Hennepin County Medical Center

Snoring and Obstructive Sleep Apnea: Oral Appliance Therapy Management

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Snoring And Sleep Apnea in the U.S.

- Approximately 40% of adults over 40 years old snore (about 100 million Americans)
- 4% of men and 2% of women have signs and symptoms of OSA (about 12 million Americans)
- OSA is as prevalent as diabetes or asthma

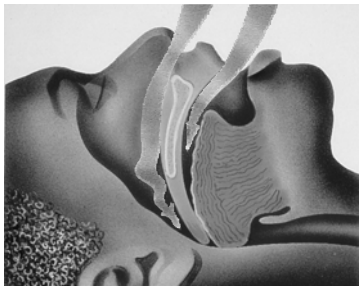
Definitions

- **Apnea:** Cessation of ventilation for ≥ 10 seconds
- **Hypopnea:** 30-50% reduction in airflow ≥ 10 seconds
- **Apnea Index (AI):** Average number of apneic episodes per hour of sleep
- **Apnea-Hypopnea Index (AHI):** Average number of apnea plus hypopneas per hour of sleep.

Defining Severity of OSA

- Length of time in apnea event
- Percentage decrease in oxygen desaturation
- Apnea-Hypopnea Index:
  - Mild OSA= 5-15 events/hour
  - Moderate OSA= 15-30 events/hour
  - Severe OSA= >30 events/hour

Obstructive Sleep Apnea



Dangers of Obstructive Sleep Apnea

- Individuals with OSA:
  - 5 x more heart attacks
  - 30-45% high blood pressure
  - 50% stroke patients have OSA
- Loss of Employment
- Uninsurability
- Marital Discord
- Increased Role of MVA's (20%)

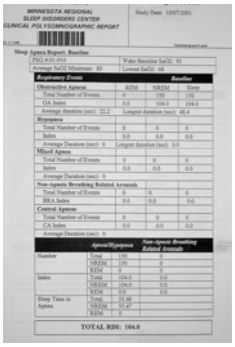
Clinical Signs & Symptoms

- Snoring: Intermittent with pauses
- Excessive daytime sleepiness
- Awakenings / gasping or choking
- Fragmented, non-refreshing, light sleep
- Poor memory, clouded intellect
- Irritability, personality changes
- Decreased sex drive, impotence
- Morning headaches

Predisposing Factors

- Age: Prevalence progressively increases with advancing age
- Obesity: Prevalence progressively increases with increasing weight
- Gender: 5 to 10 times more common in males
- Disproportionate upper airway anatomy
- ET0H, sedative-hypnotic drugs in late PM
- Hypothyroidism

Diagnosis


MINNESOTA REGIONAL SLEEP DISORDERS CENTER
CLINICAL POLYSOMNOGRAPHIC REPORT

Sleep Apnea Report: Baseline

Respiratory Events	Baseline		
Obstructive Apneas			
Total Number of Events	0	150	150
OA Index	0.0	104.0	104.0
Average duration (sec): 22.2	Longest duration (sec): 48.4		
Hypopnea			
Total Number of Events	0	0	0
Index	0.0	0.0	0.0
Average Duration (sec): 0	Longest duration (sec): 0.0		
Mixed Apnea			
Total Number of Events	0	0	0
Index	0.0	0.0	0.0
Average Duration (sec): 0			
Non-Apneic Breathing Related Arousals			
Total Number of Events	0	0	0
RRA Index	0.0	0.0	0.0
Central Apnea			
Total Number of Events	0	0	0
CA Index	0.0	0.0	0.0
Average Duration (sec): 0			

	Apnea/Hypopnea	Non-Apneic Breathing Related Arousals
Number	Total: 150	0
	NREM: 150	0
	REM: 0	0
Index	Total: 104.0	0.0
	NREM: 104.0	0.0
	REM: 0.0	0.0
Sleep Time in Apnea	Total: 51.48	
	NREM: 51.47	
	REM: 0	

TOTAL RDI: 104.0

Management of Snoring and OSA

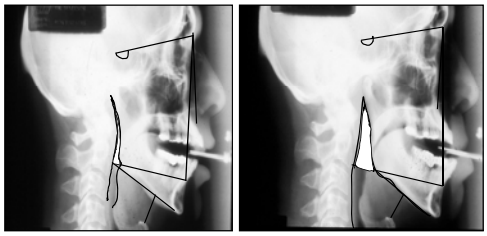
- Non-Surgical
  - Avoidance of risk factors
  - Pharmacologic agents – not very effective
  - Positive airway pressure (continuous or bilevel)
  - **Oral appliance therapy**
- Surgical
  - Tracheostomy
  - Uvulopalatopharyngoplasty – UPPP
  - LAUP
  - Pillar Procedure
  - Hyoid Suspension/Genioglossus Advancement
  - Max. / Mand. Advancement

Oral Appliance Therapy

How Do They Work?

