Measuring Sleep: A comparison of Polysomnography (PSG), wrist actigraphy and a reduced PSG solution

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METHODOLOGICAL QUESTION: What are the most effective ways of measuring sleep in a clinical trial?

INTRODUCTION

Polysomnography (PSG) is the gold standard for measuring sleep in clinical trials of CNS-active compounds. However, attaching multiple electrodes on the scalp and body demands experience and time. Hence, PSG recordings usually are limited to being conducted in a sleep lab. Alternative solutions that allow e.g. home recordings are needed.

Actigraphy is one such solution based on small wrist-watch-like devices that monitor the intensity of wrist movement. Validated computerized algorithms transform the recorded activity scores into sleep-wake-scores and allow the calculation of sleep variables such as Total Sleep Time or Sleep Efficiency.

Another approach is to simplify standard PSG by reducing the number of EEG electrodes. In this study full PSG, reduced PSG and actigraphy were recorded simultaneously to find out more about the validity of alternative sleep measurements.

METHODS

20 healthy subjects (aged 20 – 29 years) participated in the study.

A reduced montage including 2 EOG channels, and wrist movement via an activity monitor (MotionWatch 8, CamNtech, Cambridge UK) were recorded for 5 consecutive nights. During the first night, a standard PSG was also recorded.

PSG recordings were analyzed using a validated computer assisted scoring system (Anderer et al. 2010) or a modified version thereof. Actigraphy data was analyzed into Sleep-Wake scores using validated computerized algorithms. The calculated target variables included total sleep time (TST), sleep efficiency (SE), Wake after sleep onset (WASO) and sleep latency (SLAT). For comparison between methods we calculated Spearman's correlation as a measure of agreement and the difference of means (t-test) as a measure for potential bias.

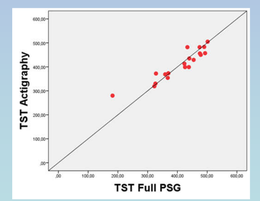
RESULTS

High correlations were found between (a) standard PSG, (b) reduced PSG, and (c) actigraphy regarding TST (r_{ab}=0.818, r_{ac}=0.920, p<0.001) with no significant bias (mean TSTa: 418.5, TSTb: 416.8, TSTc 411.5 minutes, p>0.05 for all pairwise tests). This was also true for the comparison of most other variables between full and reduced PSG, Actigraphy results, however, showed significantly shorter sleep latencies (mean SL_a.: 12.7, SL_b 13.2, SL_c: 6.8 minutes:, p<0.001). In addition, a trend towards higher values for WASO (mean $WASO_c$: 34.8 minutes) as compared to both types of PSG measurements ($WASO_a$: 26.7, $WASO_b$: 21.4 minutes) was observed.

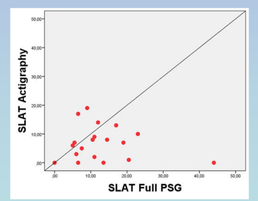
CONCLUSION

Both actigraphy and reduced PSG showed high agreement with standard PSG for variables reflecting sleep initiation and maintenance. Thus, for studies that focus on these variables actigraphy is a great alternative to PSG. Reduced PSG, on the other hand, is the best alternative for home studies focusing on sleep architecture as well as microstructural elements. Especially in studies with multiple PSG recordings per patient, reduced PSG may be the method of choice.

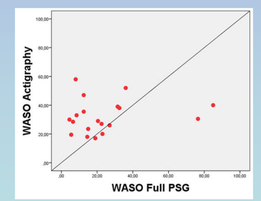
Total Sleep Time

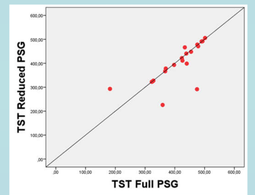


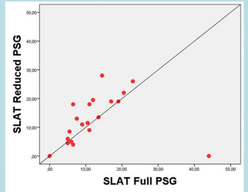
Sleep Latency

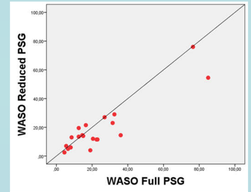


Wake after Sleep Onset









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DISCLOSURES

Georg Dorffner, Manuel Kemethofer, Silvia Parapatics, Erna Loretz and Georg Gruber are employees and shareholders of The Siesta Group, a service provider for measuring electrophysiological signals including sleep in **clinical trials.**

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