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Dentist's role in management of obstructive sleep apnoea: A review

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Abstract

Background: Obstructive sleep apnoea (OSA) is a common sleep disorder characterized by the excessive daytime sleepiness with irregular breathing at night. It is a clinical condition, with recognisable symptoms caused by collapse of the upper airway, either complete with no respiratory airflow (apnoea), or partial, with reduction in the cross-sectional area of the upper airway lumen causing hypoventilation (hypopnoea). Sleep disordered breathing (SDB) is a term which includes simple snoring, upper airway resistance syndrome (UARS), and obstructive sleep apnoea syndrome (OSA) which can affect both esthetics and health. **Aims/Objectives:** Most common complaint of the patient is excessive day time sleepiness, snoring with irregular breathing at night. Dental sleep medicine is an area of practice that focuses on the management of sleeps related breathing disorders in conjunction with the pulmonologists and otolaryngologists. **Conclusions and Significance:** The present article critically review the pathophysiology and craniofacial anatomical features of OSA patients along with current treatment modalities available published in various indexed journal and books; and the literature search from various reviewer regarding role of the dentist in evaluating and managing of snoring and OSA patients, with highlighting on oral appliances therapy as a means of management has been emphasized in this article.

Keywords: Mandibular advancement appliances, Obstructive sleep apnoea, Oral appliance therapy, Tongue retaining devices.

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INTRODUCTION

The understanding of the complex relationship between sleep, brain and body function is relatively complex dating back to 1989 when Kryger and colleagues recognised sleep medicine as a separate speciality to treat complex disturbances as related to sleep [1].

Dental sleep medicine is an area of practice that focuses on the management of sleep related breathing disorders in conjunction with the pulmonologists and otolaryngologists, one of which is obstructive sleep apnoea. An institute of Medicine reported 50-70 million Americans suffer from sleep disorders including sleep apnoea and vast majority of cases are either undiagnosed or untreated.[2] A mini literature review regarding its pathophysiology and usual features of OSA patients has been assimilated from various published indexed journal and books; and the role of the dentist has also been emphasized for the management.

Obstructive sleep apnoea (OSA) is a common sleep disorder characterized by the excessive daytime sleepiness with irregular breathing at night. It is a clinical condition, with recognisable symptoms caused by collapse of the upper airway, either complete with no respiratory airflow (apnoea), or partial, with reduction in the cross-sectional area of the upper airway lumen causing hypoventilation (hypopnoea). OSA can be diagnosed when 5 or more episodes of complete (apnoea) or partial (hypopnea) obstruction of upper airway occurs per hour of sleep. This is otherwise termed as AHI or apnoea-hypopnea index [2]. In cases of significant daytime sleepiness along with an abnormal apnoea–hypopnoea index (AHI > 5 events per hour of sleep), diagnosis of obstructive sleep apnoea syndrome (OSAS) can be considered whereas to diagnose OSA only requires an AHI > 5 as stated earlier. It is a significant public health problem with a prevalence of 3-7% in men and 2-5% in women, and the prevalence is expected to increase due to the obesity epidemic and ageing population [3]. Aim of this article is to review the role of the dentist in diagnosis and treatment of snoring and OSA, with an emphasis on oral appliances.

Etiopathogenesis:

In obstructive sleep apnoea, the muscle tone of upper pharyngeal airway decreases leading to its narrowing and these grounds to partial reductions called as "hypopneas" or complete pauses called as "apnoea" in breathing which hangovers for at least 10 seconds during sleep. Most of them remains for about 10 and 30 seconds, but some may persist for about one minute or longer. This can lead to abrupt reductions in blood oxygen saturation, with oxygen levels falling as much as 40% or more in severe cases [4]. This, in turn causes an increase in the inspiratory effort due to reduction in the oxygen delivered to the organs including heart and brain. This leads to transient arousal from deep sleep to a light sleep phase or wakefulness then again restoration of normal muscular tone and sleep. This can occur hundreds of times throughout the night, which leads to fragmentation of sleep architecture and generation of restless and disturbed sleep resulting in excessive daytime sleepiness, poor concentration and a reduction in alertness.

