, Stine A, et al. Screening for obstructive sleep apnea in adults: Evidence report and systematic review for the US Preventive Services Task Force. JAMA 2017;317:415-33.
4. Weaver TE, Grunstein RR. Adherence to continuous positive airway pressure therapy: the challenge to effective treatment. Proc Am Thorac Soc 2008;5:173-8.
5. Shapiro GK, Shapiro CM. Factors that influence CPAP adherence: an overview. Sleep Breath 2010;14:323-35.
6. Rosenthal L, Gerhardstein R, Lumley A, Guido P, Day R, Syron ML, et al. CPAP therapy in patients with mild OSA: implementation and treatment outcome. Sleep Med 2000;1:215-20.
7. Jain R, Aagja J, Bagdare S. Customer experience - a review and research agenda. J Serv Theor Pract 2017;27:642-62.
8. Weaver TE, Sawyer AM. Adherence to continuous positive airway pressure treatment for obstructive sleep apnoea: implications for future interventions. Indian J Med Res 2010;131:245-58.
9. Wild MR, Engleman HM, Douglas NJ, Espie CA. Can psychological factors help us to determine adherence to CPAP? A prospective study. Eur Respir J 2004;24:461-5.
10. Tachikawa R, Minami T, Matsumoto T, Murase K, Tanizawa K, Inouchi M, et al. Changes in habitual sleep duration after continuous positive airway pressure for obstructive sleep apnea. Ann Am Thorac Soc 2017;14:986-93.