

Obstructive Sleep Apnea Epidemiology and Diagnosis

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Epidemiology of Sleep Disorders

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- **Prevalence of common sleep disorders**

- Insomnia 10-30%
- Sleep Apnea 3%
- RLS 10%
- Narcolepsy 0.05%

Epidemiology of Sleep Disorders

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- Insomnia 10-30%
- Sleep Apnea 3%
- RLS 10%
- Narcolepsy 0.05%

- **Diagnoses of patients presenting to sleep centers**

- Sleep apnea 67.8%
- RLS 4.9%
- Narcolepsy 3.2%

Coleman II Sleep 2000

Prevalence

The “classic” prevalence of sleep apnea:

2% for women, 4% for men*

- Obtained from people 30 - 60 years old
- Defined sleep apnea as $AHI > 5$ + EDS
- Hypopnea: “discernable reduction + 4% desaturation
- Apnea: 10 second cessation
- Sleepiness: $> 2X$ /week sleepiness that interferes with daily living

**Young T. NEJM 1993*

Prevalence

- The current prevalence of sleep apnea is about 5%.
- Incidence is about 2% per year for $AHI \geq 15$

Young T. Am J Respir Crit Care Med 2002. Tischler PV. JAMA. 2003.

The Cleveland Family Study

Tischler PV. JAMA. 2003.

- Factors associated with sleep disordered breathing
 - Age
 - Gender
 - BMI
 - Waist-Hip Ratio
 - Serum Cholesterol

Gender Hormonal Effects

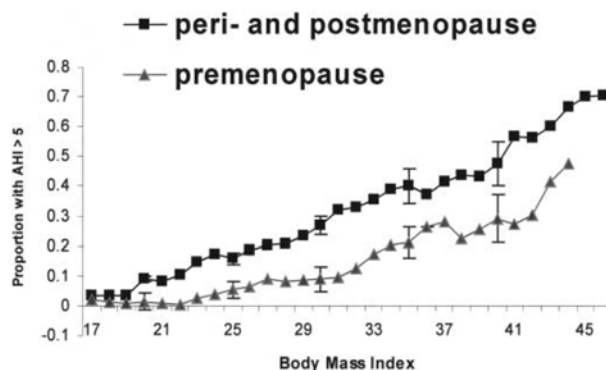


Figure 2. Prevalence of SDB indicated by an AHI of 5 or greater for premenopausal women and perimenopausal plus postmenopausal women by body mass index (BMI). Values represent a 5-unit moving average.

- The risk for OSA is 3 times greater in postmenopause women

The effects of gender and BMI are affected by aging

- **After the age of 50, gender is no longer felt to be an important variable**
- **After the age of 60, BMI is no longer felt to be an important variable**

History in OSA

- **Snoring**
- **Sleepiness**
- **Witnessed apneas**
- **Family history**
- **Erectile Dysfunction**
- **Mood, memory, attention problems**

Snoring

- **50% of men, 25% of women snore**



Excessive Daytime Sleepiness (EDS)

- **An inability to stay awake, even in situations when wakefulness is important.**

Fatigue

- **A state of overwhelming, sustained exhaustion and decreased capacity for physical and mental work that is unrelieved by rest.**

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Sleepiness

- Subjectively measured with an Epworth Sleepiness Scale (ESS)
- Objectively measured with MSLT
- Neither sensitive nor specific for OSA
- Accidents due to sleepiness ARE significant

The Epworth Sleepiness Scale

How likely are you to doze off or fall asleep in the following situations (0-3 scale):

- Sitting and reading
- Watching TV
- Sitting, inactive, in a public place
- As a passenger in a car for an hour
- Lying down in the afternoon
- Sitting and talking to someone
- Sitting quietly after a lunch without alcohol
- In a car, while stopped for a few minutes in traffic

Witnessed Apneas

- Witnessed apneas may be predictive of sleep apnea
 - Central apnea vs. obstructive apnea
 - Possible value in predicting OSA
- Self-reported apneas do not have the same value

Physical Findings in OSA

- Obesity is one of the best predictors of OSA
 - 40% of those with BMI > 40
 - 50% of those with BMI > 50
- Neck circumference is a surrogate for central obesity
 - > 17 inches for men; > 16 inches for women
- Hypertension
 - Loss of morning dip in BP
- “Narrowed oropharynx”

Polysomnogram (PSG)

Definition: Continuous and simultaneous recording of physiological variables during sleep



PSG Variables

- EEG (electroencephalogram)
- EOG (electrooculogram)
- EMG (electromyogram)
- ECG (electrocardiogram)
- Oronasal air flow
- Snoring
- Oximetry
- Body position

