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RESEARCH ARTICLE

MAIN PREDICTORS AND INTRAORAL DEVICES FOR SNORING AND SLEEP APNEA: BRIEF REVIEW

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ABSTRACT

The syndrome of apnea and obstructive sleep hypopnea (SAOSH) are respiratory disorders that occur during sleep, causing total or partial obstruction of the upper airway (UA). The etiology is multifactorial, mainly associated with obesity, craniofacial abnormalities and systemic diseases due to this therapy is multidisciplinary, requiring the exams for modified Mallampatti classification, Epworth Sleepiness Scale and polysomnography for the diagnosis and evaluation of severity of SAOSH. The objective of this study is to detail the importance and the main snoring plates in treating SAOSH through the literature review. The intraoral devices (AIOs) are conventional therapeutic modalities employed in very mild OSAS in patients with moderate, especially with mandibular advancement device (MAD), which provides initial patient comfort and improves the quality of sleep and life. Therefore, AIOs in treating mild to moderate SAOSH are effective, with cost-effective, satisfactory clinical results.

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INTRODUCTION

The syndrome of apnea and obstructive sleep hypopnea (SAOSH) is appointed by the American Academy of Sleep Medicine (AASM) as the most common abnormality of sleep (Hoekema *et al*., 2004; Vinha *et al*., 2010). Studies show that the prevalence among women and men aged 30 to 60 years of age is 2% and 4% respectively, however, estimates that 80-90% of this population is undiagnosed (Hoekema *et al*., 2004). The total interruption of flow of air for at least 10 seconds due to blockage of about 90% or more of the upper airway during sleep is called sleep apnea (Chaves *et al*., 2014; Daltro *et al*., 2006; Hoffmann *et al*., 2010). Hypopnea of the sleep, not least second AASM are episodes of partial cessation of airflow for at least 10 seconds with 50% commitment to 90% of the upper airways (Gale *et al*., 2000; Hoffmann *et al*., 2010 and The International Classification of Sleep Disorders, 2005). The SAOSH are classified according to severity, which evaluates the frequency of episodes that occur per hour of sleep, being called in light (5 to 15 SAOSH), moderate (16-30 OSAHS) and severe (more than 30 SAOSH), (Dekon *et al*., 2015; Guimarães *et al*., 2015 and Rose *et al*., 2002). The pathophysiology of SAOSH is the collapse of the upper airway, through the resistance to the air flow creates an increase of the negative intraluminal pressure pharynx, and this occurred, the walls there is a nasal obstruction (Pinto *et al*., 2000; Silva *et al*., 2010; The International Classification of Sleep Disorders *et al*., 2005). Once occurred this act in the airways and lack of air flow, the diaphragm does not stop your movement and the person still trying to breathe until it begins to make sensitive to hypoxemia, leading to an awakening, at which there is a reopening airway followed by numbness, this phenomenon can be repeated numerous times (Hoffmann *et al*., 2010; Ito *et al*., 2005; Pinto *et al*., 2000). At a time that the upper airway is compromised, the individual tries to breathe through the mouth, which leads to further narrowing of the oropharynx, both mouth opening 1.5 cm and the supine position during sleep are seen as aggravating factors SAOSH as design language for the posterior region, decreasing the diameter of the oropharynx (Pinto *et al*., 2000). The etiologic agent is not specific, the sum of neuromuscular and structural change factors such as obesity, craniofacial anomalies (retrognathia, increase lymphoid tissues in oronasofaringeana region, dilated uvula, high-arched palate, deviated nasal

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septum, inferiorly displaced hyoid bone and macroglossia) lead the development of this syndrome by obstruction of the upper airway (Silva *et al*., 2010; Vinha *et al*., 2010). In addition, OSAHS is associated with diseases such as cardiovascular diseases, hypothyroidism, diabetes mellitus and lifestyle or habits such as, physical inactivity, alcoholism, smoking and frequent consumption of drugs (tranquilizers, barbiturates or hypnotics) (Almeida *et al*., 2009; Araújo *et al*., 2011 and Daltro *et al*., 2006). The diagnosis of these respiratory disorders is through the nocturnal polysomnography examination, consisting of sleep monitoring at different stages, analyzing heart rate, degree of blood oxygen, movement of the patient ends and episodes of respiratory arrests (Almeida *et al*., 2009; Baldwin *et al*., 2010 and Bittencourt *et al*., 2009).

