

# THE MANY FACES, EFFECTS, AND TREATMENTS OF SLEEP DISTURBED BREATHING

---

DR CATHERINE ZACAL, HON BSC, DDS, QD

**DISCLOSURE:**

CANDIDATE FOR THE AMERICAN ACADEMY OF DENTAL SLEEP MEDICINE DIPLOMATE (AADSM) EXAM, JAN 2026



# LEARNING OBJECTIVES:

---

- To recognize the lesser prominent obstructive sleep apnea comorbidities
- To identify advantages / disadvantages/ differences between CPAP versus OAT
- To understand the spectrum of sleep disturbed breathing
- To appreciate the complementary nature of oral appliance therapy in the treatment of OSA and understand the workflow of offering this treatment

**QUEBEC:** DENTAL STUDENTS 6 HOURS OF DSM + 40 HOURS  
REQUIRED OF CE BEFORE CAN DELIVER ORAL APPLIANCE THERAPY

---

**ONTARIO:** 0 hours of DSM in dental school

- 2012 Canadian DSM guidelines: obtain continuing education/ AADSM
- RCDSO: yet to implement DSM curriculum (Alberta has a DSM post graduate course but not specialty)
- Very few dentists are providing OAT (due to nature of the delivery model – fam physician collaboration, paperwork, follow up – “if it were easy everyone would be doing it”)



# COLLABORATION: MEDICAL AND DENTAL, FOR BEST PATIENT CARE



## Scope of Practice

Dental sleep medicine is an extension of general dentistry with a specific concentration on providing treatment for adult patients who have been diagnosed with sleep-disordered breathing, including obstructive sleep apnea (OSA), snoring and sleep-related bruxism. Dentists who wish to extend their practice to include dental sleep medicine must be committed to advancing their knowledge, technical expertise, and clinical skills in the specific areas of OSA, snoring and sleep-related bruxism. Dentists who hold the designation of “Qualified Dentist” or “Diplomate of the American Board of Dental Sleep Medicine” are deemed qualified to screen for OSA, snoring and sleep-related bruxism; obtain a detailed medical history; conduct a physical examination; and treat, educate, and provide long-term management of patients who are diagnosed by a physician with either OSA, snoring or sleep-related bruxism.

# WHAT IS SLEEP APNEA

## TYPES OF SLEEP APNEA

### Obstructive Sleep Apnea

It is caused by a blocking of the airway when the soft tissue inside the throat collapses during sleep.

### Central Sleep Apnea

In this case, the brain is prevented from signalling the muscles to breathe, due to instability in the respiratory tract.

### Complex Sleep Apnea

It is defined as a condition occurring in patients who primarily have obstructive sleep apnea or mixed sleep apneas.



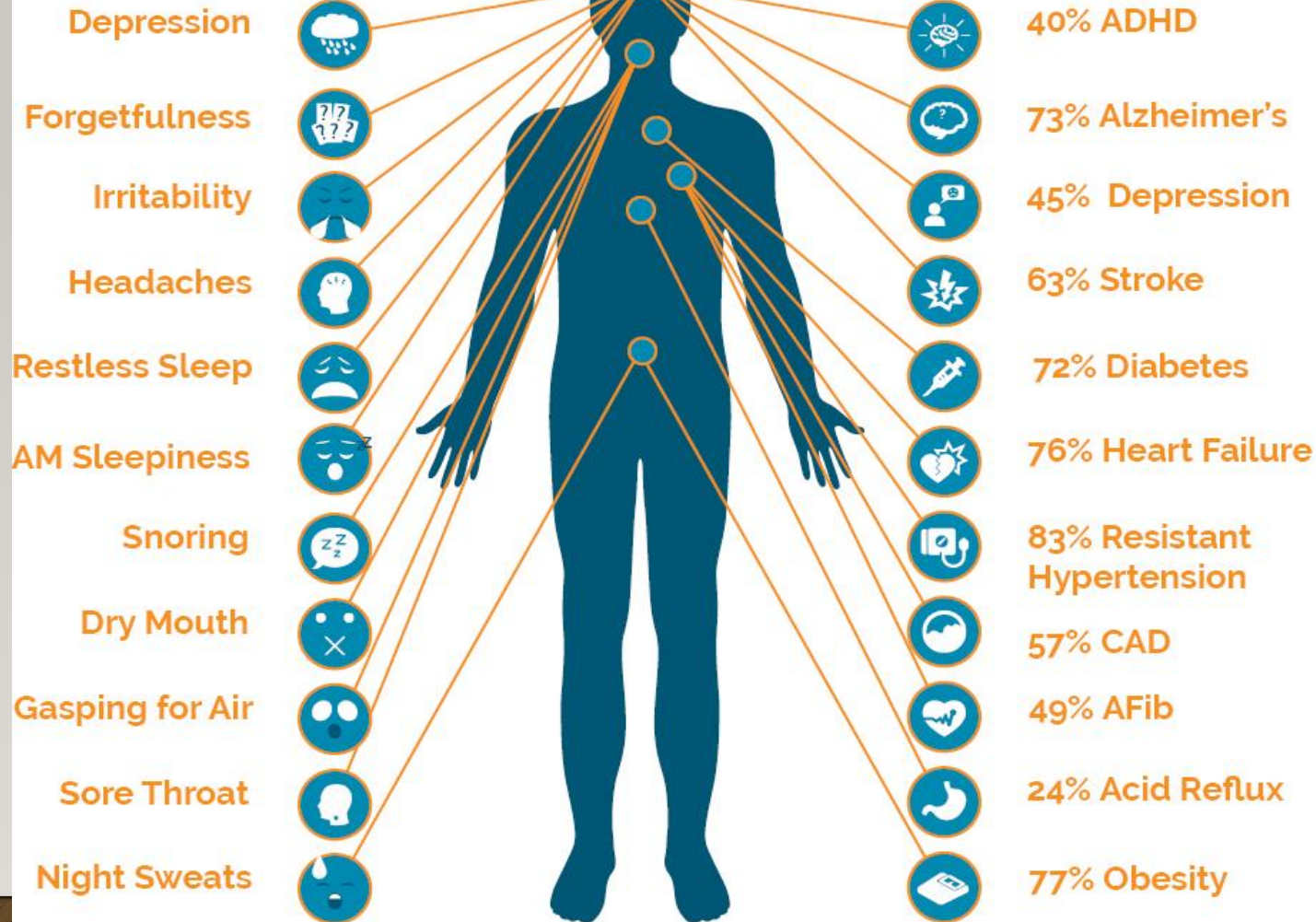


# Obstructive Sleep Apnea (OSA)

## Common Symptoms & Associated Conditions

Symptoms of Sleep Apnea

Prevalence of Sleep Apnea



**HOW MANY  
OF THESE CAN YOU  
FIND THAT COULD ALSO  
BE**

---

**MENOPAUSE SYMPTOMS  
AND CONDITIONS?**  
(IN MENOPAUSE WOMEN CATCH UP TO MEN  
IN PREVALENCE OF OSA)

# EFFECTS OF OBSTRUCTIVE SLEEP APNEA: TWO MECHANISMS OF ACTION

1. **HYPOXIA** EFFECTS  
obstructive tendencies



2. **INTERRUPTED SLEEP** EFFECT  
upper airway resistance UARS tendency

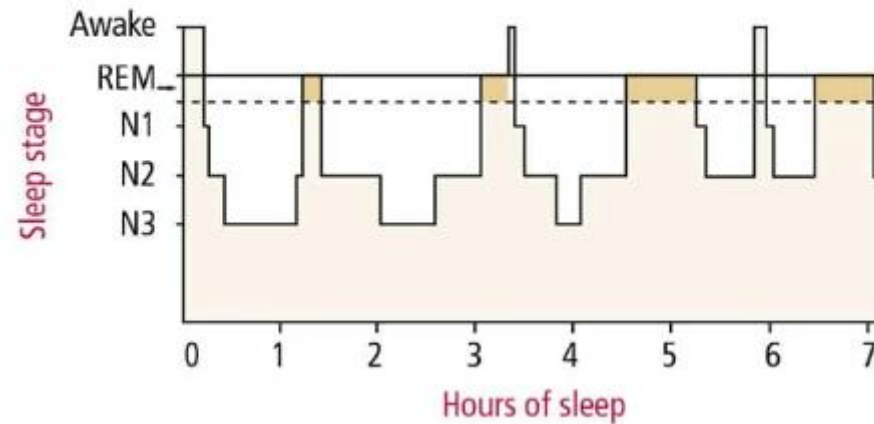
- 
- Hypoxia due to **physical/ anatomic obstruction** or Central apneas
  - Physical effects: pressure build up on cardiovascular system, GI system: nocturia, hypertension, stroke, acid reflux, morning headaches (hypoxia), afib, aortic dissection
  - Physical (dental) effects: clenching (1000 psi), grinding (headaches, TMJ), combination, erosion/acid reflux, broken teeth & titanium implants, tooth necrosis, response is jaw position moved anteriorly to open airway
  - DURATION of the hypoxia is more significant than the number of hypoxic events (AHI) for the amount of damage
  - **Repeated Interruption of sleep architecture**; unrefreshed, daytime sleepiness (Epworth scale)
  - Full or partial arousal as a response to needing to take a breath – not aware what is causing the awakenings, insomnia, hypopneas
  - **HYPOXIA/ INTERRUPTED SLEEP ALSO AFFECTS:**
    - Hormones (diabetes, fertility, ED)
    - Cognitive, Anxiety/ depression, ADHD (alzheimers, mood, sympathetic nervous system – heart palpitations)
    - Metabolic syndrome: obesity



