Academy of Sleep Medicine 2005 Position Paper

The updated practice parameters of the American Academy of Sleep Medicine recommend the use of oral appliances for mild-to-moderate OSA, or for patients with severe OSA who are unable to tolerate CPAP or refuse treatment with CPAP.

Impact on Life Span

The average life span of an untreated patient with obstructive sleep apnea is estimated to be 58 years, i.e., 20 years shorter than the average life span of the general population: 79 years for men, 83 years for women.


What is Dental Sleep Medicine?

Dental Sleep Medicine (Oral Appliance Therapy) is the treatment and management of a medical pathology (UARS, central, mixed and or obstructive sleep apnea), utilizing a medical device (oral appliances), that is delivered, adjusted and maintained by a qualified dentist working as part of the patient’s medical team.

Martin Denbar, DDS

Organizations of Relevance to Dental Sleep Medicine

Authority on the Practice of DSM.
American Board of Dental Sleep Medicine (ABDSM)

Training and Support for the DSM Dentist.
American Academy of Dental Sleep Medicine (AADSM)

Regulation of the DSM Practice.
American Academy of Sleep Medicine (AASM)

Compliance
Sleeping with an Oral Appliance

MAS Therapy vs. PAP Therapy

**Efficacy** = success in correcting Sleep Disordered Breathing (AHI<5)

**Efficiency** = clinical or therapeutic benefit to a patient population

The efficiency of MAS therapy may equal or exceed that of PAP therapy due to better patient compliance with MAS therapy, even though the efficacy of PAP is higher.


Decision on Patient’s Treatment Regimen Must Combine Objective Evaluation of Severity and Patient Preference

American Academy of Sleep Medicine

Airway Volume

Bony enclosure size changes with changing head and neck position within a subject.

Isono et al., *J Appl Physiol*, 2004

Key
- Red = Tongue
- White = Mandible
- Blue = Airway

Velopharyngeal airway images

Three Dimensional reconstructions courtesy of Alan A. Lowe, DMD, FRCD (C), FACD
Definitions

- **Titration or Calibration:** Adjusting the protrusive jaw position to obtain optimum SpO2 and sleep parameters using a screening device or PSG.
- **Active Protrusion:** Moving your lower jaw as far forward as you can on your own.
- **Passive Protrusion:** Physically moving the lower jaw beyond active protrusion.
- **T90:** Time above 90% oxygen saturation level.
- **Occlusion:** Your bite or the way your teeth fit together.

Oral Appliance Therapy vs. Nasal Continuous Positive Airway pressure in Obstructive Sleep Apnea: A Randomized, Placebo-Controlled Trial

Conclusion: There is no clinically relevant difference between MAD and nCPAP in the treatment of mild/moderate OSA when both treatment modalities are titrated objectively. (64 patients over six month period)
Long-term Follow-up of a Randomized Controlled Trial of Oral Appliance Therapy in Obstructive Sleep Apnea

Conclusion: The absence of significant long-term differences in EDS improvements between the MAD and the nCPAP groups with mild/moderate OSA may indicate that the larger improvements in AHI values in the nCPAP group are not clinically relevant.

Respiration, 2011;82(2), 162-8. March 31

Obstructive Sleep Apnea Therapy

This randomized parallel trial showed that an oral appliance was not inferior to CPAP for effective treatment of OSA. Non-inferiority of OAT was supported by a lack of significant differences in most PSG and neurobehavioral outcomes.


Efficacy of An Adjustable Oral Appliance and Comparison to Continuous Positive Airway Pressure for the Treatment of Obstructive Sleep Apnea Syndrome

In summary, in the largest patient population studied to date, we found a higher adjustable oral appliance (aOA) success rate than previously seen. Based on our results, an aOA would be a reasonable, first-line alternative to CPAP for patients with mild disease. For patients with moderate to severe disease, our higher success rates call into question the recommendation that a CPAP failure is required prior to using an adjustable OA.