Sleep

Sleep is organized into sleep stages

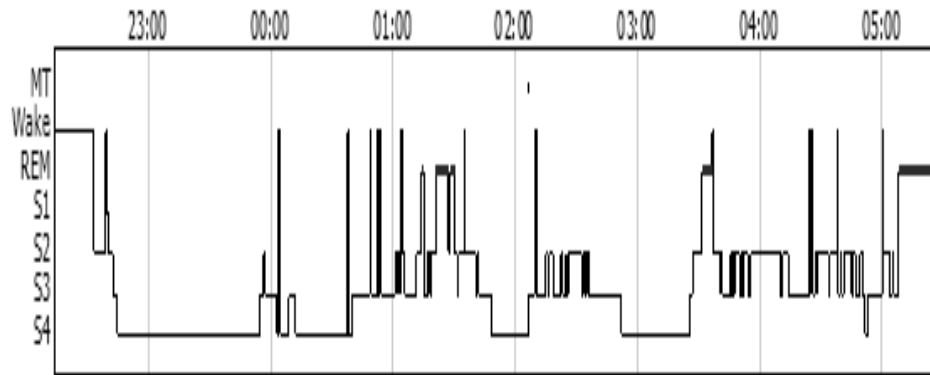
- Wake
- Stage 1
- Stage 2
- Stage 3
- REM sleep

