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RESEARCH ARTICLE

ORTHODONTICS AND OBSTRUCTIVE SLEEP APENA –RELATION

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ABSTRACT

Obstructive Sleep Apnea is a chronic sleep related breathing disorder which requires long term, multi disciplinary management. The most common clinical procedure involves continuous positive airway pressure (CPAP). Orthodontic management of OSA syndrome could be provided to children as a preventive and interceptive modal or to adults by an interdisciplinary management. Oral appliances are simple, non invasive, cost effective and reliable treatment method compare to all other airway pressure therapy and surgical approach.

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INTRODUCTION

Chronic obstructive sleep apnea (OSA) is a sleep related breathing disorder affecting all ages characterized by periodic breathing cessation (apnea) or airflow reduction (hypopnea). Overweight middleaged adult men have the highest prevalence of the disease, yet women and an increasing number of children are also affected by OSA. The association between obstructive sleep apnea syndrome (OSAS), maxillofacial malformations, and malocclusions has attracted more attention in the recent past. In several reports, Guilleminault (Guilleminault, 2001; Guilleminault, 2004; Guilleminault, 1989), from the Stanford University Medical School, has underlined the importance of multidisciplinary collaboration in the treatment of breathing-related sleep disorders and has emphasized that children suffering from mild OSAS commonly present with airway obstruction related to nasal septum deviation associated with a narrow upper jaw. Also, he has mentioned that in children with obstructive sleep apnea (OSA), the role of craniofacial abnormalities and the impact of orthodontics have often been overlooked until now, despite their impact on public health.

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Treatment of OSA by rapid maxillary expansion (RME) was mentioned by Cistulli and colleagues (Cistulli, 1998). At the third International Congress of Craniofacial and Maxillofacial Distraction Paris, France, June 2001, and the seventh World Congress on Sleep Apnea Helsinki, Finland, June 2003, Pirelli had several presentations on the potential role of RME in children with abnormal breathing during sleep, work that led to the first full report on the treatment of pediatric OSA by RME (Pirelli *et al*., 2004). Particularly interesting were the correlations found between OSAS, malocclusion, and maxillofacial malformations. In fact, many patients with OSAS show craniofacial abnormalities in both jaws as well as alteration in the skeletal structure of the respiratory dynamic space.3–6 Nasal septum alteration reduces airflow and increases resistance to nasal breathing (Harvold, 1981; Miller, 1982). Micrognathia and nasal obstruction are among the risk factors for OSAS (Guilleminault *et al*., 1989; Cistulli *et al*., 1998; Pirelli *et al*., 2004; Harvold *et al*., 1981; Miller, 1982). Nasal septum deviations are responsible not only for an asymmetric distribution of intranasal spaces but also for the internal structural alteration of the turbinates, more particularly the nasal inferior turbinate, which in turn causes a reduction of total airflow (Rubin, 1987; Pirelli *et al*., 2005; Linder-Aronson, 1969; Pirelli, 1996). Considering that a significant number of children suffering from mild OSAS show an obstructive phenomenon with nasal septum deviation with or

without turbinate hypertrophy, associated with a narrow upper jaw,9 this report describes how rapid maxillary expansion may improve the patency of the nasal airway and to which extent it may improve pediatric OSA. Clinically OSA is defined by the occurrence of day time sleepiness, loud snoring, witnessed breathing interruptions, or awakenings due to gasping or choking in the presence of 5 obstructive respiratory events (apnea, hypopnea or respiratory effort related arousal)per hour of sleep.

The main objective of OSA treatment should be aimed to normalize breathing during sleep and eliminate un-necessary day time sleepiness (Epstein *et al*., 2009). At the same time, it should provide patients with a good quality of life with no side effects or risks. There are behavioral, medical and surgical options are available for the management of the OSA. Treatment effectiveness is variable and dependent on patient needs. It is believed that treatment must be evaluated over time for good patient outcome

Symptoms: The symptoms are: (1) loud snoring (Guilleminault *et al*., 1981; Brouilette *et al*., 1984) (all cases of OSA elicit snoring, but all snoring cases need not have OSA), (2) hypersomnolence (Gozal *et al*., 2001; Rosen, 1999) (hallmark of OSA), (3) feeling of chocking, (4) restless and unrefreshing sleep, (5) change in personality, and (6) nocturia.

Diagnosis

- ***History of clinical signs and symptoms*:** Examination of facies, oropharynx. Upper airway evaluation can be done with endoscopy/laryngoscopy, pharyngometry, and radiographic evaluation (Lowe *et al*., 1986; Baik *et al*., 2002) (computed tomography (CT) or magnetic resonance imaging (MRI)).
- ***Home monitoring*:** Unattended home studies in children with OSA have been improving in quality. In one study using a comprehensive methodology including cardio respiratory and 8 h of video recording, results obtained were very similar to those obtained by PSG in the laboratory (Jacob *et al*., 1995)
- ***Laboratory sleep study*:** "Polysomnogram."(Practice parameters for the indications for polysomnography and related procedures, 1997)

