

## DENTAL CONSIDERATIONS FOR UPPER AIRWAY SLEEP DISORDER PATIENTS

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**ABSTRACT:** Sleep disorders are becoming a common medical problem. Multiple treatment options have been advocated including the use of dental devices. Dental practitioners becoming a part of the treatment team is again a problem because of the wide variety of dental devices available and the rapid advancement in the understanding of the disease. This article reviews the anatomy, physiology, etiopathogenesis of obstructive sleep apnea (OSA) and various medical and dental treatment options.

**KEYWORDS:** Obstructive Sleep Apnea, Snoring, Tongue Retaining Device (TRD), Mandibular Advancement Device (MAD)

### INTRODUCTION

Sleep disorders of the upper airway are generally the result of a condition or disease that causes partial or complete obstruction of the airway when the patient assumes a supine position and goes to sleep<sup>1</sup>.

- Snoring is the mild form of these disorders
- Obstructive sleep apnea (OSA) is the severe form
- Upper airway resistance syndrome (uars) falls somewhere between the two.

With the advancements in design and treatment of oral sleep appliances — and in combination with the high rejection rate of the continuous positive airway pressure (CPAP) — dentistry has moved to the head of the line in providing the most widely accepted treatment for obstructive sleep apnea and snoring.

#### Anatomy

In the normal anatomy, the upper airway is a soft tissue tube, maintained by muscle activity extending from the oral and nasal cavities to the bronchial tubes. The activity and timing of the tensor veli, levator veli palatine, genioglossus and geniohyoid muscles maintain the position of the soft palate, uvula, tongue and hyoid bone in a position away from the posterior wall of the pharynx.

Hence, airway patency is maintained by muscle activity, not bony structures<sup>2</sup>.

#### Snoring

The airway of snoring patients, though patent, is partially obstructed. This obstruction is very often caused by the tongue and/or hyoid bone and overlying soft tissues dropping back toward the posterior wall of the pharynx when the patient assumes the supine position and goes to sleep. In attempting to get sufficient oxygen to the lungs, there is increase in the velocity of air passing through the reduced airway space. This increase in velocity may cause flabby tissue, often the soft palate and/or uvula, to vibrate. This vibration is the sound of snoring<sup>3</sup>.

#### Obstructive sleep apnea

Obstructive sleep apnea patients have an almost completely or completely obstructed upper airway. These patients may suffer from hundreds of apneic events per night, which by definition are blockages of the airway lasting more than 10 seconds (american sleep disorder association, 1997) resulting in multiple arousals. These arousals cause loss of both quality and quantity of sleep, often resulting in daytime sleepiness, loss of productivity,

increased auto accidents, loss of cognition, and other symptoms<sup>2,3,4</sup> ( Fig.1)

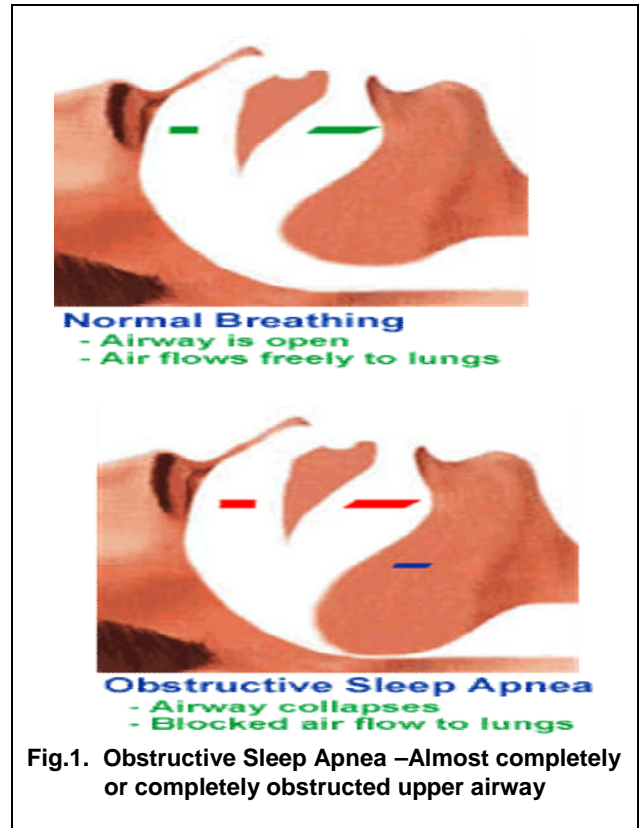
This obstruction may be caused by many conditions –