Sleep

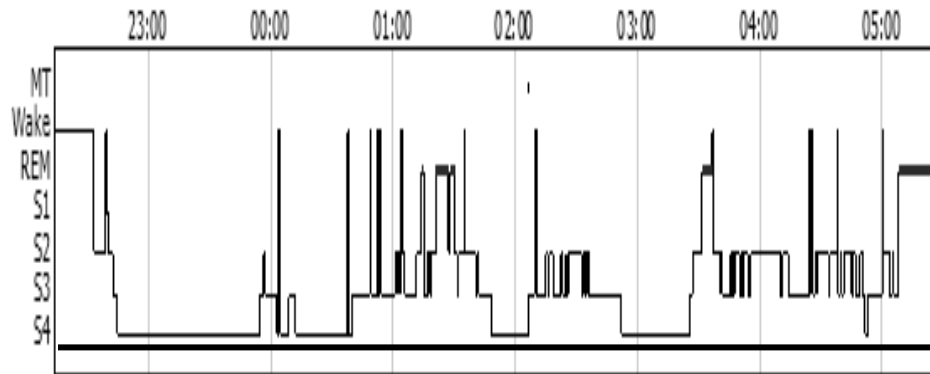
Sleep is organized into sleep stages

- Wake
 - Stage 1
 - Stage 2
 - Stage 3
 - REM sleep
- Non REM

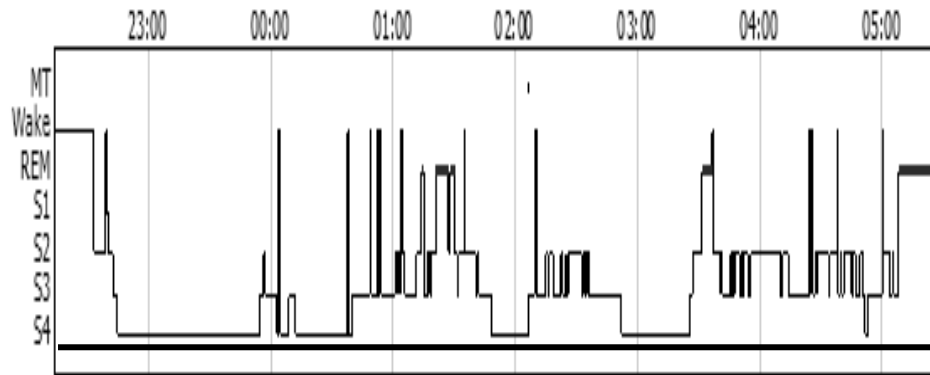
Hypnogram



Hypnogram

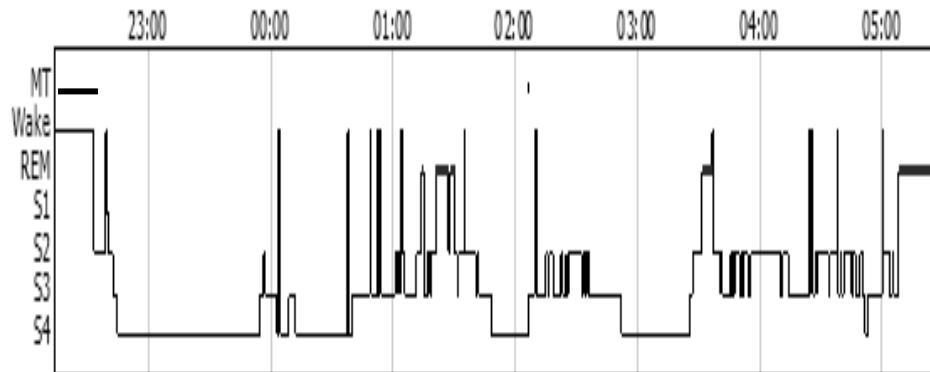


Hypnogram

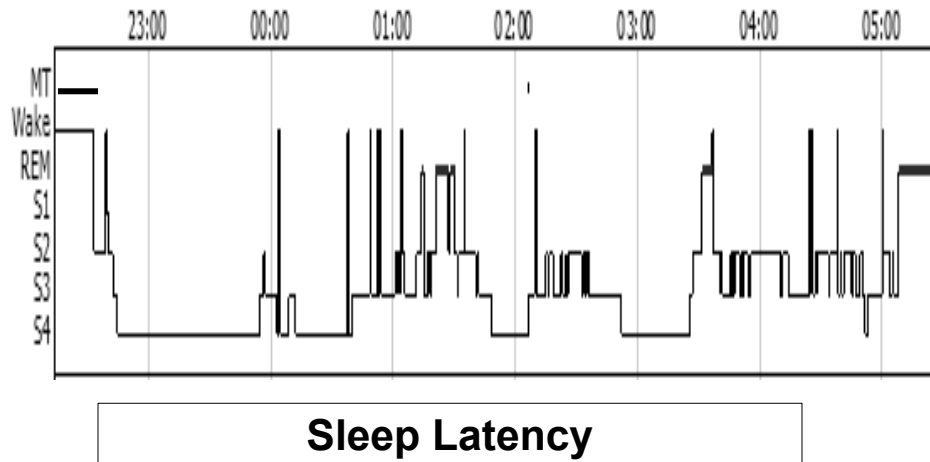


Total Recorded Time (TRT)

