

Individualized brain stimulation therapy improves language performance in stroke survivors

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Baycrest scientists are pioneering the use of individualized brain

stimulation therapy to treat aphasia in recovering stroke patients.

Aphasia is a debilitating language disorder that impacts all forms of verbal communication, including speech, language comprehension, and reading and writing abilities. It affects around one-third of [stroke](#) survivors, but can also be present in those with dementia, especially in the form of primary progressive aphasia.

"Aphasia can be very isolating," says Dr. Jed Meltzer, Baycrest's Canada Research Chair in Interventional Cognitive Neuroscience and a neurorehabilitation scientist at Baycrest's Rotman Research Institute (RRI). "It can negatively affect people's personal relationships, and it often determines whether or not someone can continue working."

In a recent study published in the journal *Scientific Reports*, Dr. Meltzer and his team tested language performance and used magnetoencephalography (MEG) to measure [brain waves](#) in 11 stroke survivors with aphasia before and after they underwent [brain stimulation](#) therapy.

The scientists found that the participants had [abnormal electrical activity](#) in [brain regions](#) close to but outside the area destroyed by the stroke. This abnormal activity was mainly a shift to slower brain waves, a pattern they have also observed in individuals with dementia.

"We mapped that abnormal activity and targeted it using non-invasive brain stimulation," says Dr. Meltzer. "We found that the stimulation made the activity more normal—that is, faster—and improved language performance in the short term."

Previous research has demonstrated that brain stimulation can improve language performance in aphasia patients. However, this study is one of the first to link this performance improvement to changes in the brain

activity surrounding the tissue destroyed by stroke. In other words, this study suggests not only that brain stimulation works in aphasia patients, but also that the reason it works may be because it addresses abnormalities in the brain surrounding the destroyed tissue.

Another novel aspect of this work is that the scientists targeted each individual's abnormal brain activity with the stimulation treatment. In contrast, the standard approach in previous studies has been to use the exact same treatment, targeting the same brain areas, on every patient.

"Our results demonstrate a promising method to personalize brain stimulation by targeting the dysfunctional activity outside of the destroyed brain tissue," says Dr. Meltzer. "Aphasia patients are highly variable in terms of where their brain damage is and what part of the brain should be stimulated for therapy. By mapping individuals' brain waves, we are finding ways to target the right area to improve their language performance."

While the participants in this study were stroke survivors, individuals with dementia have similar dysfunctional tissue in their brains, and the scientists are also examining the use of brain stimulation in this group.

Dr. Meltzer and his team looked at the immediate effects of single stimulation sessions in this study. As a next step, they have received funding from the Heart and Stroke Foundation to conduct a full-scale clinical trial looking at the longer-term impacts of repeated stimulation for stroke survivors with aphasia. However, this study has been suspended because of the restrictions on in-person research participation due to the COVID-19 pandemic. In the meantime, the scientists have pivoted to optimize other aspects of aphasia treatment.

With additional funding, the researchers could test different types of stimulation with more patients over more sessions, allowing them to

make faster progress in developing this treatment for individuals with [aphasia](#).

More information: Priyanka P. Shah-Basak et al, High definition transcranial direct current stimulation modulates abnormal neurophysiological activity in post-stroke aphasia, *Scientific Reports* (2020). [DOI: 10.1038/s41598-020-76533-0](https://doi.org/10.1038/s41598-020-76533-0)

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