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Ashesh Shah, Jerome Coste, Jean-Jacques Lemaire, Erik Schkommodau,
Simone Hemm-Ode

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Quantifying changes in patient tremor using accelerometer during deep brain stimulation surgery

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

J. Coste, Image-Guided Clinical Neuroscience and Connectomics - ISIT, EA 7282, Université d'Auvergne ; Service de Neurochirurgie, CHU de Clermont-Ferrand, Clermont-Ferrand, France, jcoste@chu-clermontferrand.fr

J. J. Lemaire, Image-Guided Clinical Neuroscience and Connectomics - ISIT, EA 7282, Université d'Auvergne ; Service de Neurochirurgie, CHU de Clermont-Ferrand, Clermont-Ferrand, France, jjlemaire@chu-clermontferrand.fr

E. Schkommodau, Institute for Medical and Analytical Technologies, University of Applied Sciences Northwestern Switzerland, Muttenz, Switzerland, erik.schkommodau@fhnw.ch

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

Objective

Deep brain stimulation (DBS), a routine neurosurgical treatment for movement related disorders, has few uncertainties associated with suboptimal target selection. Our aim is to evaluate the feasibility to objectively assess clinical effects on tremor obtained during intraoperative test stimulation based on acceleration measurements.

Methods

Five patients (1 Parkinson's disease and 4 Essential Tremor) referred for bilateral DBS-implantation were included in the study. Tremor was evaluated by fixing a 3-axis accelerometer on the patient's wrist during intraoperative test stimulation. The accelerometer data was post-operatively analyzed, statistical features were extracted and effective stimulation amplitudes (thresholds) identified (Fig 1). Wilcoxon two sided rank test was used to identify significance of changes in the statistical values before and at thresholds identified by medical experts and those before and at thresholds found using acceleration data alone.

Results

Out of the statistical features identified, the standard deviation, signal energy and peak frequency amplitude were the most sensitive to changes in patient tremor. The thresholds identified based on acceleration data were lower in 65% of the cases compared to the one chosen by the neurologist. The results of the statistical test showed higher significance for the changes at the acceleration thresholds than the ones identified subjectively.

Conclusion

The results of this study suggest that acceleration measurements are very sensitive to tremor changes. This simple method may provide additional support to the neurosurgeon in selecting the optimal target.

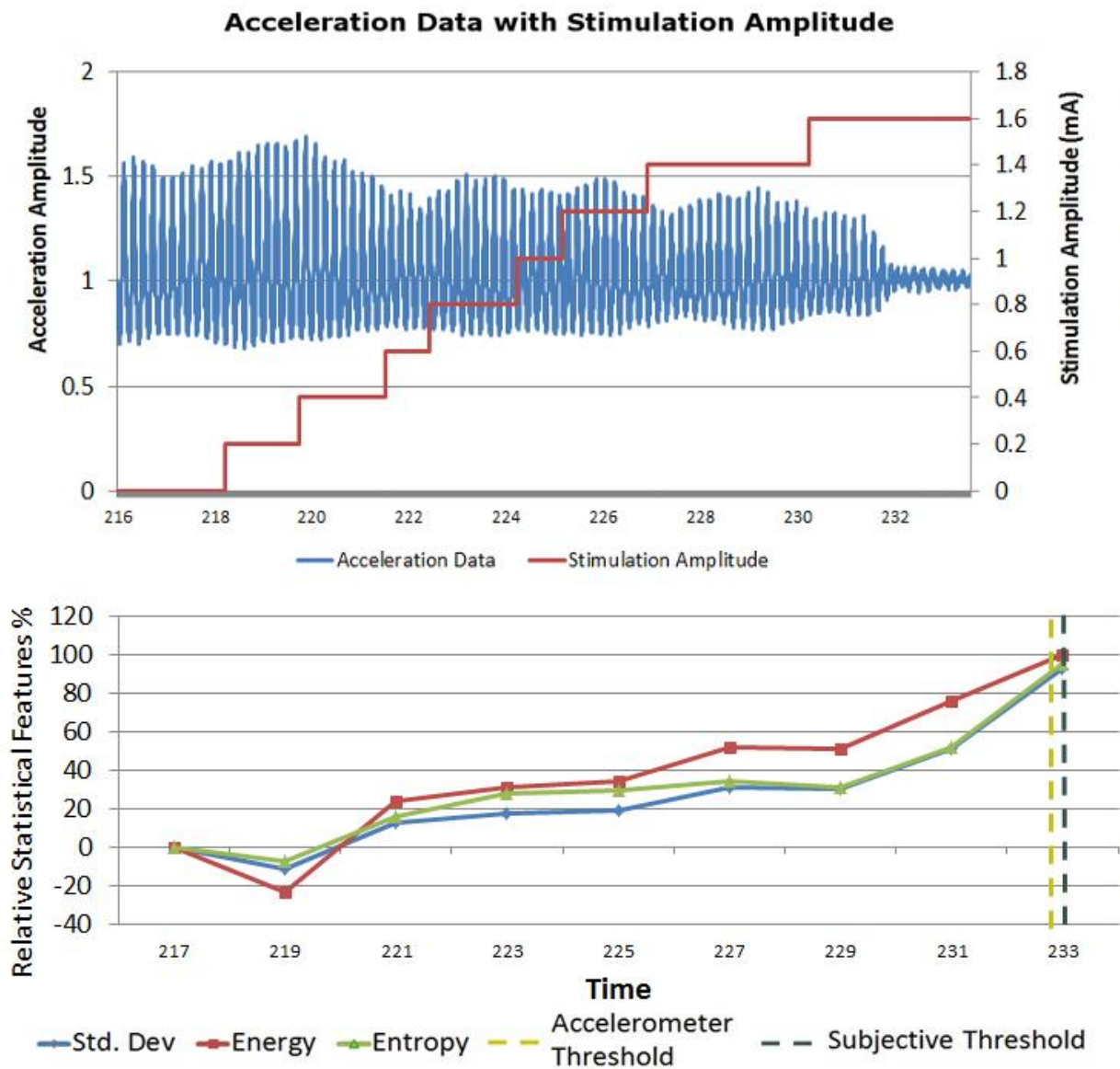


Figure 1 Recorded acceleration data and extracted statistical features.