Pathophysiology of snoring during obstructive sleep apnoea is often the result of obstructing of the upper airway consists of the nasopharynx, oropharynx, and the hypopharynx by the base of the tongue. During sleep, muscles of the soft palate, tensor veli-palatini and genioglossus muscle hold the airway patent during sleep which causes mandible moves posteriorly as does the tongue. This leads to decrease upper airway volume and decreased oxygen blood level which stimulates central reflex to increase respiratory muscle contraction. As the air is sucked at the increased velocity, vibration of the soft palate and uvula leads to snoring and obstructive sleep apnoea [5].

Multifactorial risk factors include snoring, male gender, middle age, menopause in women, obesity habits like consumption of alcohol, smoking, and sedatives may aggravate existing OSA [4], a variety of craniofacial and oropharyngeal features such as a large neck circumference, retro-or micrognatia, nasal obstruction, enlarged tonsils/adenoids, macroglossia and low-lying soft palate and environmental factors like allergies and infections can influence the size of the airway [6].

Signs and symptoms of obstructive sleep apnoea include excessive daytime sleepiness, impaired concentration, snoring and un-refreshing sleep, choking episodes during sleep. Systemic co-morbidity exists with OSA include hypertension, myocardial infarction, coronary artery disease and arrhythmias and obesity [7]. Recently, sleep-related hypoxia has also been associated with a low-grade systemic inflammation, which in turn may contribute to initiate or accelerate the process of atherogenesis [8]. In addition, an important metabolic impairment occurs in OSA independently from the body weight. Also that sleep disturbance leads to neurocognitive impairment, mood changes, irritability, personality change, loss of libido and fatigue which sums up to remarkable effect on reduced quality of life and are at a six-fold higher risk of having a stroke as well as a three- to four-fold higher mortality risk [3]. Motor vehicle accidents in untreated OSA's patients is reported to be two or three times higher than in matched control drivers. The most recent longitudinal studies have indicated that some of the excess mortality may come from cancer-related death [9].

Key clinical findings in these patient are**,** 50% of them are more likely to be obese patients with Body Mass Index (BMI)>30 kg/m2. In non-obese patients, anatomical characteristics features like high-arched palate, nasal septal deviation, longer anterior facial height, often have a neck circumference of more than 43 cm, abnormally small mandible size, lateral peri-tonsillar narrowing, tonsillar hypertrophy, macroglossia may be noted [5].

Diagnosis:

Obstructive sleep apnoea is a growing concern in health care and sometimes can cause major health problems, thus, dentists should screen their new patients for this disorder. OSA diagnosis is done in a clinical setting by obtaining a full medical history, including a subjective self-assessment via the Epworth Sleepiness Scale (ESS), physical examination, imaging studies and polysomnography [4]. A sleep history in patient suspected of OSA should include evaluation of snoring, witnessed apnoeas, choking episodes and severity of sleep measured by Epworth Sleepiness scale. The Epworth Sleepiness Scale is a validated method of assessing the likelihood of falling asleep. This consists of a short questionnaire in which the subject is asked to rate his probability of falling asleep on a scale of increasing probability from 0 to 3 in eight different situations. At the end of the questionnaire, the scores for the eight questions are added. The scores from 0-9 are considered to be normal while 10-24 indicates a likely sleep disorder [10].

Visual and clinical examinations are helpful in identifying the anatomical characteristics contributing to sleep-disordered breathing. However, establishing a diagnosis of sleep-disordered breathing and determining the severity of the disorder (i.e, snoring, obstructive sleep apnoea, mild-moderate-severe) require the use of specific diagnostic testing [11].

Laboratory findings should demonstrate respiratory disturbance index (RDI) of five or more obstructed breathing events per hour of sleep. These events include any combination of apnoeas, hypopneas, and respiratory effort related arousals [12].

