Obstructive Sleep Apnea 2016 Diagnosis and Treatment

Grand Rounds BRRH

May 17th 2016

Presented by

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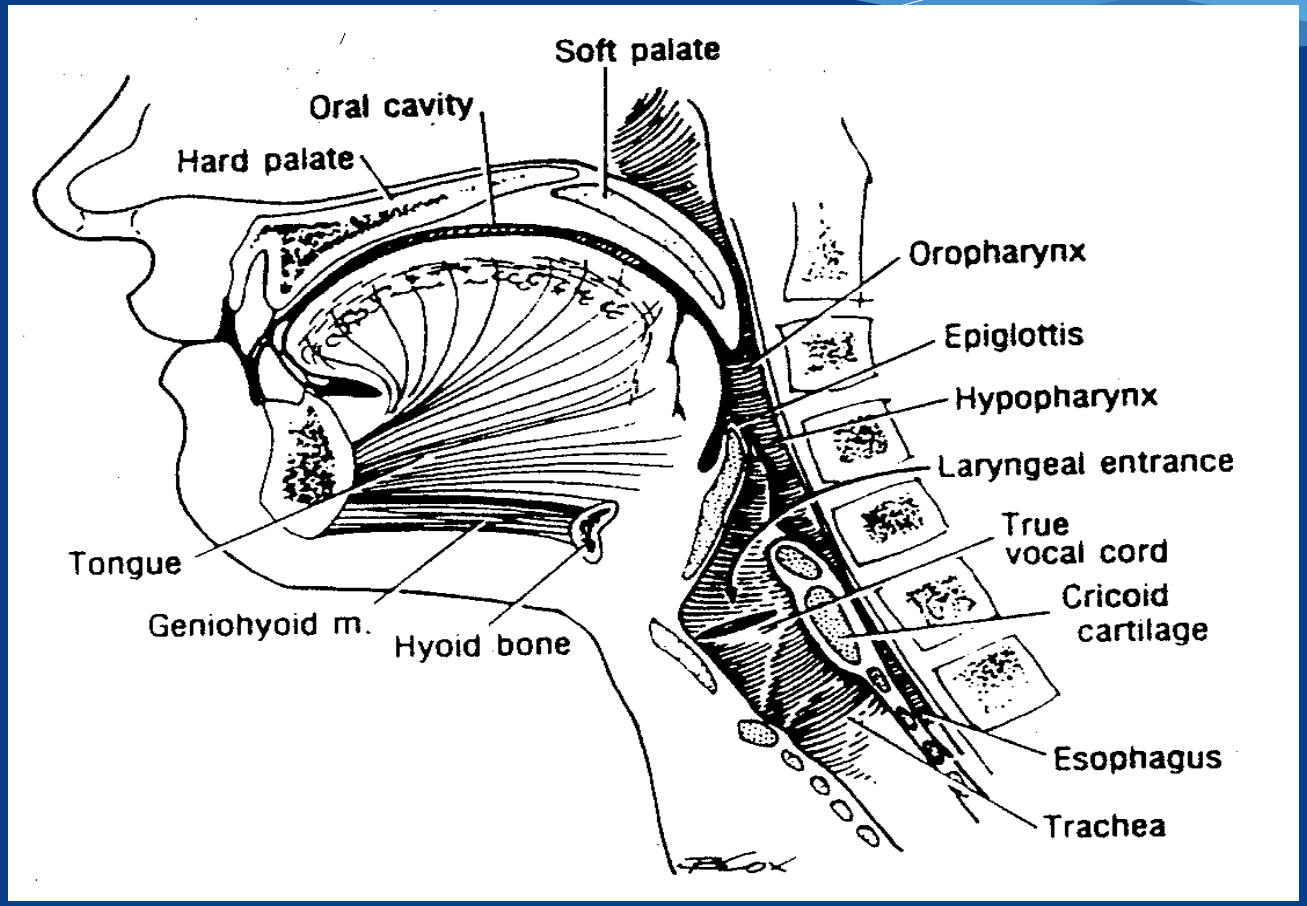
Objectives

* Understand the pathophysiology of Obstructive Sleep Apnea (OSA).
* Recognized the Symptoms of OSAS.
* Determine the appropriate Sleep Testing.
* Treatment options for OSA.
* When to refer to a Sleep Specialist.

Ventilation during NREM Sleep

* Decrease ventilatory motor neuron output leading to decease in tidal volume and minute ventilation
* Upper airway dilatory muscles relaxation leading to reduced luminal caliper and increasing resistance.
* Increase in Paco2 and decreasing in Pao2.
* **breathing becomes more dependant on central chemoresponsiveness.

Anatomy of the upper airway



Upper-Airway Changes During Sleep

* Reduced muscle activity of upper airway dilators.
* Reduced upper-airway caliber.
* Increase airway resistance.
* Increase pharyngeal collapsibility.

* LEADING TO REDUCED TIDAL VOLUME & HYPOVENTILATION

In summary

* Upper-airway resistance increases during sleep.
* Hypoventilation is a universal finding during sleep caused by upper-airway resistance and decrease central ventilatory motor output.
* Ventilation during NREM sleep is critically dependent on chemical stimuli-$PaCO_2$/PaO_2.

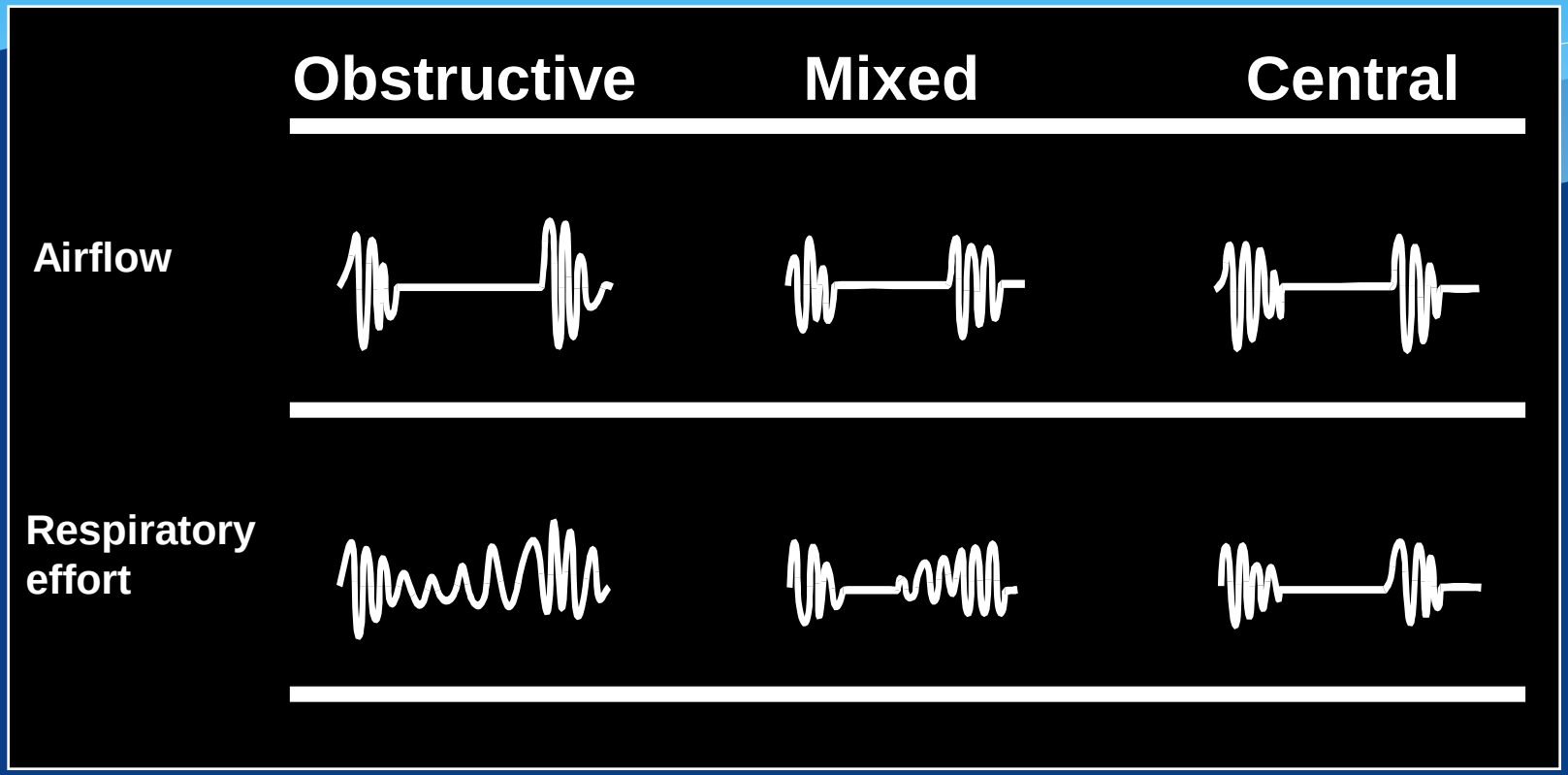
Types of sleep disordered breathing syndromes

* Obstructive (80%)
  * OSA
  * UARS
* Central (10-15%)
  * Hypocapnic
    * CSR-CSA, high altitude
  * Hypercapnic
    * Pontine lesions, RCB

