Helping the CPAP-Intolerant Patient to Become Tolerant with Oral Airway Devices

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Conflict of Interest Disclosures

Speaker: Daniel E. Taché, DMD, DABDSM

1. I do not have any potential conflicts of interest to disclose, OR
2. I wish to disclose the following conflicts of interest:

<table>
<thead>
<tr>
<th>Type of Potential Conflict</th>
<th>Details of Potential Conflict</th>
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<tr>
<td>Grant/Research Support</td>
<td>Confidential</td>
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<td>Consultant</td>
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<td>Speakers' Bureau</td>
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<td>Financial Support</td>
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3. The material presented in this lecture has no relationship with any of these potential conflicts, OR
4. This talk presents material that is related to one or more of these potential conflicts, and the following objective references are provided as support for this lecture:
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2. 

How Are We Doing?

- 93% of women and 82% of men with moderate to severe OSA are undiagnosed
- < 25% have been successfully treated!
Non-surgical Medical Management of Obstructive Sleep Apnea (OSA) Bridging The Both Worlds For Better Patient Care

Sleep Medicine  Dental Sleep Medicine

Compliance Statistics Suggest That We Could Do More and Better.

Enhanced Comfort + Efficacy = Improved Compliance

“primum non nocere”
Can We Improve Adherence and Comfort By Through Cooperation?

- CPAP
- OAT + PAP (Combination)

CPAP - Intolerance
We need more collegiality, not this…

CPAP Compliance

ORIGINAL ARTICLE

Long-term compliance with continuous positive airway pressure in patients with obstructive sleep apnea

• Although many patients with OSA derive subjective benefit from, and adhere to treatment with CPAP…
• A significant proportion of those so diagnosed either do not initiate or eventually abandon therapy

CPAP Compliance

Continuous Positive Airway Pressure Treatment and Adherence in Obstructive Sleep Apnea

Type of Mask May Impact on Continuous Positive Airway Pressure Adherence in Apneic Patients

NON-ADHERENCE STATISTICS

• Despite (CPAP) effectiveness, overall treatment adherence remains suboptimal.
• It is estimated that 15% to 30% of patients do not accept CPAP treatment from the onset.
• Approximately 25% of patients discontinue PAP within the first year.

What Contributes To Compliance Or Non-compliance Of CPAP Use?

I. Compliant patients: Disease severity
   – Patients who experience more severe daytime sleepiness have better compliance with long-term use of CPAP

   Compliance to CPAP was significantly increased after nasal surgery

II. Non-compliance: Nasal Obstruction
   – Nasal congestion or small nasal passage

Comparing nasal mask Vs. nasal pillows:
• patients using nasal pillows showed better adherence
• nasal pillows were also associated with fewer overall adverse effects
• complete face mask or oronasal mask showed notably lower adherence
• face mask can not be recommended as a first line interface due to markedly lower adherence
• Nasal pillows is the preferred interface in almost all patients


Isthmus Nasi (Nasal Valve)

Anterior Inferior Turbinate

Posterior Inferior Turbinate

Nostril

Rhinometry Landmarks

Acoustic Rhinometry: Pre- and Post-Decongesting

Acoustic Rhinometry: Helpful with the CPAP-Intolerant patient

High Upper Airway Resistance (HUAR)
- common finding with CPAP-Intolerant patient
- another potential explanation for the "intolerance"
- Why don’t we treat this OBVIOUS problem before offering complete face mask or pronasal mask when patient displays intolerance due to HUAR?

TRYING TO REVERSE THE "INTOLERANCE"

Can we improve nasal breathing? Can we do better?

Q: Why is this person CPAP-intolerant?
A: Her mask is not connected to a CPAP!

Quiz Time

Oral Airway Therapy (OAT) to improve CPAP adherence (it doesn't need to be one OR the other)
These intraoral devices... what are they called?

MAD
MAS
MRD
OATs, etc.

Mandibular Advancement Device (MAD) Therapy

• Design Characteristics
• Mechanism Of Action
  • Efficacy
  • Compliance

There are 3 basic kinds of dental appliances that are used in treatment of Snoring and O.S.A.

