

Session 4

Biomedical Application

A radiofrequency biomotion detector for the recognition of sleep and sleep disordered breathing

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Abstract

Sleep disordered breathing has a high prevalence. There new methods are developed for an unobtrusive diagnosis at home or at places outside of regular sleep medicine centers. This study compares the performance of non-contact sleep measurement devices for measuring sleep parameters in subjects against polysomnography, and to assess their relative performance.

The devices compared to each other were two non-contact radio-frequency biomotion sensors (SleepMinder and HSL-101) and a wrist worn actigraphy system (Actiwatch). Stuides were carried out in the sleep lab with polysomnography in 20 normal subjects. All recordings were done with simultaneous assessment of relevant sleep parameters. The parameters measured for sleep were total sleep time (TST), sleep efficiency (SE), sleep onset latency (SOL) and wake after sleep onset (WASO). The per-epoch agreement level for sleep/wake distinction was evaluated.

The TSTs reported by the three devices were 426 ± 34 , 434 ± 22 , and 441 ± 16 mins, for the SleepMinder, HSL-101 and Actiwatch, respectively, against PSG reported TST of 391 ± 49 mins. The SOLs were 10 ± 10 , 5 ± 6 and 3 ± 2 mins for the SleepMinder, HSL-101 and Actiwatch, respectively against PSG SOL of 19 ± 13 mins. The WASO times were 46 ± 33 , 43 ± 22 , and 38 ± 17 mins, as against PSG-reported 69 ± 46 mins. All three devices had a statistically significant bias to overestimate sleep time and underestimate WASO and SOL compared to PSG. The performance of the three devices was basically equivalent, with only minor inter-device differences. The overall per-epoch agreement levels were 86% for the Sleepminder, 86% for the HSL-101 and 85% for the Actiwatch.

Non-contact biomotionsensors for sleep recordings yield reasonable estimates for sleepparameters. We observed an over estimation of sleep. The radio-frequency biomotion sensors provided similar accuracies for sleep/wake determination in normal subjects as actigraphy. and slightly improved estimates of Total Sleep Time, SOL and WASO.

Keywords: *Biomotion sensor, Sleep recording, sleep apnea, portable sleep monitoring, actigraphy*