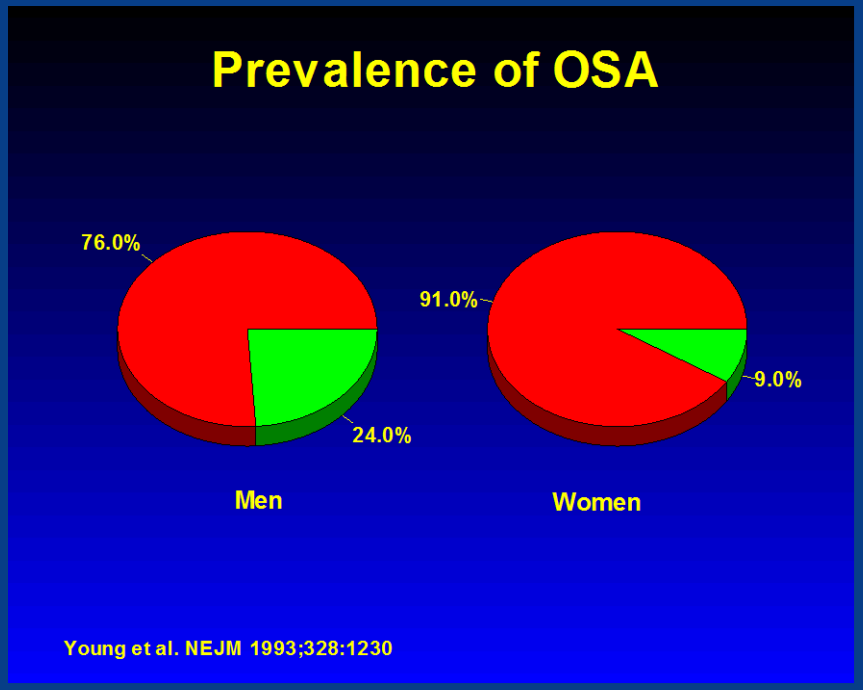
Obstructive sleep apnea, Adult

* Repetitive episodes of complete (apnea) or partial (hypopnea) upper airway obstruction occurring during sleep lasting 10 seconds or longer.
* Events often result in
  * Decrease SaO2
  * Termination of event with arousal

Apnea Patterns

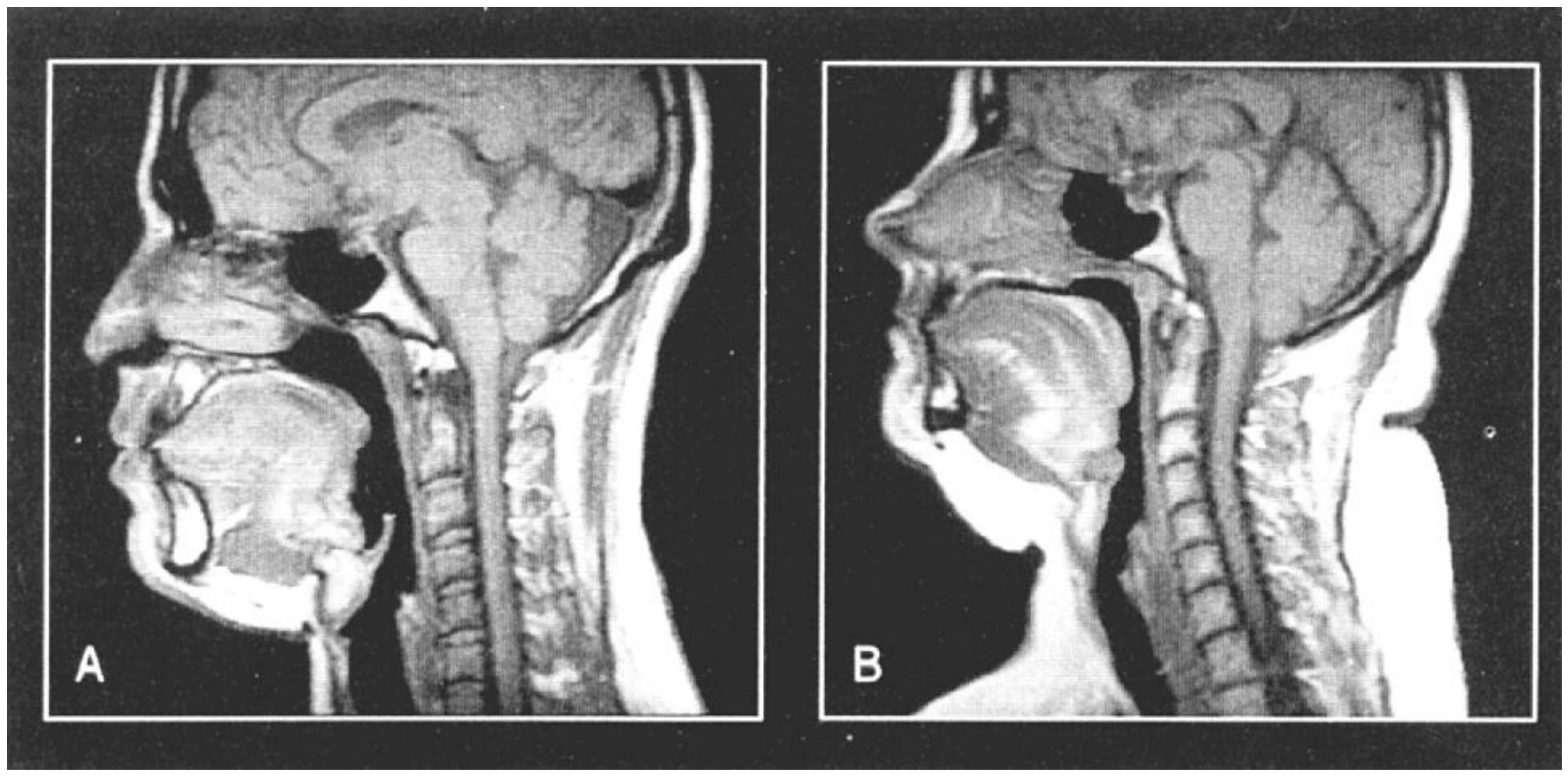


Epidemiology of OSA



- OSA = AHI ≥5
  - 24% men
  - 9% women
- OSA=AHI ≥5 and EDS
  - 4% men
  - 2% women
- Higher prevalence in Asians and Afro-American's

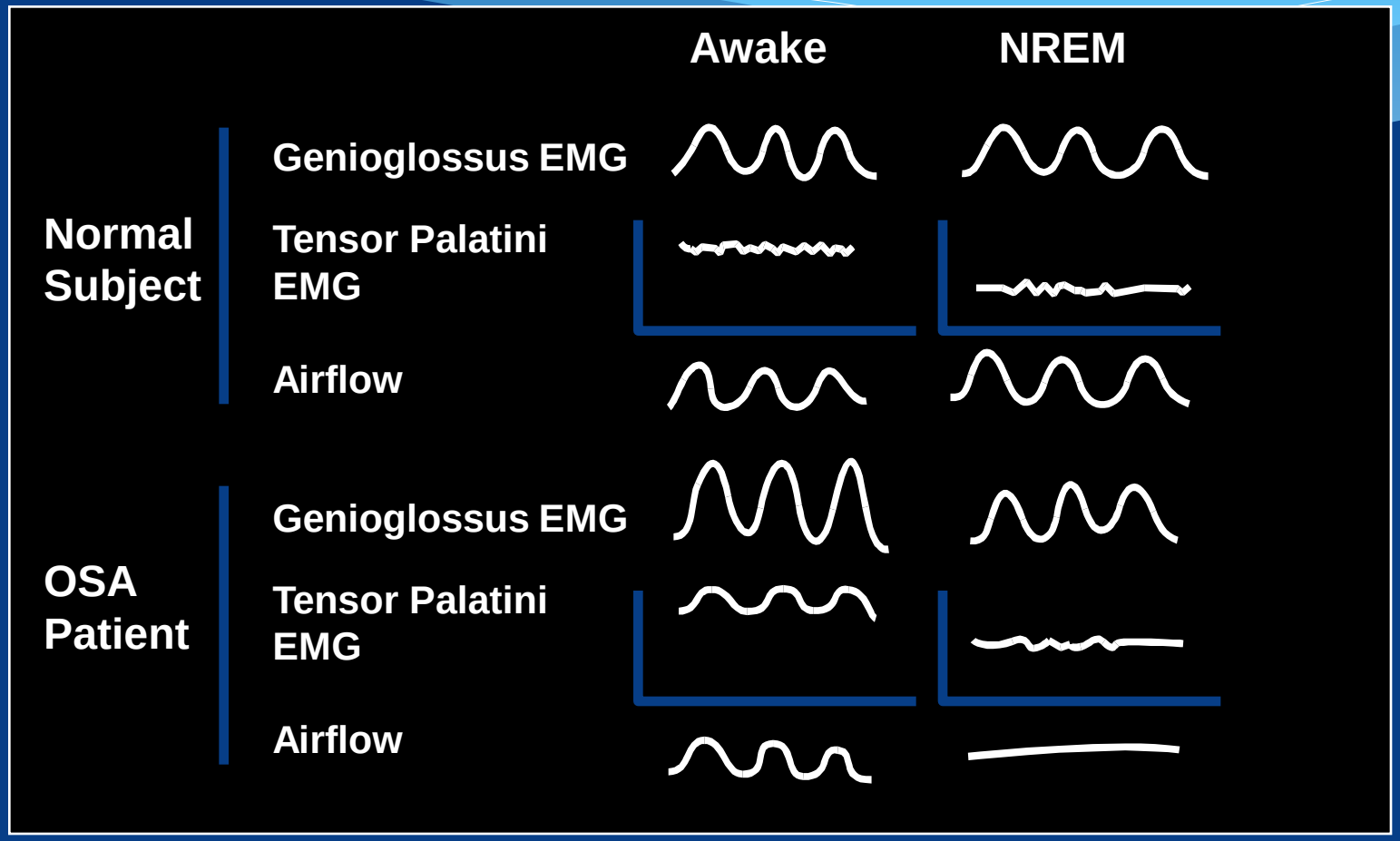
Upper airway size in OSA



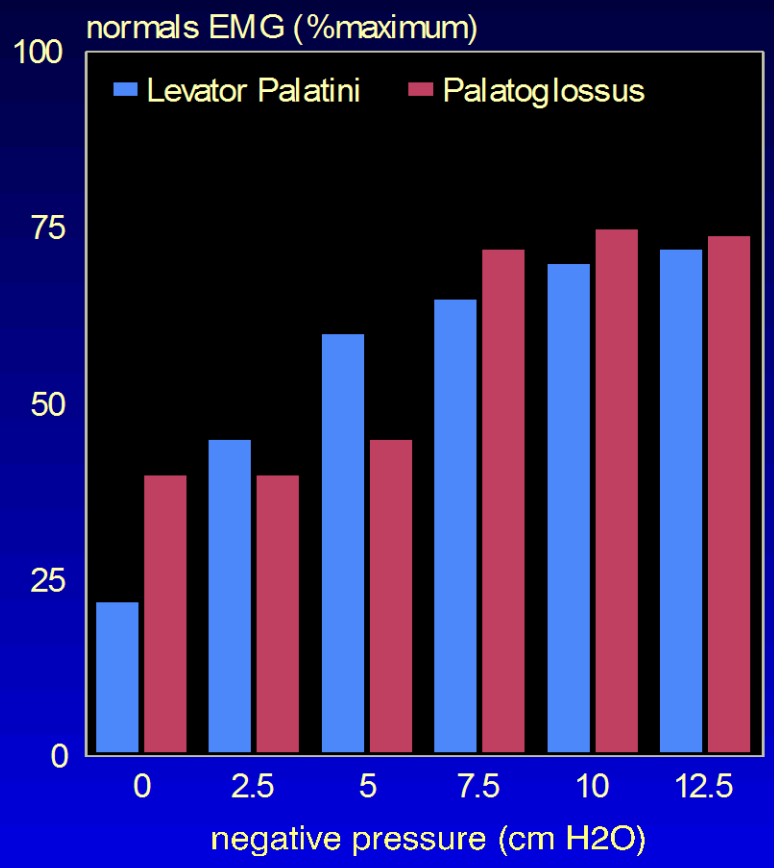
Schwab, R. Clinics in Chest Medicine 1998