Chest online June 2, 2011

Efficacy

RDI < 10 or 50% reduction and RDI < 20

<table>
<thead>
<tr>
<th></th>
<th>TAP (%)</th>
<th>CPAP (%)</th>
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<tbody>
<tr>
<td>Total population N=103</td>
<td>76.5%</td>
<td>82.7%</td>
</tr>
<tr>
<td>Non-severe OSA N=50</td>
<td>84.0%</td>
<td>80.0%</td>
</tr>
<tr>
<td>TAP slightly better</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severe OSA N=53</td>
<td>69.2%</td>
<td>85.2%</td>
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<tr>
<td>CPAP slightly better</td>
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Oral Appliance Therapy Improves Symptoms in Obstructive Sleep Apnea -- A Randomized, Controlled Trial

This study extends our previous findings, confirming the efficacy of MAS therapy in controlling OSA in a substantial number of patients, including those with moderate and severe OSA.


Oral Appliance Therapy Compliance

- Schmidt-Nawara (1991) 75% after mean 7 months
- Clark (1993) 50% after 3 years
- Eveloff (1993) 93% after mean 2 years
- Ichikawa (1995) 86% after 5 years
- Menz (1996) 70% after mean 3.4 years
- Paner (1996) 86% after 350 days
- Yoshida (2000) 96% after mean 3.4 years
- Marklund (2004) 90% at 5 years
- Ferguson (2006) 77% at 1 year
- Average of all studies combined shows an 80.3% compliance over 2.7 years.
Outcomes of Action
Normalization of Sleep Breathing

Ferguson et al (2006). Sleep 29:240-43. reviewed 181 articles of which 87 were suitable for inclusion in the analysis. Success rates:

<table>
<thead>
<tr>
<th>Severity of OSA</th>
<th>Oral Appl.</th>
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<tbody>
<tr>
<td>Mild (AHI = 5-15)</td>
<td>81%</td>
</tr>
<tr>
<td>Moderate (AHI = 15-30)</td>
<td>60%</td>
</tr>
<tr>
<td>Severe (AHI &gt; 30)</td>
<td>25%</td>
</tr>
</tbody>
</table>

Criteria for success

<table>
<thead>
<tr>
<th>Oral Appliances* (87 studies)</th>
<th>AHI &lt;10</th>
<th>52%</th>
</tr>
</thead>
<tbody>
<tr>
<td>UPPP, LAUP, RF ablation of tongue base or soft palate, T&amp;A, genioglossus advancement, hyoid myotomy suspension **</td>
<td></td>
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</tr>
</tbody>
</table>

*Ferguson et al (2006) Sleep 29:244-62. reviewed 181 articles of which 87 were suitable for inclusion in the analysis. Success rate:


Severity of OSA

Mild (AHI = 5-15)
Moderate (AHI = 15-30)
Severe (AHI > 30)

Effect of Oral Appliances on Blood Pressure in Obstructive Sleep Apnea: A Systemic Review a Meta-analysis

Conclusion:

➢ Total of 7 studies that enrolled 399 participants.

➢ The pooled estimate shows a favorable effect of Oral Appliances on systolic, diastolic and mean blood pressure.

Most of the studies were observational.

Ihbkur, IH, Hays ER, Ivensen MA, Magalang UJ, Mans AK, J Clin Sleep Med 2013;9(2); 165-174

Summary of Complications

➢ Most bite changes are minor in nature and of little concern to most patients.

➢ Most bite changes can be treated with normal dental procedures.

➢ TMJ problems are a minor concern and rare.

➢ Does not hurt healthy dentistry or teeth.

