

Oral Appliance Therapy for the Management of Obstructive Sleep Apnea

Yoshinobu Shoji¹, Thomas Mathew², Harold V. Cohen³

¹Universiti of Teknologi MARA (UiTM), Malaysia

²International Medical University, Malaysia

³University of Medicine and Dentistry in New Jersey, USA

Abstract- In recent years, the medical profession has begun to recognize the role of sleep hygiene as it pertains to patient health. Types of sleep disordered breathing (SDB) include snoring, obstructive sleep apnea (OSA), central sleep apnea and a mix of obstructive and central apnea. OSA is the most common category of SDB. The apneas are now known affect cardiovascular health and neuro-behavioral issues. In recent years, the dental profession has become involved in managing snoring and certain OSA problems using oral appliance therapy (OAT). This treatment by dentists is now well accepted by the medical profession. This paper will review the basics of OSA, and how the dentist may be involved in providing OAT for these patients.

Keywords: oral appliance (OA), oral appliance therapy (OAT), snoring, sleep disordered breathing (SDB), obstructive sleep apnea (OSA), Temporomandibular Joint (TMJ)

INTRODUCTION

As medical care is continuing to improve the treatment of disease, the dental profession has become more involved in issues relating to serious patient health problems. For those patients who are undergoing cancer therapies, organ transplants and cardiovascular procedures, and other medical treatments, dentist involvement has become a critical part of the overall medical management of these conditions. A growing area of dental/medical patient care has been dentist participation in the management of those patients with OSA using oral appliances.

This paper will overview both the current and future involvement of dentistry in the management of SDB, with a focus on OSA.

SDB and OSA

Sleep medicine today focuses on the SDB categories of OSA and central apnea. OSA describes the stopping of breathing during inspiration due to airway obstruction (Figure. 1), whereas central apnea also has interrupted breathing but is not related to inspiration. [1] Rather it is due to a disturbance in the brain's respiratory centers. [2] In both types, air does not get into the lungs and blood oxygen levels drop. There is also a mixed type with elements of both OSA and central sleep apnea. In the apnea patient, the pharynx opens during expiration, the snoring sound disappears, and the patient experiences "wake up panting" at the time of ventilation recovery.

One other type of partial airway obstruction is called a hypopnea which is a shallow breathing episode that can occur whether asleep or awake. [2] Snoring is also another example of obstructed air movement during sleep but snoring does not cause breathing to stop. However, dental patients should be asked if they are known to snore and, if so, the dentist should suggest that the patient have a medical evaluation for a possible apnea problem.

OSA – Characteristics of the patient and related medical conditions

The patient with OSA may be overweight, a smoker, and of older age. However, anyone may have this disorder. OSA can lead to myocardial infarction (heart attack), atrial fibrillation which is a life threatening heart rhythm disturbance, [3] heart failure, hypertension (persistent high blood pressure), daytime sleepiness with a risk of falling asleep at work or while driving a car, headaches and muscle aches.

Daytime sleepiness and feeling of fatigue in OSA patients has a prevalence rate of 2 - 4% in middle-

aged adults. [4]

OSA – how is the diagnosis made

A sleep apnea event is defined as interruption of air flow at the nose or mouth for 10 or more seconds and this can occur from 5 to 30 or more times an hour. [2] This is accompanied by symptoms of daytime sleepiness, snoring, awakening at night gasping, and breathing interruptions. The most common test used for diagnosis is a polysomnogram – the patient is monitored in a laboratory while sleeping. Readings of brain activity, eye movement, blood oxygen levels and chin muscle activity are all part of the study. [5] The patient is then classified in one of the following categories for treatment depending on how many times they obstruct per hour:

1. Mild – 5-15 to times per hour
2. Moderate – 15-30 times per hour
3. Severe – more than 30 times per hour

Medical Management of OSA

According to the results of sleep medicine research, the medical treatment of a snoring and sleep apnea syndrome improves not only breathing disorders at the time of the sleep, but also it leads to preventing various complications including cardiovascular disorders such as high blood pressure, abnormal heart rhythm, ischemic heart disease, and cerebral infarction.[6] Therefore, the medical treatment of snoring and sleep apnea syndrome is very important for the maintaining general health. Medical care depends upon which category of frequency the patient has: mild, moderate, severe.

- Mild OSA may include:
 - Weight loss
 - OAT

In addition to mild sleep apnea, OAT can also help with snoring. [7,8]

- Moderate to severe OSA may include:
 - Nasal continuous positive airway pressure (nCPAP) – the patient sleeps with a mask over the nose and pressurized air is forced into the nose to open the airway. [2] Many patients cannot tolerate this approach.[9] The patient does not sleep well due to noise from the machine operation and may also develop dry mouth. Also the

nCPAP device may be unsuitable for a travel or a business trip, etc.

- Surgery – palate, pharynx and jaw to aid in relieving airway obstruction
- OAT (for mild-moderate cases, not indicated for severe OSA) – this is recommended for patient who does not tolerate the nCPAP. Moreover, according to the latest Cochrane Database, [10] the following conclusions were made in reference to the effect of OAT in sleep apnea syndrome. "Although the improvement factor of the respiratory state at the time of sleep was excellent in nCPAP, about an improvement of condition, there was no big difference at OA and nCPAP." That is, although OAT is inferior to nCPAP, it has obtained the equivalent of good results with respect to the improvement of clinical conditions (snoring, sleepiness, etc.) when the apnea and hypopnea index (AHI)* used as the reference.

