



Review Article

Dental sleep medicine: A comprehensive overview

Nikita Baheti¹, Wasundhara A. Bhad^{1,*}, Santosh J. Chavan¹, Siddharth S. Sonwane¹¹Dept. of Orthodontics, Government Dental College, Nagpur, Maharashtra, India

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ABSTRACT

With the increasing awareness of the ravages of airway disorders especially obstructive sleep apnoea (OSA) as a sleep related breathing disorder and the realization that dentist has the capability of offering possible solutions in this area, it is time to consider new aspect of dentistry as Dental sleep medicine. The concept focuses on practice of clinical dentistry aimed at achieving ideal jaw relationship, establish normal oral function and performance. The principal aspect of function and performance is airway and breathing which, in fact, is one of the most important function for humans. Altered airway and pattern of breathing could change the posture of tongue, jaws and head and lead to malocclusion. Early dental treatment has a beneficial effect not only on the teeth but establish the best possible airway at the earliest possible age. Today, dental profession is crucial and integral part of the interdisciplinary group in the management of SRBDs. This review article will guide a dentist to identify a child or adult suspected or at a risk of SRBD. Also, explain role of dentist and orthodontist in the management and treatment of the SRBDs.

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1. Introduction

One of six classifications of sleep disorders is sleep-related breathing disorders (SRBDs) mentioned in the International Classification of Sleep Disorders, Third Edition (ICSD-3).¹ 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. American Academy of Dental Sleep Medicine – AADSM, European Academy of Dental Sleep Medicine – EADSM.). The AADSM came up with a definition of the discipline in 2008: ‘Dental Sleep Medicine focuses on the treatment of sleep-related breathing disorders (SRBDs), that includes snoring and obstructive sleep apnea (OSA), along with oral appliance therapy and upper airway surgery’.²

Way of breathing (mouth or nasal breathing), airway and craniofacial formation are related to each other during growth and development so, form can follow function and function can follow form.³ Altered airway and pattern of

breathing could change the posture of tongue, jaws and head and lead to malocclusion. Early dental treatment has a beneficial effect not only on the teeth but establish the best possible airway at the earliest possible age. Today, dental profession is crucial and integral part of the interdisciplinary group in the management of SRBDs, thus well poised to become a part of mainstream health profession.⁴ This overview article demonstrates how a dentist should recognise a child or adult suspected or at a risk of a SRBD. Also, explain role of dentist and orthodontist in the management and treatment of the SRBDs.

1.1. 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.⁵ The overall prevalence of habitual snoring in children is 11.2% (boys, 12.4%; girls, 8.5%).⁶

* Corresponding author.

E-mail address: wasundharabhad@gmail.com (W. A. Bhad).

1.2. Obstructive Sleep Apnea (OSA)

Obstructive sleep apnea 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.⁷ 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.⁸ 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.⁹

1.3. Pathophysiology of OSA⁹

Obstructive sleep apnea 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.

1.4. Risk factors⁹

Gender (male/female 2:1), obesity (>120% ideal body weight), neck size (collar size >17 inches in males, >15 inches in females), upper airway anatomy includes macroglossia, lateral peritonsillar narrowing, elongation/enlargement of the soft palate, tonsillar hypertrophy, nasal septal deviation, retrognathia, micrognathia, narrowing of the hard palate, class III/IV modified Mallampati airway, specific genetic diseases, e.g., Treacher Collins, Down's syndrome, Apert's syndrome, Achrodoropsia, etc.

2. Diagnosis

2.1. Case history

The dentist should note the patient's chief complaint, the medical and family histories, sleep hygiene, sleep wake timings and medications. Many of the time patients come with chief complaint of dental problem and unaware of symptoms related to SRBD. The aim of the preliminary screening is to assess the patient symptoms (e.g., snoring, gasping, sleepiness, periods breath-holding while asleep, night time restlessness) as to the likelihood of an SRBD.

2.2. Clinical examination

The dentist should do a detailed examination to recognise important features linked with SRBDs. A complete examination should include visualization and precise assessment of the craniofacial structures including the airway. Critical structures that should be evaluated are the soft palate, the palatine tonsils, and the uvula. Researchers, including Brodsky, Mallampati and Friedman established illustrative assessments of these soft-tissue entities.¹⁰⁻¹² Initial site of upper airway obstruction happens in retropalatal tissues.^{13,14} It is crucial to see any enlarged turbinates from allergic or nonallergic rhinitis, deviated nasal septum and mucosal swelling which bring about resistance to airflow. If any pharyngeal or nasal patency is jeopardized, the patient should be referred for an ENT evaluation.

