

## Obstructive sleep apnea and snoring

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## Disclosures

- None



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## Learning Objectives

- Describe the long-term and short-term complications of sleep apnea.
- Recognize the history and physical findings, including Mueller’s Maneuver and Friedman classification, that are helpful in the diagnosis of sleep apnea
- Discuss benefits and risks of surgical and non-surgical modalities of treatment.



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### Overview

- Sleep apnea and snoring
- Diagnosis
- Medical and surgical treatments
- Adults only



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### Definitions

- APNEA: no airflow for  $\geq 10$  secs
  - OBSTRUCTIVE: with breathing effort
    - 95%
  - CENTRAL: no breathing effort
    - 5%
- HYPOPNEA: diminished airflow for  $\geq 10$  seconds
- APNEA (HYPOPNEA) INDEX: number of episodes per hour



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### Definitions

- OBSTRUCTIVE SLEEP APNEA SYNDROME (OSAS): 5 or more episodes per hour of sleep, with lowered blood oxygen level



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### OSAS: Population

- Prevalence of OSAS:
  - 4% adult males; 2% adult females (aged 30-60)
  - 7 to 18 million people
- Obesity is associated with OSAS
  - Normal-weight people can have OSAS



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### Consequences of OSAS

- Excessive daytime sleepiness
  - concentration, mood problems, depression, etc.
  - Motor vehicle accidents
- Cardiovascular disease
  - hypertension, pulmonary hypertension
  - heart failure
- Increased overall death rate – if untreated



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### What happens in OSAS

- Soft tissue **collapses** as muscles relax during sleep
- Central breathing effort continues, but breathing stops
- Blood oxygen level falls
- Patient must awaken to a higher level of sleep to open upper airway and breathe
- Patient falls back into deeper sleep, cycle repeats



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### What happens in **snoring**

- Soft tissue **vibrates**



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### Snoring and OSAS

- Both caused by redundant soft tissue
- Exist together on a continuum
- Not always associated or mutually exclusive



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### Diagnosis of OSAS

- **Polysomnogram (overnight sleep study)**
  - apnea, hypopnea, respiratory effort
  - pulse oximetry
  - EEG - to measure total *sleep* time



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### Diagnosis without sleep study

- Clinical features predictive of OSAS
  - excessive daytime sleepiness
  - overweight
  - witnessed apnea
  - sensation of poor quality sleep
  - anatomy of throat



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### Assessment of airway anatomy

- Physical examination
- Fiberoptic endoscopy, through the nose
- Radiology/X-rays
  - Most patients have tissue obstruction at **more than one location** in the airway
  - Most patients have **disproportionate** upper airway anatomy
  - Obesity is a factor
  - Nasal obstruction **might** be a factor



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### Severity staging in OSAS

- AHI (Breathing disturbance per hour)
  - Mild: 5-15
  - Moderate: >15-30
  - Severe: >30



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### Nonsurgical treatment of OSAS

- Weight loss
- Avoidance of alcohol and sedatives
- Dental appliances
  - Reposition lower jaw



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### Nonsurgical treatment of OSAS

- **Positive airway pressure**
  - Continuous Positive Airway Pressure (CPAP)
  - Bi-level Positive Airway Pressure (BiPAP)
    - gold standard treatment for OSAS
    - Not all patients can tolerate it
    - long-term compliance may be poor



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### Nonsurgical treatment of OSAS

- **Positive Airway Pressure**
  - Improves survival, if used
  - Covered by insurance
  - Well-tolerated by many patients



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### PAP options



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### Surgical management of OSAS

- Upper airway surgery
  - Palate
  - Base of tongue
  - Mandible
  - Maxilla
- Nasal surgery (internal)
  - nasal septoplasty, turbinectomy
- Tracheotomy
- Snoring surgery



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### Surgical management of OSAS

- **Tracheotomy**
  - effectively bypasses upper airway obstruction
  - may not be well-tolerated by patients and families



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## Surgical management of OSAS

- **Specialized OSAS surgery**
  - Uvulopalatopharyngoplasty (UPPP)
  - Genioglossus advancement
    - with hyoid myotomy and suspension (GAHM)
  - Maxillomandibular advancement (MMO)
  - Radiofrequency tissue destruction
    - Base of tongue
    - Palate



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## Surgical management of OSAS

