PEDIATRIC DENTISTS AS GATEKEEPERS FOR PEDIATRIC OBSTRUCTIVE SLEEP APNEA: A NARRATIVE REVIEW – PART 2

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NARRATIVE REVIEW

ABSTRACT: *The first part of this review on Pediatric Obstructive Sleep Apnea (POSA) explored key literature published on the topic between 1980 to 2014. It reviewed the etiological factors, symptoms, diagnosis, clinical examination, and treatment options of POSA. The second part of this review is an update on the topic, wherein literature published between 2015 to 2023 on POSA is explored to give the reader an insight to updated diagnostic and screening tools, commonly observed craniofacial features, management protocols, and post-treatment changes that are seen in children.*

Keywords: *Obstructive Sleep Apnea, Sleep Disordered Breathing, Pediatric Dentistry, Myofunctional Therapy*

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INTRODUCTION

Ever since it was first reported in 1976, pediatric obstructive sleep apnea (POSA) has become a field of interest for researchers dealing with sleep medicine, otolaryngology, and dentistry. In 2018, the prevalence of POSA in India was reported to be 9.6%. POSA has been shown to have a potential impact on the growth, development, and overall quality of life of children. It has shown to affect the academic grades of children, cognitive functioning, learning abilities, and sleep-related problems.[1,2] As our understanding on POSA matured, the disorder now finds itself categorized under not only sleep-disordered breathing, but also as a tongue and mandibular disorder.[3]

The first part of our review emphasized on how pediatric dentists play an important role in early detection and management of POSA. This has been stressed upon in recent times as the prevalence of malocclusion in children has been reported with close associations with respect to posterior crossbite, deviations in overjet and overbite.[4] Furthermore, the presence of malocclusion has been used to classify patients of POSA based on phenotypes. A classic OSAS phenotype is one that manifests with or without malocclusion and is associated with adenotonsillar hypertrophy. A congenital OSAS phenotype is identified as a genetic disease with associated craniofacial anomalies.

Another categorization of POSA that can interest the pediatric dentist is based on whether or not the patient has associated mouth breathing.[5] However, this has been controversially contested as patients with oral breathing who have well-developed dentoalveolar structures and have mild adenotonsillar hypertrophy might in turn protect children from developing OSA.[6]

Symptoms of POSA vary based on its type. Diurnal POSA is often associated with nasal breathing difficulties, morning headache, irritability, poor academic performance, drowsiness, cardiorespiratory complications, and stature development reduction. Nocturnal POSA manifests as fragmented sleep, hypoxemia (translating to forced oral breathing), enuresis, sweating, dry mouth, habitual snoring, and abnormal thoracic or abdominal movements.[5]

CRANIOFACIAL AND DENTAL CHARACTERISTICS

The craniofacial and dental characteristics in patients of POSA have been systematically reviewed till 2022. Results from two meta-analysis has shown that overjet, jaw discrepancy in the sagital plane, increased mandibular plane angle, decreased upper molar arch width, decreased length of maxilla, mandibular retrognathia, longer facial profile, reduced dimensions of nasopharynx, narrower intercanine width were commonly observed in patients of POSA.[7-9]

Features like narrower inter-canine width of maxilla, large adenoid size, and mouth breathing can be associated in children with POSA as early as 2.5 years of age.[10] Furthermore, in children between 5 to 15 years of age, dental agenesis or extraction of at least two permanent teeth has been associated with a diagnosis of POSA in later stages.[11]

Patients diagnosed with POSA who are nearly 5-years-old have shown to have a larger waist and hip circumference, smaller neck to waist ratio, and narrower distance of first and second deciduous molars, and first permanent molars when compared with an age-matching non-snoring control group.[12]

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POSA ASSESSMENT

Many cardiovascular issues, neurocognitive deficits, and behavioral problems can be prevented if POSA is diagnosed early and steps are taken to intervene. Thus, a range of screening tools, questionnaires, scales, and monitoring of anatomical factors have been developed in recent times.[13-19] These are succinctly presented from Table 1 to Table 4. It is important to note that a single diagnostic tool will not be enough to investigate the severity of POSA due to its multifactorial etiology.

Questionnaires		
Type	Age Group	Description
Pediatric sleep questionnaire	Pediatric	Questions related to snoring, breathing difficulties, sleepiness and behavioral issues
Sleep-related breathing disorder (SRBD)	Pediatric	Focuses on snoring, apnea, and daytime sleepiness
STOP	Both	Snoring, Tiredness during daytime, Observed apnea high blood Pressure
STOP-Bang questionnaire	Both	Snoring, Tiredness during daytime, Observed apnea high blood pressure, BMI, age, neck circumference, male Gender
Brouillette's questionnaire	Pediatric	Assesses snoring, difficulty breathing during sleep, and observed apneas
ARES	Both	A questionnaire with overnight oximetry and other biometric data
Berlin questionnaire	Both	Assesses snoring, daytime sleepiness, and obesity
Pittsburgh sleep quality index	Both	Measures sleep quality over a month (not for younger children)
Kushida index	Both	Based on BMI, neck circumference, and respiratory disturbance index