The main clinical features are loud snoring and excessive daytime sleepiness (Araújo *et al*., 2011; Carneiro *et al*., 2007 and Cohen *et al*., 2004). In this sense, snoring is a prerequisite for SAOSH, research emphasize the hereditary predisposition, and a noise made by the vibration of the soft palate and adjacent tissues pharynx when these tissues relax during sleep causes the sound, which can worsen with advancing age (Marklund *et al*., 2006; Pinto *et al*., 2000 and Silva *et al*., 2010). In this context, treatment for SAOSH multidisciplinary, encompassing the fields of medicine, physical therapy, nutrition, psychology and dentistry. Measures may be surgical, clinical and behavioral depending on the complexity involved and the etiological factor (Cohen *et al*., 2004; Ferguson *et al*., 2006; Hoffmann *et al*., 2010; Ito *et al*., 2005), often it is necessary the participation of dentists (Koutsourelakis *et al*., 2008). It is therefore imperative to take measures surgical dental and maxillofacial corrections when craniofacial anomalies are the main cause of this respiratory disorder, or even more conservative treatments with the use of intra-oral devices (AIO), snoring board called (Baldwin *et al*., 2010; Bondemark *et al*., 1999; Bondemark *et al*., 2000 and Daltro *et al*., 2006). The roar of the plates are intraoral devices more used than other modalities, due to several advantages such as low cost, easy to manufacture and well accepted by patients, in order to keep open the oropharyngeal space to decrease respiratory efforts that cause snoring, apnea and possible nocturnal agitations (Ferguson *et al*., 2006; Hoffmann *et al*., 2010 and Pinto *et al*., 2000). Because of the importance of this syndrome, this study aimed to detail the importance and the main signs of snoring in the treatment of SAOSH, through the literature findings.

MATERIALS AND METHODS

This study is in a literature review focusing on AIOs, mainly AMM. To this end, a survey was conducted in scientific articles in the databases PubMed, Medline, Scielo, Lilacs and books. The key words used were Syndrome Sleep Apnea, Snoring and polysomnography, which are registered in the Health Sciences Descriptors. Selected papers passed criteria for inclusion and exclusion. We included studies that address therapeutic with AIOs, comparisons between conventional treatment modalities and tests for the diagnosis of OSAS. the studies reporting the use of other invasive treatment modalities and does not contribute to the relevance of this work were excluded.

Main Predictors Continuous or Categorical

The main predictors are obesity, craniofacial abnormalities, cardiovascular disease, hypothyroidism, diabetes mellitus and lifestyle or habits such as, physical inactivity, alcoholism, smoking and frequent consumption of drugs.

Main Predictors Answer

The main predictors of response of this study were sleep apnea and snoring.

Literature Review

Since 1985, the areas of health, especially dentistry is increasing interest in the SAOSH, since diagnosis and treatment is multidisciplinary (Hoffmann *et al*., 2010; Ito *et al*., 2014 and Koutsourelakis *et al*., 2008). As the dentist one of the leading professionals in the diagnosis and treatment of SAOSH, the resource used by the same in the diagnosis are Mallampatti rating and Epworth Sleepiness Scale, assessing the predisposition of the individual to the development of SAOSH disease by changing morphological craniofacial and mouth, and / or nap period respectively (Dekon *et al*., 2015; Gale *et al*., 2000; Ito *et al*., 2005). Changes in the external anatomy of the head and neck are identified as risk factors in the development of SAOSH, causing craniofacial dimorphism, indicative of the development of maxillary hypoplasia, mandibular retroposition and exacerbated growth of adjacent soft tissues especially the language, thus contributing to the collapse of the upper airways (Guimarães *et al*., 2015; Koutsourelakis *et al*., 2008). The modified Mallampatti classification checks the amount of visible structures in the oral cavity, subdivided into Class I to IV.

