

Advanced Treatments for Obstructive Sleep Apnea

Anthony Barber, DO

Sleep Facility Director

Colorado Sleep Institute &
Boulder Community Health

303-536-7573



Boulder Community Health

What We'll Cover

- What is OSA?
 - Causes
- Signs/symptoms of sleep apnea
- Health risks
- Latest approaches to treatment

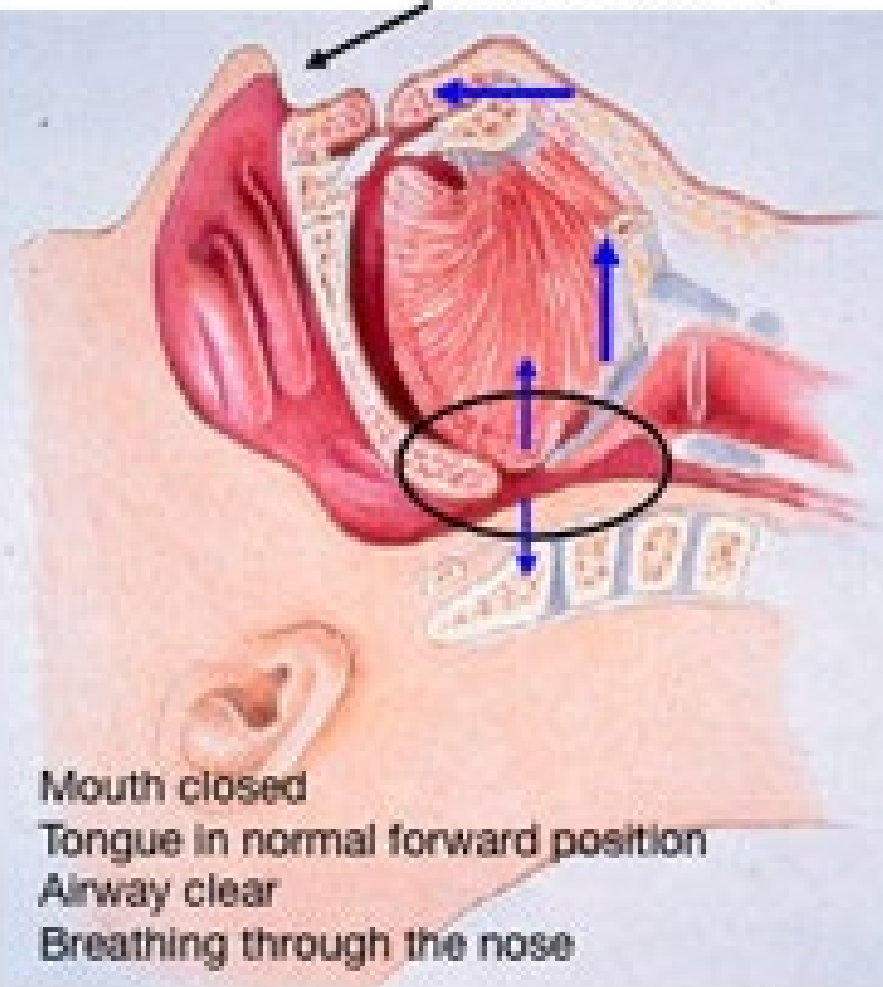
What is Sleep Apnea?

- Pliable or disproportionately large structures in upper airway collapse when airway dilators lose tone (waking input).
- Partial collapse causes reduction (“**hypopnea**”) in airflow.
- Complete collapse causes cessation (“**apnea**”) of airflow.
- Hypoxia (↓O₂) and hypercapnia (↑CO₂) prompt brief arousals during which recovery breathing occurs.
- Sleep architecture is disrupted and physiologic stress is increased, leading to daytime neurocognitive impairment and elevated cardiovascular risk.

