Alternative Therapies for Obstructive Sleep Apnea

Dennis Jurcevic, MD
Sleep Medicine Fellow
Case Western Reserve University
May 25, 2012

Anatomical Causes of Sleep Apnea

- Nasopharynx
  - Nasal Turbinate Hypertrophy/Swelling
  - Nasal Polyps
  - Deviated Septum
- Oropharynx
  - Enlarged Tongue
  - Enlarged Tonsils
  - Soft palate abnormalities
- Pharynx
  - Excess tissue
  - Muscle Relaxation
- Bone structure abnormalities
  - Maxillary Hypoplasia
  - Mandibular Hypoplasia

Treatment effectiveness

American Sleep Apnea Association
Positive Airway Pressure (PAP) Therapy

- Gold Standard therapy
- PAP therapy only definitive therapy regardless of severity of sleep apnea
- Positive pressure titrated on individual basis to keep airway open

Nasopharynx

- Swollen turbinates
  - Nasal steroids
  - Decrease swelling
  - Turbinate Reduction
- Septal deviation
  - Surgical correction
- Nasal Polyps
  - Resection
Nasal Turbinate Reduction

Positional Therapy
- Off back sleeping
- Pillow between knees
- Pillow behind back
- Tennis ball

Avoiding substances that relax muscles
- Things to avoid if have sleep apnea:
  - Alcohol
  - Muscle relaxers
  - Pain medications
Nasal EPAP (Provent)

- Nasal valves that are open on inhalation
- Valves close on exhalation
- Causes increased pressure in pharyngeal airway
- Pressure opens airway
- Use in mild to moderate sleep apnea

Oropharynx

Oral Appliances

- Treatment for snoring and mild to moderate obstructive sleep apnea
- Fits in the mouth during sleep like a mouth guard or orthodontic retainer
- Prevents collapse of tongue and soft tissues in back of the throat
- Oral appliances may be used alone or in combination with other management
  - Weight management
  - Surgery
  - CPAP
Indications for Oral Appliances

• Non-responders of positional therapy or weight loss in mild OSA
• Intolerant or refuse CPAP in moderate to severe OSA
• Not candidates for tonsillectomy and adenoidectomy, cranofacial operations, or tracheostomy

Oral Appliance Therapy

• Involves selection, fitting and use of a specially designed oral appliance when worn during sleep
• Custom-made are proven to be more effective than over-the-counter devices
• Collaboration of dentist with physician for diagnosis, treatment and ongoing care
• Evaluation can take weeks to months
  – Examination
  – Evaluation of most appropriate appliance
  – Fitting
  – Maximizing adaptation of appliance
  – Function
  – Ongoing short-and long-term follow-up is essential

Advantages of Oral Appliances

• Can be comfortable and easy to wear
• May take only a couple of weeks to become acclimated
• Small and convenient easy for travel
Disadvantages of Oral Appliances

- Can lead to Temporomandibular joint dysfunction
- Can alter teeth structure

How Oral Appliances Work

- Repositioning the lower jaw, tongue, soft palate and uvula
- Stabilizing the lower jaw and tongue
- Increasing the muscle tone of the tongue

Types of Oral appliances

- **Mandibular Repositioning Appliances**
  - Maintain lower jaw in a protruded position
  - Opens the airway by indirectly pulling tongue forward
  - Stimulating activity of muscles in the tongue making it more rigid
  - Holds the lower jaw and other structures in a stable position to prevent the mouth from opening

- **Tongue Retaining Appliances**
  - Hold the tongue in a forward position using a suction bulb
  - Keeps back of the tongue from collapsing during sleep and obstructing the airway
**FDA approved Oral appliances**

- Thornton Adjustable Positioner (TAP)
- SomnoMed MAS - Dorsal Fin Appliance
- Respire - Dorsal Fin Appliance
- The SUAD™ Device
- The Temporary SUAD™ Appliance (TSA)
- Herbst Telescopic Appliance
- Clasp Retained Mandibular Positioner
- Elastomeric Sleep Appliance
- OSAP
- Sleep Apnea Goldilocks Appliance (SAGA)
- Mandibular Inclined Repositioning Splint (MIRS)
- Nocturnal Airway Patency Appliance (NAPA)

