Accuracy of Fitbit Charge 4 for Measuring Heart Rate in Parkinson's Patients During Intense Exercise

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Abstract : Parkinson's disease (PD) is the second most common neurodegenerative disease and affects approximately 1% of the world's population. Increasing evidence suggests that aerobic physical exercise can be beneficial in mitigating both motor and non-motor symptoms of the disease. In a recent pilot study of the role of exercise on PD, we sought to confirm exercise intensity by monitoring heart rate (HR). For this purpose, we asked participants to wear a chest strap heart rate monitor (Polar Electro Oy, Kempele). The device sometimes proved uncomfortable. Looking forward to larger clinical trials, it would be convenient to employ a more comfortable and user friendly device. The Fitbit Charge 4 (Fitbit Inc) is a potentially comfortable, user-friendly solution since it is a wrist-worn heart rate monitor. Polar H10 has been used in large trials, and for our purposes, we treated it as the gold standard for the beat-to-beat period (R-R interval) assessment. In previous literature, it has been shown that Fitbit Charge 4 has comparable accuracy to Polar H10 in healthy subjects. It has yet to be determined if the Fitbit is as accurate as the Polar H10 in subjects with PD or in clinical populations, generally. Goal: To compare the Fitbit Charge 4 to the Polar H10 for monitoring HR in PD subjects engaging in an intensive exercise program. Methods: A total of 596 exercise sessions from 11 subjects (6 males) were collected simultaneously by both devices. Subjects with early-stage PD (Hoehn & Yahr <=2) were enrolled in a 6 months exercise training program designed for PD patients. Subjects participated in 3 one-hour exercise sessions per week. They wore both Fitbit and Polar H10 during each session. Sessions included rest, warm-up, intensive exercise, and cool-down periods. We calculated the bias in the HR via Fitbit under rest (5min) and intensive exercise (20min) by comparing the mean HR during each of the periods to the respective means measured by the Polar (HRFitbit – HRPolar). We also measured the sensitivity and specificity of Fitbit for detecting HRs that exceed the threshold for intensive exercise, defined as 70% of an individual's theoretical maximum HR. Different types of correlation between the two devices were investigated. Results: The mean bias was 1.68 bpm at rest and 6.29 bpm during high intensity exercise, with an overestimation by Fitbit in both conditions. The mean bias of Fitbit across both rest and intensive exercise periods was 3.98 bpm. The sensitivity of the device in identifying high intensity exercise sessions was 97.14 %. The correlation between the two devices was non-linear, suggesting a saturation tendency of Fitbit to saturate at high values of HR. Conclusion: The performance of Fitbit Charge 4 is comparable to Polar H10 for assessing exercise intensity in a cohort of PD subjects. The device should be considered a reasonable replacement for the more cumbersome chest strap technology in future similar studies of clinical populations.

Keywords : fitbit, heart rate measurements, parkinson's disease, wrist-wearable devices