



Quantitative rigidity evaluation during deep brain stimulation surgery - a preliminary study

Simone Hemm-Ode, Dagmar Gmünder, Ashesh Shah, Ulla Miguel,
Jean-Jacques Lemaire, Jerome Coste

► To cite this version:

Simone Hemm-Ode, Dagmar Gmünder, Ashesh Shah, Ulla Miguel, Jean-Jacques Lemaire, et al.. Quantitative rigidity evaluation during deep brain stimulation surgery - a preliminary study. 46th annual conference of the German Society for Biomedical Engineering, German Society for Biomedical Engineering, Sep 2012, Iéna, Germany. pp.698, 10.1515/bmt-2012-4324 . hal-01871549

HAL Id: hal-01871549

<https://uca.hal.science/hal-01871549>

Submitted on 26 Nov 2018

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Quantitative rigidity evaluation during deep brain stimulation surgery - a preliminary study

Simone Hemm-Ode, Institute for Medical and Analytical Technologies, University of Applied Sciences Northwestern Switzerland, Muttens, Switzerland,
simone.hemm@fhnw.ch

Dagmar Gmünder, Institute for Medical and Analytical Technologies, University of Applied Sciences Northwestern Switzerland, Muttens, Switzerland,
Dagmar.gmuender@gmail.com

Ashesh Shah, Institute for Medical and Analytical Technologies, University of Applied Sciences Northwestern Switzerland, Muttens, Switzerland,
ashesh.shah@fhnw.ch

Miguel Ulla, Neuro-Psycho-pharmacologie des Systèmes dopaminergiques sous-corticaux, Université d'Auvergne; Service de Neurologie, CHU de Clermont-Ferrand, Clermont-Ferrand, France,
mulla@chu-clermontferrand.fr

Jean- Jacques Lemaire, Image-Guided Clinical Neuroscience and Connectomics - ISIT, Université d'Auvergne; Service de Neurochirurgie, CHU de Clermont-Ferrand, Clermont-Ferrand, France,
jjlemaire@chu-clermontferrand.fr

Jérôme Coste, Image-Guided Clinical Neuroscience and Connectomics - ISIT, Université d'Auvergne; Service de Neurochirurgie, CHU de Clermont-Ferrand, Clermont-Ferrand, France,
jcoste@chu-clermontferrand.fr

Introduction

Deep brain stimulation (DBS) is a common neurosurgical procedure for relieving movement related disorders such as Parkinson's disease. DBS extends uncertainties associated with suboptimal target selection. Our aim was to evaluate the feasibility to objectively assess clinical effects obtained during intraoperative test stimulation based on acceleration measurements of the neurologist's wrist.

Methods

One patient referred for bilateral DBS-implantation for the treatment of Parkinson's disease was included in the study. A 3-axis accelerometer was fixed on the neurologist's wrist during intraoperative test stimulation. While the intensity of electric current used for stimulation was increased, the neurologist continuously moved the patient's wrist to determine the moment of and the amplitude at rigidity release ("stimulation threshold"). For each test stimulation position, different mathematical features were determined and statistically compared a) for the time period before reaching the stimulation threshold that had been identified by the neurologist and b) after reaching the threshold. We then visually identified the stimulation thresholds that would have been chosen based on the acceleration signal alone and compared them to the ones subjectively identified by the neurologist.

Results

A statistically significant change in rigidity ($p < 0.01$) could be identified for signal entropy, energy and standard deviation. The signal energy seemed to be the most sensible parameter showing a higher percentage change compared to the initial clinical state. The stimulation threshold identified based on the acceleration signal was in most cases lower than the subjectively determined one.

Conclusion

The present study has demonstrated the feasibility to perform rigidity assessments from the acceleration signal of the wrist. The stimulation threshold was confirmed by the acceleration measurements, and it seems that the measurements were more sensitive than the neurologist's evaluation. Results have to be confirmed by a larger clinical study.