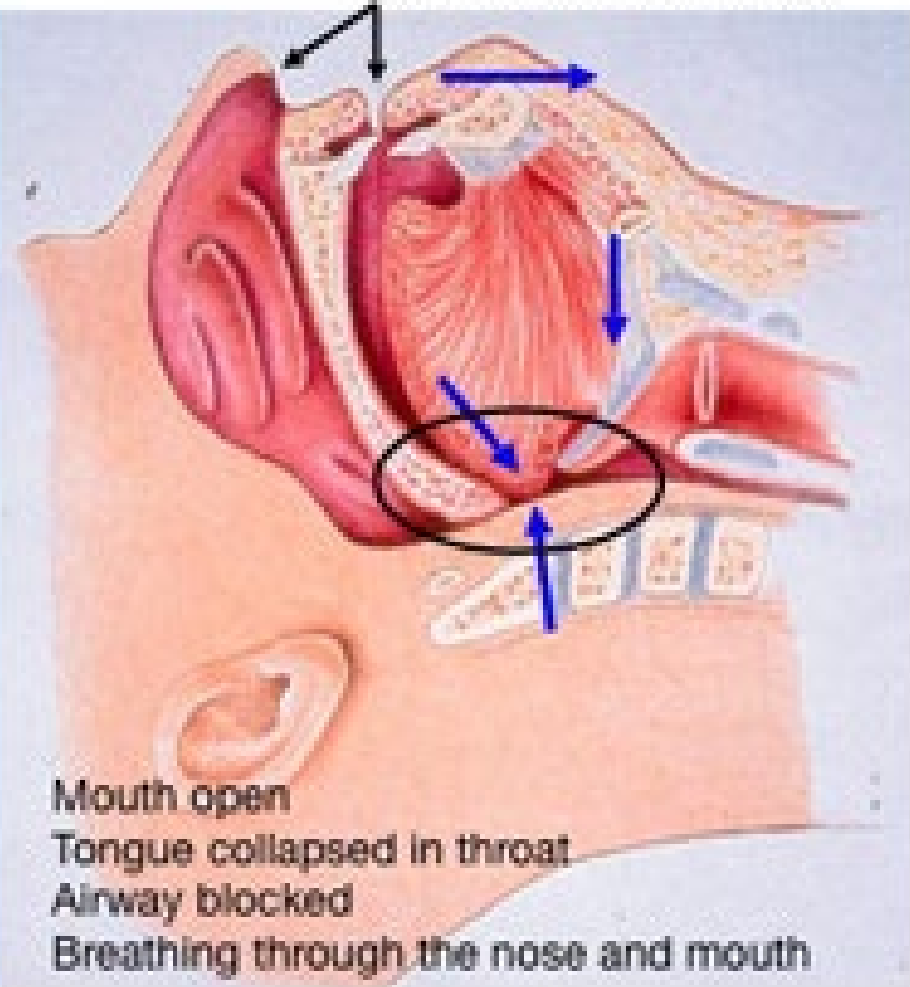
Show Me!



Normal Breathing



Obstructed Breathing



Signs/Symptoms

- Snoring, witnessed apneas, gasps for breath
- Daytime sleepiness, unrefreshing sleep
 - Increased risk of motor vehicle accidents, work problems
- Morning headaches
- Memory/concentration; ADHD (children)
- Frequent nocturia (urination at night)
 - Not ALWAYS the prostate!

Friedman Scale



Fig 1. Friedman Palate Position 1 allows visualization of the entire uvula and tonsils



Fig 2. Friedman Palate Position 2 allows visualization of the uvula but not the tonsils



Fig 3. Friedman Palate Position 3 allows visualization of the soft palate but not the uvula



