



Dental Sleep Medicine-A Futuristic Era in Dentistry

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Abstract

The dental discipline “dental sleep medicine” is highly multidisciplinary and demands a great deal of specialist. According to American Academy of Dental Sleep Medicine. It is defined as “Dental Sleep Medicine is the discipline concerned with the study of the oral and maxillofacial causes and consequences of sleep-related problems.” It contains various forms of dental sleep disorders like: snoring and Obstructive sleep apnea, orofacial pain in relation to sleep problems, sleep-related xerostomia and hypersalivation, sleep-related gastroesophageal reflux disease (GERD), and sleep-related bruxism. Altered airway and pattern of breathing could change the posture of tongue, jaws and head and lead to malocclusion. There are many ways in which the dentist/specialist can identify each complaint and the role he/she can play in its treatment. Early dental treatment has a beneficial effect not only on the teeth but establish the best possible airway at the earliest possible age and also it requires more attention for Dental Sleep Medicine in the dental curricula worldwide, as well as better postgraduate training of dentists who are interested in specializing in this intriguing domain. This paper contributes to increasing the dental researcher's, teachers and specialists insight into the discipline of ‘Dental Sleep Medicine’.

Keywords: Sleep Apnea, Obstructive, Snoring, Polysomnography, Sleep Medicine Specialty, Xerostomia, Sleep Bruxism.

Introduction:

Sleep is a natural process that enables us to recover from our energy expenditure during wakefulness. It also contributes to mood maintenance, immune system recovery, brain and muscle regeneration, and memory consolidation. The sleep ‘centre’ is localized in the brainstem, with interplay from the suprachiasmatic nucleus and the thalamus.[1] During sleep, the cortex is relatively quiet, except during specific phases of arousal that naturally occur every 20-40 seconds. These arousals are cyclic physiological phenomena that occur to preserve homeostasis and survival.[2]

Dental Sleep Medicine, an offshoot of Dentistry and more specifically of Oral Medicine, is highly multidisciplinary and requires a lot of specialist medical knowledge on the part of those working in it, including on ear, nose and throat medicine, neurology, lung disease, and internal medicine.[3] This challenging discipline is practiced mainly by maxillofacial surgeons, orthodontists, and dentists specialized in oral medicine, dental sleep medicine, or orofacial pain and dysfunction.[4]

Dental Sleep Medicine (DSM) is defined as ‘A discipline concerned with the study of the oral and maxillofacial causes and consequences of sleep-related problems.’ by Lobbezoo et al. Way of breathing (mouth or nasal breathing), airway and craniofacial formation are related to each other during growth and development.[5] Altered airway and pattern of breathing could change the posture of tongue, jaws and head and lead to malocclusion and various other sleep related breathing disorders (SRBD).[6,7] Therefore, this paper briefly reviews the need and contribution to increase the dental researcher's, teachers and specialists insight into the discipline.

History of dental sleep medicine

In 1999, Prof. Gilles Lavigne and coworkers published a comprehensive review, entitled ‘Sleep disorders and the dental patient’. This landmark article was the first to describe in detail several common sleep disorders of interest to dentists, viz., not only snoring and obstructive sleep apnea. However, Dental Sleep Medicine Academies worldwide kept their focus on the management of sleep-related breathing disorders, including snoring and obstructive sleep apnea (OSA), with oral appliance therapy and upper airway surgery.[8,9]

Dental Sleep Medicine is an up-and-coming discipline, as is reflected both nationally and internationally in the founding of professional scientific associations (e.g., European Academy of Dental Sleep Medicine – EADSM; American Academy of Dental Sleep Medicine – AADSM), the recent publication of specialized textbooks (1), and even a peer-reviewed scientific journal (the Journal of Dental Sleep Medicine).[10] The AADSM came up with a definition of the discipline in 2008: ‘Dental Sleep Medicine focuses on the management of sleep-related breathing disorders (SBD), which includes snoring and obstructive sleep apnea (OSA), with oral appliance therapy (OAT) and upper airway surgery.’ Lobbezoo et al. formulated a new definition in 2018. This new definition broadens the discipline to the diagnosis and management of other sleep related conditions where dentistry plays a pivotal role.[11,12]

