



THE USE OF ORAL APPLIANCES IN THE TREATMENT OF SNORING AND OBSTRUCTIVE SLEEP APNOEA

A Position Paper of the Australasian Sleep Association

Introduction

This position paper is based on a review of the literature which has been prepared by the Dental Oro-facial Special Interest Group for the ASA. It updates the previous "Dental appliance therapy for the treatment of sleep disordered breathing" paper published by the ASA in 2010. This review relates to the treatment of obstructive sleep apnoea (OSA) in adults and does not address the role of dentists in the management of OSA in children.

Sleep disorders are increasingly recognised as a major health concern. Snoring and obstructive sleep apnoea encompass a spectrum of diseases that involve upper airway collapse and obstruction during sleep. This may range from a reduction in airflow commonly associated with snoring to complete upper airway obstruction with periodic cessation of breathing (OSA). The gold standard for objectively assessing the severity of OSA is obtained by a sleep study / polysomnogram (PSG), requested and reported by a sleep physician who is responsible for the diagnosis. The Apnoea Hypopnoea Index (AHI) or the Respiratory Disturbance Index (RDI), are indices used to assess the severity of sleep apnoea based on the total number of complete cessations (apnoea) and reductions (hypopnoea) in breathing occurring per hour of sleep. The degree of oxygen desaturation during sleep is an independent measure of severity, though much harder to quantify, for which there are no universally agreed gradations of severity.

Obstructive Sleep Apnoea (OSA) is a modern epidemic of great health and economic importance. Young et al¹ found twenty years ago that in a population aged 30-60 years, 9% of women and 24% of men had OSA, defined as an AHI > 5/hr without excessive daytime sleepiness. Additionally, 2% of women and 4% of men had an AHI > 5/hr that was associated with

excessive sleepiness [Obstructive Sleep Apnoea Syndrome (OSAS)]. The prevalence is likely to be higher now² because of the increasing prevalence of obesity over recent years.³

Untreated OSA is an important cause of impaired alertness and daytime sleepiness. Patients with OSA have been found to consume more health care resources than those without, take more sick leave and have more work disability.^{4, 5} A high proportion of OSA cases remain undiagnosed and untreated, in part due to limited resources for case finding and diagnosis.⁶

Additionally, the investigation of patients with possible OSA has been driven largely by patients and their attending doctors relying on the recognition of the typical symptoms and signs, (e.g. tiredness or witnessed apnoeas), however, there is now evidence that OSA can commonly be present without symptoms.^{7, 8}

Male gender, increasing age and obesity are known risk factors for OSA.⁹ OSA is an independent risk factor for motor vehicle accidents¹⁰, vascular disease,¹¹ stroke,^{12, 13} hypertension,^{14, 15} difficult to control atrial fibrillation¹⁶ and probably contributes to glucose intolerance.¹⁷⁻¹⁹

Some patients have objective evidence of sleep disordered breathing on polysomnography, but do not have the typical symptoms of snoring, tiredness or altered cognitive function and mood. Such patients have OSA but not the OSA syndrome (OSA with symptoms presumed due to OSA). There are limited data about the benefit of treating such patients. The current role of dentists in the identification of patients with OSA is in screening for symptoms of OSA and appropriate onward referral to a sleep physician for further clinical review and diagnostic testing.

Oral Appliance Therapy for Snoring and OSA

Oral appliances of various designs have been used increasingly over the past 15 years to effectively treat snoring and OSA. They have potential advantages over the current first line therapy for OSA, continuous positive airway pressure (CPAP), in that they are less obtrusive, more portable, make no noise, are not reliant on a power source and often more acceptable to the patient and his/her family. Relatively high rates of patient acceptance and adherence are reported.²⁰⁻²⁵

Oral appliances generally fall into two main categories, Tongue Retaining Devices (TRD) and Mandibular Advancement Devices (MAD). A TRD uses a pliable silicon bulb fitted over a protruded tongue and held in place by suction, supported additionally by the teeth and soft tissues. The encapsulated tongue is held in a forward posture that prevents it collapsing back into the oropharyngeal airway. This effect helps maintain a patent air passage at the level of the most common site of airway collapse²⁶. MADs are the most commonly used and researched devices. These dentally-retained appliances are either a one-piece (monobloc) design or a dual component device, consisting of upper and lower teeth retainers connected by a coupling mechanism²⁷. Their exact mechanism of action on the upper airway is not clearly understood, but MADs are designed to reposition the mandible forward and support this protrusive posture during sleep.²⁸ The mode of action most likely involves a structural change to the pharynx enlarging the retroglottal airway via forward displacement of the tongue or lateral airway expansion. This has been shown by MRI studies in awake untreated patients²⁹ and by nasendoscopy in awake treated patients.³⁰ The ability to advance or titrate the mandible incrementally, with an adjustable custom-made two piece device, has been clearly shown to be of benefit in both snoring and OSA.³¹⁻³³

