PAPER OF THE MONTH 04/2022

TRR 295 ReTune

Optimal deep brain stimulation sites and networks for cervical vs. generalized dystonia.

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PNAS. 2022 Apr 5; 119(14): e2114985119. doi: 10.1073/pnas.2114985119. PMID: 35357970.

Dystonia is a rare neurological disorder, which is characterized by involuntary, twisting and distorting movements and postures. People with dystonia may be limited in their ability to perform activities of daily living, such as drinking, walking and speaking. In Germany, approximately 160,000 people have dystonia. The condition is subdivided into generalized dystonia, which affects the entire body, and focal dystonia, which is limited to specific parts of the body. The latter category includes cervical dystonia, which affects the neck. The condition's underlying causes are not fully understood, but experts assume that symptoms are the result of faulty interactions between specific areas of the brain, which lead to abnormal signal transmission. Depending on the form of dystonia, involved, genetic defects may also play a role.

Building on top of a recent study by Martin Reich, the present study reanalyzed a total of 80 patients who had received treatment for either generalized or cervical dystonia at one of five different hospitals in Germany and Austria. After analyzing the electrodes' precise positions, we were able to generate computer models showing which brain networks were being modulated in each of the patients investigated. By mapping data on symptom improvements to their network models, we were then able to determine which of the identified networks were crucial to treatment success.

One key finding was that the optimal target for stimulation depends on the type of dystonia being treated. This means that optimal treatment outcomes were associated with specific connections between the thalamus and the pallidum. In patients with cervical dystonia, stimulation of a specific neural network, which also activated the head and neck region of the primary motor cortex, was associated with optimal outcomes. In contrast, for patients with generalized dystonia, beneficial effects were associated with stimulation of a different network, which projected to the entire primary motor cortex. On a more fine-grained level, connections in the posterior comb region mattered for cervical, while stimulation of ansa and fasciculus lenticulares mattered for generalized dystonia improvement.

Dr. Andreas Horn (MD, PhD)

Andreas Horn is a group leader within the Movement Disorder and Neuromodulation Unit at Charité, and is also director of deep brain stimulation (DBS) research within the Center for Brain Circuit Therapeutics at the Brigham & Women's Hospital and appointed to Harvard Medical School. Between Berlin and Boston, his group studies the impact of neuromodulation onto networks of the human brain.

Dr. Martin Reich (MD)

Martin Reich is a consultant neurologist and group leader at University Hospital Würzburg. His visualDBSlab tackles clinical questions related to DBS and the pathophysiology of movement disorders through computer visualisation, modelling and imaging with a multidisciplinary neuroscience team. He was awarded the David Marsden Award in 2021.

Dr. Siobhan Ewert (MD)

Siobhan Ewert studied medicine in Freiburg, Germany, and completed two postdoctoral fellowships at Harvard Medical School and Charité before leaving academia for work with the United Nations World Food Program. She now works as an entrepreneur supporting other women and women-owned small businesses to create success and financial abundance.

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