UYKU APNEDE CİHAZ SEÇİMİ

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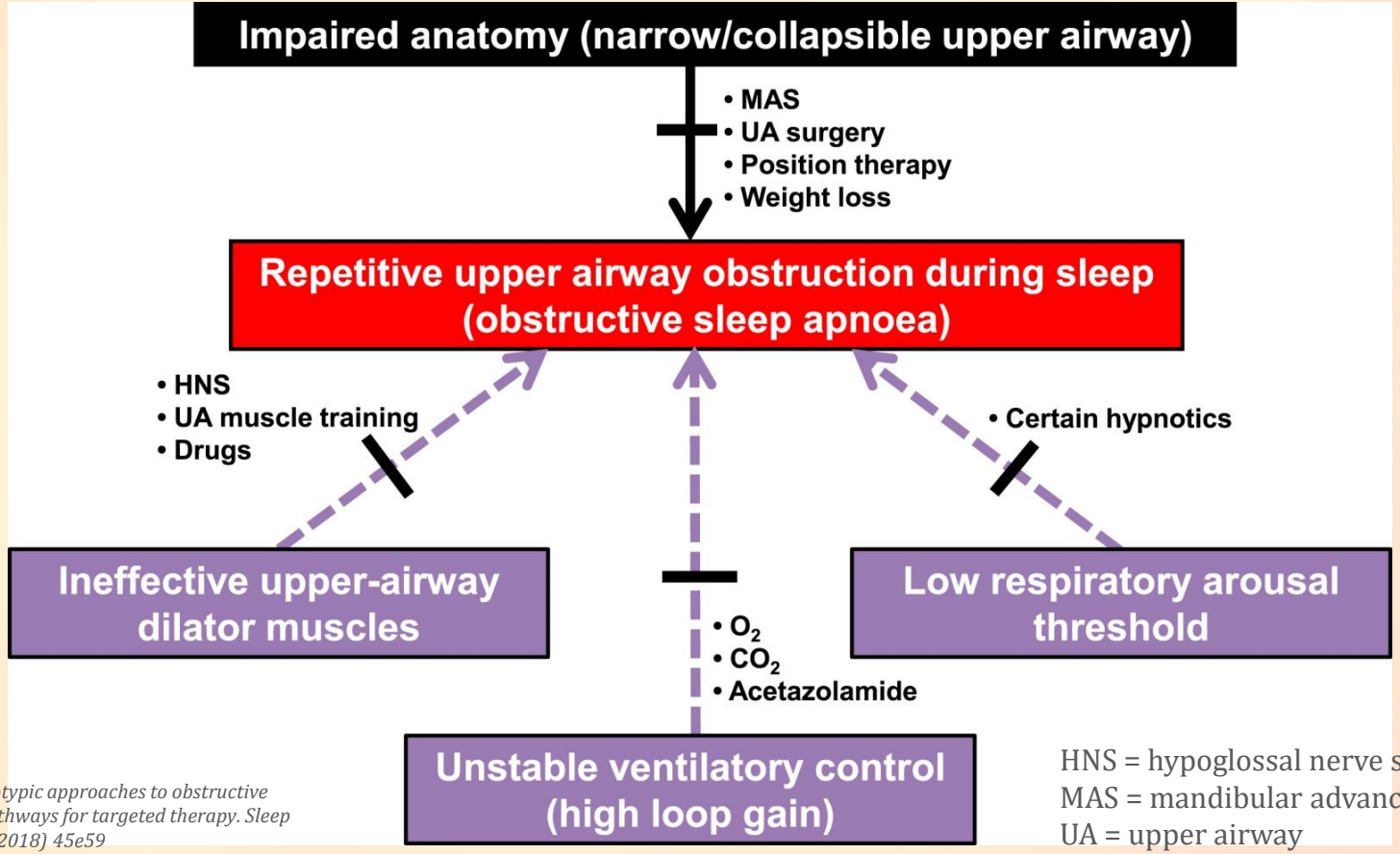
KTÜ Tıp Fakültesi, Göğüs Hastalıkları, Trabzon

21.10.2023 ASYOD Trabzon Sol. Buluşmaları

OSAS Tedavi

- **PAP Tedavisi**
  - CPAP (FixCPAP, APAP)
  - BİPAP (BİPAP-S, BİPAP-S/T, AVAPS, ASV, ACMV)
- **PAP Dışı Tedaviler**
  - Kilo Verme
  - Pozisyonel Tedavi
  - Ağız İçi Araç
  - Hipoglossal Sinir Stimulasyonu
  - Farmakoterapi
  - Cerrahi Tedavi

Schematic of the four key phenotypes that cause OSA and potential <u>non- CPAP</u> targeted therapies



HNS = hypoglossal nerve stimulation,
MAS = mandibular advancement splint,
UA = upper airway

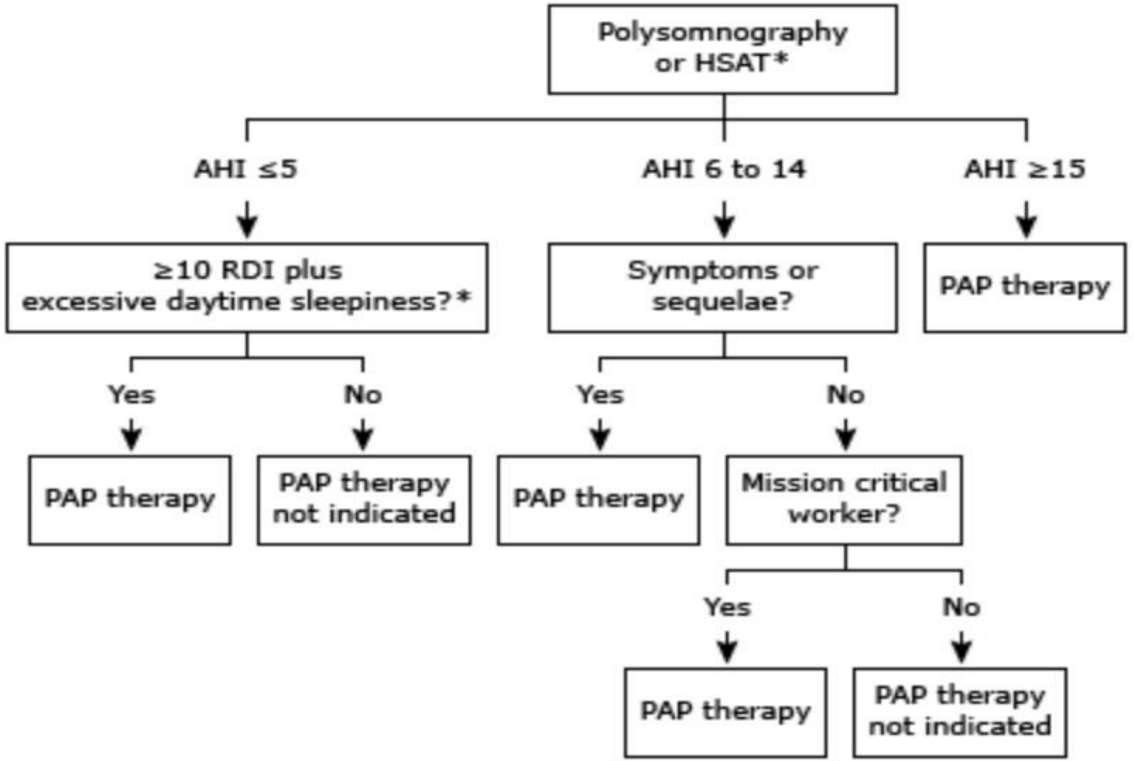
Danny J. Eckert. Phenotypic approaches to obstructive sleep apnoea. New pathways for targeted therapy. Sleep Medicine Reviews 37 (2018) 45e59

Uyu Apnede PAP Endikasyonları

- Apne hipopne indeksi>15 olan tüm olgular
- Apne hipopne indeksi 5-15 arası olan olgularda;
  - OSA semptomları (GAUH, kognitif bozukluk, vb) veya
  - Kardiyovasküler / serebrovasküler risk faktörleri (HT, KAH, SVO) varsa,

Epstein LJ, et al. Adult Obstructive Sleep Apnea Task Force of the American Academy of Sleep Medicine. J Clin Sleep Med. 2009; 5(3):263-76.

Indications for positive airway pressure therapy in adults with obstructive sleep apnea



UpToDate®

PAP Tedavisinde Amaçlar

- AHİ'yi azaltmak
- O2 desaturasyonlarını önlemek
- Arousal oluşumunu önlemek veya azaltmak
  - GAUH'u önlemek
  - NREM3 ve REM uykusunu arttırmak,
- Kardiyopulmoner septomları (HT, aritmi vb) düzeltmek
- Yaşam kalitesini arttırmak

Stasche N. Selective indication for positive airway pressure (PAP) in sleep-related breathing disorders with obstruction. GMS Curr Top Otorhinolaryngol Head Neck Surg. 2006; 5: Doc06.

Neden Farklı Modlar...

- Hasta kompliyensi düşük (%30-60)
  - Nasal tıkanma, konjesyon,
  - Maske kaçağı
  - Klaustrofobi
  - Sabit basınca karşı ekspiryum zorluğu
  - vb.

- Farklı Klinik Tip ve Fenotipler

PAP Seçenekleri

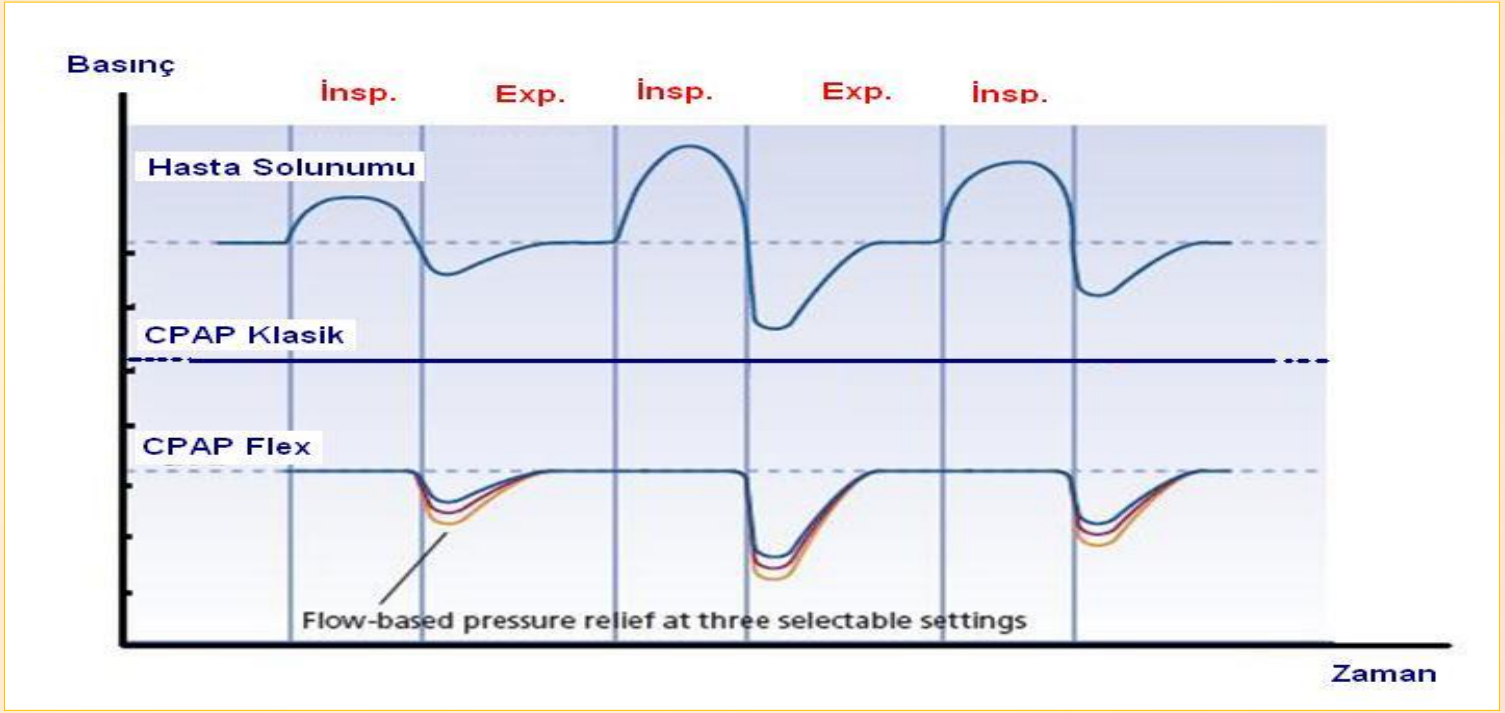
CPAP

- CPAP (Flex – EPR)
- Oto-CPAP (APAP)