- The tongue or hyoid bone and covering tissues dropping back towards or against the posterior wall of the pharynx.
- Inflammation of any soft tissue around the airway, including the tonsils, adenoids, or epiglottis.
- Tumors
- Obesity
- Structural compromise

**Diagnosis**

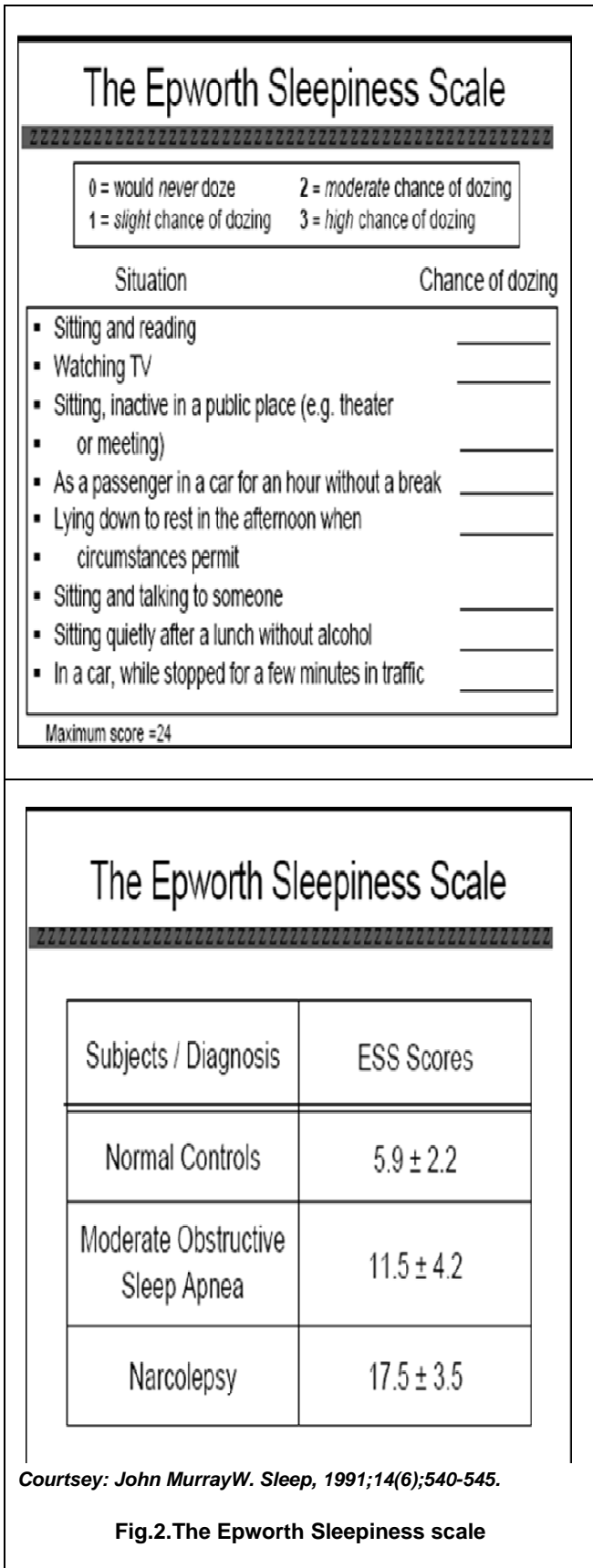
- A polysomnogram (sleep study) performed by a sleep lab is required to diagnose a upper airway sleep disorders (UASD) and determine its severity (brown, 1994)
- Patients often snore only while sleeping on their backs. Devices are available to aid in preventing a patient from sleeping on the back, and at times something as simple as pinning a rolled pair of socks to the back of pajamas may work.
- Other devices like wrist-watch like devices that detect the sound of snoring and vibrate to awaken the patient. This may reduce the snoring and help the bed partner, but would not provide the patient with good quality sleep.
- Epworth sleepiness scale (ESS) introduced by John Murray ( Fig.2) may also be beneficial in identifying potential UASD patients). The ESS places patients in 8 situations and asks patients to give themselves points based on how likely they would be to doze in those situations. This survey is a subjective patient evaluation, not a diagnostic instrument, and so subject to bias and falsification.
- Tongue size and amount of space between the soft palate and tongue are objective evaluations that may help identify a compromised airway or be useful in determining the type of device most suitable for a patient. An excessively large tongue may eliminate any device whose design impinges on the tongue space. All oral devices presently used to treat UASDs potentially place significant forces on the dentition, periodontium, and/or temporomandibular joint. Therefore, a baseline evaluation of these structures is required to provide historical data if problems develop later.
- All dental devices are intra-oral and therefore require a certain amount of space and movement of the mandible or tongue. Knowledge of the maximum protrusive movement and the amount of vertical clearance will be necessary when using these oral devices.

