

# Evaluation of fixed continuous positive airway pressure (CPAP) with C-Flex+ against fixed CPAP

<b>Submission date</b> 07/12/2010	<b>Recruitment status</b> No longer recruiting	<input type="checkbox"/> Prospectively registered
<b>Registration date</b> 13/01/2011	<b>Overall study status</b> Completed	<input type="checkbox"/> Protocol
<b>Last Edited</b> 13/01/2011	<b>Condition category</b> Nervous System Diseases	<input type="checkbox"/> Statistical analysis plan
		<input type="checkbox"/> Results
		<input type="checkbox"/> Individual participant data
		<input type="checkbox"/> Record updated in last year

**Plain English summary of protocol**  
Not provided at time of registration

## Contact information

**Type(s)**  
Scientific

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## Additional identifiers

**Protocol serial number**  
EAME09PRSTS02

## Study information

**Scientific Title**  
Evaluation of fixed continuous positive airway pressure (CPAP) with C-Flex+ against fixed CPAP in patients with obstructive sleep apnoea

## Acronym

C-Flex+

## Study objectives

Compare the performance of a fixed continuous positive airway pressure (CPAP) device with C-Flex+ (REMstar® Pro) against fixed CPAP in patients with obstructive sleep apnoea (OSA) and validate its event detection capabilities.

Primary hypothesis and end-points:

1. Fixed CPAP with C-Flex+ delivered over one night by the REMstar® Pro, to subjects with OSA, will reduce the Apnoea-Hypopnoea Index (AHI) score to a similar level to fixed CPAP delivered by the same device over one night.

Secondary hypotheses and end-points:

1. Fixed CPAP with C-Flex+ delivered throughout the night by the REMstar® Pro, to subjects with OSA, will reduce the following variables to a similar level to fixed CPAP delivered by the same device:

1.1. SpO<sub>2</sub> - Nocturnal oxygenation

1.1.1. Total time spent less than 90%

1.1.2. Lowest SpO<sub>2</sub> during the night

1.1.3. Average SpO<sub>2</sub> during the night

1.2. TST - Total sleep time

1.3. SE% Sleep efficiency

1.4. Sleep Architecture:

1.4.1. Min/% Non-REM sleep

1.4.1.1. Min/% N1

1.4.1.2. Min/% N2

1.4.1.3. Min/% N3

1.4.2. Min/% R sleep

1.4.3. Min/% Wake After Sleep Onset (WASO)

1.4.4. Arousals

1.4.4.1. # of arousals/awakenings (all cause)

1.4.4.2. Arousals due to PLMS

1.4.4.3. Arousal Index (AI)

1.4.4.4. Arousals due to Respiratory Disturbance (RDI)

2. Average Pressure Outputs will be lower on C-Flex+

3. Comfort will be rated as higher when using fixed CPAP with C-Flex+ and patients will prefer it to fixed CPAP

4. The breathing event output from the REMstar Pro will result in a number of events (AHI, flow limitation, RERAs, snore, clear airway apnoeas, obstructed airway apnoeas, hypopnoeas and periodic breathing) that is in diagnostic agreement with those obtained from a full clinical PSG over one night.

## Ethics approval required

Old ethics approval format

## Ethics approval(s)

Ethikkommission, Ethikausschuss 1 am Campus Charité - Mitte approved on the 11th March 2010 (ref: EA1/036/10)

## Study design

Double blind randomised controlled study

## **Primary study design**

Interventional

## **Study type(s)**

Treatment

## **Health condition(s) or problem(s) studied**

Obstructive sleep apnoea

## **Interventions**

Following the standard education and acclimatisation program of the centre, in which subjects will undergo a daytime CPAP session at a constant pressure of 5 cmH<sub>2</sub>O using several different interface models so that an appropriate interface can be selected, eligible subjects will complete a CPAP titration study under full PSG conditions. CPAP shall start with a value of 4 cmH<sub>2</sub>O and be increased in 1cmH<sub>2</sub>O increments to the point where disordered breathing, including hypopnoeas, RERAs and flow limitations, is eliminated. Respironics' Integrated heated humidifier will be used if needed and set to an initial setting of 2. During the course of the night, this setting can be changed to optimise participant comfort. This study shall be interpreted by the co-investigator to determine the optimal CPAP setting. A successful titration will be defined as an AHI less than 15.0/h under the determined optimal pressure. Subjects in whom CPAP does not adequately treat OSA during the titration will be excluded.

Following the CPAP determination study, subjects will be randomly assigned to one night of fixed CPAP with C-Flex+ and one night of fixed CPAP delivered by the REMstar Pro on consecutive nights in the Sleep Laboratory by the PSG technician under full PSG conditions.. These studies should be performed within 14 days of the CPAP determination study. Humidification will be standardised at the level from the CPAP determination study. The same interface will also be used on each occasion.

Visual Analogue Scales relating to comfort will be completed immediately upon waking after each therapy night. After the second therapy night a questionnaire asking which device they preferred will also be completed. These assessments will all be administered by the co-investigator at each site.

## **Intervention Type**

Other

## **Phase**

Not Applicable

## **Primary outcome(s)**

In order to test the primary hypothesis the following PSG variables will be assessed: 1. AHI (total, REM and NREM) - total, obstructive, central, mixed and hypopnoea

Comparisons will be made using the above data. These continuous variables will be summarised using means (and standard deviations) or median (interquartile range), depending on the distribution. The within-patient differences between the modes will be presented for each of

these variables using mean differences and 95% confidence intervals. The 95% confidence bounds (one sided) will be scrutinised to determine whether or not non-inferiority of the fixed CPAP with C-Flex+ can be declared.

