

# Pediatric Sleep Apnea: A Multidisciplinary Diagnosis with a Multimodality Treatment

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## ABSTRACT

Pediatric obstructive sleep apnea (OSA) is an underdiagnosed and often ignored entity. Besides, its management needs a multimodality approach including medical, surgical, dental, and positive airway pressure therapy. This short review discusses the approach, management, and screening options for pediatric OSA along with a glimpse of the latest innovations and the road ahead.

**Keywords:** Benefit, Dental, Multimodality, OSA, Pediatric, Positive airway pressure, Screening, STOP-BANG.

*Indian Journal of Sleep Medicine* (2021): 10.5005/jp-journals-10069-0079

## INTRODUCTION

Pediatric obstructive sleep apnea (OSA) is an emerging yet underdiagnosed entity. The multitude of reasons for this include underreporting of OSA by parents besides lack of symptomatic manifestations by the children. This calls for screening the patients with validated questionnaires. Similarly, treatment options are varied and include conservative, surgical interventions, dental interventions, psychological and positive airway pressure therapy. A recently published article on sleep disorders in Prader-Willi syndrome in children discusses the management of such patients with optimal positive airway pressure therapy (PAP).<sup>1</sup> Similarly, anatomical obstruction causing sleep apnea in children often needs surgical correction and dental procedures guided by clinical and anatomical (MRI) studies.<sup>2</sup> Dietary modifications and exercise can also improve AHI and daytime sleepiness in moderate to severe OSA by causing substantial weight reduction.<sup>3</sup>

Thus, OSA in children must be managed by a multidisciplinary team with multimodality treatment options including the following:

## DENTAL MANAGEMENT

The various craniofacial and intraoral parameters predispose to OSA and can be routinely diagnosed with dental and orthodontic clinical examination and radiographs. Significant associations of risk of OSA with steep mandibular plane angle (MPA), convex profile with Class II molar relationship, Type 3/4 faucial pillars, and ovoid upper arch form along with multiple cephalometric upper airways and maxillomandibular variables have been studied.<sup>4</sup> The alteration in these craniofacial relations, maxillomandibular, and tongue positioning, and dental occlusal parameters may affect the size and patency of the airway. Hence, varied oral appliances have proven beneficial in treating varied OSA severity, primarily by repositioning the mandible by mandibular advancement device or mandibular repositioning device (MAD/MRD), including removable and fixed functional appliances (Herbst, Twin block) or rapid maxillary expansion devices along with mandibular dental expansion.<sup>5,6</sup> Additionally, tongue repositioning or training devices, or appliances for soft palate lift to reduce vibrations and appliances combined with continuous positive airway pressure (CPAP) devices can also be useful.<sup>5</sup> Recent high-quality literature evidence supports CPAP and MAD's clinical effectiveness in the

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**How to cite this article:** Virk BS, Kapoor P, Chowdhry A, *et al.* Pediatric Sleep Apnea: A Multidisciplinary Diagnosis with a Multimodality Treatment. *Indian J Sleep Med* 2021;16(3):90–92.

**Source of support:** Nil

**Conflict of interest:** None

treatment of OSA; however, where patients are intolerant to CPAP, oral appliances may be the treatment of choice.<sup>7</sup> The material for constructing these mandibular appliances in OSA has also shown similar efficacy, treatment adherence, and comfort to the patients with titratable heat-molded thermoplastic MADs and custom-made acrylic appliances. Hence, they may prove to be a cost-effective, readily available alternative.<sup>8</sup> It is challenging to predict the efficacy of any appliance in OSA as the outcome factors across literature are highly variable, ranging from cephalometric to polysomnographic parameters. Studies using multisensor catheter have exhibited the highest accuracy and lowest risk of bias to date.<sup>9</sup>

## MEDICAL/PULMONARY MANAGEMENT

Continuous positive airway pressure (CPAP) is the therapy of choice for all moderate to severe OSA patients and is also indicated for mild OSA with comorbidities or symptoms. CPAP compliance is often an issue; newer modes (auto-modes, ramp pressures), newer devices (Bluetooth feedback), and interfaces (nasal pillows with cushions) are being developed to improve compliance.<sup>10</sup> Dietary modifications and exercise can improve AHI and daytime sleepiness in moderate to severe obstructive sleep apnea (OSA) by causing substantial weight reduction. Lifestyle changes like

weight reduction, nutritional advice, smoking cessation, and alcohol abstinence should be applied in all OSA patients with regular counseling and follow-up for the sustained benefit.<sup>11</sup>

