Neurology Asia 2021; 26(4) : 801 – 807

The effects of the Thai traditional triangle cushion in treating positional obstructive sleep apnea: A pilot study

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Abstract

Objectives: Positional obstructive sleep apnea (POSA) is common and affects sleep quality. This study was to identify the efficacy of using a Thai traditional triangle cushion as a position device for therapy in POSA. *Methods:* This open-label, self-control, prospective intervention study enrolled adult patients with POSA. The 8-weeks positional advice was performed, followed by 8-weeks using a Thai triangle cushion. Study outcomes were to measure changes in Epworth sleepiness scale (ESS) scores and 36-Item Short Form Health Survey (SF-36) and problems/complaints during the study. *Results:* There were 10 patients enrolled in total, with a mean age of 55.8 years old (SD 11.3), with an average apnea-hypopnea index (AHI) of 26.1, a supine AHI of 35.3, a non-supine AHI of 8.6 and the average baseline ESS was 10 (SD3.5). The positional advice did not improve the ESS score from baseline [the mean difference in ESS score of +0.20 (95%CI-2.01 to 2.41, *p*-value 0.84)]. Using cushion intervention significantly reduced the ESS score from baseline [-3.6 (95%CI-5.00 to-2.20), *p*-value<0.001]. The period of using a cushion (intervention) also significantly reduced the ESS score when compared with the period of positional advice (control), with an ESS reduction of -3.8 (95%CI-6.47 to-1.13), *p*-value 0.011. The quality of life is improved only during the period of using a cushion. There were no complaints from the patients related to positional advice or using the intervention cushion.
Conclusions: The Thai traditional triangle cushion, as a positional device in treating patients with positional obstructive sleep apnea, is effective and comfortable.

Keywords: Positional obstructive sleep apnea, positional therapy, Thai traditional triangle cushion, obstructive sleep apnea

INTRODUCTION

Obstructive sleep apnea (OSA) is a common disorder affecting at least 2% to 4% of the middle-aged population.[1] It is characterized by recurrent episodes of complete or partial obstruction in the upper airway during sleep with consequences such as significant daytime sleepiness that impairs function and quality of life (QOL)[2], increased cardiovascular mortality, depression, sexual dysfunction and traffic accidents.[3-8] As measured by polysomnography (PSG), the severity of OSA is expressed by the apnea-hypopnea index (AHI); an AHI of 5–15/h indicates mild OSA, 15–30/h is moderate, and an AHI ≥ 30 is severe. A supine sleeping position can influence OSA. This so-called positional OSA (POSA) is defined as a two-fold increase in AHI in supine compared to non-supine position and mostly with an AHI < 5 in non-supine position.[9-11] Using this definition, Mador *et al*. observed that POSA is widespread in patients with OSA and related to the severity of OSA: 49.5% in mild OSA, 19.4% in moderate OSA, and 6.5 % in severe OSA.[10]

Positional therapy (PT) is defined as preventing patients from sleeping in the supine sleeping position. The traditional PT method is the 'tennis ball technique', which involves sewing a tennis ball into the back of a shirt worn during sleep, so that the discomfort from lying on the tennis ball will force the patient into a non-supine position.[12-15] Despite its effectiveness in reducing upper airway obstruction, the tennis ball technique and its imitators have failed because they are difficult to use and tolerate.[16] Therefore, there is a need for more effective positional therapy with better adherence. Recently, a new generation of

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Date of Submission: 6 August 2021; Date of Acceptance: 3 September 2021

https://doi.org/10.54029/2021dej

PTs has been introduced: small, mainly indirect working devices, which give off a vibrating stimulus when sensing a supine position. As the devices are more comfortable, it is predicted that adherence would be better.[17-19] The study aimed to identify the clinical outcome comparing self-positional control with using a Thai traditional triangle cushion in our patients with POSA.

METHODS

Study design and participant recruitment

This was an open-label, self-controlled, prospective intervention study conducted at Phramongkutklao Hospital. Patients were recruited from outpatient neurology and sleep medicine clinics between June 2020 and September 2020, and then were followed up until December 2020. Physicians provided a description of the study to eligible patients. If a patient agreed to proceed with the study, written informed consent was obtained.