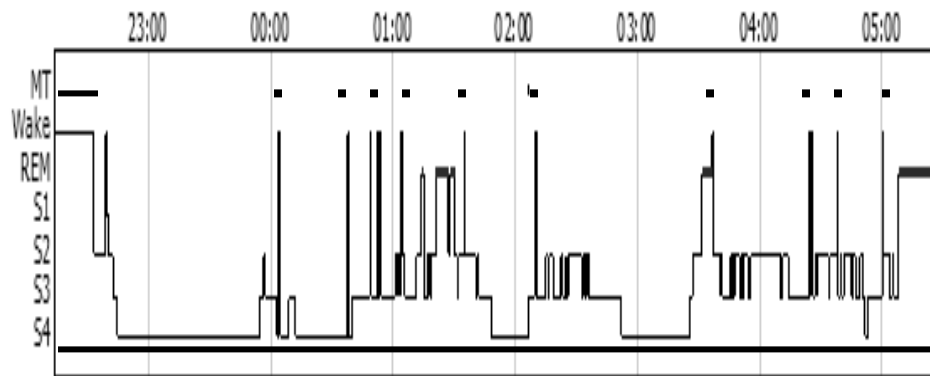
Hypnogram



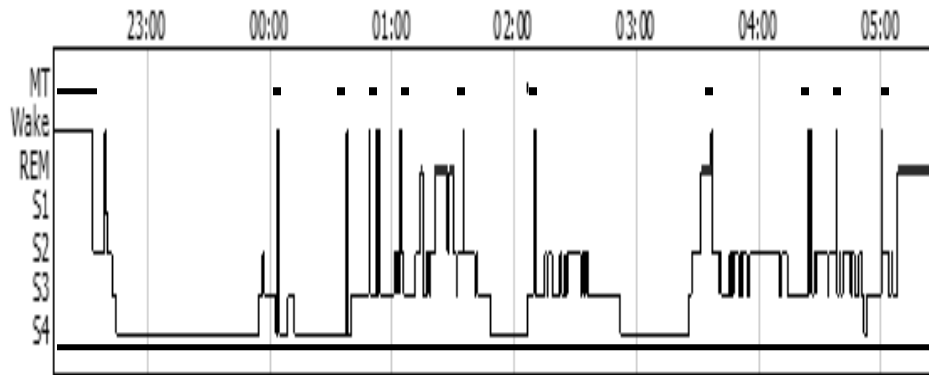
Hypnogram



Hypnogram

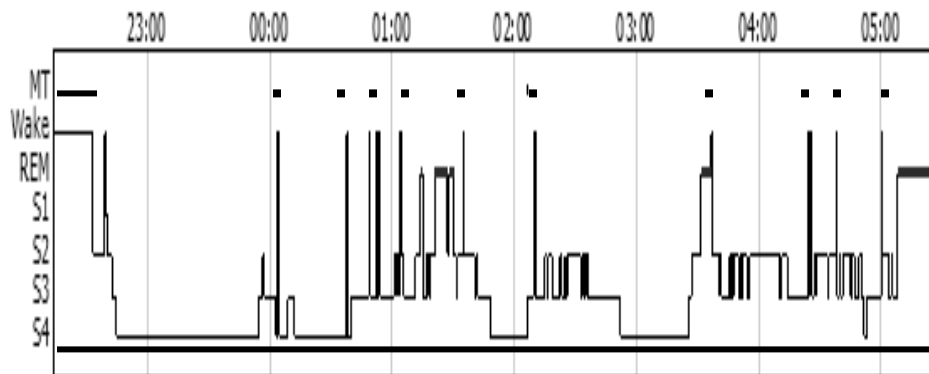


Hypnogram

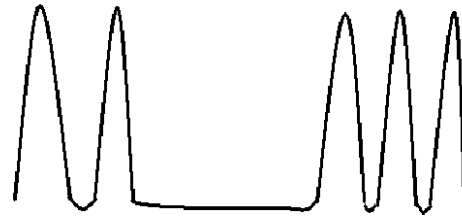


Wake After Sleep Onset (WASO)