BİPAP

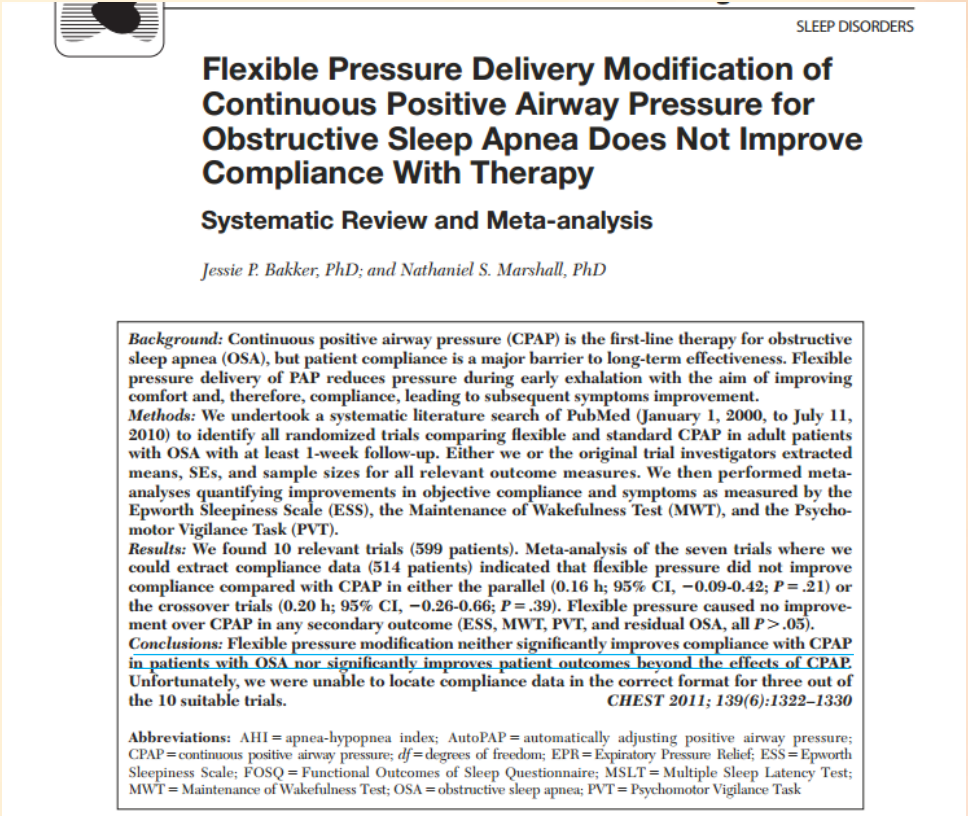
- BİPAP-S
- BİPAP-ST
- Oto-BİPAP
- AVAPS – IVAPS
- Servo-Ventilator (ASV)
- ACMV

CPAP / Flex / EPR / Smartflex



CPAP vs Flex.

Etkinlik ve kompliyens farkı yok



SLEEP DISORDERS

Flexible Pressure Delivery Modification of Continuous Positive Airway Pressure for Obstructive Sleep Apnea Does Not Improve Compliance With Therapy

Systematic Review and Meta-analysis

Jessie P. Bakker, PhD; and Nathaniel S. Marshall, PhD

Background: **Continuous positive airway pressure (CPAP) is the first-line therapy for obstructive sleep apnea (OSA), but patient compliance is a major barrier to long-term effectiveness. Flexible pressure delivery of PAP reduces pressure during early exhalation with the aim of improving comfort and, therefore, compliance, leading to subsequent symptoms improvement.**
Methods: **We undertook a systematic literature search of PubMed (January 1, 2000, to July 11, 2010) to identify all randomized trials comparing flexible and standard CPAP in adult patients with OSA with at least 1-week follow-up. Either we or the original trial investigators extracted means, SEs, and sample sizes for all relevant outcome measures. We then performed meta-analyses quantifying improvements in objective compliance and symptoms as measured by the Epworth Sleepiness Scale (ESS), the Maintenance of Wakefulness Test (MWT), and the Psychomotor Vigilance Task (PVT).**
Results: **We found 10 relevant trials (599 patients). Meta-analysis of the seven trials where we could extract compliance data (514 patients) indicated that flexible pressure did not improve compliance compared with CPAP in either the parallel (0.16 h; 95% CI, −0.09-0.42; $P = .21$) or the crossover trials (0.20 h; 95% CI, −0.26-0.66; $P = .39$). Flexible pressure caused no improvement over CPAP in any secondary outcome (ESS, MWT, PVT, and residual OSA, all $P > .05$).**
Conclusions: **Flexible pressure modification neither significantly improves compliance with CPAP in patients with OSA nor significantly improves patient outcomes beyond the effects of CPAP. Unfortunately, we were unable to locate compliance data in the correct format for three out of the 10 suitable trials.**

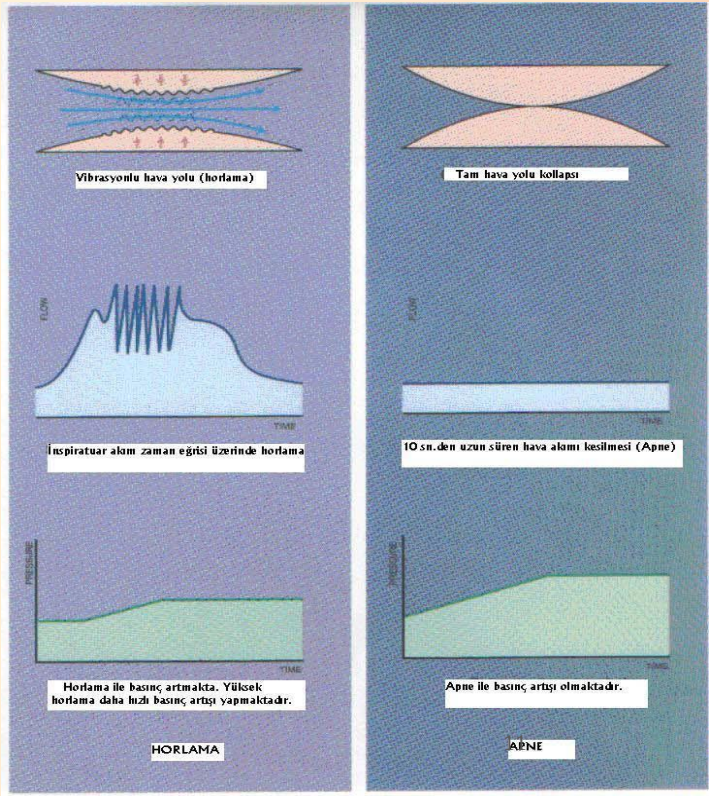
CHEST 2011; 139(6):1322–1330

Abbreviations: AHI = apnea-hypopnea index; AutoPAP = automatically adjusting positive airway pressure; CPAP = continuous positive airway pressure; *df* = degrees of freedom; EPR = Expiratory Pressure Relief; ESS = Epworth Sleepiness Scale; FOSQ = Functional Outcomes of Sleep Questionnaire; MSLT = Multiple Sleep Latency Test; MWT = Maintenance of Wakefulness Test; OSA = obstructive sleep apnea; PVT = Psychomotor Vigilance Task

Otomatik CPAP (APAP)

- Uyku süresince;
  - Hava akımı amplitüd değişiklikleri,
  - Hava akım limitasyonları,
  - Horlama (vibrasyon) ve/veya
  - Hava yolu impedans değişikliklerini

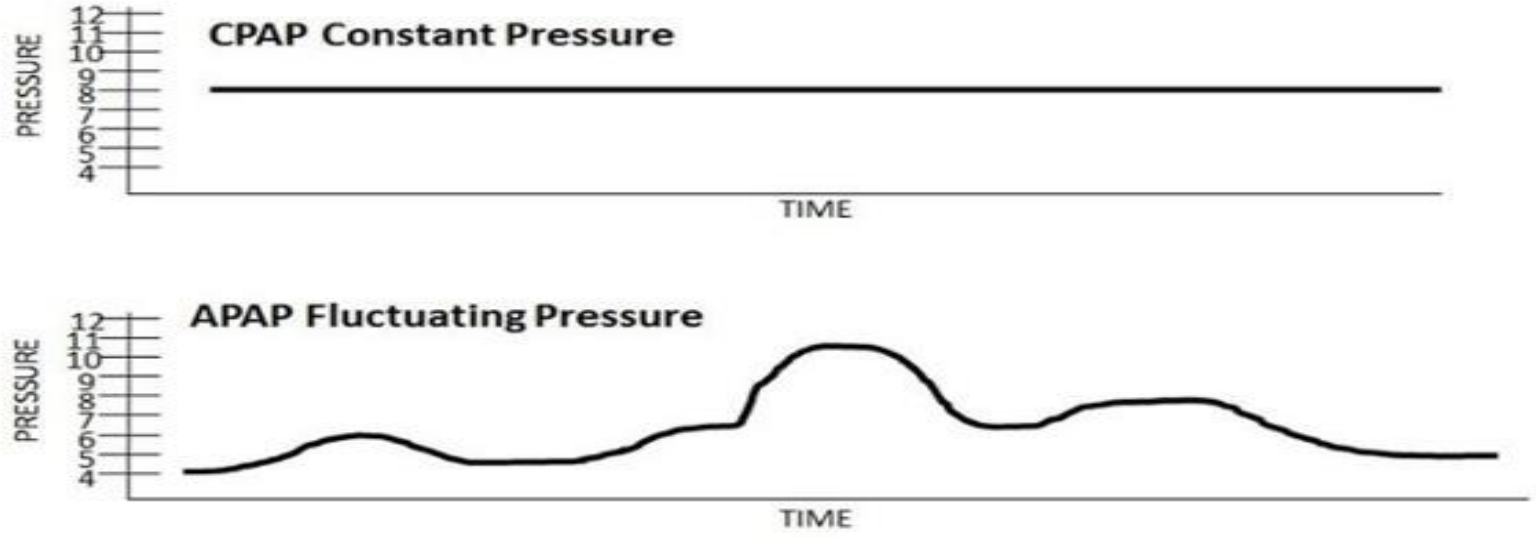
  ...izler, basıncı otomatik olarak gerektiği kadar yükseltir.



APAP Kimlere ...