- Other important information to have available is whether the patient is presently undergoing or will soon undergo active dental care. An intra-oral device may be totally unusable to a patient if a fixed partial denture or other restorative procedure is completed following insertion of the device. If possible, fabrication of dental devices should be delayed until significant active dental care has been completed. However, it is possible to relines some of the devices in situations in which unanticipated dental care renders the device unusable.



**Common signs and symptoms of an average upper airway sleep disorder patient (middle age to elderly male)<sup>5</sup>**

- Hypertensive
- Overweight
- Has large neck
- Consumes alcohol late in the day
- Has been told he stops breathing during sleep
- Does not get adequate amount or quality of sleep
- Is tired and dozes during the day
- Is accident prone
- May awaken from sleep gasping for air
- Suffers from reflux
- Often is retrognathic



**Treatment options**

Five basic treatment options<sup>2,5,6</sup> -

1. Behavioral modification
2. Surgery
3. Continuous positive airway pressure (CPAP)
4. Oral devices
5. Medication

**1. Behaviour modification** - it is possible to correct snoring and OSA problems by behavioral modifications such as change of sleep position, weight loss, and reducing alcohol or sedative usage<sup>7</sup>.

- Obesity is a common symptom of OSA. As weight increases, fat is deposited in the tongue, soft palate, surrounding pharynx resulting in decreased airway (horner et al 1989). Male patient with 17 inch or greater and female patient with 16 inch or greater neck circumference should be suspected of having OSA, (davies and stradling 1990).
- Cartwright suggested that a change in sleep posture from supine to lateral position could reduce airway collapse. In supine position during rem sleep, gravity and the reduced tone of genioglossus muscle increases the possibility of obstruction.
- Hypertension is a common finding in UASD patients.

**2. Surgery** - often in the form of -

- Uvulopalatopharyngopalasty<sup>8</sup> (UPPP)
- Laser-assisted UPPP<sup>9</sup> (LAUP)
- Tonsillectomy
- Adenoidectomy
- Tracheostomy
- Mandibular advancement
- Hyoid bone lift
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**3. Continuous positive airway pressure (CPAP)** – is the gold standard for treating OSA patients, but may be excessive treatment for many snoring patients. ( Fig.3.). CPAP is a treatment modality that utilizes a pump forcing presurgical room air through a mask through the patient’s nasal cavity and upper airway<sup>10</sup>.

**Disadvantages:**

- a) Suffers from poor patient compliance because of lack of portability
- b) Noise of motor in the bedroom
- c) discomfort of wearing a mask while trying to sleep (hoffstein et al, 1992).

**4. Medications** – have proven to be of minimal benefit to the patient and are often not used.



Fig.3 Continuous Positive Air Pressure (CPAP)

5. **Oral devices** – oral devices generally work by directly or indirectly preventing the tongue from approaching the posterior wall of the pharynx and hence compromising the airway space. These devices are extremely useful in treating snoring only patients. Patient compliance with oral devices is better than with CPAP.

Two basic configurations –

- a) Tongue retaining device (TRD)
- b) Mandibular advancement device (MAD)

a) **Tongue Retaining Device (TRD)**<sup>11,12</sup>

- The TRD (professional positioners, racine, wi) is an excellent device for edentulous patients or those who suffer from temporomandibular joint sensitivity (**Fig. 4**).
- This is one-piece device made of a non-rigid vinyl material without thermoplastic material to adapt to the teeth<sup>13,14</sup>.
- The TRD is laboratory fabricated.
- Works through the use of a hollow bulb and sufficient vacuum to hold the tongue forward<sup>14</sup>.

b) **Mandibular Advancement Device (MAD)**<sup>15,16</sup>

- Works indirectly by holding the mandible and hence the tongue forward (**Fig. 5 A and Fig. 5 B**).
- These devices also aid in preventing the hyoid bone from dropping posteriorly and its overlying tissues from impinging on the upper airway.
- MADs are either adjustable or single position devices.

- Single position MADs depend upon the clinician properly determining the protrusive position that will eliminate snoring and/or OSA, but at the same time will not cause tmj discomfort.
- MADs may be stock devices or laboratory fabricated.
- MADs are generally hard plastic-impression tray shells filled with a thermoplastic retentive material<sup>17,18,19</sup>.
- One-piece devices usually fit over both the maxillary and mandibular arches simultaneously and may or may not allow movement between them.
- Two-piece devices consists of separate maxillary and mandibular trays that fit over their respective teeth individually and allow movement between the arches.
- Most MADs depend upon excellent retention to the remaining teeth and use a thermoplastic fill material to provide the necessary retention, to allow custom fitting to the teeth and to readapt the device to the teeth if the retention is lost.

