

Sleep Disorderd Breathing and the Emerging Role of a Pediatric Dentist: A Review

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ABSTRACT

Obstructive sleep apnea ,a disorder whose prevalence is linked to obesity in Western society mostly due to the rise in unhealthy eating habits and lack of movement. Sleep apnea is due to repeated episodes of upper airway obstruction during sleep that are caused due to elevations in upper airway collapsibility during sleep. Collapsibility can be increased by underlying anatomic alterations and disturbances in upper airway neuromuscular control, both of which play important roles in the pathogenesis of obstructive sleep apnea. Obesity in particular is on a rise in children ,central adiposity is a major risk factor for sleep apnea. A variety of behavioral, pharmacologic, and surgical approaches to weight loss may be of benefit to patients with sleep apnea, through distinct effects on the mass and activity of regional adipose stores. This article reviews, SDB in children with common symptomatic presentations, and current treatment options that exclude surgical and pharmacological approaches and include dental appliances in moderate cases.

KEYWORDS:Sleep Disorderd Breathing, Obstructive Sleep Apnea , Oral Appliances

INTRODUCTION

Sleep-disordered breathing (SDB) includes obstructive sleep apnea (OSA) and upper airway resistance syndrome (UARS). OSA is defined as a disorder of breathing during sleep characterized by prolonged partial upper airway obstruction, intermittent complete or partial obstruction (obstructive apnoea or hypopnoea) or both prolonged and intermittent obstruction that disrupt normal ventilation during sleep, normal sleep patterns or both^{1,2}. It is taken into consideration that an apnoea-hypopnoea index greater than 1 is abnormal in a child^{2,3}. The International Classification of Sleep Disorders 2nd edition (ICSD 2) defines apnoea as a cessation of airflow over two or more respiratory cycles². A specific time in seconds is not applicable to children as normal respirations vary from 12 breaths per minute in an adolescent up to 60 breaths per minute in a newborn.

EPIDEMIOLOGY

Obstructive sleep apnoea has a prevalence of 0.7% to 1.8% in the pediatric population

The condition can be difficult to diagnose clinically . mild to moderate obstructive sleep apnoea cases can result in adverse neurobehavioural consequences and negatively affect the quality of life⁴. Males and females are affected equally⁵.

Medical conditions which increase the risk of developing SDB compared to the general population include obesity (including Prader- Willi syndrome), syndromes with

midface hypoplasia (e.g., Pierre Robin sequence, Treacher Collins, Crouzon syndrome),large tongue (e.g., Trisomy 21, Beckwith Wiedeman syndrome) and neuromuscular disorders (e.g., cerebral palsy and myotonic dystrophy)⁴

PHYSICAL SYMPTOMS

The Patient tends to be obese , failure to thrive, hypotensive. Neck circumference more than 40 cm increases the risk⁶. Nasopharynx shows enlarged turbinates and adenoids..the Patient is a mouth breather , shows increased facial height leading to adenoid facies which comprises of poor maxillary development , high arched narrow palate and crossbite.

CLINICAL SIGNS

3 major differences between SDB in children compared to adults:

1. Children's varied presentation is the main reason for difficult diagnosis as a constellation of symptoms defines SDB.
2. Unlike adults, daytime sleeping is more common in children. Only 7% of children with SDB present to the physicians with daytime sleepiness.⁶
3. Symptoms change with age. Some symptoms such as snoring and night time awakening may be present at any age. Habitual snoring is mostly present in 10% of children.⁷

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DIAGNOSIS

The Gold standard for SDB is laboratory polysomnography⁸ which includes EEG leads, electroculogram, EMG, nasal pressure thermister, ECG, pulse oximetry, chest and abdomen excursion belts, plethysmography, transcutaneous CO₂, oesophageal manometry and audio-video taping.⁹

TREATMENT OPTIONS

Treatment options include:

I) SURGICAL

- 1) Adenectomy
- 2) Adenotonsillectomy
- 3) UPPP (Uvulopalatopharyngoplasty)
- 4) UPPGP (Uvulopalatopharyngoglossoplasty)
- 5) Laser midline glossectomy (LMG)
- 6) LAUP (laser assisted uvuloplasty)
- 7) Orthognathic surgeries like-
 - a) mandibular advancement
 - b) genial advancement
 - c) genial advancement with hyoid myotomy and suspension
 - d) maxillo-mandibular advancement
 - e) mandibular setback

II) CPAP (CONTINUOUS POSITIVE AIRWAY PRESSURE)

III) BEHAVIOUR MODIFICATION

IV) ORAL APPLIANCES

ORAL APPLIANCES: An oral appliance is a small acrylic device that fits over the upper and lower dentition or tongue (similar to an orthodontic retainer or mouth guard). This device slightly advances the mandible or tongue, which moves the base of the tongue forward and opens the airway. This improves breathing and reduces snoring and apnea. This appliance is fabricated and customized for each patient by a dentist experienced in the treatment of snoring and sleep apnea. The appliances are comfortable and well tolerated by the patients. They are easy to place and remove, easy to clean and are convenient for travel.