* The number of apneas or hypopneas per hour.[2]

OSA and Effects of OAT

When the OA is used during sleep, the mandible is maintained in a forward position and the mouth must be kept closed on the appliance. This repositioning of the mandible results in forward movement of the tongue with opening of the airway and contraction of the suprahyoid-muscles, including the geniohyoid muscle (Figure.2). [11] The reader should also be aware that there are now available different types of OAs for apnea treatment, and there is no one preferred appliance at the present time.

Problems associated with OAT

A recent study of patients who started OAT noted that, after three years, only 50% of the study population continued to be using the OA. [11] When the OA is used during sleep, the mandible is maintained forward position and, moreover, the mouth must be kept closed. Therefore, the normal function of opening a mouth during sleep will be hindered, and pressure can be exerted on the lower front-teeth, temporomandibular joints (TMJs) and related structures. This can result in discomfort and pain for the stomatognathic system of the patient

who uses it.[12] Therefore many patients will discontinue use of their OA.

Types of OA for Apnea

Figure 3 a-c shows three types of OA, 1. tongue retaining appliance, 2. monoblock mandibular repositioning appliance, 3. dual-block mandibular repositioning appliance.

Figure 3c shows the one of dual-block adjustable device in which an opening and a lateral excursion are possible also during wearing, and the sense of discomfort at the time of wearing is mitigated first. By adjusting a built-in screw, the amount of mandibular advancement can be adjusted at any time. This can help adjust the pressures to the teeth and temporomandibular joints.

During OAT, routine check must be done to monitor and adjust the appliance over the long term of wear. [11]

CONCLUSION

OAT by trained dentists now allows the dental profession to offer to the physician another method of management of snoring and OSA. Also, it is important for dentist to continue to stay updated with the developments in medical care for the OSA patient and future advances in OAT. Dentists now have the opportunity to continue to be involved with physician in the medical management of SDB patients.

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Yoshinobu Shoji D.D.S. (Jpn), M.D.S. (Aust), Assoc Prof, Faculty of Dentistry, Universiti of Teknologi MARA (UiTM), Shah Alam, Malaysia
 Dr. Shoji is from Japan, and has over fifteen years of full-time experience in clinical care, researching, teaching in the field of Orofacial Pain/TMD and Dental Sleep Medicine. In 1983, he graduated with a DDS degree from the Matsumoto Dental School in Japan. In 1992, he obtained his MDS degree at the Department of Prosthetic Dentistry, University of Sydney. Then, he finished a fellowship

program of Orofacial Pain at the Department of Diagnostic Sciences, University of Medicine & Dentistry of New Jersey (UMDNJ). He also obtained a Diplomate of the American Board of Orofacial Pain (ABOP) in 1996.



Dr Thomas Mathew, BDS (India) MDS Orthodontics (India)

Dr Thomas graduated from Dr MGR Medical University, Chennai and also received his post graduate training from the same University in the field of Orthodontics and Dento- Facial Orthopaedics from 2004 to 2007. He is an active member of the Malaysian Dental Association and the International Association of Dental Research (IADR). His expertise is in providing interceptive and comprehensive care for children and adults in the field of Orthodontics and Dento – Facial Orthopaedics. His special clinical and research interest is in field of clinical orthodontics and Materials in Orthodontics.



Harold V. Cohen, DDS, Rutgers School of Dental Medicine, Newark, New Jersey

Dr. Harold V. Cohen is a Professor at Rutgers School of Dental Medicine. His positions include Acting Director, Division of Oral Medicine- Department of Diagnostic Sciences and Director, Diagnostic Sciences Fellowship (under Continuing Dental Education). His clinical interests center on dental management of medically complex patients and the diagnosis and management of orofacial pain. He has been published in various periodicals and textbooks and has lectured both nationally and internationally. Dr. Cohen received his dental degree from New York University College of Dentistry and formerly ran a private general dental practice with a special focus area in TMD/Orofacial Pain. He is a member of the dental staff of both University Hospital in Newark, NJ, and Robert Wood Johnson University Hospital in New Brunswick, NJ. Dr. Cohen is also a certified BLS/CPR trainer for University Hospital, Newark NJ

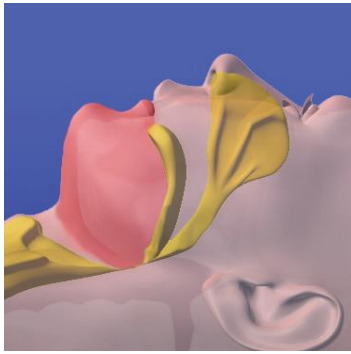


Figure 1. Narrowed upper respiratory tract. 'Reproduced by the kind permission of SomnoMed'

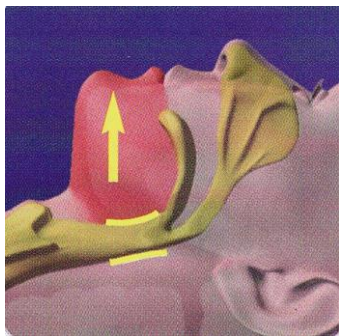


Figure 2. Mandibular repositioning to expand a respiratory tract. 'Reproduced by the kind permission of SomnoMed'



Figure 3a. Tongue Retaining Device (TRD)



Figure 3b. Monoblock mandibular repositioning appliance.



Figure 3c. Dual-block mandibular repositioning appliance.