Fig 4. Friedman Palate Position 4 allows visualization of the hard palate only

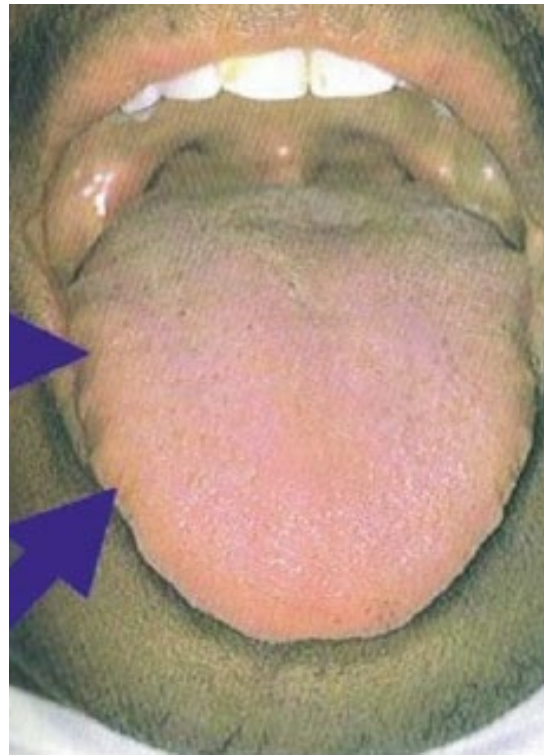
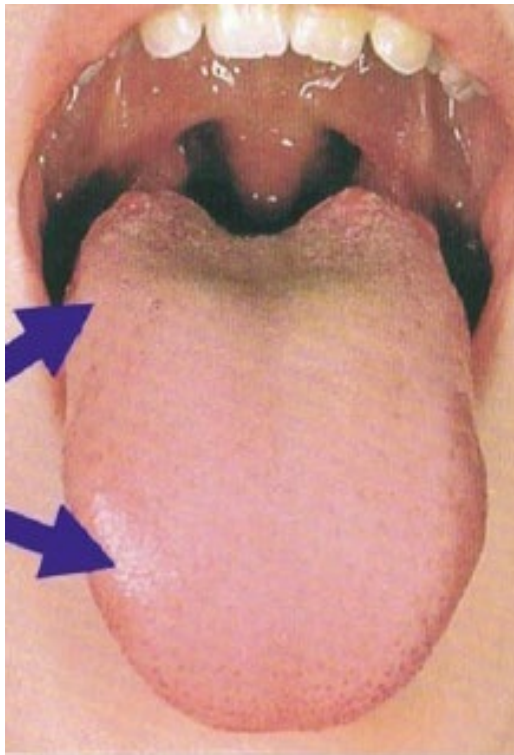
High-Arched Hard Palate

- Crowds oral airway and forces tongue backwards
- Impedes Nasal Airflow, leads to open mouth breathing and retropositioning of the tongue



The Association of Tongue Scalloping With Obstructive Sleep Apnea and Related Sleep Pathology

Todd M. Weiss, MD, Strahil Atanasov, MD, and Karen H. Calhoun, MD, FACS, Springfield, Illinois; Galveston, Texas; and Columbia, Missouri



Retrognathia: backward positioning of the mandible



Retrognathia → retropositioning of the tongue

Neck Circumference and Pretest Probability of OSA

Neck Circumference	% with OSA
Men	
17 inches	31%
Women	
15 inches	14%

Young et al. NEJM 329:1429

Obstructive Sleep Apnea

- Moderate or severe OSA in ~6% of adults in the US population
- Prevalence increasing with obesity epidemic
- Daytime impairment symptoms are **common complaints**
- Significant link to medical disease

Medical Comorbidities

- Hypertension (esp: Refractory HTN)
- Heart disease (CAD/CHF/arrhythmia)
- Stroke
- Nocturnal GERD
- Glaucoma
- Obesity, Metabolic syndrome
- Type 2 DM
- Depression/anxiety
- Insomnia
- Fibromyalgia
- Dementia
- ADHD