- **General rules:**
  - Obstruction is usually at multiple levels
  - More extensive surgery has better success rate
  - Careful evaluation and planning before surgery improves chance of good outcome



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## Surgical management of OSAS

- **Nasal surgery**
  - Helps nasal symptoms
  - Helps use of CPAP
  - Also part of problem in OSAS
  - When used **alone**, rarely cures problem



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### Uvulopalatopharyngoplasty (UPPP)

- One-hour procedure
- Overnight hospital stay
- Recovery similar to adult tonsillectomy
- Small risk of nasopharyngeal incompetence
  
- Overall success rate about 50%
- Selected patients may do much better



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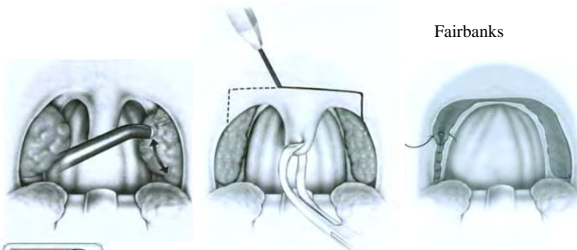
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### UPPP



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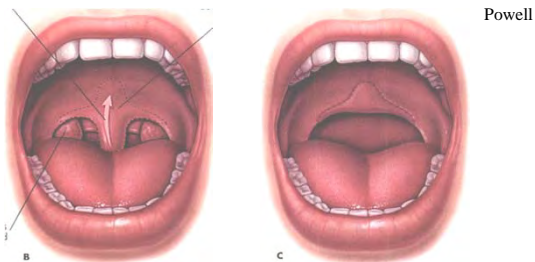
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### UPPP modification



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# Radiofrequency



Powell



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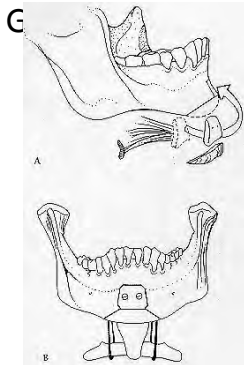
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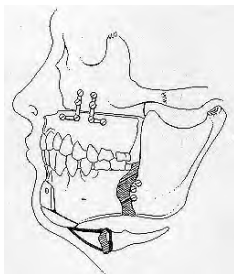
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# Maxillomandibular advancement



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### MMA results

- Success rates
  - overall, > **90%** in groups of patients with
    - 50-60% response after primary treatment (i.e., UPPP)
- Morbidity
  - cheek and chin anesthesia, resolves in 87%
  - cardiac arrhythmia, etc.
  - may require peri-operative tracheotomy



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### Case example

44 yo engineer with severe daytime sleepiness, concentration & memory problems. Cannot tolerate CPAP at 9 cm.  
AHI=21.7 Min O2 saturation= 85%  
Epworth sleepiness scale= 16



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### Pre-op



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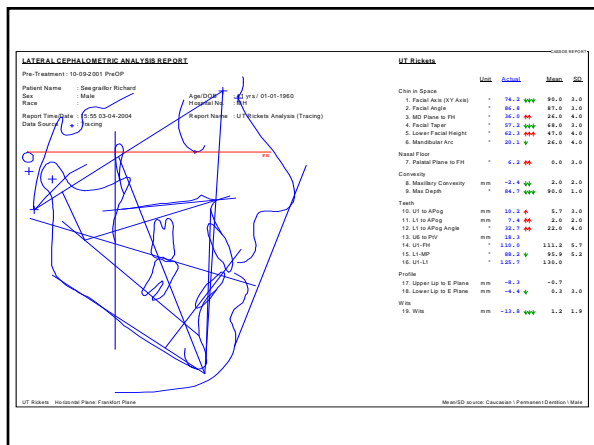
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## Treatment

- Pre-surgical orthodontics
- 4/29/03 MMA (LeFort I osteotomy with advancement, bilat sagittal split mandibular osteotomies and advancement), genioglossus advancement, hyoid suspension, UPPP.