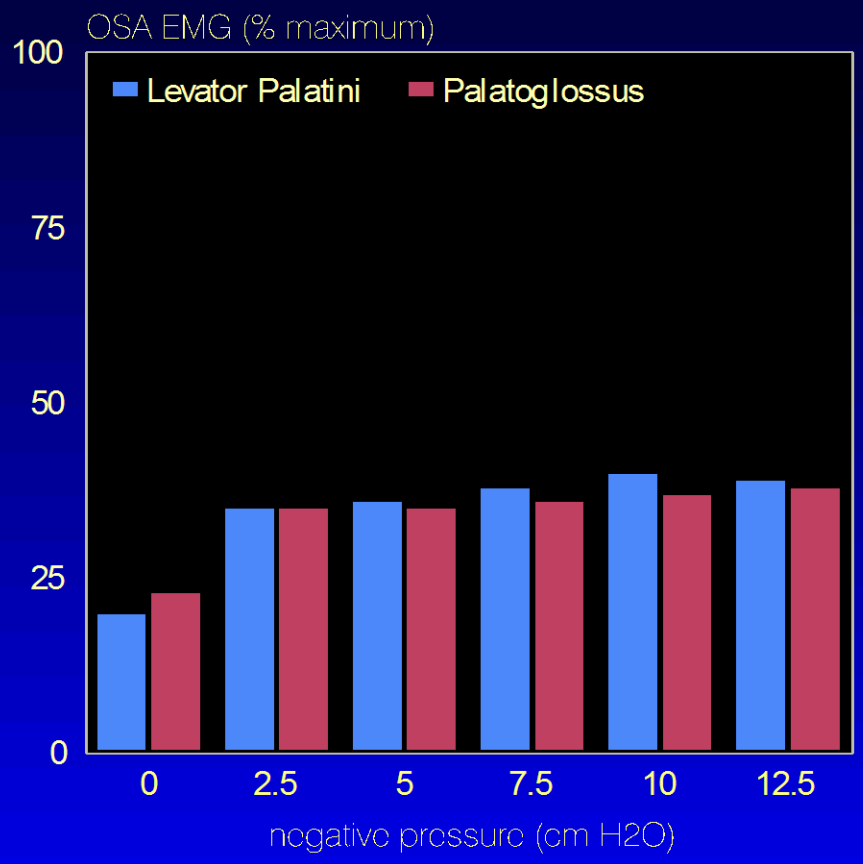
Control of Dilator Muscles

Effects On Pharyngeal Muscle Activity



Impaired upper airway EMG responses to negative pressure in patients with OSA

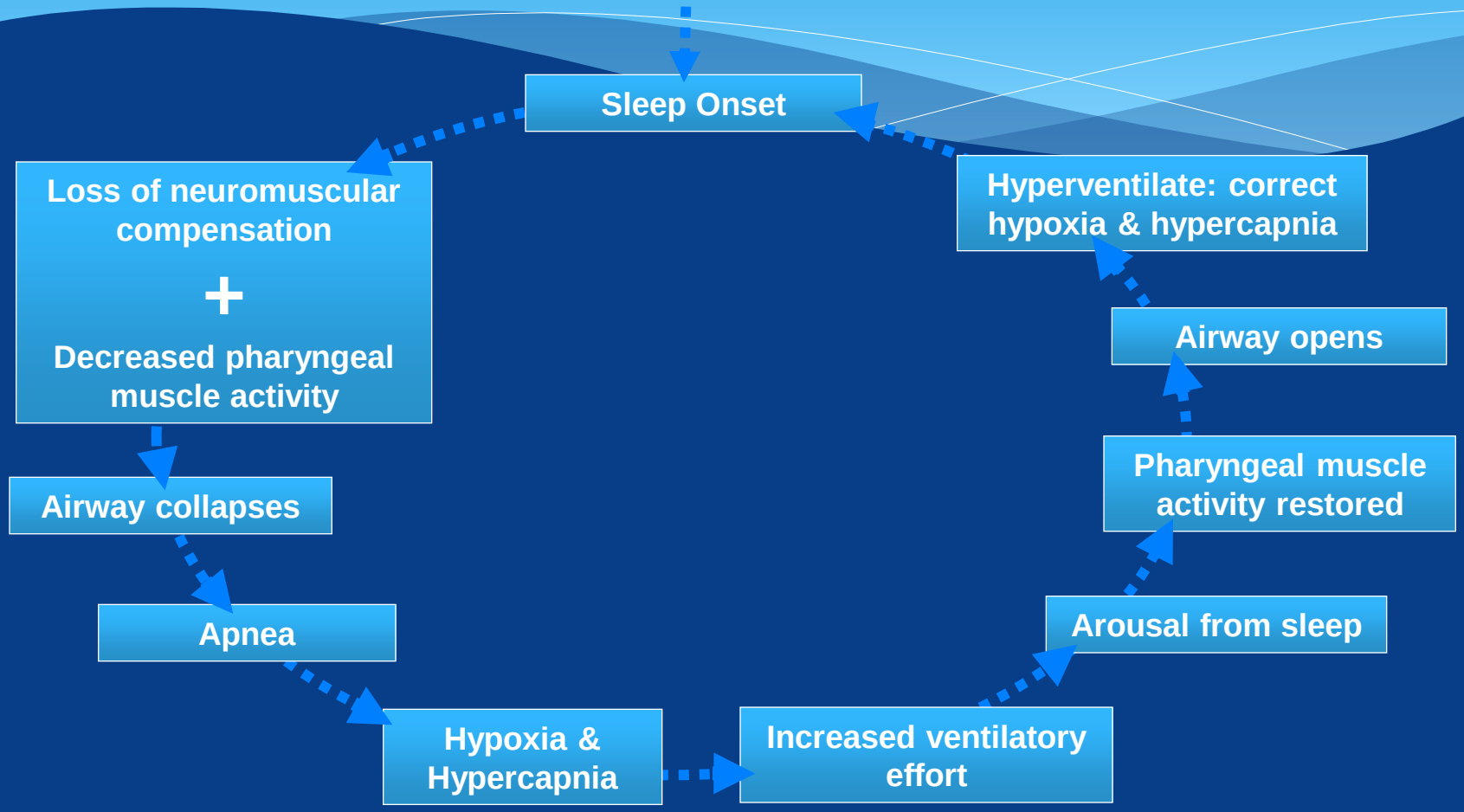




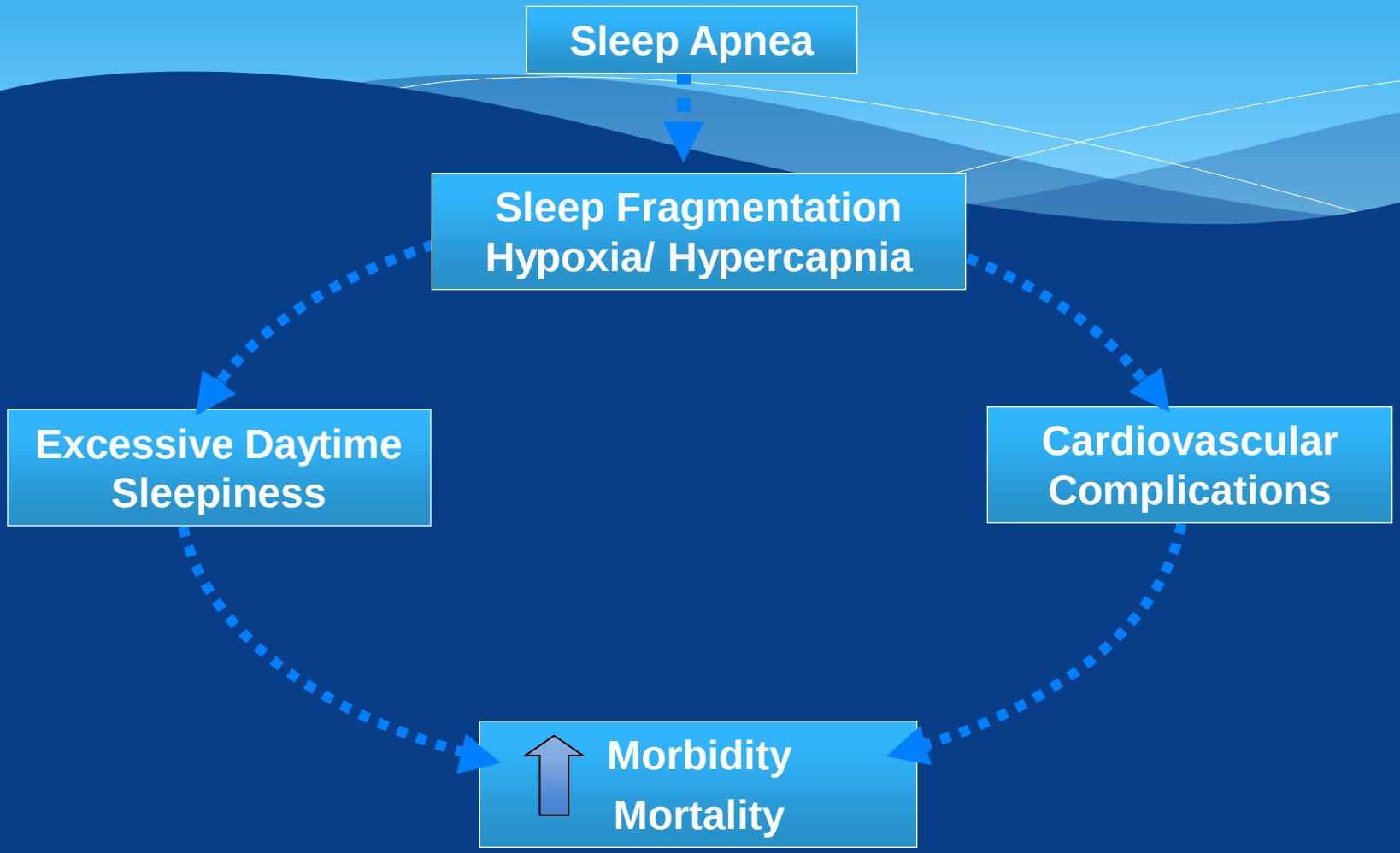
Mortimore, I.L. and Douglas, N.J. AJRCCM 1997;156:867-873

