Feature

The Role of the Dentist in the Therapeutic Support of Sleep Apnea

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Obstructive Sleep Apnea Syndrome (OSAS) is a health problem normally associated with the aging population. However, this syndrome can be just as common in children as in adults; there are important differences in the etiology, pathophysiology, polysomnography and treatment for both groups.[5] The purpose of this writing is to explore some of the most salient differences between these groups and to encourage all heath providers, especially dentists, to recognize this syndrome and to become an effective team-member with physicians treating this disorder.

A dentist's role can be crucial in the initial screening and detection of upper airway obstruction in adults and children. However, Ghiassi in 2004, found a general lack of awareness in the general population concerning sleep disorders, which is probably also due to lack of awareness in all health professionals. Thus, early diagnosis and prompt effective treatment will have positive effect on morbidity and the economic impact of delayed treatment.[14]

The prevalence of OSAS in children figures in the 1-3%, in contrast to that of 2-4% in the adult population. Children are usually brought to be evaluated due to snoring and labored breathing.[5] Additionally, from clinical experience, another common parental complaint that can signal to disordered breathing is nighttime bruxism.

Another difference is that the polysomnographic results for children are usually unremarkable;[4] children with OSAS have low apnea indices compared to adults. Nevertheless, if childhood sleep apnea goes untreated based on an inconclusive sleep study, they may develop pulmonary hypertension,[5,9] growth failure, systemic hypertension, and neurocognitive impairment.[5] As these children develop into adults, other systemic disease associations may be cardiovascular disease (right ventricular hypertrophy),[2,4] coronary heart disease and stroke; these may be a reflection of an increase in large vessel atherosclerosis in patients with sleep-disordered breathing.

Adult characteristics include cessation of breath, disruptive snoring, and excessive daytime sleepiness.[5] The adult population risk factors have been well documented. Obesity, male gender, increasing age, family history of OSA, ethnicity, smoking and alcohol use are important risk factors. Obesity is an adult major factor[5] and yields an interesting relation, which is the circumferential measure of the neck. Male obese patients with OSAS will frequently have a >40 cm/17in. neck, females >16in. This brings up the issue of "fat infiltration" into the pharyngeal space that some believe helps collapse the airway; however, it seems that this extra fat around the pharyngeal walls does not compress the airway as suspected, but rather this fat infiltration "softens" the soft palate, tongue, epiglottis and pharyngeal walls setting them up for collapse during sleep.[13]

Many general dentists who practice orthodontics are in a great position to provide further airway screening through cephalometry. The Muller Maneuver describes how to take a cephalometric film, to evaluate the airway in a dynamic fashion; prior to taking this radiograph the patient is asked to make a "forced" inspiratory effort with the mouth closed and nose plugged, the idea being that this should mimic an apneic event. If there is a dysfunction in the pharyngeal anatomy, soft palate, tongue, epiglottis or hyoid bon,e this can be evaluated on the film.[13]

Adenoid space is another finding that is visible in a child's lateral film. The range of adenoid hypertrophy blocking the epipharyngeal space can be anywhere from none to a near complete blockage.[8] Interestingly, many children with enlarged tonsils and adenoids seem to function without any breathing problems, whereas, the opposite is also true, that children with slight nasopharyngeal findings can suffer from severe obstruction.[3] With blockage of this part of the nasal airway, mouth breathing will be established with a clear predisposition to snoring, bruxism and other sleep-disordered problems. Harvold in 1981, and Behlfelt in 1989, clearly established the relation between mouth respiration and the development of malocclusion;[17,18] this is a further reason to attempt early diagnosis and necessary treatment in children. Developmental problems related to mouth breathing is not the scope of this writing, but is mentioned as a very important reason for early diagnosis.

Adenotonsillectomy, at present, seems to be an area where physicians and dentists need to have better agreement. In a study, between 1988-91, at the Fujita School of Medicine in Nagoya, Japan, 50 children where evaluated for obstructive sleep apnea. 54% were diagnosed as suffering from OSAS, the peak age was 4-5 years old, and twice as many males than females. The cause of OSAS in chil-

Figure 1. Zzzz Helper appliance, acrylic contact only in anterior area for parafunction control.

