

Non-invasive brain stimulation helps stroke patients gain prolonged language recovery

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On July 2nd, *JoVE* will publish a video article showing the details of a technique developed by researchers to improve language function in stroke patients with chronic speech-language impairment.

Strokes occur when a brain clot blocks blood flow in <u>parts of the brain</u>, essentially starving groups of neurons of oxygen, which is necessary for normal function. Nearly 130,000 of the 795,000 strokes Americans suffer annually result in death, accounting for roughly 5% of deaths in the U.S. The remaining 665,000 <u>stroke patients</u> suffer a wide variety of side effects ranging from complete loss of motor function to loss of speech to a catatonic state. Because of the horrific nature of these cerebrovascular events and their consequences, many clinical researchers focus on prevention, rehabilitation and restoration of function for <u>stroke victims</u>.

A technique developed through these efforts utilizes <u>transcranial</u> <u>magnetic stimulation</u> (TMS) to improve <u>language function</u> in stroke patients with chronic aphasia. Patients who have undergone this procedure have previously reached a plateau in their ability to produce fluent language, despite signs of understanding and frustration at their inability to communicate.

"The heart of our work is to use non-invasive <u>brain stimulation</u>... to modulate cortical networks that we think are in flux. We think that those circuits in the brain do remodel and that we can tweak them further using non-invasive stimulation," explains Roy Hamilton, M.D., the co-



director of the Laboratory for Cognition and Neural Stimulation at the University of Pennsylvania Medical School. He continues, "For most people the <u>left hemisphere</u> plays a dominant role in our language capacity. The brain does have the capacity to reorganize itself and rework some of the network and geography that represents specific cognitive skills."

Transcranial magnetic stimulation was first successfully performed in 1985 by Anthony Barker and his colleagues in Sheffield, UK. The technique takes advantage of an aspect of physics derived from the Biot-Savart Law, which states that a current running through a wire generates a magnetic field. Because neurons act like electric wires in the brain, targeting populations of neurons with a magnetic field can modulate their function, making them either more or less reactive. Over the last 28 years TMS has been used in several fields of research but has only recently been used to treat stroke patients.

Initial results from work with a well curated population of stroke patients in Dr. Hamilton's laboratory demonstrate long-term improvement in language production after TMS stimulation. "Using our technique, we can take patients who are in the theoretical plateau period [in recovery] and cause continued improvement. We like to think about it as enhancing their language plasticity." Patients treated with TMS see an extended recovery, where not only will they experience immediate improvement, but they will also gain continued development of their language capacity months after treatment.

Dr. Hamilton is eager for his first *JoVE* article. "We were intrigued by *JoVE*'s video format and the underlying premise of the journal. There is so much to performing an experiment, in the doing, which is difficult to explain. We like that the journal has the potential to communicate how we do our experiments that might have been lost in a different format."



More information: Hamilton, R. H. et. al.; Utilizing Repetitive Transcranial Magnetic Stimulation to Improve Language Function in Stroke Patients with Chronic Non-fluent Aphasia. *J. Vis. Exp.* (), e50228, <u>doi:10.3791/50228</u> (2013). <u>www.jove.com/video/50228</u>

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