UNIVERSITÀ DEGLI STUDI
DELLA CAMPANIA
LUIGI VANVITELLI

OSPEDALI DEI COLLI
MONALDI - COTUGNO - C.T.O.

La gestione del paziente con sindrome delle apnee ostruttive del sonno

Mariano Mollica

EDUCATION AND BEHAVIOR

- Alcohol avoidance
- Concomitant medications
- Excercise
- Weight Loss

Weight Loss

Lifestyle Intervention with Weight Reduction

First-line Treatment in Mild Obstructive Sleep Apnea

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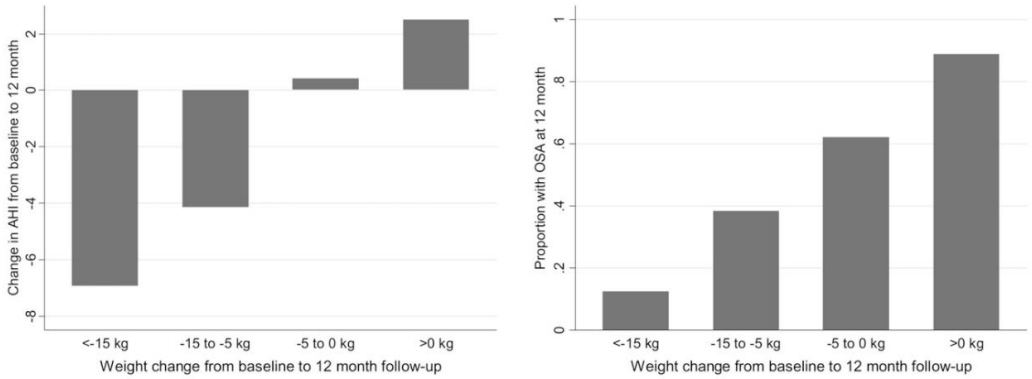


Figure 2. Changes in apnea–hypopnea index (AHI) in relation to changes in body weight (*left*), and the proportion of patients (expressed as a percentage) with OSA (AHI > 5) (*right*) in relation to the following weight change categories: less than −15 kg, −15 to −5 kg, −5 to 0 kg, and more than 0 kg.

TABLE 3. CHANGES IN CARDIORESPIRATORY RECORDINGS, BODY WEIGHT, BODY MASS INDEX, AND WAIST CIRCUMFERENCE AFTER 12-MONTH INTERVENTION

	Control Group	Intervention Group	*P* Value*	*P* adj†
Patients with follow-up data, n	37	35		
AHI (total)	0.3 (8.0)	−4.0 (5.6)	0.011	0.017
Number of cured patients,‡ n (%)	13 (35)	22 (63)	0.033	0.019
Apnea indices separately per hour	1.3 (5.1)	−0.9 (2.4)	0.029	0.005
Hypopnea indices separately per hour	−0.9 (4.3)	−3.5 (4.1)	0.013	0.053
AHI (supine)	−5.9 (23.9)	−6.5 (13.0)	0.90	0.29
AHI (positions other than supine)	1.4 (9.3)	−1.8 (8.5)	0.24	0.015
Percentage of supine recording	−1.4 (28.9)	−0.4 (21.2)	0.89	0.85
Mean Sa_{O2}	−0.3 (1.3)	0.8 (1.2)	<0.001	0.002
Time with mean Sa_{O2} below 90%, s	2.5 (21.0)	−4.8 (12.8)	0.126	0.068
Percentage of time with Sa_{O2} below 90%	1.8 (6.3)	−1.7 (4.1)	0.016	0.042
Heart rate, beats/min	1.1 (5.0)	−2.8 (5.8)	0.081	0.075
Weight, kg	−2.4 (5.6)	−10.7 (6.5)	<0.001	<0.001
BMI, kg/m²	−0.8 (2.0)	−3.5 (2.1)	<0.001	<0.001
Waist circumference, cm	−3.0 (6.0)	−11.6 (6.6)	<0.001	<0.001
Plasma glucose, fasting, mmol/L	−0.4 (1.4)	−0.6 (2.3)	0.52	0.30
Plasma insulin, mU/L	−1.2 (3.4)	−5.9 (7.0)	<0.001	0.004
Serum HDL cholesterol, mmol/L	0.05 (0.22)	0.14 (0.22)	0.085	0.103
Serum triglycerides, mmol/L	−0.06 (0.65)	−0.48 (1.13)	0.054	0.027
Systolic blood pressure, mm Hg	−1.1 (19.6)	−1.7 (14.7)	0.88	0.47
Diastolic blood pressure, mm Hg	−0.4 (12.6)	−1.9 (10.6)	0.62	0.87
SOS	11.8 (12.6)	19.0 (14.2)	0.025	0.001
ESS	−2.1 (2.9)	−3.1 (4.0)	0.25	0.31
Witnessed apneas, n (%)	33 (97)	23 (74)	0.011	<0.001

Data represent mean changes with standard deviation (SD).
* *P* value: Fisher's exact test or *t* test for equal change between groups.
† *P* adj: Test for equal change between groups, adjusted for age, sex, BMI, and baseline level of respective variable.
‡ *Cured* is defined as an apnea–hypopnea index less than 5 events/hour.

Am J Respir Crit Care Med. 2009;179(4):320. Epub 2008 Nov 14.

TO TREAT OR NOT TO TREAT

- Patients with an AHI >5 but < 15 events per hour of sleep plus one or more clinical or physiologic sequelae attributable to OSA (excessive daytime sleepiness, impaired neurocognitive function, mood disorders, insomnia, cardiovascular disease , or a history of stroke).
- Patients with an AHI ≥15 events per hour of sleep, even in the absence of symptoms.
- Patients who perform mission critical work (eg, airline pilots, air traffic controllers, locomotive engineers, bus and truck drivers) and have an AHI between 5 and 15 events per hour of sleep, even if there are no clinical or physiological symptoms attributable to OSA.
- Patients with an increased number of RERAs (eg, ≥10 per hour) and excessive daytime sleepiness, even if the AHI is ≤5 events per hour.

www.cms.hhs.gov/Transmittals/Downloads/R35NCD.pdf.

Chowduri S et al. An Official American Thoracic Society Research Statement: Impact of Mild Obstructive Sleep Apnea in Adults. Am J Respir Crit Care Med. 2016 May;193(9):e37-54.

POSITIVE AIRWAY PRESSURE THERAPY

- Reduces the frequency of respiratory events during sleep
- Decreases daytime sleepiness
- Improves systemic blood pressure (BP)
- Lowers the risk of crashes
- Improves erectile dysfunction
- Improves quality of life across a range of disease severities

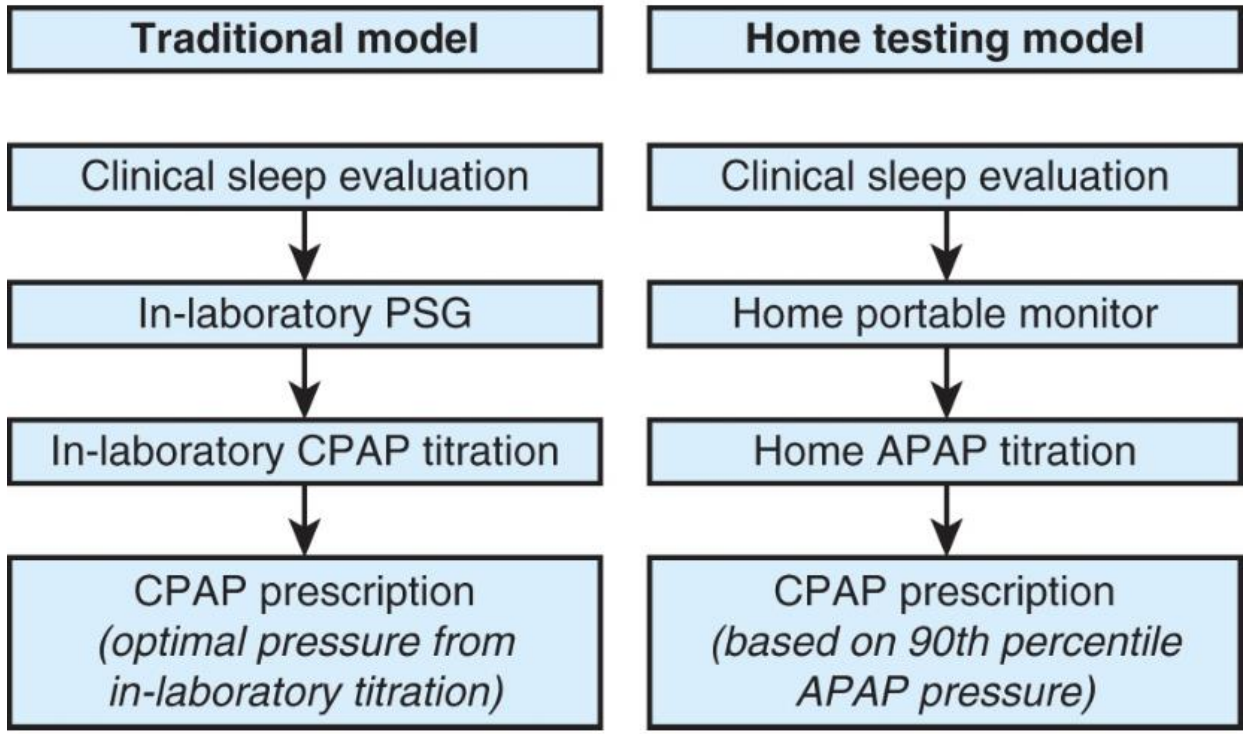
Kryger M.H A.Malhotra Management of obstructive sleep apnea in adults UpToDate Nov 21, 2019