Disorders treated by Dental Sleep Medicine

1. Oro-facial pain:

There are many types of orofacial pain, eg; dento-alveolar, musculoskeletal, neuropathic, Headaches. Headache is also classified as a type of orofacial pain. They can all affect sleep, for example by making it difficult to fall asleep or by causing nocturnal waking. All this can result in waking unrested, lowered energy levels, fatigue, lowered resistance, irritated bowels, and even feelings of depression. Nor is it the case that orofacial pain causing sleep problems is a one-way process; poor sleep can conversely cause orofacial pain.[13,14]

2. Oral moistening disorders

2.1 Xerostomia: Oral dryness can be an actual dryness of the oral cavity due to for instance hyposalivation or the feeling of a dry mouth. The latter condition is coined “xerostomia”. The following are often identified as possible causes: mouth breathing; medical conditions such as diabetes, Sjögren’s syndrome, OSA and GERD; and medication. Oral dryness can cause repeated nocturnal waking, which results in disturbance in normal sleep patterns.[15,16]

2.2. Hypersalivation: Hypersalivation is excessive saliva production, which means that there is an imbalance between saliva production and swallowing frequency. Patients with hypersalivation often complain that the pillow is wet. The prevalence is substantial at 8%, albeit lower than that of oral dryness. Possible causes are medical conditions such as Parkinson’s disease, periodontal problems, poorly fitting or loose dentures and medications. It also causes repeated nocturnal waking, with all the adverse effects of sleepiness during the day and so on. It can also cause aspiration, resulting in coughing or even aspiration pneumonia.[17,18]

3. Gastro-esophageal reflux disorder (GERD)

Gastro-esophageal reflux disorder (GERD) is described as retrograde flow of gastric acid into the distal esophagus, larynx, pharynx, and even the oral cavity. Patients report GERD as heartburn that disturbs sleep, and they may also complain of an acid taste in the mouth.[19] In addition, patients with GERD often report foreign body sensation, painful throat and hoarseness, and other aspecific throat complaints. The prevalence of GERD varies from 20% to 40% Factors that can cause GERD, as well as failure of the lower esophageal sphincter and diaphragmatic hernia, include obesity and pregnancy.[20] GERD has substantial effects on the individual: it can cause erosive (chemical) tooth wear, resulting in sensitive teeth, and it can promote hypersalivation, possibly resulting in aspiration pneumonia. GERD is also associated with OSA and even premalignant or malignant mucosal lesions in the esophagus.[21]

4. Sleep-related breathing disorders:

4.1. Snoring

Respiratory sound caused by air rushing through the narrow passage and stimulating the soft palate, uvula, throat walls and tongue to vibrate. The snoring prevalence in adult male and adult female is 29.5 % and 8.9% respectively. The overall prevalence of habitual snoring in children is 11.2% (boys, 12.4%; girls, 8.5%).[22]

4.2. Obstructive sleep apnea (OSA): OSA is considered and recognised as a major health problem, and is presented by recurrent, partial or complete closure of the upper airway during sleep, resulting in oxygen desaturation and sleep disturbance.[23] The prevalence of OSA in male and females is 9% and 4% respectively, although prevalence of OSA in children is less i.e., 2 to 3% and 10 to 20% in habitually snoring children. In India, in age group of 35 to 65 years- 9.3%

i.e., 40% suffer from OSA. Men are prone to have obstructive sleep apnoea than women before 50 years of age. After age of 50, the risk is same in both men and women.[24] It occurs due to increased collapsibility of the upper airway. Collapsibility is influenced by loss of neuromuscular compensation and decreased pharyngeal muscle activity. Followed by cessation of the airflow accompanied by hypoxia and hypercapnia which leads to increased respiratory effort to maintain airflow through a constricted airway. The increased work of breathing causes a cortical arousal from sleep and restores pharyngeal muscle activity, which increases airway patency and resumption of normal airflow, with subsequent return to sleep and recurrence of sleep-related upper airway collapsibility.[25]