Patient eligibility criteria included a diagnosis of naïve POSA, an age of 18 years or older, and no continuous positive airway pressure (CPAP) treatment or positional therapy (PT) in the past 6 months. The diagnosis of POSA was based on the following three criteria: (1) a full in-laboratory overnight polysomnography with total apnea/hypopnea index (AHI) > 10/hour, (2) supine AHI greater than or equal to two times the non-supine AHI[11], (3) at least 15 minutes of supine and non-supine sleep. Exclusion criteria were excessive daytime sleepiness (ESS ≥ 17), commercial driver, pregnancy/lactation, morbid obesity [body mass index (BMI) ≥ 40 kg/m^2], unable or unwilling to use the treatment device or concurrent use of other therapies for OSA such as mandibular advancement splints. They were also excluded if they had uncontrolled severe medical conditions or conditions that precluded their ability to lie in a non-supine position.

The Thai traditional triangle cushion, with 2 fabric straps wrapping over the patients' chest, was used as an intervention. Figure 1 show the Thai traditional triangular cushion (W 30 cm x L 47 cm x H 27cm). With this device, the patient remained in a semilateral position. The plan was to gradually train patients to avoid sleeping in the supine position. Figure 2 show the intervention, first phase, in self-position advice (control) for 8 weeks, and second phase, using our positional device (intervention) for 8 weeks.

Figure 3 shows the study protocol. At baseline (visit 1), ten patients completed two questionnaires (the Epworth Sleepiness Scale), ESS[20-21] for assessing daytime sleepiness and the 36-Item Short Form Health Survey, SF-36[22-23] for assessing quality of life. Then they were advised to perform self-positional therapy for 8 weeks. On visit 2 (eight weeks later), the ESS and SF-36 questionnaires were administered. Furthermore, the studied patients received our device, a Thai traditional triangle cushion, as positional therapy for another 8 weeks. Finally, ESS and SF-36 were assessed at visit 3 (visit 16-weeks).

Figure 1. The Thai traditional triangle cushion with 2 fabric straps

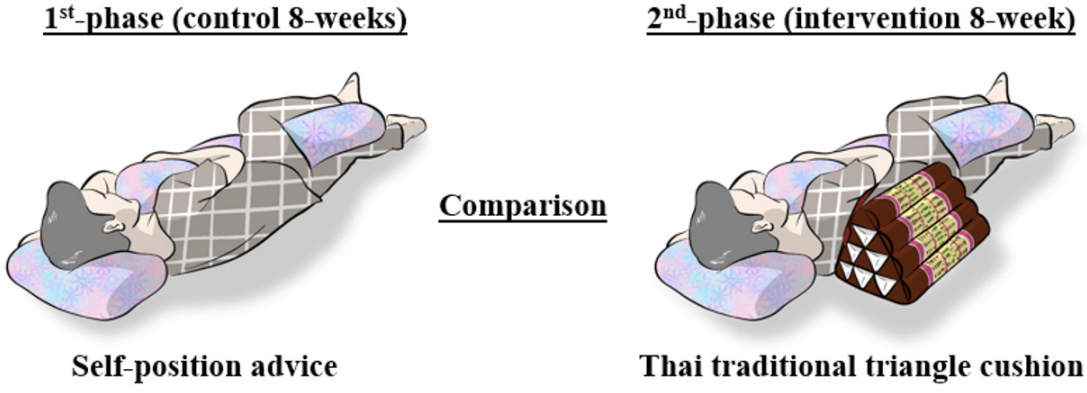

Figure 2. Intervention

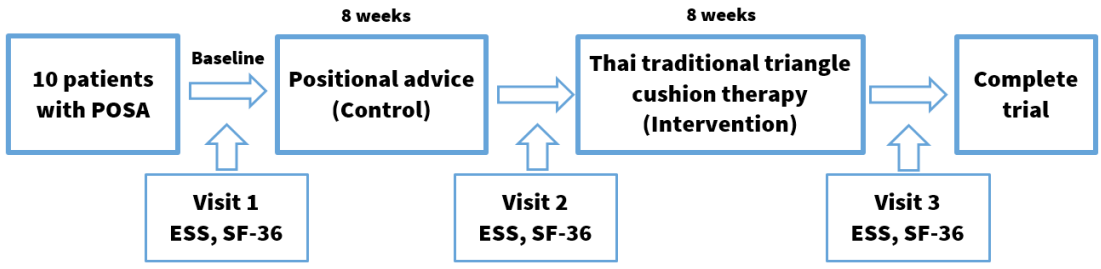

Figure 3. Trial flow diagram

POSA-positional obstructive sleep apnea, ESS- Epworth Sleepiness Scale, SF-36-36-Item Short Form Health Survey

Outcome

The primary outcome was the mean change of ESS score after 8-weeks self-positional therapy (control) and after 8-weeks of using Thai traditional triangle cushion therapy (intervention). Secondary outcomes were physical and mental health in the SF-36 evaluation and self-reported complaints during device use.