The AHI is the most common metric to predict future risk from OSA

- **Apnea-Hypopnea Index (AHI)**

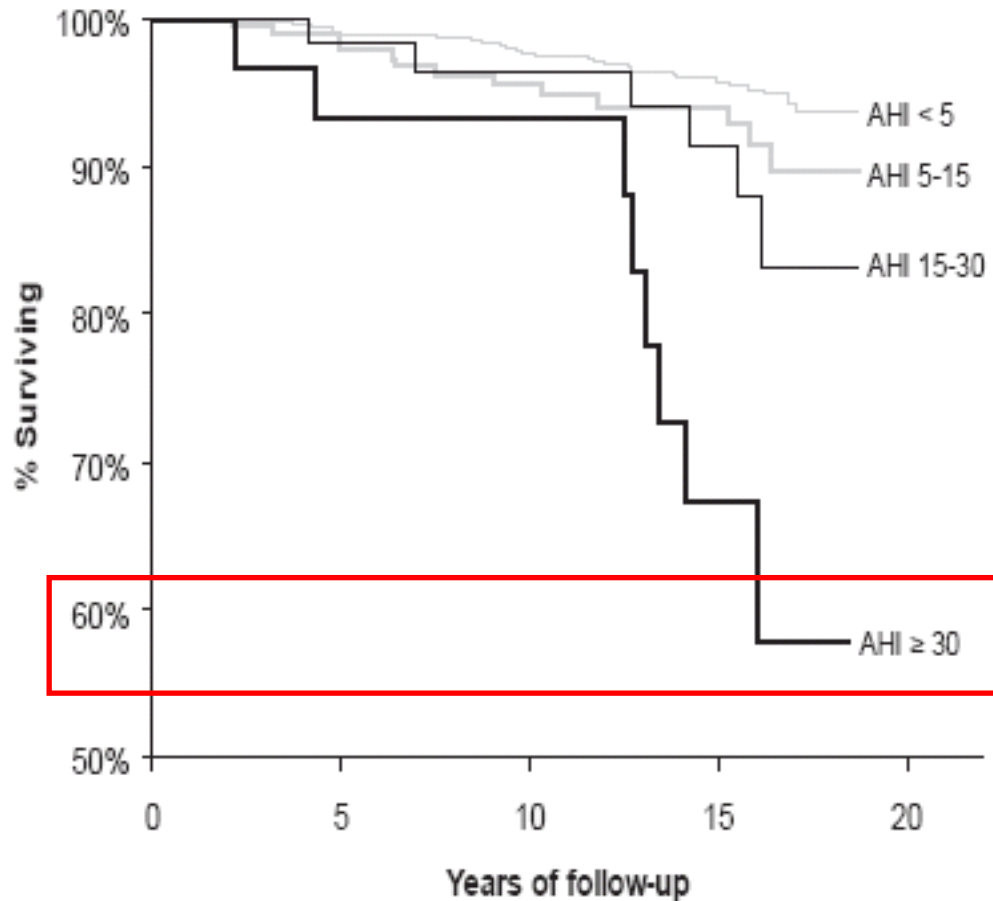
- Number of Apneas & Hypopneas per hour of sleep
- $AHI \geq 5$ is considered abnormal if CV risk factors or daytime impairment symptoms are present. BP's tend to be higher, associated with "*non-dipping status*"
- $AHI \geq 15$ —mortality risk may be increased
- **$AHI \geq 30$ is *strongly* associated with increased mortality**

The Wisconsin Sleep Cohort (2008)

- 1522 patients collected from a community-based sample underwent polysomnography
- 18-year follow up
- Compared mortality rates for no OSA (AHI<5), mild OSA (AHI 5-14), moderate OSA (AHI 15-29) and severe OSA (AHI \geq 30)

Citation: Young T; Finn L; Peppard PE; Szklo-Coxe M; Austin D; Nieto FJ; Stubbs R; Hla KM. Sleep disordered breathing and mortality: eighteen-year follow-up of the wisconsin sleep cohort. *SLEEP* 2008;31(8):1071-1078.

WSC: Risk of death tracks with the AHI



Untreated OSA

These three groups numerically began to separate, but statistically were still similar.

For AHI>30, a significant mortality increase was seen.

Important: Increased mortality was noted in sleepy and nonsleepy patients!

Citation: Young T; Finn L; Peppard PE; Szklo-Coxe M; Austin D; Nieto FJ; Stubbs R; Hla KM. Sleep disordered breathing and mortality: eighteen-year follow-up of the wisconsin sleep cohort. *SLEEP* 2008;31(8):1071-1078.

