



HAL
open science

Learning more about the optimal anatomical position for deep brain stimulation in essential tremor patients: 3d visualisation of intraoperative stimulation test results

Ashesh Shah, Fabiola Alonso, Jean-Jacques Lemaire, Daniela Pison, Jerome Coste, Karin K Wårdell, Erik Schkommodau, Simone Hemm-Ode

► To cite this version:

Ashesh Shah, Fabiola Alonso, Jean-Jacques Lemaire, Daniela Pison, Jerome Coste, et al.. Learning more about the optimal anatomical position for deep brain stimulation in essential tremor patients: 3d visualisation of intraoperative stimulation test results. 17th Quadrennial Meeting of the World Society for Stereotactic and Functional Neurosurgery, WSSFN, Jun 2017, Berlin, Germany. pp.186. hal-01654252

HAL Id: hal-01654252

<https://uca.hal.science/hal-01654252>

Submitted on 7 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.

Learning more about the optimal anatomical position for deep brain stimulation in essential tremor patients: 3d visualisation of intraoperative stimulation test results

Authors:

Ashesh Shah (1,S), Fabiola Alonso (2), Jean-Jacques Lemaire (3),
Daniela Pison (2), Jérôme Coste (3), Karin Wårdell (2),
Schkommodau Erik (1), Simone Hemm-Ode (1)

1. Institute for Medical and Analytical Technologies, University of Applied Sciences and Art Northwestern Switzerland, Muttenz, SWITZERLAND

2. Department of Biomedical Engineering, Linköping University, Linköping, SWEDEN

3. Centre Hospitalier Universitaire de Clermont-Ferrand, Image-Guided Clinical Neurosciences and Connectomics (EA 7282, IGCNC), Université d'Auvergne, Clermont-Ferrand,FRANCE

S. Speaker

Keywords: Deep Brain Stimulation, Essential Tremor, Simulations, Intraoperative Visualization

Abstract:

Introduction: The outcome of deep brain stimulation (DBS) depends heavily on the position of the implanted lead. After a preoperative anatomical planning, most groups collect numerous intraoperative data such as therapeutic effects induced by stimulation tests. To choose the final implant position, physicians “mentally” visualise all available data. The aim of the present work was to develop a method visualising intraoperative stimulation test results, patient’s images, electric field (EF) simulations for the patient-specific stimulation conditions and the corresponding therapeutic effects quantitatively evaluated by accelerometry. The application to five essential tremor (ET) patients should give a first idea about the optimal target position.

Methods: In Clermont-Ferrand University Hospital the anatomic target structure and the neighbouring structures were manually outlined, a target and a trajectory defined and two parallel trajectories per hemisphere intraoperatively evaluated. Stimulation tests were performed at 7 to 8 positions per trajectory and several stimulation current amplitudes. The therapeutic effect was evaluated using a previously published method based on accelerometry. Finite element models and simulations were performed for up to three stimulation amplitudes per position and EF isosurfaces (0.2V/mm) were extracted. For the 3D visualization of the numerous overlapping isosurfaces, we generated “improvement maps” by assigning to each voxel within the isosurfaces the highest tremor improvement. Those maps were visualized together with anatomical images, delineated structures and trajectories (Paraview, Kitware Inc). The method was applied to 5 ET patients implanted in the ventro-intermediate nucleus of the thalamus (VIM). Results were analysed by the neurosurgeon regarding the optimal implant position. Results: The clinical teams were able to identify the optimal implant position for all patients with more ease and in less time compared to the routine discussion using pen and paper. Additionally, for 7 of the 9 improvement maps, the highest improvement region was found to be in the posterior subthalamic area, inferior and posterior to the VIM.

Conclusion: Improvement maps assist the clinicians in determining the optimal implant location of the chronic DBS lead. Results support findings of other studies that the fibre tracts in the posterior subthalamic area like prelemniscal radiations may be responsible for alleviating tremor in ET patients.