Statistical analysis

Baseline characteristics were displayed as mean with standard deviation, or median with range for continuous variables or as numbers with percentage for categorical variables. The outcomes were analyzed by a paired (one-sample) t-test. Statistical significance was defined as a two-tailed p-value of less than 0.05. All statistical analyses were carried out using SPSS 27.0.

RESULTS

Patient characteristics

Ten patients with positional obstructive sleep apnea (POSA) were given informed consent from a total of 22 patients. Six patients were male (60%) and the mean age was 55.8 years. The mean body mass index (BMI) and neck circumference were 27.7 kg/m^2 and 40.2 cm, respectively. The average total apnea-hypopnea index (AHI) was 26.1 (times/hour) with an average supine AHI of 35.3 and a non-supine AHI of 8.6. The average ESS score at baseline was 10.0. The details of the patients' baseline characteristics were shown in Table 1.

The effect of 8-weeks self-positional advice as positional therapy

The ESS score on visit 2 was 10.2, compared to a baseline of 10.0 on visit 1, with a p-value

Table 1: Baseline characteristics of ten participants with positional obstructive sleep apnea

Patient characteristics	Mean ± SD
Male: number (%)	6 (60)
Age (years)	55.8 ± 11.2
Body weight (kgs)	77.3 ± 9.9
Height (cms)	167 ± 8.6
Body mass index (kg/m^2)	27.7 ± 3.3
Neck circumference (cms)	40.2 ± 4.0
ESS score	10.0 ± 3.5
Baseline AHI (time/hour)	
Total AHI	26.1 ± 17.2
Supine AHI	35.3 ± 18.5
Non-supine AHI	8.6 ± 8.5

ESS-Epworth Sleepiness Scale, AHI-apnea-hypopnea index, SD-standard deviation, cms-centimeters, kgs-kilograms, m-meter

Table 2: Outcome assessment

Outcome	Visit 1 (week-0)	Visit 2 (week-8)	Mean change from visit 1 (p-value)	Visit 3 (week-16)	Mean change from visit 1 (p-value)	Mean change from visit 2 (p-value)
	Baseline	8-weeks of self-positional therapy		8-weeks of using Thai traditional triangle cushion		
Epworth Sleepiness Scale score (mean ± SD)	10.0 ± 3.5	10.2 ± 3.9	+0.20 (p 0.842)	6.4 ± 2.5	-3.60 ($p < 0.001$) *	-3.80 (p 0.011) *
36-Item Short Form Survey (SF-36)						
Physical functioning (%)	65.0 ± 22.7	56.0 ± 26.4	-9.00 (p 0.131)	81.5 ± 25.6	+16.50 (p 0.127)	+25.50 (p 0.021) *
Role limitations due to physical health (%)	80.0 ± 30.7	70.0 ± 34.5	-10.00 (p 0.399)	92.5 ± 16.9	+12.50 (p 0.177)	+22.50 (p 0.095)
Role limitations due to emotional problems (%)	73.3 ± 37.9	66.7 ± 41.6	-6.66 (p 0.706)	86.7 ± 32.2	+13.34 (p 0.343)	+20.00 (p 0.081)
Energy/fatigue (%)	54.0 ± 25.3	55.5 ± 24.2	+1.50 (p 0.755)	68.5 ± 25.5	+14.50 (p 0.102)	+13.00 (p 0.093)
Emotional well-being (%)	64.0 ± 19.1	67.6 ± 22.9	+3.6 (p 0.367)	80.4 ± 15.4	+16.40 (p 0.034) *	+12.8 (p 0.107)
Social functioning (%)	80.0 ± 17.9	75.0 ± 17.7	-5.00 (p 0.423)	90.0 ± 11.5	+10.00 (p 0.070)	+15.00 (p 0.050)
Pain (%)	75.5 ± 26.8	78.0 ± 18.2	+2.50 (p 0.544)	79.8 ± 17.9	+4.25 (p 0.495)	+1.75 (p 0.732)
General health (%)	60.0 ± 24.4	59.5 ± 18.8	-0.50 (p 0.899)	75.5 ± 19.1	+15.50 (p 0.068)	+16.00 (p 0.035) *