- Sabit basınçlı CPAP'ı tolere edemeyenlere,
- Değişken PAP ihtiyacı olanlara,
  - Uyku pozisyonu
  - REM / N-REM
  - Allerji / Soğuk Algınlığı
  - Kilo alma / Verme
  - Alkol / Sedatif alınması
- Otomatik titrasyon düşünülen olgulara (PSG eşliğinde veya PSG olmaksızın) önerilebilir.

APAP


CPAP Constant Pressure
PRESSURE
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11
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9
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4
TIME
APAP Fluctuating Pressure
PRESSURE
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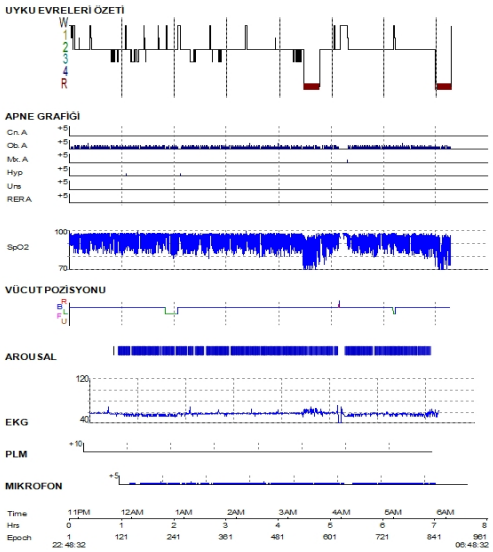
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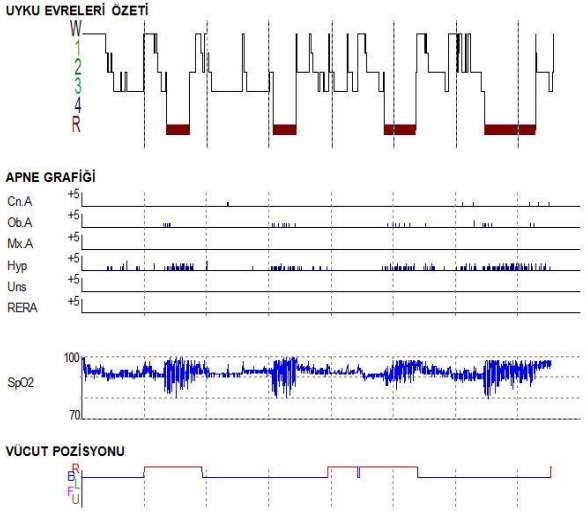
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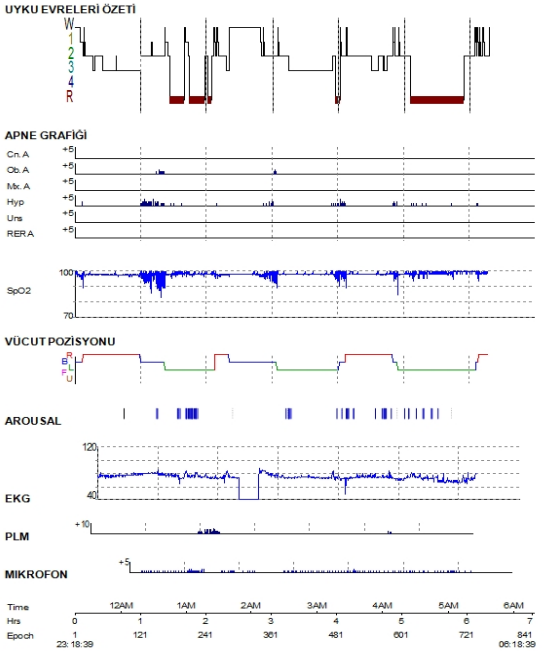
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APAP vs. FixCPAP

ORIGINAL ARTICLE

Autoadjusted versus fixed CPAP for obstructive sleep apnoea: a multicentre, randomised equivalence trial

Konrad E Bloch,[1,2] Fabienne Huber,[1] Michael Furian,[1] Tsogyal D Latshang,[1] Christian M Lo Cascio,[1] Yvonne Nussbaumer-Ochsner,[1] Oliver Senn,[3] Erich W Russi,[1,2] Malcolm Kohler,[1,2] Otto D Schoch,[4] Alexander Turk,[5] Edelbert Imhof,[6] Irène Laube,[6] Felix Matthews,[1] Robert Thurnheer[7]

► Additional material is published online only. To view please visit the journal online (http://dx.doi.org/10.1136/thoraxjnl-2016-209699).

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[4]Sleep Disorders Center and Pulmonary Division, Cantonal Hospital St. Gallen, St. Gallen, Switzerland
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[7]Sleep Disorders Center and Pulmonary Division, Cantonal Hospital Munsterlingen, Munsterlingen, Switzerland

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ABSTRACT

Background The obstructive sleep apnoea syndrome (OSAS) is conventionally treated by continuous positive airway pressure set at a fixed level (fCPAP). Automatic mask pressure adjustment (autoCPAP) is increasingly used during home therapy. We investigated whether autoCPAP is equivalent to fCPAP in improving sleepiness in patients with OSAS in the long-term.

Methods In this multicentre equivalence trial, 208 patients with OSAS, with median Epworth sleepiness score (ESS) 13, apnoea/hypopnoea index 48.4/hour, were randomised to treatment with autoCPAP (5–15 mbar) or fCPAP (pressure set at the 90th percentile applied by autoCPAP during 2–4 weeks adaptation). Coprimary outcomes were changes in subjective and objective sleepiness from baseline to 2 years after treatment. Equivalence ranges were ±2 points in ESS and ±3 min sleep resistance time evaluated by recording responses to light signals.

Results At 2 years, in the intention to treat analysis, the reduction in sleepiness versus pretreatment baseline was similar in patients using autoCPAP (n=113, mean ESS-change −6.3, 95% CI −7.1 to −5.5; sleep resistance time +8.3 min, +6.9 to +9.7) and fCPAP (n=95, mean ESS-change −6.2, 95% CI −7.0 to −5.3; sleep resistance time +6.3 min, +4.7 to +7.8). The 95% CI of difference in ESS-reduction between autoCPAP and fCPAP was −0.9 to +1.4 and the 95% CI of difference in increase in sleep resistance time was −2.6 to +1.0 min. Blood pressure reduction and OSAS-related costs were similar between groups.

Conclusions AutoCPAP and fCPAP are equivalent within prespecified ranges in improving subjective and objective sleepiness in patients with OSAS over the course of 2 years. Costs of these treatments are similar.

Trial registration number ClinicalTrials.gov NCT00280800.

Key messages

What is the key question?

Conclusions AutoCPAP and fCPAP are equivalent within prespecified ranges in improving subjective and objective sleepiness in patients with OSAS over the course of 2 years. Costs of these treatments are similar.

Trial registration number ClinicalTrials.gov

OSAS over the course of 2 years while costs of these treatments are similar.

Why read on?

► The results of this study suggest that both autoCPAP and fCPAP may serve as a first-line treatment of patients with OSAS.

application of CPAP via a mask. Traditionally, the fixed level of CPAP (fCPAP) set in the device for long-term therapy is determined by manual titration in the sleep laboratory so that all apnoeas and hypopnoeas during the different sleep stages and body positions are eliminated.[4] More recently, computer-controlled CPAP devices adjusting mask pressure continuously by feed-back control (autoCPAP) are increasingly used to determine the effective CPAP.[5] In this approach, the therapeutic fCPAP level for home therapy is set at the 90th or 95th pressure percentile applied by an autoCPAP device during home titration over a few nights.[6] The therapeutic fCPAP determined in this way agrees well with values obtained by labour-intensive manual titra-

Bloch KE, et al. Thorax 2018;73:174–184.

APAP Kontrendikasyon

- Konjestif kalp yetmezliği,
- Uyku ilişkili hipoksemi-hipoventilasyon sendromu,
- Santral uyku apne,
- Overlap Sendromu,
- Uvula operasyonu geçirmiş veya horlamayan hastalarda (sadece horlama / vibrasyon ile tetiklenen APAP cihazlarının kullanımı) uygun değildir.

Morgenthaler TI et al. Practice parameters for the use of autotitrating continuous positive airway pressure devices for titrating pressures and treating adult patients with obstructive sleep apnea syndrome: an update for 2007. An American Academy of Sleep Medicine Report. Sleep 2008; 31: 141-7.

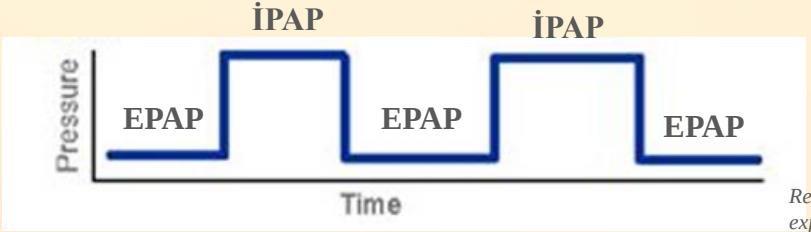
APAP - AASM 2007

- OSAS tanısında kullanılmamalı
- PSG eşliğinde APAP ile yapılan titrasyon sonucunda reçete edilen sabit basınçlı CPAP veya APAP cihazları ilk birkaç hafta yakın takip edilmeli
- Yarı gece (split-night) titrasyon uygulamalarında kullanılmamalı

Morgenthaler TI et al. Practice parameters for the use of autotitrating continuous positive airway pressure devices for titrating pressures and treating adult patients with obstructive sleep apnea syndrome: an update for 2007. An American Academy of Sleep Medicine Report. Sleep 2008; 31: 141-7.

BİPAP

- İnspiryum ve expiryumda farklı basınçlar (IPAP ve EPAP) uygular.

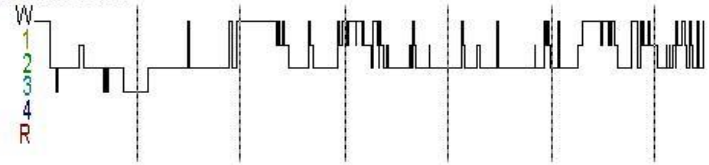


- OSAS tedavisinde ilk seçenek değil
- CPAP tedavisini tolere edemeyen,
- Yüksek basınca karşı nefes vermekte zorlanan,
- Restriktif veya obstrüktif AC hastalığı olanlarda
- Hipoksemi-hipoventilasyon sendromlarında.

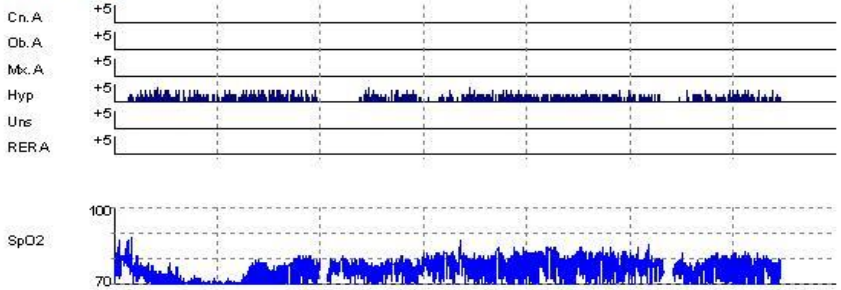
Resta O, et al. Prescription of NCPAP and nBiPAP in obstructive sleep apnoea syndrome: Italian experience in 105 subjects. A prospective two center study. Respir Med 1998: 92: 820-7.
Schafer H, et al. Failure of CPAP therapy in obstructive sleep apnoea syndrome: predictive factors and treatment with bilevel-positive airway pressure. Respir Med 1998; 92: 208-15.