**Benefits of dental devices**<sup>20,21</sup>

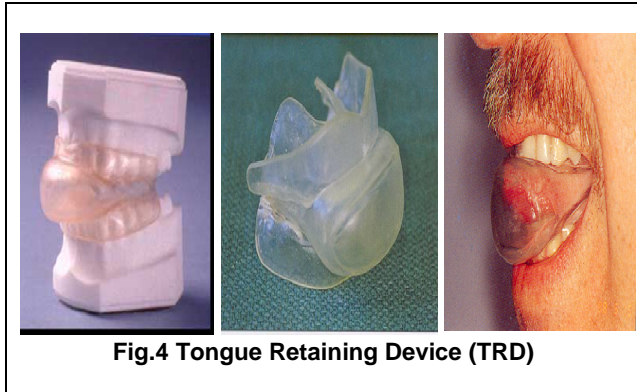
- a) Significant reduction in apneas for those with mild-to-moderate apnea, particularly if patients sleep either on their backs or stomachs. They do not work as well if patients lie on their side. The devices may also improve airflow for some patients with severe apnea.
- b) Improvement in sleep in many patients.
- c) Improvement and reduction in the frequency of snoring and loudness of snoring in most (but not all) patients.
- d) Higher compliance rates than with CPAP.

**Disadvantages of dental devices**<sup>21,22,23</sup> - dental devices are not as effective as CPAP therapy. the cost of these devices tends to be high. side effects associated with dental devices include:

1. Nighttime pain, dry lips, tooth discomfort, and excessive salivation. In general, these side effects are mild, although over the long term they cause nearly half of patients to stop using dental devices. Devices made of softer materials may produce fewer side effects<sup>24</sup>.
2. Permanent changes in the position of the teeth or jaw have occurred in some cases of long-term use. Patients should have regular visits with a health professional to check the devices and make adjustments.
3. In a small percentage of patients, the treatment may worsen apnea.

c) **Orthodontic treatments**<sup>25,26,27</sup>

An orthodontic treatment called rapid maxillary expansion, in which a screw device is temporarily applied to the upper



**Fig.4 Tongue Retaining Device (TRD)**

teeth and tightened regularly, may help patients with sleep apnea and a narrow upper jaw. this nonsurgical procedure helps to reduce nasal pressure and improve breathing.

#### Recalls

Recalls are necessary, as a minimum, at 2 weeks, 1 month, and then every 6 months. Because many of these oral appliances are retained tightly by the remaining dentition and place almost orthodontic like forces on the teeth, frequent and timely recalls are absolutely necessary<sup>28,29,30,31</sup>.

#### CONCLUSION

The dental community is responsible for the recognition of possible UASD patients, referral to a physician for diagnosis and treatment, and supporting the physician when requested. UASDs are potentially life-threatening medical problems, and therefore all snoring or UASD patients must be referred to a physician with expertise in sleep disorders prior to initiation of any oral device to treat these disorders.

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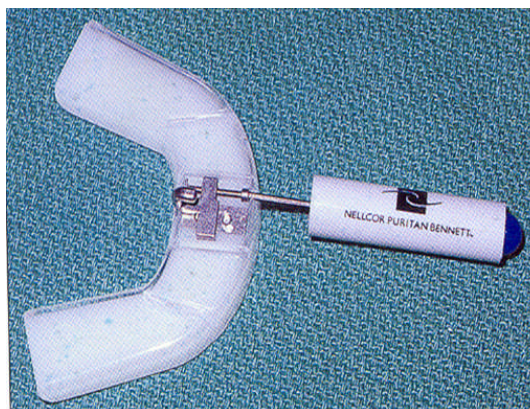
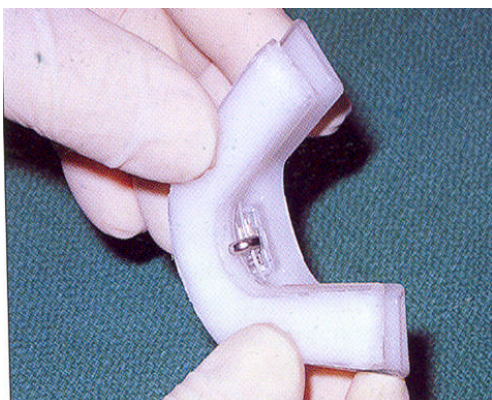


Fig.5 (a,b) Mandibular Advancement Device (MAD)

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