**FDA approved Oral appliances**

- SnoreFree
- SnoreGuard
- SomnoGuard 2.0
- Adjustable PM Positioner
- APM Ultra
- Hilsen Adjustable Positioning appliance
- Klearway Oral Appliance
- OASYS
- Silencer System
- Elastic Mandibular Advancement Appliance (EMA)
- NORAD Appliance
- Silent Nite
- Snore-Aid
- Z-appliance
- TheraSnore Adjustable
- SomnoGuard AP
- SomnoGuard AP PRO
- CPAP PRO

**FDA Tongue Retaining Devices**

- Tongue Retaining Device (TRD)
- SNOR-X
- AVEO TSD
- Nose Breathe Appliance
Thornton Adjustable Positioner (TAP)

- “Most Effective for Severe Apnea”
- Only appliance that can be titrated while patient is asleep
- Pulls lower jaw forward to prevent collapse of the airway
- Adjustable to fit individual

SomnoMed MAS - Dorsal Fin Appliance

- Custom-made
- Upper and lower dental plates
- “Fin-coupling” component
- Allows normal mouth opening and closing
- Can add an adjustable component
- Can provide incremental lower jaw advancement
- Jaw is moved only as far as is required to alleviate snoring and reduce OSA
  - Allows speech and drinking
  - Full lip-seal
  - Easily adjustable
- Made from acrylic
  - Claims to last at least four-five years

Respire - Dorsal Fin Appliance

- Custom made oral device
- Upper and a lower component that are not connected
- Jaw can open and close
- Dorsal fin holds jaw forward
- Anterior opening to allow mouth breathing
- Has an advancement screw
  - Can protrude the jaw to total advancement of 5.5 mm
The SUAD™ Device

- For treatment of snoring and all levels of obstructive sleep apnea
- Moves the lower jaw
- Withstands bruxism
- Supposed to prevent actual tooth movement
- Custom-made
- Ability to open and close mouth
- Speak clearly, yawn, and take meds while wearing appliance
- Unlimited advancement
- Adjusted by adding additional nylon-type or metal advancement spacers

The Temporary SUAD™ Appliance (TSA)

- Temporary appliance mimics the SUAD™ Device
- FDA cleared to market for snoring and sleep apnea
- Positioning lower jaw forward to maintain an open airway
- It is not a boil-and-bite
- Custom fabricated using impressions of patient’s teeth
- Used as a trial appliance for first-time patients
- Back-up appliance for CPAP users

Herbst Telescopic Appliance

- Chronic snoring and mild to moderate obstructive sleep apnea
- Move laterally and vertically without disengaging appliance
- Two options of adjustability
  - Traditional 1.2 and 3 mm shims for advancing
  - Telescopic version advance in ¼ mm increments by one full turn up to 6-8mm from the start.
Clasp Retained Mandibular Positioner

- Multiple clasps lock mandible into the appliance
- Prevents retruding
- Able to change height of the appliance

Elastomeric Sleep Appliance

- Soft, custom-injected silicone
- Tooth retained
- No clasps or wires to adjust
- Not protrusively adjustable
- Vertical opening is 5 mm
- Some mandible movement is possible

OSAP

- Full coverage mandibular advancement mouthpiece
- Soft and flexible material
- Custom made with or without an oral air passage
- Compatible with home/office based bleaching techniques
- Can work with upper edentulous and some full edentulous patients
Sleep Apnea Goldilocks Appliance (SAGA)

- Hard acrylic shell laminated to a soft vinyl liner
- Two arches connected in posterior to hold the mandible in protrusive and open position

Mandibular Inclined Repositioning Splint (MIRS)

- Holds mandible in a downward and forward position with an incline flange
- Boil and bite appliance
- Body of the appliance is made out of hard acrylic
- Body snap fits to the upper arch
- Breathing hole placed in anterior portion of the appliance

Nocturnal Airway Patency Appliance (NAPA)

- Rigid acrylic and tooth retained by Adam's clasps
- Anterior positioned "breathing beak"
  - Allows for oral breathing
- Mandible held firmly in position
- Prevents jaw movement
- Vertical opening is 5 to 10mm.
SnoreFree

• Mandibular repositioning

SnoreGuard

• Creates a ramp behind the lower anteriors
• Ramp prevents jaw from receding
• Tongue placed in opening between upper and lower portion of device