Indications for Oral Appliance Therapy⁵: The American Academy of Sleep Medicine has stated that oral appliance is indicated as a first line of or treatment of choice for patients with primary snoring and/or mild obstructive sleep apnea and as a second line of treatment option for patients with moderate or severe sleep apnea who cannot tolerate CPAP and/or are not good candidates for surgery.

Therefore, oral appliance therapy is indicated for:

- Primary/heavy snoring
- Mild or moderate sleep apnea
- Poor tolerance of nasal CPAP
- Failure of surgery
- Use during travel
- In combination with nasal CPAP
- Effectiveness of Oral Appliances

Research evidence shows that oral appliances are effective in treating snoring in 85-90% of the patients. The mandibular advancement devices are effective in normalizing the apnea levels in 75% of the patients with mild sleep apnea (5-20 events/hr.), 60% effective for patients with moderate sleep apnea (20-40- events/hr.) and 40% effective for patients with severe sleep apnea (more than 40 events/hr.). Patients with moderate or severe sleep apnea must have a follow-up sleep study, while using the oral appliance to confirm the effectiveness of the device and a consultation with the sleep medicine physician to discuss the results⁶

Types of Oral Appliances:

The five main categories of oral appliances currently in use are the :

- Mandibular Advancement Devices (MAD)
- The Tongue Retaining Devices (TRD)
- Soft Palate Lifters
- Tongue Trainers
- Oral appliances in combination with CPAP known as OPAP.

The mandibular advancement devices are custom-fabricated for each patient. The device is made of a special heat-sensitive acrylic material that will fit comfortably, over the upper and lower teeth and it will hold the lower jaw slightly forward. This will advance the tongue and soft tissues of the oropharynx to open the airway and restore normal breathing during sleep. The MADs have an adjustment mechanism built into the device that allows the patient to gradually change the position of the mandible under the dentist's supervision to improve the effectiveness of the device. Since the appropriate jaw position to achieve success with treatment is unique to each patient this is a very valuable feature. The tongue retaining device is custom-made using a softer, pliable material with a compartment that fits around the tongue to hold it forward by means of suction. This device is used most for patients with dentures or patients who cannot adequately advance their lower jaw. The patient must be able to breathe well through their nose or they may have difficulty tolerating this appliance.¹⁰

Samples of Available OA: The choice of which appliance will be used for each patient is based on some factors.

These factors include :

- Severity of the apnea condition,
- Patient's bite and jaw structure,
- The size of the tongue and soft palate,
- The presence of tooth clenching or grinding,
- jaw range of motion,
- health of teeth and gums, etc

We as pediatric dentist will use our experience and expertise to help guide the patient to using the appliance that will be most comfortable and effective for that given situation. We have used many different appliances over the past several years, but most frequently used include:¹⁰

**TYPE- MANDIBULAR REPOSITIONER,
COMMON NAME – Somnomed, MAS™**

The SomnoMed MAS™ is an oral appliance, which fits over the upper and lower dentition, much like a sports mouthguard. Unlike a sports mouthguard, however, it is a precisely-made, clinically-tested medical device, which is highly effective (in most cases) in preventing snoring and mild to moderate obstructive sleep apnea.¹⁰

The medical term for your lower jaw is ‘mandible’ and an oral appliance is worn over the teeth is a ‘splint’, hence the name SomnoMed Mandibular Advancement Splint, or SomnoMed MAS™.¹⁰



Fig: 1 Mandibular Repositioner – Somnomed, Mas™

**TYPE- MANDIBULAR REPOSITIONER,
COMMON NAME - Klearway™**

This is a thermoplastic appliance which must be heated in water every night (for making it flexible) before it is placed in the mouth. It allows for some side-to-side movement of the mandible and limited opening, so that water can be sipped without removal of the appliance.¹¹ The adjustment slot is on the roof of the mouth and it takes some time to get used to swallowing with material in that location. The patient is able to adjust the mandible forward in very tiny 25 mm increments. The appliance is completely contained within the mouth, and though it makes the lips look puffed up, it is completely hidden when in use.¹¹



Fig: 2 Mandibular Repositioner - Klearway™



Fig:3 - Mandibular Repositioner - Klearway™

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**TYPE- MANDIBULAR REPOSITIONER,
COMMON NAME – Thermoform Herbst™ ,
Modified Herbst™**

This is a hard plastic appliance which has the adjustment slot set on the cheek side of the molars. It prevents side-to-side motion, but since the mandible is held closed with small orthodontic rubber bands, opening the jaws is fairly easy.¹² The modified Herbst is smaller than most appliances and has a long life span. It allows jaw movement in all directions but backwards. The patient can take medications, use an inhaler (asthma) or talk with this appliance in place. This appliance can be fabricated out of material that has no methylmethacrylate and is thus safe for patients who are sensitive to this material. The modified Herbst is one of the ‘yardsticks’ used by other appliances seeking FDA acceptance. Bruxist who severely grind their teeth at night can crack this appliance.¹²