Oxygen Desaturation and Apnea Associated Arrhythmias

- Degree and frequency of oxygen desaturation
 - Intermittent hypoxia is linked to production of inflammatory mediators, which lead to endothelial damage as well as sleepiness
 - May be additive to other risk factors, e.g., pre-existing coronary disease
- Apnea associated arrhythmias

1st Need to Diagnose

Home sleep apnea test (HSAT)

- Basic diagnostic test
- Allows scoring of respiratory events only (does not stage sleep)
- Good positive predictive value (high specificity)
- High false negative rate (upwards of 24%)

Polysomnogram (PSG)

- Gold standard
- Mixed/central sleep apnea
- Hypoventilation
- Parasomnias
- Only way to “rule out” sleep apnea

Treatment Options for OSA

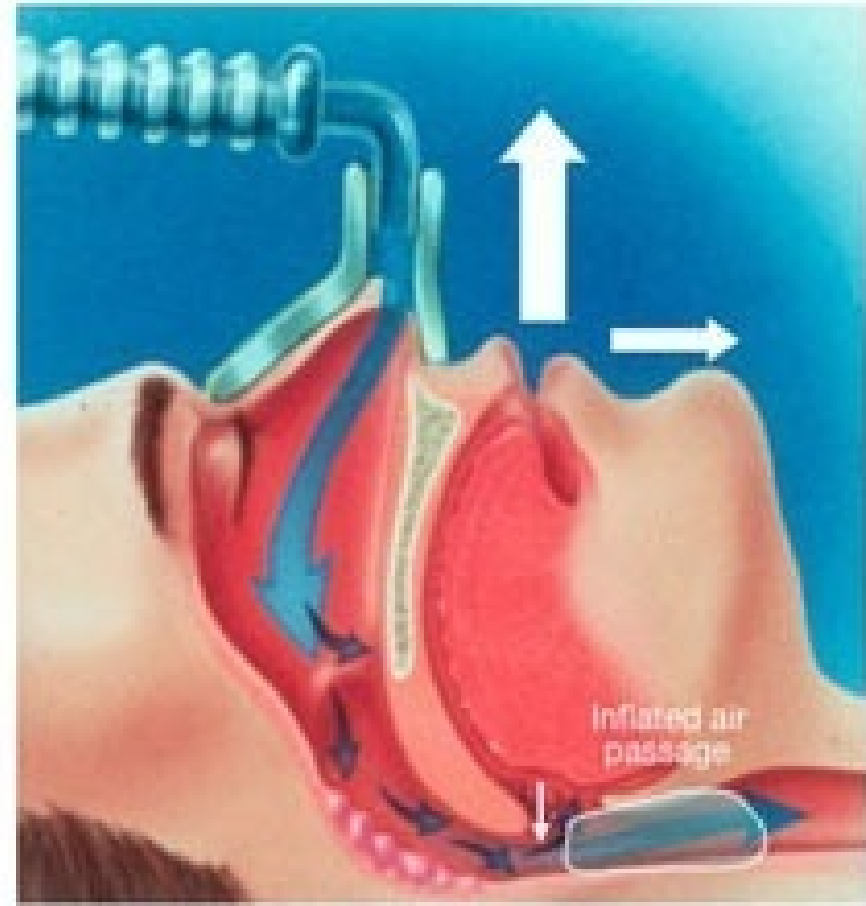
- Positive airway pressure therapy
- Oral Appliance Therapy
- Surgery:
 - Nasal, oropharyngeal, maxillofacial
 - Hypoglossal Nerve Stimulation Therapy (“INSPIRE”)
- Airway strengthening exercises
- Weight Loss
- Positional Therapy

CPAP-What It's Not



How Positive Airway Pressure Therapy Works to Open the Airway

- Positive pressure is delivered via one of many interfaces (“masks”)
- Helps keep posterior airspace open during sleep
- Works in all sleeping positions
- **Most effective noninvasive way to lower the AHI**