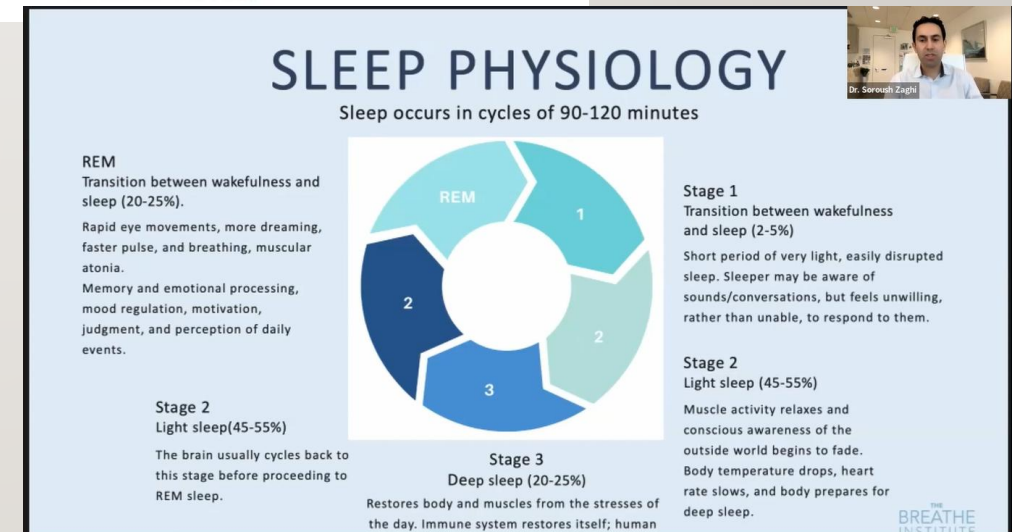
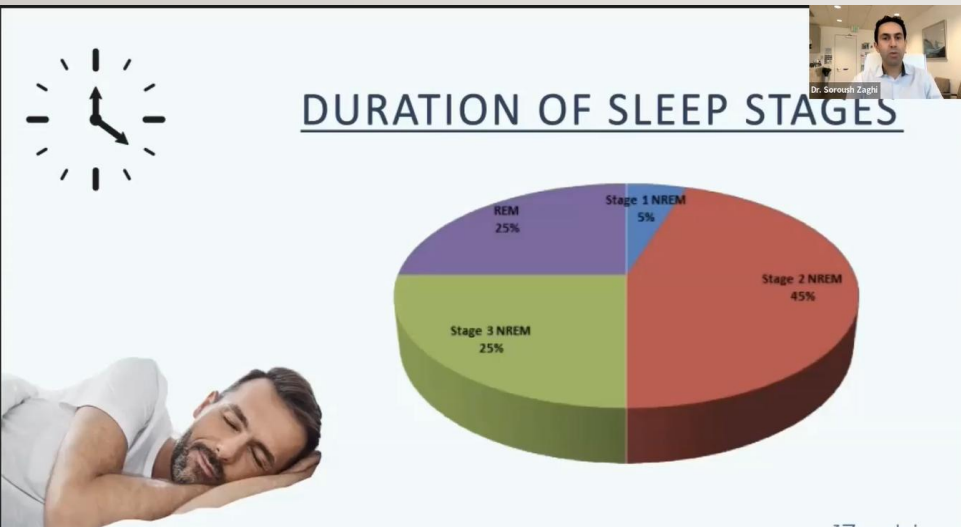
# SLEEP STAGES AND SLEEP ARCHITECTURE

Airway most collapsible during rem,  
(rem sleep is important for ptsd  
processing)

Figure 2: Sleep architecture



N3 sleep: the  
time when the  
glymphatic system  
clears away  
amyloid protein  
from the brain



COURTESY OF DR S. ZAGHI



# THE NEW FACE OF SLEEP APNEA: NOT THE STEREOTYPICAL OVERWEIGHT, OLD MALE

---

HOWEVER THE STIGMA HAS BEEN INGRAINED INTO SOCIETY  
(COURTESY OF STOP-BANG) “I CANNOT HAVE OSA, I AM NOT OVERWEIGHT/ OLD”

Sleep apnoea is a common occurrence in females  
Karl A. Franklin et. al.

- We investigated 400 females from a population-based random sample of 10,000 females aged 20–70 years. They answered a questionnaire and performed overnight polysomnography.

European Respiratory Journal, August 2012



# STOP-BANG SCREENING QUESTIONNAIRE

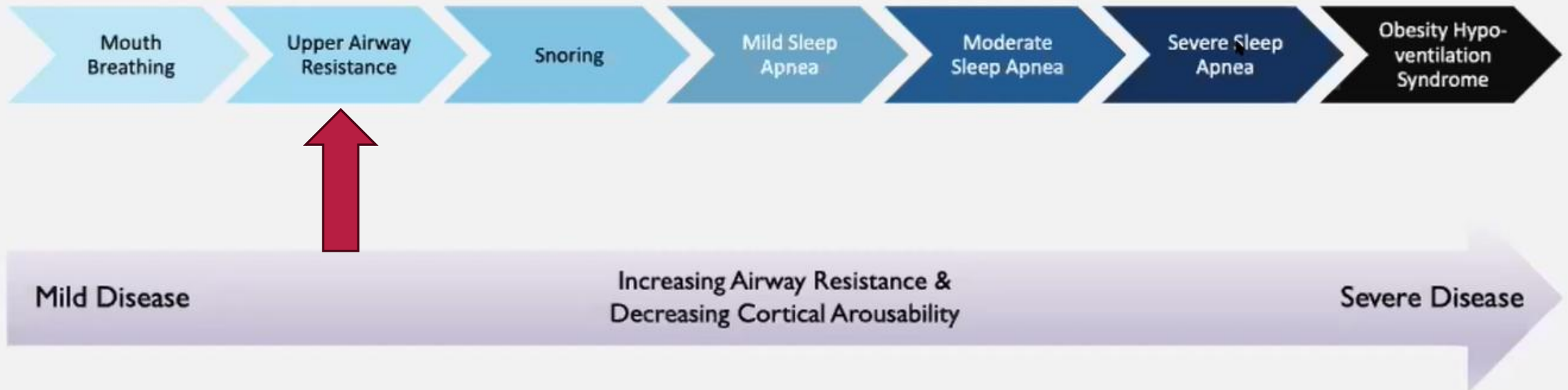
---

- Snoring
- Tiredness (ESS)
- Observed apneas
- Pressure : blood pressure
- BMI (over 35)
- Age (over 50)
- Neck circumference (over 16"0)
- Gender – male
- Score of 2-3 means 50% to 75% risk of having OSA
- Approx 15 % of those with OSA identified correctly: not a strong screener, only identifies the very obvious, need a paradigm shift for more robust screening

# A DISORDER WITH A SPECTRUM

(USED WITH PERMISSION; DR S. ZAGHI, ENT, MD.)

## Spectrum of Obstructive Sleep Disordered Breathing





# UPPER AIRWAY RESISTANCE SYNDROME (UARS)

Resistance to Airflow → Arousal by Autonomic Nervous System → Physiological Stress

## SYMPTOMS

- Fatigue
- Difficulty falling asleep
- Restless, unrefreshing sleep
- Mood disturbances
- Anxiety, mental stress
- HPA axis upregulation, increased cortisol
- Impaired immunity, growth, recovery
- Spectrum of UARS Subtypes:
  - Sympathetic dominant: "Fight or Flight"
  - Parasympathetic dominant: Adrenal Fatigue

## SLEEP STUDY FINDINGS

- SpO2 > 92%
- Adults: AHI < 5, Pediatric AHI < 1
- RDI or Arousal Index > 10-15 events/hr
- Sleep fragmentation
- Altered sleep architecture
- Interruptions to REM sleep
- ↑ Sympathetic and parasympathetic activity \*

\*Heart palpitations versus afib

UARS is characterized by sleep fragmentation due to micro-arousals during sleep in association with up-regulation of the sympathetic and parasympathetic autonomic nervous system in the setting of resistance to the flow of air through the upper airway during sleep.