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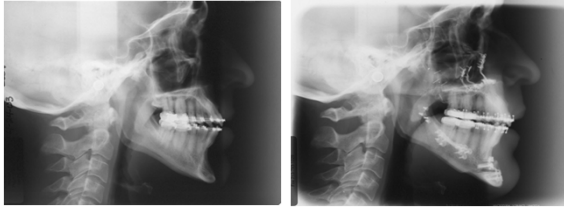
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Pre-op vs. post-op



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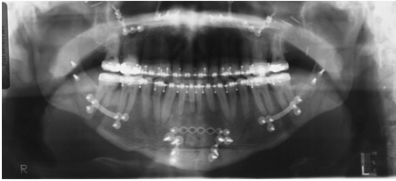
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Pre Vs. Post-op



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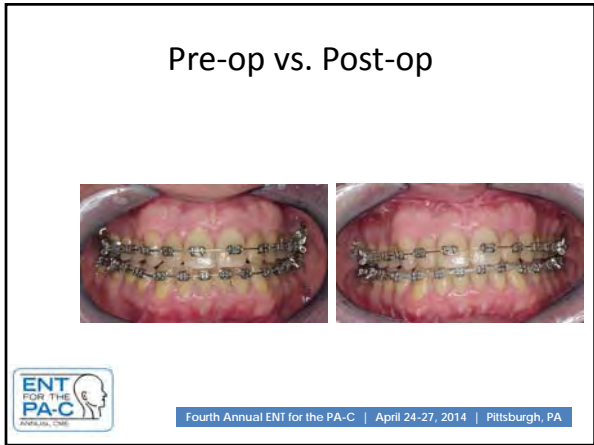
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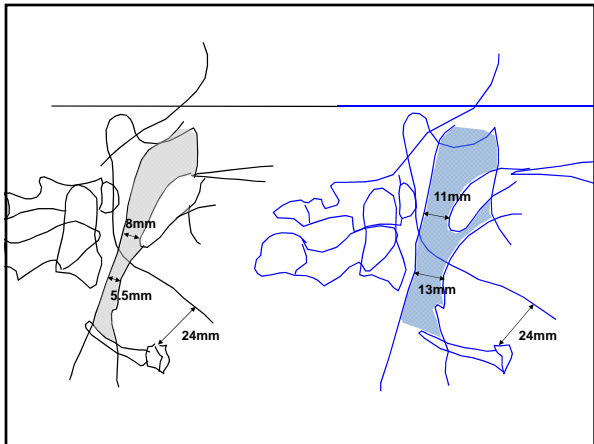
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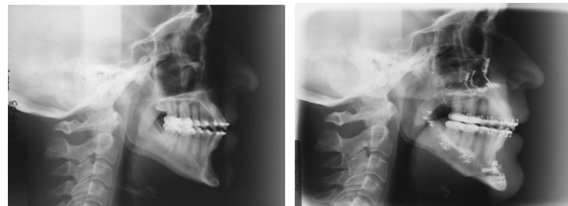
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### Pre-op vs. post-op



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### PSG findings

	AHI		Min O2 sat	Epworth scale
Pre-op	21.7	Mostly apneas	85	16
Post-op	2.7	Hypopneas	90	8

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### OSAS Summary

- If you are at risk, have a sleep study
- Nasal CPAP/BiPAP is best treatment, if tolerated
- Surgery is indicated for CPAP/BiPAP failures
  - may be curative
  - may assist future PAP management
  - Careful pre-operative evaluation is important
- 'One size does not fit all'
- Primary surgery may be indicated in young patients with clear anatomic abnormality



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**Snoring to ZZZzz**

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The wife says to her husband: "Do you know that snoring causes a lack of sleep? MINE!"



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- "Snoring is incredibly prevalent and people joke about it, yet it can create serious problems within the family,"
- "Many couples can't sleep in the same room because of snoring."



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- People who have trouble sleeping may be among 60 million Americans who suffer from socially disruptive snoring.



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- An estimated 45% of normal adults snore at least occasionally and 25% do so habitually, according to the American Academy of Otolaryngology.
- Problem snoring is more common in men and in people who are overweight. And snoring usually gets worse with advancing age.