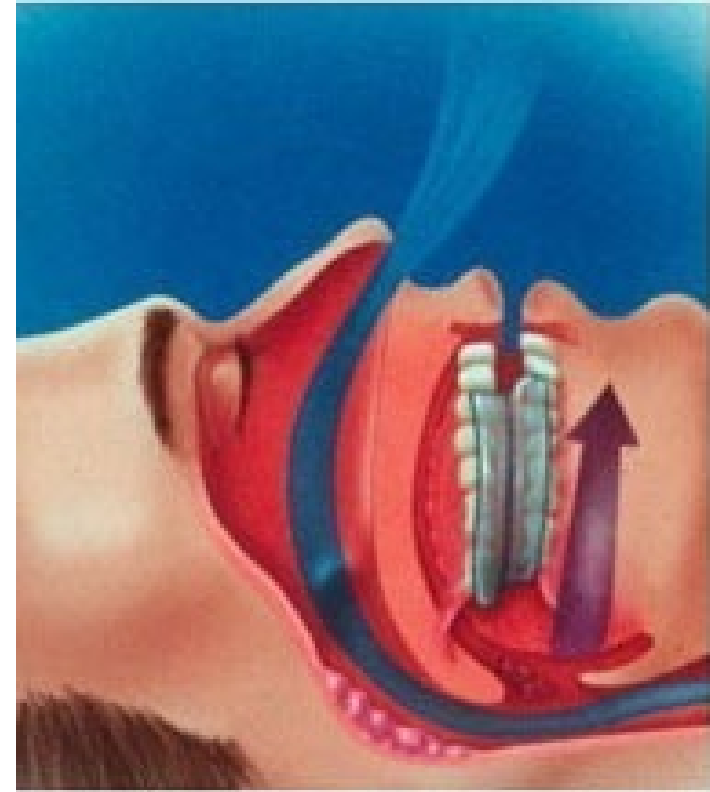


Again, No!



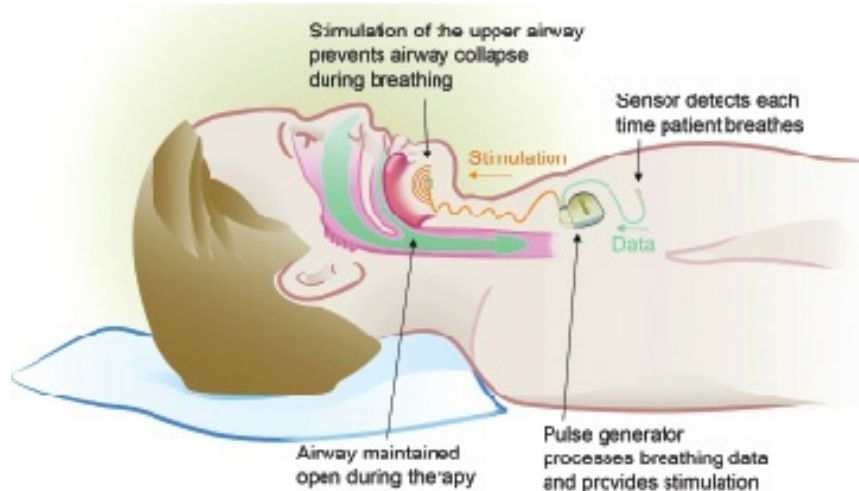
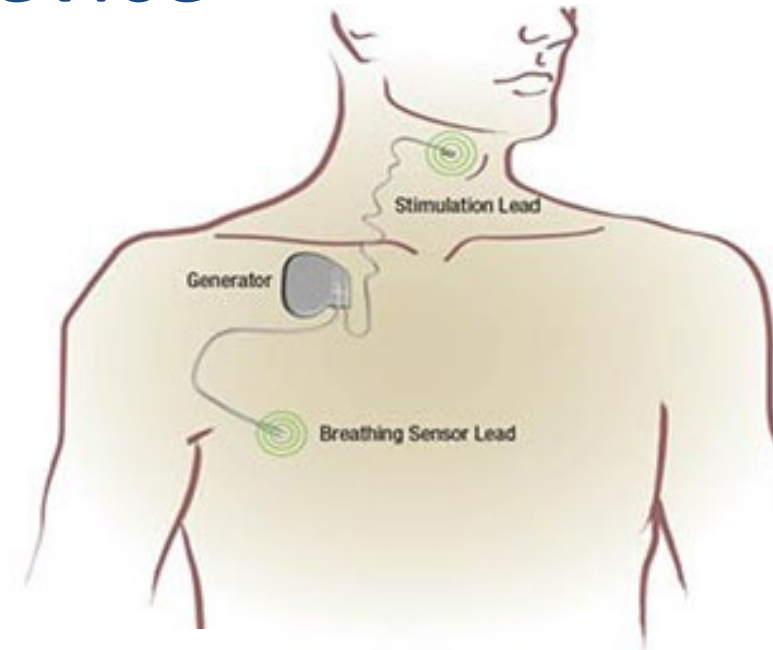
Oral Appliance Therapy