Oral appliances are worn in the mouth during sleep to prevent the oropharyngeal tissues and the base of tongue from collapsing and obstructing the upper airway.

Advancement = Increased Airway



Oral Appliances May Function in 3 Basic Ways

- Repositioning the Mandible, Tongue, Soft Palate and Hyoid Bone
- Stabilizing the Mandible / Tongue / Hyoid Bone
- Increasing Baseline Genioglossus Muscle Activity

Case Types

- Primary Snoring
- Mild / Moderate OSA
- CPAP Intolerant – any level
- Surgical Failures
- Adjunctive Therapy
- Occasional, Short-term Substitutive Therapy

Contraindications

- Central Sleep Apnea
- Significant TMJ Disorder (MRD'S)
- Inadequate Dental Status (MRD'S)
- Unmotivated Patient

Functional Classification of Oral Appliances

Categorized by Mode of Action:

- Mandibular Repositioners
- Tongue Retainers

Design Variations

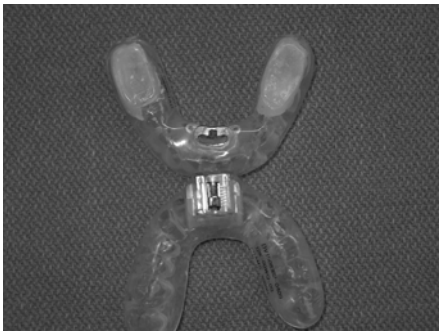
- Method of Retention
- Flexibility of Material
- Adjustability
- Vertical Opening
- Freedom of Jaw Movement
- Lab vs. Office Construction

Tongue Retaining Device (TRD)

PM Positioner

TAP 3

TAP 3



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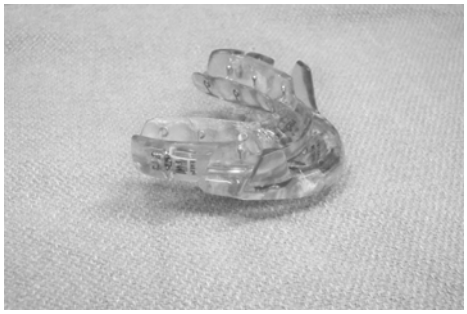

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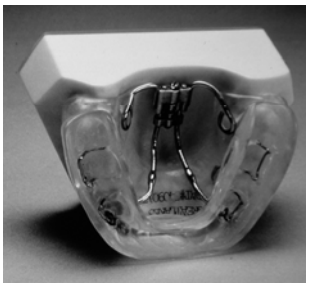
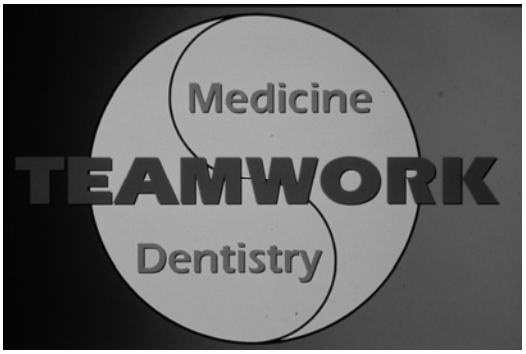
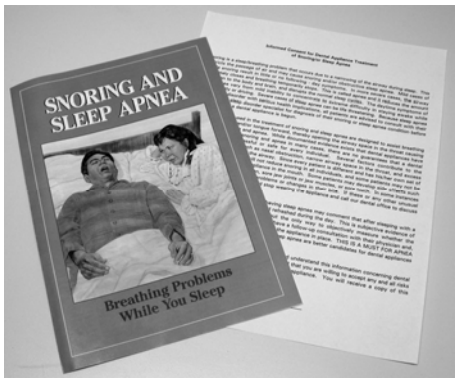
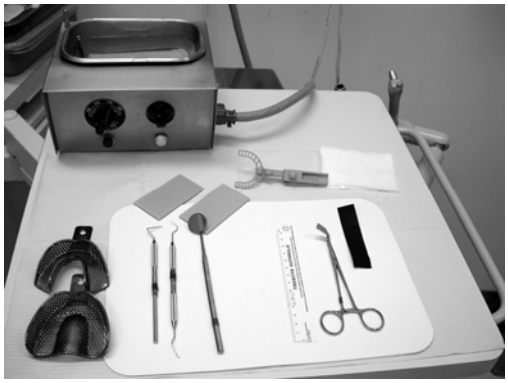