P-value < 0.05, indicating significant difference, SD-standard deviation

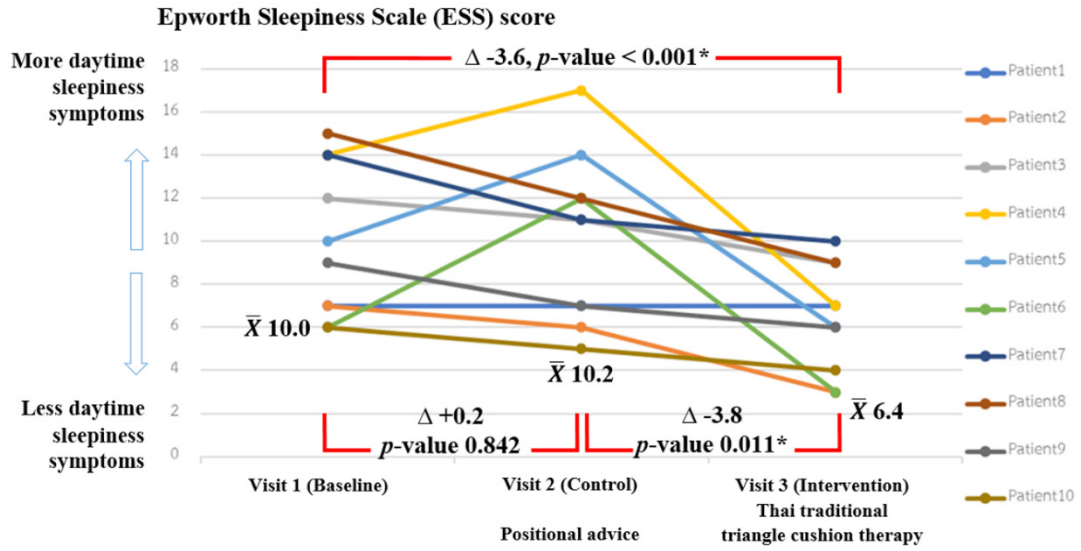

Figure 4. Individual Epworth Sleepiness Scale (ESS) score (number = 10)

Δ-mean change, $\overline{X}$–average ESS, *p-value < 0.05

of 0.842, Table 2. There was no statistically significant difference between baseline and SF-36 item scores, Table 2.

The effect of 8-weeks of using the Thai traditional triangle cushion as a positional therapy

After using the cushion device, the ESS score was 6.4 compared with a baseline of 10.0 on visit 1, with a p-value of < 0.001. Compared with the baseline visit, SF-36 in each category, including physical functioning, role limitations due to physical health, role limitations due to emotional problems, energy/fatigue, emotional well-being, social functioning, pain, and general health, were all improved (Table 2).

Comparison between 8-weeks self-positional advice and 8-weeks of using the Thai traditional triangle cushion device as positional therapy

Compared to our positional device, a Thai triangle cushion with chest straps (visit 3) and self-positional advice (visit 2), the ESS score in the cushion group was significantly reduced, with