## SURGICAL MANAGEMENT

Even though CPAP is the “gold standard” for managing OSA, adherence to it is an issue that varies from 30–60%.<sup>12</sup> In such cases, surgery is an alternative management option. Adenotonsillectomy is an effective option (up to 80%) in young children with enlarged tonsils and adenoids. On the other hand, in adults, surgical therapies are definite but have more complications and limited success rate. Uvulopalatopharyngoplasty (UPPP) in adults is effective in controlling snoring with a success rate of 40%. The low success rate can be due to the lack of a preoperative evaluation and improper selection of patients. Tongue myectomy is also an option in patients with macroglossia.<sup>2</sup> The seven-channel coblation technique, which treats the middle third and posterior third of the tongue, is a reconstructive surgical option.<sup>13</sup> It is easy to perform with less postoperative pain, low risk of velopharyngeal dysfunction, and decreased scar formation risk. Another advantage of this technique is that CPAP can be reapplied without air leaks in failed surgery cases. Of course, all these modalities can help if the patient selection is appropriate and diagnosed in time. Unfortunately, there is a lack of awareness among clinicians and patients about OSA, leading to delayed presentation and treatment.

## UNMET NEED IN DEVELOPING COUNTRIES LIKE INDIA

Obstructive sleep apnea (OSA) is an emerging epidemic with widespread mental, physical, and behavioral health effects. Its association with cardiovascular, neurocognitive, and metabolic complications makes it a major global health concern. India ranks 4th in the list, where prevalence rates are highest among adult males (14.2%) and females (11.7%) and in the pediatric age-group of 5–10 years (9.6%).<sup>14,15</sup> Unfortunately, symptoms of OSA in children are often subtle and include nocturia, attention difficulty, and noisy breathing during sleep. In India, awareness regarding sleep-related breathing disorders, including OSA, is minimal. Notably, the diagnostic polysomnography units available are few to cater to increasing cases. Additionally, there is no interdisciplinary OSA task force at the national level dedicated to counter this issue. Hence, there is an urgent requirement to address the complications and interdisciplinary patient-centric management of OSA.

## INNOVATIONS AND ROAD AHEAD

Attempts are needed to bring together multiple disciplines, including dentistry, for early diagnosis, effective clinical management, and systematic research initiatives to transform patients' lives suffering from OSA. It is the need of the hour to create a multidisciplinary yet protocol-abiding task force for the exchange of practical experiences, exploring novel treatments, and fostering innovative research.

The current global crisis of COVID-19 has disrupted healthcare services and related research, especially from an Indian perspective.<sup>16</sup> This pandemic has highlighted the necessity of self-monitoring or distant telemonitoring of various diseases, and in sync with telehealth's scope, various mobile applications (commercial and noncommercial) have proved beneficial for the assessment of OSA risk. One such indigenous, noncommercial customized mobile

application, “OSA-risk Assessment tool,” has been launched for prescreening OSA risk in all age-groups.<sup>17</sup> This application uses STOP-BANG questionnaire for adults and Pediatric Sleep Questionnaire (PSQ) for children. STOP-BANG is a comprehensive screening questionnaire including clinical history, examination features, and comorbidities.<sup>18</sup> PSQ includes a 22-point sleep-related breathing disorder scale comprising of three prominent symptom complexes: snoring, excessive daytime sleepiness, and inattentive/hyperactive behavior. The sensitivity and specificity of PSQ in reported literature are 0.85 and 0.87, respectively.<sup>19</sup> Other commercial mobile applications like SleepApp and Firefly utilize artificial intelligence and various signals to evaluate OSA.<sup>20</sup> These applications can also be used to assess the improvement in airway parameters or OSA-risk status consequent to multidisciplinary treatments, with the advantages of patient comfort, self-help, and repeated evaluation.

## Contributions

All authors were involved in conception and design of the work, acquisition and analysis of data for the work, writing and reviewing of the manuscript, and final approval of the version to be published.

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