

Recent Improvements in the Management of Obstructive Sleep Apnea: The Dental Perception

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ABSTRACT

Apnea is defined as a termination of airflow during the sleep, which lasts for minimum 10 s with oxygen desaturation of more than 3% and/or associated with arousal. It is categorized as central, obstructive and mixed type. Obstructive sleep apnea (OSA) refers to the occurrence of minimum of five apneas or hypopneas per hour resulting in sleep shattering and decreased oxygen saturation. This serious disease condition greatly reduces the quality-of-life of an affected individual and impacts their state of health unfavorably. Hence, this article explains the prevalence, symptoms, risk factors, diagnostic techniques as well as the treatment modalities that include both conservative management and the surgical interventions in order to treat OSA.

Keywords: Apnea, Dentistry, Obstructive sleep apnea

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INTRODUCTION

Apnea is a Greek word which means “without breath;” Obstructive sleep apnea (OSA) first described by Charles Dickens as “Pickwickian syndrome” in 1837.¹ In 1956, it was only that Sidney Burwell carefully recognized a case of an OSA patient, who rationalized the signs and symptoms, and made a distinction between this disease and other illnesses.² Since then there is a surfeit of information on it and now it is documented as a separate entity. Apnea is defined as a termination of airflow during the sleep, which lasts for minimum 10 s with oxygen desaturation of more than 3% and or associated with arousal. It is categorized as central, obstructive and mixed type and may be graded as mild, moderate, and severe.³

In the central sleep apnea, the respiratory muscles make no effort to breathe, as a result of central nervous system disorders. OSA refers to the occurrence of minimum five apneas or hypopneas per hour resulting in sleep shattering and decreased oxygen saturation.³ OSA is a communal sleep disorder that can be hypothetically

fatal. This serious disease condition greatly reduces the quality-of-life of an affected individual and impacts their state of health unfavorably.

This review article is destined to provide an outline of the role of the dental professionals, particularly orthodontists and surgeons in the management of OSA. Treatment of OSA not only improves the physical health of patients, but also the mental and the social well-being.

PREVALENCE OF OSA

The prevalence of disease has been found to be around 8% in men and 2% in women in the United States.⁴ Prevalence studies in western countries are estimated to be around 4% of the middle-aged men and 2% of middle-aged women being affected in general population.⁵ The likely prevalence of sleep-disordered breathing (SDB) of urban men in India was 19.5% (apnea hypopnea index [AHI] >5) and 7.5% (SDB with hypersomnolence), which is arresting and has a major public health intimation in developing countries like India.⁶

SYMPTOMS OF OSA

The symptoms are:

- Loud snoring (all the cases of OSA provoke snoring, but all snoring cases need not have the OSA)^{7,8}
- Hyper somnolence (hallmark of OSA)^{9,10}
- Feeling of choking,
- Restless and unrefreshing sleep,
- Change in personality, and
- Nocturia.

RISK FACTORS

Obesity is the main predisposing factor for OSA¹¹. Obese patients with the increased neck perimeter (collar size greater than 16–17 inches), or those with a high-body mass index (BMI \geq 25), who sleep in supine position are impending candidates for OSA. When a patient with obesity falls asleep in the supine position, then muscles relaxation causes the base of the tongue to slant the posterior wall of the pharynx. With the consequent reduced air flow and patient must be increase the speed of airflow to maintain the required oxygen supply to the lung. This increase in airflow velocity causes the vibrations of the soft tissues, which produces snoring.

In non-obese patients, craniofacial abnormality like micrognathia, macrognathia and retrognathia^{12,13} may also be predisposing factors to OSA. Other conditions that may predispose to OSA includes embrace enlarged palatine tonsils and uvula, high arched palate, longer anterior facial height,¹⁴ Shorter Anterior Cranial base,¹⁵ inferiorly displaced hyoid bone,¹⁶ unduly large tongue and long soft palate;¹⁷ and decreased posterior airway space.¹⁸ In addition to the obesity age,¹⁹ ethnic background and genetic predisposition,^{20,21} consumption of alcohol,²² smoking,²³ and sedatives may exacerbate the existing OSA. Alcohol and sedatives relaxes the airway muscles making more susceptible to obstruction.

Diagnosis of OSA Patients is Based Upon

- History of clinical signs and symptoms: Examination of face and oropharynx. Upper-airway assessment can be done with endoscopy or laryngoscopy, pharyngometry, and radiographic evaluation²⁴⁻²⁶ (computed tomography [CT] or magnetic resonance imaging [MRI]).
- Home monitoring: Unattended home studies on children with OSA have been refining in quality. In one study using a complete methodology including cardiorespiratory imaging and 8 h of video recording, results thus, obtained were very similar to those obtained by polysomnography (PSG) in the laboratory.²⁷

- Laboratory sleep study: PSG.²⁸
- Watch - "PAT 200 (Great Lakes Orthodontics, USA. Item no 256-001)."

PSG

- PSG is the gold standard in the diagnosis of OSA.^{29,30} It involves an overnight recording of the sleep breathing patterns and oxygen saturation. Sleep staging includes the electrocardiogram, electroencephalogram, and electromyogram. Generally, the blood oxygen level should be above 90%, with impediments. PSG provides AHI score that is an estimation of apnoeic-hypopnoeic episodes per hour of sleep. In an adult patient, an AHI of 5 (or sometimes 10) generally-indicates mild OSA.