**TYPE- MANDIBULAR REPOSITIONER,
COMMON NAME - E.M.A.™ (elastic mandibular
advancement)**

The E.M.A. is the thinnest and least bulky of all the appliances. It is similar to clear acrylic orthodontic retainers, and the ‘slot’ is located to the cheek side of the molars, consists of specially designed, patented elastics. This appliance moves the jaw forward in fairly significant steps, it may be difficult to tolerate.¹² Some care must be taken to avoid breaking the lower portion when replacing the elastics. The EMA is well tolerated by bruxist. It has

no metal and can be used by patients with a nickel metal hypersensitivity.¹²

**TYPE- MANDIBULAR REPOSITIONER,
COMMON NAME – PM POSITIONER (fixed and adjustable)**

Adjustable PM Positioner is a custom-fabricated appliance constructed of a heat-sensitive acrylic that fits over the upper and lower teeth. The appliance is comfortable on the teeth and leaves additional space for the tongue compared to other devices. It allows a small amount of jaw movement (4mm) so that the patient does not feel "locked into position".¹³ The adjustment slots are on the cheek side of the appliance near the molars and allows for easy advancement of the jaw, to improve effectiveness of the device when it is indicated. This appliance is used most frequently because of its ease of use, effectiveness and durability.¹³

Silent Nite, SnoreAid and Therasnore are other appliances currently used. The Silent Nite is a smaller appliance that is very comfortable to wear and can be effective for patients who are primarily snorers or suffer from mild apnea.¹³ However they are less durable and have much less adjustability. The SnoreAid and Therasnore appliances can be fitted the day of the appointment, which is a great option for patients who need the appliance immediately. However these devices are less durable and the Therasnore is bulky/heavier in comparison to other appliances.¹³

The Adjustable PM Positioner, TAP Plus and Tongue Retaining Device are all FDA accepted for snoring and sleep apnea. The Silent Nite, SnoreAid and the Therasnore are FDA accepted for snoring only.¹³

**TYPE- ORAL APPLIANCE IN COMBINATION
WITH POSITIVE AIRWAY PRESSURE.
COMMON NAME – TAP III PRO^C, THORNTON
ANTERIOR POSITIONER.**

TAP Plus is also a custom-fabricated appliance that is made of a heat-sensitive acrylic that has a separate upper and lower portion that is connected in the front of the device by a hook and bar assembly. This device is comfortable on the teeth and allows adequate freedom of movement of the jaw.¹⁴ Therefore it is used frequently for cases who tend to grind their teeth heavily. Since the position of the jaw can be adjusted while the appliance is in place, it is also used for patients who have a different jaw structure that would require that feature.¹⁴ As mentioned the front assembly is located near the tip of the tongue and it projects between the lips, so it may take a little bit more time to adapt to the device. However, most patients find it to be comfortable on adjustment (within the first 5-10 days).¹⁴

**TYPE- TONGUE RETAINER, COMMON NAME-
SUAD^C, AVEO TSD^c**

Tongue Retaining Device (TRD) is a custom-fabricated appliance made of a soft, pliable material that has a compartment in which the tongue is held by means of suction. This appliance is most frequently used for

patients who are edentulous or partially dentulous.¹⁵ The TRD may require some time for the patient to adapt to having their tongue held in place, so a tongue exercise and adaptation schedule is started a few weeks before the date of insertion of the device. This appliance may be difficult to tolerate if the patient has trouble breathing through their nose.¹⁵

The potential side effects that can be more problematic include⁵:

- Jaw muscle or joint pain
- Permanent changes in the bite
- Slight movement of teeth
- Loosening of dental restorations (crowns, bridges, etc.)

From the research evidence and our clinical experience, jaw muscle and joint pain occur in approximately 10% of the cases and the pain will disappear when the patient discontinues use of the appliance. However, the pain can return for these patients when they start wearing the appliance again. Changes in the occlusion can occur for about 20% of the patients.⁵ Although the changes may be slight it may still be difficult for the patient to close their molars together and this may have an effect on their ability to chew effectively. The slight movement of teeth and loosening of dental restorations occurs very infrequently (1% of the patients) but is still worth noting.⁵

DENTAL CONSIDERATION

- Apnea is aggravated by sedation
- Surgical extraction of teeth needing a reflection of the flap predisposes to subcutaneous emphysema on using CPAP, hence avoid raising of the flap in OSA with CPAP.
- GERD is associated with enhanced diaphragm excursion tends to scar the soft palate leading to further decrease in size of the airway
- Xerostomia is a side effect of many drugs like anticholinergics and antidepressants prescribed in conditions like ADHD, an alternative to this is the use of artificial saliva.
- Fluoride applications and maintenance of good oral hygiene decrease caries.
- Maximum occlusal splints have found to aggravate respiratory disturbance hence pediatric dentist should question their patients about OSA before fabrication of night guards or TMJ splints.

CONCLUSION

The use of OA therapy for the management of SDB is recognized and often accepted as the appropriate treatment in mild to moderate conditions. It is an alternative to the surgical approach. These appliances help the patient sleep better, feel more alert and energetic. A pedodontist in order to offer this service in his/her clinic need not embark on any additional education practice. The exciting aspect to this field is an improvement in the patients overall health and quality of life.

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