

Technology eases migraine pain in the deep brain

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Migraine pain sits at the upper end of the typical pain scale – an angry-red section often labeled "severe." At this intensity, pain is debilitating. Yet many sufferers do not get relief from – or cannot tolerate – over-the-counter and commonly prescribed pain medications.

Recently, a team of researchers that includes Dr. Marom Bikson, associate professor of biomedical engineering in CCNY's Grove School of Engineering, has shown that a brain stimulation technology can prevent migraine attacks from occurring. Their technique, using transcranial direct current stimulation (tDCS), applies a mild electrical current to the brain from electrodes attached to the scalp.

"We developed this technology and methodology in order to get the currents deep into the brain," said Bikson. The researchers aimed to tap into the so-called pain network, among other areas, a collection of interconnected brain regions involved in perceiving and regulating pain.

Professor Bikson and his colleagues, including Dr. Alexandre DaSilva at the University of Michigan School of Dentistry and Dr. Felipe Fregni at Harvard Medical School, found that the technology seems to reverse ingrained changes in the brain caused by chronic migraine, such as greater sensitivity to headache triggers.

Repeated sessions reduced the duration of attacks and decreased the pain intensity of migraines that did occur on average about 37 percent. The improvements accumulated over four weeks of treatment and they

persisted.

In pilot studies, the effects lasted for months. The only side effect subjects reported was a mild tingling sensation during treatment. Professor Bikson expects that a patient could use the system every day to ward off attacks, or periodically, like a booster.

The team's computational models show that tDCS delivers therapeutic current along the pain network through both upper (cortical) and deep brain structures. They will publish their results in the journal "Headache." It is currently available online.

Thirty-six million Americans suffer from migraine, according to the Migraine Research Foundation. Of these, 14 million of them experience chronic daily headaches. "The fact that people still suffer from migraines means that the existing treatments using electrical technology or chemistry are not working," said Professor Bikson.

Existing brain stimulation technologies can help relieve a migraine already underway. But those afflicted with chronic migraine pain may suffer 15 or more attacks a month, making treatment a constant battle.

The other techniques also have drawbacks – from heavy, unwieldy equipment to serious side effects, such as seizures. Some only stimulate the upper layers of the brain. Others reach deep brain regions, but require [brain](#) surgery to implant the electrodes.

The tDCS technology is safe, easy to use, and portable, Professor Bikson said. "You can walk around with it and keep it in your desk drawer or purse. This is definitely the first [technology](#) that operates on just a 9-volt battery and can be applied at home." He envisions future units as small as an iPod.

The next step will be to scale up clinical trials to a larger study population. A market-ready version of the tDCS is still years away.

"There's something about [migraine](#) pain that's particularly distressing," noted Professor Bikson. "If it's possible to help some people get just 30 percent better, that's a very meaningful improvement in quality of life."

More information: *Headache*, 18 April 2012. [DOI: 10.1111/j.1526-4610.2012.02141.x](#)

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