Pathophysiology of Sleep Apnea

Awake: Small airway + neuromuscular compensation



Clinical Consequences



Consequences: Excessive Daytime Sleepiness

* Increased motor vehicle crashes
* Increased work-related accidents
* Poor job performance
* Depression
* Family discord
* Decreased quality of life

Consequences: Cardiovascular

* Systemic hypertension
* Cardiac arrhythmias
* Myocardial ischemia
* Cerebrovascular disease
* Pulmonary hypertension / cor pulmonale

Mechanisms of CV dysfunction in OSA

* Arousals and/or hypoxemia
  * Sympathetic hyperactivity
  * Increased catecholamine's
  * Increased adhesion molecule activity
  * Endothelial injury
  * Suppressed circulating nitric oxide
  * Exaggerated pressor responses
  * Insulin resistance
* All improved by treatment of OSA

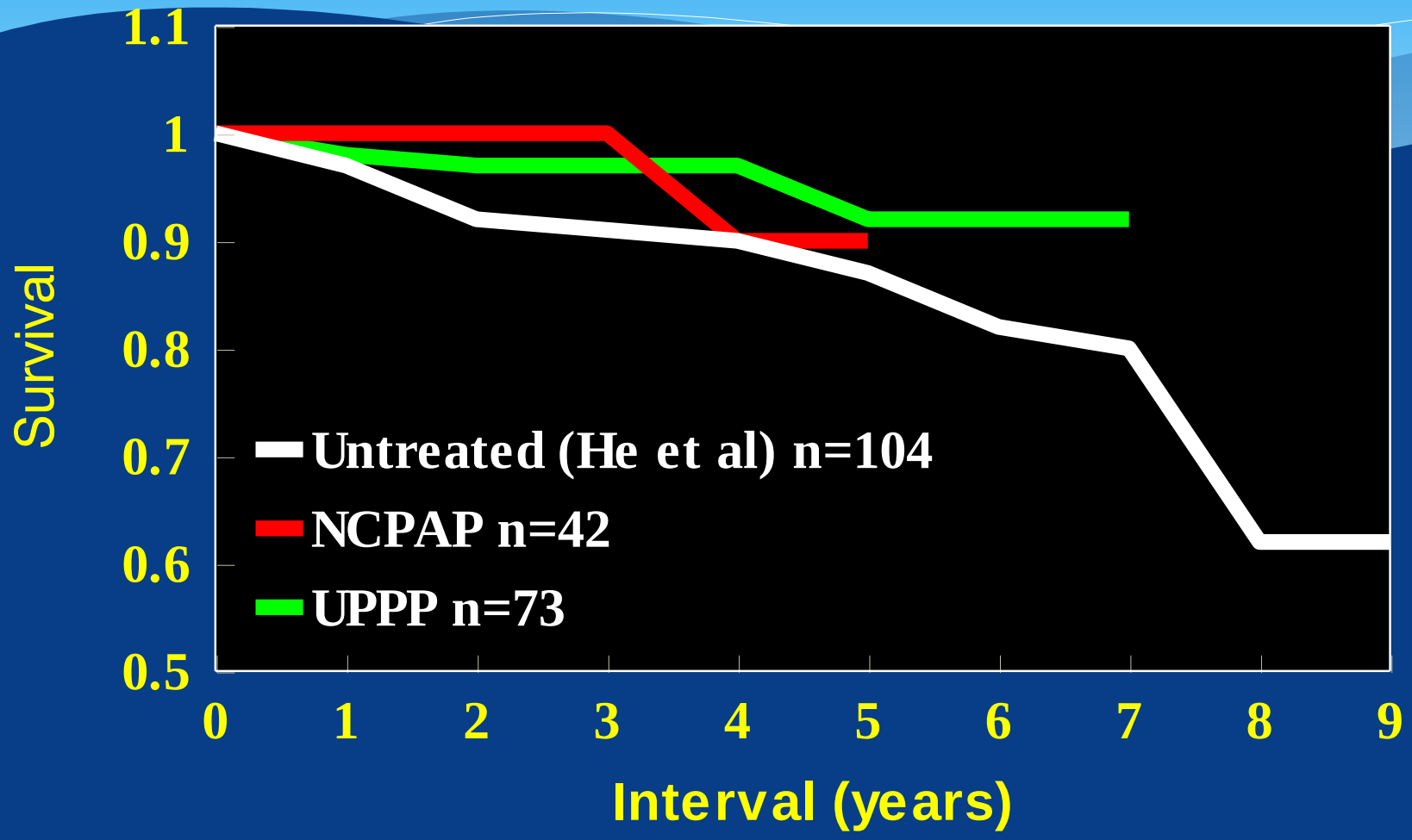
Arrhythmia and OSA

- **Diurnal arrhythmia is not common**
- **Nocturnal arrhythmias are common**
  - **Usually occur during the apneas**
  - **Sinus bradycardia most common**
    - **75% of all OSA**
  - **High grade AV blocks in 4% to 8%**
    - **Pacemaker?**
  - **PVC more often when SaO2 < 60%**
- **Therapy aimed at eliminating OSA**

Consequences: Pulmonary hypertension

- **Prevalence**
  - **10-30% if pulmonary function is normal**
  - **73% if airflow obstruction present**
- **Pathogenisis**
  - **Mechanical factors**
  - **Hypoxia**
- **Improves with NCPAP and tracheostomy, not with O2**

Mortality and OSA



Keenan, S.P. et al. Chest 1994;105:155-159

Sleep Apnea Risk Factors

* Obesity
* Increasing age
* Male gender
* Anatomic abnormalities of upper airway
* Family history
* Alcohol or sedative use
* Smoking
* Associated conditions

Risk Factor: Associated Conditions

* Hypothyroidism
* Acromegaly
* Amyloidosis
* Vocal cord paralysis
* Marfan syndrome
* Down syndrome
* Neuromuscular disorders

Diagnosis: History

* Snoring (loud, chronic)
* Nocturnal gasping and choking
  * Ask bed partner (witnessed apneas)
* Automobile or work related accidents
* Personality changes or cognitive problems
* Risk factors
* Excessive daytime sleepiness

Sleep Apnea: Is Your Patient at Risk? NIH Publication, No 95-3803.

Diagnosis: Assessing Daytime Sleepiness

* Often unrecognized by patient
  * Ask family members
* Must ask specific questions
  * Fatigue vs. sleepiness
  * Auto crashes or near misses
  * Sleep in inappropriate settings
    * Work
    * Social situations

