CPAP clinical cases: children and adolescents

Uros Krivec

Unit for pulmonary diseases

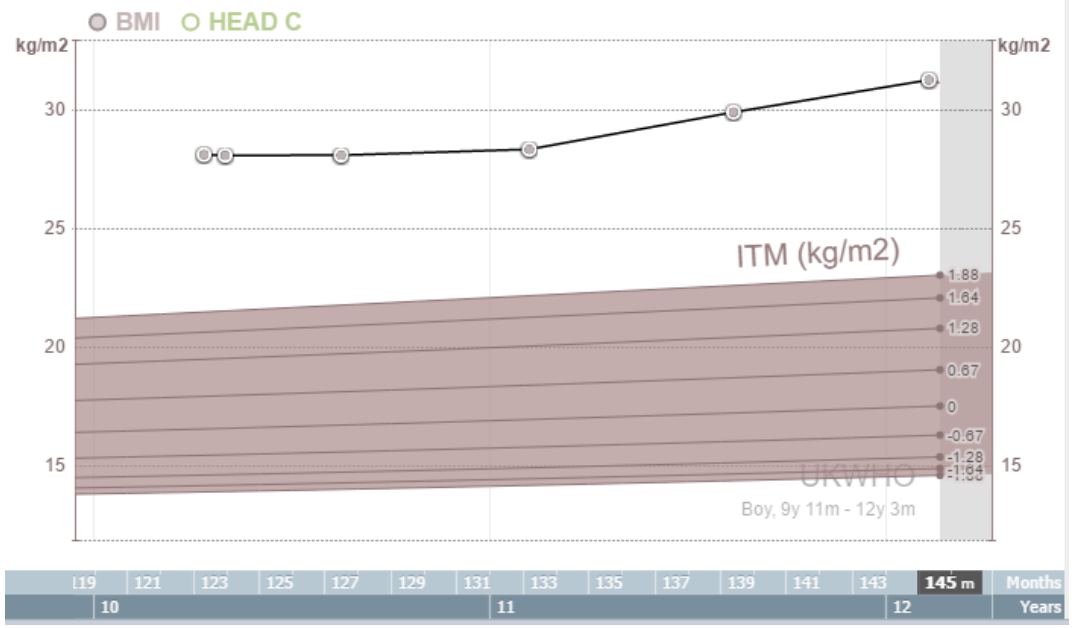
University children's hospital Ljubljana, Slovenia

univerzitetni klinični center ljubljana
University Medical Centre Ljubljana

A boy that „snores louder than his father“

Philip

- 12-yr-old boy with severe obesity
- BW 78.4 kg (>95th p, Z +3.0)
- BMI 31.3 kg/m2 (>95th p, Z +3.1)
- „Snores louder than his father“
- Tired at all times



Philip

Overnight polygraphy

Mean SpO2 93%
Minimal SpO2 79%
Time spent with SpO2 <90%: 14%
AHI 37 / h
ODI 23 / h

Morning capillary blood gases:
pH 7.43, PCO2 44 mm Hg,
HCO3 28 mmol/l

Diagnosis

- Obstructive sleep apnea syndrome (?)
- Obesity hypoventilation syndrome (?)

Obesity hypoventilation syndrome (OHS)

Pediatric OHS diagnosis

Definition based on consensus and expert opinion:

1. Obesity (BMI >30 kg/m2) or BMI >95th percentile forage and gender or weight >95th percentile for age
2. Daytime hypercapnia (PaCO2 >45 mmHg)
3. Absence of known neurological, cardiac or pulmonary causes of hypoventilation

Witmans, M et al. Section 10: Obesity hypoventilation inchildren, Canadian Journal of Respiratory, Critical Care, and Sleep Medicine 2018;2(1): 75-77

Prerequisite for OHS diagnosis

1. Sleep study (poly(somno)graphy) to establish SDB and
2. Daytime PaCO2 to establish hypercapnia

Mokhlesi B et al. Am J Respir Crit Care Med. 2019;200(3):e6-e24

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Diagnosis

- Obstructive sleep apnea syndrome
- Obesity hypoventilation syndrome

Interventions

- Enrolment in a multidisciplinary weight control program
- Plan for weight loss and maintenance
- Life-style changes (exercise and nutrition help)
- ENT - Adenotonsillectomy (?)
- Bariatric surgery (?)
- Repeat sleep study with PCO_2 monitoring

- **Respiratory support**
  - **CPAP (?)**
  - **NIV (?)**

CPAP

Respiratory support

- Appropriate interface
- Choice of device
  - fixed CAPA
  - auto-titrating PAP
- Start CPAP level
  - 4 cm H20, gradual increased to the highest tolerated level
- Titration under poly(somno)graphic and PCO2 monitoring

Assessment of response

- Sleep study in 3 months
- Compliance (!)

