



Pediatric Obstructive Sleep Apnea and Functional Appliances - A Review



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Abstract

Pediatric obstructive sleep apnea is a serious disorder that results in many medical and behavioral complications including attention deficit disorder and metabolic diseases. One of the main predisposing factors corresponds to small mandible or in a retruded position; this alteration has historically been treated through functional appliances. Hence the importance of reassessing the use of these types of devices since current evidence indicates that they are useful as part of the complementary treatment of pediatric obstructive sleep apnea.

Keywords: Obstructive sleep apnea; Functional appliances; Airway; Skeletal class II

Abbreviations: OSA: Obstructive Sleep Apnea; RSD: Respiratory Sleep Disorders; EEG: Electroencephalography; EOG: Eye Movements; ECG: Heart Rhythm; EMG: Skeletal Muscle Activity; CPAP: Continuous Positive Airway Pressure; AHI: Apnea-Hipopnea Index

Introduction

Snoring and obstructive sleep apnea (OSA) are respiratory sleep disorders (RSD) that are increasingly attracting the attention of dentists as they have become public health problems of a major nature. RSD are recognized and treated primarily by sleep specialists as they are chronic, multifactorial, and life-threatening medical problems that can lead to serious medical complications. Between 6-12% children are snorers, it is more common in toddlers (3-5 years of age). Within this group, half (50% snorers) have OSA Lavigne [1]. The consequences of this disorder can cause aggressive behavior, attention deficit, developmental delays, metabolic diseases, emotional problems and cognitive disorders Brockmann [2]. Adenoid and tonsillar hypertrophy and obesity are the main etiological factors. However, maxillary and mandibular deficiency can also become etiological factors of OSA due to decreased airway size Kim & Kim [3]. Hence, the dentist and particularly the orthodontist has a critical role in the prevention, interception and in some cases treatment of this type of disorder.

Clinical history highlights

snoring (more than 3 times a week), observed apnea, labored breathing during sleep, mouth breathing, sleep bruxism, enuresis, cyanosis, headaches upon waking, hyperactivity-attention deficit, learning problems Stark [4].

Medical conditions associated with pediatric OSA

Down syndrome, neuromuscular diseases, cerebral palsy, marfan, mucopolisaccharidosis achondroplasia, craniosynostosis, Pierre Robin, hemifacial microsomia, facial mandibular dysostosis, beckwith - Weideman, Prader- Willi, Sickle cell disease, history of pharyngoplasties, cleft lip / palate.

Diagnosis

Fisical Exam

Common features are: Adenoid facies, Adenotonsillar hypertrophy and obesity, Micrognathia and or retrognathia (Skeletal Class II), Ogival palate, maxillary compression, cross bite and increased overjet.

The gold standard test to diagnose OSA is polysomnography (PSG). Polysomnography is an exam, in which the patient spends a night sleeping in a clinic where various physiological variables are monitored, including: electroencephalography (EEG), eye movements (EOG), heart rhythm (ECG), and skeletal muscle activity (EMG) as well as respiratory effort, airflow, and oxygen saturation (Kim & Kim, 2020). An apnea is defined as a total stop of airflow lasting at least 10 seconds, whereas a hypopnea is defined as a reduction in airflow of 30% or more lasting for 10 seconds or

longer, or in the presence of concomitant oxygen desaturation of 3% or more. The number of apneas plus hypopneas per hour is reported as the apnea-hypopnea index (AHI) to rate the severity of sleep apnea Kim & Kim [3] and this index is categorized as normal (<1 event per hour), mild (1 to 5 per hour), moderate (5 to 10 per hour), and severe (> 10 per hour).

Treatment

The first line treatment is adenotonsilectomy and weight loss Kim & Kim [3]; Lavigne [1]; Lobbezoo [5], however, depending on the etiology of obstructive sleep apnea, therapeutic schemes are added. In case of neuromotor dysfunction of the airway, the treatment of choice is the CPAP type, if there is inflammation, pharmacological treatment is common, in the case of skeletal class II individuals, retruded jaw or compressed maxilla, dentofacial orthopedics arises as a valid alternative to improve the predisposition of these patients to present sleep apnea Lavigne [1]; Stark [4].

Functional appliances

Functional devices for treatment of skeletal class II, place the jaw in a more anterior location, pressures will be generated by stretching of the muscles and soft tissues that are transmitted to the skeletal and dental structures modifying or redirecting growth, there are different types, fixed and removable, the most common are: Herbst, Bionator, Fränkel II, etc. By positioning the mandible anteriorly, an opening of the oropharynx occurs (due to mandibular and hyoid advancement), which produces an improvement in oxygen saturation, which would reduce apnea episodes Agarwal Luv; Gupta [6].

What does the current evidence say?

In the meta-analysis carried out by Xiang [7], 169 articles were reviewed, among which only 7 met the inclusion and exclusion criteria and as a general conclusion, the results of the studies showed that functional devices can enlarge the dimensions of the upper airways, specifically in the oropharyngeal region, in growing subjects with Class II skeletal malocclusion. Early intervention for mandibular retrognathism with functional appliances can help to widen the dimensions of the airways and decrease the potential risk of obstructive sleep apnea syndrome for growing patients in the future. However, the enlargement of the airway does not necessarily translate into an improvement in obstructive sleep apnea, which is why our outcome to look for is a decrease in AHI. Along these lines, Huynh Huynh [8] carried out a meta-analysis that

analyzed orthodontic interventions in children with obstructive sleep apnea, concluding that there is a decrease in AHI of 5-10 episodes when functional appliances and palatal expansion are made. Bariani [9] in a literature review found that all studies using oral functional appliances for obstructive sleep apnea in children resulted in improvements in the apnea-hypopnea index score. Cephalometric (2D) and tomographic (3D) evaluations revealed enlargement of the upper airway and increased upper airspace, improving respiratory function in the short term.

Conclusion

There is a wide field of research in relation to sleep medicine and dentistry, it is the role of our profession to be included in the diagnosis and treatment of these pathologies when required. At the moment there is already evidence that treatments as old as functional orthopedics can be useful in patients with sleep-disordered breathing.

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