Devices that use a flange to "stiffen" and elevate soft palate

Devices that pull the tongue forward ("Tongue Retaining Devices")

Devices that reposition the mandible (which are the most popular)
Devices That REPOSITION The Mandible

- Most effective are TITRATABLE
- Best ones allow for gradual ADVANCEMENT & DEPRESSION of mandible
- Allow for some LATERAL movement of the jaw

The TAP Series: TAP 3

The Dorsal Appliance
The Herbst® Appliance

Mechanism Of Action

How Do MADs work?
Effects Of Mandibular Advancement On Airway Curvature And Obstructive Sleep Apnoea Severity

Mandibular Advancement:
1. Enlarges velopharynx (VPx)
2. Reduces curvature of VPx
• These changes have a favorable effect on airflow dynamics


Reduced VPx curvature = improved nasal breathing

Mandibular advancement decreases the curvature of anterior wall of VPx


Effects Of Mandibular Advancement On Airway Volume

Oral Airway Therapy

- Efficacy
- Adherence

### OAT Efficacy

<table>
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<tr>
<th>OSA Severity</th>
<th>% Success</th>
<th>Rate</th>
<th>Rate</th>
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<tbody>
<tr>
<td>Mild</td>
<td>76%</td>
<td>41/50</td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td>61%</td>
<td>50/82</td>
<td></td>
</tr>
<tr>
<td>Severe</td>
<td>40%</td>
<td>27/68</td>
<td></td>
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Definition of success: AHI <10 and/or <50% of AHI per PSG.


Oral Appliance Therapy (OAT):
Compliance = Excellent

Compliance with Oral Appliance Therapy Evaluated by Questionnaire

- Schmidt-Kowars (1991): 75% after mean 7 mos.
- Clark (1993): 50% after 3 years
- Eveskoff (1994): 93% after mean 2 years
- Schischa (1995): 86% after 5 years
- Mehn (1996): 70% after mean 3.4 years
- Pancer (1999): 86% after 350 days
- Yoshida (2000): 90% after mean of 3.5 years
- Clark (2000): 60% after 1 year
  48% after 2 years
Mild-moderate OSA:

- There are a number of EB outcomes which show a favorable comparison between CPAP and OAT

OAT Efficacy: CPAP Vs. OAT


Complexity And Efficacy Of Mandibular Advancement Splints (MAS): Understanding Their Mode Of Action

- MAS and CPAP have a similar impact on daytime sleepiness and quality of life.
- Despite MAS being inferior to CPAP in reducing the AHI... higher compliance to MAS likely translates into a similar adjusted AHI and effectiveness.


Blood Pressure Reduction CPAP vs. OA


<table>
<thead>
<tr>
<th>Source regime</th>
<th>Oral appliance</th>
<th>CPAP</th>
<th>p-value (2)</th>
<th>Mean (1)</th>
<th>Mean (2)</th>
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<td>84</td>
<td>84</td>
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<tr>
<td>Oral alcohol SF</td>
<td>82</td>
<td>82</td>
<td>0.11234</td>
<td>0.11234</td>
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SUMMARY: OAT vs. CPAP (mild-moderate OSA)

- Outcomes indicate that CPAP should be preferred to OAT treatment.
- A clear patient preference for OAT indicates that CPAP should not be considered ideal in the treatment of OSAHS.

Hoekema A., Stegenga B., deBont LGM., CROBM May 2004 vol. 15 no. 3 137-155

Combination & Hybrid Therapy

A Story for Dentistry

Improving CPAP Adherence with OAT

- Combination Therapy
- Hybrid Therapy
Combination & Hybrid Therapy Defined

**Combination Therapy:**
- CPAP user wears OAT device while wearing CPAP but is independent of the interface (i.e. NOT connected)

**Hybrid Therapy:**
- CPAP user wears intraoral device concurrently with CPAP but not attached to interface (e.g. nasal pillows; mask)

Indications for Combination & Hybrid Therapy

1. **Indication:**
   - a. emergence of central sleep apnea (CSA) due to increasing PAP pressure
   - b. difficulty in reducing AHI due to mask leaks from excessive pressure
   - c. discomfort from straps or allergies to straps

2. **Benefit:**
   - a. improved mask stability due to being connected to the jaws/cranium
   - b. reduced CPAP pressure needed to stabilize airway
   - c. less mandibular advancement needed for greater reduction in respiratory indices

Combined Oral Appliance And Positive Airway Pressure Therapy For Obstructive Sleep Apnea: A Pilot Study

**Abstract**
- The high efficacy of continuous positive airway pressure (CPAP) in treating obstructive sleep apnea (OSA) is limited by poor compliance often related to pressure intolerance.
- Mandibular advancement devices (MADs) are proven alternative therapy albeit, less effective than CPAP
"A combination of nasal CPAP and MAD may provide another option for CPAP-intolerant patients with incomplete response to MAD."

- The combination of CPAP and MAD device clearly reduced the optimal CPAP pressure by 29% while changing the AHI by 86% from baseline.

