Obstructive Sleep Apnea Syndrome in Children

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ABSTRACT
Sleep, probably a quarter of every human’s life, forms an important factor in children’s development. Sleep disorders can impair children’s sleep and lead to negative consequences. The consequences of these disorders can be substantial, leading to hypersomnia, neurocognitive deficits, and significant cardiovascular morbidity and mortality. Risk factors for obstructive sleep apnea (OSA) syndrome include adenotonsillar hypertrophy, Down’s syndrome, obesity, family history of snoring or any condition leading to narrowing of upper airway. As the dentists are becoming increasingly aware of the issue of OSA, they are frequently involved in treatment of this condition using oral appliances. Moreover, they play an active role in identifying those with enlarged tonsils and referring them for sleep assessment. This paper provides an overview of OSA, including an outline of the diagnostic protocol and a summary of the wide variety of treatment modalities in children.

Keywords: Sleep apnea, Risk factors, Dentists, Child.

INTRODUCTION
An increasing number of people are realizing that changes in their sleeping habits and daytime behavior may be attributable to obstructive sleep apnea syndrome (OSAS). This new awareness has led many patients to seek both information and definitive treatment.1 Pediatric obstructive sleep apnea syndrome is characterized by episodes of partial or complete upper airway obstruction that occur during sleep, usually associated with a reduction in oxyhemoglobin saturation or hypercarbia.2 OSAS is the most common condition among a group of disorders, known as sleep-disordered breathing, which can affect anyone irrespective of age and sex.3

OSAS is currently a public health problem of great importance. First, its main clinical manifestation, daytime hypersomnia, has an important impact on the family, work and society, including a deterioration in personal relationships, job absenteeism, traffic accidents, etc. Second, its prevalence is estimated to be quite high.4 Approximately 3 to 12% children around the world snore and out of them 1 to 10% may have OSAS.5 As sleep disorders may have devastating effects not only on the child, but also on their family, dentists may be the first to recognize such disorders and help in their treatment.

Pathophysiology
Understanding obstructive sleep apnea syndrome in children requires knowledge of the physiology of sleep and breathing. There is an immediate increase in upper airway resistance with sleep onset, with an initial ‘overshoot’ in this resistance that decreases very quickly. Still, this resistance during established sleep is mildly higher than during wakefulness.6 The size of the pediatric airway is dependent on craniofacial and soft tissue structures.7 The available airway space may be reduced by abnormalities of oral cavity, larynx, nose, nasopharynx and oropharynx.6 OSA in children is the result of a complex interaction between an airway predisposed toward collapse and neuromuscular compensation. During wakefulness, there is robust activation of pharyngeal dilator muscles and a stable ventilatory pattern. At sleep onset, there is a marked reduction in the activation of airway muscles, an increased ventilatory variability, and the appearance of an apneic threshold close to eupneic levels. Arousal from sleep contributes to ventilatory instability and therefore exacerbates obstructive cycling.7

Risk factors for development of OSA in children include adenotonsillar hypertrophy, Down’s syndrome (DS), obesity, family history of snoring or any condition leading to narrowing of upper airway. Other studies have shown that sleep-disordered breathing occurs in at least 50 to 80% of children with DS.8
as physicians usually fail to diagnose it. The prevalence of OSAS is estimated around 2%–3% in children and about 2.5 to 6% among adolescents. OSAS has a bimodal age of occurrence with the first peak coinciding with the developmental peak of adenotonsillar hyperplasia (2-5 years). The second peak appears in middle to late adolescence. Gender distribution is equal in prepubertal groups which shifts to male dominance in postpubertal group.

Signs of OSA in children include continuous snoring, pauses in breathing while asleep, indifferent sleeping position, enlarged tonsils, stunted growth and disruptive behavior in school. Excessive daytime sleepiness and snoring with pauses is usually seen in adults.

**Diagnostic Criteria and Evaluation**

The dental office can play an important role in screening patients who may have OSAS by including few questions on the medical questionnaire: Do you snore loudly? Do you have difficulty staying awake when you are inactive (e.g. while reading, watching television or driving)? A positive response to these questions should lead the dentist to suspect OSAS.