Zaghi MD

HALMARK: LOW AROUSABILITY THRESHOLD

# COMPARING OSA AND UARS (DR ZAGHI)

## OBSTRUCTIVE SLEEP APNEA (OSA)

### SYMPTOMS

- Excessive daytime sleepiness
- Accidents
- High Blood Pressure
- Insulin Resistance
- Weight gain
- Cardiovascular stress
- Neurocognitive dysfunction
- Anxiety --- > Depression
- Other systemic health effects

**Sleep Study Findings:**  
**SpO2<90%, AHI high, RDI high**

## UPPER AIRWAY RESISTANCE SYNDROME (UARS)

### SYMPTOMS

- Fatigue
- Difficulty falling asleep
- Restless, unrefreshing sleep
- Mood disturbances
- Anxiety, mental stress
- HPA axis upregulation, increased cortisol
- Impaired immunity, growth, recovery

**Sleep Study Findings:**  
**SpO2>92%, AHI low, RDI high**

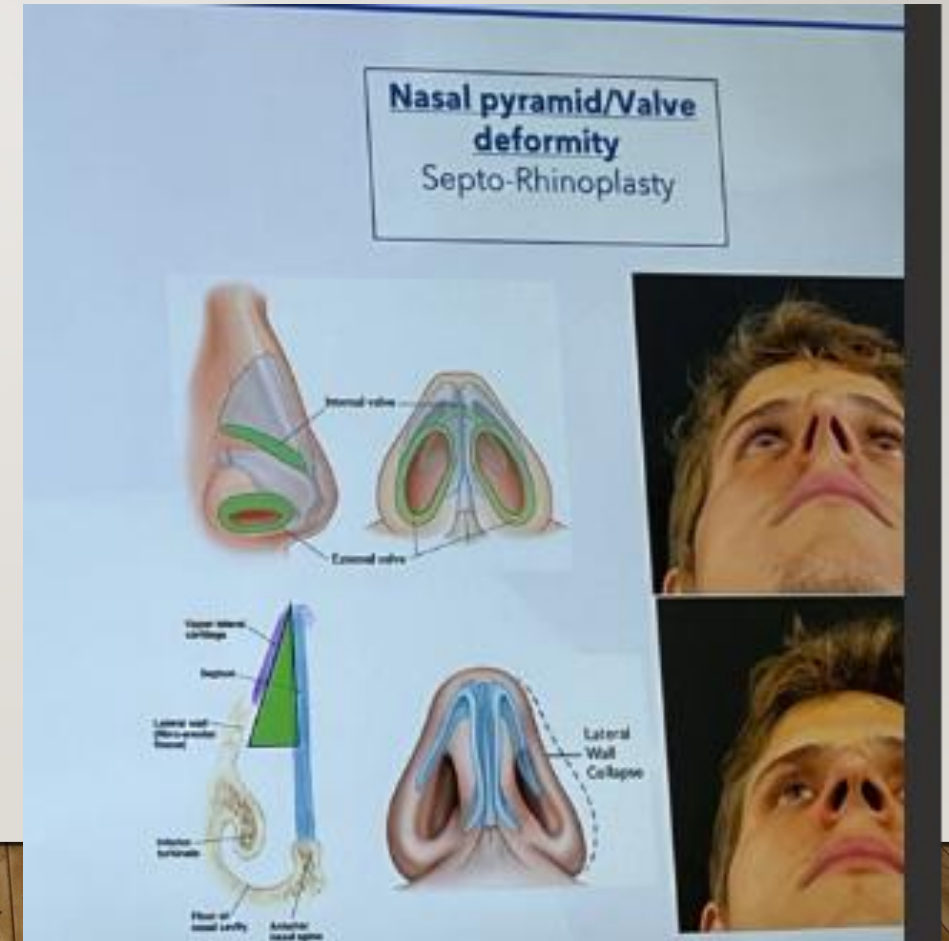


# INCREASED NASAL BREATHING PERPETUATES NASAL BREATHING

---

(SOME) patient reported effects:  
“Extra Strength Breathe Right Strip”

- Dreaming
- Sleep uninterrupted (wake up refreshed)
- Significantly less use of asthma puffer
- Improved CPAP effectiveness (less events)
- Decreased cravings
- (can also try nose cones – reusable)





# NASAL VALVE COLLAPSE AND UARS

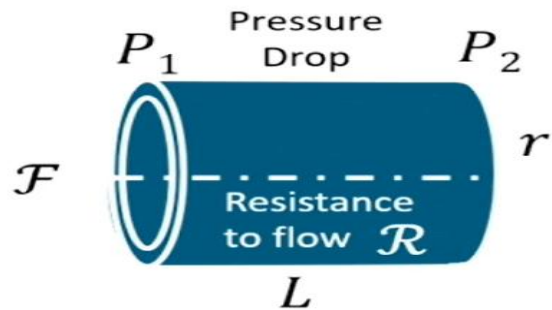
---



# STARLING MODEL OF AIR RESISTANCE

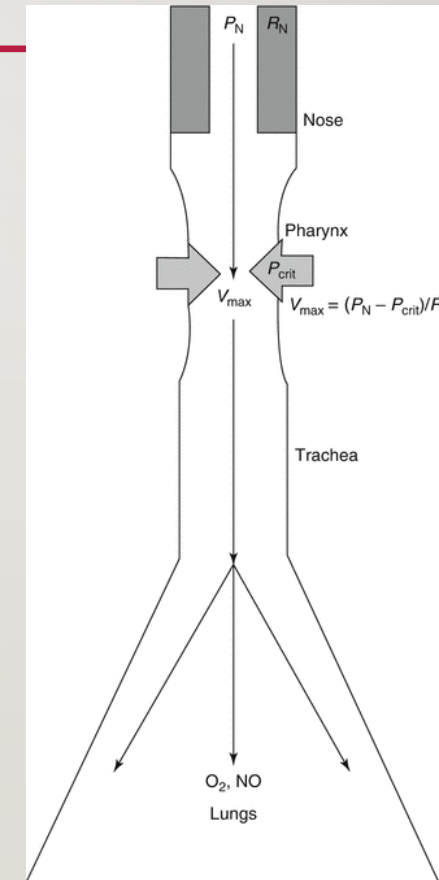
## Poiseuille's Law: Treatment Principle

Airflow is proportional to the 4th power of the change in radius



$$\text{Flow } \mathcal{F} = \frac{\Delta p \pi r^4}{(8\eta L)}$$

A small change in the size of the nasal valve



**MOUTH BREATHING:  
FORWARD HEAD POSTURE, MOUTH OPEN, ACTIVE MENTALIS  
LONG FACE (SKELETAL GROWTH EFFECTS: RETROGRNATHIA)**

---





# Orbital Findings: Maxillary Deficiency & Vertical Facial Growth

⇒ Lateral canthus of the eye lower than medial canthus. ⇐



Reference: Calvo-Henriquez C, Martins-Neves S, Martinez-Capoccioni G, Neves-Leal D, Ruano-Ravina A, Faraldo-García A, Lowy-Benoliel A, Martin-Martin C. **Validation of the Vertical Facial Growth Screening Test.** Clin Pediatr (Phila). 2019 Oct;58(11-12):1187-1193. doi: 10.1177/0009922819868684. Epub 2019 Aug 12. PMID: 31402692.

