ORIGINAL RESEARCH

Combined Surgical and Orthodontic Treatments in Children with OSA

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Abstract
Background: To evaluate the combined surgical and orthodontic treatments in children with OSA.
Materials & Methods: A total of 20 subjects were enrolled. The orthodontic treatment started in order to solve the maxillary transverse discrepancy using a RPE. Dental records were taken in order to built the device in a dental technician laboratory. After one week the RPE were delivered and applied to the subjects. Oxygen saturation was recorded. The results were analysed using SPSS software.
Results: The patient's parents recommended a more pleasant sleep environment free from episodes of sleep apnea at the subsequent medical assessment.
Conclusion: The resolution of the condition of severe OSA can restore a physiological development of young patients.
Keywords:obstructive sleep apnea, children, surgical.

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Introduction

Obstructive sleep apnea (OSA) is described as a sleeping breathing disorder, characterized by prolonged partial upper airway obstruction and/or intermittent complete obstruction. [1] This syndrome is commonly correlated with intermittent hypoxemia and sleep fragmentation. [2] The prevalence of OSA has been estimated, in a general orthodontic population, by questionnaires and it was found to be 10.8%, which is more than double that reported by similar methods in a healthy pediatric population. [3] OSA has also been associated with frequent snoring, disturbed sleep, daytime neurobehavioral problems, neurocognitive impairments, academic underperformance, hypertension, cardiac dysfunction and systemic inflammation. Daytime sleepiness may occur but is uncommon in young children. [4] Etiological factors include any condition that reduces the caliber of the upper airways, such as craniofacial dysmorphism, hypertrophy of lymphoid tissues, obesity, hypotonic neuromuscular diseases and neuromotor control alterations during sleep. However, adenotonsillar hypertrophy remains the main anatomical risk factor. [4,5] The primary medical surgical treatment of pediatric OSA is adenotonsillectomy (AT). Treatment of OSA with AT resulted in improvements in behavior and attention and likely improvement in cognitive abilities. [6] Quality of life in children with OSA has been shown to improve after AT. [7] Obese children, positive family history of OSA, and African American children are at high risk for having residual OSA after AT. [8] Abnormal mandibular development and malocclusion can affect the respiratory function of a patient. Children with habitual snoring and OSA have a unique craniofacial morphology. [9,10] The craniofacial abnormality that leads to OSA may involve delayed growth of the mandible, leading to mandibular retroposition commonly found in patients with OSA. Mandibular retroposition is also associated with posterior displacement of the tongue. [11] This narrows the upper airway, predisposing it to collapse and contributing to the development of OSA. [12] Another common abnormality in patients with OSA is a narrow, high-arched palate. Orthodontic treatment can result in changes in both dental and maxillomandibular

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alignments and the airway which can help resolve OSA. A study of treatment of OSA with a rapid palatal expander (RPE) reported that in 9 of 10 patients maxillary expansion reduced symptoms. [13] A RPE was shown to be an effective treatment for OSA in children with enlarged tonsils and adenoids and also in treating adult OSA. [14] Obstructive sleep apnea (OSA) in adults causes daytime sleepiness (EDS). However, it is rare for children to have DS. The prevalence of children's drowsiness, which was identified as an OSA characteristic, has been the subject of numerous investigations.[15] Children who had adenotonsillectomy for the treatment of pediatric OSA were compared to children who received WWSC in a randomized controlled trial., there was a significantly higher rate of parental comments of drowsiness on the mESS and PSQ-SS sleepiness questionnaires. African American children's drowsiness scores improved after having an adenotonsillectomy surgery, despite having higher baseline and endpoint sleepiness scores on the m ESS than non-African American children without OSA. These findings may help parents of sleepy kids with OSA to think about examination and therapy because sleepiness can have a big influence on interpersonal connections, athletic performance, and academic success. AHI levels or physiological factors cannot reliably predict sleepiness, which emphasizes the significance of assessing sleepiness even in low AHI scenarios. [15]Although signs of stomatological attention disorder/hyperactivity were the behavior that was most commonly researched in kids with OSA, a rise in depressed symptoms has also been noted. There are contradictory findings on the link between depression and OSA in both adults and children, though. An intermediate impact size was reported between baseline depressed symptoms and OSA Depression symptoms in children with OSA were compared to controls before and after treatment in a recent meta-analysis of 11 studies having their tonsils removed. [16] Hence, this study was conducted to evaluate the combined surgical and orthodontic treatments in children with OSA.

Materials & Methods

A total of 20 subjects were enrolled. The orthodontic treatment started in order to solve the maxillary transverse discrepancy using a RPE (rapid palatal expander). Dental records were taken in order to built the device in a dental technician laboratory. After one week the RPE were delivered and applied to the subjects. Daily activations were required (1/die for 20 days). Every activation consists in a 0,2 mm of maxillary transverse expansion, so at the end of the therapy 4 mm of expansion were reached.The device was kept in place for six months in order to waiting for the stabilization of the expansion and at the end of this period the RPE was finally removed. At the same time the subjects were operated of epiglottoplasty and of reduction of the tongue base. Apnea-hypopnea index (AHI) was examined. Oxygen saturation was recorded. The results were analysed using SPSS software.

