

Major Approaches of Orthognathic Surgery in Obstructive Sleep Apnea Syndrome: A Systematic Review

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Abstract

Introduction: In the scenario of Obstructive Sleep Apnea Syndrome (OSAS), Orthognathic Surgery (OS) corrected the deformities of the maxillary and mandibular bones OS has evolved a lot in the last two decades. OS treats patients with moderate and severe facial deformities, allowing the achievement of functional balance and harmony in facial aesthetics.

Objective: To present the current findings of the importance of orthognathic surgery in the treatment of obstructive sleep apnea syndrome.

Methods: A total of 34 articles were found involving mesh terms about Orthognathic Surgery and OSAS. Initially, it was held the exclusion existing title and duplications following the interest described this work. After this process, the summaries were evaluated, and a new exclusion was held. Thus, 17 articles were included and discussed in this study.

Major considerations and conclusion: In recent years, with the involvement and deepening of oral medicine in the diagnosis and treatment of OSAS, the role of OS in OSAS has become increasingly recognized. Early appropriate diagnosis and treatment can significantly improve patients' quality of life, reduce sudden death, and prevent various complications. OS corrects maxillofacial deformities through an incision of the upper and lower jaws, has a significant relief effect on the symptoms of OSAS in patients with upper airway stenosis, especially in small mandibular patients.

Keywords: Orthognathic Surgery; Obstructive Sleep Apnea Syndrome; Malocclusion; Quality of life

Introduction

In the scenario of Obstructive Sleep Apnea Syndrome (OSAS), Orthognathic Surgery (OS) corrected the deformities of maxillary and mandibular bones [1]. OS has evolved a lot in the last two decades. The importance of airway dimensions is that they are related to respiratory disorders since the narrow dimensions of

the upper airways in the oropharynx area cause respiratory problems and may lead to reduced levels of growth hormone in children [2].

In this context, facial deformity with destructive psychological and social potential has a negative impact, which may influence not only the patient's self-confidence but also external relations, resulting in social and psychological disadvantages [3]. The objectives of the patient with dentofacial deformity, related to the repair, are also psychosocial and this can express the expectation of solving their personal and social difficulties with the physical change [3].

Thus, OS treats patients with moderate and severe facial deformities, allowing the achievement of functional balance and harmony in facial aesthetics [4]. In this sense, as a consequence of functional imbalance, OSAS can occur, which is the airway arrest by the upper airway, in the presence of respiratory effort, lasting more than 10 seconds. Hypopnea constitutes a reduction in the passage of air, in said area, in this same period of time. These respiratory events occur innumerable times and exclusively during sleep, determining symptoms and signs that characterize OSAS [5].

Furthermore, OSAS is related to comorbidities such as systemic arterial hypertension or diabetes mellitus. The prevalence reaches 32% in the general population, ranging from 1% to 20% when it is associated with COPD (overlap syndrome) and is described as over 60% in populations with COPD and obesity (COPD triad, OSAS, and obesity) [5]. The methods of treatment are numerous and presented. Multidisciplinary participation and multidisciplinary development trends. In recent years, with the participation and deepening of oral medicine in the diagnosis and treatment of OSAS, the role of OS in OSAS has become increasingly recognized [5].

Therefore, the present systematic review aimed to present the current findings of the importance of orthognathic surgery in the treatment of obstructive sleep apnea syndrome.

Methods

Eligibility and study design

A total of 34 articles were found involving Orthognathic Surgery, Obstructive Sleep Apnea Syndrome, Malocclusion and Quality of life. Initially, it was held the exclusion existing title and duplications following the interest described this work. After this process, the summaries were evaluated, and a new exclusion was held. Thus, 17 articles were included and discussed in this study.

Experimental and clinical studies were included (case reports, retrospective, prospective, randomized trials and systematic review and meta-analysis) with qualitative and/or quantitative analysis. Initially, the keywords were determined by searching the DeCS tool (Descriptors in Health Sciences, BIREME base) and later verified and validated by MeSh system (Medical Subject Headings, the US National Library of Medicine) in order to achieve consistent search, following the rules of systematic review- PRISMA (Transparent reporting of systematic reviews and meta-analyses-<http://www.prisma-statement.org/>).