COURTESY DR. S. ZAGHI, ENT

# Malampatti

**OSA**



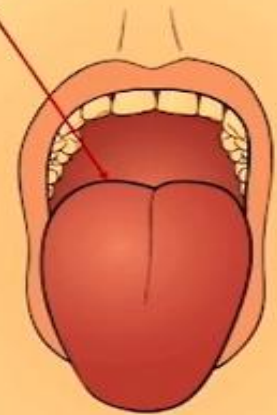
Class I



Class II



Class III



Class IV

(ELONGATED SOFT PALATE)

# Normal vs Obstructed



**Redness may indicate acid reflux or silent reflux**



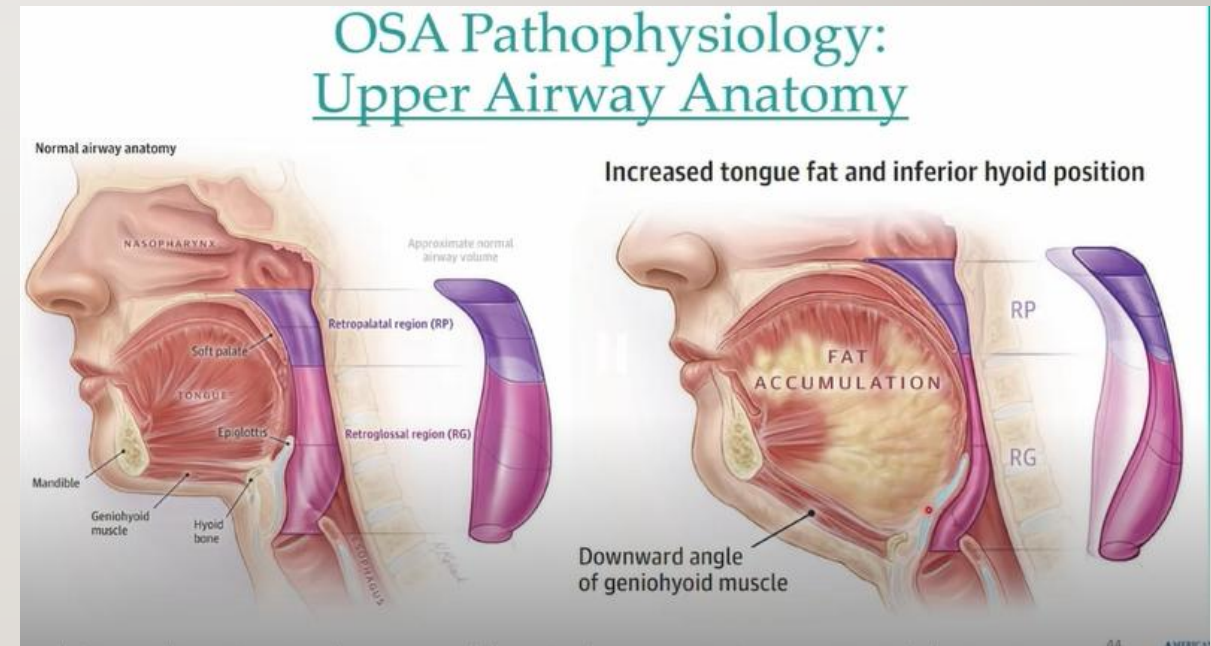
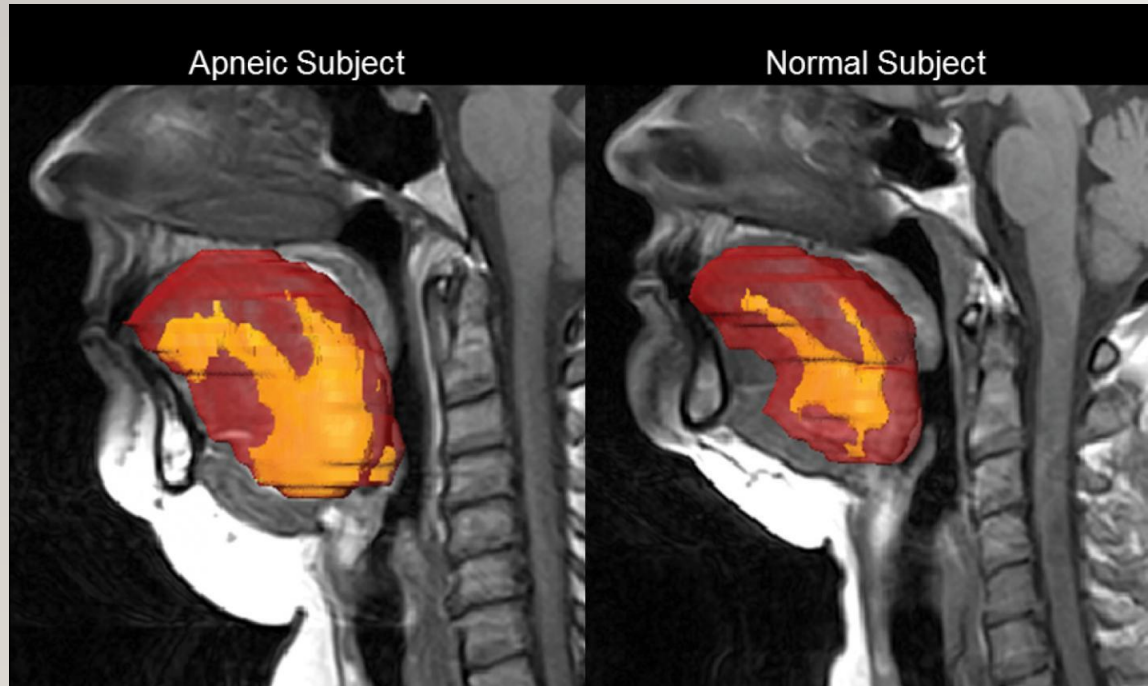
# SCALLOPED TONGUE: PRESSURE ON THE TEETH TO BRING TONGUE FORWARD



Also: Tongue pops up to sit above occlusal plane when open mouth normally

# IMPORTANCE OF WEIGHT LOSS FOR TONGUE FAT REDUCTION: 10% WEIGHT LOSS = 25% REDUCTION IN OSA

---





# DENTAL AND PHARYNGEAL SCREENING RED FLAGS

- 

nightguard intolerance

- 

bruxism

reflux

- 

Mallampati

tonsils

uvula



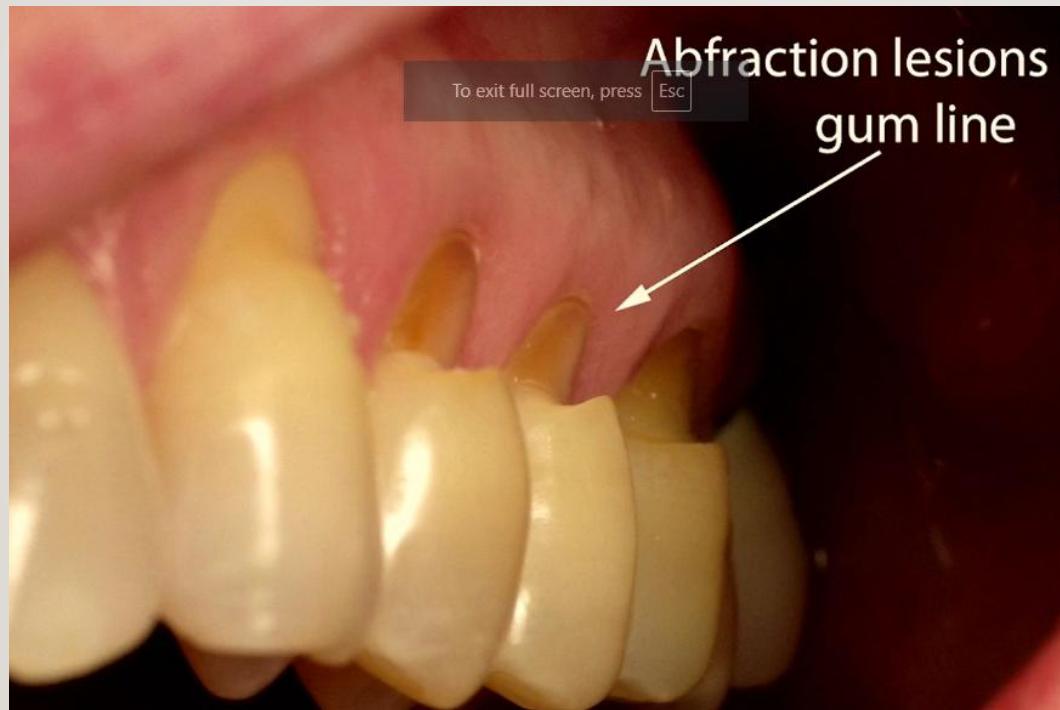


# CLENCHING PRESENTATION: ABFRACTIONS

ENTRY INTO THE PULP IS FASTER FROM THE LATERAL ASPECT OF THE TOOTH

---

(NOT CAUSED BY TOOTH BRUSHING)



SNORING (DRY MOUTH) + BRUXISM + ACID REFLUX

(SHINY GUMS, TRANSPARENT ENAMEL, WORN TEETH, GROSS DECAY)



# NARROW PALATE: CONSTRICTED NOSE

## THE ROOF OF THE MOUTH IS THE FLOOR OF THE NOSE (DR ZAGHI)

Tongue position is integral to development of maxillary morphology which affects n

