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Sleep-disordered breathing in children

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Abstract
Sleep disordered breathing (SDB) leads to pathological changes that lead to increased morbidity and mortality in patients.
Objective: To analyze the literature on sleep disordered breathing, its etiology, diagnosis, signs and symptoms and treatment in children.
Methodology: Articles on the subject published through the PubMed, SCOPUS and Google Academic databases were analyzed, with an emphasis on the last 5 years. It was carried out with the words "Sleep-Disordered Breathing", "children" "etiology" "diagnosis" "symptoms" "treatment".
Results: The etiology of SDB is associated in children with developmental anomalies, craniofacial malformations, syndromes, these lead to airway narrowing that triggers adenotonsillar hypertrophy and shortness of breath. Polysomnography is found as an effective and most used diagnostic test, however in very young children or with severe diseases additional studies are needed with a pediatric otolaryngologist, other tests are pulse oximetry or questionnaires. There are nighttime symptoms such as shortness of breath, night sweats, sleep irregularities and snoring, those present during the day are summarized as lack of performance, poor performance, moodiness, hyperactivity. Together they result in signs of malocclusion and altered facial development. Tonsillectomy or adenoidectomy is the most effective treatment in patients with SDB, this is complemented with orthodontic treatment and functional appliances improve the quality of life of patients.
Conclusion: It is of great importance to diagnose and treatment SDB because it causes alterations in the development of facial growth and in the quality of life of pediatric patients.

Keywords: sleep-disordered breathing", "children" "etiology" "diagnosis" "symptoms" "treatment"

1. Introduction
SDB leads to pathological changes that are conducive to increased morbidity and mortality in patients [1]. It encompasses a number of conditions ranging from primary snoring to severe obstructive sleep apnea (OSA) [2]. It is characterized by intermittent upper airway obstruction that disrupts normal ventilation during sleep [3]. Mouth breathing in infancy can compromise the functions performed by the stomatognathic system [4]. The proportion of bad habits and malocclusion is an important issue in view of prevention and early treatment of craniofacial growth disorders [5]. Rationale: SDB is a clinical problem that is becoming increasingly prevalent among children and there are a number of difficulties in its diagnosis. Early treatment helps to arrest and correct a growth deficiency and improves the quality of life of children. Objective: To analyze the literature on sleep disordered breathing, etiology, diagnosis, signs and symptoms as well as treatment in children.

2. Materials and Methods
Information from articles published in PubMed, Science Direct, Springer and EBSCO was analyzed with emphasis on the last 5 years. The quality of the articles was analyzed based on the PRISMA guidelines, i.e., identification, review, choice, and inclusion. The quality of the review was assessed using the measurement instrument for evaluating systemic reviews (AMSTAR-2) [6]. The search was performed using Boolean logical operators AND, OR and

NOT. It was realized with the words "Sleep-Disordered Breathing", "children", "etiology", "diagnosis", "symptoms" and "treatment", in conjunction with logical Boolean operators OR y AND.

3. Results

3.1 Etiology

Adenotonsillar hypertrophy is the most frequent cause of pediatric sleep-disordered breathing, however the spectrum of etiologies is very broad [7,8,9]. It is also associated with craniofacial malformations such as Crouzon, Apert and Pierre Robin syndrome, maxillary narrowing, mandibular retrusion, neuromuscular diseases (Duchenne muscular dystrophy, cerebral palsy) and rhinological causes such as allergic rhinitis, deviated septum, etc [8]. Symptoms in the etiology of SDB that affect the quality of life of children, such as craniofacial developmental anomalies, malocclusions, and bruxism, can be diagnosed and treated by dentists [10]. In preterm birth SDB is a common risk or potential mediating factor for many of these same disorders, but has rarely been examined in preterm birth survivors [3].

Sleep disordered breathing is much more common when some of the above risk factors are present, mainly in children with syndromic diseases who also have other health problems [11]. Upper airway tone decreases, leading to increased upper airway resistance and an increased tendency to collapse [12]. The pathophysiology of SDB in children is similar to that seen in adults, during sleep, ventilatory drive and upper airway muscle tone decrease. The inspiratory force collapses the already anatomically narrowed pharyngeal airway [9]. It is recognized as a major cause of morbidity in children, with behavioral disorders and cognitive abnormalities more frequent in children with SDB than in those without SDB [13].

The etiology of SDB is associated in children with developmental anomalies, craniofacial malformations, syndromes, these lead to airway narrowing that triggers adenotonsillar hypertrophy and shortness of breath.

