Recent Research Advances in the Use of Oral Appliances for the Treatment of Sleep Disordered Breathing

by

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The Web site has information about the AADSM, a geographic listing of members, certification status and Web site links.
Sleep Disordered Breathing

Snoring

Upper Airway Resistance Syndrome

Obstructive Sleep Apnea

Mild
Moderate
Severe

++/+ Symptoms
+++/- Health Implications

++/+ Symptoms
+++/- Health Implications

++++/- Symptoms
++++++ Health Implications
Definitions

Apnea
Cessation of airflow > 10 sec whereby the drop in airflow amplitude is > 90% of the baseline

Hypopnea
Breathing that is shollower or slower than normal by > 30% for at least 10 seconds

Desaturation
A drop of >4% SpO2. A value below 90% is considered abnormal

Severity is classified by the Apnea Hypopnea Index (AHI)
0-5 events/hr Normal
5-15 Mild
15-30 Moderate
>30 Severe
Oral Appliances – AASM Practice Parameters (Sleep, 2006; 29:240-243)

Diagnostic evaluation required at baseline for all patients
OA to be fitted by a dentist
Indicated for snorers after no behavioral change
Indicated for mild and moderate OSA
Initial trial of CPAP before OA in severe OSA
Follow-up PSG for OSA patients required
Regular medical/dental visits to assess for worsening OSA
OSA Characteristics

Common medical disorder
Characterized by recurrent collapse of the upper airway at night
Often leads to
  - Nocturnal hypoxia/hypercapnia
  - Sleep fragmentation
  - Excessive daytime sleepiness
  - Cardiovascular disease
Pathophysiology of OSA
EFFECT OF AI ON MORTALITY

Untreated, All Ages

Cumulative Survival

Years From Diagnosis

Common Symptoms of OSA

- Loud Snoring
- Witnessed Apneas
- Excessive Daytime Sleepiness
- Morning Headaches
- Poor memory/Clouded intellect
- Decreased Sex Drive/Impotence
- Irritability

OSA tends to worsen with age and increasing weight.
Management of Sleep Disordered Breathing

1) Avoidance of Risk Factors
2) Surgery - Tracheostomy, UPPP, Maxillofacial, Genial Tubercle, Hyoid Sling
3) Nasal Continuous Positive Airway Pressure (nCPAP)
4) Oral Appliances – More than 130 options
CONTINUOUS POSITIVE AIRWAY PRESSURE (CPAP)
Effect of nCPAP on Upper Airway
Normal Appearance of Throat

- Hard palate
- Soft palate
- Uvula
- Tonsils
- Tongue
Appearance of Throat Following Surgery

- Hard Palate
- Soft Palate
Design Variations of OAs

- Preformed vs laboratory constructed
- Method of retention
- Amount of jaw opening
- Flexibility of material
- Adjustability both vertically and AP
- Freedom of jaw movement
Mandibular Repositioner
TAP
Tongue Retaining Device
OA Patient Titration Goals

• The patient feels more rested during the day and experiences deep uninterrupted sleep.

• A resolution of morning headaches has occurred.

• An inability to tolerate any further advancement.

• A change in dream patterns may indicate REM catch up.

• A history from the bed partner (bed side tape recorder) that the snoring intensity and/or frequency has changed. Usually a Snore Score of 2 or 3 suggests that the airway is open. However, be cautious of silent apneics until after the follow up analysis is completed.
Titration Aids

- Patient or bed partner titration goals
- Oximetry at home
- Portable monitoring at home
- Polysomnogram attended in the laboratory
MINIMUM $\text{SaO}_2$

- CPAP: *p < 0.001
- OA: *p < 0.01

- Baseline
- Outcome
APNEA + HYPOPNEA INDEX

*\( p < 0.001 \)
EPWORTH SLEEPINESS SCALE

* \( p < 0.001 \)

* \( p < 0.002 \)
Systolic (SBP) & Diastolic (DBP)
Mean Covert Compliance with Klearway

6.8 hours with a range of 5.6 to 7.5 hours
ADVANTAGES

- Measures time worn
- Measures head posture
- Battery life of 2 years
T Scan II Analyses

Maximum bite force changes even at 2 weeks post OA insertion
Occlusal Changes After Five Years of OA Use

No Change

Favorable Change
- Correction of Class II molar
- Correction of Class II cuspid
- Reduced OJ or OB
- Reduced palatal impingement
- Reduced lower incisor crowding

Unfavorable Change
- Edge to edge incisors
- Reverse OJ or OB
- Vertical open bite
- Reduced interarch contacts
- Posterior cross bite
Patients: 70 OSA