Polysomnography

Polysomnography (PSG) is the gold standard (Marcus *et al*., 1992; Uliel *et al*., 2004) in the diagnosis of OSA. It involves the overnight recording of sleep breathing patterns and oxygen saturation. Sleep staging includes electrocardiogram (ECG), electroencephalogram (EEG), and electromyogram (EMG). Normally the blood oxygen level should be above 90%, with obstructions, we can have varying degrees of desaturation. PSG provides AHI score, which is an estimation of apnoeic–hypoapnoeic episode per hour of sleep. In an adult patient, an AHI of 5 (or sometimes 10) generally indicates mild OSA

Treatment Modalities: Treatment modalities of OSA are aimed to increase the life expectancy, decrease the disease problems, and improve the quality-of-life. Less invasive treatment options should be selected whenever possible. These include: behavior modification, diet and medication, continuous positive airway pressure (CPAP) devices, surgical options, and oral appliances

Behavior modification: Behavior modification includes changing the sleep position from the supine to the side position by the use of pillow/tennis ball, avoidance of alcohol, and sedatives for 3 h before the sleep, and body weight control.

Diet and medication: For obese children, weight loss and maintaining a healthy diet might prove to be the ultimate treatment for their OSA (Benninger, 2007) Antibiotic medication, (Sclafani, 1998) topical intranasal application of corticosteroids, (Alexopoulos *et al*., 2004) leukotriene receptor antagonist, (Goldbart *et al*., 2005) and anti-inflammatory therapy (Goldbart *et al*., 2006) can be used for mild or residual OSA after surgery.

Continuous positive airway pressure device: Continuous positive airway pressure device (CPAP) (Hoffstein, 1992) is the noninvasive gold standard treatment for patients with moderate-to-severe OSA. It acts by continuously pumping the room air under pressure through a sealed face mask or nose mask into upper airway or lung. Although CPAP is most efficacious treatment option, it requires use of mask interface, sealed tubing, and a device connected power sources. This complexity limits its acceptance by patients and leads to suboptimal treatment adherence.

Surgery: Surgery may be appropriate for patients who cannot comply with or are not appropriate candidates for conservative therapies or CPAP alone. Historically surgical procedures for OSA treatment have included intranasal procedures, reduction glossectomies, uvulopalatopharyngoplasty procedures, and tracheostomy; Careful and thorough preoperative examination by radiography, imaging, and direct visualization is needed to identify the airway obstruction site(s) and to select the appropriate surgery.

Nasal, Septal and Adenoid surgery: Nasal, Septal and Adenoid surgeries are sometimes performed for Chronically enlarged nasal turbinates, Weak or malpositioned cartilages, deviated nasal septum, enlarged adenoid that may interfere with breathing order to open the nasal breathing passages and permit easier breathing are helpful in removing the mechanical obstruction and can facilitate the use of nasal CPAP.

Maxillomandibular advancement (Li, 2011): Maxillo-mandibular Advancement (MMA) or double jaw advancement is a procedure whereby the upper and lower jaws are surgically moved forward (Lefort 1 osteotomy of the maxilla & bilateral saggital split advancement of the mandible). The concept is that as the bones are surgically advanced the soft tissues of the tongue and palate are also moved forward, again opening the upper airway. In the past 20 years, maxillomandibular advancement has been widely accepted as the most effective surgical therapy for obstructive sleep apnea syndrome. Maxillomandibular advancement has been shown to enlarge the pharyngeal and hypopharyngeal airway by physically expanding the facial skeletal framework. It has also been shown that the forward movement of the maxillomandibular complex increases soft tissue tension, prevents airway collapsibility.

Oral Appliances: Oral appliances have been recommended as a treatment option for being simple to use and noninvasive (Warunek, 2004). Oral appliances are designed to increase the upper airway volume and prevent the airway collapse through

a mechanical maneuver (Chan *et al*., 2010; Lee *et al*., 2010) Oral appliances are comfortable to wear, economical, easy to use and good patient compliance. Several studies demonstrate that oral appliances can be a useful alternative to positive air way pressure with mild to moderate sleep apnea (Hoekema *et al*., 2007; Krishnan *et al*., 2008). There is also robust evidence of the efficacy of oral appliances for improving polysomnographic indices and modifying the health risk associated with OSA (Chan, 2009). Oral device may be helpful in the management of OSA by; improving upper air way potency, increasing the cross sectional area or decreasing the upper air way collapsibility by increasing the muscle tone. The US FDA approved 16 devices for use in sleep apnea oral appliances as an alternative to CPAP therapy They are designed to keep upper air way open (Lim, 2006). During sleep all the gravity dependent tissues tends to fall back posteriorly, oral appliance prevent the tongue fall back by means of tongue retaining devices, other group of oral appliances advance the mandible in a forward position. By this way, airway remain patent reducing the apneic and hypopneic events. Side effects of Mandibular advancement devices are overbite alteration, tooth pain, and TMJ problems (Conley, 2015).

Conclusion

Hence the therapeutic interventions that are directed at the site of airway obstruction in the maxillofacial region are within the scope of dentistry. Dental practitioners can play a significant role in the treatment of OSA syndrome. It is imperative that the dental community continues to participate in the research and treatment of this serious and pervasive health problem.

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