Class I is possible to observe the posterior oropharynx, including the inferior pole of the tonsils; Class II observes a part of the posterior wall of the oropharynx; Class III is observed entering the uvula and soft palate; and Class IV is observed only part of the soft and hard palate (Dekon *et al*., 2015; Gale *et al*., 2000; Ito *et al*., 2004; Rose *et al*., 2002). The Epworth Sleepiness Scale is a subjective evaluation method for some researchers, however, widespread since its invention in 1991, by Dr. John W. Murray, is numbered 0 to 3 for the possibility of measuring daytime sleepiness which 0 is no and High is (Baldwin *et al*., 2010 and Guimarães *et al*., 2015). The polysomnography is also quite used and recommended by the American Sleep Disordes Association (ASDA) (The International Classification of Sleep Disorders, 2005). and is considered "gold standard" for the diagnosis of SAOSH. Polysomnography is the patient monitoring during the entire night in analyzed specialized environment in various physiological parameters, including electroencephalogram (EEG), electrocardiogram (ECG), electrooculogram (EOG), electromyogram (EMG) and the desaturation of oxygen (The International Classification of Sleep Disorders, 2005).

The results will indicate whether the patient is a carrier of SAOSH, when there is at least 5 events of apnea or hypopnea per hour of sleep and the severity by the number of episodes, light (5 to 15), moderate (15 to 30) and severe (above 30). These episodes are grounded during NREM REM-sleep cycle, which consists of 4 to 6 minutes each 90 cycle per episode (Bondemark *et al*., 1999 and Gale, 2000). The literature points out various forms of therapy used for SAOSH due to the huge range of acute signs and symptoms and relevant atypical, difficult diagnosis and depending on the severity of the case, the patient can go to death. Consists of snoring, daytime sleepiness, fatigue, and even systemic conditions, behavioral

and structural, related mainly cardiovascular disease, alcohol consumption and physical inactivity and craniofacial alterations, which ends up inducing the patient to seek a qualified practitioner (Marklund *et al*., 2006 and Rose *et al*., 2002). Although they are palliative measures the AIOs ASDA (1995) recommends therapy with the use of oral appliances for snoring and obstructive apnea, and post-treatment control through polysomnography (Bondemark *et al*., 1999; Ferguson *et al*., 2006 and Koutsourelakis *et al*., 2008) as these devices can reduce episodes of SAOSH and increase oxygen saturation, favoring the quality of sleep and reducing the arousal index (Hoffmann *et al*., 2010; Ito *et al*., 2004&2005) Since these devices, when properly made and shown, keeps the jaw or tongue protruded position and elevation of the soft palate during sleep (Almeida *et al*., 2009; Araújo *et al*., 2011 and Baldwin *et al*., 2010). influencing the dimensions of the upper airways, furthermore, stimulate muscle activity genioglossus and pterygoid creating muscle tone, which influence positively also on the dimensions of the upper airways (Pinto *et al*., 2000). The AIOs are quite used in the treatment, known since 1934, when the French pediatrician Pierre Robin used a device in the treatment of SAOSH associated with glossoptosis. There are over 55 types of oral appliances used in the treatment of SAOSH and the number is growing (Chaves *et al*., 2014; Hoffmann *et al*., 2010 and Ito *et al*., 2015). It highlights two main types, such as lingual retainers (ARL) and mandibular advancement devices (AAM). However, the most widely used and studied by the dental profession are the AAM (Baldwin *et al*., 2010; Bittencourt *et al*., 2009 and Hoekema *et al*., 2004).

Lingual Retainers (LR)

The LRs were developed by Cartwright and Samelson (1982), and devices that keep the anterior tongue during sleep through the traction to a bulb located in the region of the upper and lower anterior teeth via a negative suction. The best known are the ARLs retaining device tongue (TRD), tongue stabilizing device (TSD) and Snor-X. These devices are prefabricated flexible and thermoplastic materials supplied in four different sizes and shaped in hot water to fit over the teeth and the alveolar ridge. The TRD was the first device to be used and also suitable for mouth breathing, since they have lateral fittings (Chaves *et al*., 2014; Gale *et al*., 2000 and Ito *et al*., 2014). The LR itself are given preferentially to patients with poor dental conditions with great loss of teeth, advanced periodontal disease, or use of partial or full dentures, which would preclude the facilities of other devices for SAOSH as jaw positioners due to lack of support tooth, however, the LR retention tongue is (Chaves *et al*., 2014). Despite the lack of literature on the mechanism of action of LR, it is believed that the LR creates openness in VAS levels of the oropharynx, hypopharynx and velopharynx, thereby reducing snoring and SAOSH episode. Once it stimulates increased genioglossus muscle activity, increased muscle tone that contributes to the passage of air VAS (Chaves *et al*., 2014 and Gale *et al*., 2000).