POSITIVE AIRWAY PRESSURE THERAPY

- CPAP delivers positive airway pressure at a level that remains constant throughout the respiratory cycle.
- CPAPexp is similar to traditional CPAP with the exception of allowing a transient decrease in pressure during early expiration
- APAP increases or decreases the level of positive airway pressure in response to a change in airflow, a change in circuit pressure, or a vibratory snore
- BPAP delivers a preset inspiratory positive airway pressure (IPAP) and expiratory positive airway pressure (EPAP). The degree of pressure support and consequently tidal volume is related to the difference between the IPAP and EPAP.
- Adaptive servo-ventilation (ASV) provides a varying amount of inspiratory pressure superimposed on a low level of CPAP. It can be helpful in patients who have concomitant central apneas, which may occur as a consequence of CPAP (treatment-emergent central apneas), patients on long-acting opioids (narcotic-induced central sleep apnea), and patients who have had a stroke or kidney disease (central sleep apnea due to other conditions).

Epstein Lj et al. Clinical guideline for the evaluation, management and long-term care of obstructive sleep apnea in adults. J Clin Sleep Med. 2009;5(3):263.

POSITIVE AIRWAY PRESSURE TITRATION



Alon Y. Avidan Review of Sleep Medicine 4th Edition Chapter 13 Figure 13.5

POSITIVE AIRWAY PRESSURE TITRATION

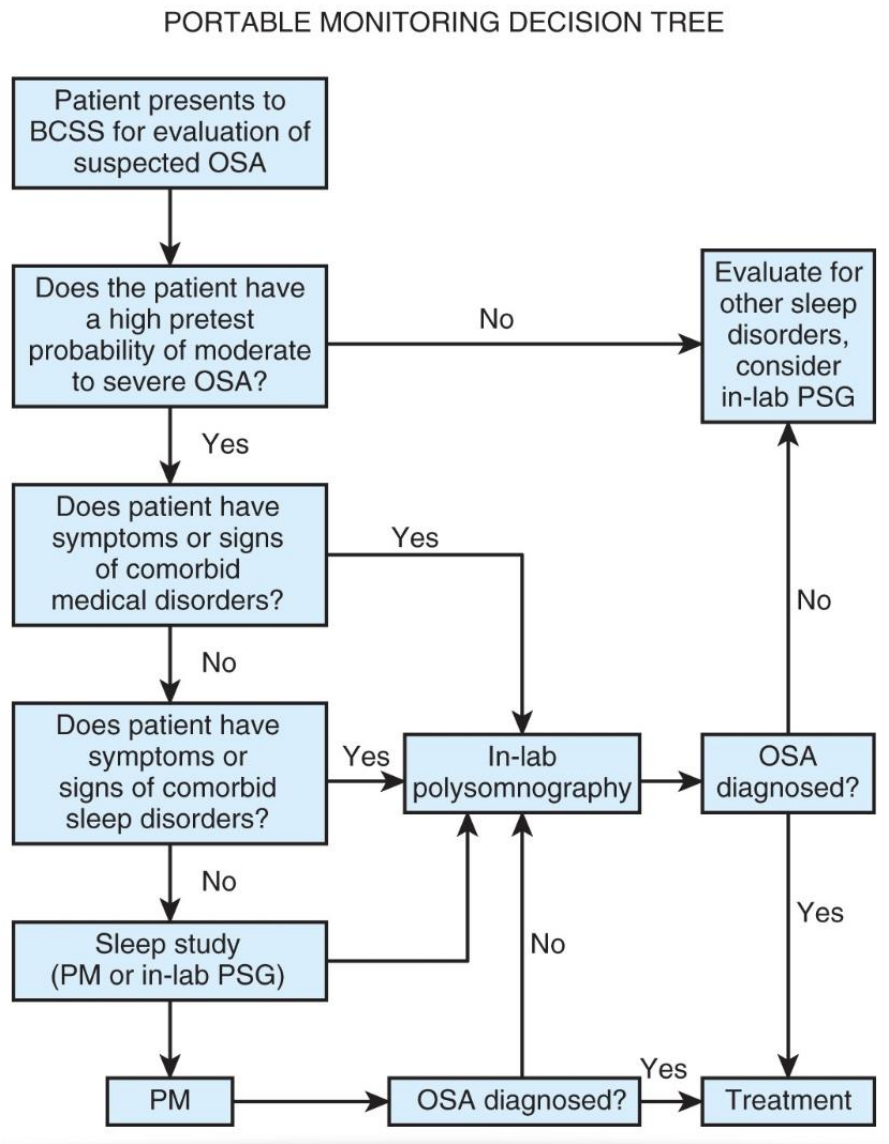
Uncomplicated OSA : OSA that is not associated with chronic lung diseases such as:

- COPD
- Interstitial lung disease
- Sleep-related oxygen requirements
- Heart failure
- Hypoventilation syndromes

Complicated OSA: presence of conditions that place the patient at risk of nonobstructive sleep disordered breathing such as:

- COPD
- Heart failure
- Neuromuscular weakness,
- Hypoventilation syndromes
- Use of opioid medication
- Stroke
- Suspected non OSA disorders: narcolepsy, severe insomnia, parasomnias, movement disorders

Pack AI. POINT: Does Laboratory Polysomnography Yield Better Outcomes Than Home Sleep Testing? Yes. Chest 2015; 148:306.



Alon Y. Avidan Review of Sleep Medicine 4th Edition Chapter 13 Figure 13.4

AT HOME APAP TITRATION VS IN-LAB MANUAL TITRATION

Continuous positive airway pressure titration for obstructive sleep apnoea: automatic versus manual titration

Nigel McArdle,[1] Bhajan Singh,[2] Michelle Murphy,[2] Kevin R Gain,[1] Christine Maguire,[2] Sarah Mutch,[2] David R Hillman[2]

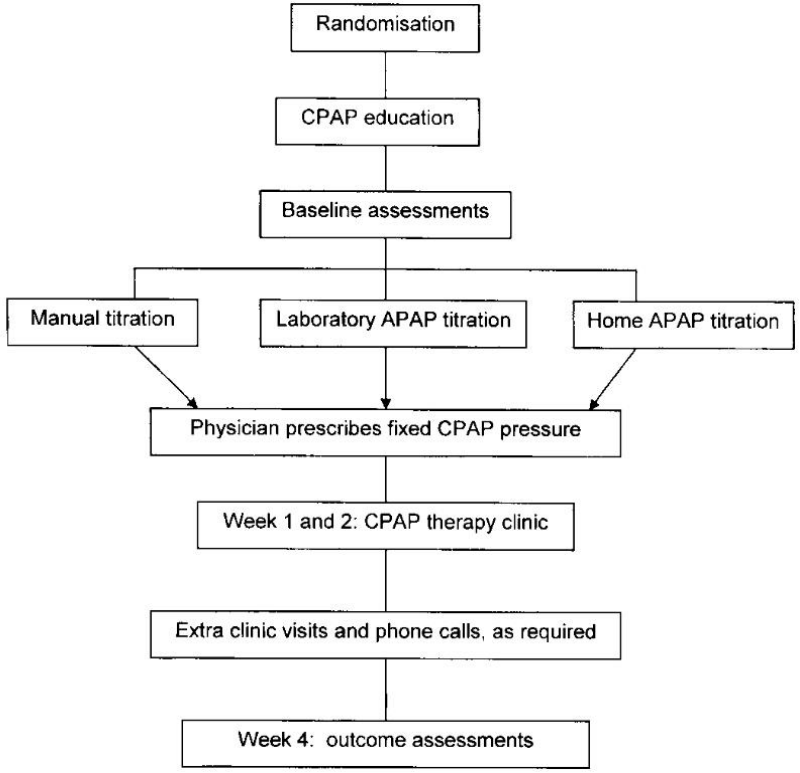


Table 2 Comparison of week 4 per protocol overnight polysomnographic (PSG) outcomes on CPAP at the prescribed pressure