The "gold standard" for the diagnosis of OSA is Polysomnography(PSG) (Table 1) or nocturnal cardio-respiratory poligraphy which combines the results of electroencephalogram, electrocardiogram, electrooculogram, and electromyography along with respiration rate, tidal volume, inspiration and expiration volumes, aimed to detect the obstructive events and the following changes in blood oxygen saturation (SaO2), resulting in the patient's apnoea– hypopnea index (AHI). Other simplified diagnostic techniques do exist like limited channel testing, split-night testing, which provides less information for differential diagnoses such as REM Behaviour Disorder, Periodic Limb Movement Disorder or Central Sleep Apnoea and may require a full PSG [3]. Pretreatment dental assessment for occlusion, any tooth wear and malocclusion along with airway assessment for tongue positioning the oral cavity has to be done with the aid of imaging techniques such as fluoroscopy, cephalometry, Magnetic Resonance imaging, and both conventional and electron-beam Computed Tomography scanning have been used to assess the airway [10].

Table 1: Polysomnography findings characteristics of OSA

Apneic episodes occur in the presence of respiratory muscle effort
Apneic episodes lasting 10 seconds or longer
Apneic episodes are almost prevalent during REM sleep
Patients may have a combination of apneas and hypopneas
Mixed apneas may occur
Sleep disruption due to arousals, is usually seen at the termination of an episode of apnoea

The most commonly used index to define the severity of OSA is the [12] (Table 2), calculated as the number of obstructive events per hour of sleep and obtained by nocturnal cardiorespiratory monitoring [4].

Table 2: Apnoea/Hypopnoea Index (AHI)

Diagnosis	Events per hour
Normal	<5
Mild OSA	5-15
Moderate OSA	15-30
Severe OSA	>30

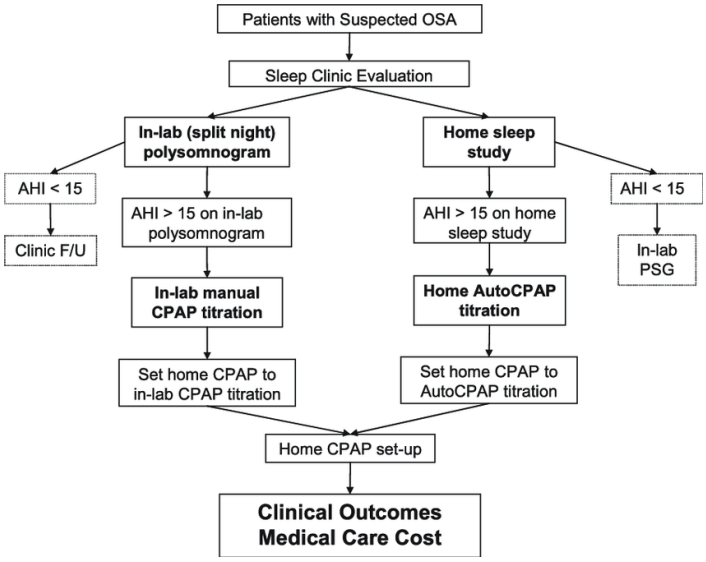
Mild OSA: Involuntary sleepiness during activities that require little attention, such as watching TV or reading. Moderate OSA: Involuntary sleepiness during activities that require some attention, such as meetings or presentations. Severe OSA: Involuntary sleepiness during activities that require more active attention, such as talking or driving [9].

Management:

OSA is a chronic condition requiring long-term, multidisciplinary treatment approach involving medical, dental, behavioural, and surgical protocols. The most appropriate management of OSA depends on the severity of the condition, the characteristics of an individual patient and the patient's general health, and the preference and experience of the team members. Henceforth, preferable less invasive treatment options are selected wherever possible [12].