5. Mandibular movement disorders

5.1 Orofacial dyskinesias: This group of motor dysfunctions is characterized by involuntary, mainly choreatic (dance-like) movements of the face, lips, tongue and jaws. If the condition is confined to the jaws it is important to differentiate it from bruxism related teeth grinding. Possible causes can be underlying psychiatric disorders and certain drugs (e.g., neuroleptics and dopamine-related drugs). Patients with this disabling condition can also have disturbed sleep.[26]

5.2 Oromandibular dystonias: these excessive, involuntary, persistent muscle contractions in the lips, tongue, and jaws are confined to the latter structure, they can easily be confused with bruxism-related clenching.[27]

5.3 Sleep bruxism: Bruxism has recently been defined as repetitive masticatory muscle activity characterized by clenching or grinding the teeth and/or bracing or thrusting the mandible. The prevalence of sleep bruxism in the general population is 8%.[27] A variety of factors play a role in the multifactorial etiology: psychosocial (stress, anxiety), biological (neurotransmitter abnormalities, genetics), and exogenous (medication, smoking, alcohol). The following are identified as possible effects: breakage or loss of teeth, fillings or implants; mechanical tooth wear in the form of attrition; masticatory muscle hypertrophy; musculoskeletal pain; and mandibular dysfunctions.[28]

5.4 Sleep bruxism and restless leg syndrome (RLS): RLS also has a primary motor symptom that is characterized by the occurrence of periodic leg movements in sleep (PLMS). The resulting brief arousals can contribute significantly to disturbed sleep.[29]

6. Role of oral medicine specialist in diagnosis and management of sleep disorders:

6.1 Case History: The specialist should note the patient's chief complaint, the medical and family histories, sleep hygiene, sleep wake timings, medications and other habit like smoking, alcohol, caffeine, opioid use. The preliminary screening is to assess the patient symptoms (e.g., snoring, gasping, sleepiness, periods breath-holding while asleep, night time restlessness, abnormal behaviours and movements, sound/noise (eg talking).[30]

6.2 Clinical examination: a. Related to OSA: obesity, neck circumference, craniofacial morphology (micrognathia, macroglossia, tonsillar/adenoid). b. Related to RLS: an urge to move the legs with uncomfortable/ unpleasant sensation in the evening or at bedtime.[31]

6.3 Oral examination:

The findings seen are Hypotonic tongue, Macroglossy, Retrognathic mandible/maxilla, Micrognathism, V-shaped palate, Narrow arches, Crossbites, Signs of mouth breathing, Severe attrition, signs of myofascial pain and temporomandibular joint disorders. Critical structures that should be evaluated are the soft palate, the palatine tonsils, and the uvula. Evaluate for enlarged turbinates from allergic or nonallergic rhinitis, Deviated nasal septum and mucosal swelling

which bring about resistance to airflow. Tongue occlusal positioning and size may indicate oropharyngeal crowding. A detailed examination of the TMJ is necessary.[32,33]

6.4 Radiographic examination:

Cephalogram assists in findings enlarged adenoids, reduction in mandibular length, posterior displacement of the mandible, inferior displacement of hyoid bone and repositioned maxilla.[34]

6.5 Diagnostics test:

Specific tests are required for the establishing the diagnosis of the OSA like polysomnography (PSG) or portable monitoring (PM). A gold standard test for OSA. The test involves overnight recording of sleep, breathing pattern and oxygenation. The study records analysis of apnoea, oxygen saturation, body position change, heart rate, snoring and sleep staging.[35] In dentistry, portable EMG recordings (type III or IV level examination in sleep medicine) have preferably been used to detect and quantify 'sleep-related' masticatory EMG activity. These tests are prescribed and interpreted by a medical doctor. PSG score yield AHI(apnea-hypopnea index) scores which divides the OSA into 3 categories depending upon the severity. Among adults, normal AHI normal is <5 while mild OSA is considered when AHI score is 5 to 15, moderate OSA is with 15-30 AHI score and severe OSA is with >30 AHI score.[36]