PSG outcome (per protocol)	Manual (n=59)	Laboratory APAP (n=64)	Home APAP (n=62)	p Value
Total recording time, min	467±70	457±71	464±57	0.7
Total sleep time, min	351±79	345±74	364±71	0.4
Stage 1+2, min	257±62	248±59	264±61	0.3
Stage 3+4, min	34±32	31±26	32±22	0.8
Stage REM, min	63±35	67±33	71±31	0.4
AHI, events/h slept	7.1 (3.9–16)	6.7 (4.1–14)	8.0 (5.2–14)	0.8
Arousal index, events/h slept	23±12	24±12	22±9	0.6
Oxygen saturation time <90%, min	0 (0–0)	0 (0–0)	0 (0–0)	0.8
Oxygen saturation average, %	95.±8 2	95.7±2	96.0±2	0.5
Oxygen saturation lowest, %	89.0±13	88.2±12	90.1±5	0.6
Median mask leak, l/min	3.6 (0–10.8)	1.2 (0–8.1)	1.2 (0–6.0)	0.16
95th centile mask leak, l/min	20.4 (9–37.8)	12.6 (7.2–29.7)	14.4 (6–26.4)	0.24

Data are presented as mean±SD or median (IQR).
CPAP use = average nightly 'mask on' time.
Five per protocol patients did not have overnight PSG at week 4 (3 manual, 1 laboratory APAP, 1 home APAP titration).
AHI, apnoea/hypopnoea index; APAP, automatic positive airway pressure; CPAP, continuous positive airway pressure; REM, rapid eye movement.

Conclusions: Among patients with moderate-severe OSA without serious co-morbidities, outcomes at 1 month indicate that APAP titration is more cost-effective than manual laboratory titration to determine an appropriate pressure for CPAP for long-term use.

Thorax 2010;65:606e611. doi:10.1136/thx.2009.116756

http://dx.doi.org/10.5665/sleep.1870

A Multisite Randomized Trial of Portable Sleep Studies and Positive Airway Pressure Autotitration Versus Laboratory-Based Polysomnography for the Diagnosis and Treatment of Obstructive Sleep Apnea: The HomePAP Study

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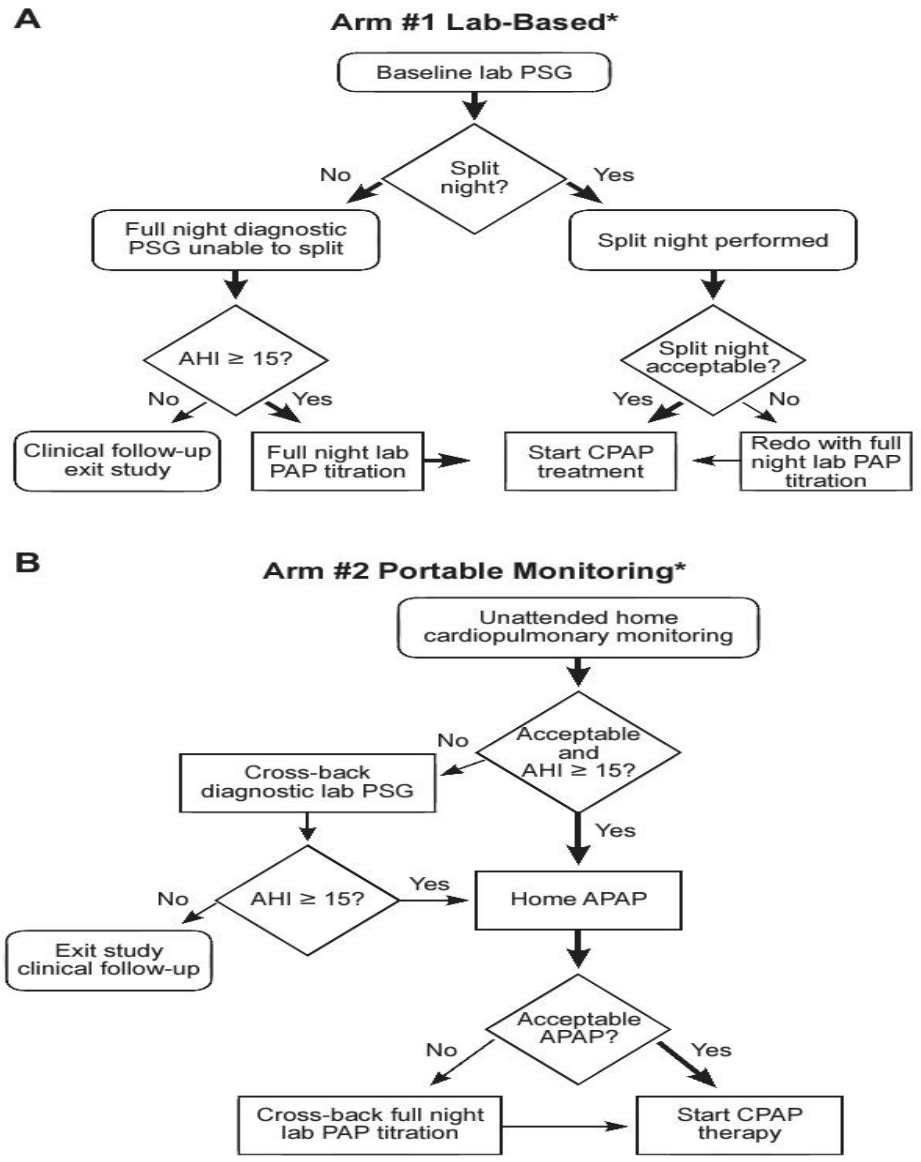
Results: Of 373 participants, approximately one-half in each study arm remained eligible (AHI ≥15) to continue in the study. At 3 mo, PAP usage (nightly time at pressure) was 1 hr greater: 4.7 ± 2.1 hr (HOME) compared with 3.7 ± 2.4 hr (LAB). Adherence (percentage of night used ≥ 4 hr) was 12.6% higher: 62.8 ± 29.2% compared with 49.4 ± 36.1% in the HOME versus LAB. Acceptance of PAP therapy, titration pressures, effective titrations, time to treatment, and ESS score change did not differ between arms.

Conclusions: A home-based strategy for diagnosis and treatment compared with in-laboratory PSG was not inferior in terms of acceptance, adherence, time to treatment, and functional improvements.

Rosen et al. Sleep. 2012 Jun 1; 35(6): 757–767.



POSITIVE AIRWAY PRESSURE IN-LAB MANUAL TITRATION ADEQUACY

- **Optimal** – Reduces the respiratory disturbance index (RDI) <5 for at least 15 minutes; supine rapid eye movement (REM) sleep should not be interrupted by spontaneous arousals or awakenings.
- **Good** – Reduces the RDI ≤10 or by 50 percent if the baseline RDI <15; supine REM sleep should not be interrupted by spontaneous arousals or awakenings.
- **Adequate** – Does not reduce the RDI ≤10 but reduces the RDI by 75 percent from baseline (especially in severe OSA patients), or one in which the titration grading criteria for **optimal** or **good** are met with the exception that supine REM sleep did not occur at the selected pressure.
- **Inadequate** – A titration that does not meet any one of the previous grading criteria.

Kushida CA Clinical guidelines for the manual titration of positive airway pressure in patients with obstructive sleep apnea. J Clin Sleep Med. 2008;4(2):157.

