Can CPAP Be Discontinued?

Teofilo Lee-Chiong MD
Professor of Medicine
National Jewish Health
University of Colorado
Professor of Medicine
Chief Medical Liaison
Philips Respironics
Disclosure

- **Research funding:** Philips Respironics
- **Consulting:** Elsevier, CareCore National
- **Chief Medical Liaison:** Philips Respironics
- **Royalties:** Oxford, Lippincott, Elsevier, Wiley, CreateSpace
- I will not be discussing off-label uses
Learning Objectives

• Learn the common reasons why patients discontinue PAP therapy
• Understand methods to improve adherence to PAP therapy
• Learn alternative therapies for OSA in patients who refuse PAP treatment
Non-commercial drivers at risk for SDB based on responses to Epworth and Berlin questionnaires were more likely have car crashes.

1

Responses to questionnaires indicating high risk for SDB were noted in 75% of subjects

2

10% had a prior diagnosis of SDB but only one subject was receiving effective treatment

Untreated OSA increased rates of motor vehicle crashes and near misses; risk was highest in those who were excessively sleepy.

**Crash Rates**

0.02 in general community

0.06 in untreated OSA

Motor vehicle crashes/person-year

Persons with OSA had more sick leaves greater than 30 days and lower productivity compared to those without the disorder.

<table>
<thead>
<tr>
<th></th>
<th>OSA</th>
<th>No OSA</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sick leave &gt; 30 days</td>
<td>16.6%</td>
<td>7%</td>
<td>.049</td>
</tr>
<tr>
<td>Productivity</td>
<td>63.80%</td>
<td>83.20%</td>
<td>.000</td>
</tr>
<tr>
<td>Rate of workplace accidents</td>
<td>27.4%</td>
<td>25.4%</td>
<td>&gt; .050</td>
</tr>
</tbody>
</table>

*182 OSA subjects and 71 healthy controls

Among elderly patients, highest healthcare utilization was in newly diagnosed OSA compared to those with either chronic or no OSA.

<table>
<thead>
<tr>
<th></th>
<th>New OSA</th>
<th>Chronic OSA</th>
<th>No OSA</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proportion of patients who required ≥ 1 ED visit</td>
<td>37%</td>
<td>32%</td>
<td>15%</td>
<td>P &lt; 0.05</td>
</tr>
<tr>
<td>Proportion of patients who required ≥ 1 hospitalization</td>
<td>24%</td>
<td>17%</td>
<td>7%</td>
<td>P &lt; 0.05</td>
</tr>
</tbody>
</table>

*1,867,876 veterans; 82,178 with OSA

Best reason to use CPAP for OSA? It improves your golf performance. Now, if it can only improve your fishing....

<table>
<thead>
<tr>
<th>Compared to baseline</th>
<th>Control subjects</th>
<th>OSA (RDI &gt; 15) on PAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handicap index</td>
<td>No significant change</td>
<td>Significant drop – 11.3%, P = 0.01</td>
</tr>
<tr>
<td>Epworth sleepiness scale</td>
<td>No significant change</td>
<td>Significant drop – P = 0.01</td>
</tr>
<tr>
<td>Sleep questionnaire</td>
<td>No significant change</td>
<td>Significant drop – P = 0.003</td>
</tr>
</tbody>
</table>

Benefits of PAP therapy for OSA

• Frequency and duration of treatment needed to improve symptoms and functioning is not known

• PAP should be used for a significant portion of sleep nightly to be optimally effective
PAP adherence rates

- In a large European multi-center study
- Use of PAP ≥ 4 hrs per night on ≥ 70% nights was 79%
PAP adherence rates

- 60% of subjects used CPAP nightly
- Mean daily use of 7.1 ± 1.1 hrs

Fleury B Eur Respir J 1996
Essential to objectively monitor PAP adherence

• Self-reported usage often overestimates actual use

• In one study, 60% reported using CPAP regularly, but only 46% used CPAP for ≥ 4 hrs on 70% of monitored days

Kribbs NB ARRD 1993
PAP adherence

- *Intermittent* use is common

Weaver TE Sleep 1997
OSA, measured by ODI, did not recur during a 4-day CPAP discontinuation in 29% of patients on long-term PAP therapy.