Epworth sleepiness scale is a commonly used scale to assess ESS. This screening tool can be easily applied and can be incorporated while taking health of the suspected subjects. A score of 10 or more on this scale indicated presence of ESS. At the time of presence of positive findings, one should refer the patient to general physician for further diagnosis.[37]

Kushida index and Berlin questionnaire has been successfully used as a screening tool for primary care of the population. In this survey questions address snoring behavior, EDS/fatigue, and history of obesity or hypertension. The sensitivity of the Berlin questionnaire with regards to high-risk patients having sleep apnea was 86%.[38]

The questionnaire such as MBQOL- Quality of life questionnaire for Mouth breathers. Weaver's functional outcome of sleep questionnaire(FOSQ) helps to evaluate quality of life and sleep.[39]

Another screening tool called the STOP BANG questionnaire was developed to screen for the most common risk factors seen specifically in OSA. STOPBANG questionnaire which asks yes or no questions based on its acronym: snoring(S), tiredness (T), observed pauses in breathing (O), high blood pressure (P), BMI >35 kg/m² (B), age >50 years (A), neck circumference of >17 inches in men, or >16 inches in women (N), and male gender (G).[40]

7. Management:

7.1 Behavioural therapy: Weight loss accompanied by healthy diet will eradicate the problem completely. Also, abstaining from alcohol consumption 3-5 hours before sleep can help in reducing the resistance of upper airway. Guiding the patient with mild OSA symptoms to sleep sidewise and positioning head at a higher level than the body. Nasal dilator strips or sprays can be used to reduce snoring to an extent. Avoid night grinding.[41]

7.2 Mechanical methods:

7.2.1 Pharmacotherapy: FDA approved drug is Modafinil for use in patients with sleep disorders having residual daytime sleepiness. Armodafinil, the Renantiomer of modafinil, is also now a FDA approved for use. Drugs such as tricyclic antidepressants (Desipramine), Zolpidem, which are serotonergic, noradrenergic and which acts on the potassium channels can improve muscle responsiveness during airway narrowing. Avoid benzodiazepines or opioids. Refer to psychologist, ENT or physical therapist when indicated.[42]

7.2.2 Continuous Positive Airway Pressure (CPAP): CPAP is the most effective treatment for relieving symptoms of moderate to severe cases of OSAS. It is considered to be the gold standard treatment and usually the first line treatment specially in the case of severe OSA. It consists of a mask which the patient has to wear during sleep over the nose or/and mouth. It provides steady and continuous air pressure which can be adjusted to prevent the soft tissue in the back of the neck to collapse and cause upper airway obstruction. As this has a bulky apparatus, its compliance among patients is low.[43]

7.2.3 Oral Appliance therapy: Taking in account the poor compliance with CPAP, Orthodontic correction with use of oral appliances therapy(OAT) is alternative but effective way of correcting OSAS by advancing the mandible and changing the tongue posture to improve the airflow in upper airway and reduce the incidence of supine apnea.[44]

Indications of Oral Appliance Therapy (OAT)[45]

- i. Mild to moderate symptoms of OSAS
- ii. Low BMI rate
- iii. 8mm or more mandible advancement
- iv. Intolerance or failure of CPAP therapy
- v. Patients unwilling for surgery.

Contraindications of Oral Appliance Therapy[45]:

- i. TMJ disorders
- ii. Limited mandibular movements
- iii. Poor oral hygiene
- iv. Presence of 6 to 10 teeth or less than in each arch.
- v. For behavioral measures such as weight loss or sleep-position change.