**Combined OAT And Positive Airway Pressure Therapy For OSA**

**Historical Overview**
The TAP®-It begins: Dallas Rehabilitation Institute 1993

The Problem: Polio/Respirators
Constant Volume Ventilators: 45 cmw !!!
The Lyon Mask: Developed by Respiratory Therapists

W. Keith Thornton: TAP®-PAP Developer

“I determined that not only could I improve the mask but improve the whole technology using Dental techniques.”
Meet Dorothy

Dorothy

Generally, in people with neuromuscular disorders who are having breathing problems, the main problem is hypoventilation.

Who would not be inspired to help?

What can we do to help?

First:
• Separate their mouth guard and advance the mandible
• Dropped pressure to 22 cmw

Then:
• Stainless steel rod on the upper section of appliance with a “swivel”
Early designs

Other early attempts/some success!

Custom and Non-custom Interface
Products for Enhanced Combined Therapy with a MRD

• CPAP PRO® Attachment Interface
• The TAP®-PAP CS (Chairside)
• The TAP®-PAP Custom
• TAP-PAP Nasal Pillows (NP)
Applying Combination Therapy To The CPAP-Intolerant Patient

CASE STUDIES
- Strap Irritation
- Excessive Pressure; Elevated AHI

THIS IS CINDY; HAVING PROBLEMS WITH STRAP IRRITATION/"ALLERGY"
The TAP® Appliance: Adaptable for Hybridization

Converting a TAP® to a Hybrid TAP (TAP®-PAP)

TAP®-PAP Post & Plate Assembly

Post Attached

TAP®-PAP CS (Chairside)
TAP-PAP CS IN PLACE-NO STRAPS
“VERY COMFORTABLE”

Support post in place; nasal pillows stabilized

Off-the-shelf-hybrid interface
LIMITATIONS:

• Better fit if moulded to a dental model Vs. direct
• No mandibular repositioning so no reduction of pressure
• Cannot wear a lower appliance so no jaw joint support
Case Study

My History

Using Hybrid Therapy To Improve Adherence

With the nasal mask alone, the pressure required to stabilize airway was 11-15 cmw; very uncomfortable.
Fully titrated MAD

AHI was reduced from 22.9 to appx. 14

...what I did...

“Hybrid” Therapy

Making the Moulage
TAP-PAP™CM

Auto CPAP ONLY!

CPAP Pressure Prior to Combination Therapy:

Oral Appliance with CPAP all night

CPAP Pressure: TAP®-PAP In Place
COMPLIANCE!

Case Study: Combination Therapy
- Controlling Excessive Pressure / Leaks
- Persistent Elevated AHI

HPI:
- 72 y.o. Caucasian male with severe OSA
- Unstable HTN & CVD
- CPAP is not reducing his apnea sufficiently despite very high pressures

BG: A Study of Hybrid Therapy
BG: Sleep Report Reveals...

- Current setting of his BiPAP are as follows:
- Pressure range = 21.0/17 cmw
- With BiPAP, apnea index remains elevated at 42.5!

Acoustic Pharyngometry (APh)

Acoustic airway analysis suggests that he should respond well to both advancement and depression.

The George Gauge Bite
Respiratory Indices before treatment (downloads from PAP)

AHI is still 56 with CPAP!

Oral Airway Appliance: TAP3
TAP 3 appliance is maximally advanced to comfort

Post-Insertion Titration and Downloads

Re-evaluating Utilizing Acoustic Pharyngometry: "finding an airway"
10/17/13

Re-evaluate our airway to look for a direction

TAP3 Appliance

6 mm Vertical Titration Key [Airway Metrics VTK] in place; airway stability evaluated with Pharyngometer

TAP 3 is modified (+ 6mm of vertical)

TAP 3 is modified (+ 6mm of vertical)

Successive downloads following the change in VDO

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With the passage of a little time, more improvement

Success:
Completing our work: add posterior contact

A happy outcome!
Some final thoughts

• Consider referring for Combination Therapy (ComT), those patients who are having problems with excessive CPAP pressures.
• Consider referring for ComT those patients who display the emergence of central or mixed apnea associated with excessive CPAP pressure in lieu of simply reducing PAP pressure and thereby reducing PAP efficacy.
• Consider referring for Hybrid Therapy (HT) when patients’ apnea is well-controlled however patients are having problems with toleration of straps or intolerance stems from mask leaks.
• Take time to provide adequate training for sleep techs what are the best early training how to adjust commonly used oral airway therapy devices and dental sleep medicine today.