Carillo A, et al. Noninvasive ventilation in acute hypercapnic respiratory failure caused by obesity hypoventilation syndrome and chronic obstructive pulmonary disease. Am J Respir Crit Care Med 2012; 186: 1279-85.

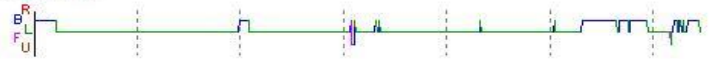
UYKU EVRELERİ ÖZETİ



APNE GRAFİĞİ

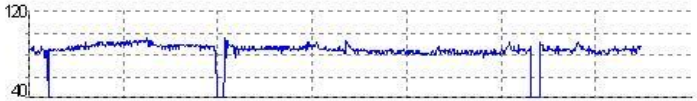


VÜCUT POZİSYONU



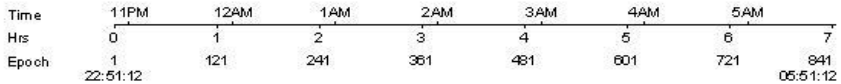
AROUSAL

EKG



PLM

MIKROFON



KARADENIZ TEKNIK UNIVERSITESI
TIP FAKULTESI FARABI HASTANESI

Pulmonary Function Analysis

Patient:
Id: 1590586
Date: 05/15/17
Physician:

Diagnosis:

Age: 62 Height(cm): 173 Weight(kg): 71.0 Gender: Male Race: Caucasian

Spirometry

		Ref	Pre Meas	Pre % Ref	Post Meas	Post % Ref	Post % Chg
FVC	Liters	4.29	1.81	42	1.73	40	-5
FEV1	Liters	3.02	0.81	27	0.84	28	3
FEV1/FVC	%	71	45		49		
FEF25-75%	L/sec	2.92	0.37	13	0.42	14	14
FEF50%	L/sec	4.02	0.40	10	0.40	10	1
PEF	L/sec	8.09	2.31	29	2.51	31	9
MVV	L/min	131					

Lung Volumes

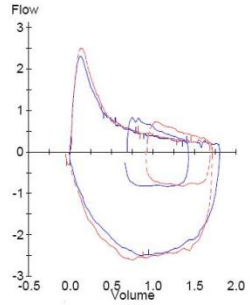
TLC	Liters	6.18
RV	Liters	2.28
RV/TLC	%	38
FRC N2	Liters	3.62

Diffusion

DLCO	mL/mmHg/min	20.6
DL Adj	mL/mmHg/min	20.6
DLCO/VA	mL/mHg/min/L	3.98
DL/VA Adj	mL/Hg/min/L	
VA	Liters	6.74

Maximal Respiratory Pressures

PI max	cmH2O	109
PI Volume	Liters	



Sayfa No : 1

T.C.
KARADENİZ TEKNİK ÜNİVERSİTESİ
FARABİ HASTANESİ
LABORATUVAR SONUÇ RAPORU

Hasta	**: 1544089**	Cinsiyet/Yas	: BAYAN , 69
Örnek No	**: 2855627**	Gönd.Birim	: Göğüs Hastalıkları Servisi { S }
Müracat Tar.	: 04.12.2016 10:15	Kurum	: SGK
Rapor Ver.Tar.	: 08.12.2016 11:07	Gönd.Doktor	: MERVE ÖZDOĞAN

UYGULANAN TESTLER	SONUÇ	BIRIM	REFERANS ARALIGI	AÇIKLAMA
BIYO (KAN GAZI)		***Kabul Tarihi:*** 04.12.2016 10:14	***Onay Tarihi :*** 04.12.2016 10:29	
PH	7.390		7.35 - 7.45	
pCO2	* **51.6**	mmHg	**32 - 48**	
pO2	84.7	mmHg	83 - 108	
HCO3-std	28.7	mmol/L		
BE(ecf)	5.7	mmol/L		
ctHb	13.8	g/dL	12 - 17.5	
ctO2(a)	18.1	VOL/%		
sO2	96.1	%	95 - 99	

BİPAP vs CPAP

- 27 hastada BPAP ile Fix CPAP farklı bulunmamış (komplians, ölçümler, uykululuk ve yaşam kalitesi açısından)
- CPAP tolere edemeyen olgular (OHS, KOAH) BİPAP'ı tolere edebilmiş.

Sleep. 2003 Nov 1;26(7):864-9.

A randomized, double-blind clinical trial comparing continuous positive airway pressure with a novel bilevel pressure system for treatment of obstructive sleep apnea syndrome.

Gay PC[1], Herold DL, Olson EJ.

Author information

Abstract

STUDY OBJECTIVES: To obtain efficacy, objective compliance, and self-assessment data from obstructive sleep apnea syndrome (OSAS) patients treated with continuous positive airway pressure (CPAP) or a novel bilevel (NBL) therapy.

DESIGN: Randomized, controlled, double-blind trial.

SETTING: Home treatment after diagnosis and titration by split-night polysomnography (PSG) in a sleep laboratory.

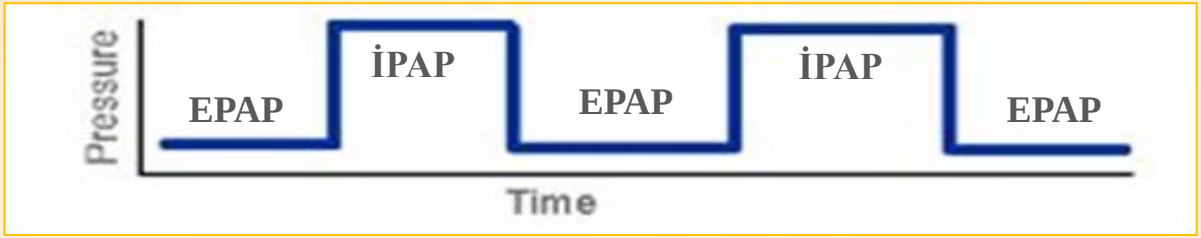
PATIENTS: Twenty-seven adults (22 men) newly referred for suspected OSAS but without concomitant medical or sleep disorders.

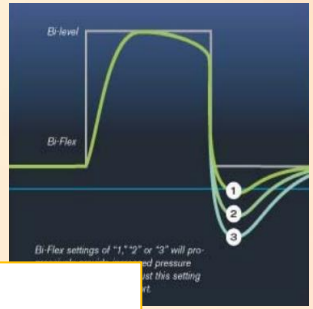
INTERVENTIONS: If the subject's apnea-hypopnea index was greater than 10 and less than 100, the CPAP was titrated during PSG and then followed by NBL titration. Treatment was randomly and blindly set to either CPAP or NBL mode for 1 month.

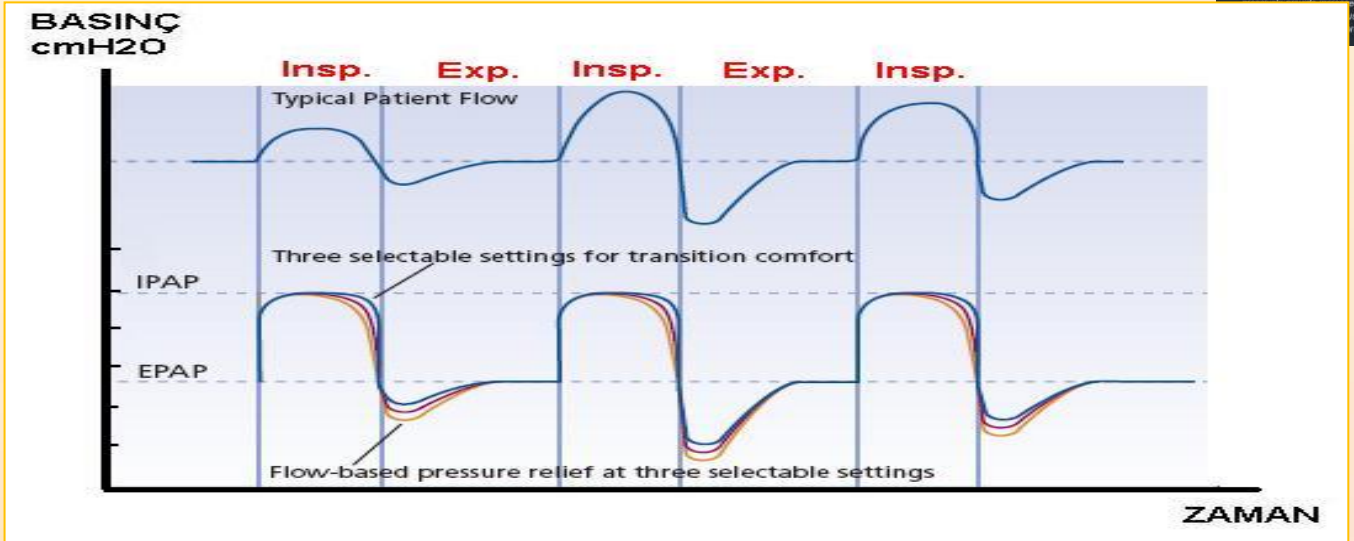
MEASUREMENTS & RESULTS: There were no significant baseline group differences in age, body mass index, apnea-hypopnea index (mean +/- SD, CPAP group vs NBL group of 46.1 +/- 23.1/hour vs 41.8 +/- 25.8), CPAP requirement, or scores on the Epworth Sleepiness Scale and Functional Outcomes of Sleep Questionnaire. Treatment with CPAP and NBL equivalently reduced the apnea-hypopnea index during the laboratory titration (7.6 +/- 11.9/hour vs. 3.7 +/- 4.4, respectively). At 1 month, there were no significant group compliance differences as determined by percentage of nights with at least 4 hours of use (CPAP, 80.5 +/- 24 vs NBL, 77.6 +/- 24.8) and hours of use per night (CPAP, 5.6 +/- 1.4 hours/night vs NBL, 5.6 +/- 1.7). Similar improvements were seen in scores on the Epworth Sleepiness Scale and Functional Outcomes of Sleep Questionnaire.

CONCLUSIONS: The NBL appeared to be as effective as CPAP for the treatment of OSAS but offered no advantages in patients receiving first-time therapy for OSAS.