Hypnogram



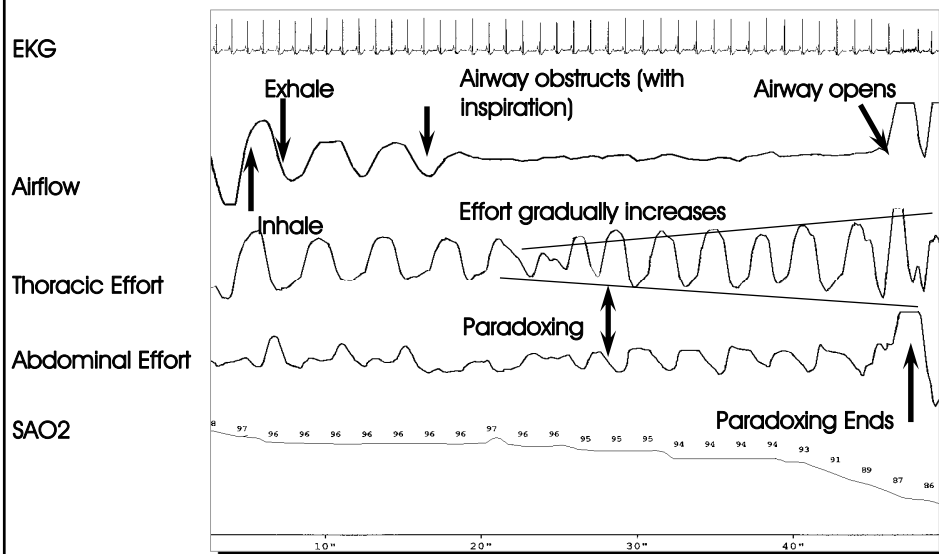
Total Sleep Time = TRT – SL –WASO



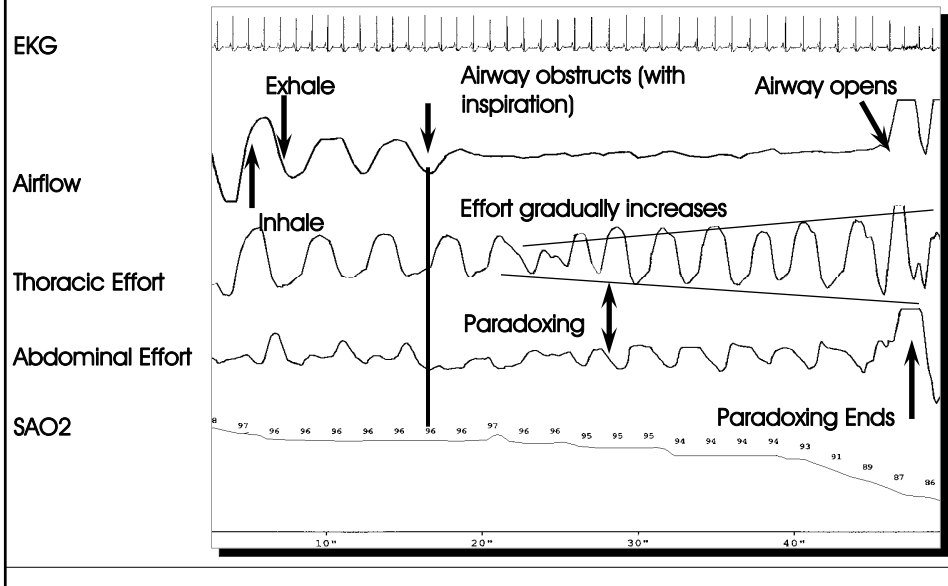
Apnea

- 1. Drop in flow by >90% of baseline**
- 2. Duration is a minimum of 10 seconds**

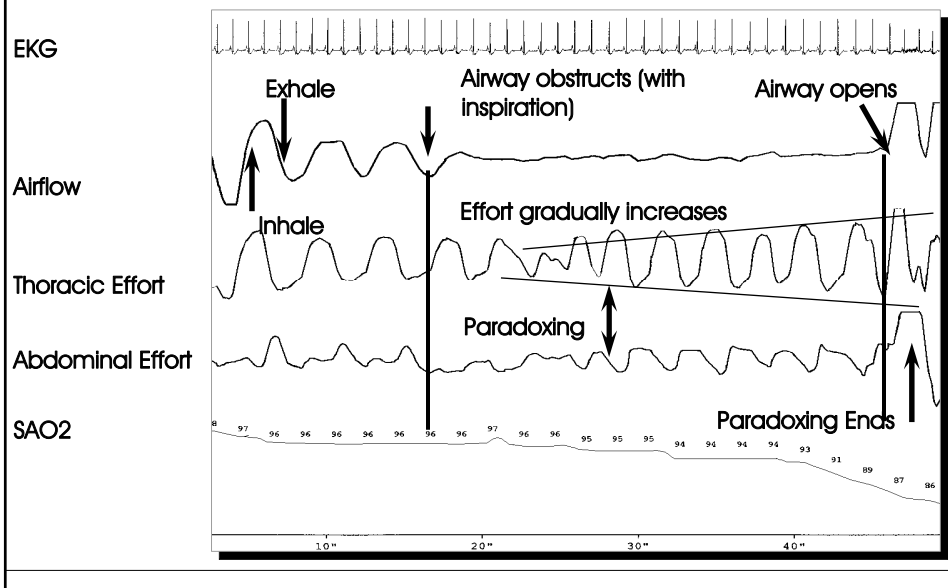
Obstructive Apnea

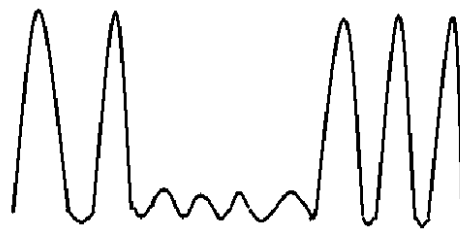


Obstructive Apnea



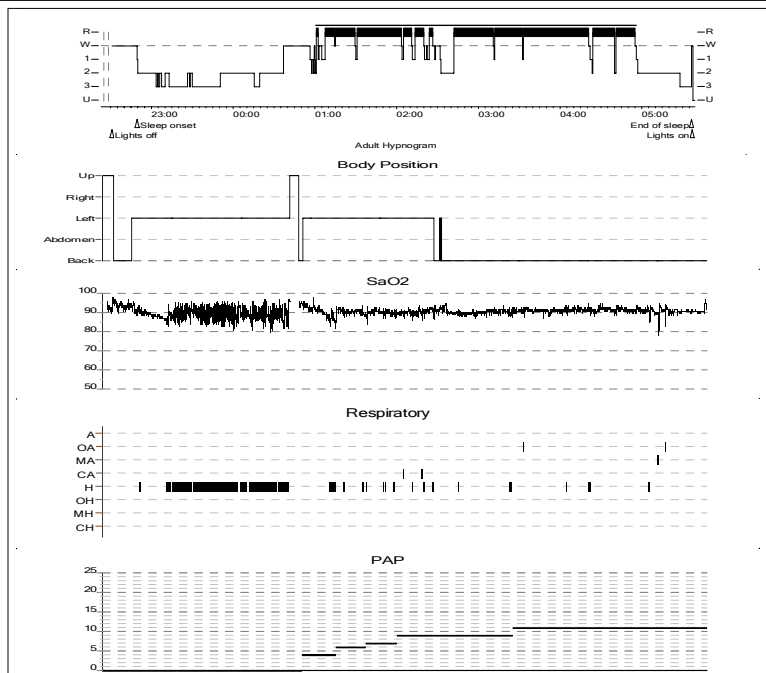
Obstructive Apnea





Hypopnea

1. Flow drops by $>30\%$ of baseline
2. Duration is a minimum of 10 seconds
3. $\geq 4\%$ drop in oxygen saturation from pre-event baseline



