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Title: The PowerGlove: Assessment of hand and finger movements in Parkinson's disease patients.

Objective: The aim of the study is to test whether the PowerGlove (PG), an instrumented glove which consists of inertial (accelerometers and gyroscopes) and magnetic sensors, is a valid and reliable instrument to measure different degrees of hand motor impairments in patients with Parkinson's disease (PD).

Background: Assessment of hand movements is an important part of the motor function section of the Unified PD Rating Scale (UPDRS). Unfortunately, the assessment often varies per physician and is highly dependent on experience. This subjective nature sometimes makes it hard to interpret the UPDRS correctly. Recently, the University of Twente developed the PG which enables accurate and ambulant measurement of hand and finger movements (Fig. 1A)[1]. Application of the PG during the clinical scoring will enable more accurate observation of hand function and quantification of the PD motor symptoms.

Methods: We plan to include 35 PD patients. We will assess the hand movements of the patients in medication on/off state with the PG during 7 UPDRS items, i.e. tremor at rest, action and postural tremor, finger tapping, rapid opening/closing of the hand, pro/supination of the hand, and wrist rigidity. Sensor units of the PG are attached to the dorsal side of the left hand and on the finger segments of the thumb, index and middle finger. One additional PG sensor is attached to the forearm to measure the wrist angle. A force sensor is used to measure the force which is applied to passively flex the wrist of the patient. Prior to measurement, an anatomical calibration procedure is performed to determine the sensor-to-segment coordinate systems.

Results: Visual inspection of preliminary results showed there were notable differences in the recorded data within a patient in medication on/off state (Fig 1B-D).
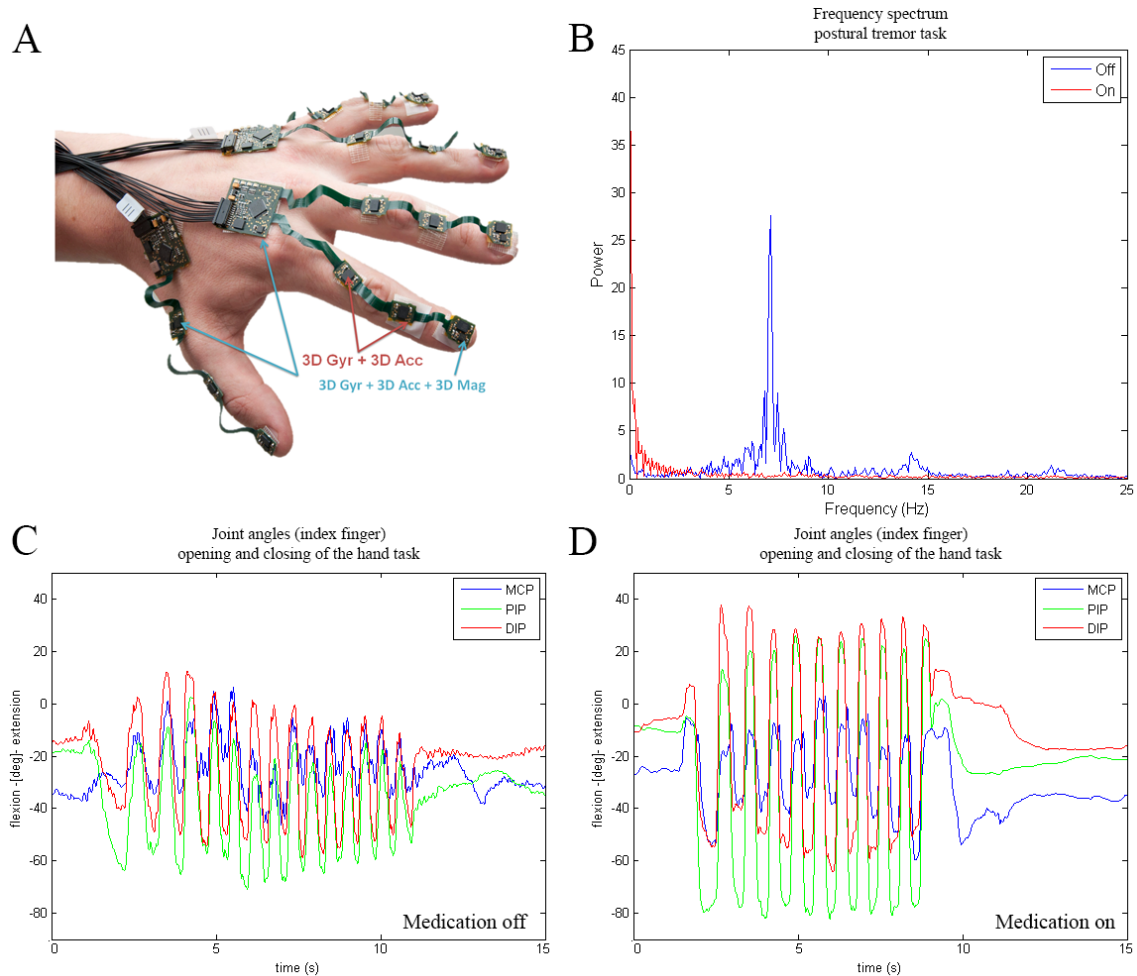
Figure 1, (A) the PG, (B) an example of the power spectrum from acceleration data during the postural tremor task, (C-D) the joint angles of the index finger during rapid opening/closing of the hand (on/off medication).

Conclusions: The results indicate that the PG enables to quantitatively detect differences in the clinical state of the patient. In the next phase of this study, parameters need to be found which describe the performance of UPDRS tasks and include these in the group analyses of the 35 PD patients.

[1]Noort, J. et al. [quot]Applications of the PowerGlove for measurement of finger kinematics.[quot] BSN Workshops IEEE, 2014