Change: 60 (85.7%)
No Change: 10 (14.3%)
Favorable: 29 (41.4%)
Unfavorable: 31 (44.3%)
### Skeletal Type and Outcomes

<table>
<thead>
<tr>
<th>Class</th>
<th>No Change</th>
<th>Favorable</th>
<th>Unfavorable</th>
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<tbody>
<tr>
<td>Class I</td>
<td>12.5%</td>
<td>25.0%</td>
<td>62.5%</td>
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<tr>
<td>Class II/1</td>
<td>10%</td>
<td>90%</td>
<td>-</td>
</tr>
<tr>
<td>Class II/2</td>
<td>20%</td>
<td>80%</td>
<td>-</td>
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<tr>
<td>Class III</td>
<td>50%</td>
<td>-</td>
<td>50%</td>
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Duration of OA Wear and Amount of Craniofacial Change

- < 6yrs
- 6-8yrs
- >8yrs

Variables:
- SNA°
- SNPG°
- SNMP°
- TFH
- OB
- MDMH
- U6S
- LU6SN
Appliance Design Changes

Case 5
How long was an OA used in this next patient?
Four Years of Profile Lite Nasal Mask (Respirronics)
Aim
To determine the prevalence and characteristics of dental and skeletal changes in long-term nCPAP users and to estimate the factors that affect such changes.

Hypothesis
Long-term use of a nCPAP machine could directly affect the maxilla as well as anterior tooth position.
Superimposition on the SN line of a typical OSA subject at baseline and after 35M of nCPCP wear
NASAL PILLOW ALTERNATIVES

Profile Lite Nasal Mask - Respironics

Mirage Swift - ResMed

Breeze SleepGear – Puritan Bennett
Klearway Effects and Sleep Disordered Breathing In Children
<table>
<thead>
<tr>
<th></th>
<th>Date</th>
<th>Questionnaire</th>
<th>Min O₂ (%)</th>
<th>RDI/hr</th>
<th>AHI/hr</th>
<th>ODI/hr</th>
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<tbody>
<tr>
<td>Pretreatment</td>
<td>2008/2/29</td>
<td>69</td>
<td>89</td>
<td>8</td>
<td>5</td>
<td>2.5</td>
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<tr>
<td>Posttreatment (with Klearway)</td>
<td>2008/9/20</td>
<td>34</td>
<td>94</td>
<td>2.4</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Posttreatment (without Klearway)</td>
<td>2008/9/30</td>
<td>93</td>
<td>3.2</td>
<td>2.6</td>
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Portable Monitor (Watch-Pat)
Clinical Aspects

**Klearway**
- Protocol consistent
- Rarely lost
- Compliance higher since only sleep time wear
- Keeps both jaws closed while sleep
- Less chair side adjustment
- No transverse expansion adjustments
- Retention less compromised in the mixed dentition

**Twin block**
- Protocol various (combined with FEA, HG, etc)
- Higher chance to be lost
- Compliance lower due to full time wear
- No orthopedic effect during sleep if mouth breathing
- Longer appointment if adjustment needed
- Can adjust to allow transverse expansion
- Retention can be compromised in the mixed dentition
Case 1 (TB) Baseline

Female
DOB: Oct13/2002
Insertion date:
Oct28/2011
Case 1 (TB) Follow-up

Female
DOB: Oct13/2002
Follow-up: Apr18/2012
Duration: 6 months (Phase I not finished)
Case 1 (TB) Appliance
Case 2 (KW) Baseline

Female
DOB: May 18/2001
Insertion: Nov 4/2011
Case 2 (KW) Follow-up

Female
DOB: Oct13/2002
Follow-up : Mar2/2012
Duration: 4 months
(Phase I finished)
Case 2 (KW) Appliance
Both indicated to treat growing children with retruded mandibles (Angle Class II, Division 1)
Both result in significant mandibular dentoalveolar changes in 17-18M
Klearway exhibits more significant dento-alveolar changes in the same treatment period with less wear
Klearway is not useful for posterior crossbites
Klearway appears to be more retentive in the transitional dentition
Klearway has advantages of a heat sensitive material, good compliance, gradual mandibular advancement, maintenance of mandibular closure during sleep and rapid chair-side adjustment
Some OSA Guidelines for Orthodontists

- Don’t hesitate to refer to adult/pediatric sleep specialists
- Avoid treatment without a written referral from a physician
- Be cautious in patients with previous orthodontic therapy
- Use recognized appliances with RCT research
- Both case and appliance selection are very important
- Be aware of silent apneics and post titration follow up
- Don’t over treat post OA or nCPAP occlusal changes
- Not all Class IIs have OSA /not all OSAs are Class II
- Be engaged in this rapidly changing and exciting field
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