Apnea Hypopnea Index

Total Apneas + Total Hypopneas

Total Sleep Time

AHI \geq 5 events/hr mild

AHI \geq 15 events/hr moderate

AHI \geq 30 events/hr severe

Treatment of OSA

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Division of Pulmonary, Critical Care, Sleep, and Allergy

Outline

- **Who do we treat**
- **What are the forms of treatment**
- **Health consequences associated with untreated OSA and benefits of treatment**

Treatment of OSA

- **Recommendations for treatment**
 - **AHI \geq 15/hr regardless of symptoms.**
 - **AHI \geq 5 and \leq 14/hr with symptoms**
 - **Excessive daytime sleepiness, impaired cognition, mood disorders, insomnia**
 - or
 - **Documented hypertension, coronary artery disease or stroke**

Treatment of OSA

- **Behavioral modification**
 - **Weight loss**
 - **Positional therapy**
- **Interventional treatment**
 - **Positive airway pressure**
 - **Oral appliance**
 - **Surgery**

Weight Loss

- **Weight Loss of 5-10% can decrease collapsibility of upper airway**
- **Diet/exercise**
- **Bariatric surgery**

Lateral Positional Therapy

- Encourage patients to sleep in the non supine position
- Consider in those pts whose AHI in the supine position is 2x more than in the non-supine AND the non-supine AHI <5 /hour.
- Methods: posture alarm, ball on pajama top, pillows, or simple instruction
- No long term efficacy studies available.

Positive Airway Pressure (PAP)

- Gold standard of therapy
- Delivers pressurized air via close fitting nasal mask
- Pneumatic splint



Positive Airway Pressure (PAP)

Positive airway pressure is mostly delivered by a continuous positive airway pressure device (CPAP)



- Full face mask



- Nasal Mask



- Nasal Pillow

Positive Airway Pressure (PAP)

- **Abolish apnea/hypopneas**
- **Diminish snoring**
- **Improve oxygen saturation**
- **Improve sleep quality**
- **Reduces subjective and objective sleepiness**
- **Improves cognitive function**
- **Improves psychological well being**
- **Improve quality of life**

Positive Airway Pressure (PAP)

- **Compliance less than 50%- use of ≥ 4 hrs a night 70% of nights**
- **Mask discomfort**
- **Pressure discomfort**
- **Nasal congestion**
- **Dryness**
- **Claustrophobia**

Positive Airway Pressure (PAP)

- **Other PAP Devices**
- **BIPAP**
 - One pressure for inhaling and one for exhaling
 - 10/6 as opposed to CPAP 10
- **Automatic adjusting CPAP**
 - Measure flow and give pressure accordingly- can vary through the night
- **C-flex**
 - Drop pressure at beginning of exhalation

Humidifier

- **AASM recommends the use of heated humidification to improve the utilization of CPAP therapy**
- **The original CPAP humidifiers used cold, "passover" humidification to reduce nasal dryness and congestion.**
- **Newer models now use heated humidification to provide patients with an extra measure of comfort.**

- **Following patients on PAP therapy**
- **Objective monitoring**
 - **Smart Card**
 - **Remote monitoring**
- **Monitor response to therapy**
- **Monitor side effects**
- **Education!!!!!!!**



- **PAP therapy is gold standard- compliance is low- device is difficult to tolerate**
- **Other treatments have evolved for those unable to use PAP therapy**

Oral Appliances

Mandibular repositioning device



Tongue retaining device



Mandibular Repositioning Appliances (MRA)



Cover the upper and lower teeth.

Hold the mandible in a forward position

Need ≥ 8 teeth on upper and lower arch

Fixed or adjustable

Tongue Retaining Device (TRD)



Tongue held in a bulb using suction

Hold the tongue forward.

