J Korean Med. 2014;35(2):*12-18*
http://dx.doi.org/10.13048/jkm.14017
pISSN 1010-0695 • eISSN 2288-3339

Original Article

Nasal Breath in the Lateral Position for Sleep Apnea: a Retrospective Case Series

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Objectives: This was a retrospective case series about the clinical effect of integrated approach with behavior therapy for obstructive sleep apnea (OSA).
Methods: Medical records of twelve patients with OSA who were treated with behavior modification including nasal breathing with oral appliances and sleep in lateral position, oral administration of herbal medicines and acupuncture treatment between January and September of 2013 were reviewed. Apnea-hypopnea index (AHI), day time sleepiness, apneas and hypopneas counts during sleep, risk indicator (RI), oxygen desaturation index, average saturation during sleep, lowest desaturation, lowest saturation, snoring events ratio and number of desaturations (%) were assessed before and after treatments with the ApneaLink device, which is a portable diagnostic apparatus for monitoring airflows of the patient's breath at home.
Results: After an average 62.67 (SD 37.16) days of treatment, AHI (from 17.67, 12.79 to 8.75, 8.25, p=0.007), RI (from 22.00, 13.26 to 12.09, 8.03, p=0.004), oxygen desaturation index (from 17.33, 12.17 to 8.17, 7.86, p=0.005), and number of desaturations (from 7.00 times, 9.79 to 0.92 times, 1.39, p=0.044) showed significant improvement. Daytime sleepiness improved from 6.5 (3.2) to 3.8 (1.8) but there was no significant difference after treatment (p=0.17). No adverse events related to treatment were observed during participation in the treatment.
Conclusion: From this case series, we found that behavior modification with herbal medication and acupuncture may be effective for improving sleep apnea without serious adverse events. Future randomized controlled trials with larger sample size will be necessary for concrete evidence on the benefit of this integrated treatment for OSA.

Key Words : Obstructive sleep apnea, behavior modification, nasal breath, lateral position, herbal medicine, acupuncture

Introduction

It has been suggested that sleep position is associated with apneic events in both positional and nonpositional patients with obstructive sleep apnea (OSA)[1]. The supine position affects the size of the upper airway, so avoiding the supine position is regarded to be an effective alternative treatment to applying continuous positive airway pressure (CPAP) devices[2]. Avoidance of the supine position during sleep is simple, costless, and most of all not difficult to do compared to CPAP which shows quite low adherence for use[3].

Mouth breathing is another deteriorating factor of OSA in patients without nasal obstruction, not to mention of those with nasal obstruction as well[4]. When the mouth is open, the sizes of retropalatal and retroglossal cross-sectional areas decrease and

・Received : 4 February 2014 ・Revised : 12 May 2014 ・Accepted : 12 May 2014
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pharyngeal length increases, which makes airflow faster while passing through the narrower and longer upper airway and increases its collapsibility[5]. Due to this anatomical change, patients who breathe mainly through the mouth during sleep show worse results in respiratory disturbance index than those breathing nasally[6]. In this sense, oral appliances are a suggested treatment option for OSA[1].

In traditional Korean medicine, behavior modification during sleep is as important a part of treatment for sleep disturbance as herbal therapy and acupuncture. In DONGUIBOGAM, which has been the most used text of traditional Korean medicine for 15 centuries, a lateral position with knees bent was recommend for improving sleep quality. In addition, closing the mouth during sleep was encouraged to prevent wasting *qi* and pathogenic invasion[7]. This is a retrospective case series about the OSA patients treated in an integrated approach with behavior therapy. Through this study, we wanted to explore the possible benefit of traditional medicine for improving sleep apnea.

Methods

This is a retrospective case series. All the medical records of the patients, who were diagnosed with OSA and visited the sleep department of Dong-In Traditional Medical Clinic, Seoul, South Korea between January and September of 2013 were reviewed. Information assessment and data extraction were conducted complying with the guidelines of the Gachon Human Research Ethics Committee.

A patient's medical records were included if the patient was diagnosed previously as OSA and had suffered OSA for at least one year.