Conservative management include behaviour modification, which is considered simplest and first option, especially for mild to moderate OSA patients. Behaviour changes such as modifying sleep position from the supine to the side position, along with abstinence from alcohol, tobacco and use of respiratory depressant or sedative medication as they have a depressing effect on the central nervous system and act as muscle relaxants, which in-turn has effect on reduction of airway patency. Recommendation of weight reduction in obese patients, as it has significant effect on airway passage [8]. Mechanical techniques of management include placement of appropriate oral devices for mild to moderate OSA patients. Prior to recommending patient for mechanical management, medical assessment with respect to change in weight, history of allergies, nasal congestion, neck size, on any medication such as sedative, blood pressure, blood sugar, and body mass index (BMI) are recorded [12]. Idea of use of mechanical oral device was eloped from an appliance used to treat glossoptosis in infants with micrognathia by Robin's in early 1905's. Later in 1990's with the advent of adjustable mandibular oral appliance to manage the patient with this disorder and subsequently, dentistry has become a part of sleep medicine as it requires multidisciplinary team. In 1991, The American Academy of Sleep Dentistry was formed for the education and certification of dental sleep-disorders specialists [10] and evolution of oral appliance therapy which includes mandibular repositioning appliances, tongue repositioning appliances, soft palate lifters. In case of severe OSA, management by upper airway surgical correction is recommended which fall under three categories, which includes classic procedure where directly enlargement of upper airway is done, specialized procedures wherein enlargement done by modifying soft tissue elements and/or the skeletal anatomy and skeletal modifications surgeries which includes genioglossal advancement, and maxillomandibular advancement surgery and tracheotomy. Most procedures tend to address either the retropalatal or the retrolingual portion of the pharyngeal airway and these procedures may be synchronously or sequentially with other procedures, depending on the nature of the anatomic abnormality [11]. Pharmacological management in these patients mainly aimed to treat obesity, drugs like Sibutramin, Orlistat, Lorcaserin, and topiramate etc are used by the patients and few studies [13] have also shown lowered in AHI and OSA association with weight loss. Pharmacotherapy that directly treats sleep apnoea rather than through weight loss includes, wake promoting agents (e.g., modafinil) that stimulant the central nervous system to promote wakefulness. However, side effects like xerostomia, from this pharmacotherapy are inevitable. Dental considerations like prescribing artificial saliva to help in complete denture retention, should have fluoride applications to avoid the incidence of caries, and must maintain good oral hygiene for xerostomia has to be done. Patients should also be advised to avoid cariogenic food and beverages [3].

The most recommended treatment for moderate to severe obstructive sleep apnoea is continuous positive airway pressure (CPAP). With a 70% acceptance rate, CPAP machines require patients to wear a mask during night-time sleep. The unit introduces air into nasal passage and exerts positive pressure to open the upper airway, which enables the patient to breathe. Patients with this treatment have reduced blood pressure, arterial stiffness and have a lower risk of having a cardiovascular event compared with those with untreated moderate–severe OSA. While CPAP is a highly efficacious, most recommended and gold standard treatment when used correctly, but many patients struggle to adapt to it. Some patients report finding the mask uncomfortable, too invasive or experience claustrophobia and non-adherence rates are probably at least 50% [9]. In general, surgical interventions for OSA are only indicated when a nonsurgical intervention, such as CPAP fails.



Oral Appliance therapy (OAT): Its usefulness and side effects

Oral appliance therapy has emerged as a treatment option for mild to moderate OSA and as alternative for patients with severe OSA who are unwilling or unable to tolerate continuous positive airway pressure (CPAP).

These appliances aim to increase the upper airway by preventing the tongue and soft tissues of the throat from collapsing into the pharynx while holding the mandible and attached soft tissues, including the tongue base forward, which enlarges the upper airway dimensions by specifically increasing the lateral dimensions of the velopharynx [14]. (Figure 1)

Oral appliances may be roughly divided into tongue retaining devices (TRD) and mandibular repositioning appliances (MRA) which are the most commonly used devices. Most randomized trials have shown preference to an oral appliance as compared to other treatment modalities [15].