The tongue also plays an important role in upper airway obstruction. Tongue occlusal positioning and size may give additional indication as to the prospect of oropharyngeal crowding. There may be an connection between temporomandibular disorders and SRBDs.¹⁵ A detailed examination of the temporomandibular joint (TMJ) is necessary.

The use of radiographic imaging as cephalogram assists dentist in findings such as enlarged adenoids, reduction in mandibular length, posterior displacement of the mandible, inferior displacement of hyoid bone and retropositioned maxilla. The upper and lower pharyngeal airways can be measured according to the method of McNamara.¹⁶

2.3. Questionnaires

Screening questionnaires are found to be helpful in identifying patients at increased risk for SRBDs. STOP-BANG questionnaire¹⁷ 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). A patient is judge to be at low risk for OSA if the questionnaire has no more than 2 "yes" answers, at intermediate risk if here are 3 or 4 "yes" answers and at high risk if there are 5 or more "yes" answers.¹⁸ The questionnaire such as MBQOL- Quality of life questionnaire for Mouth breathers,¹⁹ Paediatric Sleep Questionnaire,²⁰ Weaver's functional outcome of sleep questionnaire (FOSQ)²¹ helps to evaluate quality of life and sleep. The Epworth Sleepiness Scale is merely a suggestive indicator of OSA.²² The sleepiness score is determined from a questionnaire designed to assess how likely a person would be to doze off in eight specific situations. Clinicians also may find the the Kushida index,²³ and the Berlin Questionnaire for Sleep Apnea useful.²⁴

2.4. Polysomnogram (PSG)

The dentist can elucidate and gather findings as part of an immense screening process and should refer a suspected patient of a SRBD to the physician for analysis and proper medical diagnosis. For diagnosis of OSA Polysomnogram (PSG) is considered the gold standard test. 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.²⁵

3. Management

3.1. Treatment for paediatric patients

3.1.1. Habit Interception

Abnormal habits such as mouth breathing and finger sucking can be interrupted by habit breaking appliances such as oral screen, tongue cribs etc.

3.1.2. ENT management

Hypertrophic tonsils and adenoids are the most common risk factors for SRBDs in children, thus tonsillectomy and adenoidectomy typically considered as the first line of treatment. Various forms of pharmacologic agents may be prescribed to reduce the size of the nasal soft tissues.

3.1.3. Dentofacial Orthopaedic management

Rapid maxillary expansion (RME) is a well-known treatment option for patients with a narrow maxilla. Nasal, nasopharyngeal, maxillary sinus and oropharyngeal volume increases after RME.²⁶ Normal growth and functioning of craniofacial complex can be restored with early interception but RME improves only the upper airway dimensions. Effect of RME in OSA: In study by Cistulli et al (1998) showed that RME was an effective treatment in 9 out of 10 patients having mild- moderate OSA and maxillary constriction and Villa et al showed that statistically significant decreases occurred in apnea-hypopnea index and arousal index of children with OSA with constricted maxilla.²⁷

3.1.4. Mandibular anterior repositioning appliances

Growth modification appliances or functional appliances in children not only corrects the retrognathism/retroposition of mandible but in addition modulates the airway, thus preventing future risk of developing OSA. In 1934 Pierre Robin developed Monoblock for treatment of Airway obstruction. Studies²⁸ have shown that in growing patients with Class II div 1 the upper airway shows a volumetric expansion in nasopharynx, oropharynx and hypopharynx along with horizontal movement of hyoid bone by Twin

Block therapy.

3.1.5. Soft tissue surgery

Surgery in children has a different role than in adults. Because the most common cause of SRBDs in children is adenotonsillar hypertrophy hence, adenotonsillectomy is common surgical procedure performed in children. Other soft tissue surgeries such as nasal surgery, turbinate reduction and deviated septum correction, sinus surgery, also may be considered in selected cases. Orthognathic surgery usually is not indicated until craniofacial growth is completed. As a result, the paediatric patient that presents with clear skeletal issues should typically be managed to adulthood in the normal fashion with corrective jaw surgery planned later when the timing of the surgery is appropriate.