SYSTEMATIC REVIEWS

Auto-titrating versus fixed continuous positive airway pressure for the treatment of obstructive sleep apnea: a systematic review with meta-analyses

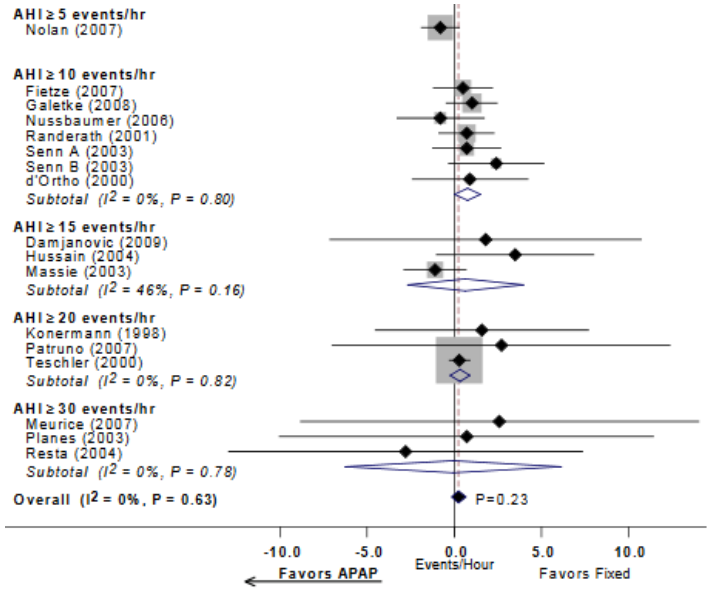


Figure 3 AHI (events/hour) with APAP versus fixed CPAP

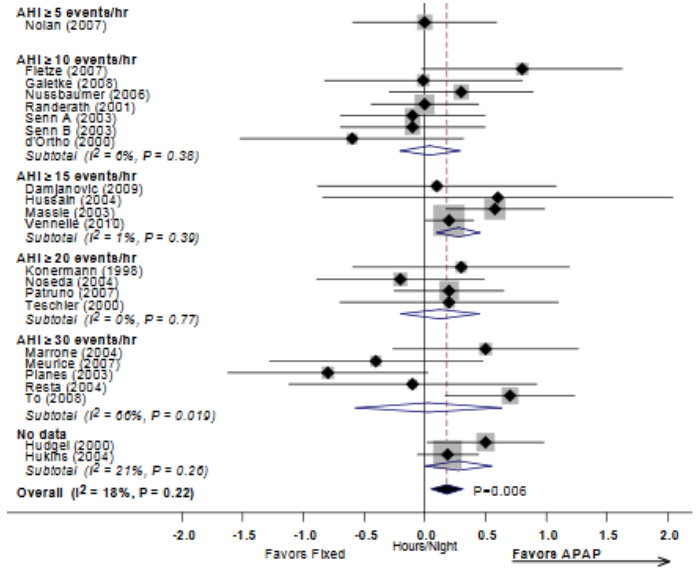


Figure 2 CPAP compliance (hour/night) with APAP versus fixed CPAP

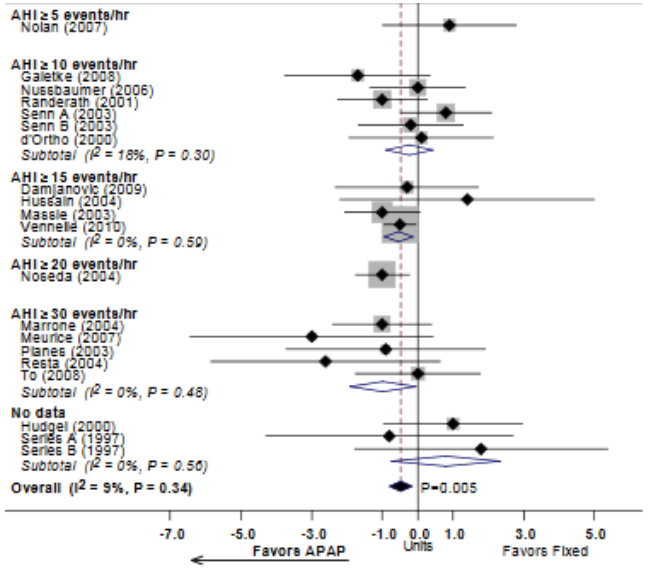


Figure 4 ESS with APAP versus fixed CPAP

- **Clinical importance** of statistically significant differences **is unclear.**
- **Choice of device** may be supported by**: patient preference, specific reasons for non-compliance and cost.**

Ip S et al. Syst Rev. 2012;1:20.

