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Evaluation of a combined actigraphy and heart rate variability monitor for determining sleep and wake in adult subjects

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Background

• Studies of heart rate variability during sleep have shown sleep stage specific changes in the autonomic tone. We set out to examine if a commercially available monitor combining heart rate variability and actigraphy (Actiheart®), could be used to evaluate wake and sleep stage in healthy adult volunteers.

Methods

- 19 healthy volunteers (13 men) median age 29 years (range 22-37) were included in the study.
- Subjects were examined in their home environment.
- One night polysomnography and Actiheart monitoring was completed for every subject. The recording was synchronized and started in the period between 22:30 h and 00:30 h and ended between 06:30 h and 08:30 h. Sleep stages were analyzed in 30 second epochs.
- The recording was defined as wake, light sleep (LS: stage I and II), slow wave sleep (SWS: stage III and IV) and rapid eye movement (REM) sleep.
- An epoch by epoch sensitivity and specificity analysis was made. Individual sleep stage durations measured by the two methods were compared

Results

- 1 patient was excluded because of electrode displacement during the night.
- The mean (±SD) sleep onset time was 19 minutes (± 16) and 14 minutes (± 21) for the PSG and Actiheart respectively (P=0.5).
- The mean (± SD) sensitivity for wake, LS, SWS and REM sleep was 36 % (± 24), 60 %(± 14), 54 %(±17) and 56 % (± 29) respectively. The mean (± SD) specificity for wake, LS, SWS and REM sleep was 99 % (± 4), 61 % (± 19), 83 % (±5) and 86 % (±7) respectively.
- No significant differences were present between the Actiheart and the PSG, in determining duration of LS, SWS and REM-sleep (Figure 1).
- In some patients there was overall good correlation between the two methods (Figure 2), whereas in others the correlation was poor (Figure 3)

Conclusion and perspectives

• Sleep onset time and sleep stage durations were not significantly different between the two methods.

• However, there was an overall low sensitivity for detection of wake, LS, SWS and REM-sleep with the combined actigraphy and heart rate variability monitor compared with PSG.

•Further software improvement can probably reduce the effects of the considerable individual differences that exist between subjects in the tone of the autonomic nervous system during sleep.

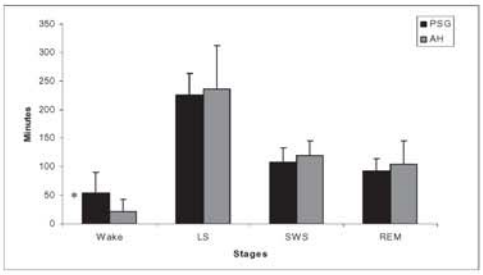

Figure 1: Comparison of individual stages between polysomnography (PSG) and the Actiheart®(AH). *=P< 0.05. No significant changes between the two recording methods where found in light sleep(LS), slow wave sleep (SWS) and REM-sleep.

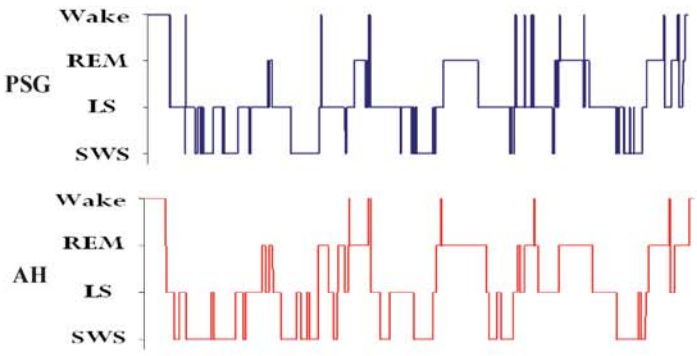

Figure 2: Example of subject with overall good correlation between polysomnography(PSG) and Actiheart® (AH).Recording started at 23:30 h and ended 07:30 h.

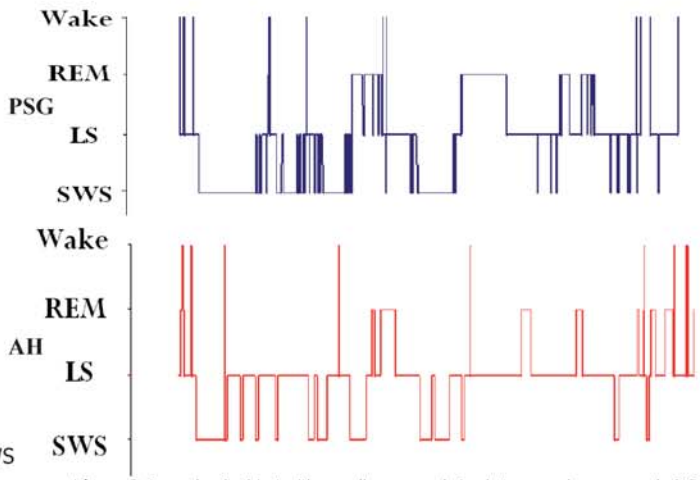

Figure 3: Example of subject with overall poor correlation between polysomnography(PSG) and Actiheart® (AH) Recording started at 23:30 h and ended 08:00 h.

ABSTRACT

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Conclusions:

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