
Dissemination and promotion of screening for sleep disorders

1. Background and goals

Sleep apnea syndrome (SAS)⁽¹⁾ is a pathological condition characterized by intermittent episodes of loud snoring and a pause in breathing (i.e., apnea) due to upper airway obstruction by the tongue sliding into the back of the throat. This results in shallow sleep and insufficient oxygen supply to the brain, so individuals with SAS are unable to obtain sufficient sleep, experience excessive daytime sleepiness, and easily fall asleep, resulting in low concentration and a high incidence of accidents due to careless driving and falling asleep at the wheel.

Several million people are estimated to have SAS in Japan. Even though continuous positive airway pressure (CPAP)⁽²⁾ therapy has been established to treat SAS, only about 300,000 patients are currently treated by CPAP. This is in part because sleepiness due to SAS can be easily mistaken as an age-related chronic fatigue symptom, and also because many individuals with SAS do not readily feel sleepy after living with chronic sleep loss for years and therefore do not consult a physician, leaving SAS untreated. Against this background, a first step would be to establish a system to screen individuals with SAS who require further treatment. However, it is impossible to impose the burden of comprehensive testing on every person who is suspected of having SAS because a definitive diagnosis of SAS requires elaborate and costly overnight testing at a specialized medical facility. For this reason, a simple screening system is required to narrow down those individuals who need comprehensive testing. This study aims to develop and disseminate an SAS screening test and promote the treatment of SAS.

2. Research content

2-1. Special seminar on sleep-disordered breathing

In 2012, at the Nara Trucking Association, the International Association of Traffic and Safety Sciences hosted a special seminar entitled “Sleep-Disordered Breathing and Health Problems among Truck Drivers” and provided comprehensive information about SAS to trucking business owners, health

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(1) Sleep apnea syndrome (SAS): a disease characterized by episodes of apnea during sleep. Apnea is defined as a pause in breathing that lasts more than 10 seconds. SAS is diagnosed when apnea occurs more than 5 times in 1 hour or 30 times in 7 hours during sleep.

(2) Continuous positive airway pressure (CPAP): a method used to prevent airway obstruction by sending pressurized air (positive airway pressure) via a tube to a mask worn on the nose in order to compress the soft tissues surrounding the root of the tongue and thereby open the airway.

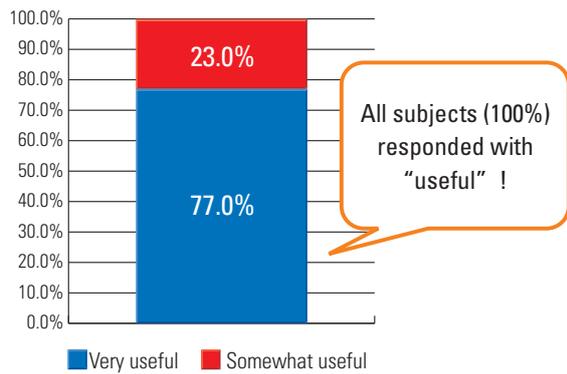


Figure 1. Impact of the special seminar

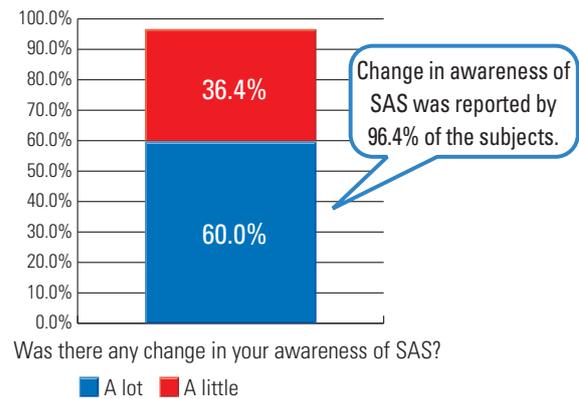


Figure 2. Change in awareness of sleep apnea syndrome

supervisors, and truck drivers. A survey conducted after the meeting revealed that the meeting was an excellent learning experience for the attendees (Figs. 1, 2).

2-2. Administration of a screening test

After the seminar, attendees were recruited for an SAS screening test, and the openings for 200 test subjects were filled in just 3 days, revealing high levels of interest in SAS among meeting attendees.

In this study, a flow sensor, used as a simple tool to monitor breathing and screen for SAS, was mounted over the nose and mouth to examine for apnea and hypopnea during sleep based on the degree and frequency of changes in air flow (Fig. 3). The notable feature of this testing is that SAS screening can be performed at home using a small take-home device with a little burden on the subject.