Useful if large tongue, poor dentition or poor protrusive ability

Oral Appliance

Anterior movement of tongue or mandible can increase cross sectional area of upper airway in apneic and non apneic patients

Oral Appliance

- **Not as effective as CPAP but some studies do show preference to CPAP**
- **AASM recommends using in those with mild to moderate OSA who prefer OA to CPAP, do not respond to CPAP, are not candidates for CPAP, or fail CPAP and behavioral treatment**

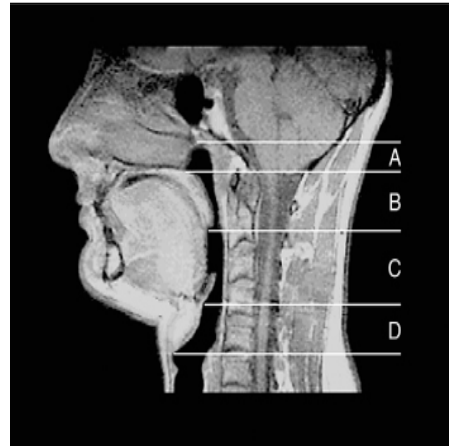
Sleep 2006;29(2):240-243

Oral Appliance

- **Side effects of oral appliance**
 - **Excessive salivation**
 - **TMJ pain**
 - **Change in bite**

Surgical Treatment

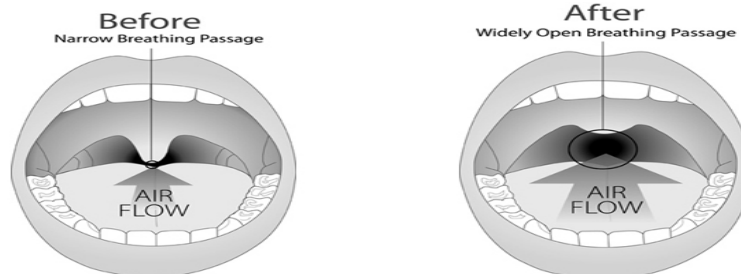
- Nasal obstruction
 - Septum, turbinates
- Pharyngeal area
 - Uvula, soft palate
- Hypopharyngeal area
 - Base of tongue obstruction
- Tracheotomy



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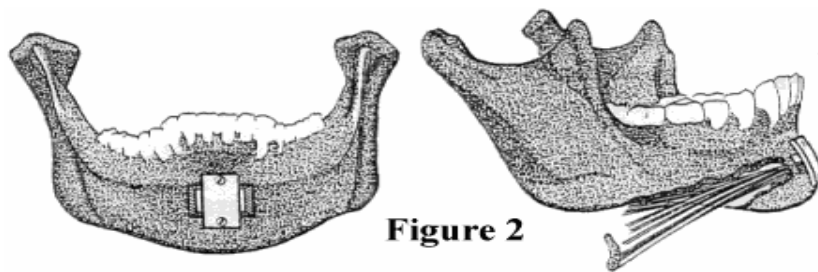
Uvulopalatopharyngoplasty (UPPP)

- Address the palate and lateral pharyngeal tissue
- Remove tonsils if present



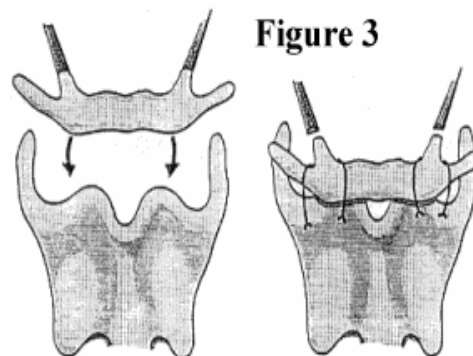
Genioglossus Advancement

- Base of tongue
- Genial tubercle (where the genioglossus muscle attaches to mandible) is advanced to place tension on tongue to limit it falling back during sleep



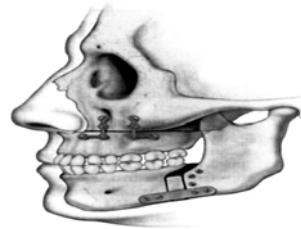
Hyoid Myotomy and Suspension

- Base of tongue
- Adjunct to genioglossus advancement
- Hyoid complex helps maintain the upper airway space
- Move hyoid forward to increase upper airway space



Maxillary Mandibular Osteotomy (MMO)

- Base of the tongue obstruction
- Increase posterior airway space



Surgical Treatment

- About $\leq 50\%$ effective- when addressing base of tongue may be higher
- Best outcome is with MMO
- Not many long term studies

Surgical treatment

- **Possible adverse events of surgery**
 - Infection
 - Tooth anesthesia
 - Root canal
 - Seroma
 - Numb lip or chin

Persistent Daytime Sleepiness in OSA

- **A subgroup of patients with OSA remain sleepy despite CPAP.**
- **Modafinil, a wakefulness promoting agent, has been found to improve daytime alertness in these patients.**
- **Need to check adequacy of sleep hours, CPAP compliance, and presence of concomitant sleep disorders prior to start.**