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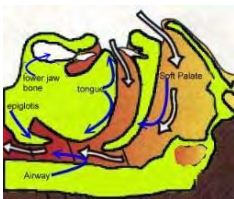
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### Anatomy of Snoring



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## Epworth Sleepiness Score

Sitting and Reading	
Watching TV	
Sitting, inactive in a public place (e.g. a theater or a meeting)	
As a passenger in a car for an hour without a break	
Lying down to rest in the afternoon when circumstances permit	
Sitting and talking to someone	
Sitting quietly after lunch without alcohol	
In a car, while stopped for a few minutes in traffic	

- 1 – Never doze
- 2 – Slight chance
- 3- Moderate chance
- 4- High chance

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## Classification of Snoring

- Grade I- Occasional
- Overtired, Alcohol Intake or lying on the back
- Grade II - Frequent
- All positions, all night but heard only in the room
- Grade III- Always ( can be associated with sleep apnea)
- Heard through out the house



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- 1. A snoring event that is dominated by a harmonic pattern or single tone with a fundamental frequency lower than 180 Hz;
- 2. A snoring event that is spectrally more diffuse but still dominated by frequencies lower than 180 Hz;
- 3. A snoring event with both low- and high-frequency components;
- 4. A snoring event that is more diffuse (than 5) but is still dominated by frequency components greater than 180 Hz; or
- 5. WL (wheeze-like)-A snoring event that is dominated by a harmonic pattern or single tone with a fundamental frequency greater than 180 Hz.



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Term	Abbreviation	Definition
Snoring index	SI	Average number of snores per hour
• Maximum relative respiratory noise loudness (dB)	MRI	Average loudness of 10% of the loudest of all events recorded*
Average relative snoring loudness (dB)	ARL	Average snoring loudness of only snoring events*
Percentage of low frequency (velum-like) snores	VL%	Percentage of snores classified as type 1 and 2 relative to all snoring events
Low frequency (velum-like) snoring relative loudness (dB)	VRL	The difference between the maximum snoring loudness and the lowest loudness level where types 1 and 2 snorers constitute >85% of all events
Average fundamental frequency of snoring (Hz)	FREQ	The average frequency of the fundamental component of snores classified as type 1, 2, or wheeze-like (WL)

\*Relative to quiet respiration.

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• Type I and Type II patients – snoring from the palate and will benefit from the intervention



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### Physical Exam

- Look for
  - A deviated septum or other causes of nasal obstruction
  - Large tonsils/adenoids or soft palate



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## Physical Exam

- Look for
  - Pt can create a snoring sound with mouth open or closed
  - Nasal endoscopy or flexible laryngoscopy with Muller’s test for possible of obstruction



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## Sleep study

- To R/O any sleep apnea
- See the intensity of snoring



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## Management of snoring

- Non Surgical
  - **1. Change your sleep position.**
    - Snoring occurs when the soft palate, uvula, tongue, tonsils and/or muscles in the back of the throat rub against each other and generate a vibrating sound during sleep.
    - If you are one of these snorers, sleeping on your sides will usually help\* you stop snoring.
    - You may also want to try raising the head of your bed 4 inches, according to the American Academy of Otolaryngology. To do this, place blocks or a wedge under the head of the mattress.



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## Management of snoring

- Non Surgical
  - 2. Lose 10% of your body weight to help stop snoring.
    - Overweight people tend have bulky neck tissue which increases snoring risk. If you are overweight, losing just modest amount of weight - even just 10% of your body weight -- can help you stop snoring



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## Management of snoring

- Non Surgical
  - 2. Lose 10% of your body weight to help stop snoring.
    - » If you think you are overweight, find out by checking your Body Mass Index (BMI). You can do this by dividing your weight (kg) by your height<sup>2</sup> (m).
    - » If your BMI is greater than 25 you are overweight. If your BMI is greater than 30 you are obese. In both instances you need to lose weight not only to help stop snoring, but to prevent other diseases associated with obesity.



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## Management of snoring

- Non Surgical
  - 3. Avoid alcohol and sedatives to stop snoring.
    - Anything that causes sedation such as sleeping pills or low dose alcohol can also cause snoring because they tend to suppress your breathing drive
    - Alcohol travels to all areas of the body and slows the brain's responses, causing the muscles to relax. Alcohol also acts as a depressant. The relaxation of the muscles causes the oropharynx to collapse causing snoring.



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## Management of snoring

- Non Surgical
  - **4. Inhale steam before bed to stop snoring.**
    - Nasal congestion can often cause snoring. You try to reduce congestion before bedtime by deep breathing steam through your nose.



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## Management of snoring

- Non Surgical
  - **5. Try nasal strips to stop snoring.**
    - Studies show that nasal strips can provide temporary relief from congestion and may also help some people stop snoring.
    - Looking in a mirror, press the side of one nostril to close it. With your mouth closed, breathe in through your other nostril. If the nostril tends to collapse try propping it open with the clean end of a Q tip. If breathing is easier with the nostril propped open, [nasal dilators](#) may solve your snoring problem. Test both nostrils.



