

Imaging brain connections can predict improvements in OCD patients after deep brain stimulation

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Deep brain stimulation (DBS) is a promising therapy for treatment-resistant obsessive-compulsive disorder (OCD). A first-of-its-kind

collaborative study led by researchers at Texas Children's Hospital, Baylor College of Medicine, and Brigham & Women's Hospital has found that mapping neural connections in the brains of OCD patients offers key insights that explain the observed improvements in their clinical outcomes after DBS. The study was published in *Biological Psychiatry*.

Neuropsychiatric disorders such as obsessive-compulsive disorder are a result of dysfunction across broad neural networks and typically involve brain domains responsible for cognitive and higher-order decision-making such as the prefrontal cortex.

"The goal of neuromodulatory therapies like DBS is to restore the functional balance within these networks. Since the extent of functional dysfunction in these networks varies between individuals, it is important to customize DBS surgery for each patient. To do that reliably, we first need to precisely map the [neural connections](#) involved in the specific condition and then understand how these connections are affected by DBS," said co-corresponding author Dr. Sameer Sheth, professor in the department of neurosurgery at Baylor College of Medicine, director of the Cain Foundation Labs, and principal investigator at the Jan and Dan Duncan Neurological Research Institute (Duncan NRI) at Texas Children's Hospital.

In 2020, a seminal study by Dr. Andreas Horn and his team at Brigham & Women's Hospital identified an "OCD response tract"—a white matter circuit that precisely mapped the specific fiber bundles and [brain regions](#) whose modulation by DBS could improve [clinical outcomes](#) in OCD patients. The present study is the first one to conduct blind testing of the OCD response tract model with the goal of developing a predictive "connectomic" model.

Connectomic imaging strategies such as white matter tractography—a

three-dimensional magnetic resonance imaging (MRI) technique that maps the location and direction of white matter bundles and their constituent fibers within the brain—are becoming increasingly reliable methods to identify these networks that inform surgeons where to implant DBS electrodes in the brain of the patient during surgery. Here, Sheth and colleagues used this approach to rank and conduct 'blind' comparison of clinical outcomes in ten OCD patients who had undergone a specific DBS procedure six months prior to the study.

DBS programming was performed by Dr. Wayne Goodman, Chair of the department of psychiatry at Baylor College, and patient outcomes were periodically assessed by Dr. Eric Storch, Vice Chair of psychology, for changes in the severity of their OCD and mood symptoms.

Then the Brigham & Women's Hospital (BWH) team led by Dr. Andreas Horn analyzed the [imaging data](#) and provided rank predictions based solely on the neuroimaging data and stimulation parameters. This team was not involved in DBS planning or programming and did not have prior knowledge of clinical outcomes. The outcomes predicted by the BWH team closely matched the actual clinical outcomes that the Baylor team observed in these patients.

"To our knowledge, this is the first example of such a collaborative 'blinded' team effort by two research centers to validate DBS therapy for a brain tract proposed on the basis of retrospective data," co-corresponding author, Dr. Horn added.

"This is also a big step in the continued optimization and improving the efficacy of DBS procedures that target this brain tract to treat OCD, even as efforts are underway to make this therapy more widely available to patients. Finally, this two-center 'blinded' approach could serve as a model for validating and optimizing DBS therapies for other neurological conditions in the future."

More information: Ron Gadot et al, Tractography-Based Modeling Explains Treatment Outcomes in Patients Undergoing Deep Brain Stimulation for Obsessive-Compulsive Disorder, *Biological Psychiatry* (2023). [DOI: 10.1016/j.biopsych.2023.01.017](https://doi.org/10.1016/j.biopsych.2023.01.017)

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