3.2 Diagnosis

In the diagnosis of SDB, polysomnography (PSG) is used as gold standard, it is used to evaluate before tonsillectomy, available [14,8,15]. However, the use of PSG in pediatric patients is a debated topic due to the difficulty of application and evaluation, lack of standardization and limitation of epidemiological studies that aim to reach large masses [16]. Another study used is the comprehensive pediatric sleep study in a laboratory accredited by the American Academy of Sleep Medicine, includes monitoring of various physiological parameters throughout the night. In very young infants, daytime "nap" sleep studies may also be appropriate [17]. Questionnaires that can be easily applied by dentists, which are proven for utility and validity in early diagnosis, can also be used to diagnose SDB and allow timely interventions in children with suspected sleep disorders [18, 19]. The Pediatric Sleep Questionnaire is not a good screening tool for obstructive sleep apnea syndrome in children with complex underlying disorders [20]. There is substantial variability in practice patterns for the diagnosis and management of SDB in infants, so further studies are needed [21]. In children with risk factors such as neurological, genetic, and craniofacial disorders, they should undergo further evaluation, including referral to a sleep specialist or pediatric otolaryngologist and overnight polysomnography, which provides a definitive diagnosis. Cardiologic and/or endocrinologic evaluation should be considered in high-risk children [22]. Home oximetry is probably not sufficient for diagnosis, but may be informative in settings where full PSG is not available [17].

Polysomnography is found to be an effective and most commonly used diagnostic test, however in very young children or those with severe disease additional studies with a pediatric otolaryngologist are needed, there are other tests such as pulse oximetry or questionnaires, with which the diagnosis can be complemented.

3.3 Signs and Symptoms

Typical nocturnal symptoms include mouth breathing, sweating, enuresis, sleep irregularities, shortness of breath and snoring, respiratory effort secondary to increased airway resistance, and pharyngeal obstruction. Daytime symptoms include rapid fatigue, hyperactivity, short temper, developmental and growth disability, mouth breathing, learning disability [1, 23]. These symptoms, which vary in severity from primary snoring to obstructive sleep apnea (OSA), play a role in mediating the increased risks of cardiometabolic or neuropsychiatric disorders in preterm infants and adults [24]. They impact cardiovascular function and cognitive development, syndromic craniofacial malformations and metabolic disorders, neurocognitive disorders, in addition to behavioral disorders, so correct and child-oriented diagnoses are essential to enable appropriate therapy [7, 25].

Patients with these sleep disorders have a narrower maxilla and posterior, crossbite, anterior open bite, and dolichofacial mandibular growth direction compared to normal children [26]. A variety of psychological and neuropsychiatric studies have clearly linked it to learning and attention deficits and behavioral problems [27]. Craniofacial development is influenced by genetic and functional factors, meanwhile, mouth breathing causes increased nasal breathing resistance, altering muscle balance and affecting the child's craniofacial development, thus increasing the risk of malocclusion [23]. Respiratory disorders not only cause impairment in affected children, but also lead parents to a relevant reduction in quality of life [28].

There are nocturnal symptoms such as shortness of breath, night sweats, sleep irregularities and snoring, those present during the day are summarized as poor performance, poor achievement, moodiness, hyperactivity. Together they result in signs of malocclusion and altered facial development.

3.4 Treatment

The first-line treatment is tonsillectomy and adenoidectomy, some children present with multiple levels of airway obstruction due to adenotonsillar hypertrophy and may require further evaluation and management, in most cases, their removal serves as definitive treatment of SDB [9,22,29]. This treatment improves the quality of life of children with sleep-disordered breathing [30]. TA together with orthodontic treatment is considered more effective together than separately for SDB in pediatric patients, however, recurrence of SDB may occur several years later. To prevent recurrence, myofunctional therapy could be recommended as a follow-up, however, more studies with good clinical evidence are required to confirm this finding [31]. The childhood adenotonsillectomy trial demonstrated improvement in PSG metrics, as well as secondary behavioral and quality of life outcomes, in both obese and non-obese children with PSG-diagnosed OSA [29]. Although no surgical procedure is without risk, AT is generally safe and well tolerated, even in obese pediatric patients [32]. Anti-inflammatory medications,

weight loss, and oral appliances may be appropriate in selected cases, especially in mild cases [22]. Some patients with severe SDB and nocturnal hypoventilation may benefit from supplemental oxygen therapy, although oxygen does not alleviate the mechanical ventilatory problem inherent in OSA, it may serve to minimize nocturnal hypoxemia and its effects on intellectual development and cardiopulmonary health [27]. There is insufficient evidence of the efficacy of intranasal corticosteroids for the treatment of SDB in children; they may have short-term beneficial effects on desaturation index and oxygen saturation in children with mild to moderate OSA, but the certainty of benefit on the primary outcome, is low [33].
Tonsillectomy or adenoidectomy is the most effective treatment in patients with SDB, this is complemented by orthodontic treatment and functional appliances, improve the quality of life of patients.

4. Conclusions

The etiology of SDB in children is associated with developmental anomalies, craniofacial malformations, different syndromes, which cause a narrowing of the airway triggering hypertrophied tonsils and adenoids causing difficulty in breathing. As an effective and most used diagnostic test is the polysomnography, however in very young children or with serious diseases additional studies are needed with a pediatric otolaryngologist, other tests that help the diagnosis are pulse oximetry or questionnaires. There are nocturnal symptoms such as difficulty breathing, night sweats, sleep irregularities and snoring, those present during the day are summarized as lack of performance, poor achievement, bad mood, hyperactivity, as well as low quality of life of children and parents, these symptoms result in signs of malocclusion and altered facial development. Tonsillectomy or adenoidectomy is the most effective treatment in patients with SDB, this is complemented with orthodontic treatment and functional appliances improve the quality of life of patients.

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