AT HOME APAP TITRATION ADEQUACY

Successful or adequate APAP trial :

- Mean use of 6 hours per night
- A device-calculated apnea-hypopnea index (AHI_{Flow}) ≤10 events per hour and a normal leak profile (which is dependent on the individual device manufacturer, mask type, and proprietary algorithm)
- Symptoms must also be considered in assessment of treatment success, as the AHI_{Flow} is based on proprietary algorithms and has received only limited study

Freedman et al. Mode selection for positive airway pressure titration in adults with obstructive sleep apnea UpToDate Apr 18 ,2019

KEY POINTS FOR AT HOME APAP TITRATION

- Choose the right patient
- Mask Fitting and Patient Education
- Daytime Nap acclimatization
- Program APAP for a brief period (2 to 7 nights)
- Switch to o a fixed pressure (90th or 95th percentile)

Susheel P. Patil. Et al Treatment of Adult Obstructive Sleep Apnea With Positive Airway Pressure: An American Academy of Sle ep Medicine Systematic Review, Meta-Analysis, and GRADE Assessment Journal of Clinical Sleep Medicine, Vol. 15, No. 2 Feb. 2019

APAP VS CPAP

pii: jc-18-00760

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JCSM
Journal of Clinical Sleep Medicine

REVIEW ARTICLES

Treatment of Adult Obstructive Sleep Apnea With Positive Airway Pressure: An American Academy of Sleep Medicine Systematic Review, Meta-Analysis, and GRADE Assessment

Susheel P. Patil, MD, PhD[1]; Indu A. Ayappa, PhD[2]; Sean M. Caples, DO[3]; R. John Kimoff, MD[4]; Sanjay R. Patel, MD[5]; Christopher G. Harrod, MS[6]

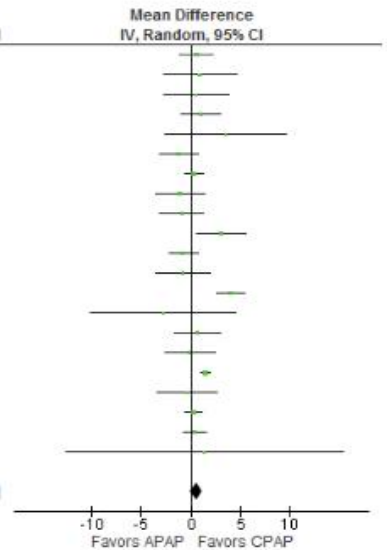
[1]Johns Hopkins University, Baltimore, Maryland; [2]Icahn School of Medicine at Mount Sinai, New York, New York; [3]Mayo Clinic, Rochester, Minnesota; [4]McGill University Health Centre, Montreal, Quebec, Canada; [5]University of Pittsburgh, Pittsburgh, Pennsylvania; [6]American Academy of Sleep Medicine, Darien, Illinois

APAP vs. CPAP for the treatment of obstructive sleep apnea in adults

Figure S62. APAP vs. CPAP (AHI, events/hr)

	APAP			CPAP				Mean Difference	Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI	IV, Random, 95% CI
Berry 2014	5.5	4.7	66	4.9	4.9	59	6.0%	0.60 [-1.09, 2.29]	
d'Ortho 2000	10.6	9.3	25	9.7	1.9	25	2.2%	0.90 [-2.82, 4.62]	
Fietze 2007	4.4	3.4	10	3.9	4.3	11	2.7%	0.50 [-2.80, 3.80]	
Galetke 2008	5.6	3.6	20	4.6	2.9	20	5.1%	1.00 [-1.03, 3.03]	
Hussain 2004	13.1	8.3	10	9.6	5.4	10	0.9%	3.50 [-2.64, 9.64]	
Konermann 1998	2.4	1.6	25	3.6	4.4	23	5.4%	-1.20 [-3.10, 0.70]	
Kushida 2011	1.3	2.9	46	1	1.3	47	8.8%	0.30 [-0.62, 1.22]	
Massie 2003	9.6	5.3	44	10.7	6.6	44	4.0%	-1.10 [-3.60, 1.40]	
Meurice 1996	1.7	1.2	8	2.6	3	8	4.5%	-0.90 [-3.14, 1.34]	
Meurice 2007	5.5	6.3	51	2.4	3.4	14	4.0%	3.10 [0.62, 5.58]	
Nolan 2007	2.7	2.1	29	3.5	3.5	29	6.7%	-0.80 [-2.29, 0.69]	
Nussbaumer 2006	4.6	3.8	30	5.4	6.6	30	3.5%	-0.80 [-3.53, 1.93]	
Patruno 2007	6	2.3	15	2	1.6	16	7.0%	4.00 [2.60, 5.40]	
Planes 2003	7.6	6.9	16	10.4	12.5	14	0.7%	-2.80 [-10.17, 4.57]	
Randerath 2001	5	5.2	47	4.3	6.3	47	4.3%	0.70 [-1.64, 3.04]	
Resta 2004	8.3	2	10	8.4	3.6	10	3.9%	-0.10 [-2.65, 2.45]	
Senn 2003	6.8	1.3	58	5.3	1	29	10.1%	1.50 [1.01, 1.99]	
Series 2001	3.3	1.8	11	3.7	4.6	10	3.0%	-0.40 [-3.44, 2.64]	
Teschler 2000	4	1	10	3.7	1	10	8.9%	0.30 [-0.58, 1.18]	
Vennelle 2010	6.7	5.4	181	6.3	5.4	181	8.0%	0.40 [-0.71, 1.51]	
West 2006	5.2	16.1	29	3.8	35	29	0.2%	1.40 [-12.62, 15.42]	
Total (95% CI)			**741**			**666**	**100.0%**	**0.56 [-0.07, 1.19]**	

Heterogeneity: Tau² = 0.95; Chi² = 50.93, df = 20 (P = 0.0002); I² = 61%
Test for overall effect: Z = 1.76 (P = 0.08)



APAP VS CPAP

pii: jc-18-00760

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Treatment of Adult Obstructive Sleep Apnea With Positive Airway Pressure: An American Academy of Sleep Medicine Systematic Review, Meta-Analysis, and GRADE Assessment

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[1]Johns Hopkins University, Baltimore, Maryland; [2]Icahn School of Medicine at Mount Sinai, New York, New York; [3]Mayo Clinic, Rochester, Minnesota; [4]McGill University Health Centre, Montreal, Quebec, Canada; [5]University of Pittsburgh, Pittsburgh, Pennsylvania; [6]American Academy of Sleep Medicine, Darien, Illinois

Figure S63. APAP vs. CPAP (Adherence; hrs/night)

Study or Subgroup	APAP Mean	APAP SD	APAP Total	CPAP Mean	CPAP SD	CPAP Total	Weight	Mean Difference IV, Random, 95% CI
Berry 2014	4.45	2.3	66	4	2.3	59	5.3%	0.45 [-0.36, 1.26]
d'Ortho 2000	4.1	1.8	25	4.7	1.8	25	3.5%	-0.60 [-1.60, 0.40]
Fietze 2007	5	1.6	10	4.2	2.2	11	1.3%	0.80 [-0.84, 2.44]
Galetke 2008	6.4	1.8	20	6.4	1.9	20	2.6%	0.00 [-1.15, 1.15]
Hudgel 2000	6	1.8	14	5.5	1.8	19	2.2%	0.50 [-0.74, 1.74]
Hukins 2004	5.1	2.4	27	4.7	2.7	19	1.5%	0.40 [-1.11, 1.91]
Hussain 2004	4.3	1.9	10	3.7	2.6	10	0.9%	0.60 [-1.40, 2.60]
Konermann 1998	5.9	1.6	25	5.6	2.5	23	2.4%	0.30 [-0.90, 1.50]
Kushida 2011	4.4	2	54	4.4	2	57	6.3%	0.00 [-0.74, 0.74]
Marrone 2004	4.9	1.7	22	4.4	1.9	22	3.1%	0.50 [-0.57, 1.57]
Massie 2003	5.1	1.9	44	4.5	1.9	44	5.5%	0.60 [-0.19, 1.39]
Meurice 2007	5.9	1.6	51	6.5	1.8	14	3.2%	-0.60 [-1.64, 0.44]
Nolan 2007	4.9	2.1	29	4.9	1.9	29	3.3%	0.00 [-1.03, 1.03]
Noseda 2004	5.3	1.9	24	5.5	1.5	24	3.7%	-0.20 [-1.17, 0.77]
Nussbaumer 2006	5.1	1.6	30	4.8	1.6	30	5.3%	0.30 [-0.51, 1.11]
Patruno 2007	6.2	0.8	15	6	1	16	8.6%	0.20 [-0.44, 0.84]
Planes 2003	4.5	1.7	16	5.3	1.4	14	2.8%	-0.80 [-1.91, 0.31]
Randerath 2001	5.3	1.6	47	5.3	1.6	47	8.3%	0.00 [-0.65, 0.65]
Resta 2004	5.2	1.4	10	5.3	1.8	10	1.7%	-0.10 [-1.51, 1.31]
Senn 2003	5.5	1.5	58	5.6	1.1	29	11.2%	-0.10 [-0.66, 0.46]
Teschler 2000	6.3	1.3	10	6.1	1.6	10	2.1%	0.20 [-1.08, 1.48]
To 2008	4.4	2.3	41	3.8	2	41	4.0%	0.60 [-0.33, 1.53]
Vennelle 2010	4.2	2.7	181	4	2.7	181	11.2%	0.20 [-0.36, 0.76]
Total (95% CI)			**829**			**754**	**100.0%**	**0.11 [-0.07, 0.30]**