Factors associated with higher ODI after four nights of CPAP withdrawal

- Higher original ODI
- Longer duration of CPAP therapy
- Current smoking
- Larger neck circumference

*all P < 0.05; 125 subjects with OSA (ODI > 10)
Note: 13% of subjects had ODI < 10 after another 2 weeks off CPAP

Predictors of PAP adherence

• % days skipped correlated with decreased nightly use

Weaver TE Sleep 1997
PAP adherence

• Virtually all benefits derived from PAP therapy are *rapidly lost* with discontinuation of its use

Kribbs NB ARRD 1993
Long-term PAP adherence
PAP adherence

- Early patterns of use can predict long-term adherence
- Patterns of CPAP use evident by the 4th day of treatment

Weaver TE Sleep 1997
Kribbs NB ARRD 1993
Rosenthal L Sleep Med 2000
Predictors of PAP adherence

• Self-reported sleepiness
• Subjective perception of benefit
• Severity of illness
  – Adherence is less in patients with mild disease

Rosenthal L Sleep Med 2000
McArdle N AJRCCM 1999
Long-term PAP adherence
Some adverse effects during CPAP treatment, such as dry mouth and increased number of awakenings, significantly reduced adherence to therapy.

<table>
<thead>
<tr>
<th>Most common side effects of CPAP therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blocked up nose</td>
</tr>
<tr>
<td>Dry mouth*</td>
</tr>
<tr>
<td>Increased number of awakenings*</td>
</tr>
<tr>
<td>Mask leaks</td>
</tr>
<tr>
<td>Mask pressure</td>
</tr>
</tbody>
</table>

*Associated with treatment dropout during the first year

CPAP use and side effects at 1 month independently predicted long-term CPAP adherence in patients with OSA and cardiovascular disease.

**Independent predictors of 12-month CPAP adherence**

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Effect estimate ± standard error</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPAP use at 1 month</td>
<td>0.65 ± 0.07 per h increase</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Side effects at 1 month</td>
<td>-0.24 ± 0.092 per additional side effect</td>
<td>= 0.009</td>
</tr>
</tbody>
</table>

Reasons for PAP non-adherence

• Disbelief that PAP would help
• Identity issues
• Negative feedback or miscommunication regarding efficacy
• Lack of confidence to change behavior and use PAP
Disbelief that PAP would help

• Education

• Asking why it won’t work for them when it works for everyone else

• Insistent denial of potential for benefit may be a marker for comorbid depression
Identity issues

- PAP reminds patients that they have a health disorder
- Empathy and collaboration
Simple feedback can be dangerous

- Feedback for someone who is doing well is reinforcing
- Feedback for someone who is not can be deflating
Factors that change behavior

• Personal relevance

• Confidence
  • Proper goal setting

• Information can be delivered to *shape* behavior
  • Information can be delivered piecemeal so as not to overwhelm
Improving PAP adherence

• Airway humidification
• Short-term use of hypnotic agents
• PAP education
• Proper mask selection
PAP education

- Outpatient group clinics (2-hr q 6 mos)
  - Education
  - Support
  - Symptom treatment

Likar LL Chest 1997
PAP education

• Usual support vs. nursing PAP education at home
  – Additional home visits

Hoy CI AJRRCM 1999
Compared to standard care, intensive follow-up after initiation of CPAP therapy improved adherence, sleepiness, QOL, depression, hospitalization and CVD-related mortality.

<table>
<thead>
<tr>
<th>Benefits of intensive follow-up compared to standard care at 2 years of CPAP treatment</th>
<th>Significantly more CPAP use (6.9 vs. 5.2 hrs per night; P &lt; 0.001)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Better ESS, SF-36 and BDI scores</td>
</tr>
<tr>
<td></td>
<td>Less deaths and hospitalizations due to CVD</td>
</tr>
</tbody>
</table>

3,100 subjects with newly diagnosed sleep apnea; intensive follow-up consisted of additional visits, telephone calls and education; SF-36: 36-item Short Form Health Survey; BDI: Beck Depression Inventory

Adherence to auto-titrating positive airway pressure therapy for obstructive sleep apnea was enhanced by an educational intervention utilizing motivational techniques.