Side Effects

➢ CPAP: Nasal congestion, dripping nose, irritation, skin lesions, eye irritation, dry mouth

➢ MAD: Jaw pain, tooth pain, muscle stiffness, dry mouth, hypersalivation, bite change

➢ Conclusion: Similar Symptom Score: (3.2 vs. 3.2)

Gagnadour ERJ, 2009

Experiences with Majority of Patients

➢ “However, this presents a clinical dilemma when the patient is unconcerned about the occlusal change and refuses to abandon the appliance citing that the perceived benefits of treatment outweigh the dentist’s concern with the altered occlusion.”


Influences of the breathing route on upper airway dynamics properties in normal awake subjects with constant mouth opening

Conclusions:

➢ When compared with nasal breathing, mouth breathing decreases the stability of the lower airway independent of mouth opening.

➢ This effect of mouth opening and moving from nasal breathing to mouth breathing may add to the effects of sleep on upper airway muscle tone activity to worsen upper airway stability and favor the occurrence of upper airway obstruction during sleep.

The Effects of Breathing on Emotion and Behavior

- Nose breathing imposes approximately 50 percent more resistance to the air stream in normal individuals than does mouth breathing, resulting in 10-20 percent more oxygen uptake.

Cottle, 1972; Rohrer, 1915

Effect of nasal or oral breathing route on upper airway resistance during sleep

- Nitric oxide inhaled via nasal respiration has been shown to increase oxygen exchange efficiency and increase blood oxygen by 18%, while improving the lungs’ ability to absorb oxygen.

Growth & Development 2005

Myofunctional Therapy

- Myofunctional therapy is the “neuromuscular re-education or re-patterning of the oral and facial muscles.”
- Myofunctional therapy includes facial and tongue exercises that improve or correct muscle function, helps to reduce negative habits, improve breathing, chewing and swallowing and can also improve patient aesthetics.

Myofunctional Therapy to Treat Obstructive Sleep Apnea: A Systematic Review and Meta-Analysis

Myofunctional Therapy decreases AHI by approximately 50% in adults and 62% in children.

The searches were performed through June 18, 2014. To be published in Sleep

Lingual Frenectomy: Functional Evaluation and New Therapeutically Approach

- Early diagnosis and intervention in ankyloglossia are fundamental for the subsequent morpho-functional development of the child and of the adolescent.
- Ankyloglossia, can create breastfeeding difficulties.
- Ankyloglossia can create atypical swallowing and therefore be responsible for functional alterations with speech impediment.
- Ankyloglossia can cause morphological dentoskeletal alterations creating orthodontic problems.
- Ankyloglossia creates a tendency toward altered posture initially and later with postural alteration.

European Journal of Pediatric Dentistry vol. 13/2-2012

Effects of One Week Tongue Task Training on Sleep Apnea Severity: A Pilot Study

- 7 men, Age: 52, AHI: 20, BMI: 26
- One week tongue task training was associated with a 48% decrease in obstructive breathing disturbances during REM sleep.
- We consider the result to be clinically relevant and worthy of further investigation.

Can Respir J Vol 22 Number 3 May/June 2015
Histological Characteristics of Altered Human Frenulum

- Due to the fact that type 1 collagen is resistant to traction, stretching exercises may not be helpful to elongate the lingual frenulum.
- Lingual frenectomy may be considered the appropriate procedure to release the tongue in order to provide better oral functions.

Bruxism

When your patient presents with this type of dentition, an estimated 50%+ of those patients will have OSA.

Combined Therapy

Any combination of CPAP (or any variant), surgery and or Oral Appliance Therapy to derive the desired outcome of patient compliance and disease management.

Martin Denbar, DDS 2013

TAP-PAP (CS) Nasal Pillows

- Reduced forward movement of mandible.
- Comfortable stomach and side sleeping.
- Allows for easy titration in the lab.
- Well received by majority of patients.
- Excellent for fibromyalgia or chronic fatigue patients with sensitive scalps.