BİPAP / Flex. BİPAP

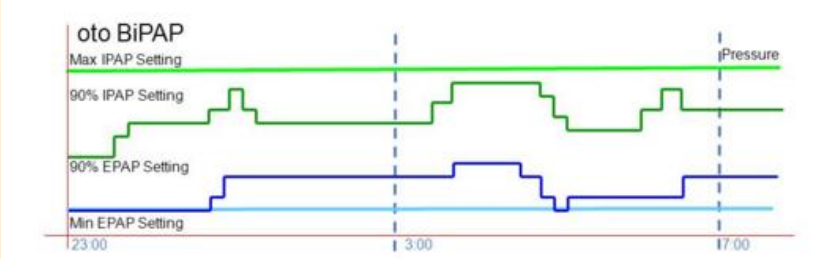


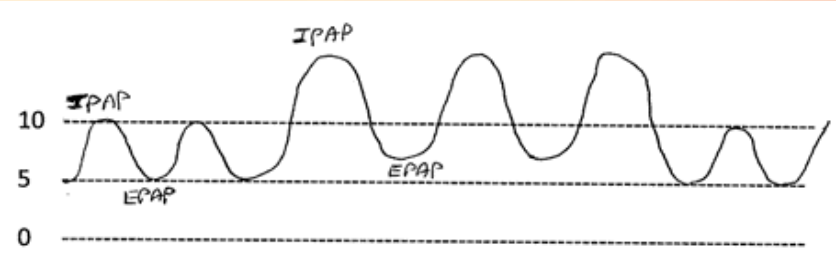




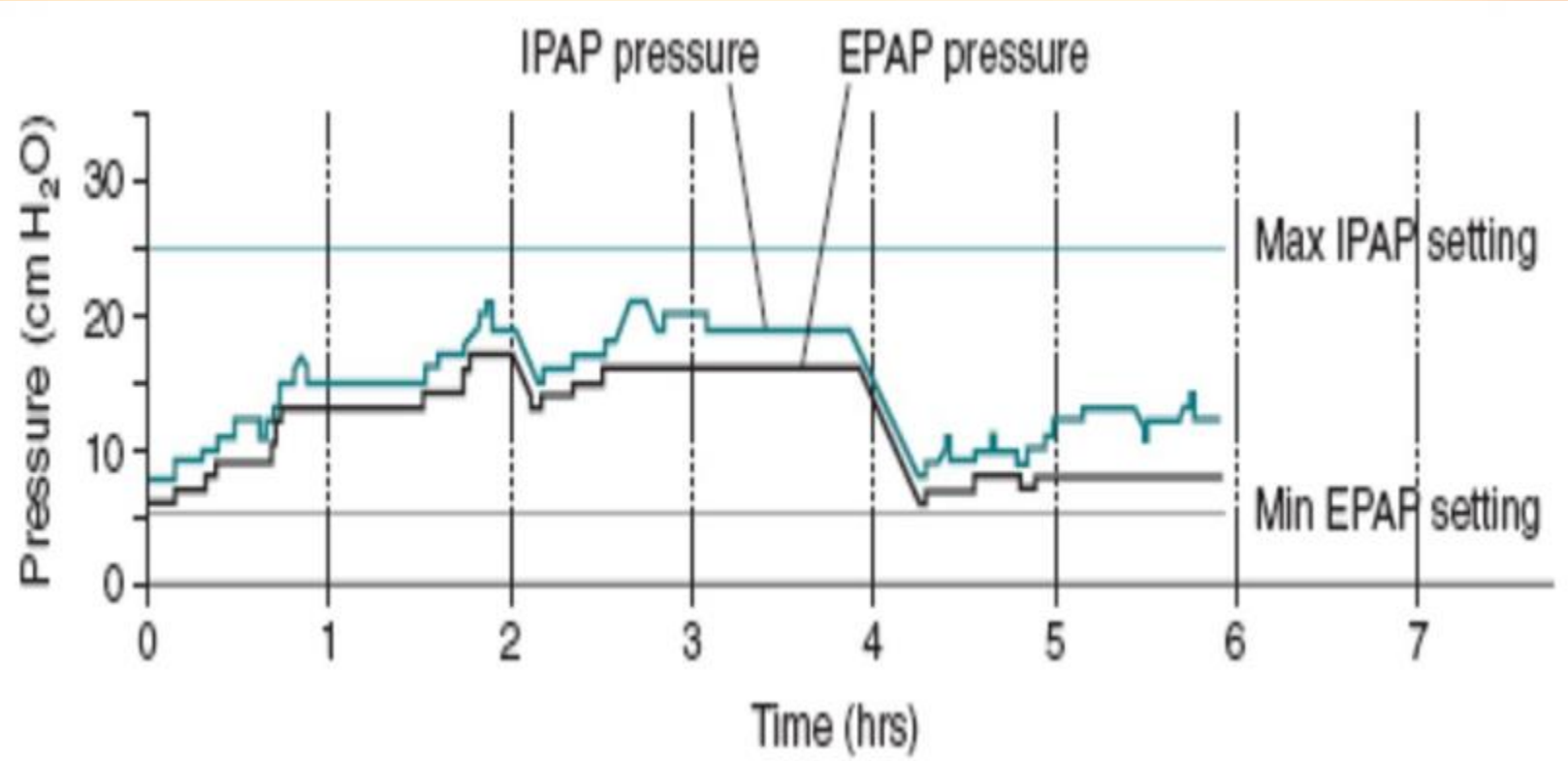
Otomatik BİPAP

- BİPAP endikasyonu olan, ancak
  - BİPAP basıncını tolere edemeyen ya da
  - Etkili BİPAP basıncının değişken olması nedeniyle uygun tedavi basıncına karar verilemeyen durumlarda kullanılabilmekte.
- Diğer PAP tekniklerine üstünlüğü ispatlanmamış.





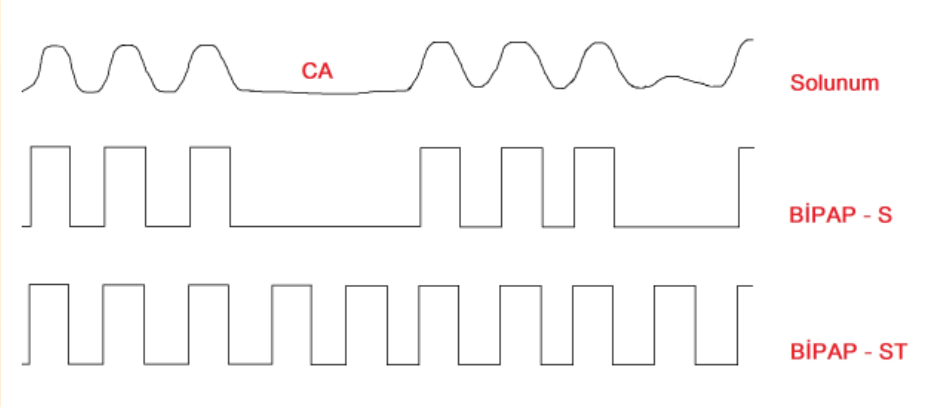
Kakkar RK, Berry RB. Positive Airway Pressure Treatment for Obstructive Sleep Apnea. Chest 2007; 132: 1057-72



Kakkar RK, Berry RB. Positive Airway Pressure Treatment for Obstructive Sleep Apnea. Chest 2007; 132: 1057-72

BİPAP-ST Endikasyon

- BİPAP ile solunumu düzene girmeyen,
- Yüksek basınçta tedavi gereken,
- Özellikle santral apne varlığında, kompleks uyku apnesinde



Kushida C, et al. Clinical Guidelines for the Manual Titration of Positive Airway Pressure in Patients with Obstructive Sleep Apnea. Positive Airway Pressure Titration Task Force of the American Academy of Sleep Medicine. Journal of Clinical Sleep Medicine Vol. 4, No. 2, 2008.

BİPAP-ST Endikasyon

- Uyku ilişkili hipoventilasyon/hipoksemi sendromu (Restriktif AC Hastalığı, KOAH, OHS, Pulmoner parankimal veya vasküler patolojilere bağlı hipoventilasyon/ hipoksemi vb.) olan hastalarda;
- Spontan solunumu ve tetikleme gücü yetersiz hastalarda (solunum yetmezliği gelişen nöromusküler kas hastalıklarında)

Berry RB, Chediak A, Brown LK, et al; NPPV Titration Task Force of the American Academy of Sleep Medicine. Best clinical practices for the sleep center adjustment of noninvasive positive pressure ventilation (NPPV) in stable chronic alveolar hypoventilation syndromes.J Clin Sleep Med. 2010; 15: 491-509.

Antonescu-Turcu A, Parthasarathy S. CPAP and Bi-level PAP Therapy: New and Established Roles. Respir Care 2010; 55: 1216-28.

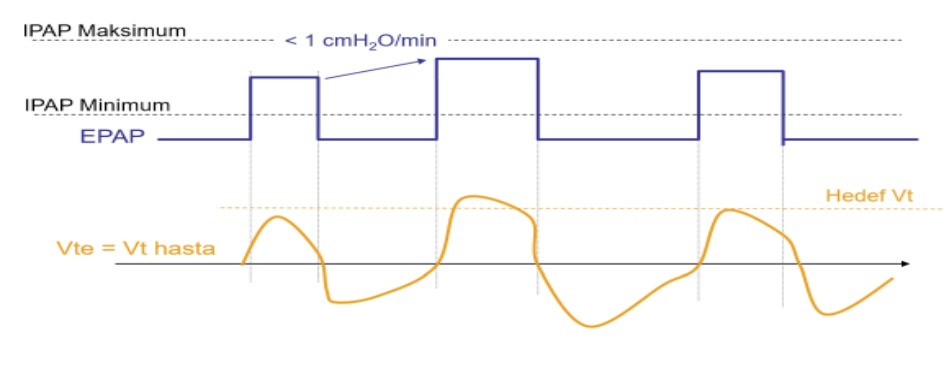
AVAPS / IVAPS

AVAPSR (Average Volume Assured Pressure Support)

IVAPSR (Intelligent Volume Assured Pressure Support)

VOLÜM GARANTİLİ BASINÇ DESTEĞİ

- Her solukta VT hesaplayıp, dakika ventilasyon, ortalama VT ve hedef VT arasındaki dengeyi sağlamak için basınç ayarlaması yapar .
- Hedef VT 8 mL/kg üzerinden (ideal kilo) hesaplanır (ya da uyanıklık VT'nin %110'u olarak hesaplanır).

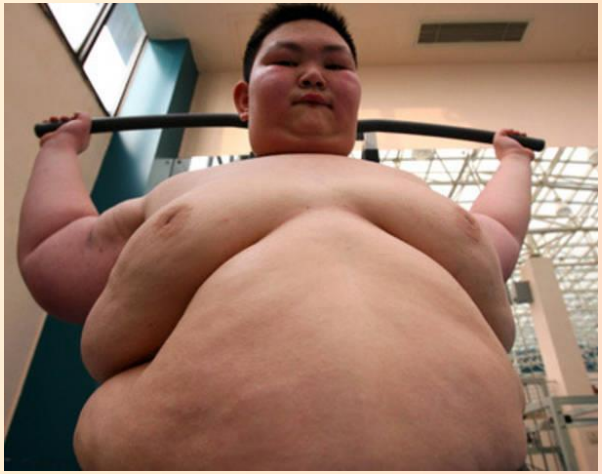


Antonescu-Turcu A, Parthasarathy S. CPAP and Bi-level PAP Therapy: New and Established Roles. Respir Care 2010; 55: 1216-28.

AVAPS / IVAPS Endikasyon

- Değişken tidal volüm durumunda;
  - Uyku pozisyonu,
  - Uyku evresi vb nedenlerle değişen TV

- Özellikle OHS, Restriktif göğüs duvarı bozuklukları (kifoskolyoz vb) ve Nöromuskuler bozukluğu olanlarda (ALS vb) hipoventilasyonu düzeltmek için



Antonescu-Turcu A, Parthasarathy S. CPAP and Bi-level PAP Therapy: New and Established Roles. Respir Care 2010; 55: 1216-28.
Storre JH, et al. Average volume-assured pressure support in obesity hypoventilation: a randomized crossover trial. Chest 2006; 130: 815-21.

AVAPS vs. BİPAP

- Ventilasyon kalitesi ve CO2'yi azalmada etkin
- Uyku ve yaşam kalitesi açısından fark yok.

Chest. 2006 Sep;130(3):815-21.

Average volume-assured pressure support in obesity hypoventilation: A randomized crossover trial.

Storre JH[1], Seuthe B, Fiechter R, Milioglou S, Dreher M, Sorichter S, Windisch W.