Indications to treat snoring and OSA

Snoring is a very common³⁴ and irritating condition, which is often a marker of OSA. It can lead to social disharmony, relationship difficulties and may have independent effects on the carotid arteries, separate from the effects of any associated OSA.³⁵ There are, however, no data on the health benefits of treating snoring.

MADs are a proven treatment for snoring.³⁶⁻³⁹ They have also been shown to be effective in treating mild to moderate levels of OSA.^{36, 38-40} MADs are also recommended for treatment of patients with moderate to severe OSA, who have either failed a trial of CPAP therapy, or are intolerant of it.³⁹

Decisions about using MADs to treat individual patients should be based on individual risk benefit assessments, until more outcome data are available. This applies particularly in those patients with an AHI less than 30/hr. The presence of symptoms and co-morbidities will be important influences on treatment choices, as will the probability of a successful outcome in any individual patient.

Side Effects of Oral Appliances

No effective therapeutic intervention comes without the potential for some undesirable side effects. The adjustment and the final set position of an oral appliance is a delicate balance between side effects and effectiveness. MADs nightly reposition the mandible during sleep in a protrusive position. After 2 years, self-reported oral appliance usage, ranges from 48% to 84%, with a declining trend over time.^{23, 28} The most common reasons for discontinuing oral appliance therapy were lack of efficacy, side effects and device complications.⁴¹

Side effects are relatively common. These include excessive salivation, dry mouth, gum irritation, tooth tenderness/pain, abnormal dental occlusion in the morning, masticatory muscle tenderness and temporo-mandibular joint discomfort and/or stiffness.^{42, 43}

Continued use of an oral appliance has been shown to permanently change the bite or occlusal contacts in many sleep apnoea patients and is mainly related to tooth movement.⁴³

Significant or persistent temporo-mandibular joint dysfunction or an increase in its prevalence has not been found.⁴⁴

Although side effects may be undesirable they are usually well tolerated^{21, 23-25} and accepted by patients, particularly when symptomatic relief of their condition is achieved.

Dental Practice

1. The role of the dentist

- 1.1. Dentists can have an important role in screening both for symptoms and treatment effectiveness of OSA. To manage SDB successfully, the dentist must work in cooperation with a sleep physician and the patient's medical practitioner. The diagnosis of this medical condition is not within the scope of dental practice, but a dentist should be able to recognise and be familiar with the typical signs and symptoms, as well as be aware of the predictive co-morbidities (obesity, hypertension, ischaemic heart

disease and Type 2 diabetes⁷⁾, and the fact that OSA may be asymptomatic.

- 1.2. Dentists should be able to provide patients with explanations and information on the treatment options available, including but not limited to: lifestyle modification, behavioural therapy, sleep hygiene, sleeping position, surgical and CPAP options, as may be recommended by the attending physician. They are not expected to provide a detailed discussion of the pros and cons for individual patients however, as this is the role of the treating physician.
- 1.3. If treatment with an oral appliance is medically indicated, the dentist is responsible for determining if the patient is a suitable candidate from a dental perspective and to choose an appropriate device. Routine dental, periodontal health, TMJ, occlusal and radiographic examination, is to be conducted prior to and during the term of the therapy.
- 1.4. Dentists also need to be aware of, and routinely examine for soft tissue and craniofacial morphology that predisposes to OSA, including a disproportionately large tongue⁴⁵ and the association between sleep bruxism⁴⁶ and OSA.
- 1.5. Dentists are the only dental care providers who are qualified to manage oral appliance therapy for SDB. Practitioners who offer these services should be able to demonstrate competency in this field.
- 1.6. To refer patients suspected of having OSA to a sleep physician, who will determine the need for a diagnostic test (usually a polysomnogram) and all treatment options, which may include an oral appliance.
- 1.7. To refer patients requiring more specialized care, such as a pre-existing temporomandibular joint dysfunction or orofacial pain, to an appropriately trained dental specialist.
- 1.8. To refer patients back to their regular dental care practitioner, where the patient's oral condition requires attention, before a MAD is fitted.
- 1.9. To follow up patients after the fitting and adjustment of a MAD for both effectiveness, (often in collaboration with the referring physician), and for detecting side effects, particularly changes to the bite.