Results

The patient's parents recommended a more pleasant sleep environment free from episodes of sleep apnea at the subsequent medical assessment. Another PSG was carried out 2 years following the initial procedure. The examination showed that the average oxygen saturation changed from 95% to 98%, the oxygen desaturation events 5 episodes/hr to 1 episode/hr, and the AHI improved from 9 episodes/hr at the baseline to 5 episodes/hr. The patients had the option of sleeping in a supine or non-supine position. These documents attested to the severe OSA's decision.

Table 1: Mean parameters

Parameters	Before surgery	After surgery
AHI (episodes/hour)	9	5
Oxygen saturation	95%	98%
Oxygen desaturation (episodes/ hour)	5	1

Discussion

Obstructive sleep apnea (OSA) is a condition with varied degrees of severity, from main snoring to its occurrence (OSA). Compared to kids who don't snore, kids who have primary snoring have greater rates of social issues and signs of anxiety and despair. Due to the upper airway impairment caused by adenotonsillar hypertrophy, OSA prevalence peaks in preschoolers. [17] The American Academy of Pediatrics (AAP) advises scheduling OSA tests in conjunction with regular physical examinations. Children who exhibit typical symptoms (such snoring, restless sleep, or daytime hyperactivity) or risk factors (including craniofacial, neurological, or genetic problems) may be investigated for the diagnosis, which should then be verified by nightly polysomnography. [18] Expanded tonsils, adenoid level, body mass index (BMI) z-score, and diastolic blood pressure are among the risk factors for pediatric OSA (DBP). [17] The choice to treat children with OSA is made based on the child's age, the severity of their symptoms, clinical findings, the existence of other disorders, and PSG results. [19] Increased nasal resistance affects the maxillomandibular skeleton by inhibiting growth and causing adaptive changes in soft tissues that

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are linked to anomalies in jaw position and tongue function. The nasomaxillary and mandibular complexes modify how they function as a result of nasal airflow limitation. The mouth opening and mouth breathing that happens both during waking and sleep evolved in the research group of newborn rhesus monkeys associated with increased nasal resistance. Other unfavorable results were mouth breathing that developed along with lack of development, which damaged the maxilla and restricted the nose and maxilla, as well as mandibular displacement, which led to mouth breathing. The skull bone narrows as a result of these modifications. [20] General observation of the patient precedes the physical examination. It is important to think about adenoid facies and mouth breathing. Muffled sounds are a sign of adenotonsillar hypertrophy, but hyponasal noises are a sign of nasal blockage. Retrognathia, micrognathia, and midfacial hypoplasia should all be checked for on the lateral facial profile. All of these symptoms are crucial for diagnosis and have an impact on the nasopharyngeal and oropharyngeal tracts. SDB may be predisposed by having a wide tongue, a high or long arching palate, or a low hanging palate. These qualities should be examined in the oral cavity. [21] Currently, invasive breathing treatments like Continuous Positive Airway Pressure (CPAP), surgical procedures Invasive procedures, such as tongue suspension and adenotonsillectomy, as well as non-invasive ones, such the use of orthodontic appliances, are used to treat obstructive sleep apnea syndrome (OSA). Recent studies have shown that orofacial anatomic abnormalities, including as a high palatal arch, a hypotonic tongue, and weak lip muscles, can impair orofacial growth in children with OSA. These abnormalities cause upper airway obstruction. Numerous studies have demonstrated the value of myofunctional therapy movement training for increasing tongue, throat, and facial muscle tone, which can enhance minimize airway constriction by taking advantage of the orofacial structures' anatomical space. [22] Hence, this study was conducted to evaluate the combined surgical and orthodontic treatments in children with OSA. In the present study, the patient's parents recommended a more pleasant sleep environment free from episodes of sleep apnea at the subsequent medical assessment. Another PSG was carried out 2 years following the initial procedure. A study by Templier L et al, obstructive sleep apnea (OSA) is a sleeping breathing disorder. In children, adenotonsillar hypertrophy remains the main anatomical risk factor of OSA. The aim of this study was to assess the current scientific data and to systematically summarize the evidence for the efficiency of adenotonsillectomy (AT) and orthodontic treatment (i.e., rapid maxillary expansion (RME) and mandibular advancement (MA)) in the treatment of pediatric OSA. The initial search yielded 509 articles, with 10 articles being identified as eligible after screening. AT and orthodontic treatment were more effective together than separately to cure OSA in pediatric patients. There was a greater decrease in apnea hypoapnea index (AHI) and respiratory disturbance index (RDI), and a major increase in the lowest oxygen saturation and the oxygen desaturation index (ODI) after undergoing both treatments. Nevertheless, the reappearance of OSA could occur several years after reporting adequate treatment. In order to avoid recurrence, myofunctional therapy (MT) could be recommended as a follow-up. However, further studies with good clinical evidence are required to confirm this finding. [23]In the present study, the examination showed that the average oxygen saturation changed from 95% to 98%, the oxygen desaturation events 5 episodes/hr to 1 episode/hr, and the AHI improved from 9 episodes/hr at the baseline to 5 episodes/hr. The patients had the option of sleeping in a supine or non-supine position. These documents attested to the severe OSA's decision. Another study by Achmad H et al, systemically analyzed the literature on the effectiveness of orthodontic treatment with adenotonsillectomy surgery in children with obstructive sleep apnea (OSA) and to identify differences in the two treatments' effectiveness. The effectiveness of adenotonsillectomy, orthodontic treatment, and orthodontic treatment combined with adenotonsillectomy was assessed in children with mild OSA and mandibular retrognathia. That study, which needed a large sample size (352 children) and had a high dropout rate, revealed that combine orthodontic adenotonsillectomy (RME and/or MAD treatment) was more effective when given simultaneously than when given individually for treating OSA in pediatric patients. To date, the effectiveness of these two treatments cannot currently be compared due to a lack of strong evidence. If the treatment outcomes were unsatisfactory at 7 months after the initial treatment, subjects could receive further treatment following assessment by a stomatologist and ear, nose, and throat (ENT) specialist. [24] Adenotonsillectomy (AT), braces, the use of medication, constant positive airway pressure, and weight loss are among the traditional therapies for pediatric OSA. Regarding the management of OSA, there is, however, no patent opinion. Although multiple studies have revealed that this treatment may not be as effective as expected, adenotonsillectomy is the preferred way of treatment because Adenotonsillar hypertrophy is the primary factor causing OSA in children. According to reports, AT's effectiveness can range from 27.2% to 82.9%. Numerous studies have demonstrated the effectiveness of AT in treating OSA; nevertheless, there may still be a residual apnea hypopnea index (AHI) in some patients, particularly obese children. The truth is that the cause, degree, and