**Effects of intervention compared to controls**

<table>
<thead>
<tr>
<th>Effect</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Higher adherence to APAP (percentage of days of use &gt; 4 hrs)</td>
<td>89.8%; P = 0.013</td>
</tr>
<tr>
<td>Greater mean effective use per day</td>
<td>6.2; P = 0.000</td>
</tr>
<tr>
<td>Lower AHI at 2 months</td>
<td>2.7; P = 0.019</td>
</tr>
</tbody>
</table>

61 subjects with OSA

In a systematic review of randomized controlled trials, educational, supportive and behavioral interventions enhanced CPAP use in adults with OSA.

<table>
<thead>
<tr>
<th>Compared with usual care</th>
<th>Supportive interventions</th>
<th>Educational interventions</th>
<th>Behavioral therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased machine usage per night</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Increased number of participants who used their machines &gt; 4 hours per night</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Reduced likelihood of study withdrawal</td>
<td>✔</td>
<td>✔</td>
<td></td>
</tr>
</tbody>
</table>

Most subjects using continuous positive airway pressure therapy for OSA were satisfied with training and clinical follow-up provided via telemedicine.

<table>
<thead>
<tr>
<th>Telemedicine management of OSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 95% satisfaction with teleconsultation</td>
</tr>
<tr>
<td>2/3 of teleconsultation could replace 50%-100% of CPAP follow-up visits</td>
</tr>
<tr>
<td>Comparison between videoconference vs. face-to-face CPAP training:</td>
</tr>
<tr>
<td>1. Similar knowledge about OSA and CPAP</td>
</tr>
<tr>
<td>2. Similar skills (mask and headgear placement, leaks avoidance)</td>
</tr>
</tbody>
</table>

Nasal vs. full face masks

• Residual respiratory events, arousals and leaks were greater with full-face masks

• Full-face masks required higher CPAP settings to treat moderate-severe OSA

• Switching from nasal to full-face masks after CPAP titration increased residual AHI

Teo M et al. Sleep 2011
Ebben MR et al. Sleep Med 2012
Ebben MR et al. Sleep Med 2014
Both therapeutic pressures and residual AHIs were higher when using oronasal compared to nasal masks during APAP treatment of OSA.

<table>
<thead>
<tr>
<th></th>
<th>Nasal mask</th>
<th>Oronasal mask</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean pressure delivered with APAP (cmH2O)</td>
<td>10.0 ± 2.0</td>
<td>11.2 ± 2.1</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Residual apneas (average AHI)</td>
<td>2.6 ± 2.5</td>
<td>4.5 ± 4.0</td>
<td>&lt; 0.05</td>
</tr>
</tbody>
</table>

Oronasal masks require higher levels of positive airway pressure than nasal masks to treat obstructive sleep apnea. Bettinzoli M, Taranto-Montemurro L, Messineo L, et al. *Sleep Breath. 2014 Feb 15.*
Use of a chinstrap was associated with improvements in PAP adherence, duration of PAP use, residual AHI and air leak.

**Benefits of chinstrap use**

- Higher PAP adherence
- Longer duration of PAP use (nightly)
- Less residual AHI
- Less leak

*Compared to non-chinstrap at 1st follow-up visit

CPAP vs. OA for OSA

- CPAP was better in improving AHI and SaO2\(^1\)
- CPAP had worse compliance\(^2\)
- CPAP was equally effective in lowering risk of fatal CVD events\(^3\)

Li W et al. Respir Care 2013
Phillips CL et al. AJRCCM 2013
Anandam A et al. Respirology 2013
Factors influencing choice of treatment

- Relative effectiveness
- Portability
- Sense of embarrassment
- Cost of CPAP vs. OA
This review showed that OAs for OSA were more effective than controls, but less effective than CPAP, in reducing AHI.