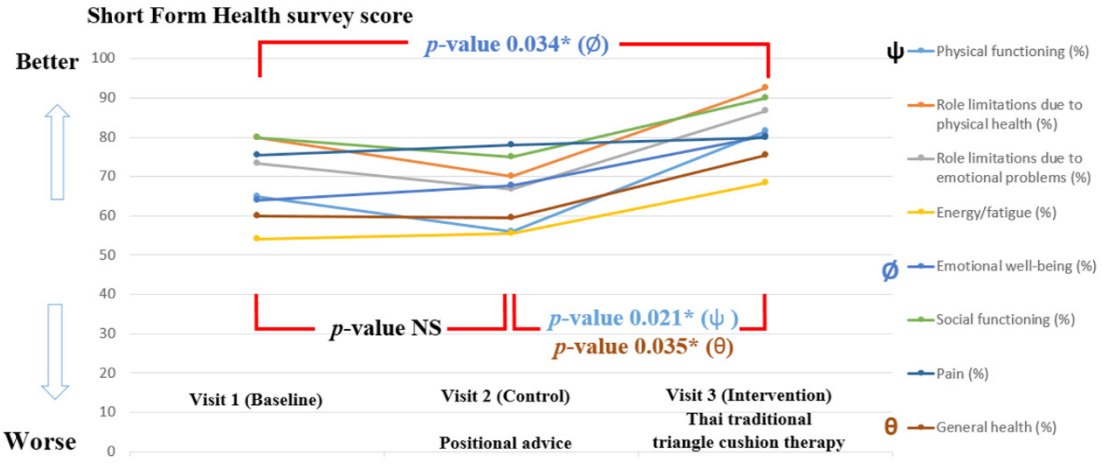

Figure 5. Individual 36-item Short Form Health survey score (number = 10)

NS-non-significant, *p-value < 0.05

a mean reduction of ESS score compared with self-positional treatment of -3.8, *p*-value 0.011.

The individual scores for the ten patients with POSA and details of the average ESS and SF-36 scores were illustrated in Table 2, Figure 4, and Figure 5. For adverse outcomes of the Thai cushion as well as positional advice, there was no complaint or concern from any of the patients.

DISCUSSION

Positional therapies are simple and can be effective tools in positional obstructive sleep apnea treatment.[12-15,24] Permut *et al*.[9] demonstrated that the effects of position therapy were comparable to CPAP treatment, but more convenient to use. Positional therapy devices include chest or lumbar blinders, full-length cushions, a tennis ball attached to the back of nightwear, semirigid backpacks, and electric sensors that alert when people change position. These devices can progressively train people with POSA to sleep on their sides. Positional therapies may be attractive options because of their cost-effectiveness, especially in those with moderate OSA, and for whom adherence to CPAP treatment is poor.[16,25-28]

In our research, using a Thai traditional triangle cushion as a positional therapy was a new insight for positional therapy in Thai patients with POSA. To our knowledge, this triangle cushion study has never been conducted before. Our research findings supported Permut *et al*. as it was found that after using their positional device, the ESS score was significantly reduced from the baseline and from the positional advice period. Moreover, the quality of life in terms of physical and mental health was also improved among our Thai cushion group, although some items did not show a statistically significant difference. Bignold *et al*.[16] recognized that long-term adherence to tennis ball techniques is poor, with less than 10% of patients reporting continued use for approximately 30 months after prescription. The majority of people with nonadherence reported that it was unpleasant or uncomfortable.[16] There were no complaints about our short-term use of the cushion or positional advice from the studied patients, indicating its use was comfortable, although we did not monitor its long-term adherence.

The strength of this study was that it was a prospective self-controlled design as well as the appropriate duration of the study (16 weeks). In addition, POSA was diagnosed objectively by overnight polysomnography. The triangle cushion is easy to find, especially in Thailand or Asian countries, and is inexpensive, so this positional therapy is feasible and accessible. The limitations of our study were 1) the relatively small sample size, 2) half of our patients had milder daytime sleepiness symptoms scores (ESS < 11) and 3) the measurement outcomes we monitored were only 2 sleep questionnaires (ESS and SF-36). Therefore, further studies in larger populations using various outcome measurements are warranted to provide further insight into the role of the Thai traditional triangle cushion therapy in patients with POSA.

In conclusion, the Thai traditional triangle cushion as a positional device in treating patients with positional obstructive sleep apnea is effective and convenient. It significantly reduces excessive daytime sleepiness and tends to improve the quality of life compared to no treatment or self-positional advice therapy.

ACKNOWLEDGEMENT

We thank the patients for their time to participate in this study. An English language review of this manuscript was conducted by Stephen Pinder a native English speaker specializing in healthcare.

DISCLOSURE

Financial support: This study was funded by the Department of Medicine, Phramongkutklao Hospital and College of Medicine, Bangkok, Thailand.

Conflict of interest: None

Ethical approval: This study was approved by the Institutional Review Board, Royal Thai Army Medical Department, Reference: IRBRTA 486/2563 (13 April 2020).

Data availability: The data that support the findings of this study are available from the corresponding author upon reasonable request. The data that support the findings of this study are available from the corresponding author upon reasonable request.

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