Diagnosis: Physical Examination

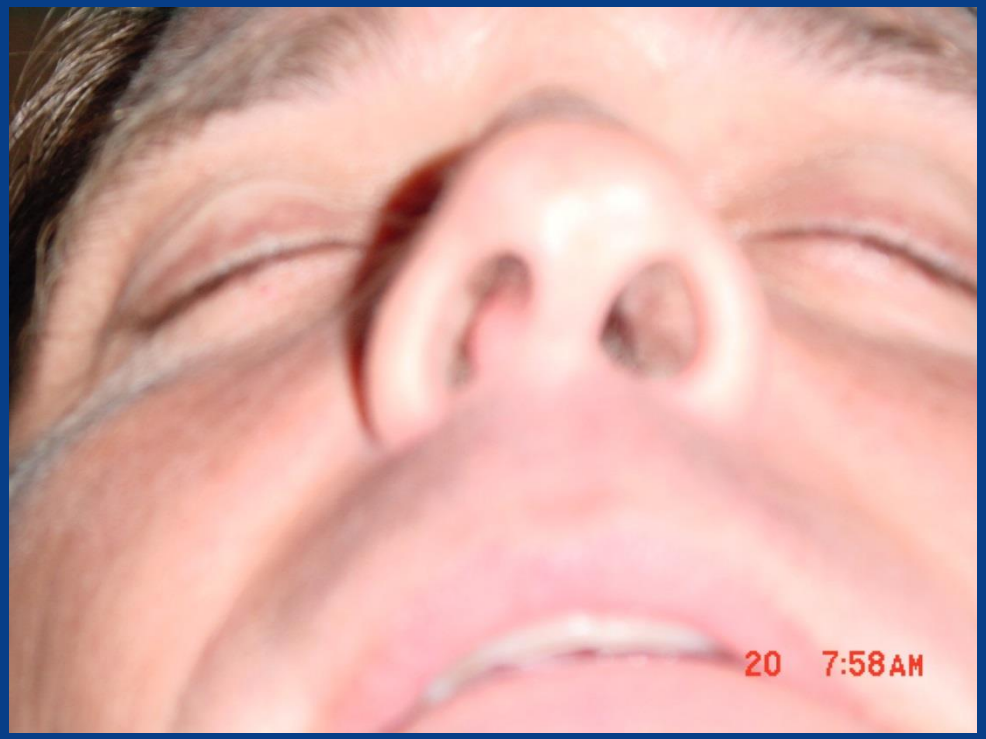
* Upper body obesity / thick neck

  ≥ 17-18” males

  ≥ 16” females

* Hypertension
* Obvious airway abnormality

Septal Deviation causing Nasal Resistance



Tonsillar hypertrophy in OSA

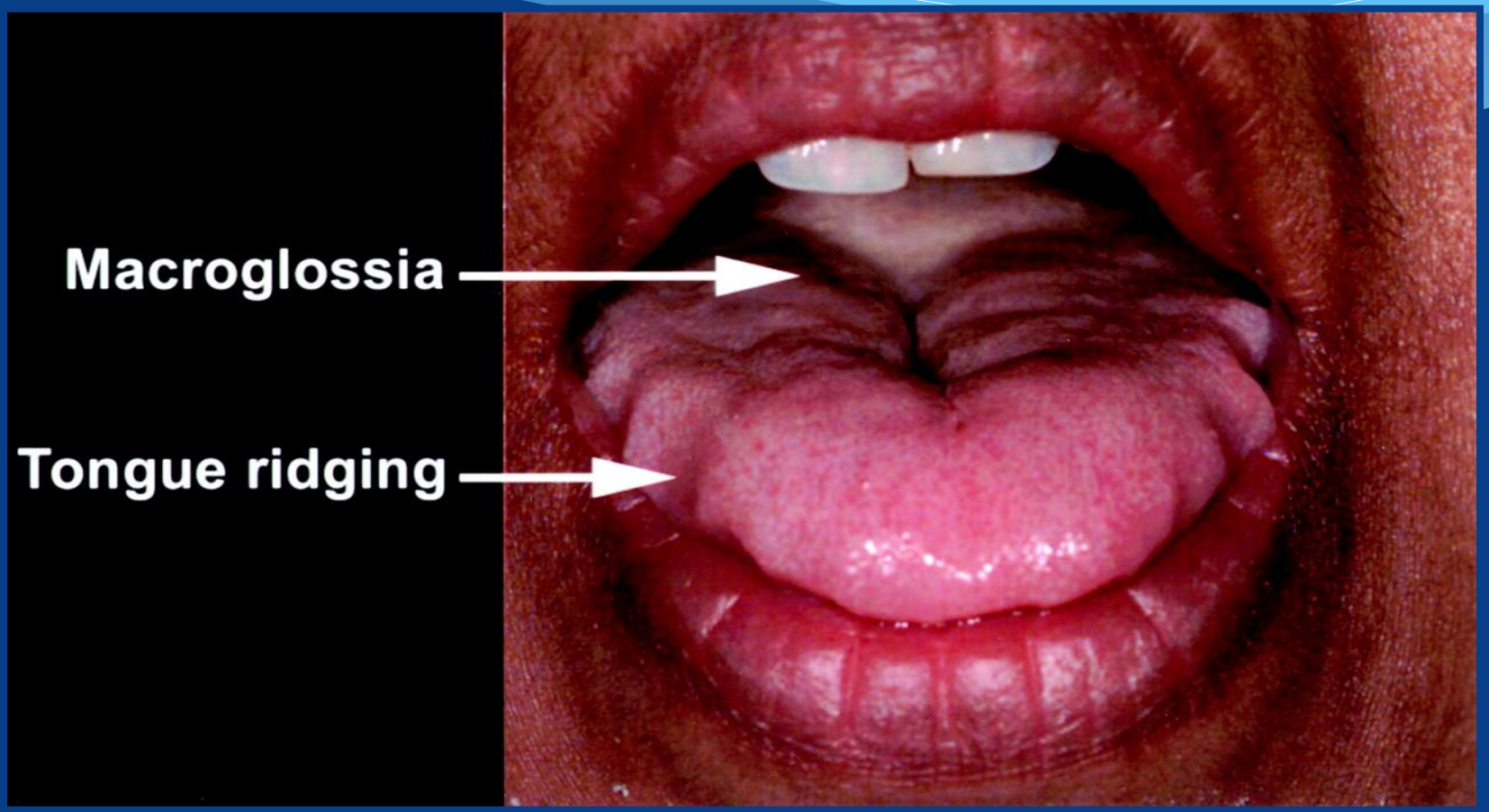
Normal

Patient

Palatomegaly in OSA

Schellenberg, J ARRCCM 2000;162:740-748

Tongue size in OSA



Schellenberg, J ARRCCM 2000;162:740-748

Retrognathia in OSA

Schellenberg, J ARRCCM 2000;162:740-748

What Test Should be Used?

* In-laboratory full night polysomnography
  * Split night studies
* Home diagnostic systems
  * Oximetry to full polysomnography

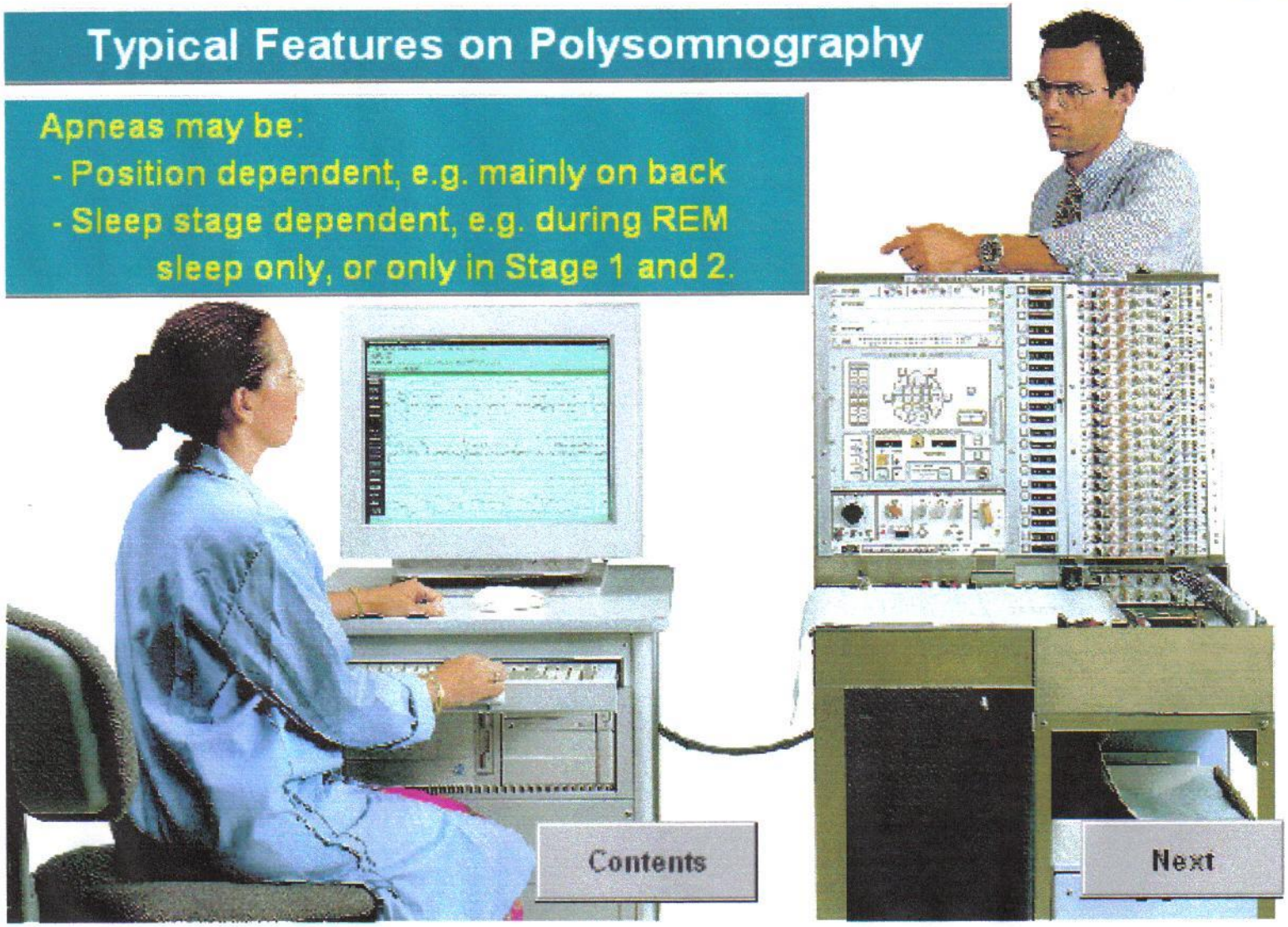
Diagnostic Conclusions

* Signs and symptoms
  * Excessive daytime sleepiness
  * Hypertension and other cardiovascular outcomes.
* Sleep study results
  * Apnea / hypopnea frequency
  * Sleep fragmentation
  * Oxyhemoglobin desaturation

Typical Features on Polysomnography

Apneas may be:

- Position dependent, e.g. mainly on back
- Sleep stage dependent, e.g. during REM sleep only, or only in Stage 1 and 2.