High Arched Palate → Narrow Nasal Cavity

Maxillary Deficiency  
Transverse



Yoon, A. J., Zaghi, S., Ha, S., Law, C. S., Guilleminault, C., & Liu, S. Y. (2017). Ankyloglossia as a risk factor for maxillary hypoplasia and soft palate elongation: A functional-morphological study. *Orthodontics &*





NARROW, V-SHAPED, HIGH VAULTED PALATE =  
NARROW BASE OF NOSE

### Palatal Vaulting

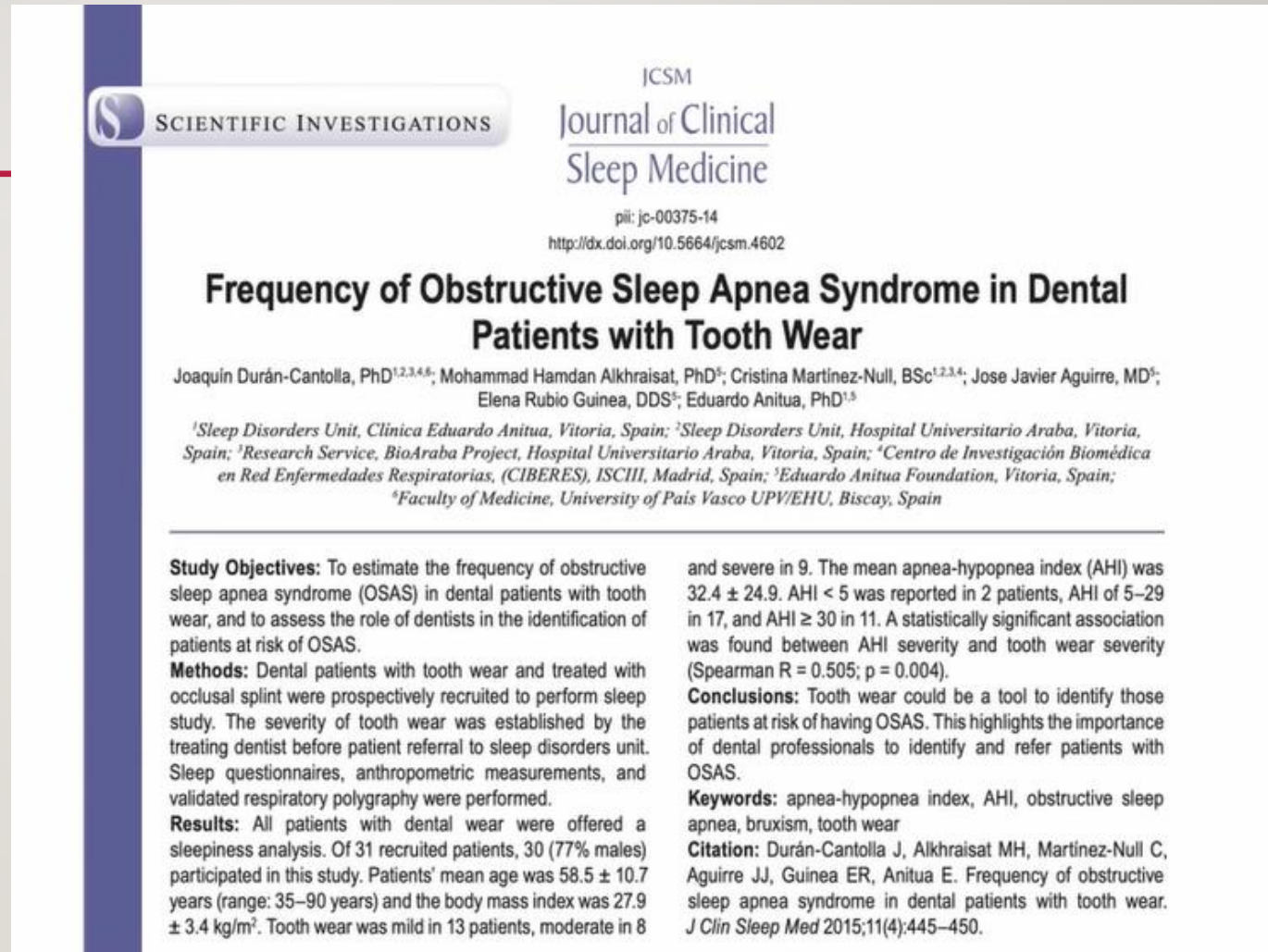


Dental crowding as a result of constricted arches

HISTORICALLY:  
BRUXISM WAS  
THOUGHT TO BE  
STRESS RELATED

STRESS CAN ALSO  
INCREASE SLEEP  
DISTURBED BREATHING  
AND THEREFORE  
BRUXISM

SOME  
ANTIDEPRESSANTS  
ALSO CAUSE  
CLENCHING/ BRUXISM





**HISTORICALLY:** NIGHTGUARDS PRESCRIBED FOR GRINDING.

**RECENTLY** EVIDENCE FOUND NG TO MAKE OSA WORSE  
(NG INTOLERANT PATIENTS ARE SUSPECT)

---



## *Night guards make OSA Worse*

### **Effects of Occlusal Stabilization Splints on Obstructive Sleep Apnea: A Randomized Controlled Trial.**

Nikolopoulou, Maria; Ahlberg, Jari; Visscher, Corine M.; Hamburger, Hans L.; Naeije, Machiel; Lobbezoo, Frank; Journal of Orofacial Pain, 2013 Summer; 27 (3): 199-205.

### **Aggravation of respiratory disturbances by the use of an occlusal splint in apneic patients: a pilot study.**

Gagnon Y; Mayer P; Morisson F; Rompré PH; Lavigne GJ, The International Journal Of Prosthodontics [Int J Prosthodont], ISSN: 0893-2174, 2004 Jul-Aug; Vol. 17 (4), pp. 447-53; Publisher: Quintessence Pub. Co.

NIKOLOPOULOU, M., NAEIJE, M., AARAB, G., HAMBURGER, H. L., VISSCHER, C. M. and LOBBEZOO, F. (2011), **The effect of raising the bite without mandibular protrusion on obstructive sleep apnoea.** Journal of Oral Rehabilitation, 38: no. doi: 10.1111/j.1365-2842.2011.02221.x



# SUBJECTIVE SCREENING IN ADDITION TO OBJECTIVE ORAL SIGNS

---

- Snoring
- Witnessed apneas
- Gasping/choking episodes
- Difficulty falling asleep
- Restless / unrefreshing sleep
- Clenching or grinding
- Predominant side or stomach sleeping
- Mouth vs. Nasal Breathing
- Morning headaches
- Jaw pain
- Dry mouth
- Daytime sleepiness
- Attention and concentration
- Stress, anxiety, depression
- Fatigue, energy levels
- Systemic effects: nocturia, high blood pressure, obesity