- Repositioning the lower jaw
 - Stabilizing the lower jaw and tongue
 - Increasing the muscle tone of the tongue
- Advantages: convenient, portable
- Disadvantages:
 - Less effective than PAP to lower AHI
 - May induce dental/TMJ side effects
 - Expensive
 - Treatment may take months
 - Typically requires patient to avoid supine sleep to be optimally effective
- Predictors for success:
 - Non-obese
 - Milder OSA
 - Retrognathia
 - Patient able to tolerate non-supine sleep
 - Functional nasal airspace



Hypoglossal Nerve Stimulation “INSPIRE” device

- Device implanted like a pacemaker
- Turned on during sleep
- Stimulates distal hypoglossal nerve, which allows airway dilation



An Inspired Candidate

- Must meet the following criteria:
 - Moderate to Severe OSA (AHI 15-65); with less than 25% centrals
 - Not significantly overweight (BMI < 33)
 - Unsuccessful with CPAP/BPAP
 - 22 years or older
 - Not pregnant or expecting to get pregnant during the process of receiving/titrating device
 - No current need for MRI

Other Surgical Treatment

- Nasal reconstruction (septal repair, turbinate reduction)
 - Mild OSA
- Oropharyngeal Soft Tissue Surgery:
 - Tonsillectomy & Adenoidectomy
 - May be first line therapy for pediatric OSA
 - Uvulo/palatal pharyngeoplasty (UPPP)
 - Base of tongue reduction/lingual tonsil resection
- Maxillofacial surgery
 - Genioglossus advancement-hyoid myotomy and suspension (GAHMS)
 - Bi-Maxillary advancement or Maxillary and Mandibular osteotomy (MMO)

Other Considerations

- Weight Loss
 - Usually improves the problem, but most often does not cure it
 - Can possibly decrease pressure requirement, which can improve tolerability
 - Bariatric surgery can improve OSA, but typically does not cure it.
- Positional Therapy--Get off your back!
 - Only effective in “supine predominant” OSA

“And now for something completely different”



Airway Strengthening

- Didgeridoo Practice Therapy¹
 - One RCT showed 50% reduction in AHI with 4 months of practice
 - Circular breathing*
- “Singing for Snorers”
 - Reduced snoring frequency and improved Epworth Scores
- Myofunctional therapy



1. Puhan M et al. Didgeridoo playing as alternative treatment for obstructive sleep apnoea syndrome: randomised controlled trial. *BMJ*, doi:10.1136/bmj.38705.470590.55
2. Hilton MP et al. Singing Exercises Improve Sleepiness and Frequency of Snoring among Snorers—A Randomized Controlled Trial. *International Journal of Otolaryngology and Head & Neck Surgery*, 2013,2,97-102

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Medical Director
Colorado Sleep Institute

Questions?



Anthony Barber, DO

Colorado Sleep Institute

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