Author information

Abstract

BACKGROUND: Average volume-assured pressure support (AVAPS) has been introduced as a new additional mode for a bilevel pressure ventilation (BPV) device (BiPAP; Respironics; Murrysville, PA), but studies on the physiologic and clinical effects have not yet been performed. There is a particular need to better define the most efficient ventilatory treatment modality for patients with obesity hypoventilation syndrome (OHS).

METHODS: In OHS patients who did not respond to therapy with continuous positive airway pressure, the effects of BPV with the spontaneous/timed (S/T) ventilation mode with and without AVAPS over 6 weeks on ventilation pattern, gas exchange, sleep quality, and health-related quality of life (HRQL) assessed by the severe respiratory insufficiency questionnaire (SRI) were prospectively investigated in a randomized crossover trial.

RESULTS: Ten patients (mean [+/- SD] age, 53.5 +/- 11.7 years; mean body mass index, 41.6 +/- 12.1 kg/m2; mean FEV1/FVC ratio, 79.4 +/- 6.5%; mean transcutaneous P(CO2) [PtcCO2], 58 +/- 12 mm Hg) were studied. PtcCO2 nonsignificantly decreased during nocturnal BPV-S/T by -5.6 +/- 11.8 mm Hg (95% confidence interval [CI], -14.7 to 3.4 mm Hg; p = 0.188), but significantly decreased during BPV-S/T-AVAPS by -12.6 +/- 12.2 mm Hg (95% CI, -22.0 to -3.2 mm Hg; p = 0.015). Pneumotachographic measurements revealed a higher individual variance of peak inspiratory pressure (p < 0.001) and a trend for lower leak volumes but also for higher tidal volumes during BPV-S/T-AVAPS. The SRI summary scale score improved from 63 +/- 15 to 78 +/- 14 during BPV-S/T (p = 0.004) and to 76 +/- 16 during BPV-S/T-AVAPS (p = 0.014). Sleep quality and oxygen saturation also comparably improved following BPV-S/T and BPV-S/T-AVAPS.

CONCLUSION: BPV-S/T substantially improved oxygenation, sleep quality, and HRQL in patients with OHS. AVAPS provided additional benefits on ventilation quality, thus resulting in a more efficient decrease of PtcCO2. However, this did not provide further clinical benefits regarding sleep quality and HRQL.

Thorax. 2012 Aug;67(8):727-34. doi: 10.1136/thoraxjnl-2011-201081. Epub 2012 Mar 1.

Volume targeted versus pressure support non-invasive ventilation in patients with super obesity and chronic respiratory failure: a randomised controlled trial.

Murphy PB[1], Davidson C, Hind MD, Simonds A, Williams AJ, Hopkinson NS, Moxham J, Polkey M, Hart N.

⊕ Author information

Abstract

INTRODUCTION: Automatic titration modes of non-invasive ventilation, including average volume assured pressure support (AVAPS), are hybrid technologies that target a set volume by automated adjustment of pressure support (PS). These automated modes could offer potential advantages over fixed level PS, in particular, in patients who are super obese.

METHODS: Consecutive patients with obesity hypoventilation syndrome were enrolled in a two-centre prospective single-blind randomised controlled trial of AVAPS versus fixed-level PS using a strict protocolised setup.

MEASUREMENTS: The primary outcome was change in daytime arterial PCO(2) (PaCO(2)) at 3 months. Body composition, physical activity (7-day actigraphy) and health-related quality of life (severe respiratory insufficiency questionnaire, SRI) were secondary outcome measures.

RESULTS: 50 patients (body mass index 50±7 kg/m(2); 55±11 years; 53% men) were enrolled with a mean PaCO(2) of 6.9±0.8 kPa and SRI of 53±17. 46 patients (23 AVAPS and 23 PS) completed the trial. At 3 months, improvements in PaCO(2) were observed in both groups (AVAPS 0.6 kPa, 95% CI 0.2 to 1.1, p<0.01 vs PS 0.6 kPa, 95% CI 0.1 to 1.1, p=0.02) but no between-group difference (-0.1 kPa, 95% CI -0.7 to 0.6, p=0.87). SRI also improved in both groups (AVAPS 11, 95% CI 6 to 17, p<0.001 vs PS 7, 95% CI 1 to 12, p=0.02; between groups 5, 95% CI -3 to 12, p=0.21). Secondary analysis of both groups combined showed improvements in daytime physical activity that correlated with reduction in fat mass (r=0.48; p=0.01).

CONCLUSION: The study demonstrated no differences between automated AVAPS mode and fixed-level PS mode using a strict protocolised setup in patients who were super obese. The data suggest that the management of sleep-disordered breathing may enhance daytime activity and promote weight loss in super-obese patients.

Comment in

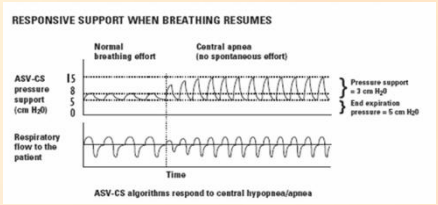
Safety and efficacy of auto-titrating noninvasive ventilation in COPD and obstructive sleep apnoea overlap syndrome. [Eur Respir J. 2015]
Target volume settings for home mechanical ventilation: great progress or just a gadget? [Thorax. 2012]

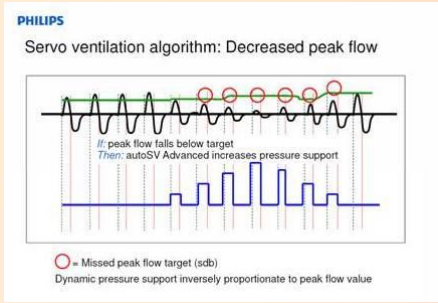
AVAPS vs. BİPAP

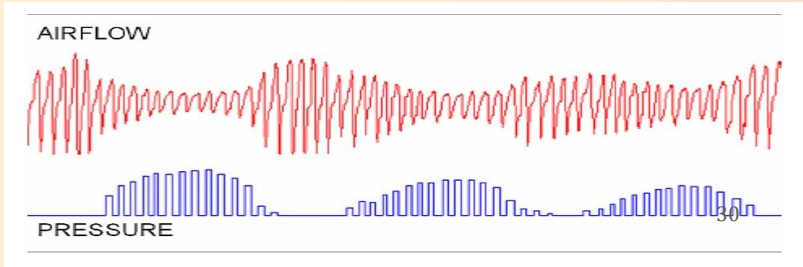
- Süper OBEZ kişilerde CO2 azalması ve yaşam kalitesi açısından fark yok.

Servo Ventilatör (ASV)

- Bazal CPAP üzerine değişken basınç ekleyen bir sistem.
- Apne ve hipopnelerde basınç artarken, hiperventilasyon durumunda azalır.
- ASV de solunum volümündeki her değişikliğine anında ve hızlı bir yanıt mümkün iken, AVAPS'ın hızlı yanıt yeteneği yok.







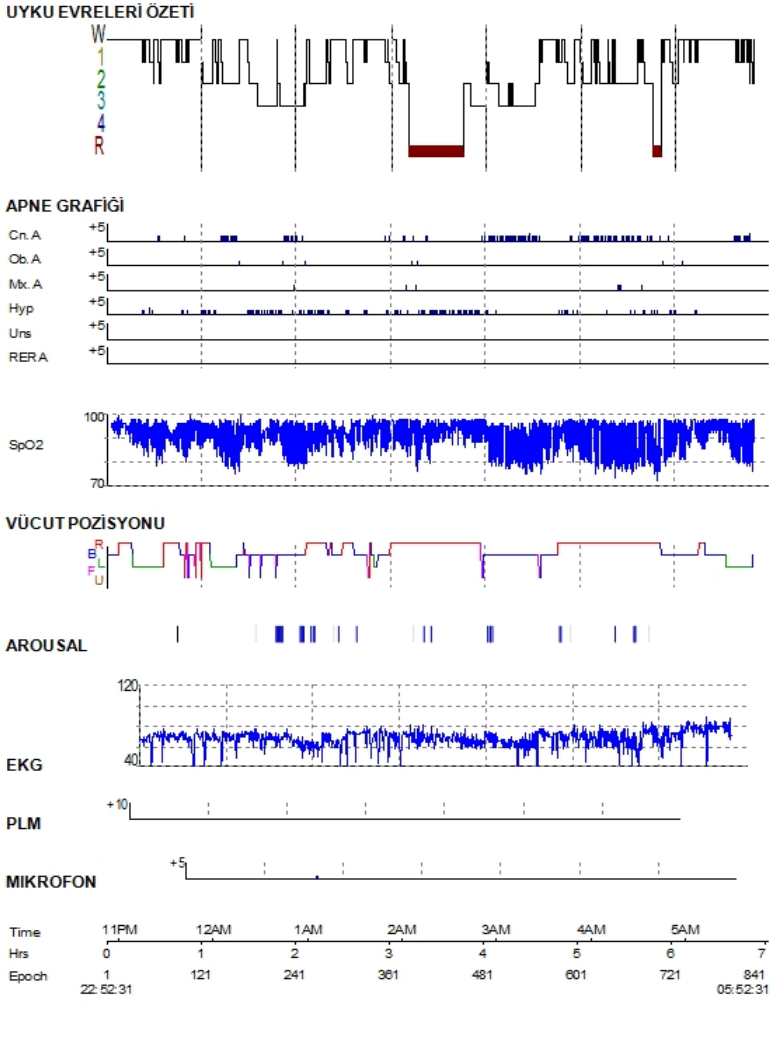
Servo Ventilatör (ASV) Endikasyon

- CPAP'ın başarısız olduğu ya da tolere edilemediği olgularda (hiperventilasyon ilişkili CSA'da) sec. line tedavi.
- Cheyne- Stokes Solunumu veya Santral apnede
- Kompleks uyku apnede kullanımı önerilmekte.

- Yeterli insp. basınç ile hastayı solutarak, gereksiz santral apne oluşumunu önler.

Aurora RN, Chowdhuri S, Ramar K, et al. The treatment of central sleep apnea syndromes in adults: practice parameters with an evidence-based literature review and meta-analyses. Sleep 2012; 35: 17-40
Winfried J. Randerath. Therapeutic options for the treatment of Cheyne-Stokes respiration. Swiss med wkly 2009; 139: 135-9

Randerath WJ, Galetke W, Kenter M, Richter K, Schafer T. Combined adaptive servo-ventilation and automatic positive airway pressure (anticyclic modulated ventilation) in co-existing obstructive and central sleep apnea syndrome and periodic breathing. Sleep Med 2009; 10: 898-903.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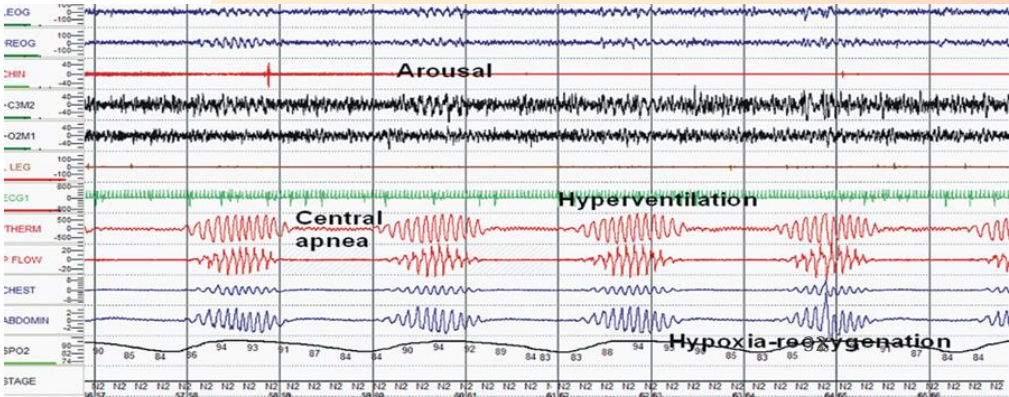

Arousal
Central
apnea
Hyperventilation
Hypoxia-reoxygenation

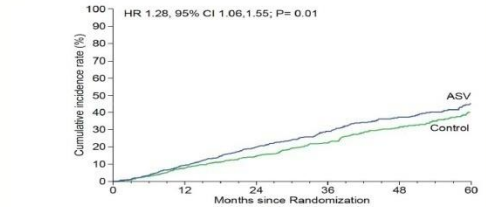
ORIGINAL ARTICLE

Adaptive Servo-Ventilation for Central Sleep Apnea in Systolic Heart Failure

Martin R. Cowie, M.D., Holger Woehrle, M.D., Karl Wegscheider, Ph.D., Christiane Angermann, M.D., Marie-Pia d'Ortho, M.D., Ph.D., Erland Erdmann, M.D., Patrick Levy, M.D., Ph.D., Anita K. Simonds, M.D., Virend K. Somers, M.D., Ph.D., Faiez Zannad, M.D., Ph.D., and Helmut Teschler, M.D.