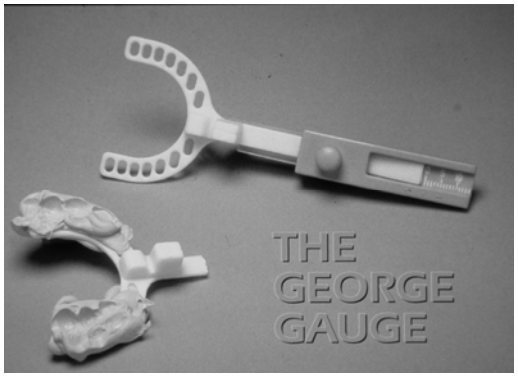


Evaluation and Consultation

- MD Referral
- Review Sleep Study
- Review History
- Oral Examination
- Informed Consent
- Models and George Gauge Bite
- MRD Type
- Letters to MD and Patient's DDS





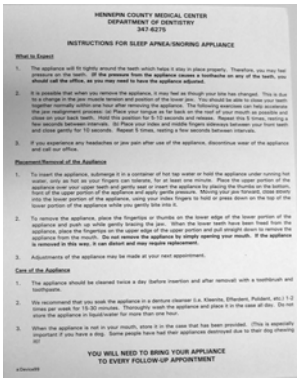


Final GG bite registration

- Starting mandibular treatment position is 60% of maximum protrusion
- Minimum of 7mm protrusion needed
- 3-5 mm interincisal opening in anterior
- Mandible positioned symmetrically forward

Side Effects and Complications

- **Common Side Effects**:
  - Excessive Salivation
  - Transient Discomfort – Teeth, TMJ
  - Dry Mouth
  - Soft Tissue Irritation
  - Temporary, Minor Disharmonies
- **Complications**:
  - Significant TMJ Discomfort/Dysfunction
  - Permanent Occlusal Changes



HENNEPIN COUNTY MEDICAL CENTER
DEPARTMENT OF DENTISTRY
347-6275

INSTRUCTIONS FOR SLEEP APNEA/SNORING APPLIANCE

What to Expect

1. The appliance will fit tightly around the teeth which helps it stay in place properly. Therefore, you may feel pressure on the teeth. **If the pressure from the appliance causes a toothache on any of the teeth, you should call the office, as you may need to have the appliance adjusted.**
2. It is possible that when you remove the appliance, it may feel as though your bite has changed. This is due to a change in the jaw muscle tension and position of the lower jaw. You should be able to close your teeth together normally within one hour after removing the appliance. The following exercises can help accelerate the jaw realignment process: (a) Place your tongue as far back on the roof of your mouth as possible and close on your back teeth. Hold this position for 5-10 seconds and release. Repeat this 5 times, resting a few seconds between intervals. (b) Place your index and middle fingers sideways between your front teeth and close gently for 10 seconds. Repeat 5 times, resting a few seconds between intervals.
3. If you experience any headaches or jaw pain after use of the appliance, discontinue wear of the appliance and call our office.

Placement/Removal of the Appliance

1. To insert the appliance, submerge it in a container of hot tap water or hold the appliance under running hot water, only as hot as your fingers can tolerate, for at least one minute. Place the upper portion of the appliance over your upper teeth and gently seat or insert the appliance by placing the thumbs on the bottom, front of the upper portion of the appliance and apply gentle pressure. Moving your jaw forward, close slowly into the lower portion of the appliance, using your index fingers to hold or press down on the top of the lower portion of the appliance while you gently bite into it.
2. To remove the appliance, place the fingertips or thumbs on the lower edge of the lower portion of the appliance and push up while gently biasing the jaw. When the lower teeth have been freed from the appliance, place the fingertips on the upper edge of the upper portion and pull straight down to remove the appliance from the mouth. **Do not remove the appliance by simply opening your mouth. If the appliance is removed in this way, it can distort and may require replacement.**
3. Adjustments of the appliance may be made at your next appointment.

Care of the Appliance

1. The appliance should be cleaned twice a day (before insertion and after removal) with a toothbrush and toothpaste.
2. We recommend that you soak the appliance in a denture cleaner (i.e. Kleenite, Effervdent, Polident, etc.) 1-2 times per week for 15-30 minutes. Thoroughly wash the appliance and place it in the case all day. Do not store the appliance in liquid/water for more than one hour.
3. When the appliance is not in your mouth, store it in the case that has been provided. (This is especially important if you have a dog. Some people have had their appliances destroyed due to their dog chewing on it!