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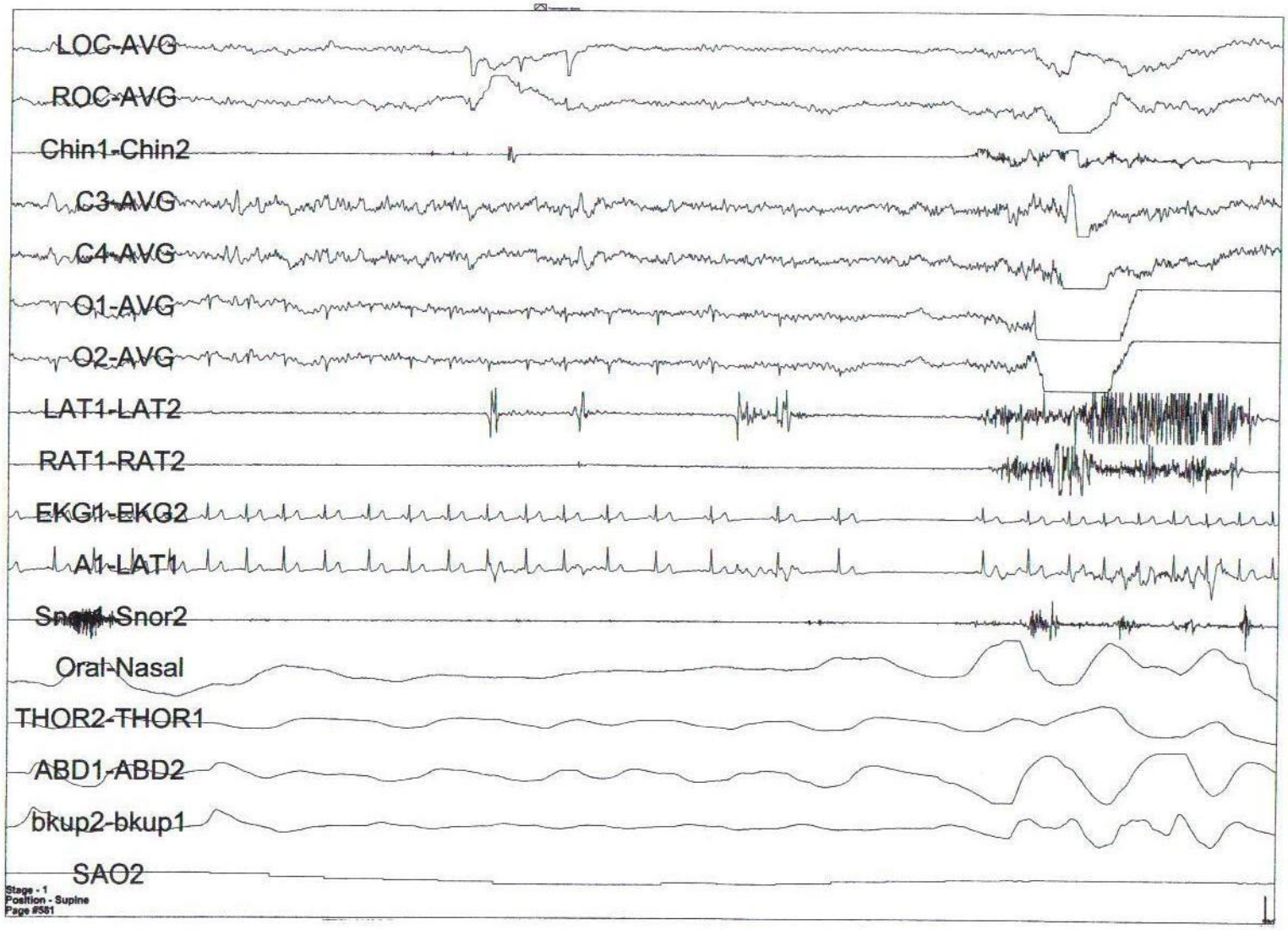
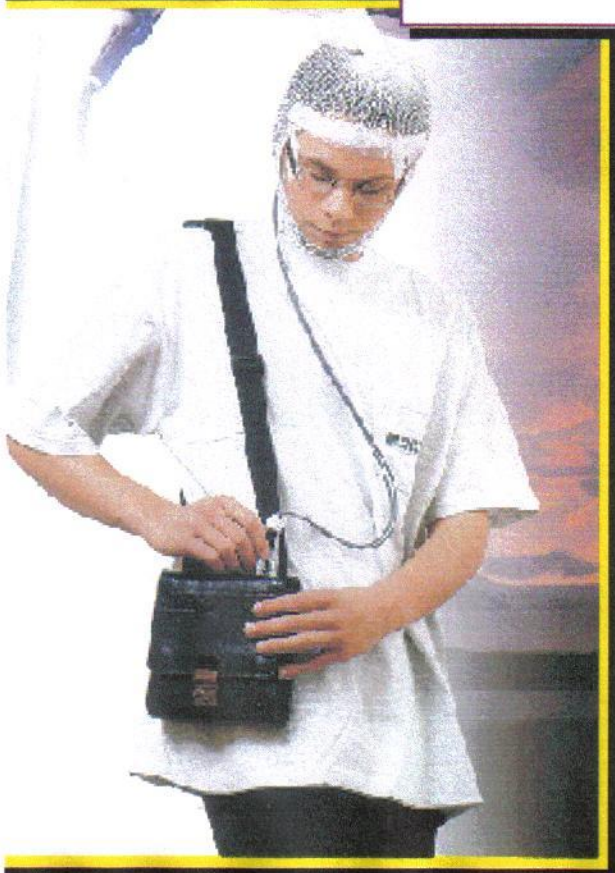


FIG. 8-9 Polysomnogram: Standard montage; 30-second page.
Clinical: Forty-year-old woman with obstructive sleep apnea.
Staging: Stage REM sleep with an arousal.
Respiratory: Apnea followed by an arousal and an oxygen desaturation. The oxygen desaturation on this page was caused by an apnea from the preceding page of the record.
EKG: Bradycardia with the apnea. There is a 3-second asystole at the end of the apnea.

PORTABLE POLYSOMNOGRAPHY



Use

Portable monitoring devices can be useful for assessing sleep-related breathing disorders in patients who are unable to undergo standard in-lab polysomnography. Many devices are available and most differ in the parameters measured.

Diagnostic Conclusions

* Signs and symptoms
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  * Hypertension and other cardiovascular outcomes.
* Sleep study results
  * Apnea / hypopnea frequency
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Why treat OSA?

* Improve bed partners sleep
* Improve patients sleep
* Alleviate daytime sleepiness
* Reverse cognitive impairment
* Improve diurnal blood pressure
* Minimize cardiovascular risk
* Reverse pulmonary hypertension and/or hypercapnia

Therapeutic Approach

* Risk counseling
  * Motor vehicle crashes
  * Job-related hazards
  * Judgment impairment
* OSA and comorbidity treatment
  * Behavioral
  * Medical
  * Surgical

Treatment of obstructive sleep disordered breathing

* Behavioral
  * Weight loss
  * Postural therapy
  * Avoid ethanol and tobacco
* Mechanical
  * Positive airway pressure
  * Oral appliance
* Surgical

Medical Interventions

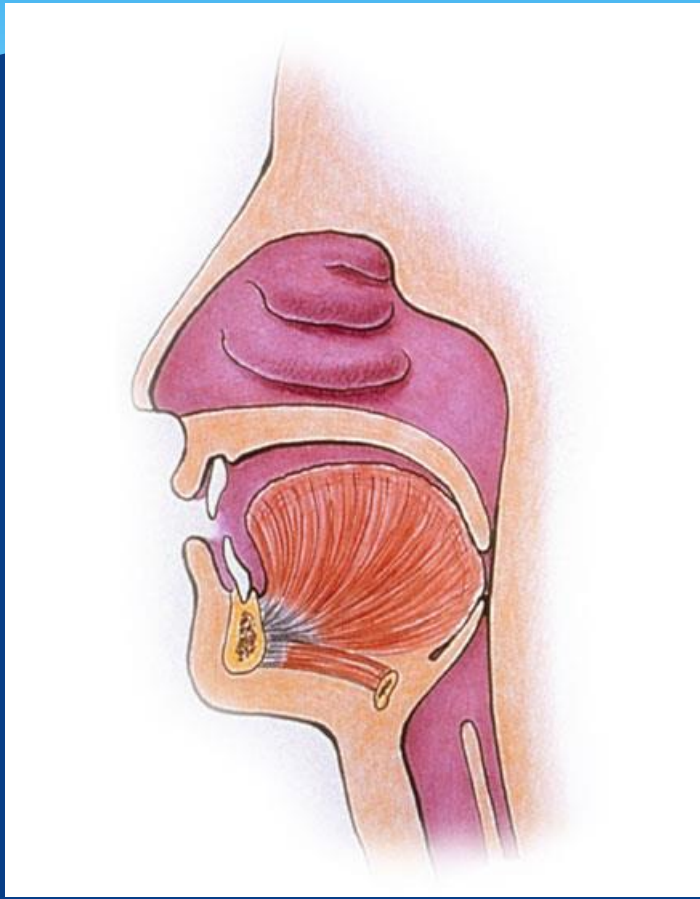
* Positive airway pressure
  * Continuous positive airway pressure (CPAP)
  * Bi-level positive airway pressure (BiPAP or Bi-level PAP)
  * Self adjusting positive airway pressure
  * Expiratory pressure release
* Oral appliances
* Other (limited role)
  * Medications
  * Oxygen

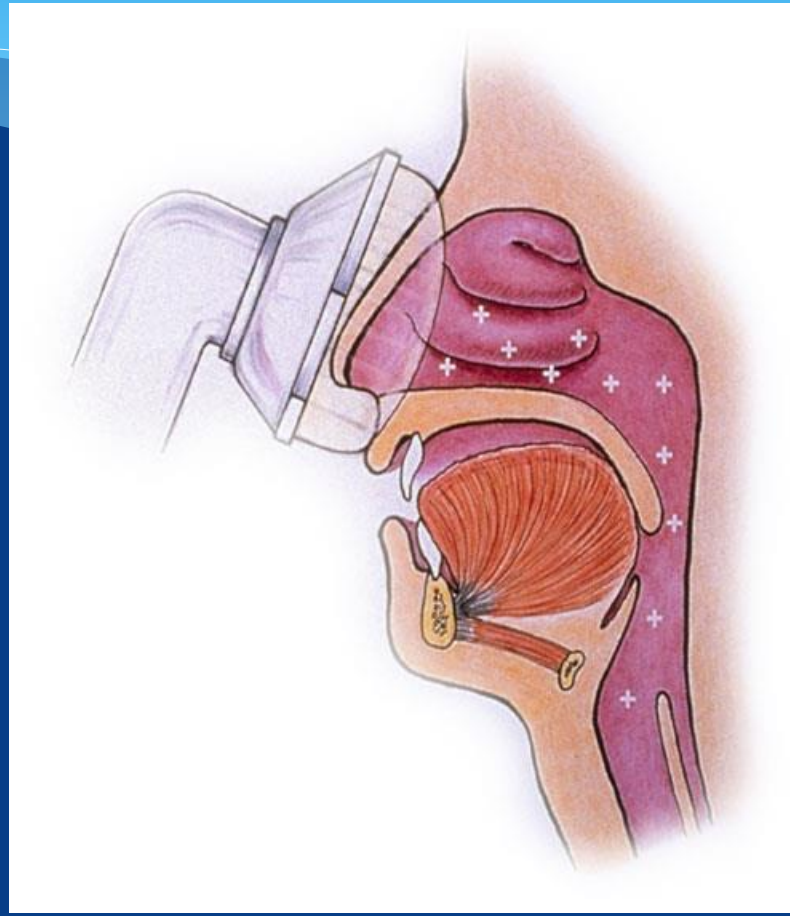
Indications for positive airway pressure therapy

* RDI ≥ 30 regardless of symptoms
* RDI 5-30
  * EDS
  * Impaired cognition
  * Mood disorder
  * Insomnia
  * ASCVD

