ORIGINAL ARTICLE

EFFICACY OF RAPID MAXILLARY EXPANSION IN THE TREATMENT OF OBSTRUCTIVE SLEEP APNEA SYNDROME: A SYSTEMATIC REVIEW WITH META-ANALYSIS

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ABSTRACT

Objective
The objective of this study was to assess the efficacy of rapid maxillary expansion (RME) in the treatment of OSAS in children and adolescents.

Methods
Five electronic databases were searched systematically: PubMed, Web of Science, LILACS, Embase and Cochrane Library.

Selection Criteria
Randomized controlled trials, nonrandomized controlled trials, cohort studies, and systematic reviews published in English, Spanish, or Portuguese between January 2000 and December 2016, performed on children and adolescents younger than 18 years with OSAS who underwent RME, and assessing RME efficacy as measured by the Apnea-Hypopnea Index (AHI) normalization were included. Qualitative assessment of the selected studies was performed using Critical Appraisal Skills Programme checklists. Statistical evaluation included 2 meta-analyses and was based on a random-effects model and Cochran's Q test and I^2 statistics to assess heterogeneity across the publications. Electronic searches identified 84 publications. Five publications were considered valid and included in this systematic review.

Results
Results from the meta-analysis show an overall reduction in AHI after RME therapy.

Conclusions
Increasingly the evidence indicates that RME devices reduce AHI in children with OSAS, making RME therapy an appropriate alternative treatment option for these patients.

INTRODUCTION

Obstructive sleep apnea syndrome (OSAS) is a sleep-related breathing disorder caused by partial (hypopnea) or complete (apnea) recurrent upper airway obstruction that disrupts the normal sleep pattern and ventilation.[1-3] This

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condition induces intermittent hypoxia and hypercapnia, leading to increased respiratory effort and changes in intrathoracic pressure as well as subcortical or cortical arousals during sleep.[1,4]

OSAS can occur in children of all ages, from newborns to teenagers.[5,6] The highest prevalence is in preschool-aged children, whose pharyngeal lymphatic tissues (such as tonsils and adenoids) are the largest when considering the underlying airway volume.[1] Peak prevalence occurs between ages 2 and 8 years, with values ranging from 1% to 3%.[1,4]

The etiology of OSAS is multifactorial, and the condition usually develops when there is an imbalance between the factors that contribute to airway patency and those that promote airway collapse.[7] In children, this event may be caused by anatomic alterations and constriction of the upper airway or may originate in hypotonia of the pharyngeal ring and the muscles of the tongue.[8] Other commonly identified abnormalities are mandibular retrusion, position of the hyoid bone inferiorly to the mandibular plane, and maxillary constriction.[9,10]

Children with OSAS tend to exhibit some common signs and symptoms, notably, excessive sleepiness during the daytime combined with morning headaches.[4,11] In addition, these children frequently manifest nighttime snoring, enuresis, mouth breathing, witnessed apnea, and disturbed sleep with frequent awakenings and parasomnias (night terrors and nightmares).[1,12]

OSAS is usually diagnosed based on the evidence collected from caregivers, the physical examination, and polysomnographic studies (PSGs). PSG is considered the gold standard for diagnosing OSAS[1,13] and consists of recordings of chest and abdominal movements during sleep combined with sleep-related parameters such as the AHI during each hour of sleep. These parameters permit one to distinguish simple snoring from OSAS[1,14] and to quantify the severity of sleep disruption.[12] AHI measures the number of apnea and hypopnea episodes per hour of sleep, which is directly related to OSAS.[3]

PSG findings are considered normal as long as AHI is below 1 respiratory event per hour, the duration of the apnea episode is less than 5 seconds, and the oxyhemoglobin saturation is more than 90% and less than 10% of the carbon dioxide value at the end of expiration. However, AHI less than 5 might also be accepted as normal but is commonly categorized as mild OSAS.[2,15]

Another measure often linked to OSAS is the Mallampati test, which is used to identify patients at higher risk for OSAS progression.[16] The Mallampati score is determined after careful examination of the oropharyngeal region to detect intubation difficulties.[17] Patients with a high Mallampati score tend to have airway obstruction, often related to macroglossia.[16]

The treatment strategy for OSAS in children depends on several factors. Among them are the severity of the syndrome, the cause of the obstruction, and likely patient compliance.[8] The most frequent treatment options for OSAS are adenotonsillectomy, ventilation by continuous positive airway pressure (CPAP), and the use of oral appliances.[10,18]

The most common cause of OSAS in children is adenotonsillar hypertrophy. This condition can be corrected by performing adenotonsillectomy; however, this surgical technique presents several risks, and in some patients, there is a high probability of relapse.[19,20]

The use of oral appliances is considered highly effective in many cases of mild OSAS and represents a viable alternative to CPAP.[21] For example, RME devices can be used in children with maxillary constriction and posterior crossbite, making it possible to broaden the maxillary arch and widen the nasal vault.[10,22] The space gained improves nasal and oropharyngeal patency within a relatively short period (a few weeks), thereby helping to resolve nasal airway and nasorespiratory problems.[8,9,23] Figure 1 shows the increased size of the upper airways after RME treatment.

Objective

The aim of this systematic review with meta-analysis was to answer the following clinical question according to the PICO model (P, population; I, intervention; C, comparative intervention; O, outcome): "Considering children and adolescents under 18 years with OSAS, does RME treatment result in AHI normalization?"

MATERIALS AND METHODS

A standardized literature search was performed in electronic bibliographic databases (PubMed, Web of Science, LILACS, Embase, and Cochrane Library), along with a manual search in the references of the articles identified. The search was conducted in March 2015 and December 2016, using the following keywords:

PubMed: ("Palatal Expansion Technique" [Mesh]) AND ("Sleep Apnea, obstructive" [Mesh])

Web of Science and Cochrane Library: (palatal expansion technique OR oral appliances) AND (sleep apnea, obstructive OR sleep apnea).

LILACS: (sleep apnea OR apneia do sono) AND (palatal expansion OR expansão maxilar).

Embase: "palatal expansion technique" AND "sleep apnea"