**Effects of oral devices for OSA**

Compared to controls

- Significantly reduced WMD in AHI (P = 0.006)
- Significantly reduced WMD in arousal index (P = 0.005)

Compared to CPAP

- Less effecting in reducing WMD in AHI (P = 0.0001)
- Less effecting in improving lowest SaO\(_2\) (P = 0.03)
- Less effecting in improving SF-36 (P = 0.01)

5 studies; WMD: weighted mean difference

OAs were associated with a 48% success rate among patients who chose this modality as initial therapy for their OSA.

Responses to mandibular advancement devices

<table>
<thead>
<tr>
<th></th>
<th>Successful group</th>
<th>Unsuccessful group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower facial height</td>
<td>35.61 ± 4.26</td>
<td>38.19 ± 4.89</td>
</tr>
<tr>
<td>AI</td>
<td>19.79 ± 17.32</td>
<td>30.08 ± 23.28</td>
</tr>
<tr>
<td>SaO₂mean</td>
<td>95.03 ± 1.42</td>
<td>94.32 ± 1.56</td>
</tr>
<tr>
<td>SaO₂min</td>
<td>81.44 ± 6.64</td>
<td>76.87 ± 7.98</td>
</tr>
<tr>
<td>SaO₂ &lt; 90%</td>
<td>4.47 ± 5.90</td>
<td>9.01 ± 9.29</td>
</tr>
<tr>
<td>ODI</td>
<td>23.58 ± 17.46</td>
<td>37.16 ± 22.35</td>
</tr>
</tbody>
</table>

*86 subjects with OSA

Higher therapeutic CPAP pressures (cutoff of 13 cmH₂O), age and greater AHI predicted nonresponders to oral device treatment for OSA.

**Predictors of OA treatment response**

- CPAP pressure: 0.53 [0.33-0.87]
- Age: 0.93 [0.87-0.99]
- AHI: 0.92 [0.86-0.97]

* Odds ratio [95% confidence interval]; multivariate regression; model r(2) = 0.54, P < 0.001; 78 OSA subjects with predominantly moderate-severe OSA (AHI 30.0 ± 12.7); one-month crossover trial

A study of 67 subjects demonstrated that a remotely controlled mandibular repositioner accurately predicted oral device therapeutic outcome for OSA.

Remotely controlled mandibular protrusion during sleep predicts therapeutic success with oral appliances in patients with obstructive sleep apnea. Remmers J; Charkhandeh S; Grosse J; Topor Z; Brant R; Santosham P; Bruehlmann S. Sleep 2013;36(10):1517-1525.
An implanted upper airway stimulation device improved AHI and ODI in 126 subjects with moderate-to-severe OSA in uncontrolled cohort study.

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>At 12 months</th>
<th>Reduction</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median AHI (events per hour)</td>
<td>29.3</td>
<td>9.0</td>
<td>68%</td>
<td>P &lt; 0.001</td>
</tr>
<tr>
<td>ODI score (events per hour)</td>
<td>25.4</td>
<td>7.4</td>
<td>70%</td>
<td>P &lt; 0.001</td>
</tr>
</tbody>
</table>

Hypoglossal nerve stimulation improved AHI and sleep-related QOL in 31 subjects with moderate-to-severe OSA who were unable to tolerate PAP.

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>HNS at 12 months</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AHI</td>
<td>45.4 ± 17.5</td>
<td>25.3 ± 20.6</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>FOSQ score</td>
<td>14.2 ± 2.0</td>
<td>17.0 ± 2.4</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

FOSQ: Functional Outcomes of Sleep Questionnaire;
HHS: hypoglossal nerve stimulation

Unresolved issues on PAP therapy and adherence

• Increased screening
• More use of home sleep studies
• Greater role for primary care providers
• Increase in comorbidities
• Biomarkers for outcomes – beyond AHI
Conclusion: Creating change in your patients

• By working directly with patients,
• *Personalizing* therapy and goals,
• *Helping* patients with behavior change,
• *Transforming* medical care