SomnoGuard 2.0

• Boil and bite device
  Has 3.0 mm thicker molar biting zone
• Fitting is faster and easier for those with a "deep bite"
Adjustable PM Positioner

- Provides patient control of adjusting the jaw position under dentist's supervision
- Expansion screws on the right and left buccal areas
- Maximum tongue space

APM Ultra

- Boil and Bite
- No clasps
- Allows for mouth breathing
- Can move jaw laterally

Hilsen Adjustable Positioning Appliance
Klearway Oral Appliance

- Small increments (0.25mm) of forward lower jaw advancement
- Initiated by the patient under the direction of a dentist
- Lateral and vertical jaw movement is permitted

OASYS

- Mandibular repositioning
- Also acts as a nasal dilator reduced nasal resistance

Silencer System
Elastic Mandibular Advancement Appliance (EMA)

- Moving the mandible forward
- Uses interchangeable elastic straps for varying degrees of mandibular advancement
- Flexibility of elastic straps allows for lateral movement
- Maximum anterior tongue space because no projections in the palate

Medical Dental Sleep Appliance (MDSA)

NORAD Appliance

- Auto titratable
- Immediate placement
- Mandibular repositioning device
- Moves jaw downward and forward
Silent Nite

- Adjustable mandibular bite plate
- Advances the mandible and repositions the tongue anteriorly and superiorly.
- External lip shield
- Occlusal coverage to minimize tooth pressures
- Can be used for bruxism and TMD patients

Snore-Aid

- The Z-appliance is a combination of a soft palate lifter and a mandibular advancement device [the herbst].
TheraSnore Adjustable

- No laboratory construction
- "Easily fitted chairside from a boil and bite"
- Non-adjustable device

SomnoGuard AP®

- Mandibular advancement device
- "Infinitely" adjustable protrusion
- Bite and boil

SomnoGuard AP Pro®

- Components are very durable
- Inexpensive
- Often reused when the oral appliance has to re-made
- Patients with missing teeth or dentures can wear it
CPAP Pro

- Nasal pillow device
- Held in place by custom or boil and bite appliance
- Can attach to a mandibular repositioning appliance

Tongue Retaining Device (TRD)

- Flexible polyvinyl
- Uses general contours of the teeth and dental arches.
- Does not depend on teeth for retention
- Tongue is held forward by negative pressure in the vacuum bulb on the front of the appliance
- Only custom fit Tongue Retaining Device Available

SNOR-X

- Mouth guard that gently holds the tongue forward during sleep
- Keeping upper airway open and free from obstruction
- Prevention of this obstruction relieves snoring
- Made of two pieces
  - Tongue sleeve
  - Plastic ring that goes around the device and is held in place by notches on each side of the sleeve
- Place tongue into tongue sleeve
- Squeezes the front end to create gentle suction
- This holds the tongue in an extended position
- Tongue extension can be adjusted for comfort and effectiveness
- Air vents sculpted onto upper surface of device for mouth breathing
aveoTSD

- Tongue retaining device
- Does not attach to the teeth
- Does not require specialist fitting by a dental professional
- Non-adjustable universal device
- Most cost effective and simple to use
- Approved by the F.D.A as a medical device

Nose Breathe Appliance

- Tongue-retaining oral appliance
- Tongue is held at the roof of the mouth
- Retained by a natural lip seal and tongue suction
- Only works with nasal breathing

Oral Pressure Appliance (OPAP)

- Oral positive air pressure delivered by a newly conceived dental appliance
- Alternative to nasal positive airway pressure
Weight Loss

• Diet and Exercise
  – Weight loss is shown to decrease sleep apnea and even cure it

• Bariatric Surgery

Bariatric Surgery

Surgical Procedures

• Maxillo-Mandibular Advancement (MMA)
• Uvulopalatopharyngoplasty (UPPP)
• Genial Bone Advancement (GBAT)
• Tongue Base Suspension (Repose)
• Soft Palatal Implants
• Soft Palatal Procedures
• Modified UPPP and other pharyngeal procedures
• Distraction osteogenesis in pediatric patients
• Laser Assisted Uvulopalatoplasty (LAUP)
• Upper Airway Radiofrequency Treatment
Bone abnormalities

Maxillary Hypoplasia

Mandibular Hypoplasia

Maxillo-Mandibular Advancement (MMA)