Literature Review

This review has demonstrated through the main literary findings the main benefits of orthognathic surgery on the treatment of OSAS.

In this sense, OSAS refers to when an adult presents at least 30 apneas during 7 hours of nocturnal sleep, at least 10's or more for each episode; or more than 4% of apnea during apnea or an apnea-hypopnea index (apnea and hypopnea index, AHI, the average number of apnea hypopneas per hour) is greater than 5 times per hour, so apnea is mainly obstructive [1,6].

Thus, it can be highlighted that the main pathophysiological characteristic of OSAS is high stenosis caused by apnea or restricted ventilation during sleep, causing nocturnal hypoxemia, resulting in chronic damage to multiple organs of the body [2,7]. Long-term presence may cause or aggravate respiratory failure, or cerebrovascular risk factors for accidents, myocardial infarction, and hypertension [3,8-10]. Early appropriate diagnosis and treatment can significantly improve patients' quality of life, reduce sudden death, and prevent various complications [11-17].

Thus, the basic principle of surgical treatment is to alleviate the structural factors of upper airway stenosis [4]. It is suitable for patients who can actually alleviate upper airway obstruction through surgery. The surgical methods commonly used include uvulus palate pharyngoplasty (UPPP) and its enhancement, mandibular advancement, anterior and mandibular migration, anterior maxillofacial migration and suspension of lingual muscle suspension, laser-assisted pharyngoplasty, pharyngeal angioplasty, tracheostomy, bariatric surgery, implant surgery such as soft abutment implantation, hypoglossal nerve stimulation, reconstruction of upper airway surgery, soft airway reconstruction, tonsillectomy, adenoidectomy, nasal septoplasty, nasal concha radiofrequency ablation or nasal surgery, etc.

In particular, Orthognathic Surgery (OS) is an effective treatment for OSA due to mandibular factors. OS is a type of surgery that corrects maxillofacial deformities by incising the upper and lower jaws. It has a significant relief effect on the symptoms of OSAS in patients with upper airway stenosis, especially in small mandibular patients. Surgical methods include maxillary and maxillary incision, mandibular incision, mandibular incision, and osteogenic distraction of a small, severe mandibular deformity. Due to the advancement of the maxilla and mandible, the parameters of the upper airway volume and the upper transverse area of the upper airways were significantly increased compared to those before surgery, which can significantly improve the symptoms of OSAS and until reaching the complete disappearance of symptoms.

In this surgical context, a case report study in a 12-year-old boy with unilateral temporomandibular joint ankylosis and obstructive sleep apnea (OSAS) was submitted to surgical release of ankylosis with the successful opening of the mouth [1]. However, he continued to suffer from OSAS, as confirmed by postoperative polysomnography. Thus, OS for mandibular advancement was not favorable because of its small age and mandibular distraction. Osteogenesis was not a choice. A mandibular advancement device similar to the orthodontic myofunctional appliance was the preferred choice in the postoperative period while awaiting the surgical treatment of definite retrognathism after skeletal maturity. Surgical release of ankylosis of the temporomandibular joint corrects the oral problem but does not adequately address the narrow air space of the pharynx [1].

Furthermore, OSAS is a common problem in patients with achondroplasia. One study aimed to evaluate changes in airway volumes after various degrees of advancement of the facial skeleton. Six patients with achondroplasia were submitted to the advancement of the middle of the face for the treatment of OSAS. Therefore, in patients with OSAS associated with achondroplasia, there are variable improvements in airway volume. This preliminary report suggests that mandibular distraction can provide consistent reductions in the rate of apnea and hypopnea [2].