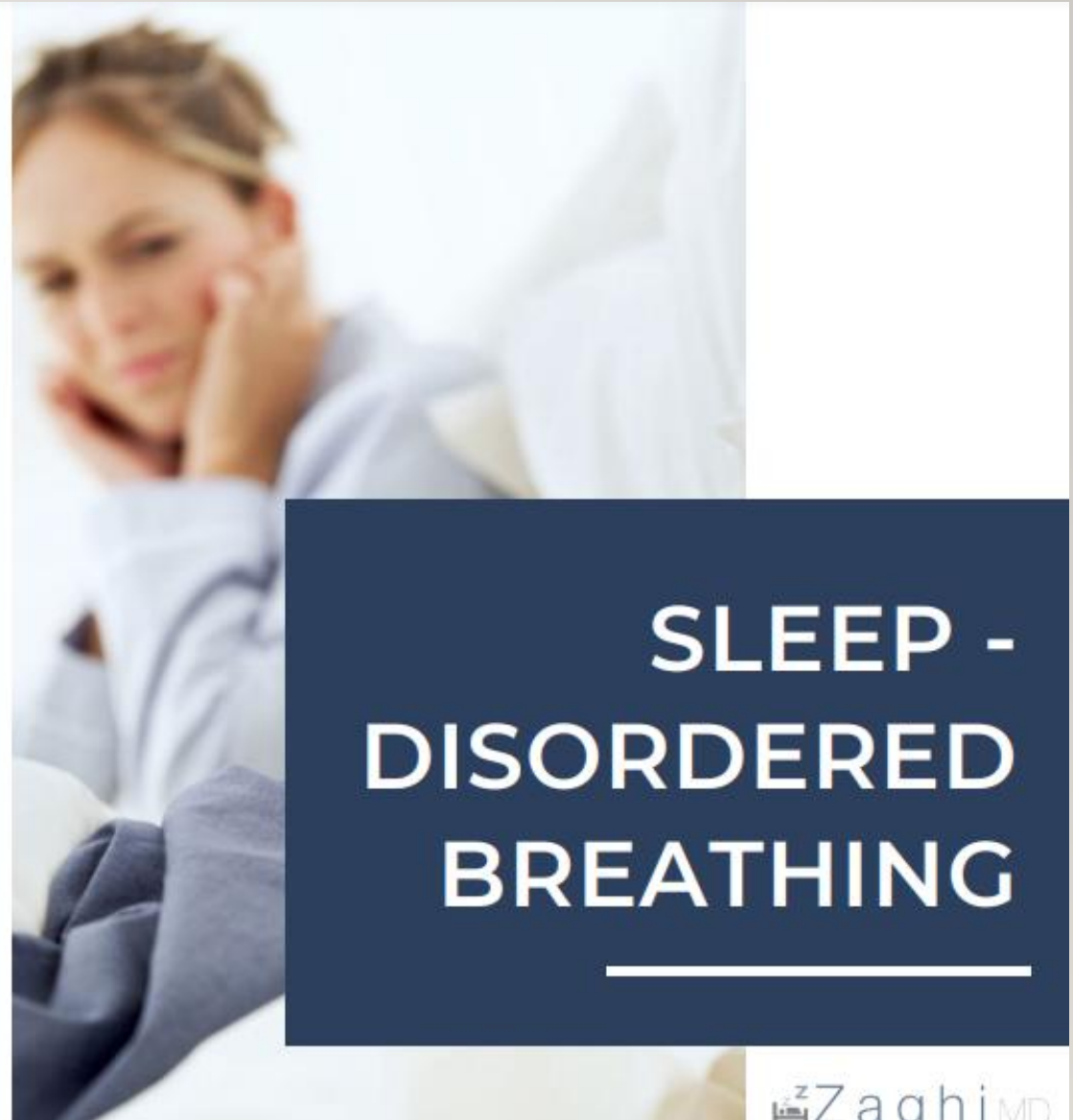
- Acid reflux
- Nocturia  
(atrial natriuretic peptide response to increased BP)
- Family history of OSA (40% hereditary – anatomy)

# OSA TREATMENT MODALITIES



## TREATMENT TOOL BOX ADULTS

- ORAL APPLIANCES
- CPAP
- MYOFUNCTIONAL
- ENT SURGICAL
- OMFS SURGICAL
- ORTHODONTIC /  
DENTAL ORTHOPEDIC



## SLEEP - DISORDERED BREATHING

---

 ZaahiMD



## DEFINITIONS: COMPLIANCE FOR CPAP VS OAT

---

- CPAP

- 4 hours per night

- 70% of the nights

- CPAP: start with efficacy  
and chase compliance

### OAT

80% of the night

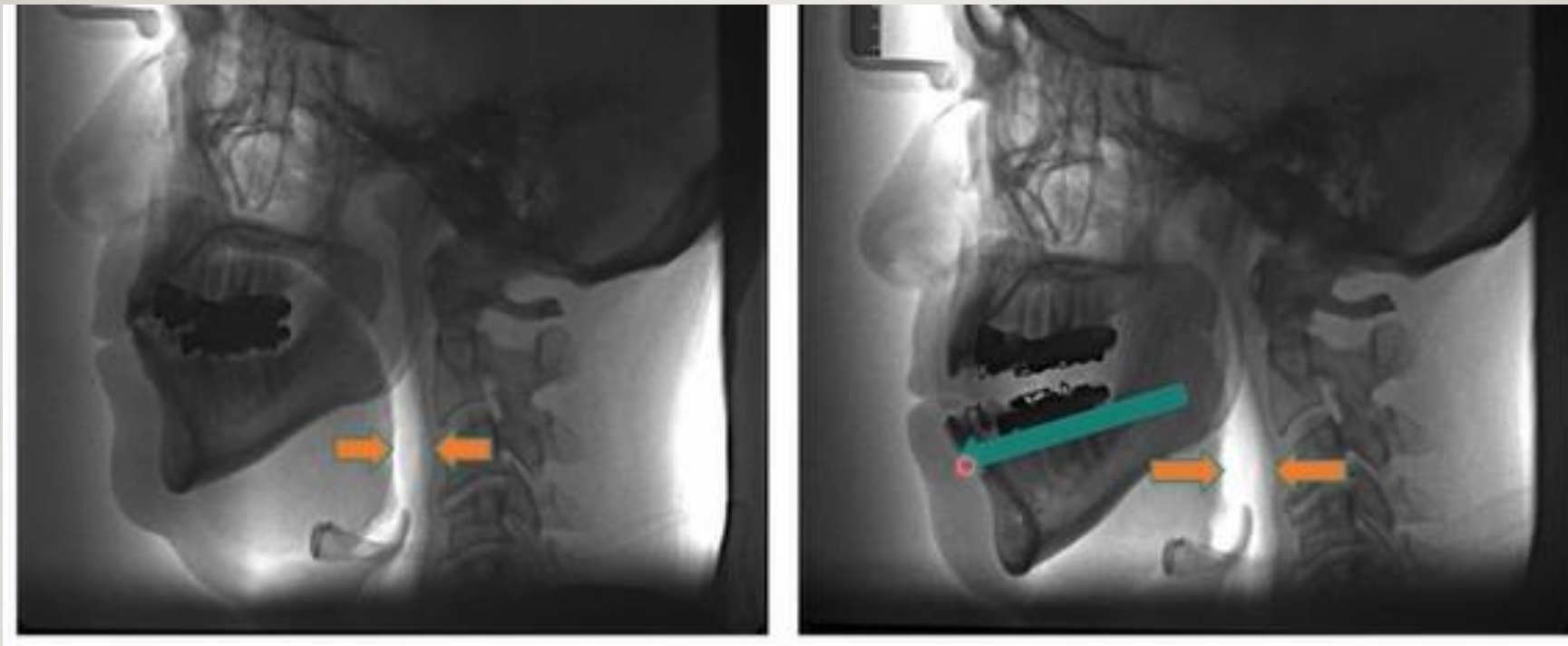
5 nights per week

OAT: start with compliance  
and chase efficacy

CPAP TO OPEN A COLLAPSIBLE  
AIRWAY WITH POSITIVE AIR  
PRESSURE (BAG-VALVE-MASK)

OAT TO MECHANICALLY OPEN THE  
AIRWAY BY MOVING THE MANDIBLE  
AND TONGUE FORWARD (JAW THRUST)

---



# CPAP

## • Advantages

- Continuous airway support
- High efficacy
- Cost – some coverage by OHIP
- Works for everyone
- 
- 
- 
- 
- 
- 
- 

## Disadvantages

- dry mouth
- mask leakage, loss of seal and function
- noisy for self and partner, keeps awake
- difficult to move with hoses attached
- difficulty exhaling against pressure
- lines on face from mask
- not all masks fit every face (cost for each mask to try)
- claustrophobia
- cleaning the hoses/ maintenance
- cannot go to remote locations without power
- bloated belly from air
- high long term intolerance (various percentages cited)



# CPAP FIRST LINE OF THERAPY:

IF FAILURE TO CPAP, OAT **MAY BE MORE TOLERATED** AS PATIENTS MAY KNOW THE BENEFITS OF RESTORATIVE SLEEP (NOT BEING FATIGUED) AND CAN **COMPARE OAT TO CPAP**

---

## CPAP

- Gold standard in treatment of OSA
- Those that benefit from it should stay on it
- Different models and features
  - Pressure changing/self titrating
  - Humidifiers
  - Different masks/cushions/pillows
  - Compact/quieter
- There are complications and side effects
  - Including tooth movement



## LONG-TERM ADHERENCE TO CPAP TREATMENT IN PATIENTS WITH OBSTRUCTIVE SLEEP APNEA: IMPORTANCE OF EDUCATIONAL PROGRAM

GIUSEPPE EMANUELE LA PIANA, ALESSANDRO SCARTABELLATI, LODOVICO CHIESA, LUCA RONCHI, PAOLA RAIMONDI, MIRIAM A CARRO **PATIENT PREFERENCE AND ADHERENCE** PAGES 555-562 | PUBLISHED ONLINE: 04 NOV 2011

- The degree of patient satisfaction was reported as follows:

---
- **three months** 60% of patients felt very satisfied with CPAP, 32% were sufficiently satisfied, and 8% were poorly satisfied at.
- **At one year**, 65% of patients felt very satisfied, 28% were sufficiently satisfied, and 7% were poorly satisfied.
- **At two years**, 49% of patients felt very satisfied, 3% were sufficiently satisfied, and **48% were poorly satisfied**.
- **Three months** after the beginning of ventilation (average pressure  $10 \pm 2$  cm H<sub>2</sub>O), CPAP adherence was 82%..
- **one year after the long-term support program** Adherence to CPAP was 80%.
- **Two years after the start of treatment** and at one year since the **last session of the support program**, long-term adherence to ventilation was **43%**.