Heterogeneity: Tau² = 0.00; Chi² = 13.27, df = 22 (P = 0.93); I² = 0%
Test for overall effect: Z = 1.19 (P = 0.23)

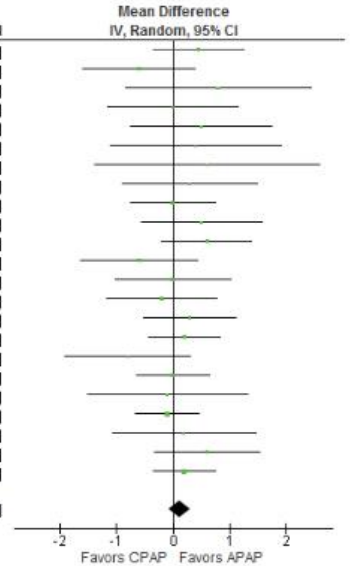


Figure S64. APAP vs. CPAP (Adherence; % nights used)

Study or Subgroup	APAP Mean	APAP SD	APAP Total	CPAP Mean	CPAP SD	CPAP Total	Weight	Mean Difference IV, Random, 95% CI
Hukins 2004	83.3	23.3	27	78	32.6	19	4.1%	5.30 [-11.79, 22.39]
Marrone 2004	88.8	15.2	22	83.9	18.6	22	11.8%	4.90 [-5.14, 14.94]
Massie 2003	92	11	44	88	15	44	39.2%	4.00 [-1.50, 9.50]
Nolan 2007	79	29	29	81	25	29	6.1%	-2.00 [-15.94, 11.94]
Noseda 2004	96.5	15	24	95.5	13.8	24	17.8%	1.00 [-7.15, 9.15]
Teschler 2000	98	4.1	10	96	11.4	10	21.0%	2.00 [-5.51, 9.51]
Total (95% CI)			**156**			**148**	**100.0%**	**2.84 [-0.61, 6.28]**

Heterogeneity: Tau² = 0.00; Chi² = 1.12, df = 5 (P = 0.95); I² = 0%
Test for overall effect: Z = 1.62 (P = 0.11)

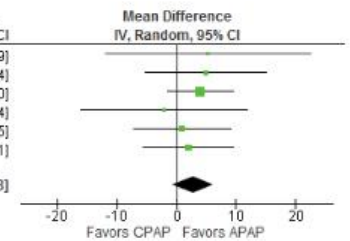
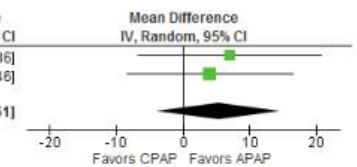


Figure S65. APAP vs. CPAP (Adherence; % nights >4 hrs)

Study or Subgroup	APAP Mean	APAP SD	APAP Total	CPAP Mean	CPAP SD	CPAP Total	Weight	Mean Difference IV, Random, 95% CI
Hudgel 2000	73	18.7	14	66	21.8	19	44.7%	7.00 [-6.86, 20.86]
Nussbaumer 2006	72	22	30	68	27	30	55.3%	4.00 [-8.46, 16.46]
Total (95% CI)			**44**			**49**	**100.0%**	**5.34 [-3.93, 14.61]**

Heterogeneity: Tau² = 0.00; Chi² = 0.10, df = 1 (P = 0.75); I² = 0%
Test for overall effect: Z = 1.13 (P = 0.26)



APAP VS CPAP

Sleep

ORIGINAL ARTICLE

Fixed-pressure CPAP versus auto-adjusting CPAP: comparison of efficacy on blood pressure in obstructive sleep apnoea, a randomised clinical trial

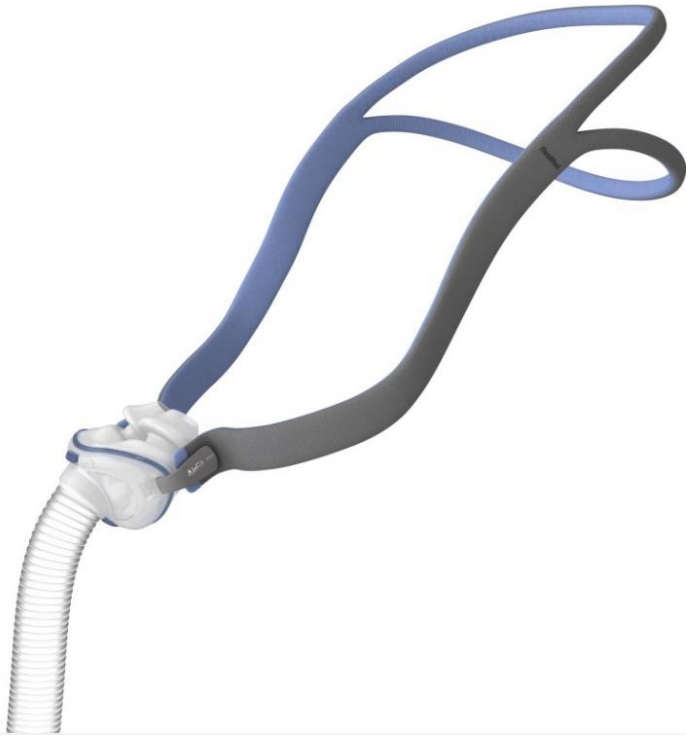
J L Pépin,[1,2] R Tamisier,[1,2] J P Baguet,[6] B Lepaulle,[4] F Arbib,[4] N Arnol,[1,2] J F Timsit,[5] P Lévy[1,2]

Table 4 Effect of CPAP treatments on BP levels in the per-protocol population

	FP-CPAP (n=133)			AutoCPAP (n=143)			Intergroup raw		Intergroup adjusted*	
BP, mm Hg	Baseline	Follow-up	p Value	Baseline	Follow-up	p Value	Differences (95% CI)	p Value	Differences (95% CI)	p Value
Office SBP	136.0±15.4	132.9±14.2	0.007	134.6±17.1	133.9±16.7	0.52	−2.4 (−5.5 to 0.7)	0.13	−1.8 (−4.6 to 1.0)	0.20
Office DBP	79.5±9.6	76.1±9.3	<0.001	80.5±9.7	78.0±8.9	0.001	−1.0 (−3.0 to 1.0)	0.35	−1.4 (−3.2 to 0.3)	0.11
24 h SBP	129.0±12.6	126.8±11.4	0.012	127.8±13.5	127.6±12.9	0.82	−2.0 (−4.4 to 0.3)	0.09	−1.7 (−3.9 to 0.5)	0.13
24 h DBP	78.8±8.2	76.7±7.5	<0.001	78.6±8.2	77.8±7.5	0.08	−1.3 (−2.6 to −0.03)	0.046	−1.3 (−2.4 to −0.1)	0.032
24 h mean BP	95.4±8.2	93.4±7.5	<0.001	94.8±8.8	94.1±7.9	0.24	−1.4 (−2.9 to 0.2)	0.08	−1.2 (−2.5 to 0.2)	0.09
Daytime SBP	134.4±13.8	131.8±11.9	0.001	132.5±13.6	132.5±12.9	0.94	−2.5 (−5.2 to 0.2)	0.07	−1.8 (−4.2 to 0.5)	0.13
Daytime DBP	82.8±9.0	80.3±8.3	<0.001	82.5±8.5	81.3±8.1	0.031	−1.4 (−2.8 to 0.1)	0.07	−1.3 (−2.6 to 0.1)	0.07
Daytime mean BP	99.6±9.2	97.0±8.2	<0.001	98.6±8.9	97.9±8.2	0.28	−1.9 (−3.6 to −0.1)	0.041	−1.6 (−3.1 to −0.01)	0.049
Nighttime SBP	119.3±12.6	117.7±12.6	0.12	119.3±15.3	118.8±14.3	0.58	−1.0 (−3.6 to 1.6)	0.45	−1.0 (−3.4 to 1.4)	0.40
Nighttime DBP	71.4±7.9	70.3±7.4	0.040	71.5±9.0	71.3±7.8	0.81	−1.0 (−2.6 to 0.5)	0.19	−1.0 (−2.4 to 0.3)	0.13
Nighttime mean BP	87.6±8.1	86.6±8.0	0.12	87.8±10.1	87.4±8.9	0.49	−0.6 (−2.3 to 1.2)	0.52	−0.6 (−2.2 to 0.9)	0.43

Data are presented as mean±SD.
*Adjusted by baseline BP values.
AutoCPAP, auto-adjusted CPAP; BP, blood pressure; DBP, diastolic blood pressure; FP-CPAP, fixed-pressure CPAP; SBP, systolic blood pressure.