N Engl J Med 2015; 373:1095-1105 | September 17, 2015 | DOI: 10.1056/NEJMoa1506459

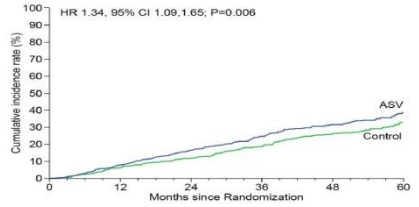
All-Cause Death



Cowie et al. NEJM 2015, 1 Sep [Epub ahead of print].

ESC CONGRESS LONDON 2015 Hot Line presentation www.escardio.org/ESC2015

Cardiovascular Death



Cowie et al. NEJM 2015, 1 Sep [Epub ahead of print].

ESC CONGRESS LONDON 2015 Hot Line presentation www.escardio.org/ESC2015

CONCLUSIONS

Adaptive servo-ventilation had no significant effect on the primary end point in patients who had heart failure with reduced ejection fraction and predominantly central sleep apnea, but all-cause and cardiovascular mortality were both increased with this therapy. (Funded by ResMed and others; SERVE-HF ClinicalTrials.gov number, NCT00733343.)

Cowie et al. N Engl J Med 2015; 373:1095-1105

Anti-Cyclic Modulated Ventilation (ACMV)

- Auto-CPAP + ASV
- OSAS + Cheyne Stokes

Sleep Medicine 15 (2014) 874–879

Contents lists available at ScienceDirect

Sleep Medicine

journal homepage: www.elsevier.com/locate/sleep

Original Article

Anticyclic modulated ventilation versus continuous positive airway pressure in patients with coexisting obstructive sleep apnea and Cheyne–Stokes respiration: a randomized crossover trial

Wolfgang Galetke [a,b,*], Babak M. Ghassemi [b], Christina Priegnitz [b,c], Sven Stieglitz [b,c], Norbert Anduleit [b], Kerstin Richter [b], Winfried J. Randerath [b,c]

[a] Krankenhaus der Augustinerinnen Cologne, Cologne, Germany
[b] Institute for Pneumology at the University Witten/Herdecke, Solingen, Germany
[c] Krankenhaus Bethanien Solingen, Solingen, Germany

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Keywords:
Adaptive servo-ventilation
Anticyclic modulated ventilation
Cheyne–Stokes respiration
Coexisting sleep-disordered breathing
Continuous positive airway pressure
Obstructive sleep apnea

ABSTRACT

Background: Although coexisting obstructive sleep apnea (OSA) and Cheyne–Stokes respiration (CSR) occur frequently in patients with heart diseases, optimal treatment remains unclear. Positive airway pressure (PAP) effectively treats OSA and adaptive servo-ventilation (ASV) has been shown to improve CSR. We compared a new treatment algorithm combining automatic continuous positive airway pressure (APAP) and ASV (anticyclic modulated ventilation, ACMV) versus continuous positive airway pressure (CPAP).

Methods: Thirty-nine patients (35 male, four female; aged 65.5 ± 9.7 years; body mass index, 31.0 ± 5.9 kg/m^2) with underlying heart disease and coexisting OSA and CSR were enrolled. After diagnostic polysomnography (PSG) and CPAP titration, patients were randomized either to CPAP or to ACMV for four weeks of treatment in a crossover design.

Results: Total apnea–hypopnea index (AHI) was 49.0 ± 18.8/h at baseline, 12.3 ± 14.6/h with CPAP ($P < 0.001$ vs baseline), and 3.7 ± 5.6/h with ACMV ($P < 0.001$ vs baseline and vs CPAP). Obstructive AHI was 20.7 ± 14.4/h at baseline, 5.1 ± 9.3/h with CPAP ($P < 0.001$ vs baseline), and 0.4 ± 0.4/h with ACMV ($P < 0.001$ vs baseline and vs CPAP). Central AHI was 28.3 ± 13.4/h at baseline, 7.2 ± 9.7/h with CPAP ($P < 0.001$ vs baseline) and 3.3 ± 5.4/h with ACMV ($P < 0.001$ vs baseline and vs CPAP). Ejection fraction was increased significantly (from 38.6 ± 15.6 to 44.4 ± 12.2%) only with ACMV. Subjective sleepiness significantly improved only with CPAP whereas objective sleep quality and treatment adherence were not different between both treatment modalities.

Conclusion: ACMV is an effective treatment option in patients with coexisting OSA and CSR. It is superior to CPAP in reducing total AHI as well as obstructive and central AHI.

Sleep Med 2014;15:874–879

Sleep and Breathing (2019) 23:735–740
https://doi.org/10.1007/s11325-018-1750-3

SLEEP BREATHING PHYSIOLOGY AND DISORDERS • ORIGINAL ARTICLE

Comparison between auto-trilevel and bilevel positive airway pressure ventilation for treatment of patients with concurrent obesity hypoventilation syndrome and obstructive sleep apnea syndrome

Chunfang Zou[1] · Weiwei Sheng[1] · De Huai[2] · Juan Cao[3] · Mei Su[1] · Ding Ning[1] · Rong Xue[1] · Yanli Wang[1] · Mao Huang[1] · Xilong Zhang[1]

Received: 12 April 2018 / Revised: 31 October 2018 / Accepted: 6 November 2018 / Published online: 13 November 2018

Abstract

Purpose Our study aims to compare the difference in clinical efficacy between auto-trilevel positive airway pressure (auto-trilevel PAP) ventilator and conventional fixed bilevel positive airway pressure (BiPAP) ventilator for obesity hypoventilation syndrome (OHS) patients with coexisting moderate or severe obstructive sleep apnea hypopnea syndrome (OSAHS).

Methods Twenty-three OHS patients with moderate or severe OSAHS enrolled between January 2015 and September 2017 underwent ventilation by three different modes of positive airway pressure (PAP) for 8 h per night. A single variable mode was applied at the first night followed by two nights when no PAP therapy was carried out as a washout period between each mode. The inspiratory positive airway pressure (IPAP) decided by $PaCO_2$ was consistently used for modes 1, 2, and 3. In mode 1, the expiratory positive airway pressure (EPAP) issued by BiPAP was decided by the minimal PAP levels for cessation of snoring. However, in mode 2, the EPAP was fixed at 3 cmH_2O higher than this value. With the use of auto-trilevel PAP in mode 3, the EPAP was set to initially match that of mode 1 but the end of EPAP (EEPAP) was automatically regulated to be elevated according to upper airway patency condition. We also compared the following parameters including apnea hypopnea index (AHI), minimal SpO_2 ($miniSpO_2$), arousal index, and sleep efficiency during sleep; $PaCO_2$ in the morning and Epword sleepiness score (ESS) at daytime were measured prior to and during PAP treatment as well as between three selected PAP modes.

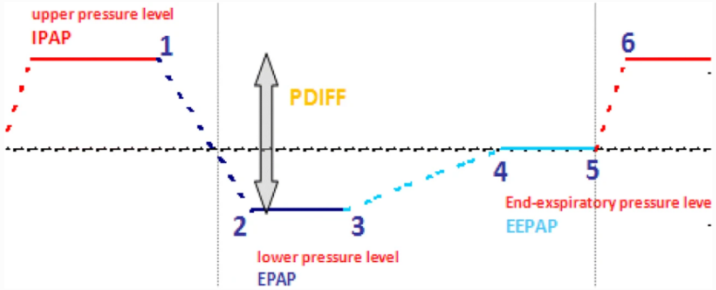
Results Compared with the parameters before ventilation therapies, all three variable modes of ventilation were associated with a higher nocturnal $miniSpO_2$ and sleep efficiency (all $P < 0.01$). Among the three variable modes, mode 3 resulted in not only the lowest arousal index and daytime ESS but also the highest sleep efficiency. Compared to mode 1, mode 2 demonstrated a significantly reduced AHI and an elevated $miniSpO_2$ and morning $PaCO_2$ (all $P < 0.05$), while mode 3 was associated with a decreased AHI, an increased $miniSpO_2$ (all $P < 0.05$), and no statistical change of $PaCO_2$ following the end of PAP treatment ($P > 0.05$). Comparison between mode 2 and mode 3 revealed that mode 3 had a significantly lower $PaCO_2$ ($P < 0.05$), but displayed no remarkable changes of AHI and $miniSpO_2$ (all $P > 0.05$).

Conclusion Compared to fixed BiPAP ventilation, auto-trilevel PAP ventilation could more effectively correct hypercapnia, achieve lower index of nocturnal apnea and hypopnea, more improved sleep quality, and lower daytime sleepiness score. Auto-trilevel PAP ventilation is therefore more efficacious than conventional BiPAP ventilation in non-invasive ventilation therapy for OHS patients with concurrent moderate or severe OSAHS.

