

Modeling the Effectiveness of Treatments for Obstructive Sleep Apnea/Hypopnea

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Introduction:

- The standard treatment for obstructive sleep apnea (OSA) is continuous positive airway pressure (CPAP). CPAP has been shown to be very effective in reducing AHI in the laboratory, but can be limited by poor patient acceptance and compliance. The need for alternative therapies that are both effective and acceptable to patients was documented as early as 1996 by KA Ferguson et al.
- Correct assessment of any therapy is a function of both efficacy and compliance. A therapy that is effective in the lab, but has low compliance, may be less effective over a patient's lifetime due to lack of use, whereas a slightly less effective therapy that has high compliance may be more appropriate to treat OSA chronically in some patients.
- Practically speaking, compliance for alternative therapies to CPAP can be difficult to measure. However, if the therapy is a nightly disposable device which requires a prescription, patient compliance may be measured by prescription refill requests. One such therapy is a nasal expiratory positive airway pressure (nEPAP) device called PROVENT[®] Sleep Apnea Therapy (Ventus Medical, Inc.).
- The purpose of this model is to compare the effectiveness of CPAP versus nEPAP taking into consideration both apneas and hypopneas *prevented* during hours of use and those *not prevented* due to lack of use.
- The model tests the hypothesis that a therapy which is less effective than CPAP in the lab may provide equal or better benefit as measured by dAH% if the patient has higher compliance. This model examined multiple scenarios by combining AHI and compliance data from prior investigations, then performing sensitivity analysis.

Methods:

Efficacy and compliance data on CPAP from the literature were contrasted with nEPAP data from prior investigations. dAH% was calculated by multiplying the percent effectiveness for each therapy by the percent of sleep hours spent on the therapy (percent compliance). This took into account the hours of use of a treatment, its efficacy during use, and hours of non-use (with its associated untreated apneas/hypopneas). A higher dAH% indicates a more effective treatment.

In this model, all CPAP subjects are used because CPAP is generally effective in all patients in the laboratory. For nEPAP, the model includes the subset of patients who responded to treatment (treatment AHI < 10 and reduction in AHI by > 50% of baseline); effectiveness and compliance data used are based on data from previous investigations. Compliance in this model is defined as hours of therapy use divided by a patient's hours of sleep.

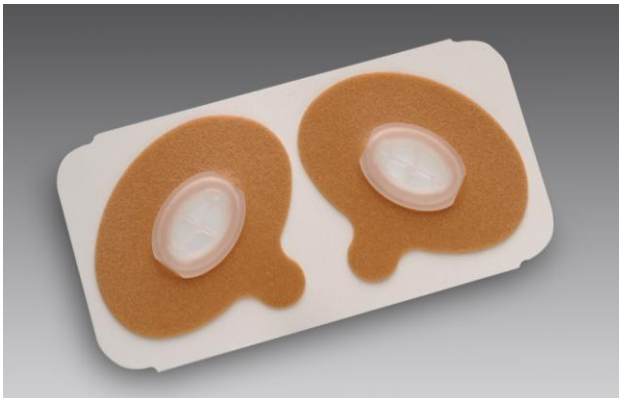
Results:

Using this approach, the dAH% for patients who used CPAP an average of 4 hours/night on 70% of nights (40% compliance) ranged from 32%-40%, while patients who used CPAP 4.6 hours every night (66% compliance) experienced a dAH% of 52-66%. For nEPAP the dAH% range was 53%-58% for patients with 75% compliance, while for patients with 94% compliance the dAH% range of nEPAP was 67%-72%. (see Table)

Conclusion:

This model uses AHI reduction and compliance rates for CPAP and nEPAP from the medical literature and studies on file at the sponsor. While nEPAP studies report smaller AHI reduction than CPAP in the lab setting, the higher reported compliance rates for nEPAP therapy may more than offset the in-lab effectiveness differences. Under model scenarios, nEPAP results in a greater reduction in lifetime apneas and hypopneas for OSA patients than CPAP.

PROVENT Therapy nEPAP Device



	CPAP				nEPAP			
	40% Compliance		66% Compliance		94% Compliance		75% Compliance	
	80% Efficacy	100% Efficacy	80% Efficacy	100% Efficacy	71% Efficacy	77% Efficacy	71% Efficacy	77% Efficacy
Calculation of AH % Reduction								
Assumed Therapy Effectiveness	80%	100%	80%	100%	71%	77%	71%	77%
Assumed Therapy Compliance (% / hours per night out of 7 hrs sleep time)	40% / 2.80	40% / 2.80	66% / 4.60	66% / 4.60	94% / 6.58	94% / 6.58	75% / 5.25	75% / 5.25
Percent AH Reduction (dAH%)	32%	40%	52%	66%	67%	72%	53%	58%
Actual AHs reduced for patient w/baseline AHI of 25								
Possible AHs during 7 hours sleep time	175	175	175	175	175	175	175	175
Actual AHs on therapy	14	-	24	-	48	38	38	30
Actual AHs off therapy	105	105	60	60	11	11	44	44
Total Actual AHs (AHs on therapy + off therapy)	119	105	84	60	58	48	82	74
Nightly AH reduction (Possible AHs minus Actual AHs)	56 of 175	70 of 175	91 of 175	115 of 175	117 of 175	127 of 175	93 of 175	101 of 175

References:

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