Interventions

Behavior modification was the main treatment for all OSA patients. To induce nasal breathing, oral appliances were applied to each patient and the mouth was closed with medical adhesive tape. The device was made of putty (CharmFlex, DENTKIST, Inc. Korea) and was located between the teeth. It was designed to set the mandible in the neutral position and to change cervical lordosis, which increases tension of cervical extensor muscles[8]. To avoid open-mouth breathing, skin tape was applied over the lips to fix the mouth closed after the oral appliance was set between the teeth(Figure 1). Sleep in the lateral position was recommended as well (Figure 2). Every patient participated in a one-hour training for behavior modification and adherence to the sleep position guidance was checked at every visit.

Fig. 1. Oral application and acupuncture treatments around the nose and at head

Fig. 2. Closing mouth with adhesive tape and lateral sleep position

Herbal medication and acupuncture were offered as co-interventions. Herbal medication, *Cheungsimsansodan* composed of *Rehmaniae Radix Crudus* 9g, *Akebiae Caulis* 6g, *Glycyrrhizae Resina* 4.5g, *Gypsum Fibrosum* 5g, *Bambusae Caulis In Liquamen* 60ml, *Arisaema Praeparatus cum Bile* 6g, *Xanthii Fructus* 6g, *Zanthoxyli Cortex* 1.5g, *Zingiberis Rhizoma* 3g, *Scrophulariae Radix* 4.5g, *Bubalus bubalis* L. 4.5g, *Uncariae Ramulus Et Uncus* 6g, *Benzoinum* 0.5g and *Typhonium giganteum Engl* 6g, was administered three times a day. Acupuncture treatment was applied at both sides of five transport points of the visceral organs on the back (BL13, BL15, BL18, BL20 and BL23) as well as points on the hands (LI4) and around the nose (LI20, GV24 and Ex1) twice a week. 0.2*30mm stainless steel needles were inserted in 0.5cm depth at each point. *Deqi* sensation was induced through manual stimulation by rotating the needles. The purpose of acupuncture and herbal medication treatment was to improve nasal obstruction and reduce tension and mental irritability.

Outcome assessment

The primary outcome was an apnea-hypopnea index (AHI) before and after treatments (Figure 3). All outcomes related to sleep apnea were screened through an ApneaLink device (ResMed Corporation, Poway, Calif)[9]. Every patient wore this device at home during sleep before and after treatment. Full polysomnography is the standard diagnostic test for evaluating OSA but usually must be assessed in a well-equipped sleep center[10]. This device monitors airflows of patient's breath during sleep. It can be used in various settings including the home, which is very effective for small private clinics[9]. In addition, the results from this device show as reliable sensitivity and specificity for detecting sleep apnea as polysomnographic testing[9]. Using this device, hypopnea was defined by detection of a reduction of 50% of airflow continuing an average of five breath cycles or reduction of 30% if desaturation of 4% was detected from the oximetry according to the AASM apnea criteria[11]; apnea was detected when more than 80% reduction of airflow was observed. AHI, a widely used tool for assessing OSA, was measured through counting mean number of apnea and hypopnea per hour during sleep[12]. The normal score is under five per hour.

Fig. 3. ApneaLink device

The secondary outcomes were patient-reported day time sleepiness (0 best to 10 worst) before and after treatments. Apneas and hypopneas counts during sleep, risk indicator (RI), oxygen desaturation index, average saturation during sleep, lowest desaturation, lowest saturation, snoring events ratio (snoring events/total respirations) and number of desaturations (%) were assessed with the ApneaLink device. Risk indicator is sum of number of AHI points and score of the ratio of numbers of flow-limited breaths with and without snoring[13]. The normal score is under five. Oxygen desaturation index means the number of oxygen desaturations per hour during sleep. The normal score is under five. Snoring events were recorded when 0 to 60 Hz acoustic signal was detected through sensing device. Adverse events related to behavior modification treatment, herbal medication and acupuncture treatment were reviewed from the patient records.

Statistical analysis

All the statistical analyses were conducted with SAS package (SAS Version 9.1.3, SAS Institute. Inc., Cary, NC, USA). Baseline characteristics were suggested with mean and standard deviation (SD). After testing for normality with Shapiro-Wilk normality test, paired T-test was conducted for normally distributed data and Wilcoxon signed-rank test was applied to non-normal data.