Consensus Statment in Chest 1999;115:863-866

Positive Airway Pressure





CPAP Compliance

* Patient report: 75%
* Objectively measured use

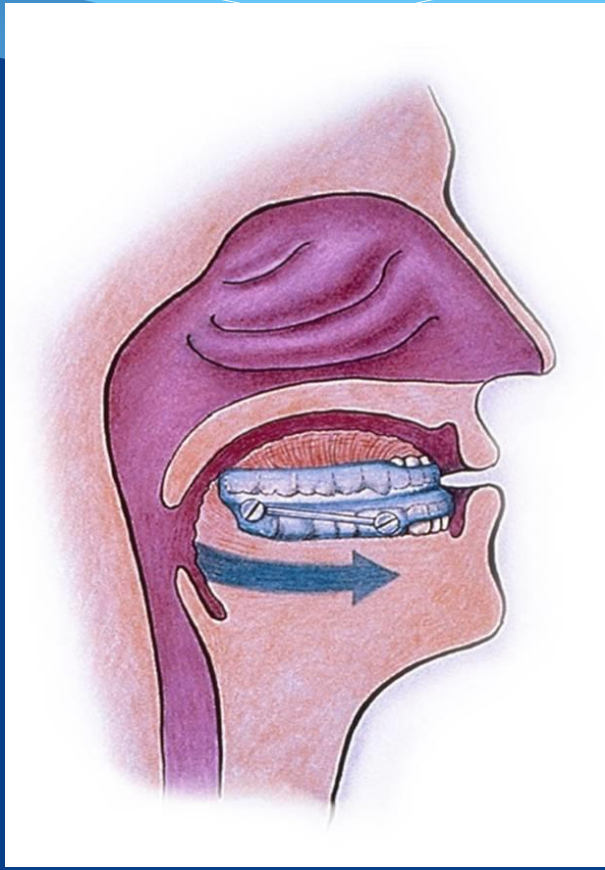
  $\geq$ 4 hrs for $\geq$ 5 nights / week: 46%
* Asthma-medicine compliance: 30%

Strategies to Improve Compliance

* Machine-patient interfaces
  * Masks
  * Nasal pillows
  * Chin straps
* Humidifiers
* Ramp
* Desensitization
* Pressure modification strategies

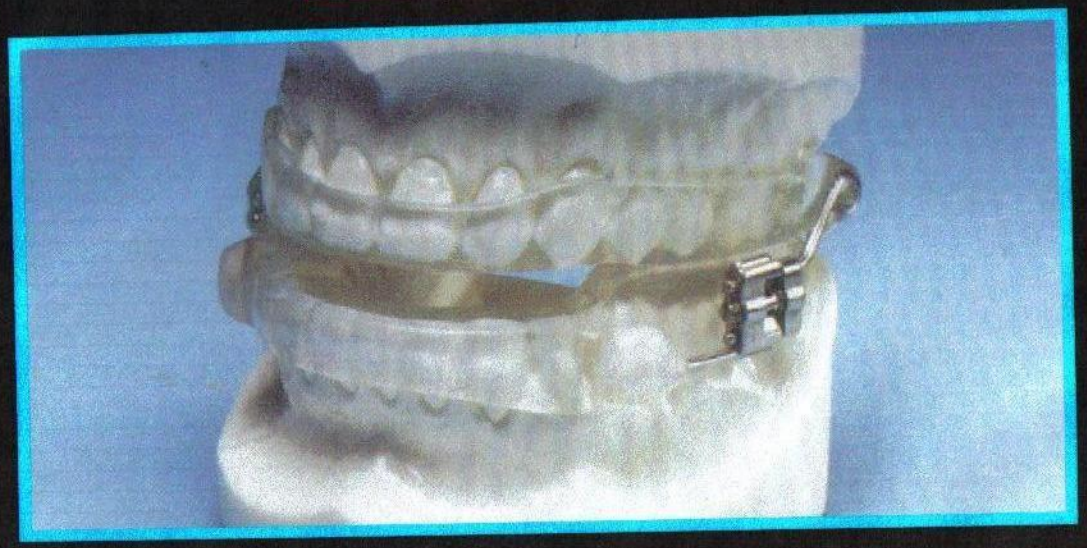
Oral Appliances

* Indications
  * Snoring and apnea (not severe)
* Efficacy
  * Variable
* Side effects
  * TMJ discomfort, dental misalignment, and salivation



Oral Appliances

PM Positioner

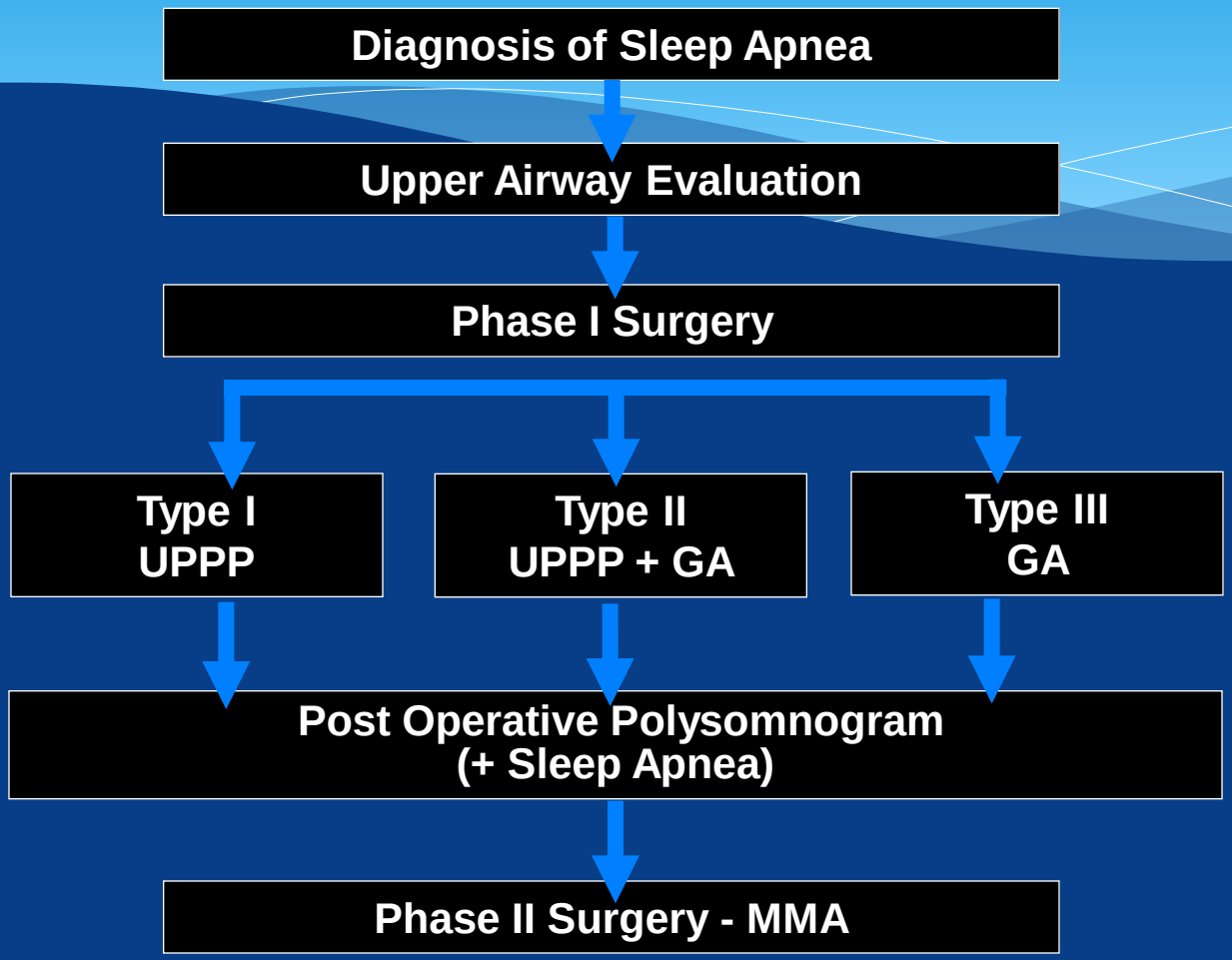


The PM Positioner functions as a mandibular repositioner and may be laboratory constructed from thermoplastic material allowing for easy insertion and removal when warmed. It is tooth retained via friction grip and may be constructed with unique acrylic projections located in the cervical areas of the posterior teeth to aid retention. Protrusive adjustability is quick, easy and accurate by movement of two expansion screws located bilaterally