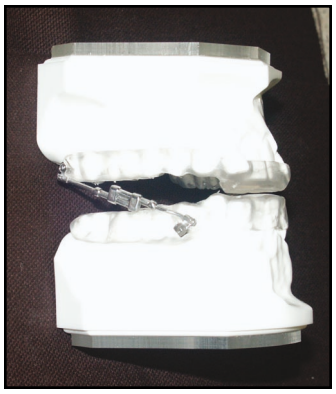


Figure 2. Mandibular repositioning for maximum airway improvement.

Figure 3. This is an inserted TAP (Thornton Adjustable Positioner) Appliance. This appliance was designed by Dr. Keith Thornton of Dallas, Texas. The titration assembly is protruding extra-orally. The TAP II is entirely intra-oral.

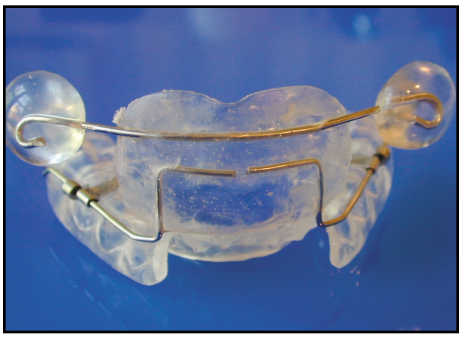


Figure 4. This is an OASYS appliance. This appliance was designed by Dr. Mark Abramson of Stanford. The appliance is titratable, and has the advantage of being readily used for patients with maxillary dentures.

dren is adenoid or palatine tonsil hypertrophy.4,[8] Even as far back as 1986 (Postic) found the daytime tiredness manifested by children with an upper airway obstruction was resolved after adenotonsillectomy. This same author points to the absolute need to substantiate an upper airway impairment with a thorough history and clinical examination, and not simply because the tonsils "look too big."[1] Elsherif in 1999 found a marked improvement in both daytime (sleepiness, noisy eating) and nighttime (snoring, mouth breathing, sleep apnea, choking and cyanosis) symptoms in children after adenotonsillectomy.[4] The 2003 study by Uruma et.al, also clearly demonstrated a marked improvement in clinical symptoms such as snoring, sleep apnea attacks and mouth breathing after adenotonsillectomy.[8]

Typically, when a patient is referred for Adenotonsillectomy it is assumed that the entire tonsils will be removed, but an alternative procedure called a Tonsillotomy is being employed. Tonsillotomy removes ~50% of the tonsil volume and its main benefit if post-surgical recovery. It also appears to resolve the upper airway obstruction as well as the complete removal method.[6,7] This method preserves the tonsillar capsule and avoids direct surgical exposure of the pharyngeal muscles, thus less pain and morbidity; the only contraindication noted is chronic tonsillitis. This last point may eliminate a great number of patients, thus still requiring the complete removal of tonsillar tissue.

The dental patient history and questionnaire should elicit responses to specific questions about sleep patterns that, coupled with a thorough clinical examination (dryness of the mouth, halitosis, tonsillar size, evidence of impaired nasal respiration, developmental abnormalities-long lower face, etc.), will help dentists treat patients with this potentially life threatening disease.

This questionnaire should include questions on snoring, night or daytime bruxism, episodes of breath cessation, kicking/moving around during sleep, choking/gasping, abrupt awakening form sleep, and excessive daytime sleepiness.[10] Another question should address nighttime sweating. Because acidification of the esophagus is related to breathing disturbances in adults, we recommend that this also be part of the questionnaire. Gastrointestinal reflux occurs when the acidic contents of the stomach chronically back-up into the esophagus setting up the potential risk of perforation; obesity is also linked to this syndrome.[12]

Sleep apnea is categorized as Central or Obstructive; this paper will describe only the obstructive type. Central Apnea occurs because of depressed central respiratory activity and is associated with patients that suffer from CHF. The treatment of choice for central sleep apnea is continuous positive airway pressure (CPAP). Nothing else will be said in reference to central apnea.