YOU WILL NEED TO BRING YOUR APPLIANCE TO EVERY FOLLOW-UP APPOINTMENT

MRD Success Rates

Diagnosis	% Success
snoring	90+
mild OSA	80+
moderate OSA	70+
Severe OSA	50-50

Periodic Follow Up

- Medical Assessment
- Dental Assessment

Follow-up Evaluation During Appliance Therapy

History:
- Snoring
- Apneic Events
- Quality of Sleep
- Daytime fatigue (EDS)
- Focus
- Side Effects

Follow-up Evaluation During Appliance Therapy

Examination:

- Appliance Fit and Comfort
- OB, OJ
- Occlusal Contact
- Muscle Tenderness
- TMJ Assessment

Follow-up Schedule During Appliance Therapy

First Year:

- 3 weeks post insertion
- 3 month intervals

Second Year:

- 6 months

Annual Thereafter

Recommend Follow-up Evaluation with Physician and PSG with Oral Appliance

For patients with moderate to severe OSA:

- Refer for sleep study when patient has relief of symptoms
- During study, mandibular position is advanced 1 mm/1/2 hour, if needed, until estimated AHI is below 10 events/hour

Pre MAD
54 y.o. Female

PSG #: 05-606 — Wake Baseline SaO2: 97
Average SaO2 Minimum: 95 — Lowest SaO2: 87

Respiratory Events		Baseline	
Obstructive Apneas	REM	NREM	Sleep
Total Number of Events	14	89	103
OA Index	76.4	22.3	24.7
Average duration (sec): 26.1	Longest duration (sec): 46.0		
Hypopnea			
Total Number of Events	0	0	0
Index	0.0	0.0	0.0
Average Duration (sec): 0.0	Longest duration (sec): 0.0		
Mixed Apnea			
Total Number of Events	0	0	0
Index	0.0	0.0	0.0
Average Duration (sec): 0.0			
Non-Apneic Breathing Related Arousals			
Total Number of Events	2	31	33
BRA Index	10.9	7.8	7.9

		Apnea/Hypopnea	Respiratory Event Related Arousals (RERAs)
Number	Total	103	33
	NREM	89	31
	REM	14	2
Index	Total	24.7	7.9
	NREM	22.3	7.8
	REM	76.4	10.9
Sleep Time in Apnea	Total	44.8	
	NREM	38.4	
	REM	6.4	

TOTAL AHI: 24.7

Post MAD
56 y.o Female

PSG #:07-1066 — Wake Baseline SaO2: 95
Average SaO2 Minimum: 94 — Lowest SaO2: 89

Respiratory Events		Baseline	
Obstructive Apneas	REM	NREM	Sleep
Total Number of Events	0	0	0
OA Index	0.0	0.0	0.0
Average duration (sec): 0.0	Longest duration (sec): 0.0		
Hypopnea			
Total Number of Events	0	2	2
Index	0.0	0.3	0.2
Average Duration (sec): 46.6	Longest duration (sec): 47.7		
Mixed Apnea			
Total Number of Events	0	0	0
Index	0.0	0.0	0.0
Average Duration (sec): 0.0			
Non-Apneic Breathing Related Arousals			
Total Number of Events	13	23	36
BRA Index	11.8	3.1	4.2

		Apnea/Hypopnea	Respiratory Event Related Arousals (RERAs)
Number	Total	2	36
	NREM	2	23
	REM	0	13
Index	Total	0.2	4.2
	NREM	0.3	3.1
	REM	0.0	11.8
Sleep Time in Apnea	Total	1.6	
	NREM	1.6	
	REM	0.0	

TOTAL AHI: 0.2

Long-Term Sequellae of Oral Appliance Therapy in Obstructive Sleep Apnea

Almeida F R et al. Am J Orthod Dentofac Orthop 129:195-213, 2006

Skeletal Types and Outcomes				
	Class I	Class II/1	Class II/2	Class III
No Change	12.5%	10%	20%	50%
Favorable	25%	90%	80%	---
Unfavorable	62.5%	---	---	50%

Other Findings

Overjet: Decreased anterior to mesial of the first molars
Overbite: Significantly decreased in the entire arch
Arch Width: Mandibular arch increased more than the maxillary
Curve of Spee: Flattened significantly in the premolar area after long-term therapy.

Conclusions

Long-term oral appliance therapy affects the entire occlusion in all three dimensions:

Transversely: Arch widths increase; overjets decrease.

Antero-posteriorly: Mandibular dentition moves forward; anterior overjets decrease

Vertically: Overbites decrease

Tooth movement is much more common in patients who have had orthodontic therapy

Tooth movement is guaranteed in patients who have had adult orthodontics .

Alan Lowe BDS, PhD

Risks vs. Benefits

Our responsibility lies in adequately treating a medical condition with a dental device while recognizing and managing (as best we can) occlusal changes and to a lesser degree TMJ symptamotology.