Mandibular Advancement Devices (MAD)

The MADs were developed with freshly sensed to maintain the protruded jaw during sleep, thus it is believed that mandibular advancement creates an opening in the upper airways levels of the oropharynx, hypopharynx, and the nasopharynx, improving airflow and reducing snoring and the episode of SAOSH (Gale *et al*., 2000; Ito *et al*., 2004 and 2005). These devices are particularly suitable for patients with toothed sufficient amount of teeth and for anchoring of the retaining device (Almeida *et al*., 2009; Araújo *et al*., 2011). Thus, MADs can be fixed, adjustable or dynamic devices. The fixed MAD is characterized in a single block which provides immediate advance in a single step, since the adjustable MAD has devices which permit the gradual advancement, however, with jaw movement restriction, the dynamic MAD provides a mechanism that allows mandibular movement considering the neuromuscular physiology of the stomatognathic system (Ito *et al*., 2004 and 2005).

DISCUSSION

The prevalence of SAOSH is 2: 1 or 3: 1 between men and women (Marklund *et al*., 2006) associated with risk factors such as cardiovascular disease and diabetes mellitus mainly consists of one of the major syndromes of sleep, which still has sequels and rate high mortality. Because of this, several published studies emphasize the importance of SAOSH treatment is for AIOs or other modalities. According Daltro *et al*. (2006) the principiais risk factors are obesity, male and aging, and about 70 % are obese and apneic (Marklund *et al*., 2006). Therefore, the diagnosis made by examining Mallampatti classification, Epworth and nocturnal polysomnography scale will establish the severity of OSA and define the therapy to be used by the professional in question, each case addressed in different ways. One of the most used therapies are the AIOs that successful when indicated for mild and moderate OSAHS, in addition to providing initial comfort for the patient, improves sleep quality and life as well (Ferguson *et al*., 2006). In contrast, the gold standard for the treatment of SAOSH is continuous positive airway pressure (CPAP), consists of a device with continuous flow system, which provides a gas mixture enriched with oxygen and is applicable to all gravity mainly for severe, but it requires the use of a mask, hindering the adjustment device (Ferguson *et al*., 2006 and Silva *et al*., 2010). Several studies demonstrate the acceptance of devices for patients with high success rate of AiOs and less side effects when long term therapy is especiallyamm (Almeida *et al*., 2009; Bondemark *et al*., 1999; Cohen *et al*., 2004; Daltro *et al*., 2006; Ito *et al*., 2005 Rose *et al*., 2002). For the LRs has its very restricted, only recommended for edentulous patients or partial (Chaves *et al*., 2014).

However, is less and less used by the dental professional, being replaced by the MAD or other therapies because of the discomfort caused by the mechanism of action of this device. Through negative pressure provides the LR advance from 50% to 75% of maximum protrusion having side effects as pain, numbness in the tongue and excessive salivation (Rose *et al*., 2002; Silva *et al*., 2010). But the MAD, as well as having excellent value for money, you get satisfactory clinical results in approximately 85% of cases when used mainly for primary snoring patients, SAOSH with intensity from mild to moderate and patients dissatisfied with other therapies or who do not accept interventions more invasive (Baldwin *et al*., 2010; Carneiro *et al*., 2016). For cephalometric analysis can observe the changes in the morphology of the VAS and the positioning of the hyoid produced by MADs, through two-dimensional images, increasing the pharyngeal airspace (Pinto *et al*., 2000). However, in cases of severe SAOSH or nasal septum deviation, the MAD has limitations, with higher risks of failure, and recommended more invasive therapies or CPAP.

Which according Ferguson (2008) CPAP therapy for severe SAOSH has 62% success rate compared with 48% AiOs. In this way the AIOs are not indicated as first choice for SAOSH severe (Ferguson *et al*., 2016; Hoffmann *et al*., 2010; Ito *et al*., 2005). For this inefficiency, one of the hypotheses is that during the MAD action occurs change of VAS and lip seal, leading to failure, especially for patients with nasal and pharyngeal impairment (Guimarães *et al*., 2015; Marklund *et al*., 2006), However, Cohen study we were about 60% success rate in patients with moderate to severe SAOSH (Hoffmann *et al*., 2010; Pinto *et al*., 2000).

Conclusion

According to this study, it is evident the effectiveness of AIOs in treating mild to moderate SAOSH, especially the MAD. Besides being the most accepted by most patients, it presents excellent value for money.

Competing Interests

The authors declare que they have no competing interests.

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