A complete physical examination and history should be obtained in children with suspected OSAS. History of snoring every night is most significant in predicting OSA. Carroll et al in 1995 reported the inability of clinical history alone to differentiate primary snoring from OSAS in children. Nocturnal attended polysomnography, which requires an overnight stay in a sleep facility, is the standard diagnostic modality in determining if a patient has OSA.

The polysomnogram records parameters including electroencephalography (brain waves), electrocuculography (eye movement), electocardiography, electromyography (chin and leg movement), sleep positioning, respiratory activity and oxygen saturations. Apnea is defined as the cessation of airflow—a complete obstruction for at least 10 seconds with a concomitant 2 to 4% drop in arterial oxygen saturation. The definition of hypopnea is more variable, but it commonly is thought of as a reduction in airflow of at least 30 to 50% with a drop in oxygen saturation. The apnea-hypopnea index (AHI) is the average number of apneas and hypopneas per hour of sleep.

The American Academy of Pediatrics (AAP) has established clinical guidelines for better recognition and management of young patients with OSA. Dentists should also be aware of these guidelines. The guidelines recommended that for the diagnosis of OSA:

1. Compulsory screening is must in all children with snoring.
2. Referral to a specialist for high complex high-risk patients.
3. Elective evaluation for patients with cardiorespiratory failure.
4. Diagnostic evaluation is useful in discriminating primary snoring and OSA, with the gold standard being polysomnography.
5. The first line of treatment remains adenotonsillectomy for most children, and continuous positive airway pressure is an option for those who are not candidates for surgery or who do not respond to surgery.

6. High-risk patients should be monitored as inpatients postoperatively.
7. All patients should undergo clinical reevaluation postoperatively to determine whether additional treatment is required.

**Management of Pediatric OSA**

OSAS can be managed nonsurgically or surgically. The treatment should target the potential contributing factors identified by the history, the physical examination and upper airway imaging. The severity of the patient’s condition must also be considered in developing a treatment plan. Speciality referral is guided by the chief complaint of the parents and initial physical examination. The decision on type of intervention depends on severity of OSA. OSA severity is classified on the basis of the patient’s AHI score, into three categories: Mild (AHI score between 5 and 15), moderate (AHI score between 15 and 30) and severe (AHI score greater than 30). Among children, an AHI score more than one and oxygen desaturation more than four percent are indicators of mild OSA.

The various treatment options are listed below:

**Diet and medications:** Weight loss and a healthy diet may work as the only and ultimate treatment in some children. Guiding the parents to help in proper sleep posture may help. A short course of broad spectrum antibiotics and treatment of nasal pathology (if any) should be given.

**Continuous positive airway pressure (CPAP):** The most successful nonsurgical treatment is CPAP. The use of CPAP in the treatment of OSAS was first described in 1981. Since then it has become the gold standard in the treatment of this condition. CPAP therapy is indicated in children with specific surgical contraindications, minimal adenotonsilar tissue, or persistent OSAS after adenotonsillectomy or for those who prefer nonsurgical alternatives. It has to be used indefinitely, unlike surgical treatment which is a onetime procedure.

CPAP is noninvasive and continuously pumps room air under pressure through a sealed face or nose mask into the upper airway and the lungs. It increases the upper airway caliber by acting as a pneumatic splint. CPAP has better tolerance in older children and requires frequent clinician assessment of adherence and efficacy. Attention to compliance with this therapy is must.

**Surgery:** The main surgical treatments offered for OSA target the anatomical areas of the posterior airway where collapse is suspected to occur. Surgical procedures include adenotonsillectomy, septoplasty, uvulopharyngoplasty (UPP), tracheotomy, maxillary/mandibular surgery, etc.

The traditional surgical procedure for treating OSAS in children is tonsillectomy with adenoidectomy. The goal of this procedure is to remove the obstruction by resection of all the lymphoid tissue of the tonsils. E Eviatar et al in 2008 undertook a study to found the long-term effectiveness of previously treated children (having OSAS) by tonsillectomy and tonsillotomy. They concluded that tonsillotomy is as effective as tonsillectomy for the long-term treatment of children suffering from OSAS due to hypertrophic tonsils.
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Uvulopalatopharyngoplasty: Fujita et al first described the use of the UPPP for the treatment of OSAS in 1981. It is usually considered in case of long thick palate and uvula. However, parents should be made aware of potential velopharyngeal insufficiency postoperatively.