### **Key secondary outcome(s)**

In order to test the secondary hypotheses the following variables will be assessed:

1. SpO<sub>2</sub> - Nocturnal oxygenation
  - 1.1. Total time spent less than 90%
  - 1.2. Lowest SpO<sub>2</sub> during the night
  - 1.3. Average SpO<sub>2</sub> during the night
2. TST - Total sleep time
3. SE% Sleep efficiency
4. Sleep Architecture:
  - 4.1. Min/% Non-REM sleep
    - 4.1.1. Min/% N1
    - 4.1.2. Min/% N2
    - 4.1.3. Min/% N3
  - 4.2. Min/% R sleep
  - 4.3. Min/% Wake After Sleep Onset (WASO)
  - 4.4. Arousals:
    - 4.4.1. # of arousals/awakenings (all cause)
    - 4.4.2. Arousals due to PLMS
    - 4.4.3. Arousal Index (AI)
    - 4.4.4. Arousals due to Respiratory Disturbance (RDI)

Comparisons will be made using the above data. These continuous variables will be summarised using means (and standard deviations) or median (interquartile range), depending on the distribution. The within-patient differences between the modes will be presented for each of these variables using mean differences and 95% confidence intervals. The 95% confidence bounds (one sided) will be scrutinised to determine whether or not non-inferiority of fixed CPAP with C-Flex+ can be declared.

5. Average Pressure Outputs will be summarised using means (and standard deviations) or median (interquartile range), depending on the distribution. The pairwise within-patient differences between the modes will be presented as mean differences and 95% confidence intervals, and the single sample t-test will be used to assess whether the differences between the modes are statistically significant.

6. Comfort - The 10cm comfort visual analogue scale will be summarised for each of the modes from data collected on nights 1 and 2 of the study using means (and standard deviations) or median (interquartile range), depending on the distribution of the data. The pairwise within-patient differences between the modes will be presented as mean differences and 95% confidence intervals, and the single sample t-test will be used to assess whether the differences between the modes are statistically significant.

7. Preference - The number (and percentage) of patients who prefer each of the modes will be presented, along with 95% confidence intervals for these percentages and McNemar's test using a X<sup>2</sup> test in a 2 by 2 contingency table will be used to assess whether the differences between the modes are statistically significant.

8. Breathing event output - Device reported scoring will be compared to both standard and specialised PSG scoring. The correlation coefficients will be determined. The PSG's from the study night will be considered the gold standard for identifying and quantifying apnoeas and hypopnoeas during sleep. The accuracy of the CPAP device in detecting residual events (clear airway apnoea, obstructed airway apnoea, hypopnoea, apnoea hypopnoea index, respiratory

effort related arousals and Cheyne Stokes Respiration) will be based on comparisons of the CPAP and the PSG by correlation and agreement using the method of Bland and Altman. During these analyses, a clear airway apnoea will be considered a surrogate of a central apnoea and an obstructed airway apnoea a surrogate of an obstructive apnoea. Mixed apnoeas will be classified as central on the PSG recording. For the AHI, Receiver-Operator Characteristic (ROC) curves will be constructed to determine optimal cut-off values for determining positive and negative likelihood ratios. A log transformation of the data may be performed to improve the scatter of the differences as the AHI increases. Patients with and without residual OSA on CPAP will be compared using a two sample t-test.

9. Other relevant statistical tests including multivariate analysis may be performed according to the discretion of the Principal Investigator and Statistician.

Any deviations from points 1 - 8 in this plan will be reported in the final manuscript.

### **Completion date**

10/01/2012

## **Eligibility**

### **Key inclusion criteria**

1. AHI greater than 15 confirmed (greater than than 50% obstructive events) by full PSG within last 14 days
2. Age greater than or equal to 21 years of age
3. Able to provide consent
4. Able to follow the instructions given by the investigator regarding using their CPAP device and their participation in this study

### **Participant type(s)**

Patient

### **Healthy volunteers allowed**

No

### **Age group**

Adult

### **Sex**

All

### **Key exclusion criteria**

1. Inability to tolerate CPAP during the daytime CPAP session
2. Failure of CPAP to adequately treat OSA during titration (AHI greater than or equal to 15.0/h under the determined optimal pressure)
3. PAP therapy is otherwise medically contraindicated: acute upper respiratory infection, encephalitis, sinusitis or middle ear infection or surgery of the upper airway, nose, sinus, or middle ear within the previous 90 days
4. Untreated, non-OSA sleep disorders, including but not limited to; insomnia, periodic leg movements (PLM)/restless legs syndrome (RLS)
5. Treated insomnia
6. Intake of central relevant drugs, sedatives, or other drugs which impair sleep
7. Previous exposure to positive airways pressure therapy

8. Acute dermatitis or other skin lesions or trauma interfering with the application of a mask
9. Unwilling to participate in the study
10. Participation in another clinical study in the past 4 weeks
11. Shift worker

**Date of first enrolment**

10/01/2011

**Date of final enrolment**

10/01/2012

## Locations

**Countries of recruitment**

Germany

**Study participating centre**

Center of Sleep Medicine

Berlin

Germany

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## Sponsor information

**Organisation**

Philips Respironics (France)

**ROR**

<https://ror.org/05jz46060>

## Funder(s)

**Funder type**

Industry

**Funder Name**

Philips Respironics (France)

## Results and Publications

## **Individual participant data (IPD) sharing plan**

### **IPD sharing plan summary**

Not provided at time of registration