2. Professional Relationships

- 2.1. There is now an increasingly prominent role for the dentist in screening for and making MAD to treat snoring and OSA. This has resulted from the development of a range of suitable devices, and the weight of evidence supporting oral appliance therapy.
- 2.2. At this time the ASA advocates a "shared care" approach, where there is close collaboration between a dentist and a medical practitioner (sleep physician or other doctor appropriately trained in sleep medicine), who is the clinical team leader.
- 2.3. To be responsibly involved in the construction of MADs for management of OSA a dentist must have additional training and experience, ideally evidenced by regular attendance at training courses endorsed by the ASA and the Dental Board of Australia, as well as mentored clinical experience in the selection, fitting, adjustment and trouble shooting of a range of MADs.
- 2.4. The ASA regards it as essential that there is written professional communication about each patient undergoing dental treatment of OSA between the GP, sleep physician and dentist, and any other involved medical practitioners.
- 2.5. A written report to the referring practitioner, detailing the dental treatment and the patient's symptomatic feedback is required. A systematic follow-up program should be established between the practitioners to monitor the patient's progress.⁴⁷ The dental aspects of the treatment are the responsibility of the dentist. The treating physician, who holds the primary responsibility for managing the patient's medical conditions, should monitor the appropriate health indices. A high degree of collaboration and communication between the dental and medical care providers is expected, to enable optimal patient outcomes to be achieved.
- 2.6. There may be appropriate referral by the dentist to periodontists, orthodontists and prosthodontists for complications and co-incidental conditions.

3. Code of Practice

As this field of dentistry is developing rapidly, dentists practicing in the discipline of Dental Sleep Medicine must follow “best practice” procedures, including the following:

- 3.1. Obtain written informed consent from each patient prior to commencing any oral appliance therapy.
- 3.2. Satisfy the DBA, ADA and NZDA policies and codes of conduct as published from time to time.
- 3.3. Have appropriate and recognized training and experience (as accepted by the ASA and revised from time to time).
- 3.4. Be aware of the relevant “Driving Guidelines” as issued by the relevant traffic authorities.
- 3.5. Keep comprehensive dental and other clinical records, including relevant dental casts, radiographs and photographs.
- 3.6. Participate in ongoing education relevant to the practice of dental sleep medicine.
- 3.7. Avoid real or perceived conflicts of interest and in particular, avoid compromising arrangements with industry.

4. Oral Appliances and Devices

- 4.1. The ASA does not endorse any particular oral appliance or device.
- 4.2. Both the available data and expert clinicians’ experience suggest that there is a very limited role for off the shelf or “boil and bite” type MADs. Such devices may be of some benefit in “simple snoring” of moderate intensity, but are unsuitable for the treatment of OSA. Most of these devices are either fixed position, or cannot be titrated reliably. They offer poor fit and inadequate retention and the unreliable fit often leads to poor tolerance and potentially undesirable dental side effects. The provision of these or any teeth-retained devices should only be undertaken by an appropriately trained dentist.
- 4.3. Patients undergoing any type of oral appliance therapy must have a dental examination by an appropriately trained dentist to be fully informed in considering their treatment options.

References:

1. Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S. The occurrence of sleep-disordered breathing among middle-aged adults. *N. Engl. J. Med.* 1993;328:1230-5.
2. Hiestand D, Britz P, Goldman M, Phillips B. Prevalence of symptoms and risk of sleep apnea in the US population: Results from the National Sleep Foundation Sleep in America 2005 Poll. *Chest* 2008;130:780-6.
3. Health Statistics New South Wales. Overweight or obesity by age and sex, persons aged 16 years and over. NSW, 2011. 2012 [cited; Available from: www.healthstats.nsw.gov.au/indicator/beh_bmi_age
4. Reuveni H, Greenberg-Dotan S, Simon-Tuval T, Oksenberg A, Tarasiuk A. Elevated healthcare utilisation in young adult males with obstructive sleep apnea. *Eur. Respir. J.* 2008;31:273-9.
5. Hillman D, Murphy A, Pezullo L. The economic cost of sleep disorders. *Sleep* 2006;29:299-305.
6. Flemons W, Douglas N, Kuna S, Rodenstein D, Wheatley J. Access to diagnosis and treatment of patients with suspected sleep apnea. *Am. J. Respir. Crit. Care Med.* 2004;169:668.
7. Burgess K, Havryk A, Newton S, Tsai W, Whitelaw W. Targeted case finding for OSA within the primary care setting. *J. Clin. Sleep Med.* 2013;15 July 2013.
8. Schotland H, Georeno A, Al P. Obstructive sleep apnea: Feasibility of a disease management strategy utilizing primary care case finding. *Journal of Clinical Outcomes Management* 2000;7:34-8.
9. Guilleminault C. Clinical features and evaluation of obstructive sleep apnoea. 2nd ed. Philadelphia: Saunders, 1994.
10. Tregear S, Reston J, Schoelles K, Phillips B. Obstructive sleep apnea and risk of motor vehicle crash: Systematic review and meta-analysis. *J. Clin. Sleep Med.* 2009;5(6):573-81.
11. Wolk R, Kara T, Somers V. Sleep-disordered breathing and cardiovascular disease. *Circulation* 2003;108:9-12.
12. Artz M, Young T, Finn L, Skatrud J, Bradley T. Association of sleep-disordered breathing and the occurrence of stroke. *Am. J. Respir. Crit. Care Med.* 2005;172:1447-51.
13. Yaggi H, Concato J, Kernan W, Lichtman J, Brass L, Mohsenin V. Obstructive sleep apnea as a risk factor for stroke and death. *N. Engl. J. Med.* 2005;353:2034-41.
14. Peppard P, Young T, Palta M, Skatrud J. Prospective study of the association between sleep-disordered breathing and hypertension. *N. Engl. J. Med.* 2000;342:1378-84.
15. Logan A. Sleep-disordered breathing and hypertension. *Am. J. Respir. Crit. Care Med.* 2009;179:1082-3.
16. Gami A, Pressman G, Caples S, et al. Association of atrial fibrillation and obstructive sleep apnea. *Circulation* 2004;110:364-7.