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timeline of elevated upper airway resistance are anticipated to influence the final therapy decision. Currently, orthodontic methods are commonly used in pediatric OSA as an alternative to or in conjunction with AT. The two most widely utilized orthodontic equipment are Mandibular Advancement (MA) and Rapid Maxillary Expansion (RME) Devices (MADs). By enlarging the nasal cavity and widening the maxilla, RME is a therapy that helps kids with OSA breathe through their noses more easily and improve their tongue position. MADs can expand the upper airway as well as the forward migration of the jaw and hyoid bone. Numerous studies have demonstrated the steady long-term efficacy of RME and MAD in the treatment of juvenile OSA when used in the clinical setting, such as the Frankel and Twinblock apparatus.[25]An extensive analysis of cognitive and behavioral testing, sleep, and sleep quality was conducted as part of a significant, randomized, controlled trial for the treatment of children obstructive sleep apnea. complaints. School-aged OSA patients without protracted oxyhemoglobin desaturation who underwent surgical adenotonsillectomy after a 7-month intervention period compared to kids in the watchful-waiting group, did not noticeably improve in clinical appearance or performance as shown by neuropsychological tests. But after surgery, the patient's conduct, quality of life, polysomnographic findings, and symptom alleviation all improved substantially. Despite the fact that 46% of kids who received watchful-waiting group also saw a resolution of their polysomnographic abnormalities, adenotonsillectomy appeared to ameliorate the bulk of children's (79%) findings. Obese children who were randomly assigned to have an adenotonsillectomy operation showed higher symptom reduction, behavioral improvement, and polysomnographic improvement compared to the watchful waiting group. [26] Although adenotonsillectomy is considered a first line of treatment in pediatric OSA, the Pediatric Sleep Disorders Program at the University of Chicago felt that the patient was not a candidate for these procedures. Rather he was referred to the University of Illinois Orthodontic Department for evaluation and treatment. After evaluation it was felt that expansion of both upper and lower arches would be indicated to decrease his OSA symptoms with the possibility of orthognathic surgery if sufficient reduction in his AHI was not achieved. This is what occurred in the patient's treatment and necessitated his two stages of orthodontic treatment. It has been reported that an anteriorly titrated mandibular position reduced Obstructive Sleep Apnea severity, enlarged the velopharynx, and diminished the curvature of the anterior velopharyngeal wall. It is proposed that this change in the upper airway curvature associated with mandibular advancement may affect Obstructive Sleep Apnea severity through its effect on airflow dynamics. [27] Surgical maxillomandibular advancement is prescribed as a functional and curative treatment for OSA. It can result in significant improvement in the quality of life and reduction in OSA health-related risks. [28,29]

Conclusion

The resolution of the condition of severe OSA can restore a physiological development of young patients.

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