In case of nonresponsiveness to all above measures, tracheotomy remains the most reliable treatment. It is indicated in recalcitrant cases, infant with Robin sequence, severe glossophtosis and small tonsils.

Oral appliances: The availability of more than 55 dental devices on the market for sleep apnea itself explains the role of a general dental practitioner in its management. Oral appliances are portable and require no cumbersome headgear, nasal mask or electric power. They generally fall into two broad categories.

1. Tongue-retaining devices
2. Mandibular advancement devices.

By repositioning the lower jaw and thus the tongue, the oral appliance keeps the pharyngeal airway open. Tongue retainers are used less commonly and are more cumbersome, but they tend to be an effective appliance. It has a suction cup that attaches to the front of the tongue, hence preventing the tongue from collapsing. It is difficult to tolerate in cases of Down syndrome.

Mandibular advancement appliances reduce the number of apneas and hypopneas, improve oxygen desaturation and improve overnight sleep quality. They work best for patients with primary snoring and in mild-to-moderate OSA cases.

Consequences of Untreated OSA

OSA in children can lead to various unwanted medical problems. Its effect can negatively influence mood, behavior, cognitive capacity and family function.

It causes increased strain on cardiovascular system due to acute rise in blood pressure and associated arrhythmias. Regardless of whether obstructive sleep apnea is sufficient to cause heart failure, there is enough evidence to believe that it could adversely affect left ventricular function in those with an already failing heart.

Depression has been reported to be the most common mood disorder associated with OSAS. It still remains unclear if depression and anxiety in OSAS is a primary consequence or if it occurs secondary to OSAS-related symptoms (sleepiness, sleep problems, irritability, social withdrawal) or to other factors related to OSAS.

In advanced childhood OSAS, carbon dioxide accumulation coupled with acidosis leads to impaired response to growth hormone. Increased respiratory effort during sleep depletes the calorie bank, leading to impaired somatic growth and failure to thrive in severe cases. Apart from these, the child could face neurobehavioral problems and may suffer from attention deficit hyperactivity disorder in future.

Role of Dentist

The dentist may be the first to recognize a patient’s sleep disorder. Patients with sleep apnea have a wide range of physical and dental attributes. The most common orofacial characteristics encountered include a retrognathic mandible, narrow palate, large neck circumference, long soft palate, tonsillar hypertrophy, nasal septal deviation and relative macroglossia.

A dentist can act as a ‘gatekeeper’ in identifying children with adenotonsillar hypertrophy. Screening for such patients is not cumbersome. Surgical extractions in patients undergoing CPAP should be avoided as it may predispose the patient to subcutaneous emphysema. Such patients should not be prescribed intravenous sedation because of compromised airway. Clinicians can quantify patients’ daytime hypersomnolence by administering the Epworth Sleepiness Scale to their parents or guardians (a total score greater than 10 suggests excessive daytime sleepiness).

Dentists suspecting OSA can go for lateral cephalogram of the patient to determine hooking of soft palate. Hooking of the soft palate while awake may facilitate pharyngeal collapse during sleep. Dentists caring for these patients can perform restorative procedures that enhance the dentition and enable the patient to properly masticate a high-fiber, high-protein, low-calorie diet that is nutritious and conducive to weight loss.

CONCLUSION

OSAS is a common condition associated with significant morbidity and mortality. It is therefore important that dental professionals be aware of the signs and symptoms of OSAS, so that the diagnosis can be confirmed and treatment initiated as soon as possible. As knowledge about the pathophysiology of OSAS improves, treatments may be designed to address the specific causes of the condition. Oral appliances play a major role in the nonsurgical management of OSA and have become the first line of treatment. Also, it is necessary to be in touch with other healthcare professionals, to offer good multidisciplinary treatment.

REFERENCES