CPAP - assessment of response

Sleep study after 3 months

Mean SpO2 96%
Minimal SpO2 88%
Time spent with SpO2 <90%: 3%
AHI 7 / h
ODI 3 / h
Time spent with PtcCO2 >50 mm Hg: 0%
Peak PtcCO2: 52 mm Hg
Morning capillary blood gases:
pH 7.42, PCO2 41 mm Hg,
HCO3 25 mmol/l

Switch to NIV needed?

Consider switching from CPAP to NIV if:

- Periods with SpO2 <80% for ≥10 min
- Persistent hypopnea and RERA
- Rise of PtcCO2 of ≥10 mm Hg during REM sleep or rise in diurnal PaCO2 of ≥10 mm Hg (if starting PaCO2 >55 mm Hg)
- CPAP intolerance

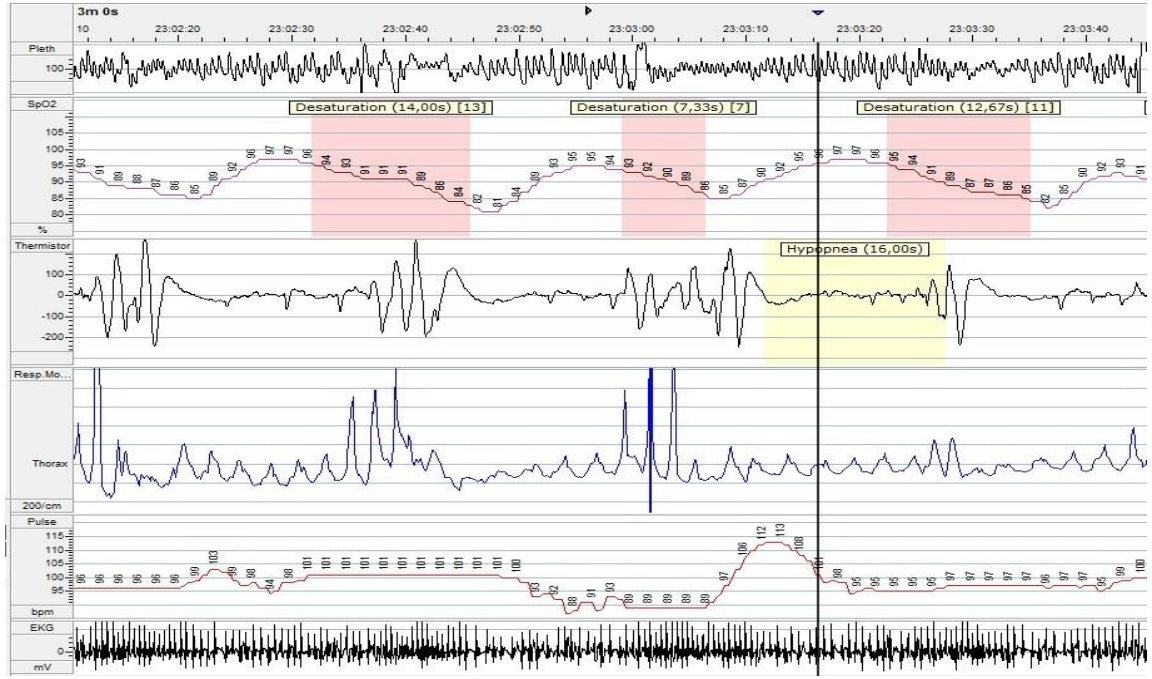
Piper A et al. Sleep Med Clin. 2017;12(4):587-596
Mokhlesi B et al. Am J Respir Crit Care Med. 2019;200(3):e6-e24