Keywords Obesity hypoventilation syndrome · Obstructive sleep apnea hypopnea syndrome · Positive airway pressure ventilation

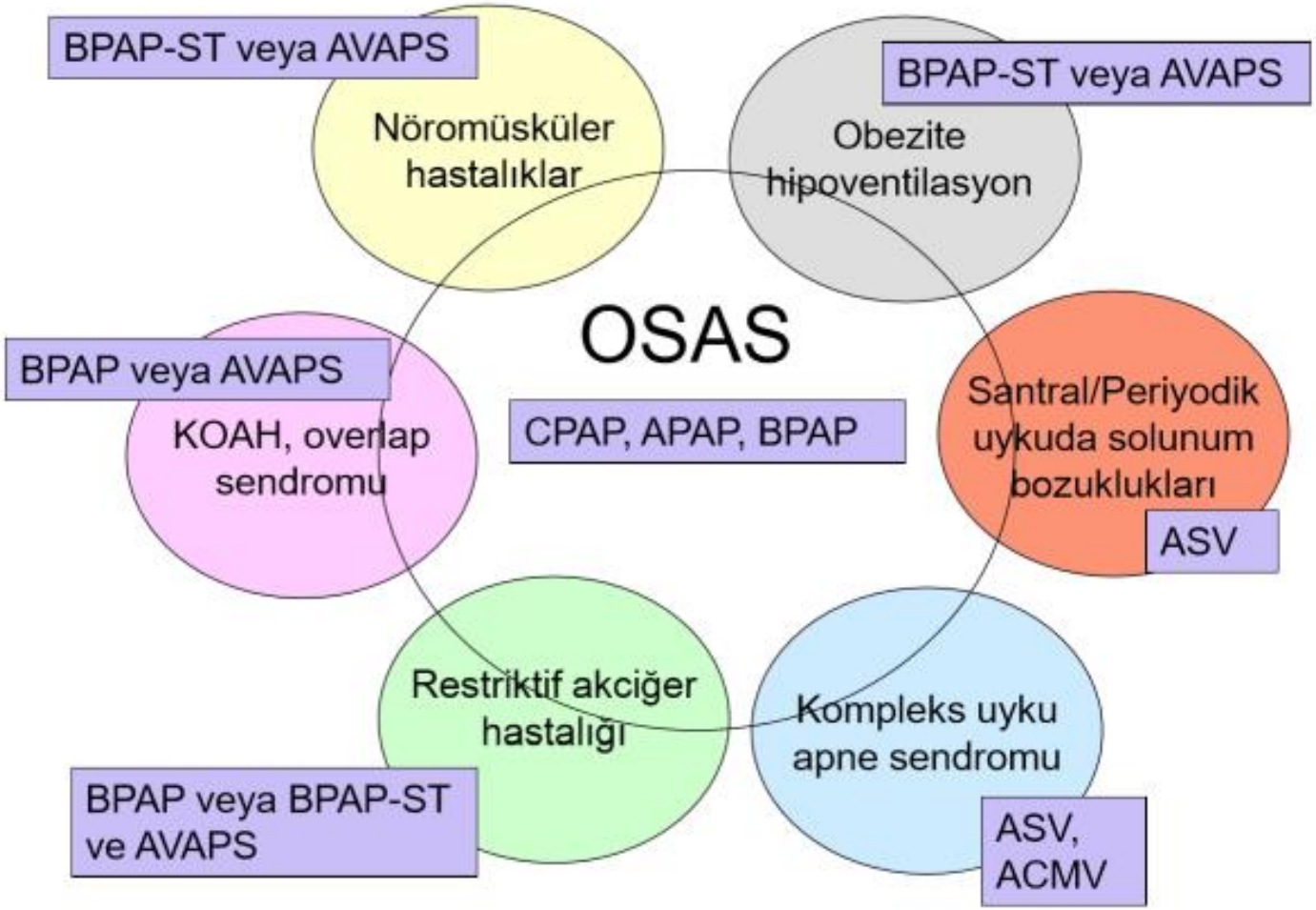
Trilevel PAP

From: Comparison between auto-trilevel and bilevel positive airway pressure ventilation for treatment of patients with concurrent obesity hypoventilation syndrome and obstructive sleep apnea syndrome



Characteristic of trilevel positive pressure support at a respiratory cycle. IPAP, inspiratory positive airway pressure; EPAP, expiratory positive airway pressure; EEPAP, end expiratory positive airway pressure; PDIFF, pressure difference between IPAP and EPAP. In auto-trilevel PAP mode, EPAP was displayed with two different parts, i.e., a relatively lower EPAP level at the beginning part of expiratory phase while an adjustably elevated EEPAP level at the end of expiratory phase

Conclusion: Compared to fixed BiPAP ventilation, auto-trilevel PAP ventilation could more effectively correct hypercapnia, achieve lower index of nocturnal apnea and hypopnea, more improved sleep quality, and lower daytime sleepiness score. Auto-trilevel PAP ventilation is therefore more efficacious than conventional BiPAP ventilation in non-invasive ventilation therapy for OHS patients with concurrent moderate or severe OSAHS.


BPAP-ST veya AVAPS
Nöromüsküler hastalıklar
BPAP-ST veya AVAPS
Obezite hipoventilasyon
OSAS
BPAP veya AVAPS
KOAH, overlap sendromu
CPAP, APAP, BPAP
Santral/Periyodik uykuda solunum bozuklukları
ASV
Restriktif akciğer hastalığı
Kompleks uyku apne sendromu
BPAP veya BPAP-ST ve AVAPS
ASV, ACMV

PAP Tedavisi Etkinlik

- Solunumsal olayları (AHİ) azaltıyor
- Gündüz uyku halini azaltıyor
- Kaza ihtimalini azaltıyor
- Sistemik KB düzeltiyor
- Erektil disfonksiyonu önlüyor,
- Reflü semptomlarını azaltıyor
- Yaşam kalitesini arttırıyor

- Kognitif durum ve depresif semptomlar üzerine etkisi belirsiz

- Birçok gözlemsel çalışmanın aksine, PAP tedavisinin kardiyovasküler hastalık(MI, inme vb) veya mortalite üzerine pozitif etkisi gösterilememiş.

https://www.uptodate.com/contents/obstructive-sleep-apnea-overview-of-management-in-adults (erişim 29.09.2023)

General predictors of nonadherence with nasal CPAP

Patient-related factors	Therapy- and medication-related factors	Health professional-related factors
▪ Failure to understand the importance of the therapy. ▪ Failure to understand instructions concerning the therapy. ▪ Concomitant self-administration of prescription or nonprescription medications or alcohol. ▪ Social isolation, thus lack of social support. (Patients with supportive families have been shown to be more compliant with prescription drugs – data not available for CPAP use.) ▪ Feeling ill, or being too tired to use the therapy. ▪ Physical limitations, including vision, hearing, hand coordination. ▪ Poor self-efficacy. ▪ Younger age. ▪ African-American. ▪ Lower socioeconomic status. ▪ Moderate to severe obstructive sleep apnea. ▪ Lack of bed partner engagement. ▪ Less severe oxyhemoglobin desaturation during sleep. ▪ Small nasal volume. ▪ Comorbid insomnia.	▪ Complexity of therapy, in device use or medication dosing. ▪ Increased rate of adverse reactions. (Device use has complications, and the provider needs to meet with the patient periodically to determine adverse events and help address these issues.) ▪ Characteristics of illness; long-term or chronic illnesses are a problem, as compliance decreases over time. ▪ Expensive therapy (only a problem when a patient must pay out of pocket or has not met the deductible). ▪ Lack of efficacy (higher residual apnea-hypopnea index). ▪ Less than 4 hours of CPAP nightly use in first 2 weeks. ▪ Problems on first night of use.	▪ Poor relationship with patient. ▪ Expression of doubt concerning therapeutic potential. ▪ Unwillingness to educate patients. ▪ Lack of knowledge of medications the patient is taking or has access to. (Sedatives and alcohol can compound OSA, and their use should be evaluated.)

CPAP: continuous positive airway pressure; OSA: obstructive sleep apnea.

Graphic 50144 Version 6.0

PAP Uyum (Kompliyens)

- Her gece min 4 saat ve haftada en az 5 gün kullanılmalı…
- 90 günde yaklaşık %75 kullanım olmalı

OSAS Tedavi

- **PAP Tedavisi**
  - CPAP (FixCPAP, APAP)
  - BİPAP (BİPAP-S, BİPAP-S/T, AVAPS, ASV, ACMV)
- **PAP Dışı Tedaviler**
  - Kilo Verme
  - Pozisyonel Tedavi
  - Ağız İçi Araç
  - Hipoglossal Sinir Stimulasyonu
  - Farmakoterapi
  - Cerrahi Tedavi

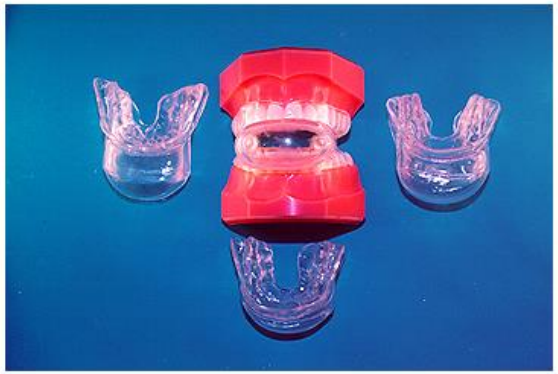
Ağız İçi Araçlar

- Mandibulayı öne alan
- Dili önce tutan

Mandibular advancement splint

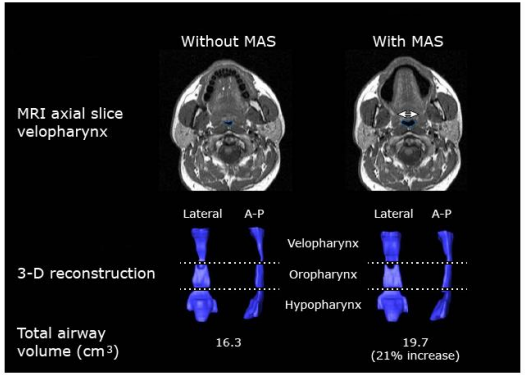
Another example of a two-piece device, with full occlusal coverage, and a titratable slot and flange coupling mechanism in the vicinity of the posterior teeth, permitting mouth opening and closing whilst in advancement (SomnoMed MAS, SomnoMed Ltd, Australia).

Tongue retaining device (four views)



When inserted into the suction cavity of this oral appliance, the tongue is held forward to maintain airway patency. (Tongue Retaining Device, Professional Positioners, Inc, Racine, WI)

MRI of typical oral appliance-induced changes

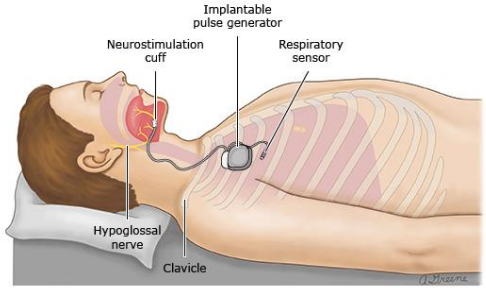


Axial MRI images of the upper airway at the level of the velopharynx (upper panel), showing the effect of MAS in a complete responder to treatment. The arrow demonstrates the lateral widening of the velopharynx. The lower panel demonstrates 3D reconstructions of the upper airway showing the enlargement of total airway volume, mediated predominantly by lateral widening of the velopharynx.

https://www.uptodate.com/contents/oral-appliances-in-the-treatment-of-obstructive-sleep-apnea-in-adults?topicRef=7695&source=see_link (erişim tarihi 12.10.2023)

Hipoglossal Sinir Stimulasyonu

Hypoglossal nerve stimulation implant



This image depicts the hypoglossal nerve stimulation device components. A neurostimulation cuff with electrodes is typically placed on the medial branches of cranial nerve 12 through an incision in the submandibular area. The neurostimulation lead is tunneled subcutaneously and connected to the implantable pulse generator. The implantable pulse generator and the respiratory sensor lead are placed through an incision in the anterior chest. The respiratory sensor is placed in the second or third intercostal space.

Patient selection criteria for hypoglossal nerve stimulation therapy

Parameter	Criteria
Age	18 years or older
AHI	15 to 100 events/hour
BMI	40 kg/m^2*
Central and mixed apneas	<25% of total events
Drug-induced sleep endoscopy findings	No complete concentric collapse of the velopharynx or soft palate
Failed or declined PAP therapy	Yes

HNS: hypoglossal nerve stimulation; AHI: apnea hypopnea index; BMI: body mass index; PAP: positive airway pressure.

* Since most trials were conducted in patients with a BMI <32 kg/m^2, most United States commercial insurances require a BMI <32 kg/m^2, although Medicare coverage and coverage in Europe extends to patients with BMI <35 kg/m^2.

https://www.uptodate.com/contents/hypoglossal-nerve-stimulation-for-adult-patients-with-obstructive-sleep-apnea?topicRef=7695&source=see_link (erişim tarihi 12.10.2023)