• Goal to enlarge the velo-orohypopharyngeal airway without direct manipulation of the pharyngeal tissues
• Advances anterior pharyngeal tissues (soft palate, tongue base, and suprahypoid musculature) attached to the maxilla, mandible, and hyoid bone
• Accomplished by LeFort I and bilateral sagittal split rami osteotomies that are stabilized with screws, plates, or bone grafts

MMA
Uvulopalatopharyngoplasty (UPPP)
- Excision of the tonsils
- Posterior soft palate
- Uvula
- Closure of tonsillar pillars

Downsides to UPPP Surgery
- Downsides:
  - Risk of complications
    - Nasopharyngeal regurgitation (UPPP)
    - Infection
  - High failure rate (50%)
  - Reoccurrence of sleep apnea
Genial bone advancement (GBAT)

- Advancement of genioglossus muscle
- Performed in conjunction with UPPP
- Goal to enlarge the posterior airway space

Repose (Tongue Base Suspension)

- Tongue suspension
- Alternative to Genial Bone Advancement
- Uses a suture to pull hyoid bone forward
- This pulls tongue forward
- Held in by a screw in the chin

Pillar Implant (Soft Palate)

- Implants surgically inserted soft palate
- Stiffens soft palate to prevent collapse
- Can be effective in snoring
- Does not treat sleep apnea
Transpalatal Advancement
Pharyngoplasty
• Increases upper oropharyngeal and retropalatal airway size by advancing the soft palate

Lateral Pharyngoplasty
• Operation of soft palate and throat

• Goal to produce a greater radius of opening in the soft palate and throat

Tonsillectomy and Adenoidectomy-
Hypertrophic Tonsils
• First-line treatment in children with sleep apnea
• Some adults
• Adenoids can grow back
Distraction Osteogenesis in Pediatric patient

- Removal of part of bone
- Mandible is expanded
- New bone growth occurs between the gap

Laryngeal View

Hypoglossal Nerve Stimulation

- Produces dose-related airflow increases in patients with obstructive sleep apnea
Tracheostomy

- Historically the first treatment for sleep apnea
- Definitive treatment for OSA
- Permanent opening in the neck to the trachea
- Tube is placed in the airway to let air in
- Valve closes tube during the day
  - Patient can speak and breathe normally
- Valve is opened at night so air can go around the blockage during sleep
- Done only if severe OSA, failed other treatments or and other surgery is not appropriate

Tracheostomy

References
References

- [http://www.voicedoctor.net/sites/default/files/Flexible-videoscope-exam-3.jpg](http://www.voicedoctor.net/sites/default/files/Flexible-videoscope-exam-3.jpg)
- [http://dynamicchiropractor.files.wordpress.com/2012/01/getty_rm_photo_of_pregnant_woman_sleeping_with_pillow_between_knees.jpg](http://dynamicchiropractor.files.wordpress.com/2012/01/getty_rm_photo_of_pregnant_woman_sleeping_with_pillow_between_knees.jpg)
- [http://sleepgroupsolutions.com/2/UpscaleImages/uvp3_60247a56489.jpg](http://sleepgroupsolutions.com/2/UpscaleImages/uvp3_60247a56489.jpg)
- [http://www.sleepapneala.com/pix/genioglossal.gif](http://www.sleepapneala.com/pix/genioglossal.gif)
- [http://www.stevens.edu/ses/me/fileadmin/me/senior_design/2004/grp7/Grishma_Rana_Dorothy_White/myweb5/_derived/about_distraction_osteogenesis.htm_txt_cranio.gif](http://www.stevens.edu/ses/me/fileadmin/me/senior_design/2004/grp7/Grishma_Rana_Dorothy_White/myweb5/_derived/about_distraction_osteogenesis.htm_txt_cranio.gif)
- [http://www.nycoms.com/media/personal/assets/distraction.jpg](http://www.nycoms.com/media/personal/assets/distraction.jpg)
- [http://smc.kramesonline.com/HealthSheets/7529.img](http://smc.kramesonline.com/HealthSheets/7529.img)
- [http://www.drrahmatorlummc.com/DSC04982EE.jpg](http://www.drrahmatorlummc.com/DSC04982EE.jpg)

Didgeridoo playing

- May work in mild to moderate sleep apnea
- Need to play and average of 5.9 days/week for 25.3 minutes