A boy with cerebral palsy and nosy breathing

Ian

- 16-yr-old boy with cerebral palsy (GMFCS level V)
- Rattling day and night – „He never clears his airway“
- Parents concerned about long breathing pauses during sleep
- Serval times admitted to regional hospital for minor respiratory infections
- In hospital additional oxygen needed only at night

Ian



Overnight polygraphy

Mean SpO2 92%

Minimal SpO2 74%

Time spent with SpO2 <90%: 19%

AHI 38 / h

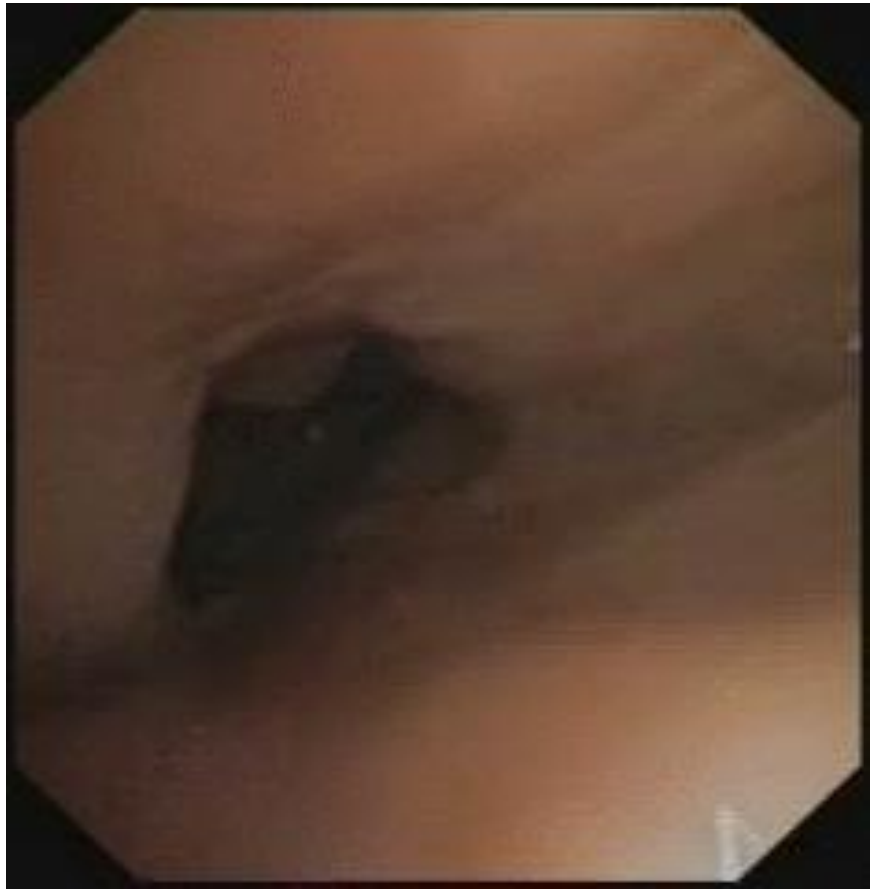
ODI 21 / h

Morning capillary blood gases

pH 7.36, PCO2 43 mm Hg, HCO3 28 mmol/l

Ian

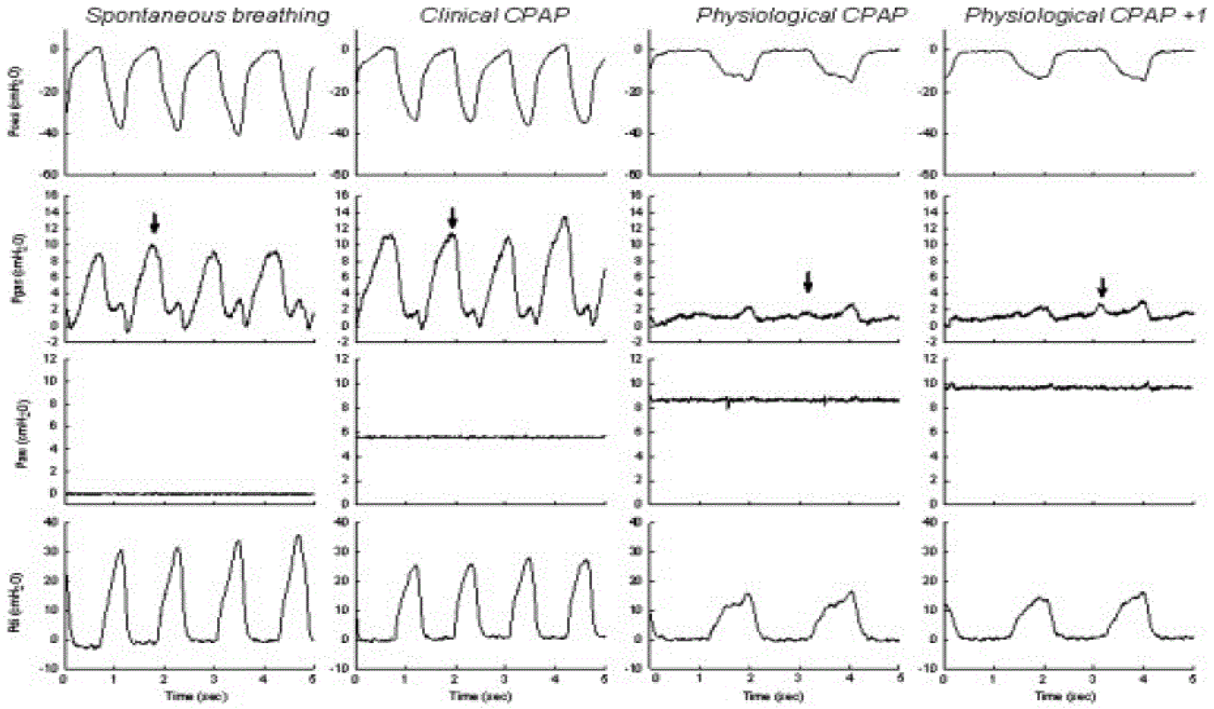
Drug induced sleep study (DISE)



Initiating CPAP

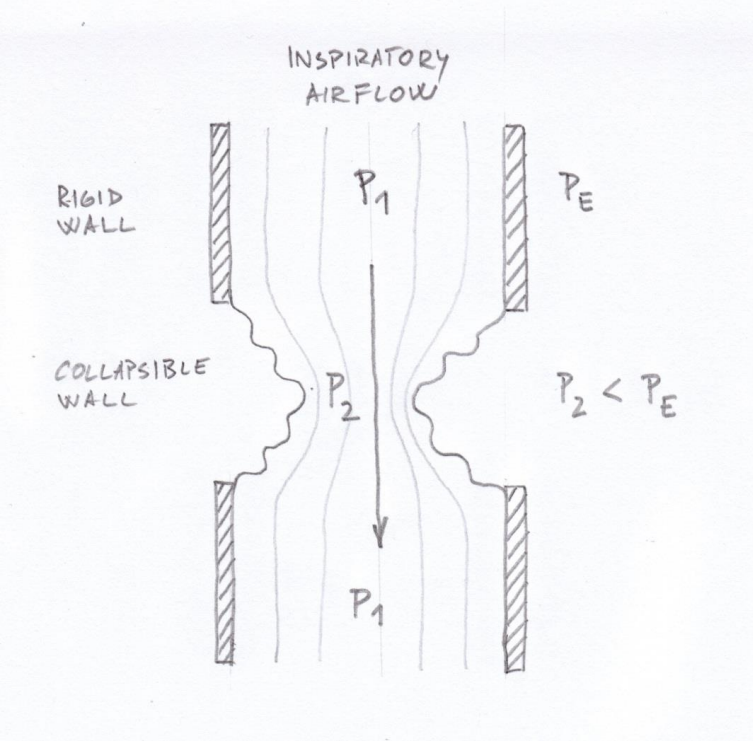
- Appropriate interface
- Choice of device according to manufacturers' recommendations (minimal weight)
- Start CPAP level:

  4 cm H_20, gradual increased to the highest tolerated level (8.5 ± 1.0)