ONE MASK FITS ALL ?



Impact of the type of mask on the effectiveness of and adherence to continuous positive airway pressure treatment for obstructive sleep apnea

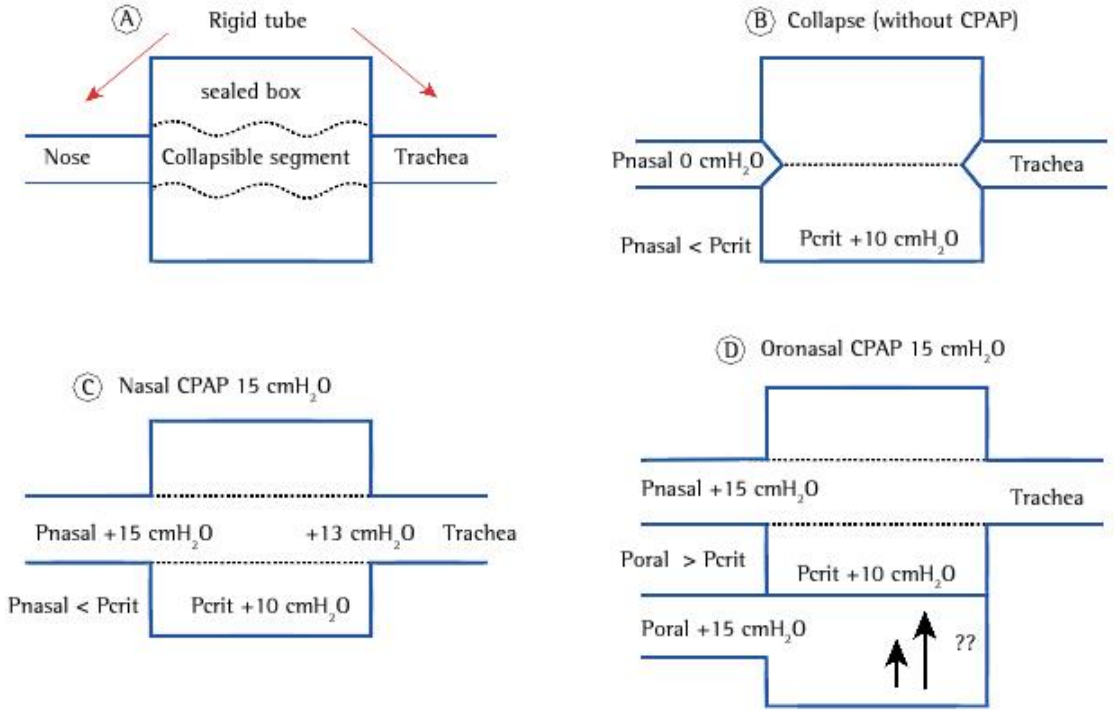


Figure 2 – Schematic illustration of the Starling resistor. In A, the nose and the trachea are represented by two rigid tubes connected by a collapsible segment (the pharynx). In B, pharyngeal collapse occurs when the pharyngeal critical pressure (Pcrit) is greater than the upper airway pressure (Pnasal). In C, nasal continuous positive airway pressure (CPAP) applied to the upper airway is greater than Pcrit and can therefore maintain upper airway patency. In D, oronasal CPAP; the hypothesis is that upper airway collapse occurs when oral pressure (Poral) is greater than Pcrit. Source: Sleep Laboratory, Heart Institute, University of São Paulo School of Medicine *Hospital das Clínicas*.

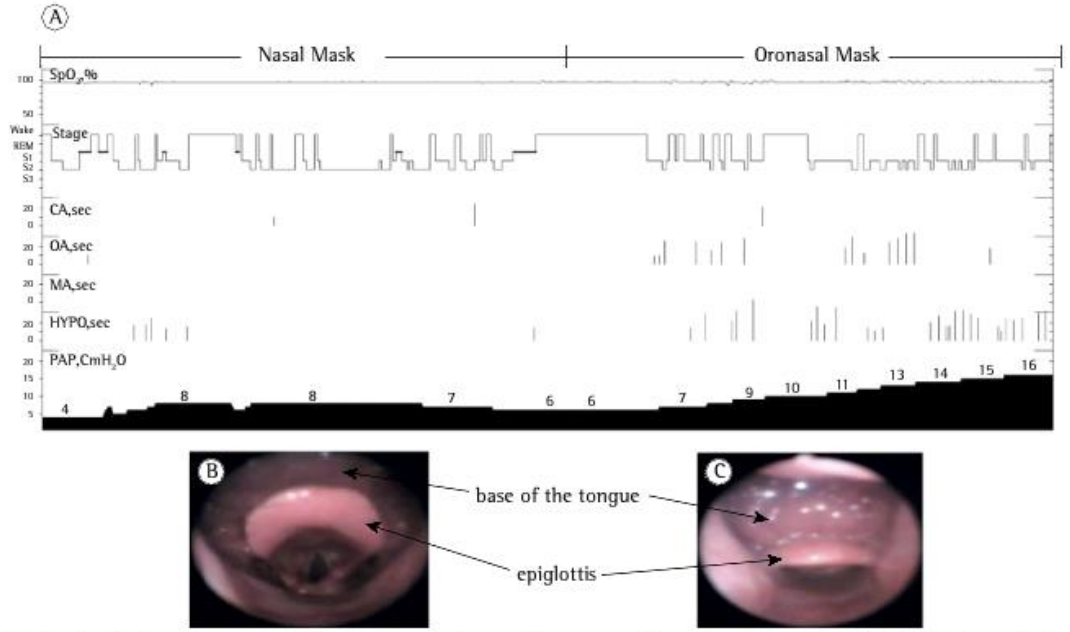


Figure 4 – In A, polysomnography summary of a continuous positive airway pressure (CPAP) titration study during natural sleep. In B and C, sleep endoscopy images showing the patient wearing a nasal mask and an oronasal mask, respectively. During the first half of the CPAP titration study, a nasal CPAP of 7 cmH_2O was enough to control obstructive events. During the second half of the CPAP titration study, an oronasal mask was used. Obstructive events persist, despite the fact that the pressure was gradually increased to 16 cmH_2O. The endoscopic image obtained when a nasal CPAP of 7 cmH_2O was used (B) shows that the oropharynx is open. In contrast, the image obtained when an oronasal CPAP of 16 cmH_2O was used (C) shows posterior displacement of the base of the tongue, which pushes the epiglottis and significantly narrows the airway lumen. Respiratory events are expressed in seconds (sec). SpO_2 measured by pulse oximetry. CA: central apnea; OA: obstructive apnea; MA: mixed apnea; Hypo: hypopnea; PAP: pulmonary artery pressure; and REM: rapid eye movement.

Andrade Rg et al. J Bras Pneumol. 2014 Nov-Dec;40(6):658-68. doi: 10.1590/S1806-37132014000600010.