Results

1. Baseline characteristics

A total of twelve patients' medical records were included in this study; eight men and four women. Average age was 44.8 years old (27 to 57 years old). Four patients were overweight and eight were standard body weight based on body mass index (BMI). Five patients had one- to five-year sleep apnea history; one had five- to ten-year history; the other five had over 10-years sleep history. Five patients had current rhinitis symptoms. Most patients showed frequent alcohol consumption but only a small number of patients currently smoked. Patients attended behavior modification treatment, herbal medication and acupuncture for an average of 62.67 (SD 37.16) days (Table 1).

2. Outcomes

The primary outcome, AHI improved significantly after treatment (17.67, 12.79 in the 1st assessment and 8.75, 8.25 in the 2nd assessment, p=0.007) even though the average scores did not decrease below five. Daytime sleepiness improved from 6.5 (3.2) in before-treatment assessment to 3.8 (1.8) in after-treatment assessment but there was no significant difference after treatment (p=0.17). Apneas and hypopneas counts during sleep decreased after treatment but there were no significant differences. RI improved significantly after treatment (22.00, 13.26 in the 1st assessment and 12.09, 8.03 in the 2nd assessment, p=0.004). Indexes related to oxygen saturation and desaturation showed significant improvement after treatment: oxygen desaturation index (17.33, 12.17 in the 1st assessment and 8.17, 7.86 in the 2nd assessment, p=0.005), average saturation during sleep (94.83, 1.75 in the 1st and 96.08, 1.24 in the 2nd, p=0.000), lowest desaturation (81.91, 4.83 in the 1st assessment and 87.00, 4.35 in the 2nd assessment, p=0.002) and lowest saturation (81.58, 4.89 in the 1st and 86.33, 4.77 in the 2nd, p=0.005). Number of desaturations also showed significant improvement after treatment (7.00 times, 9.79 before treatment and 0.92 times,

Table 1. Baseline characteristics

Patient number	Sex	Age (yrs)	BMI (Kg/㎡)	Snoring duration (yrs)	Current rhinitis	Alcohol consumption	Currently smoking	Treatment duration (days)
1	Female	43	28.04	1 to 5	None	None	None	58
2	Male	53	23.81	Over 10	None	2~3 times per week	None	44
3	Male	32	25.59	Over 10	Yes	Frequently	None	127
4	Male	42	23.62	5 to 10	Yes	Frequently	1 pack a day	57
5	Male	35	27.16	Over 10	None	Rarely	None	95
6	Female	50	25	1 to 5	Yes	Very rarely	None	10
7	Female	52	24.97	Over 10	None	None	None	46
8	Male	27	23.77	1 to 5	Yes	At least 3 times per week	1 pack a day	30
9	Male	46	22.49	5 to 10	None	Frequently	1 pack a day	48
10	Male	45	23.60	Over 10	Yes	1 to 2 times per week	None	133
11	Female	56	24.84	1 to 5	None	None	None	59
12	Male	57	26.70	1 to 5	None	4 to 5 times per week	None	45

Table 2. Major outcomes related to screening of sleep apnea

Outcomes	Before treatment (mean, SD)	After treatment (mean, SD)	P-value
Daytime sleepiness (0 none to 10 worst)[a]	6.5, 3.2	3.8, 1.8	0.17
AHI[a]	17.67, 12.79	8.75, 8.25	0.007
RI[a]	22.00, 13.26	12.09, 8.03	0.004
Oxygen desaturation index[a]	17.33, 12.17	8.17, 7.86	0.005
Average saturation during sleep[a]	94.83, 1.75	96.08, 1.24	0.000
Lowest desaturation[a]	81.91, 4.83	87.00, 4.35	0.002
Lowest saturation[a]	81.58, 4.89	86.33, 4.77	0.005
Apneas (event)			
Obstructive apneas[b]	73.82, 37.81	55.45, 46.63	0.106
Central apneas[b]	1.82, 3.37	1.08, 1.44	0.459
Mixed apneas[b]	0.55, 1.04	0.08, 0.29	0.211
Hypopneas (event, n)[a]	37.00, 31.14	21.50, 24.02	0.075
Snoring events ratio (snoring events/total respirations)[a]	0.35, 0.23	0.29, 0.19	0.602
Number of desaturations (%)[*,b]	7.00, 9.79	0.92, 1.39	0.044

[*] The percentage of time during sleep when oxygen saturation is below 90%; [a] statistical analysis was conducted with paired T-test; [b] statistical analysis was conducted with Wilcoxon signed-rank test.