Khirani S et. al. Crit Care. 2013;17(4):R167

CPAP


INSPIRATORY AIRFLOW
RIGID WALL
COLLAPSIBLE WALL
P_1
P_E
P_2
$P_2 < P_E$
P_1

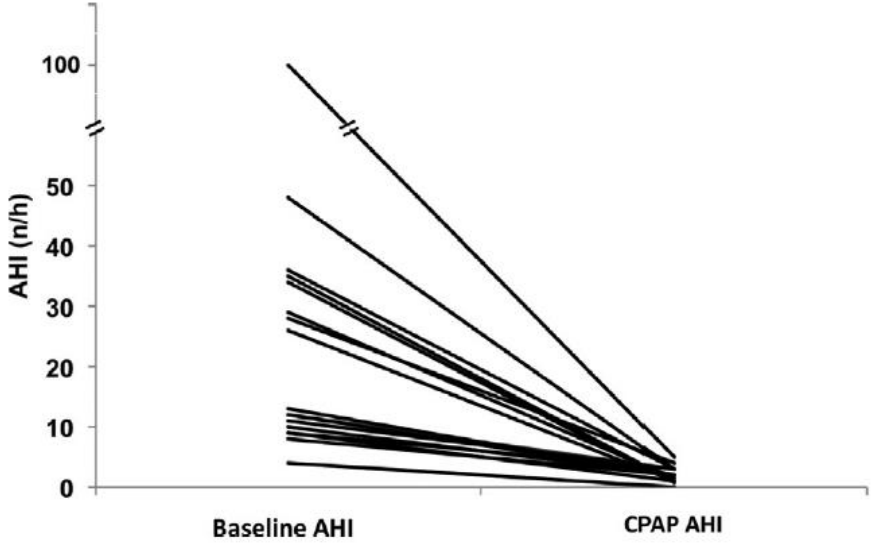

PEEP 0 cm H20

Initiating CPAP

Pediatric Pulmonology. 2018;1–7.

Outpatient initiation of long-term continuous positive airway pressure in children

Alessandro Amaddeo MD, PhD[1,2,3] | Annick Frapin MSN[1] | Samira Touil BSc[1] | Sonia Khirani PhD[1,4] | Lucie Griffon MD[1] | Brigitte Fauroux MD, PhD[1,2,3]



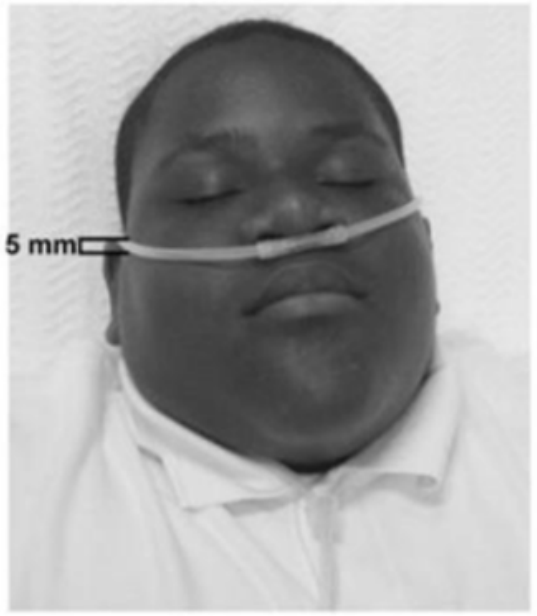
- Right approach
- Cartoons, a booklet explaining CPAP, teddy bear with a CPAP device, …