Combined Therapy Using the TAP-PAP Interface

- Significant reduction of air pressures (40-60%)
- Provides a stable platform for nasal pillows.
- Elimination of the head gear and chin straps.
- Significant reduction of air leaks.
Impact of CPAP interface and mandibular advancement device on upper airway mechanical properties assessed with phrenic nerve stimulation in sleep apnea patients

**Conclusion:** The combination of a nasal mask and mandibular advancement device reduced velopharyngeal resistance compared to those measured with an oronasal mask as well as a nasal mask only.

*Respiratory Physiology & Neurobiology 12 June 2012*

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**Dental Clinicians’ Observations of Combination Therapy in PAP-Intolerant Patients**

- 72 patients from 4 different dental practices from different areas of the country.
- Treatment time: 11.3 months – 46 months
- Untreated: mean AHI was 49.6 events/hour
- Treated: mean AHI was 2.5 events/hour
- 66.7% (48) of the 72 cases were successful
- My practice: 81.3% success rate.

*Essick, Denbar, Rogers, Prehn, White Sleep Review March 2015*

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**SUSTAINED TOLERANCE OF CPAP USING MAS SUPPORTED NASAL PILLOWS**

**Conclusions:** Adherence to CPAP therapy can be improved and maintained using hybrid (combined) therapy, which proves to be as efficacious as conventional CPAP.

*APSS 2012 Abstract, Boota, White, Pardue, Essick*

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**Combined Therapy and T90 levels**

- My personal experience using CT has shown that approximately 10-20% of patients treated will have a normal AHI but low T90 requiring supplemental oxygen being added to the patient’s PAP device.

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**Case Report #1**

73 year old male 6 Ft. 175 lbs. 18 in. neck

Chief complaint: Aerophagia, forgetfulness, fatigue, CPAP intolerance

Medical History: Hypertension, COPD, allergic rhinitis, GERD, atrial fibrillations, prostate surgery, OSA, nocturia

**Diagnosis:** Moderate Sleep Apnea

AHI: 17  REM AHI: 46
Nadir: 76%

**BiPAP Titration:** BiPAP ideal pressure 15/11 cmH20
Combined Therapy Immediately Initiated (Physician ordered)

First four night’s results using REMstar® auto-CPAP set 4-20 cmH2O:
- OA index: .1
- CA index: .1
- Hypopnea Index: 4.9
- Average AHI: 5.1
- Average usage/night: 7 hrs. 24 minutes
- Average pressure: 4.2 cmH2O (Previous 15/11 cmH2O)

All symptoms of Aerophagia abated
- Physician ordered increase of minimum pressure to 8 cmH2O
- Patient is scheduled for follow-up evaluation with physician of record.

Thoughts to Mull Over

- As of today, there are few trained dentists in this field. Only approx. eleven Diplomates of the American Board of Dental Sleep Medicine in Texas.
- Dentistry is where medicine was 30 years ago with credentialed physicians in the sleep medicine field.
- Dentists cannot legally diagnose OSA or prescribe a sleep study.
- Dentists are not trained to treat patients’ co-morbidities and therefore must treat as part of the medical team.
- There are no studies to show that expensive pre-diagnostic testing performed by a dentist, cone beam technology, lateral cephalogram x-rays, pharyngometry or rhinometry, impact or alter the patient’s final outcome.
- Simple screening tests such as oximetry, Epworth Sleep Scale, patient symptoms or other pre-screening tests done by health care professionals help to keep patient fees to a minimum and still move the patient into the healthcare system.
Treatment outcomes are not the same for store or internet bought boil and bite stock oral appliances and custom made oral appliances.

There is no research to support using a boil and bite adjustable oral appliance except for temporary use or as a trial appliance.

Proper treatment protocol requires titration after an appliance has been placed, almost always done by the dentist, and then the patient is referred back to the physician of record for evaluation and a post-treatment PSG if required.

Ideally a dynamic titration should be performed post-treatment vs. a static titration. Reduced insurance reimbursement for OAT will cause more post-treatment in-lab or home sleep testing to occur.

Thank You

Please feel free to ask any questions.