17. Ip M, Lam B, Ng M, Lam W, Tsang K, Lam K. Obstructive sleep apnea is independently associated with insulin resistance. *Am. J. Respir. Crit. Care Med.* 2002;165:670-6.
18. Punjabi N, Ahmed M, Polotsky V, Beamer B, O'Donnell C. Sleep-disordered breathing, glucose intolerance, and insulin resistance. *Respir. Physiol. Neurobiol.* 2003;136:167-78.
19. Resnick H, Redline S, Shahar E, et al. Diabetes and sleep disturbance: findings from the Sleep Heart Health Study. *Diabetes Care* 2003;26:702-9.
20. Lindman R, Bondemark L. A review of oral devices in the treatment of habitual snoring and obstructive sleep apnoea. *Swed. Dent. J.* 2001;25(1):39-51.
21. Fransson A. Mandibular protruding device in obstructive sleep apnea and snoring. *Swed. Dent. J. Suppl.* 2003;163:1-49.
22. Dort L, Hussein J. Snoring and obstructive sleep apnea: compliance with oral appliance therapy. *The Journal of Otolaryngology* 2004;33(3):172-6.
23. Almeida F, Lowe A, Tsuike S, et al. Long-term compliance and side effects of oral appliances used for the treatment of snoring and obstructive sleep apnea syndrome. *J. Clin. Sleep Med.* 2005;15(1(2)):143-52.
24. Marklund M. Predictors of long-term orthodontic side effects from mandibular advancement devices in patients with snoring and obstructive sleep apnea. *Am. J. Orthod. Dentofacial Orthop.* 2006;129(2):214-21.
25. Gong X, Zhang J, Zhao Y, FGao X. Long-term therapeutic efficacy of oral appliances in treatment of obstructive sleep apnea-hypopnea syndrome. *Angle Orthod.* 2012.
26. Cartwright R, Samelson C. The effects of nonsurgical treatment for obstructive sleep apnea. The tongue-retaining device. *The Journal of the American Medical Association* 1982;248:705-9.
27. Aherns A, McGrath C, Hagg U. Subjective efficacy of oral appliance design features in the management of obstructive sleep apnea: A systematic review. *Am. J. Orthod. Dentofacial Orthop.* 2010;138:559-76.
28. Cistulli P, Gotsopoulos H, Marklund M, Lowe A. Treatment of snoring and obstructive sleep apnea with mandibular repositioning appliances. *Sleep Medicine Reviews* 2004;8:443-57.
29. Brown E, Cheng S, McKenzie D, Butler J, Gandevia S, Bilston L. Tongue and lateral upper airway movement with mandibular advancement. *Sleep* 2013;36:397-404.
30. Chan A, Lee R, Srinivasan V, Darendeliler M, Grunstein R, Cistulli P. Nasopharyngoscopic evaluation of oral appliance therapy for obstructive sleep apnea. *Eur. Respir. J.* 2009;35(4):836-42.
31. Phillips C, Grunstein R, Darendeliler M, et al. Health outcomes of continuous positive airway pressure versus oral appliance treatment for obstructive sleep apnea. *Am. J. Respir. Crit. Care Med.* 2013;187(8):879-87.
32. White D. Continuous positive airway pressure versus the mandibular advancing splint: Are they equally effective in obstructive sleep apnea management? *Am. J. Respir. Crit. Care Med.* 2013;187:795-7.
33. Almeida F, Mulgrew A, Ayas N, et al. Mandibular advancement splint as short-term alternative treatment in patients with obstructive sleep apnea already effectively treated with continuous positive airway pressure. *J. Clin. Sleep Med.* 2013;9(4):319-24.
34. Knuiman M, James A, Divitini M, Batholomew H. Correlates of habitual snoring and witnessed apnoeas in Busselton, Western Australia. *Australian & New Zealand Public Health* 2005;5:412-5.
35. Lee S, Amis T, Byth K, et al. Heavy snoring as a cause of carotid artery atherosclerosis. *Sleep* 2008;31:1207-13.
36. Pepperell J, Ramdassingh-Dow S, Crosthwaite N, et al. Ambulatory blood pressure after therapeutic and subtherapeutic nasal continuous positive airway pressure for obstructive sleep apnoea. A randomized parallel trial. *Lancet* 2002;359:204-10.
37. Gotsopoulos H, Kelly J, Cistulli P. Oral appliance therapy reduces blood pressure in obstructive sleep apnea: a randomized, controlled trial. *Sleep* 2004;27:934-41.
38. Barnes M, McEvoy R, Banks ST, N, Murray C, Vowles N, Pierce R. Efficiency of positive airway pressure and oral appliances in mild to moderate obstructive sleep apnea. *Am. J. Respir. Crit. Care Med.* 2004;170:656-64.
39. Fleetham J, Ayas N, Bradley D, et al. Canadian Thoracic Society 2011 guideline update: Diagnosis and treatment of sleep disordered breathing. *Can. Respir. J.* 2011;1:25-47.
40. Kushida C, Morgenthaler T, Littner M, et al. American Academy of Sleep Medicine. Practice parameters for the treatment of snoring and obstructive sleep apnea with oral appliances: An update for 2005. *Sleep Res. Online* 2006;29:240-3.
41. Ferguson K, Cartwright R, Rogers R, Schmidt-Nowarra W. Oral appliances for snoring and obstructive sleep apnea: A Review. *Sleep* 2006;29(2):244-62.
42. Pantin C, Hillman D, Tennant M. Dental side effects of an oral device to treat snoring and obstructive sleep apnea. *Sleep* 1999;22:237-40.
43. Almeida F, Lowe A, Sung J, Tsuike S, Otsuka R. Long-term sequelae of oral appliance therapy in obstructive sleep apnea patients; Part 1 & Part 2. *Am. J. Orthod. Dentofacial Orthop.* 2006;2006(129):2.
44. Martinez-Gomis J, Willaert E, Nogues L, Pascual M, Somoza M, Monasterio C. Five years of sleep apnea treatment with a mandibular advancement device. Side effects and technical complications. *The Angle Orthodontist* 2010;80(1):30-6.
45. Nuckton T, Glidden D, Browner W, Claman D. Physical examination: Mallampati Score as an independent predictor of obstructive sleep apnea. *Sleep* 2012;29:903-8.
46. Ohayon M, Li K, Guilleminault C. Risk factors for sleep bruxism in the general population. *Chest* 2001;119:53-61.
47. Association AD. Use of dental appliances to treat sleep-disordered breathing. Policy Statement. In.