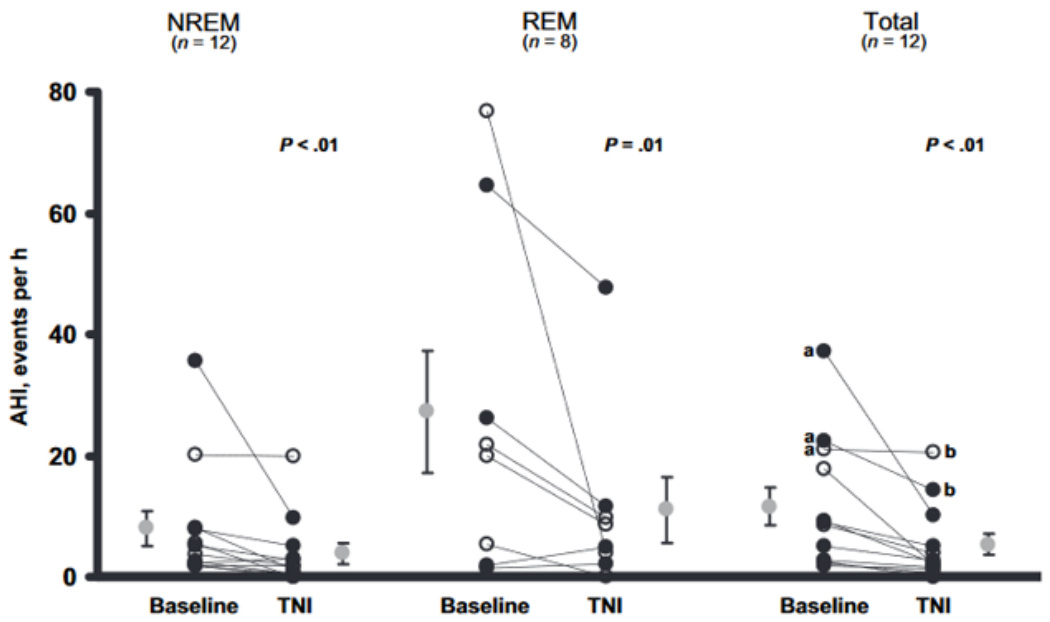
No CPAP tolerance

Pediatrics. 2009 July ; 124(1): 179–188. doi:10.1542/peds.2008-2824.

Effect of a High-Flow Open Nasal Cannula System on Obstructive Sleep Apnea in Children

Brian McGinley, MD[a], Ann Halbower, MD[b], Alan R. Schwartz, MD[c], Philip L. Smith, MD[c], Susheel P. Patil, MD, PhD[c], and Hartmut Schneider, MD, PhD[c]





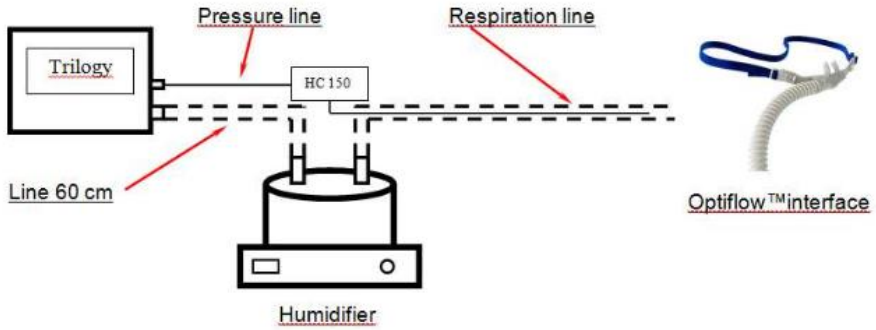
No CPAP tolerance

Sleep Medicine
Volume 44, April 2018, Pages 1-3

Brief Communication

The Optiflow™ interface for chronic CPAP use in children

C. Overbergh [a], S. Installe [a], A. Boudewyns [b], K. Van Hoorenbeeck [a, c], S.L. Verhulst [a, c]

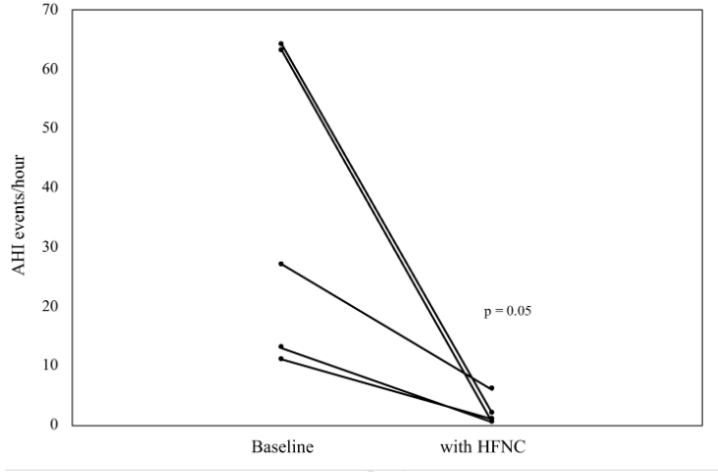


Sleep Medicine
Volume 63, November 2019, Pages 24-28

Original Article

High-flow nasal cannula for children not compliant with continuous positive airway pressure

Alessandro Amaddeo [a, b], Sonia Khirani [a, b, c], Annick Frapin [a], Theo Teng [a], Lucie Griffon [a, b], Brigitte Fauroux [a]



Thank you for your attention!

Questions?