In addition to the use of a flow sensor, a self-administered questionnaire survey was performed in order to look for a correlation between SAS and perceived sleep quality. This questionnaire is the Japanese version of the Sleep Disorders Screening Survey used at Harvard University in the United States and employs the Epworth Sleepiness Scale as a measure of daytime sleepiness and also asks about subjects' sleep and driving patterns.



Figure 3. Simple diagnosis with a flow sensor

2-3. Results

(1) Subjects

The survey results showed that 48 subjects (24%) were living with moderate to severe sleep-disordered breathing. The severity of respiratory disturbance was positively correlated with the degree of obesity but not with other factors, such as age, smoking or drinking habits, blood pressure, and neck circumference.

(2) Association between subjects’ experiences and sleep-disordered breathing

Many subjects with a high respiratory disturbance index had suspected in the back of their mind that they had SAS or narcolepsy. Moreover, a relatively large number of subjects had been informed about their apnea or snoring even by someone who was in the next room. Respiratory disturbance index was not significantly correlated with the sleepiness scale score.

(3) Sleepiness and severe sleep-disordered breathing

The findings of this study revealed that more than 90% of the subjects with sleep-disordered breathing did not actually experience intense daytime sleepiness.

2-4. Comprehensive testing

Diagnostic criteria for SAS are based on polysomnography (PSG)⁽³⁾ testing. PSG evaluates the quality and amount of sleep by using numerous sensors and electrodes to measure air flow in the nose and mouth, snoring, arterial oxygen saturation, breathing motion in the chest and abdomen, and posture (Fig. 4). A special examination room and a technician trained in PSG are needed to conduct PSG, and therefore, it is not only costly but also time-consuming and a large burden on patients.

PSG involves electroencephalography as the major component, electrooculography, electrocardiography, and the measurements of breathing patterns, peripheral blood oxygen saturation, and body posture. PSG requires a special examination room, a technician trained in PSG, and skills in data recording and analysis.



Figure 4. Overnight PSG: a time-consuming and costly definitive diagnostic method for SAS

Although 13 subjects were suspected of having severe SAS according to the screening test conducted by the Nara Trucking Association, only 2 of them subsequently underwent PSG (Fig. 5). This outcome stands in sharp contrast to the high levels of interest in SAS shown by the subjects prior to the screening test, most likely reflecting the large burden imposed by PSG.

3. Conclusion

In this study, a special seminar was offered to trucking business owners, health supervisors, and truck drivers affiliated with the Nara Trucking Association,

SAS screening of 200 subjects

Screening test results

Grade A:	2 subjects (1%)
Grade B:	26 subjects (13%)
Grade C:	76 subjects (38%)
Grade D:	35 subjects (18%)
Grade E:	13 subjects (6.5%)
Unable to grade:	40 subjects (20%)
Cancellation:	8 subjects (4%)

Outpatient Sleep Clinic, Tenri Municipal Medical Center

Number of contacts:	4 subjects (2%)
Appointment for PSG:	2 subjects (1%)
PSG performed:	2 subjects (1%)

Figure 5. Approach taken by the Nara Trucking Association

(3) Overnight polysomnography (PSG): an overnight screening test performed on admission to a special examination room to examine sleep patterns by using electroencephalography, electrooculography, and electromyography of the mentalis, as well as breathing patterns by collecting data on airflow through the mouth and nose and the movement of the chest and abdomen. PSG is used to determine the severity of SAS and the appropriate treatment.

followed by a questionnaire survey and screening test administered to approximately 200 truck drivers. In this way, we attempted to establish a system with the following flow: awareness-raising about SAS screening → screening test → comprehensive examination and treatment.

With regard to the correlation between sleep-disordered breathing and daytime sleepiness, more than 90% of the present subjects with moderate to severe sleep-disordered breathing answered that they did not experience daytime sleepiness. This clearly indicates that subjective tests are not enough to screen for SAS, and therefore, more objective screening tests, such as the flow sensor method, are needed to detect individuals with undiagnosed SAS. This study also suggests that society as a whole needs to be aware of SAS because some aspects of the disease cannot be addressed by individuals who have SAS.

4. Future outlook

The awareness-raising activity presented in this study is an example that can be applied to any region across Japan. Our goals are to develop and disseminate an effective SAS screening system and to reduce the number of traffic accidents via the promotion of early detection and early treatment of sleep-disordered breathing. In collaboration with the relevant administrative agencies, we will also recommend approaches for the early detection of sleep disorders for which awareness among drivers is low.