# ORAL APPLIANCE THERAPY OPTIONS FOR USE

---

- Used **on its own**, Mandibular Advancement Device (MAD) : KEEP JAW FORWARD/ TONGUE FROM FALLING BACK INTO THROAT
- CAN BE **COMBINED** WITH CPAP TO DECREASE PRESSURE (combination therapy)
- **ALTERATING** THERAPY (night to night, or OAT for vacations, CPAP for home)
- ESTABLISH/ MAINTAIN **NASAL BREATHING FOR OPTIMAL EFFECT**





# BENEFITS OF ORAL APPLIANCE THERAPY

---

- For mild to moderate OSA – 1<sup>st</sup> line option
- For failed CPAP / intolerance – 2<sup>nd</sup> line option
- For back up (forget CPAP in hotel, travel)
- Not affected by power outage
- Portable for travelling (and less maintenance), travelling to remote areas without power (back country camping, hunting)
- Patient is not a surgical candidate
- Instead of a night guard for bruxism: addresses bruxism also
- PREVENTATIVE; decrease inflammation in throat from reduction of snoring over time to prevent or delay sleep apnea development, need for future cpap

# DIS ADVANTAGES OF OAT

---

- Tooth movement, Jaw changes (tmj) Less now than there used to be: studies indicate tooth movement changes still exist but these have been mitigated with newer appliances and the use of a morning bite reprogrammer
- Drooling
- Longer titration period may be required, guesstimate at jaw position
- Breakage, wear and tear (can be repaired, some milled appliances cannot be repaired)
- Cost: due to customization, monitoring and follow up
- Morning maintenance protocol for bite and TMJ: bite repositioner jig, morning jaw exercises
- Jaw pain, dislodged restorations
- Difficult for edentulous patients (full dentures – have to wear dentures at night time)

# Examples of morning exercises

## Isometric Exercises

- Moving jaw against resistance
- Two fingers for resistance for certain movements
- Fist or hand resistance for opening exercises.

### 3 ISOMETRIC EXERCISE

- Place fist under chin
- Open mouth slowly against light pressure
- Do not overextend jaw
- Close mouth



Repeat each exercise 10 x

### 4 ISOMETRIC EXERCISE

- Place two fingers on center of chin
- Push chin outward against fingers
- Bring chin to resting position



### 5 ISOMETRIC EXERCISE

- Place two fingers on right side of chin
- Move jaw to right against light pressure
- Do not overextend jaw
- Bring jaw to resting position



Also do the  
Left side



## Mandibular Advancement vs CPAP for Blood Pressure Reduction in Patients With Obstructive Sleep Apnea



**BACKGROUND** Hypertension guidelines recommend diagnosis and treatment of obstructive sleep apnea (OSA) in patients with hypertension. The mandibular advancement device (MAD) is an oral appliance therapy for patients who decline or cannot tolerate continuous positive airway pressure (CPAP).

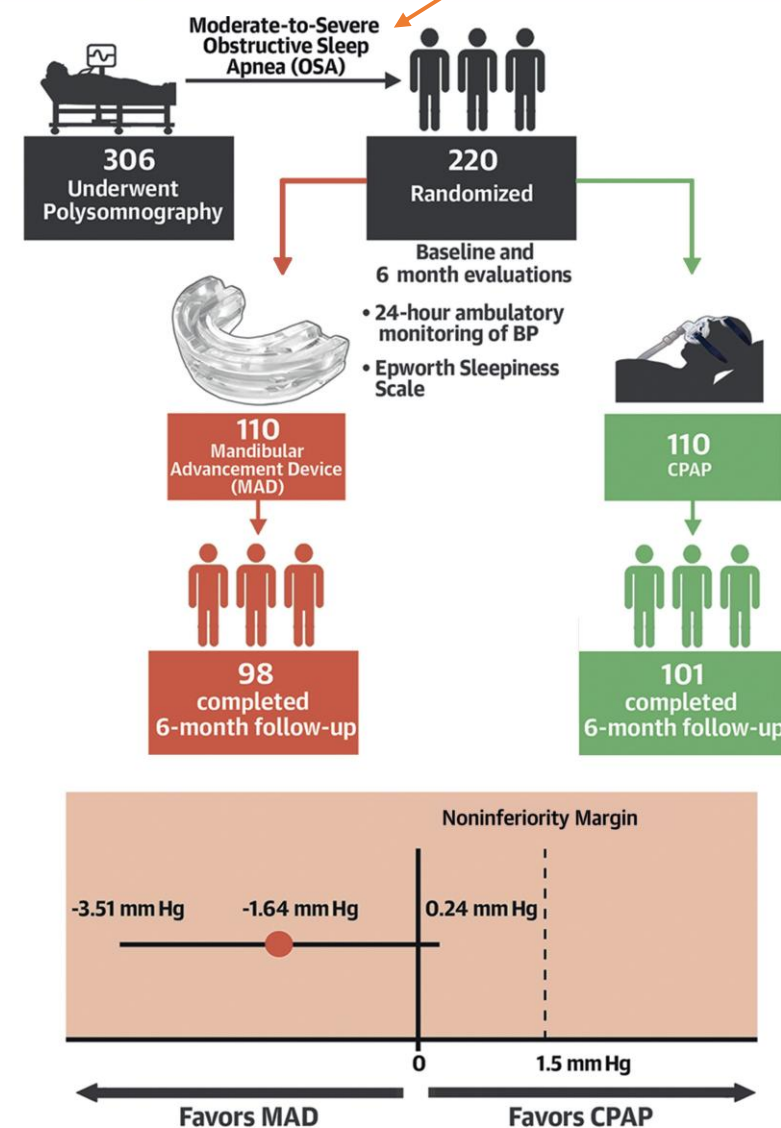
**OBJECTIVES** We compared the relative effectiveness of MAD vs CPAP in reducing 24-hour ambulatory blood pressure (BP).

**METHODS** In an investigator-initiated, randomized, noninferiority trial (prespecified margin 1.5 mm Hg), 321 participants aged  $\geq 40$  years with hypertension and increased cardiovascular risk were recruited at 3 public hospitals for polysomnography. Of these, 220 participants with moderate-to-severe OSA (apnea-hypopnea index  $\geq 15$  events per hour) were randomized to either MAD or CPAP (1:1). The primary outcome was the difference between the 24-hour mean arterial BP at baseline and 6 months.

**RESULTS** Compared with baseline, the 24-hour mean arterial BP decreased by 2.5 mm Hg ( $P = 0.003$ ) at 6 months in the MAD group, whereas no change was observed in the CPAP group ( $P = 0.374$ ). The between-group difference was  $-1.6$  mm Hg (95% CI:  $-3.51$  to  $0.24$ , noninferiority  $P < 0.001$ ). The MAD group demonstrated a larger between-group reduction in all secondary ambulatory BP parameters compared with the CPAP group, with the most pronounced effects observed in the asleep BP parameters. Both the MAD and CPAP improved daytime sleepiness, with the between-group difference similar ( $P = 0.384$ ). There were no between-group differences in cardiovascular biomarkers.

**CONCLUSIONS** MAD is noninferior to CPAP for reducing 24-hour mean arterial BP in participants with hypertension and increased cardiovascular risk. (Cardiosleep Research Program on Obstructive Sleep Apnea, Blood Pressure Control and Maladaptive Myocardial Remodeling—Non-inferiority Trial [CRESCENT]; [NCT04119999](https://clinicaltrials.gov/ct2/show/study/NCT04119999)) (J Am Coll Cardiol 2024;83:1760-1772) © 2024 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

### CENTRAL ILLUSTRATION: Cardiosleep Research Program on Obstructive Sleep Apnea, Blood Pressure Control, and Maladaptive Myocardial Remodeling—Noninferiority Trial



Ou Y-H, et al. J Am Coll Cardiol. 2024;83(18):1760-1772.