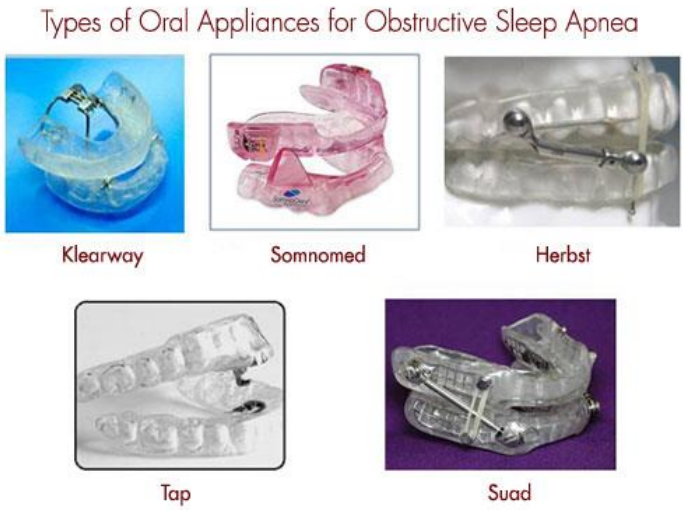


Figure 1: Types of oral application for obstructive sleep apnea

Mandibular advancement appliances (also called mandibular advancement devices) (Figure 2) are now the most widely used oral appliances for sleep disordered breathing. The mandibular advancement appliances are either a one-piece or a two-piece design and can be either prefabricated or custom-made. The prefabricated appliances generally are constructed of a thermo-labile material which is warmed and moulded by the individual, a so called "boil and bite" appliance. The custom made appliances are generally constructed by a dentist via impression making, jaw registration and then fabrication in a dental laboratory. A recent randomized controlled cross-over trial has shown that the custom-made appliances are superior to the pre-formed appliances in terms of reduction in snoring and apnoeas [16].

Figure 2: Mandibular advancement device

The appliances can have partial or full occlusal coverage. They may be constructed using a soft or hard material and some permit jaw movement. It is also possible to provide adjustment of protrusion to provide maximum relief of symptoms with minimal side effects. In bruxism patients, it is advised that a flexible two-piece design is used to permit lateral movement [15].

There is some debate over the amount of jaw opening provided by the appliance, as too much opening increases the chance of posterior displacement of the tongue and soft palate, although it also may improve upper-airway patency by stretching palatoglossus and the superior pharyngeal constrictor muscles [17]. One randomized controlled crossover study [18] compared appliances which provided 4mm and 14mm of jaw opening. Although there was no difference in efficacy in the short term of the study, 78 % of patients preferred the appliance with less increase in vertical dimension.

Mandibular advancement appliances are reported to reduce snoring by 73% to 100%. It is also noted that these appliances improve snoring according to bed partners and this is probably the most relevant outcome measure [19]. Hoffstein reviewed the evidence on the efficacy of oral appliances for the treatment of sleep apnoea, found that 21% of 1577 patients from 51 studies had a 50% reduction in AHI (response rate) and 54% of 2087 patients from 59 studies had an AHI less than 10 (success rate) [18]. Only five randomised, crossover, controlled studies of the efficacy of oral appliances have been reported. In meta-analysis, 232 patients from seven studies compared CPAP and oral appliances, and found that AHI with an oral appliance remained at 14, whereas AHI with CPAP was 6. However, patients in general preferred the oral appliance to CPAP because of good compliance and tolerance, non-invasive, long term effectiveness of appliance therapy and easy to wear [20].

The side effects most commonly reported are dry mouth, excessive salivation, discomfort, occlusal changes, tooth sensitivity, headaches and temporo-mandibular joint discomfort [21]. As most patients receive an appliance for mild sleep apnoea or chronic snoring, they may be less motivated to wear the appliance, even if the side effects are minimal, as the main complaint may be from the patient's bed partner. If the bed partner was no longer present, or no longer complained of the snoring, the patient is unlikely to wear the appliance. Compliance with mandibular advancement appliances has been reported to range from 4-76% at the end of one year [19,20]. Hoffstein reviewed 21 studies with 3107 patients using mandibular advancement appliances, with longer term follow up of 33 months found compliance rates of 56-68% [18].

CONCLUSION

The role of a dentist in the area of OSA is important both in diagnosis and in referral for further evaluation to other specialists. At the same time, the dentist can act as a provider of treatment in OSA. Oral appliances act as treatment option where other treatments have failed, and could be offered as a first-choice treatment for patients with snoring and mild to moderate OSA, or patients with severe OSA who do not tolerate CPAP therapy. General practitioners and dentists have to work in concord in order to provide the patient with the best treatment possible, tailored specifically to each individual patient.