Table 1 Questionnaires for assessment of POSA

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Scales		
Epworth sleepiness scale	Both	Measure the daytime sleepiness- the severity of sleep disorders
ESS-CHAD	Pediatric	ESS for children
Children's Sleep Habits Questionnaire	Pediatric	Assesses various sleep domains
BEARS Sleep Screening tool	Pediatric	Bedtime issues, Excessive daytime sleepiness, disturbed sleep at night, Regularity and duration of sleep, and Snoring.
Visual Analog Scale for Snoring (VAS-S)	Both	To assess the severity of snoring
PALM	Both	Evaluates critical closing pressure, arousal threshold, loop gain, and muscle responsiveness to evaluate the severity of upper airway collapsibility

Table 2 Scales for Assessment of POSA

Indices		
Apnea- Hypopnea Index	Both	Quantifies the number of apneas and hypopneas (polysomnography)
Oxygen desaturation index	Both	Measure of the number of times per hour that the blood's oxygen level drops by a certain degree
Oxygen saturation Nadir	Both	The lowest level of oxygen saturation was recorded during sleep.

Table 3 Indices for assessment of POSA

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Anatomical factors		
Mallampati score	Both	Assesses the visibility of the structures in the oral cavity- soft palate and uvula
Pediatric modified Mallampati Score	Pediatric	To assess the visibility of the tonsils and soft palate
Tonsil size	Pediatric	Size of the tonsil as an indicator of OSA risk in children
Adenoid size	Pediatric	Enlarged adenoids contribute to airway obstruction during sleep (nasopharyngoscopy)
Neck circumference	Both	Larger neck circumference indicative of a higher risk of airway circulation
Predictors of pharyngeal collapsibility	Both	Tonsillar Hypertrophy, Obesity, Narrow Palate. Has been proved only for patients with African ancestry.
Nocturnal Oximetry	Both	Measures oxygen levels overnight to detect desaturation events associated with OSA. Used in cases where polysomnography is not readily available
3D Stereophotogrammetry	Pediatric	Uses images that can be rotated in 3D view to predict OSA. It has a low diagnostic value.
Lateral cephalometry	Both	To identify anatomical risk factors for OSA like mandibular retrognathia, enlarged adenoids, and a narrow airway
Polysomnography	Both	Assessment correlating anatomical findings with functional breathing disturbances (apneas and hypopneas)
Cone-Beam Computed Tomography	Both	To evaluate the airway, volume of the nasal cavity, oropharynx, and hypopharynx
Magnetic Resonance Imaging	Both	Soft tissue evaluation (tonsils or adenoids)
Facial soft tissue analysis	Both	Soft tissue analysis involving the external and internal soft tissues of the face and neck

Table 4 Methods to monitor anatomical factors for assessment of POSA

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EFFECTIVENESS OF COMMON MANAGEMENT OPTIONS

Surgical and non-surgical therapies for POSA have been reviewed in the first part of this review. The effectiveness of these therapies, and comparative studies to decide upon the better treatment option have been a topic of interest for researchers in the recent past.

Surgical management of POSA with partial or full tonsillectomy or adenotonsillectomy has been advocated in children due to high effectiveness, and less recovery time. However, POSA has been reported to persist even after adenotonsillectomy in many cases. In such cases, lingual tonsillectomy and tracheostomy are often the recommended surgical options.[20] In a more updated expert consensus statement on the management of POSA after adenotonsillectomy, the recommended treatment algorithm included drug-induced sleep endoscopy, assessment of quality of life, weight reduction (if necessary), nutrition counselling, autoPAP, intranasal steroids, and montelukast.[21]

Uvulopalatopharyngoplasty as a surgical treatment option for POSA has found success in adults. However, limited evidence is available on its application in pediatric patients. Moreover, it has been opted for in children only when they present with neurological impairment.[20]

Positive airway pressure (PAP) is the most common non-surgical intervention and is very effective even in cases of severe OSA. However, the use of nasal PAP is warranted with caution. This is because it has been reported to alter midfacial and dental characteristics like retrusion of maxilla, counterclockwise rotation of palate, and upper incisor flaring.[22]

Functional orthodontic appliances have been a common non-surgical intervention. Literature reviews have shown that these appliances have effectively reduced the AHI index and increased the upper airway and airspace in children under the age of 14 years.[23,24]

Rapid maxillary expansion is another successful treatment modality for POSA. Anatomical changes induced following a treatment with RME have been evaluated through advanced radiographic techniques. These studies have demonstrated an opening of mid-palatal suture, increase in nasal osseous width, nasopharynx, oropharynx, enlarged pterygoid processes, minimal tipping of upper posterior teeth, and a restoration of normal nasal airflow.[25] Non-obese children without adenotonsillar enlargement and with constricted maxilla can be given RME for a shorter treatment plan. Supplemental oxygen is best for infants and with those with no other treatment option left.[20]

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The interested reader is advised to read about the multidisciplinary proposal published by Yoon et al. in 2023 who give a roadmap for craniofacial modification of children with POSA based on their age-dependent skeletal and dental characteristics.[26]

CONCLUSION

POSA, a respiratory sleep disorder, can result from various factors from tonsil/adenoid enlargement and reduced upper airway space to obesity. During regular check-ups, pediatric dentists might come across symptoms like mouth breathing, snoring, or certain clinical features like high arched palate or enlarged tonsils/ adenoids. In such cases, a pediatric dentist must perform a detailed investigation and collaborate with other sleep specialists to achieve early and proper diagnosis and plan the treatment accordingly.

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