FOLLOW UP

- First Visit after 1 to 8 week of therapy
- Centers for Medicare and Medicaid Services require evaluation no longer than 90 days after PAP therapy starts.
- Symptoms Evaluation (snoring, mask tolerance, and oronasal effects)
- Device-recorded data review

Freedman et al. Mode selection for positive airway pressure titration in adults with obstructive sleep apnea UpToDate Apr 18 ,2019

ADHERENCE WITH PAP TREATMENT

- The Centers for Medicare and Medicaid Services (CMS) requires 4 hours per night for five out of seven nights.
- 29-83% percent of patients are nonadherent, when nonadherence is defined as a mean of ≤4 hours of use per night
- Patients generally make the decision to adhere to CPAP therapy early during the first week of therapy
- Patients who used CPAP for more than two years increased their duration of use approximately eight minutes per night during each year of therapy

Weaver et al . Adherence with continuous positive airway pressure (CPAP) UpToDate Oct 09 ,2019

INTERVENTIONS TO PROMOTE ADHERENCE

- Pressure ramp
- Humidification
- Pressure relief
- Air leaks
- Intimacy
- Aerophagia

Weaver et al . Adherence with continuous positive airway pressure (CPAP) UpToDate Oct 09 ,2019

SIDE EFFECTS OF PAP AND POTENTIAL INTERVENTIONS

Side Effect	Intervention
Mask-Related	
Discomfort	Interface change to different type or brand
Rash	Interface change to type or brand made of different materials.
Skin breakdown	Avoid excessive tightening. Interface change (consider nasal pillow). Protective barrier for skin.
Claustrophobia	Change to nasal pillow interface. Trial of desensitization therapy.
Eye irritation	Interface assessment. Lower pressure or trial ACPAP or BPAP.
Pressure-Related	
Nasal congestion	Heated humidification. Change to full face mask. Nasal topical sprays (i.e., steroids, antihistamines). Avoid long-term decongestant use.
Sinus pain	Heated humidiication. Lower pressure or trial ACPAP or BPAP. Nasal topical sprays (i.e., steroids, antihistamines).
Nasal/oral dryness	Heated humidification. Saline nasal spray or gel. Interface change. Lower pressure or trial. ACPAP or BPAP.
Epistaxis	Heated humidification. Saline nasal spray or gel. Interface change.
Rhinorrehea	Nasal ipratroprium
Pressure Intollerance	Lower pressure or trial ACPAP, CPAPexp or BPAP.
Aerophagia	Lower pressure or trial ACPAP or BPAP. Avoid full face mask. Trial of treatment for reflux.

Adapted by Alon Y. Avidan Review of Sleep Medicine 4th Edition Chapter 14 Table 14.3

OTHER THERAPEUTIC OPTIONS

- Sleep position treatment
- Oral appliance Therapy
- Surgical Therapy
- Hypoglossal Nerve Stimulators
- Pharmacologic Therapies

POSITIONAL OSAS TREATMENT

LONG-TERM EFFECTIVENESS AND COMPLIANCE OF POSITIONAL THERAPY FOR OSA

http://dx.doi.org/10.5665/sleep.3840

Long-Term Effectiveness and Compliance of Positional Therapy with the Sleep Position Trainer in the Treatment of Positional Obstructive Sleep Apnea Syndrome

J. Peter van Maanen, MD; Nico de Vries, MD, PhD

Department of Otolaryngology/Head Neck Surgery, Sint Lucas Andreas Hospital, Amsterdam, the Netherlands

Study Objectives: To investigate effectiveness, long-term compliance, and effects on subjective sleep of the Sleep Position Trainer (SPT) in patients with position-dependent obstructive sleep apnea syndrome (POSAS).

Design: Prospective, multicenter cohort study.

Patients or Participants: Adult patients with mild and moderate POSAS were included.

Interventions: Patients asked to use the SPT for 6 mo. At baseline and after 1, 3, and 6 mo, questionnaires would be completed: Epworth Sleepiness Scale (ESS), Pittsburgh Sleep Quality Index (PSQI), Functional Outcomes of Sleep Questionnaire (FOSQ), and questions related to SPT use.

Measurements and Results: One hundred forty-five patients were included. SPT use and SPT data could not be retrieved in 39 patients. In the remaining 106 patients, median percentage of supine sleep decreased rapidly during SPT's training phase (day 3 to 9) to near-total avoidance of supine sleep. This decrease was maintained during the following months of treatment (21% at baseline versus 3% at 6 mo). SPT compliance, defined as more than 4 h of nightly use, was 64.4%. Regular use, defined as more than 4 h of usage over 5 nights/w, was 71.2%. Subjective compliance and regular use were 59.8% and 74.4%, respectively. Median ESS (11 to 8), PSQI (8 to 6), and FOSQ (87 to 103) values significantly improved compared with baseline.

Conclusions: Positional therapy using the Sleep Position Trainer (SPT) effectively diminished the percentage of supine sleep and subjective sleepiness and improved sleep related quality of life in patients with mild to moderate position-dependent obstructive sleep apnea syndrome. SPT treatment appeared to have sustained effects over 6 months. SPT compliance and regular use rate were relatively good. Subjective and objective compliance data corresponded well. The lack of a placebo-controlled group limited the efficacy of conclusions.

Keywords: OSAS, position dependency, positional therapy, SPT, treatment

Citation: van Maamen JP, de Vries N. Long-term effectiveness and compliance of positional therapy with the Sleep Position Trainer in the treatment of positional obstructive sleep apnea syndrome. *SLEEP* 2014;37(7):1209-1215.

POSITIONAL OSAS TREATMENT

NightBalance Sleep Position Treatment Device Versus AutoAdjusting PositiveAirway Pressure for Treatment of Positional Obstructive Sleep Apnea. Berry RB, Uhles ML, Abaluck BK, Winslow DH, Schweitzer PK, Gaskins RA Jr, Doekel RC Jr, Emsellem HA. J Clin Sleep Med. **2019 Jul 15;15(7):947-956.**

- Prospective multicenter randomized crossover trial
- Naive participants with POSA
- (AHI ≥ 15 events/h and nsAHI < 10 events/h) or (AHI > 10 and < 15 events/h with daytime sleepiness and nsAH < 5 events/h).

Conclusions: Treatment with SPT resulted in non inferior treatment efficacy and greater adherence compared to APAP in ePOSA suggesting that SPT is an effective treatment for this group.

Hypoglossal Nerve Stimulators

The NEW ENGLAND JOURNAL of MEDICINE

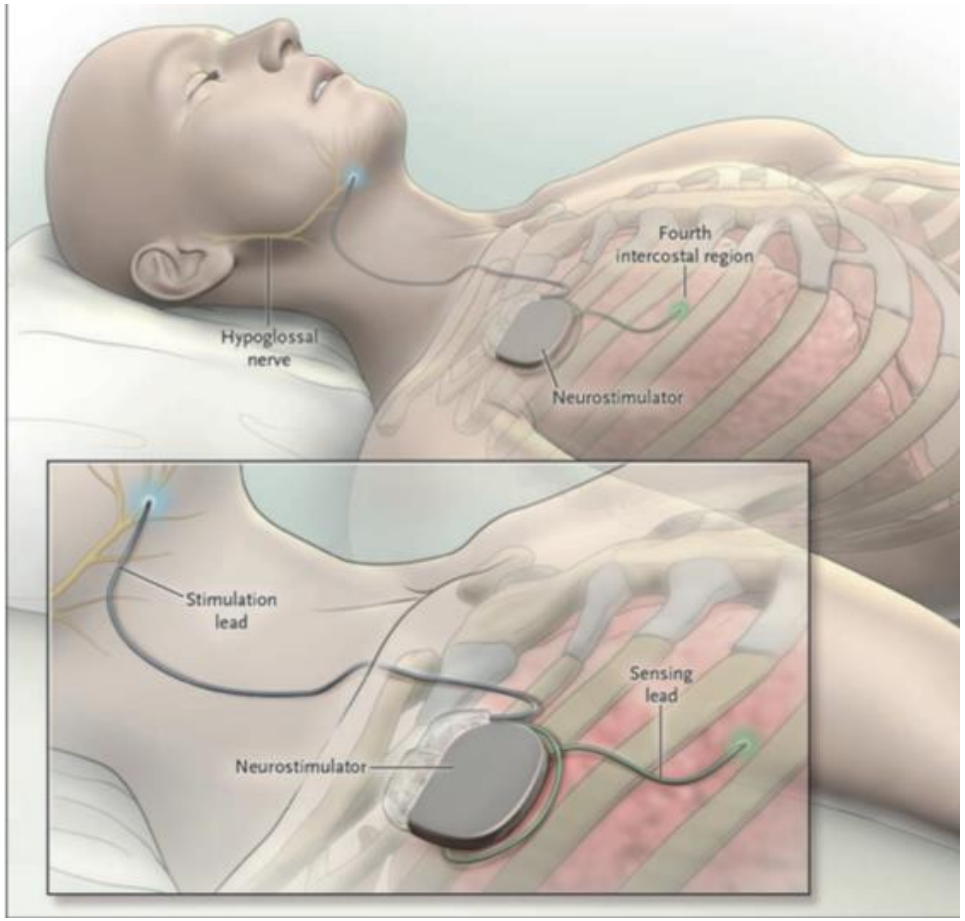
ORIGINAL ARTICLE

Upper-Airway Stimulation for Obstructive Sleep Apnea

Patrick J. Strollo, Jr., M.D., Ryan J. Soose, M.D., Joachim T. Maurer, M.D., Nico de Vries, M.D., Jason Cornelius, M.D., Oleg Froymovich, M.D., Ronald D. Hanson, M.D., Tapan A. Padhya, M.D., David L. Steward, M.D., M. Boyd Gillespie, M.D., B. Tucker Woodson, M.D., Paul H. Van de Heyning, M.D., Ph.D., Mark G. Goetting, M.D., Olivier M. Vanderveken, M.D., Ph.D., Neil Feldman, M.D., Lennart Knaack, M.D., and Kingman P. Strohl, M.D., for the STAR Trial Group*

