

Validation of the new actigraphy system SOMNOwatch® for the measurement of periodic leg movements

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Introduction: Activity monitoring of leg or foot movements by motion detection systems (e.g., actigraphs) have been described as valid tools to assess periodic leg movements (PLMs). New devices like the SOMNOwatch® (Somnomedics, Kist, Germany) are in need for validation. According to the new standards of the World Association of Sleep Medicine (WASM, Zucconi et al., Sleep Med 2006;7:175-183), simultaneous comparison of the actigraph recordings with blind scoring of a standard EMG assessment of the events is required for validation.

Objective: We report correlations between EMG measures (as part of polysomnography, SOMNOscreen® from SOMNOmedics GmbH) and actigraphy measures with

overall rates of periodic leg movements (PLMs) for full nights as well as for hourly intervals per night.

Methods: SOMNOwatch is a miniaturized and waterproofed actimeter which records the acceleration in x,y, and z - direction simultaneously as well the position and the ambient light. Recordings with EMG and actigraph were derived from both legs. To record both legs simultaneously, two SOMNOwatch devices were synchronized, one on each leg. The PLM-Index including PLMs during sleep and wake was used for analysis. Both legs were analyzed separately and in a combined analysis using the SOMNOwatch software "Domino®" to determine leg-matched PLMs. The same procedure was used for the analysis of EMG recordings dur-

ing polysomnography (derived from the anterior tibialis muscles). A 30 minute period per night was randomly chosen for simultaneous event-to-event assessment in PSG and actigraphy. Pearson correlations were calculated for the number of PLMs including PLM during sleep (PLMS) and when awake during time in bed (PLMW).

Participants: One sleep night each was recorded from 19 consecutive patients of our sleep laboratory. 12 patients suffered from RLS, 7 patients had other sleep disturbances.

Figure 1: Example. The figure shows the hypnogram across the total night (above) of one RLS patient. For an identical 30-minute interval, the EMG recordings (anterior tibialis muscle) from the left and right leg during PSG (center), and the XYZ movements of the leg activity meter (below) are presented