3.2. Treatment for adult patients

Treatment for sleep apnea depends on the severity of the problem and patient compliance to the treatment modality.

A) Non surgical management

- a. Behavioural therapy
- b. Pharmacological management
- c. Measures to increase upper airway
 - i. CPAP
 - ii. Oral appliances

B) Surgical management

Subheading again should have normal bullets without any number

3.2.1. Behavioral therapy

Encourage patients to lose weight,²⁹ avoid alcohol,³⁰ stop smoking,³¹ avoid sleep deprivation drugs, avoid supine sleep position and nasal congestion and allergic rhinitis may be managed with the use of nasal steroids and other oral medications as indicated.

3.2.2. Oral appliance therapy

The gold-standard for OSA treatment was considered to be a positive airway pressure (PAP) therapy. Few patients using PAP can find the pressure too high, leading to PAP adherence question. Many studies have illustrated that OAs and PAP therapy were equivalent in improving daytime somnolence, quality-of-life indices, hypertension, neurocognitive function and cardiovascular mortality.^{32,33} Oral appliances, which include mandibular advancing oral appliances, tongue retaining devices, tongue posture training devices and soft palate lifter are usually effective options for OSA management in appropriately selected patients. American academy of sleep medicine recommends “oral appliance for mild-to-moderate OSA and/or for patients with severe OSA who are unable to tolerate CPAP or refuse treatment with CPAP”.³⁴ Mandibular advancing oral appliances are intended to hold the mandible or the

associated soft tissues ahead, following in an enlarged volume of the upper airway at the oropharyngeal level.³⁵

Many types of OAs are used in the treatment of OSA in adults. The appliances vary based on the coupling design, mode of fabrication and activation, titration capability,³⁶ degree of vertical opening, lateral jaw movement, whether they are custom made or prefabricated. Proper indications for each design should be considered. The patient undergoing oral appliance therapy should be educated of their SRBD intensity along with an understanding of the resulting apnea-hypopnea index (AHI), respiratory event index (REI), or respiratory disturbance index (RDI), from objective sleep apnea testing.

Advantages of mandibular advancing appliances are effective in mild to moderate OSA, easy to wear, portable, power source not required, cost effective but the problems with appliances are lifelong wear, frequent breakage, TMJ disorders, need healthy dentition.

3.2.3. Surgery

American academy of sleep medicine recommends that “surgical treatment of severe OSA in patients who cannot tolerate or who are unwilling to adhere to positive airway pressure therapy.” Different hard and soft tissue surgeries have been described for OSA as follow:

- Tracheostomy 1965
- Hard tissue surgeries

1979 mandibular advancement surgery,³⁷ 1986 MMA (Maxillo-mandibular advancement),³⁸ 2002 Mandibular-distraction

- Soft tissue surgeries

1975 Tonsillectomy,³⁹ 1981 UPPP (Uvulopalatopharyngoplasty), 1984 Genioglossus Advancement, 1990 LAUP (Laser-assisted uvulopalatoplasty), 1991 laser midline glossectomy,³⁹ 1992 Nasal surgeries

Patients typically should proceed with routine diagnosis and treatment planning, including comprehensive soft tissue facial evaluation to assure optimal presurgical preparation and that the surgery performed will not adversely affect facial esthetics. Orthodontic care is usually a beneficial adjunct for patients to facilitate obtaining optimal occlusion while simultaneously reducing the risk of postoperative malocclusion.

Surgically assisted rapid maxillary expansion (SARME) which aims to correct a maxillary transverse deficiency. In OSA patients with maxillary transverse deficiency, normalizing the width of the maxilla with the use of SARME and developing a functional and esthetic occlusion with comprehensive orthodontic treatment afterward has been suggested to improve PSG parameters.⁴⁰

4. Conclusion

As an emerging field of dental practice, there are amplifying numbers of dentists electing to participate in the treatment and management of SRBDs. Early dental treatment can intercept the airway disorders; as well modulate the airway with growth. Mandibular Repositioning Appliances have proved to be cost effective in management of OSA. Surgeries not only improve the esthetic but also improve the airway function with stability. However, dentist must be a part of multidisciplinary team.

5. Source of Funding

None.

6. Conflict of Interest

None.

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Author biography

Nikita Baheti Post Graduate IIIrd Year

Wasundhara A. Bhad Professor and HOD

Santosh J. Chavan Associate Professor

Siddharth S. Sonwane Associate Professor

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