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Does the Low Power Mode of the Actigraph GT3X+ Accelerometer Influence the Device Output in Sleep Research in Healthy Subjects?

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Abstract and Objective

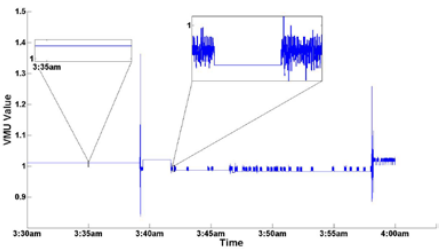
We measured lower limb activity by means two, above each ankle vertically aligned GT3X+ accelerometers in 4 healthy adults during a single night. Triaxial raw data vector magnitude units (VMU) were recorded at 100 Hz, in order to compare two different modes of operation (i.e. low power mode (LPM) on vs. off).

Keywords:

Sleep research, Actigraphy, GT3X+, Low power mode

Introduction

Polysomnography (PSG) is the gold standard in sleep research but it requires complex examinations in the laboratory. Alternatively, accelerometers with proprietary data representations were shown to be a valid diagnostic tool. As recent devices support raw data recordings, the GT3X+ (Actigraph) was used in a sleep study. However, after short periods of inactivity (i.e. 10 seconds) the device was found to reduces the sampling rate to 1 Hz due to the activation of a low power mode (LPM). Therefore, we sought to compare raw data recordings in both modes of operation (i.e. LPM on vs. off).



Materials and Methods

Activity was measured by means of actigraphy during a single night in 4 healthy adults (2 females, 2 males, 23-58y). Participants recorded bed- and wake-up time and wore two vertically aligned accelerometers (GT3X+, Actigraph) in the lower region of the tibia, close to the ankle of both legs. The devices were attached using tape (see Figure 1) and used with firmware version 2.0.0. The GT3X+ is a small and lightweight (4.6*3.3*1.5 cm³, 19 grams) MEMS device, which records accelerations in a dynamic range of ±6g, sampled at a frequency of up to 100 Hz. The device output with the LPM mode turned on was compared to the output with it turned off for each leg separately using descriptive statistics (median, interquartile range, sum). Additionally, the inter-device coefficient of variation (CV_{inter}) was calculated in %, as well as Spearman's rank correlation coefficient and the intraclass correlation coefficient (ICC), based on a two-way random-effects model for absolute agreement.

Results

The results from the direct comparison of the VMU output of all devices in all 4 subjects are summarized below, including the total number of detected peaks, the number of mean crossings and the ICC. Spearman's rank correlation coefficient showed weak to moderate correlations for both, left ($0.15 < r < 0.47$) and right ankle ($-0.15 < r < 0.69$, both $p < 0.01$).

Ankle	LPM mode	VMU [IQR]	∑ Peaks	∑ Mean Crossings	ICC
Left	Off	0.9989 [0.0097]	3617216	2092244	0.04 < ICC < 0.34
Left	On	1.0049 [0.0074]	580915	282830	
Right	Off	1.0003 [0.0146]	3575285	1319976	0.04 < ICC < 0.32
Right	On	1.0030 [0.0076]	710706	282975	

Conclusion

In this work, the difference in the raw acceleration output was compared. Our results indicate that the total VMU output is not affected by the LPM of the GT3X+ for measurements during nights. However, differences in the acceleration signals were found, likely affecting minute-by-minute comparisons.