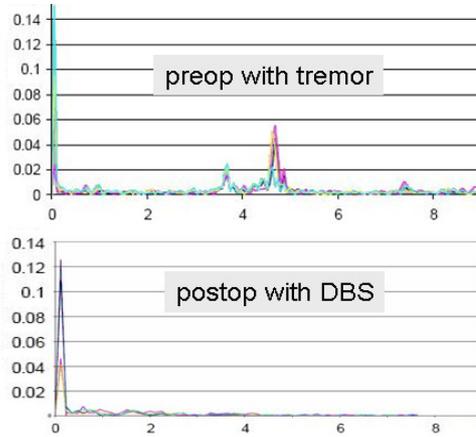


# Deep Brain Stimulation

## Motion Analysis in Parkinson patients



Deep Brain Stimulation (DBS) has proved to be a highly efficient treatment of symptoms related to Parkinson's disease (PD). Assessing the severity of tremor for example is important especially before, during and after surgery to evaluate the patient state, with and without DBS, and to quantify clinical changes. Current methods such as the Unified Parkinson's Disease Rating Scale (UPDRS) are mainly semi-quantitative (clinical rating scales relying on ordinal ratings anchored on descriptive terms such as "mild", "moderate", "severe") and not objective. The objective of the present work was to develop a system based on an accelerometer fixed to the patients wrist to quantitatively evaluate the patient state.

### Method

The Freescale ZSTAR3 Sensor (digital 3D axes accelerometer) has been chosen because of the supplied software allowing multiple data storage formats and because of its wireless data transmission. To protect the sensor and to allow its fixation to patients wrist, a special case had to be designed and printed out with Rapid Prototyping. The most suitable scanning frequency was 60 Hz. Furthermore a software was developed (Java) to read and convert the measured data. For each measurement the integral (derivation between 0.6 and 16 Hz), the middle derivation and the sum of the products of each derivation and frequency were calculated.

To test the systems reactivity we first made measurements on a hydropulser, i.e. with defined movements. Second, we performed measurements on a patient prior and after a DBS operation and we

compared the results.

### Discussion

The designed case with its fixation proved to be adapted for these kinds of measurements. The tests showed that the sensor can be operated in a fairly straightforward way and that the written software works satisfactorily. The frequency analysis of the patient data clearly confirmed the reduction of tremor during stimulation compared to the preoperative measurements. The next step will be to refine the data analysis and to look for other quantitative parameters in order to identify further pathologic movements of Parkinson patients in addition to tremor. In the long term such a system should be used to add quantitative information about the improvement of the patient state to the clinical evaluation

### Ongoing projects in the field of DBS:

- Refinement of movement pattern analysis
- Improvement of the intraoperative patient data visualisation during the DBS implantation procedure

### Literatur:

Legros A., Diakonova N. Cif L., Hemm S. et. al. Accelerometric measurement of involuntary movements during pallidal deep brain stimulation of patients with generalized dystonia. *Brain Research*. 2004; 64(4): 363-9.

Hemm S., Caire F., Coste J. et al. Postoperative control in DBS of the subthalamic region: the contact membership concept. *Int J CARS*, 2008;3(1-2):69-77.

Hemm S., Mennessier G., Vayssière N. et al. DBS in Movement Disorders: Stereotactic Co-Registration of Electric Field 2D Modeling and MRI. *J Neurosurg*. 2005;103:949-55.

We invite you to explore and develop new ideas together with us!

Simone Hemm  
T : +41 61 4674-796  
M: simone.hemm@fhnw.ch

Erik Schkommodau  
T : +41 61 4674-246  
M: erik.schkommodau@fhnw.ch