TREATMENT MODALITIES

- Treatment modalities of OSA are meant to increase the life expectancy, and decrease the disease problems, and improve the quality-of-life. Less offensive treatment options should be selected whenever possible. These include - diet and medication, behavior modification, continuous positive airway pressure (CPAP) devices, oral appliances and surgical options.

Behavior Modification

- Behavior modification includes changing in the sleep position from supine to the side position using the of pillow or tennis ball, evading the consumption of alcohol and sedatives 3 h before sleeping and body weight control.

Diet and Medication

- For obese children, weight loss and maintaining a healthy diet might be the ultimate treatment for their OSA.³¹ antibiotic medication,³² topical intranasal application of corticosteroids,³³ leukotriene receptor antagonist,³⁴ and anti-inflammatory therapy³⁵ can be used for a mild or residual OSA after surgery.

CPA Device

- CPAP device³⁶ is the non-invasive gold standard treatment for patients with moderate-to-severe OSA. It acts by the continuous pumping in room air under pressure through a sealed face mask or nose mask into the upper airway or lung. Though CPAP is most efficacious treatment option, it requires the use of mask interface, sealed tubing, and the device connected to the power sources. This intricacy limits its acceptance by patients and leads to suboptimal treatment adherence.

Surgery

- Rojewski *et al.*, in 1984; assessed that 1.5% of patients with OSA have space occupying lesions. In such type of cases, surgical extirpation is the potentially corrective treatment option. Kuo *et al.*³⁷ - initiated the use of orthognathic surgeries for the treatment of OSA in 1979. Hard tissue surgeries for the OSA include genioglossus advancement, maxillomandibular advancement (MMA) with overall success rate of 96% to 100%.^{38,39}
- The amelioration of OSA by MMA surgery can be expected by analyzing anatomical airway changes with three-dimensional (3D) geometrical reconstruction and computational fluid dynamics.⁴⁰ Computer enable technology lab (ETLab) and computational simulation lab (CSLab) can be used to analyze an anatomical airway changes for previously operated patients with a clinical cure of OSA. MMA surgery reduces the airway resistance and pressure effort (gradient) of OSA by increasing the dimensions of an airway. ETLab has been used to reconstruct an upper airway as a 3D computer model (pharyngeal airway is surrounded by bone and soft tissue) from the prevailing computed helical tomography scan format of OSA patients. ETLab can equate and construct the geometry with numerical meshes of the airway between pre and postoperative MMA using of bioengineering software. This technology uses high-fidelity computation fluid dynamics simulations that are developed by CSLab, for prediction and analysis of the flow field in airway for pre and postoperative MMA. It is possible to use the imitation to predict the probable success of the future treatment and develop a prognostic factor.
- Rather, pre-operative orthodontic treatment should be used to ensure the good postoperative occlusion as well as correcting any pre-existing malalignment of the teeth to improve the cosmetic appearance of the patients. The purposes of presurgical orthodontic treatment for MMA patients are different from those of the routine orthognathic surgery for patients who have dentofacial deformities. In Class II patients, it is suitable to retract the lower incisor teeth and procline the upper-incisor teeth to make the most amount of mandibular advancement. This step would provide the greatest amount of airway improvement.

Oral Appliances

- In 1900, Pierre Robin was the first, who used oral appliances for glossoptosis.⁴¹ In 1990, adjustable mandibular advancement devices (MADs) turn into the principal form of dental therapy for SDB, gesticulating the entry of dentistry into the conventional sleep medicine. In 2000, a separate

section of oral appliances was created in American Academy of sleep Medicine (AAOSM).⁴²

- Now AAOSM has recommended oral appliances^{43,44} for primary snoring and mild to moderate OSA, the patients intolerant to CPAP or those who refuse for the surgery. Various oral appliances used in OSA are: MAD or mandibular retaining devices - e.g. Herbst appliance, snore guard, silencer - tongue retaining devices, e.g., Snor Ex. Soft Palate Lifter and a combination of Oral appliances and CPAP.
- Oral appliances act by enlarging obstructed upper airway by moving the mandible and tongue anteriorly during sleep time. It leads to the activation of the upper-airway dilator muscles, which decreases the airway collapsibility. Henceforth, this action prevents the airway occlusion. In an AAOSM⁴⁴ report, standard best practices for the oral appliance treatment in OSA patients are:
 1. To form the presence or the absence of OSA, using the standard diagnostic criteria that include PSG before the decision to recommend the oral appliances.
 2. To treat the OSA patients, to the desired outcomes of AHI <five events per hour and arterial oxyhemoglobin saturation levels >85% with a resolution of clinical signs and symptoms.

CONCLUSION

Henceforth, the therapeutic interventions that are directed to the site of airway obstruction in the maxillofacial region are within the space of dentistry. Dental practitioners can play an extensive role in the treatment of OSA syndrome. It is domineering that the dental community continues to participate in the research and treatment of this serious and pervasive health problem.

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