1.39 after treatment, p=0.044). Snoring events ratio decreased but there was no significant difference (0.35, 0.23 in the 1st assessment and 0.29, 0.19 in the 2nd assessment, p=0.602, Table 2).

Discussion

From this retrospective case series, we found that behavior modification including nasal breath and lateral positioning during sleep may be effective in sleep apnea in terms of improving AHI and oxygen saturation, when herbal medication and acupuncture were used as well. No adverse events were observed during an average treatment of 63 days which suggests short-term compliance with this treatment. Even though there was no statistical significance, daytime sleepiness improved after treatment which may reflect that there was progress in sleep quality. It is also suggested that this integrated treatment may be effective in reducing snoring events as well.

One strength of this study is that a portable device was used for the assessment of sleep apnea. Polysomnography is the standard test for sleep apnea but admission for the test is necessary which may affect the sleep quality of the patients in an unfamiliar hospital setting. However, we used an ApneaLink device for assessing sleep apnea in the patients' own homes which leaves patients more comfortable and at ease when tested, so it can reflect a more normal state of sleep apnea.

Another point was that it reflected the real world situation of clinical practice in traditional Korean medicine for the treatment of sleep apnea. Settings of other studies on sleep apnea are mostly well-equipped hospitals where polysomnography is assessable[10]. However, this study was conducted in a local clinic, where most of the practice takes place in Korea.

A weak point of this study is that conclusive evidence cannot be ensured from the results. This is only a case series which suggests limited evidence. Many components of combination therapy with behavior modification, herbal medicine and acupuncture treatment, which are offered to patients in general practice, contribute to the therapeutic effect so it is not clear which part is essential to the treatment. Different treatment durations of the patients cannot suggest any information for the appropriate treatment

 http://dx.doi.org/10.13048/jkm.14017

period of this package treatment. Longer term effects remain unclear as well.

The mechanism of this package treatment can be assessed in part. The oral appliance which was used for promoting nasal breath may change the functional structure of the upper airway and improve air flow during sleep[5),14)]. Keeping a lateral position during sleep may prevent supine position of the body which aggravates sleep apnea due to gravity effects on the air way[15)]. Acupuncture may affect the change of air flow through the regulation of muscles around the upper airway including lingual muscles[16)]. Additionally, acupuncture may improve the condition of the nasal cavity through alleviating rhinitis or sinusitis[17),18)]. Several studies on the effect of herbal medications for sleep apnea suggest that different herbal drugs according to the subjects' individual needs could improve snoring and sleep apnea[19),20)]. However, in our cases, it was impossible to know which herbal compounds were exactly engaged in the therapeutic effect. Several individual herbs including Magnoliae Flos[21)] have anti-allergic effect so may improve nasal condition, which in turn could encourage nasal breathing. Among all this partial evidence of individual portions of treatment effect, general mechanism involving interactions between interventions cannot be assessed through this study.

CPSP is the standard treatment for OSA but it is expensive and difficult to use which causes patient's low adherence in long-term treatment[3)]. Many types of surgical strategy for OSA are recommended according to the pathology and the patient's condition[22)] but potential adverse events and fear of surgery make patients hesitant to undergo operations for OSA. Therefore, behavior treatment with herbal medication and acupuncture may be a good alternative to CPSP and various surgical modalities. In future, randomized controlled trials with CPSP during long-term evaluation will suggest concrete evidence of this package treatment. In addition, experimental studies on the effect of individual treatment modalities in parts and of interactions between interventions will be necessary to support the mechanism of this complex treatment. As a basic step to the clinical evidence, this case series can suggest the possibility of traditional medicine for the treatment of sleep apnea.

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