# CPAP for Prevention of Cardiovascular Events in Obstructive Sleep Apnea

**Authors:** R. Doug McEvoy, M.D., Nick A. Antic, M.D., Ph.D., Emma Heeley, Ph.D., Yuanming Luo, M.D., Qiong Ou, M.D., Xilong Zhang, M.D., Olga Mediano, M.D., [+20](#), for the SAVE Investigators and Coordinators\* [Author Info & Affiliations](#)

Published September 8, 2016 | N Engl J Med 2016;375:919-931 | DOI: 10.1056/NEJMoa1606599

[VOL. 375 NO. 10](#) | [Copyright © 2016](#)



## Abstract

### BACKGROUND

Obstructive sleep apnea is associated with an increased risk of cardiovascular events; whether treatment with continuous positive airway pressure (CPAP) prevents major cardiovascular events is uncertain.

### METHODS

After a 1-week run-in period during which the participants used sham CPAP, we randomly assigned 2717 eligible adults between 45 and 75 years of age who had moderate-to-severe obstructive sleep apnea and coronary or cerebrovascular disease to receive CPAP treatment

Potential participants were required to have a minimum level of adherence to CPAP therapy, which was defined as an average of 3 hours per night, during a 1-week run-in period in which sham CPAP was used (i.e., CPAP at subtherapeutic pressure). Further details of the inclusion and exclusion criteria and of the procedures performed at the core sleep laboratory are provided in the [Supplementary Appendix](#).

# “SAVE” study

(Sleep Apnea cardioVascular Endpoints)

## CONCLUSIONS

Therapy with CPAP plus usual care, as compared with usual care alone, did not prevent cardiovascular events in patients with moderate-to-severe obstructive sleep apnea and established cardiovascular disease. (Funded by the National Health and Medical Research Council of Australia and others; SAVE ClinicalTrials.gov number, [NCT00738179](#); Australian New Zealand Clinical Trials Registry number, [ACTRN12608000409370](#).)



## Discussion

This secondary prevention trial in adults with cardiovascular disease and obstructive sleep apnea showed that the risk of serious cardiovascular events was not lower among patients who received treatment with CPAP in addition to usual care than among those who received usual care alone. Treatment with CPAP was associated with a greater reduction in symptoms of daytime sleepiness and with improved health-related quality of life, mood, and attendance at work. This study was not powered to provide definitive answers regarding the effects of CPAP on secondary cardiovascular end points, but there was no indication of a significant benefit with respect to any cause-specific cardiovascular outcome.

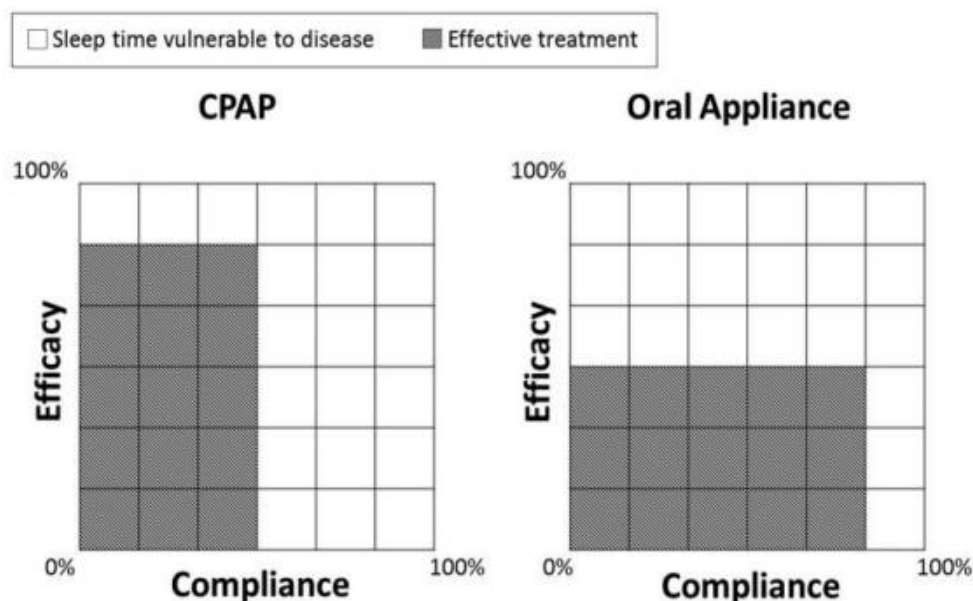


# Efficacy versus Effectiveness in the Treatment of Obstructive Sleep Apnea: CPAP and Oral Appliances

Kate Sutherland, PhD<sup>1,2</sup>; Craig L. Phillips, PhD<sup>1,2</sup>; Peter A. Cistulli, MD, PhD<sup>1</sup>

<sup>1</sup>Department of Respiratory and Sleep Medicine, Royal North Shore Hospital and Sydney Medical School, University of Sydney, Sydney, Australia; <sup>2</sup>Woolcock Institute of Medical Research, University of Sydney, Sydney, Australia

**Figure 1**—Comparison of treatment effectiveness profile of CPAP and oral appliances.



Efficacy (y axis) reflects the ability of treatment to prevent obstructive breathing events when it is physically applied. Compliance (x axis) reflects the hours the treatment is applied for over the total sleep time when obstructive events can occur. "Effectiveness" requires both efficacy and compliance and the balance of these likely reflects over health outcomes. This schematic illustrates the scenario of an oral appliance which is only half as efficacious as CPAP but has two-fold greater compliance which results in equivalent effectiveness (shaded area).



## CONCLUSIONS AND FUTURE DIRECTIONS

Although effectiveness, as a combined measure of real world usage and efficacy, is difficult to accurately assess, proposed formulas which account for sleep time on and off treatment potentially may be a more accurate marker of health outcome responses. However this remains to be assessed in prospective trials. There is limited evidence of comparative effectiveness of CPAP and oral appliance treatments longer-term. If equivalent short-term health outcomes are found to be sustained in the long term, this opens up treatment options for patients with this chronic disease. Comparative-effectiveness and Patient-Centered Outcomes Research aims to help patients (and their healthcare providers) to make informed decisions about health and healthcare options base on outcomes that are important to them.<sup>58</sup> We propose a greater emphasis on treatment effectiveness rather than efficacy as part of a chronic disease management approach. Future comparative effectiveness research of CPAP and Oral appliance treatment could allow patients more freedom to choose their preferred treatment over all aspects of treatment effectiveness and health outcomes.



## Investigation

# Long-term mandibular advancement appliance therapy for obstructive sleep apnea: Adherence and outcomes over 10 years

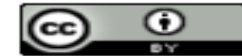
Clarissa Martensen Abruzzi DDS, MS, Audrey Yoon DDS, MS, Jorge Faber DDS, MS, PhD  

## Conclusions

Among the study participants who responded to the questionnaire after 10 years of treatment with an MAA, 44.6% continued to use the device. The predictive factors for long-term treatment adherence were

- experiencing morning headaches before treatment (odds ratio [OR], 32.11; 95% CI, 2.52 to 404.13;  $P = .007$ ) ...
- perception that MAA therapy enhances sleep quality (OR, 6.58; 95% CI, 1.58 to 27.38;  $P = .01$ ) ...
- having a bed partner satisfied with the therapy (OR, 4.12; 95% CI, 1.64 to 10.36;  $P = .003$ ) ...
- ...

*Original Research Article*



## **Trends in CPAP adherence over twenty years of data collection: A flattened curve**

**Brian W. Rotenberg, Dorian Murariu, and Kenny P. Pang**

**Conclusions** The rate of CPAP adherence remains persistently low over twenty years worth of reported data. No clinically significant improvement in CPAP adherence was seen even in recent years despite efforts toward behavioral intervention and patient coaching. This low rate of adherence is problematic, and calls into question the concept of CPAP as gold-standard of therapy for OSA.

the cost-effectiveness of these interventions needs to be considered.

The most recent comprehensive literature review of CPAP adherence looks to be by Donovan et al. [91]. The authors investigated various outcomes including CPAP efficacy, behavioral interventions, and personalizing CPAP to patient need. The authors maintained that its main limitation is intolerability, which leads to low adherence. The authors call for more research on tailoring therapies to individual patients in order to enhance adherence.

The long-term effects of non-adherence bring to light the health related impact of untreated OSA. It is not sufficient to simply prescribe a CPAP machine and consider the patient to be treated. For example, BaHammam et al. [92] found that adherence to CPAP declined over a 10-month period, such that only 33 % of the OSA patients were considered to have “good adherence” by 10 months, even after receiving an educational intervention. Gagnadoux et al. [93] found that AHI scores and socioeconomic

# PATIENT LED THERAPY FOR BEST COMPLIANCE ??

---

## The Best Combination Therapy?



**Whatever oral appliance  
you feel is the best choice  
for the patient**



**Whatever CPAP mask  
works best for the patient**



# SNORING AND SLEEP APNEA APPLIANCE

## FLOW CHART:

