The possibilities of clinical assessment of patients with Parkinson's disease after Deep Brain Stimulation (DBS) based on Motion Capture data. Preliminary results.

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Introduction: Deep Brain Stimulation (DBS) is the method of symptomatic treatment of selected Parkinson's disease (PD) patients. The evaluation of final effect of DBS is problematic, because subjective patient's assessment may differ from clinician's objective assessment. The aim of the study is the analysis of PD-DBS patients' motor ability based on Motion Capture (MOCAP) technology.

Methods: PD patients after DBS, treated in the Department of Neurology and Department of Neurosurgery of Medical University of Silesia in Katowice, Poland are evaluated in Human Motion Laboratory in Polish-Japanese Institute of Information Technology in Bytom, Poland. Motion ability is evaluated in four conditions: 1.MedicationOFFStimulationOFF,2.MedicationOFFStimulationON,3.MedicationONStimulationOFF, 4.MedicationONStimulationON with MOCAP technology: using Vicon system with 10 NIR cameras and 39 reflective markers placed on body segments, Ground Reaction Force (GRF) with two Kistler platforms, Dynamic Electromyography System (EMG) and video recording of four video cameras with HD 1080. Neurologist evaluate motor symptoms with Unified Parkinson's Disease Rating Scale (UPDRS) part III. Six tasks are analysed: turnover, walking, sway ratio analysis on force platform, pull-test, leg agility, arising from chair. Gait coefficients were evaluated: gait velocity, stride length, ASA (Arm Swing Asymetry), ASS (Arm Swing Size), DI (Decompositon Index) and AST (Asymetry in Stride Time) to reflect asymetry of lower and upper limbs between left and right side during gait. Results were statistically analyzed.

Results: The preliminary results after examining first patient are presented. UPDRS part III scores were: MedOFFStimOFF-53; MedOFFStimON-23; MedONStimOFF-10; MedONStimON-8. All coefficients revealed significant improvement of motion ability and diminution of tremor when stimulator is ON. Analysis of DI showed statistically significant difference between MedOnStimON and two other sessions – MedONStimOFF and MedONStimON. These differences are joint specific and can be observed only for two pairs, knee vs ankle and ankle vs hip. Only sessions when patient was ON medications provide p-values < 0.05. We do not observe statistically significant changes in MedOFFStimON, but we notice improvement of motor skills in MedONStimON. In GFR evaluation, standing on one foot in MedOFFStimOFF

evoked high frequency oscillations recorded by the platform, which were not observed in MedONStimON.

Conclusions: The effect of medication and electrical DBS are complex and their interactions are not only side specific but they may be also a joint specific. Isolated DBS stimulation will not provide significant reduction in UPDRS scores as in DI. Only concomitant pharmacological and stereotactic treatment may have the most beneficial effect on patient's motor ability.

This work was supported by The National Science Center (NN518289240 A. Polański; NN516475740 K. Wojciechowski.), by the European Union from the European Social Fund (grant agreement number: UDA-POKL.04.01.01-00-106/09, M. Stawarz).