Table 2. Primary and Secondary Outcome Measures.*

Outcome	Baseline	12 Months	Change	P Value
Primary outcomes				
AHI score†	32.0±11.8	15.3±16.1	−16.4±16.7	<0.001
Median	29.3	9.0	−17.3	
Interquartile range	23.7 to 38.6	4.2 to 22.5	−26.4 to −9.3	
ODI score‡	28.9±12.0	13.9±15.7	−14.6±15.8	<0.001
Median	25.4	7.4	−15.7	
Interquartile range	19.5 to 36.6	3.5 to 20.5	−24.0 to −8.6	
Secondary outcomes				
FOSQ score§	14.3±3.2	17.3±2.9	2.9±3.1	<0.001
Median	14.6	18.2	2.4	
Interquartile range	12.1 to 17.1	16.2 to 19.5	0.7 to 4.7	
Epworth Sleepiness Scale score¶	11.6±5.0	7.0±4.2	−4.7±5.0	<0.001
Median	11.0	6.0	−4.0	
Interquartile range	8.0 to 15.0	4.0 to 10.0	−8.0 to −1.0	
Percentage of sleep time with oxygen saturation <90%	8.7±10.2	5.9±12.4	−2.5±11.1	0.01
Median	5.4	0.9	−2.2	
Interquartile range	2.1 to 10.9	0.2 to 5.2	−6.6 to −0.3	



Oral Appliance Therapy

REVIEW ARTICLES

JCSM
Journal of Clinical Sleep Medicine
http://dx.doi.org/10.5664/jcsm.3460

Oral Appliance Treatment for Obstructive Sleep Apnea: An Update

Kate Sutherland, Ph.D.[1,2]; Olivier M. Vanderveken, M.D., Ph.D.[3,4]; Hiroko Tsuda, Ph.D.[5]; Marie Marklund, Ph.D.[6]; Frederic Gagnadoux, M.D., Ph.D.[7,8,9]; Clete A. Kushida, M.D., Ph.D., F.A.A.S.M.[10]; Peter A. Cistulli, M.D., Ph.D.[1,2]; on behalf of the ORANGE-Registry (Oral Appliance Network on Global Effectiveness)

[1]Centre for Sleep Health and Research, Department of Respiratory Medicine, Royal North Shore Hospital, St Leonards, Sydney, NSW, Australia; [2]NHMRC Centre for Integrated Research and Understanding of Sleep (CIRUS), University of Sydney and Woolcock Institute of Medical Research, Sydney, Australia; [3]Department of Otolaryngology and Head and Neck Surgery, Antwerp University Hospital, Antwerp, Belgium; [4]Faculty of Medicine and Health Sciences, University of Antwerp, Antwerp, Belgium; [5]General Oral Care, Kyushu University Hospital, Fukuoka, Japan; [6]Department of Orthodontics, Faculty of Medicine, Umea University, Umea Sweden; [7]LUNAM University, Angers, France; [8]Department of Respiratory Diseases, Angers University Hospital, Angers, France; [9]INSERM U1063, Angers, France; [10]Stanford University, Stanford, CA

- Oral Appliance therapy is an effective treatment improving AHI and physiologic and behavioral outcomes
- CPAP appears superior to Oral appliance therapy in AHI improvement
- Adherence to Oral Appliance is superior to CPAP 76% at 1 year, 62% at 4 years
- Periodic visits with qualified dentist and sleep physician are required

TRDs → Tongue-retaining devices

MRAs→ Mandibular-repositioning devices

Pharmacologic Therapy

- Medication that minimize symptoms (CNS stimulant as Modafinil, Armodafinil) (Patients with residual OSA-related daytime sleepiness despite optimal PAP therapy)
- Medication affecting airway neuromechanical properties: 5 HT3 Antagonist (Ondansetron, Mirtazapine), Selective serotonin re-uptake inhibitor (Fluoxetine, paroxetine) Non sedating tricyclic antidepressant (Protiptyline) (NOT RECOMMENDED)
- Medication affecting control of breathing : Medroxyprogesterone, acetazolamide, theophylline. (NOT RECOMMENDED)

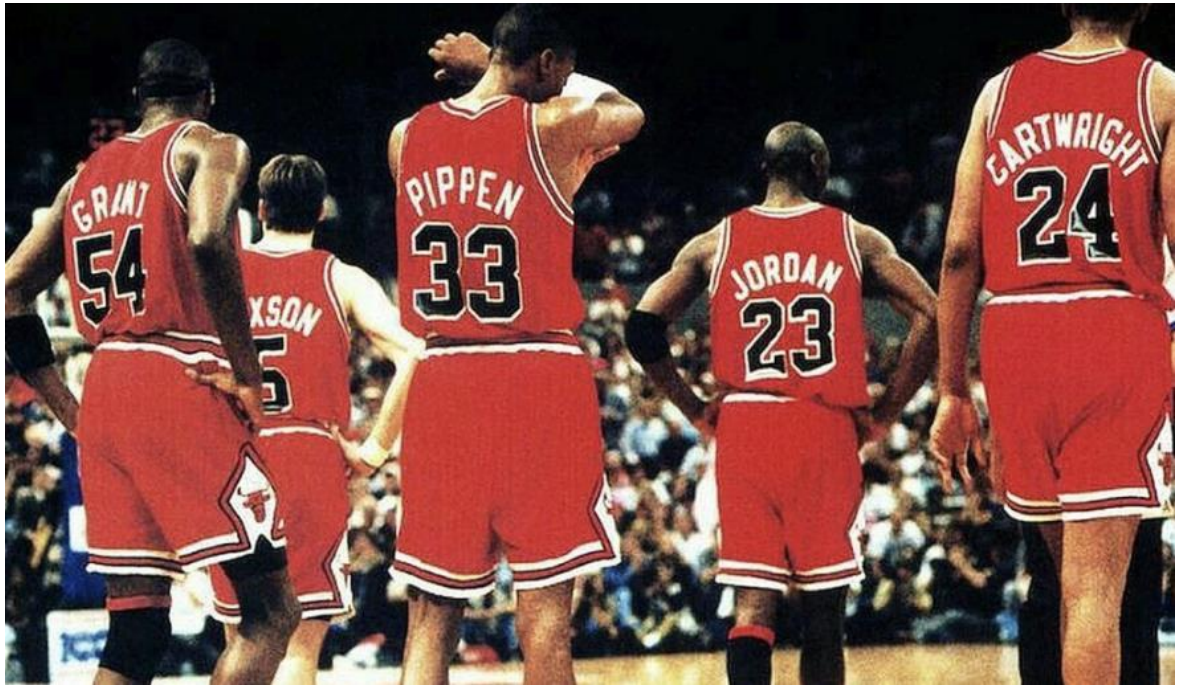
Alon Y. Avidan Review of Sleep Medicine 4th Edition Chapter 14

Surgical Therapy

Surgical Approaches for the Management of Obstructive Sleep Apnea	
Anatomic Site of Surgery	**Surgery**
Nasopharynx	Septoplasty Turbinate reduction Adenoidecomy/Polypectomy
Oropharynx	Tonsillectomy Uvulopalatopharyngoplasty (and variants)
Hypopharynx	Midline glossectomy Base of tongue reduction Genioglossis advancement Hyoid suspension Mandibular advancement
Trachea	Tracheostomy
Multiple sites	Maxillomandibular advancement
Weight loss	Bariatric Surgery

Adapted by Alon Y. Avidan Review of Sleep Medicine 4th Edition Chapter 14 Table 14.4

MULTIDISCIPLINARY APPROACH



- Pulmonologist
- Cardiologist
- Otorhinolaryngologist- Maxillofacial Surgeon
- Nutritionist
- Dentist

UNIVERSITÀ DEGLI STUDI
DELLA CAMPANIA
LUIGI VANVITELLI

OSPEDALI DEI COLLI
MONALDI - COTUGNO - C.T.O.

La gestione del paziente con sindrome delle apnee ostruttive del sonno

Mariano Mollica