Type of OAT presently available in the market are- MAD (Mandibular advancement devices), TRD (Tongue retaining device), SPL (Soft Palate Lift). These appliances are given depending upon the case severity and underlying etiology of the patients.[45]

7.2.4 Surgical methods: These methods include surgeries removing structures that obstruct the airway passage and they are Adenotonsillectomy, Somnoplasty, Uvulopalatopharyngoplasty (UPPP), Maxillomandibular advancement surgery and Nasal surgery.[40]

The summary of the above context ‘American Dental Association (ADA)’ has adopted a policy that outlines the role of dentist as given in Table 1.[44]

Ada policy on role of dentist in treating sleep related sleep disorders[44]	
Screening	Should be a part of comprehensive medical and dental history. - Signs and symptoms should be properly examined to assess the presence of OSA.
Referral	If the patient is suspected of OSA, referral should be made to appropriate physician for the final diagnosis.
Oral Appliance Therapy (OAT)	OAT should be given if- -Prescribed by a physician -Mild and moderate sleep apnea, and for severe sleep apnea when a CPAP is not -tolerated by the patient. Dentist should first assess the patient for the appropriateness for fabricating the appliance. Dentist should also take well-informed consent

	from the patient after telling the probable side-effects of OAT.
Surgical interventions	Though secondary, but surgical intervention can be given by dentist when CPAP or OAT is inadequate or not tolerated by the patient.
Follow – up	Once the appliance is given or patient is screened for OSA, dentist must follow-up according to the severity of the condition and also should be in regular communication with patient's physician for progress of the treatment or when the patients seems to develop recurring OSA relevant symptoms or comorbidities.
Continuing-education	A dentist should keep oneself upbreast with knowledge and training of dental sleep medicine with related continuing education.

Dental sleep medicine in Indian scenario

Still there is huge number of unmet medical needs concerned with sleep related breathing disorders. The rising awareness about the same has lead to increased rate of screening of the ailment. To the rescue, dental sleep medicine is gaining enormous attention. It is a rapidly growing field working in close approximation with general medicine and further enhancing the timely diagnoses along with appropriate treatment to the patients. Scenario in India is still grave. So far few prevalence studies in India have been conducted, findings from these suggests high prevalence of OSA. It can be pertained to high cost of equipments, methodologic difficulties and high. patient load in hospitals. Also, sleep medicine has been slow to develop in India, as there are only 40 sleep laboratories in the country with the population more than 1 billion. Studies has shown lack of awareness among Indian dentists as well as physicians about prevalence, diagnosis and management of sleep apnea syndrome. Since India is developing nation, change in lifestyles with urbanisation is affecting the health of the people. As we are having a huge proportion of people with obesity, diabetes and cardiovascular disorders, the impact of undetected OSA as a public health burden cannot be undermined.[46]

Futuristic directions:

In the light of evidence available, there is need for implementation of appropriate diagnostic and preventive measures. The aim is to determine the optimal OA design with the strongest effectiveness for each patient phenotype. One promising avenue is to develop algorithms to assist clinical decision making. Another is to apply machine learning approaches to advance the field of precision dental sleep medicine. The predictability of treatment choices (CPAP or OA with or without adjunct alternatives to surgery) according to individual characteristics needs to be improved (Sutherland, Almeida, et al. 2018; Cistulli and Sutherland 2019). Finally, further data should be obtained on some important oral health–related issues associated with the feasibility of OA implementation and its success, such as risk of caries, periodontal disease, and oral health–related quality of life. Also, dental sleep medicine should be incorporated in the curriculum of dental education. This way we can nib this problem in the bud by training the budding dental

clinicians. Subsidy on the diagnostic facilities as well as treatment modalities can be another measure to address this problem in under-served areas of India.[47,48]

Conclusion:

From the present review, it can be concluded that this recent finding of dedicated professional Academies suggests that Dental Sleep Medicine is a genuine new offshoot of Dentistry, a wider discipline of “Oral Medicine”. Being in a position of screening patients more frequently, Oral Medicine specialist can aid in much early diagnosis of OSA. This can further prevent the life-threatening complications that may follow this condition. Therefore, dental sleep medicine should be incorporated in the curriculum or continuing dental education (CDE) programs must be organised to prepare dentists to combat this unseen but widely prevalent health problem.

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