Associations of Untreated OSA

Traffic Accidents

- **There is a strong association between OSA and the risk of traffic accidents.**

Teran-Santos. N Engl J Med 1999
Young, Sleep 1997

- **Impairment on simulated driving performance in patients with OSA is reversed by CPAP. This effect is evident early (first few days).**

George CF, Thorax 1997

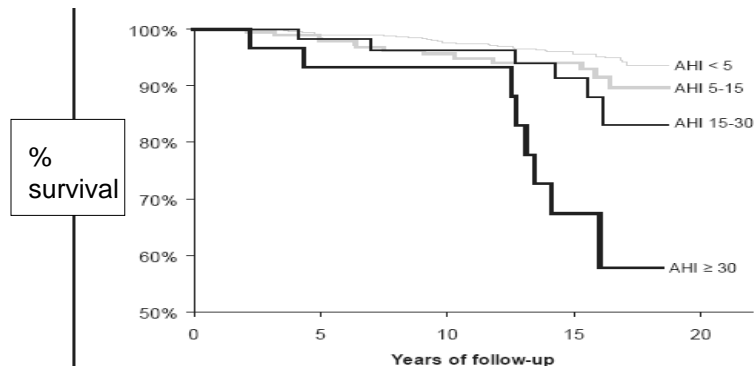
- **CPAP decreases vehicular crashes in patients with OSA.**

George CF, Thorax 2001

Prevalence of OSA in Cardiovascular Disease

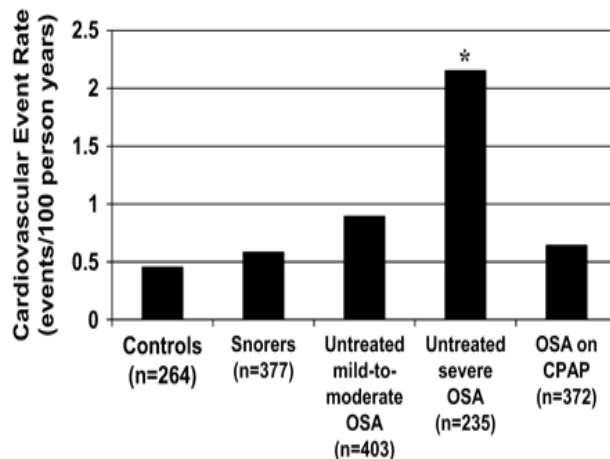
- Hypertension- 30-83%
 - Difficult to control hypertension
- Congestive heart failure- 12-53%
- Ischemic heart disease- 30-58%
- Association with insulin resistance
- Association with recurrence of atrial fibrillation

Increased Mortality Associated with OSA



- Wisconsin Group -1522 people for 13.8 yrs
- Severe OSA associated with all cause mortality

Association of Fatal and Nonfatal Vascular Events with Severe OSA vs Treated OSA and Controls



Lancet 2005;365:1046-53

Association of Fatal and Nonfatal Vascular Events with Untreated Mild/Moderate OSA vs Treated OSA

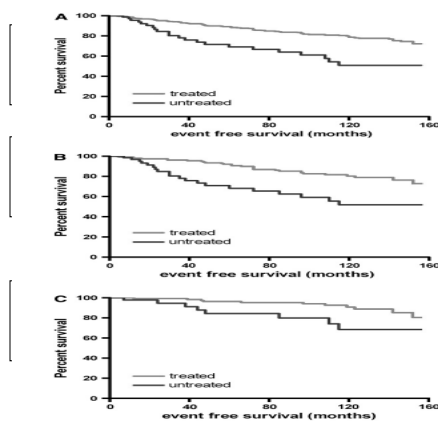


Figure 2. Kaplan-Meier estimates of the probability of event-free survival in (A) treated versus untreated patients with obstructive sleep apnea (OSA), (B) treated versus untreated patients with mild-moderate OSA, and (C) treated versus untreated patients with mild-moderate OSA without preexisting cardiovascular disease.

Am J Resp Care 2007;167

Other Factors Associated with CPAP trt of OSA

- Improved daytime LVEF
- Decreased systolic BP
- Improved insulin sensitivity
- Decreases recurrence rate of Afib after cardioversion

Conclusions

- Important to ask patients and about symptoms of OSA and send for evaluation and treatment if appropriate
- Treating OSA has been shown to improve sleep quality, daytime sleepiness, and quality of life
- Evidence that untreated OSA is associated with hypertension, cardiovascular events, cerebrovascular events, and death
- Treating OSA can improve these outcomes.