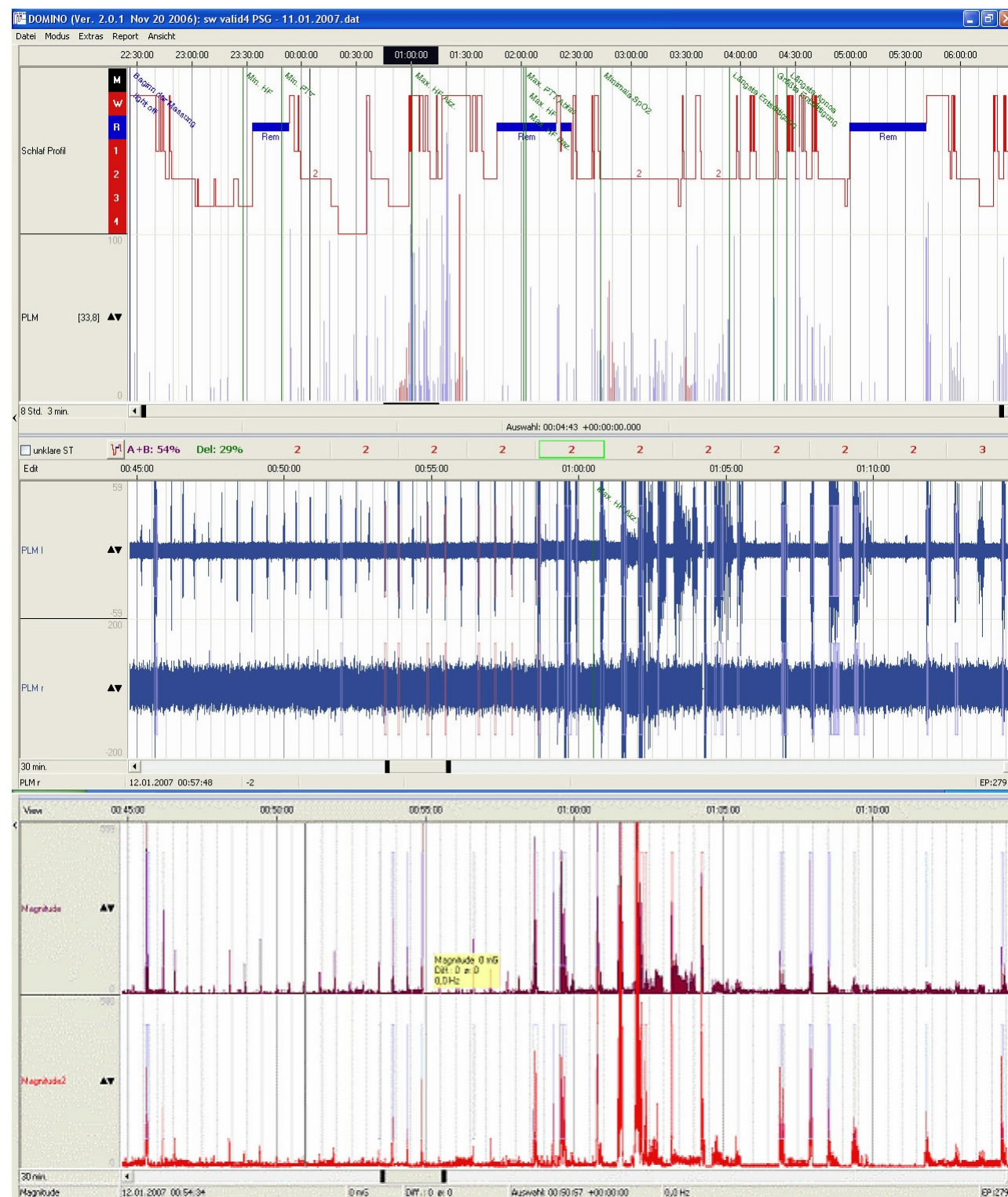
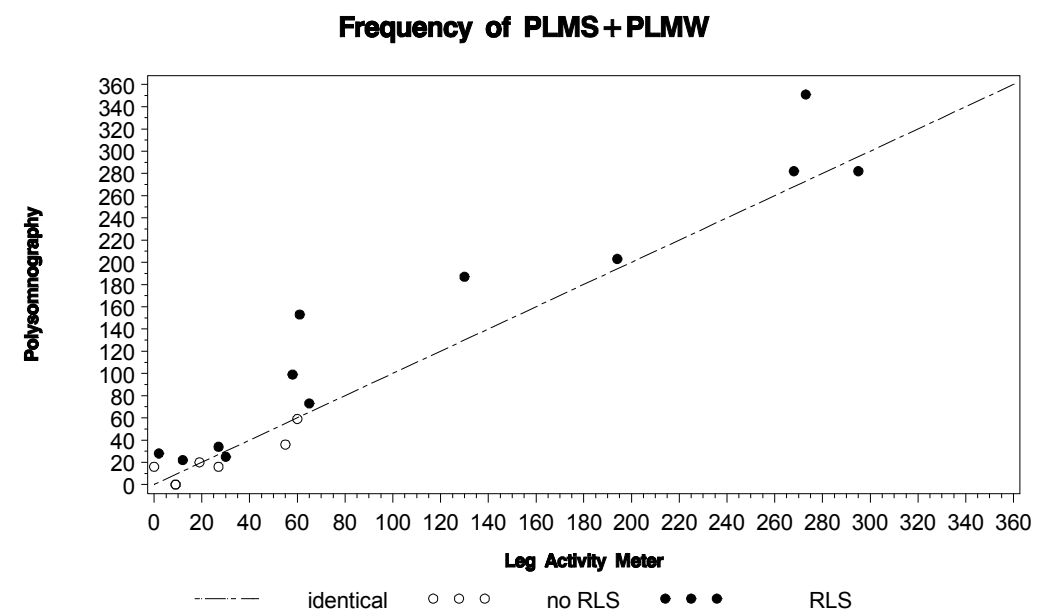


Figure 2. Frequency of PLMs (leg-matched) as derived from EMG recordings during PSG (vertical axis) and XYZ-movements with the leg activity meter (horizontal axis) for the total night



Results: Both methods correlated high with $r=0.962$ ($p<.0001$) for PLMS + PLMW during the total night. The concordance of simultaneous 1 to 1 comparisons of the recordings from both methods varies between 91 and 99% (analysis is still ongoing).

Conclusion: The leg activity meter under investigation (SOMNOwatch®) showed sufficient agreement with the EMG measures from polysomnography in this study. This motion detector approximately meets the same scoring criteria as for the EMG signal.

It allows the simultaneous measurement of leg movements from both legs and provides a validated software for leg-matched determination of PLMs (Domino®). The device includes a measure for body position to discriminate time in bed and out of bed.

We recommend the use leg activity meters primarily for recording of leg movements in the patients home environment or in experimental settings like the Suggested Immobilization Test (SIT). Any assessment should be based on measures from both legs.

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Conflict of interest: The leg activity meter SOMNOwatch is distributed by the company of Dr. Küchler. No financial support was provided to Dr. Benes and Dr. Kohnen for conducting this study.