REFERENCES

1. Kryger MH. Management of obstructive sleep apnoea. Clin Chest Med. 1992; 13(3):481-92.
2. Epstein LJ, Kristo D, Strollo PJ Jr et al. Adult Obstructive Sleep Apnoea Task Force of the American Academy of Sleep Medicine: Clinical Guideline for the Evaluation, Management and Long-term Care of Obstructive Sleep Apnoea in Adults. J Clin Sleep Med. 2009;5(3):263-76.
3. Booth AJ, Djavadkhani Y and Marshall NS. A critical review of the treatment options available for obstructive sleep apnoea: an overview of the current literature available on treatment methods for obstructive sleep apnoea and future research directions. Bioscience Horizons 2014;7:1-8
4. Berry R, Budhiraja R, Gottlieb D, et al. Rules for scoring respiratory events in sleep: update of the 2007 AASM Manual for the Scoring of Sleep and Associated Events. J Clin Sleep Med 2012;8: 597–619
5. Malhotra A, and White DP. Obstructive sleep apnoea. The Lancet 2002;360(9328):237-245.
6. Yaggi HK, Concato J, Kernan WN et al. Obstructive sleep apnoea as a risk factor for stroke and death. N Engl J Med 2005; 353(19):2034-2041.
7. Mc Nicholas WT. Chronic obstructive pulmonary disease and obstructive sleep apnoea: overlaps in pathophysiology, systemic inflammation, and cardiovascular disease. Am J Respir Crit Care Med 2009; 180(8):692-700.

8. Jordan A, McSharry D, Malhotra A. Adult obstructive sleep apnoea. Lancet 2014;22: 736–747.
9. Marshall NS, Wong KK, Cullen SR. et al. Sleep apnea and 20-year follow-up for all-cause mortality, stroke, and cancer inci¬dence and mortality in the busselton health study cohort, Journal of Clinical Sleep Medicine, 2014;10:355–362.
10. Padma A, Ramakrishnan N, Narayanan V. Management of obstructive sleep apnea: A dental perspective. Indian J Dent Res 2007;18:201-9
11. Roure N, Gomez S, Mediano O et al. Daytime sleepiness and polysomnography in obstructive sleep apnoea patients. Sleep Med 2008; 9(7):727-731.
12. Gotsopoulos H, Chen C, Qian J et al Oral appliance therapy improves symptoms in obstructive sleep apnoea: a randomized, controlled trial. Am J Respir Crit Care Med 2002; 166(5):743-748.
13. Tuomilehto H, Seppa J, Uusitupa M. et al. (2013) Weight reduction and increased physical activity to prevent the progression of obstructive sleep apnea: a 4-year observational postintervention follow-up of a randomized clinical trial. The Journal of American Medical Association Internal Medicine 2013; 173: 929–930.
14. Ferguson KA, Cartwright R et al Oral appliances for snoring and obstructive sleep apnoea: a review. Sleep. 2006; 29(2):244-62.
15. Vanderveken OM, Devolder A et al. Comparison of a custom-made and a thermoplastic oral appliance for the treatment of mild sleep apnoea. Am J Respir Crit Care Med 2008; 178(2), 197-202.
16. Makkar S, Jain A, Ugrappa S, Fuloria NK, Fuloria S. Obstructive sleep apnea: Diagnose the dental way. Ann Trop Med Public Health 2017; 10:821-5.
17. Pitsis AJ, Darendeliler MA et al. Effect of vertical dimension on efficacy of oral appliance therapy in obstructive sleep apnoea. Am J Respir Crit Care Med. 2002; 166(6):860-4.
18. Hoffstein V. Review of oral appliances for treatment of sleep-disordered breathing. Sleep Breath. 2007; 11(1):1-22.
19. Johnston CD, Gleadhill IC et al. Mandibular advancement appliances and obstructive sleep apnoea: randomized clinical trial. Eur J Orthod. 2002; 24(3):251-62.
20. Jauhar S, Lyons MF, Banham SW, Cameron DA, Orchardson R. Ten-year follow-up of mandibular advancement devices for the management of snoring and sleep apnoea. J Prosthet Dent. 2008; 99(4):314-21.