Return to List of Oral Appliances

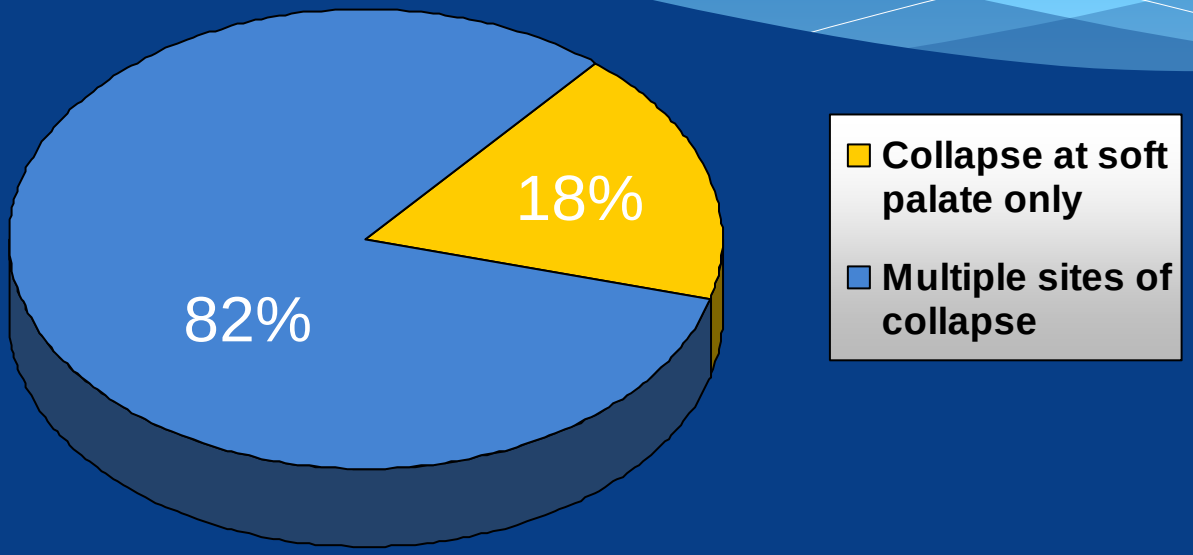
Photos courtesy of Robert Rogers DMD

Staging of Surgical Procedures



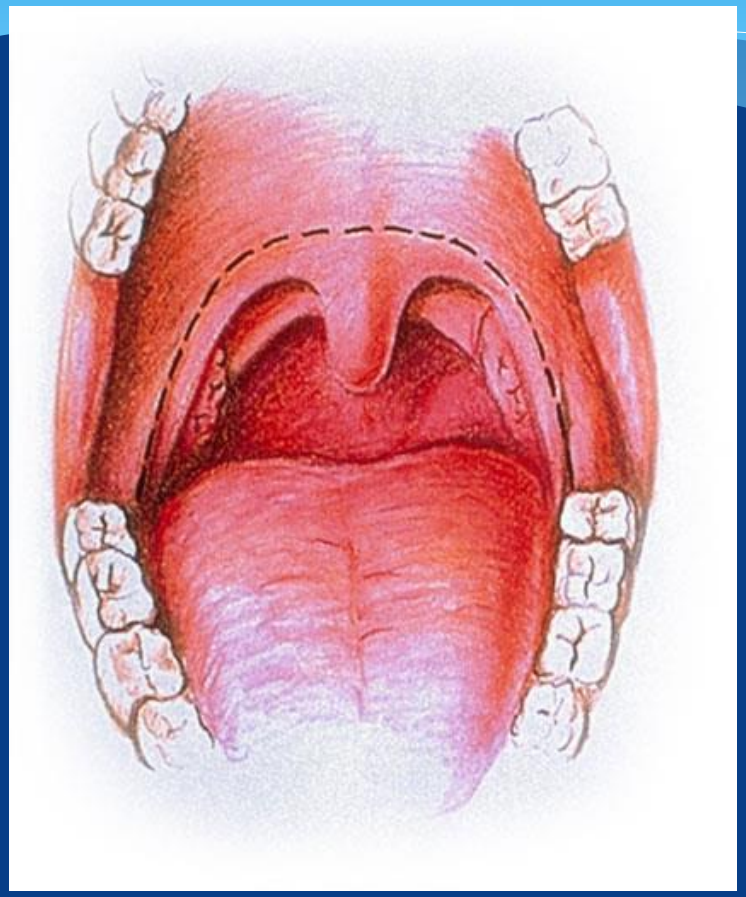
Adapted from Riley RW et al. Otolaryngol Head Neck Surg 1993;108.

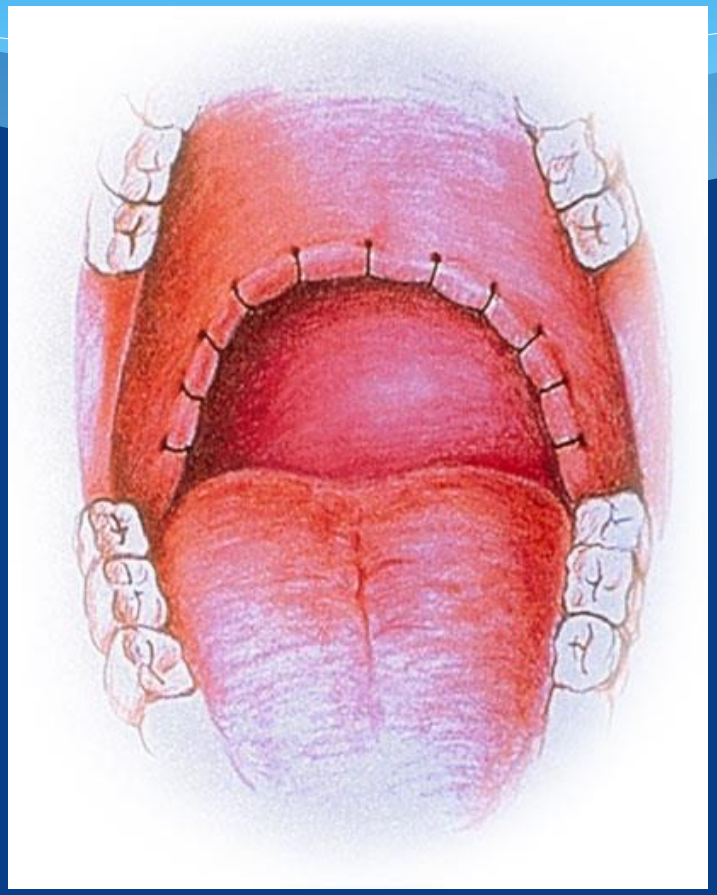
Sites of Airway Narrowing



Adapted from Morrison DL et al. Am Rev Respir Dis 1993;148.

Uvulopalatopharyngoplasty (UPPP)

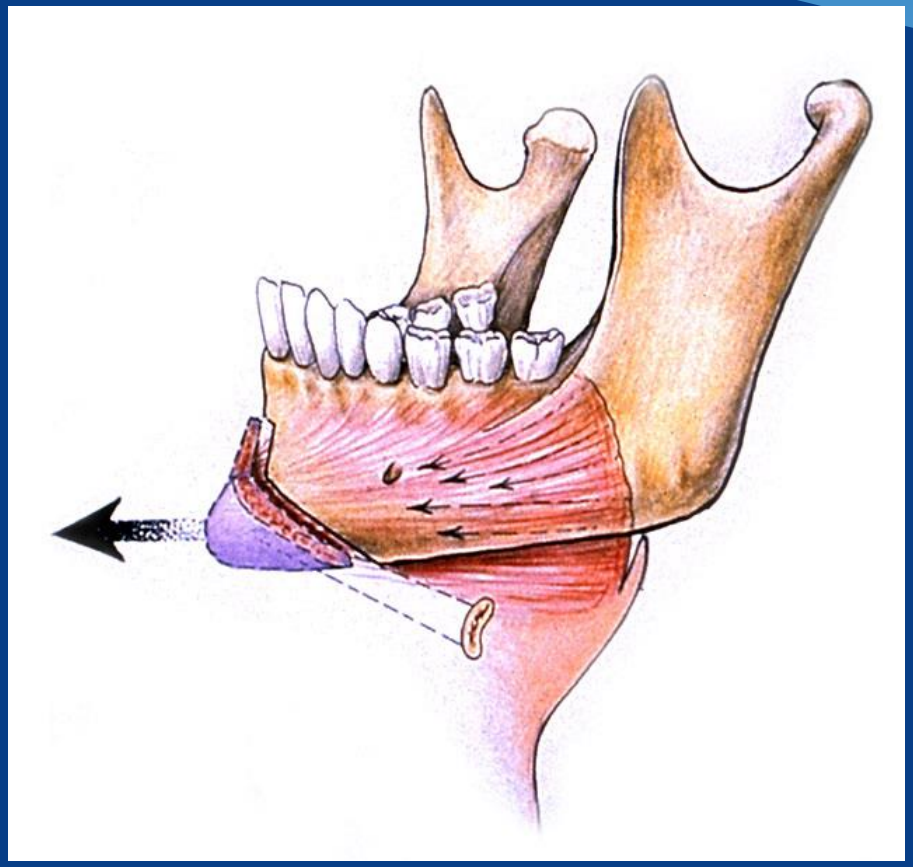


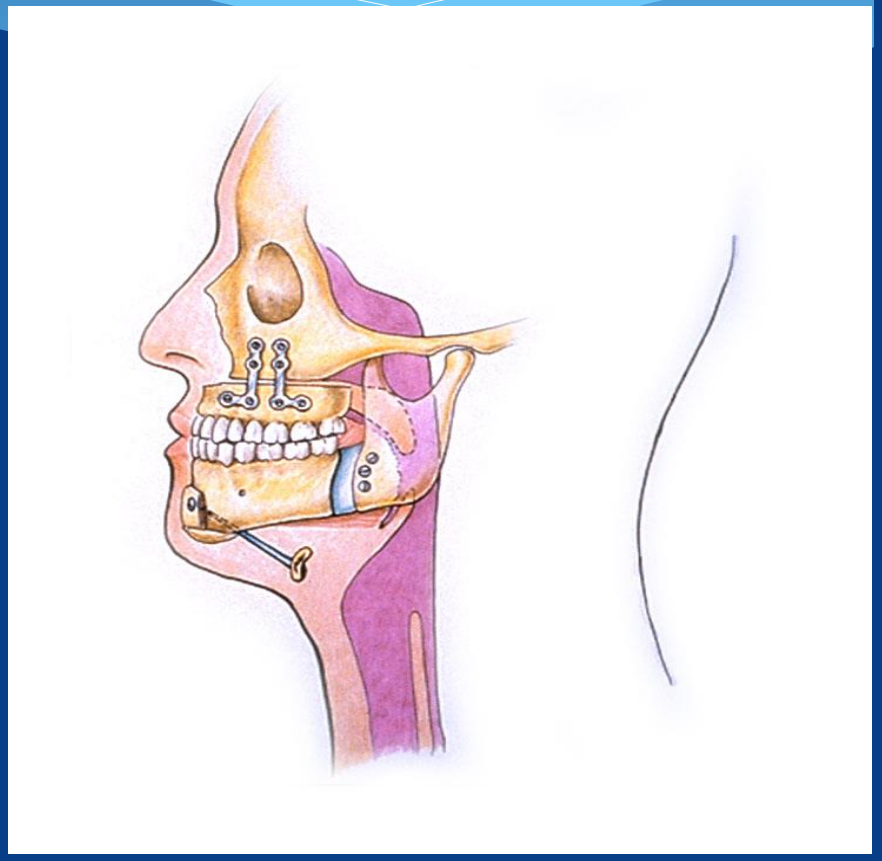


UPPP success in OSA

Author	Reported	Adjusted
Borowiecki	46%	43%
Wetmore	63%	40%
Katsantonis	33%	9%
Caldarelli	50%	29%
Gislason	65%	57%
Total n=126		37%

Staged Surgical Procedures





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* Reverse cognitive impairment
* Improve diurnal blood pressure
* Minimize cardiovascular risk
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When to refer to a Sleep Specialist

* When the case does not respond to therapy or intolerante to treatment.
* Complex Sleep History- OSA plus RLS,RBD, Insomnia.