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## Nose opening strips



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### Management of snoring

- Non Surgical
  - **6. Ergonomic pillows**
    - Support the neck and shoulder may reduced snoring



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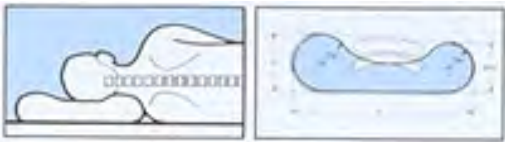
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### Supportive Pillows



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### Management of snoring

- Non Surgical
  - **6. Oral splints and Snore guards**
    - Help prevent the jaw from falling backwards
      - Pros-comfortable and non surgical approach
      - Cons-may lead to bite problems as the teeth bare the brunt of the forces



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### Snore Guards



The slide features three diagrams and a photograph. On the left is a red-to-orange gradient diagram of a human head in profile, showing the tongue and throat area. In the center is a photograph of three different colored (yellow, white, blue) snore guards. On the right is a green-to-blue gradient diagram of a human head in profile, showing the tongue and throat area with a dashed line indicating the tongue's position.

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### Management of snoring

- Non Surgical
  - 6. Use of Nasal sprays
    - Nasal Steroid Sprays
    - Antihistamine sprays

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### Anti-snoring mouth sprays



DOES NOT WORK

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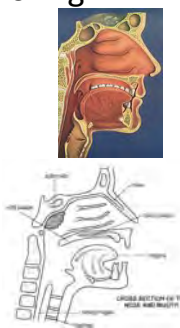
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### Management of snoring

- Surgical
  - 1. **Surgery on the nose**
    - Deviated Septum repair
    - Turbinate reduction
    - Removal of nasal polyps



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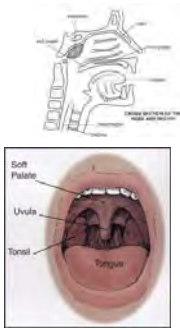
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### Management of snoring

- Surgical
  - 1. **Surgery on the Tonsils and Adenoids**
    - Conventional
    - Partial
    - Radiofrequency surgery



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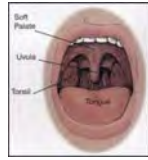
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### Management of snoring

- Surgical
  - 1. **Surgery on the Palate**
    - LAUP
    - CAPSO
    - Pillar
    - Radiofrequency
    - Injection Snoroplasty



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### LAUP

Preop      Part 1 Bilateral Vertical Trenches      Part 2 Uvula Ablation      Postop

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### CAPSO

Mair

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### Palatal Implants

**The Pillar® Palatal Implant System**  
Effective first-line treatment for OSA | 2 hours of sleep

The Pillar® Procedure is a minimally invasive, effective treatment for mild to moderate obstructive sleep apnea (OSA) and disruptive snoring.

FDA-cleared and clinically proven, the Pillar Procedure has achieved results comparable to those of more aggressive surgical procedures—with very low complications.

Front view

Hard palate/soft palate junction

Target zone

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## Radiofrequency



Powell



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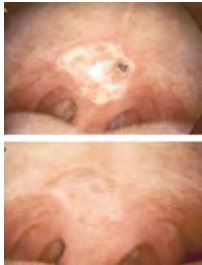
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## Injection Snoreplasty



Mair

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## Preparation for surgery

- Anesthesia
  - Local or General
- Avoid Aspirin, Motrin other related medication for 1 week prior to surgery



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### What to expect after surgery

- Pain similar in most procedures
  - Post operative pain medication
  - Oral rinses with lidocaine
    - Avoid alcohol based mouth washes



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### What to expect after surgery

- Food
  - Soft food
  - Liquids
  - Avoid citrus, sour and spicy foods for 1-2 weeks



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### What to expect after surgery

- Complications
  - Infection
  - Bleeding
  - Stenosis of the nasopharynx



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### What to expect after surgery

- Time out of work
  - Usually 24-48 hours
- Working out
  - Usually after 2 weeks



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### What does insurance cover?

- Nasal surgery – usually covered
- Adenoid and Tonsil surgery- usually covered
- Palate Surgery- Usually **NOT** covered



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