Obstructive Apnea has been treated with CPAP, uvulopalatopharyngoplasty (surgical removal of the soft palate and uvula) and through the dental professional involvement with some form of oral appliance that attempts to "open" the airway. Use of a mandibular repositioning appliance (MRA) is reversible, less complicated and more cost-effective than CPAP or UPPP.[15]

The efficacy and co-morbidity of intraoral appliances has been well documented by several studies. One of the documented positive side effects of an MRA is a lowering of high blood pressure in patients with OSAS, a similar result found with CPAP treatment.[22] Oral appliance treatment is better than control therapy (no treatment), and perhaps better than uvulopalatopharyngoplasty. Patients generally prefer an oral appliance, and such are recommended for mild to moderate OSAS;[23,24] yet the standard of care, if used, remains CPAP. Some of the adverse effects of an MRA, include masticatory muscle pain/discomfort, TMJ pain/discomfort, teeth discomfort, changes in occlusal contacts between the upper and

lower arches,[23,24] dry-mouth, hyper salivation, potential tooth fracture, gingival erosion; most of these, however, are transient and subside in most patients. The main problem in assessing oral appliance co-morbidity is that variations in design obscure the findings. Hoekema, clearly points to the need for controlled studies to address design, degree of mandibular advancement, and occurrence of adverse sequela.

Intraoral appliances vary in design significantly. An MRA should positively place the lower jaw in a predictable and maximally therapeutic position. Some[20] incorrectly call a maxillary flat splint an anterior repositioning appliance and then draw a general conclusion on the ineffectiveness of oral appliance therapy for sleep apnea treatment. An effective appliance for sleep apnea treatment should be able to move the lower jaw horizontally to attempt to open the airway, and not rotate the lower jaw clockwise with a resultant further closing of the pharyngeal space. The appliance described by the authors is a full occlusal coverage, "double arch" type, with the ability to provide for lateral movements to the lower jaw, and that is "titratable" (the position of the mandibular part can be changed either vertically or horizontally relative to the maxillary part). The reason a titratable appliance is desirable is that the ideal mandibular position is not known. It is suggested that as the mandible protrudes the upper airway widens.[17] The Tsuiki 2004 study clearly found that a titratable MRA had the positive effect of enlarging the velopharynx (the most collapsible part of the airway) and repositioning the soft palate, resulting in a reduction of the OSA severity.[17] The efficacy of an MRA seems to be related to the degree of anterior repositioning of the lower jaw. Nevertheless, many OSA patients will not be helped with an MRA, no matter what position their mandible is placed in.[23]

Another desirable characteristic is the ability of any effective obstructive sleep apnea appliance to prevent nighttime bruxism; therefore, this appliance should not have any posterior contact with any part of the device. The relation between bruxism and OSAS is not a definitive one; SB has a neurological as well as sleep disordered breathing associa-

Comparison Table:

	CPAP	ORAL APPLIANCE
POLYSOMNOGRAPHY	Yes	Yes
TYPE OSA TREATED	All	Mild and Moderate
EFFECTIVENESS	More predictable in some cases, titration done during polysomnography	Less predictable, titration done by Dr. or patient during treatment
COMPLIANCE	50 to 80 % of those prescribed will try; 45-70% percent of those who begin therapy continue regular usage.[25]	Over 90%
COST	More costly, but more likely paid by medical insurance	Variable cost, maintenance required, less likely paid by 3rd party
COMFORT/CONVENIENCE	Preferred by some, generally less convenient to wear, travel, requires electrical power.	Preferred by most, easy to insert and wear, easy to travel, requires no electrical power
SIDE EFFECTS	Lowers blood pressure, not as effective for snoring	Lowers blood pressure, very effective for snoring
MORBIDITY	Mask discomfort, claustrophobia, nasal mucosal dryness and irritation, difficulty breathing vs. air pressure, facial marking form strap	Tooth movement/soreness, occlusal changes, muscle/joint pain, hypersalivation at first then dryness
BED PARTNER/ROOM PARTNER PREFERENCE	Noise levels significant and "embarrassment" factor	No noise, less conspicuous, less body image adjustment
ORAL FACTOR	Can be used in edentulous cases	Requires suitable dentition
BRUXISM CONTROL	Not part of CPAP concept	Can be designed into MRA

tion. The relation between SB and OSAS is 32.7%,[24] and is significant enough to warrant designing an oral appliance that will help prevent this problem.