In addition, although maxillomandibular advancement (MMA) is an orthognathic surgical procedure used to control OSAS, it encounters problems in terms of aesthetic results with pre-existing dentoalveolar protrusion. Thus, a prospective study investigated changes in posterior pharyngeal space and aesthetic outcomes of patients suffering from OSAS after OS rotational counter-clockwise [3]. Patients were skeletal class II patients undergoing OS. A total of 14 patients were included. Satisfactory results were achieved without complications in all patients with OSAS. Airway parameters for anteroposterior length increased significantly. Thirteen patients answered a questionnaire about their facial appearance, and the visual analog scale averaged 7.31 points, indicating a favorable facial appearance. A rotational counterclockwise OS without advancing the maxilla for OSAS correction can effectively increase posterior pharyngeal space with favorable aesthetic results [3].

Also, in some patients with severe skeletal Class III, mandibular recoil surgery using sagittal branch osteotomy (SSRO) is performed to correct mandibular protrusion. However, in patients diagnosed with OSAS, the risk of worsening as a result of SSRO is very high [4]. The advancement of the maxilla can reduce the degree of mandibular retropositioning and expand the skeletal structure in the pharyngeal region, leading to an increase in the airway. However, the nasal deformity is an undesirable outcome of the procedure. Thus, a case report described a 23-year-old man with the maxilla and retrograde OSAS. Maxillary retrusion was treated with Le Fort I osteotomy with alar suture and mucoperiosteal V-Y closure (ACVY). After treatment, better occlusal relationships and improvement in OSAS were observed [4].

Another study explored how mandibular advancement without maxillary involvement would affect posterior air space in patients with mandibular retrognathism [9]. Cone-beam computed tomography (CT) was performed for 20 patients before and six months after the mandibular advancement. Cephalometric analysis at both moments included two-dimensional and three-dimensional upper airway evaluation. Eight men and 12 women presented preoperative mean W values (7.4) (1.54) mm, with airway area of 7.11 (1.88) cm² and volume of 14.92 (4.46) cm³. Six months postoperatively presented a Wits value of 2.7 (0.41) mm, an airway area of 11.33 (3.49) cm² and a volume of 25.7 (6.10) cm³. There was an average increase (range) of 59 (22-82)% of the area and 73 (29-108)% of the volume. A preoperative figure of 8.0 mm or greater was significantly correlated with a greater increase in posterior air space ($p=0.002$). At the same time, an improvement in the Reasoning value of 4.5 mm or more correlated significantly with an increase in volume ($p= 0.016$). The effect of mandibular advancement on posterior air space was significant, and the volumetric effect appears to be even more relevant than two-dimensional changes [9].

Discussion

Thus, as literary results, Foltan et al. [10], in a study on the influence of orthognathic surgery on ventilation during sleep, found an average age of 22 ± 0.8 years, ranging from 16 to 28 years, which contrasts with our study in which the mean of patients were older, 36.50 ± 12.10 years, with ages ranging from 23 to 52 years and with a higher prevalence in the female gender. There is little data available on the predominance of facial features. However, Sant'ana et al. [11] showed that the Brazilian profile presented a substantial difference when compared to the North American profile.

In addition, Faria et al. [12], Who demonstrated, through comparisons of cephalometric radiographs, that in each millimeter of maxillo-mandibular advancement, there is an increase of 0.76 mm in the retropalatal region and 1.2 mm in a retrolingual region. However, there was a decrease in the upper airway space in patients submitted to maxillary advancement associated with mandibular retreat, confirming with Mattos et al. [13] that in orthognathic surgery mandibular retreatment leads to a decrease in parapharyngeal space and maxillary

advances, combined with indentations can lead to a moderate decrease in the upper airways.

Conclusion

In recent years, with the involvement and deepening of oral medicine in the diagnosis and treatment of OSAS, the role of OS in OSAS has become increasingly recognized. Early appropriate diagnosis and treatment can significantly improve patients' quality of life, reduce sudden death, and prevent various complications. OS corrects maxillofacial deformities through an incision of the upper and lower jaws, has a significant relief effect on the symptoms of OSAS in patients with upper airway stenosis, especially in small mandibular patients.

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