Most would agree the early diagnosis and treatment in children is desirable. Since the literature surveyed suggests a relation between Adenotonsillar hypertrophy and mouth breathing, and the latter with the development of malocclusion, it is reasonable to suggest that after adenotonsillectomy a child with the resultant malocclusion be evaluated for orthodontic treatment. Pirelli, et al, in 2004, recommends that Rapid Palatal Expansion (RPE) be considered as a useful treatment modality in dealing with abnormal breathing during sleep. The suggestion is that maxillary expansion has a direct positive impact on improving the nasal airway through a decrease in nasal resistance.[18]

If clear evidence of a severe dysfunctional airway is documented, a proper referral to an ENT physician, which has been interviewed by the dentist, should be initiated. This referral will accompany the dentist's clinical examination, and/or cephalometric airway evaluation and initial differential diagnosis. It is the individual professional judgment

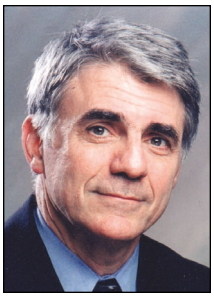
when to take impressions for a sleep apnea appliance for an adult or to begin some form of orthopedic/orthodontic treatment in a child, but it may be in everybody's best interest to gather all pertinent data prior to the initiation of upper airway obstruction treatment. If an MRA is the chosen treatment, it should be followed only after the severity of the apnea is diagnosed through polysomnography. Due to the increased use of oral appliances and the present medicolegal environment, it is advised that the treatment of OSAS should involve a multidisciplinary approach between the sleep specialist and a highly trained dental team. According to the American Academy of Sleep Medicine and the American Academy of Sleep Disorders, "management of sleep disorders by dentists needs to be done with sleep laboratory assessment of the frequency of sleep apnea-hypopnea index before and after treatment. Collaborative management with a physician is mandatory."[21]

Regardless of the differences between children and adults, most agree that the quality of life of someone that is not getting proper rest is adversely affected. There are definite mood and functional problems that both develop. If we consider quality of life important, then our treatment modality, be it CPAP, a Mandibular Repositioning Appliance or a combination of both, should provide a measurable improvement. The informed dentist can play a significant role in the initial diagnosis, the proper referral and in the likely supportive therapy of this population of patients.

References

1. Postic, P. William, MD, et.al, Relief of upper airway obstruction by adenotonsillectomy, *Otolaryngology Head Neck Surgery,* 94: 476, 1986.
2. Dundar, Ahmet, MD, et.al, Lingual Tonsil Hypertrophy Producing Obstructive Sleep Apnea, *Larygoscope,* 106: 1167-1169, 1996.
3. Laurikainen, E., MD, et.al, Sleep Apnea Syndrome in Children-Secondary to Adenotonsillar Hypertrophy? *Otolaryngology* (Stockholm), 1992, Supplement, 492:38-41.
4. Elsherif, Ibrahim, MD, DLO, FRCSI, Kareemullah, Chillem, MD, DLO, Tonsil and adenoid surgery for upper airway obstruction in children, *ENT-Ear, Nose & Throat Journal,* 1991, August, Vol 78, number 8, pp 617-20.
5. Marcus, Carole, MD, MBBCh, Obstructive Sleep Apnea Syndrome: Differences Between Children and Adults, *Sleep,* 2000, vol. 23, supplement 4, pp S140-41.
6. Densert, Ove, MD, et.al, Tonsillotomy in Children with Tonsillar Hypertrophy, *Acta Otolaryngologica,* 2001, vol 121, pp 854-58.
7. Koltai, J. Peter, MD, et.al, Intracapsular Partial Tonsillectomy for Tonsillar Hypertrophy in Children, *Laryngoscope,* 2002, August, vol 112, pp 17-19.
8. Uruma, Yoshiyuki, MD, et.al, Obstructive Sleep Apnea Syndrome in Children, *Acta Otolaryngologica,* 2003, supplement, 550: 6-10.
9. Flemons, W. W., MD, Measuring quality of life in patients with sleep apnea: whose life is it anyway?, *Thorax,* 2004, vol 59, pp 457-458.
10. Khoo, M. See, MD, et.al, Risk factors associated with habitual snoring and sleep disordered breathing in a multi-ethnic Asian population: a population based study, *Respiratory Medicine,* 2004, vol 98, pp 557-566.
11. Boland, L. Don, MD, et.al, Sleep Disordered Breathing is not Associated with the Presence of Microvascular Abnormalities: The Sleep Heart Health Study, *Sleep,* 2004, vol 27, No. 3, pp 467-73.
12. Berg, Soren, MD, et.al, Acidification of Distal Esophagus and Sleep-Related Breathing Disturbances, *Chest,* 2004, vol 125, pp 2101-2106.
13. Liao, Yu-Fang, DDS, et.al, Upper Airway and Its Surrounding Structures in Obese and Nonobese Patients With Sleep-Disordered Breathing, *Laryngoscope,* 2004, June, vol 114, pp 1052-1052-59.
14. Ghiassi, R., MD, Partridge, R. M., MD, Delays in diagnosis of ASAHS, *Thorax,* 2004, vol 59, 56-9.
15. Eskafi, Mahmoud, DDS, et.al, Use of mandibular advancement device in patients with congestive heart failure and sleep apnea, *Gerodontology,* 2004, vol 21, pp 100-107.
16. Tsuiki, Satoru, DDS, PhD, et.al, Effects of an anteriorly titrated mandibular position on awake airway and obstructive sleep apnea severity, *American Journal of Orthodontics and Dentofacial Orthopedics,* 2004, vol 125, pp 548-55.
17. Harvold, EP, Tomer, BS, Vargervik, K, Chierichi, G, Primate Experiments on Oral Respiration, *American Journal of Orthodontics,* April 1981, vol79, pp 359-72.
18. Pirelli, Paola, DDS, et al, Rapid Maxillary Expansion in Children with Sleep Apnea Syndrome, *Sleep,* 2004, vol 4, pp 761-66.
19. Behlfelt, K, et al, Dentition in Children with Enlarged Tonsils Compared to Control Children, *European Journal of Orthodontics,* November 1989, vol 11, pp 416-29.
20. Gagnon, Yves, DMD, et al, Aggravation of Respiratory Disturbances by the use of an Occlusal Splint in Apneic Patients: A Pilot Study, *International Journal of Prosthodontics,* 2004, vol 17, pp447-53.
21. Cistulli, PA, et al, Treatment of Snoring and Obstructive Sleep Apnea with Mandibular Repositioning Appliances, *Sleep Medicine Review,* December 2004, vol 8, pp 443-57.
22. Gotsopoulos, H, Kelly JJ, Cistulli, PA, Oral Appliance Therapy reduces blood pressure in obstructive sleep apnea: a randomized, controlled trial, *Sleep,* August 2004, vol 27, pp842-3.

23. Hoekema, A, et al, Efficacy and Co-Morbidity of Oral Appliances in the Treatment of Obstructive Sleep Apnea-Hypopnea: A Systematic Review, *Critical Review Oral Biological Medicine,* June 2004, vol 15, pp 137-55.
24. Kato, Takafumi, DDS, Sleep Bruxism and its Relation to Obstructive Sleep Apnea-Hypopnea Syndrome, *Sleep and Biological Rhythms,* Vol 2, pp 1-15.
25. Silber, Krahn, and Morgenthaler, *Sleep Medicine In Clincial Practice,* Taylor and Francis, UK, 2004. p 153



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