

Current stimulation of the brain restores vision in patients with glaucoma and optic nerve damage

June 29 2016



Credit: public domain

Vision loss due to glaucoma or optic nerve damage is generally considered irreversible. Now a new prospective, randomized, multi-center clinical trial demonstrates significant vision improvement in partially blind patients after 10 days of noninvasive, transorbital alternating current stimulation (ACS). In addition to activation of their residual vision, patients also experienced improvement in vision-related

quality of life such as acuity, reading, mobility or orientation. The results are reported in *PLOS ONE*.

"ACS treatment is a safe and effective means to partially restore [vision](#) after [optic nerve](#) damage probably by modulating brain plasticity, re-synchronizing brain networks, which were desynchronized by vision loss. This class 1 evidence is the first ever large-scale multi-center clinical trial in the field of non-invasive brain modulation using electric currents and suggests that visual fields can be improved in a clinically meaningful way," commented lead investigator Bernhard A. Sabel, PhD, of the Institute of Medical Psychology, Medical Faculty, Otto-von-Guericke University of Magdeburg (Germany).

In a study conducted at three German clinical centers (University of Göttingen, Charité Berlin, and University of Magdeburg), 82 patients were enrolled in a double-blind, randomized, sham-controlled clinical trial, 33 with visual deficits caused by glaucoma and 32 with anterior ischemic optic neuropathy caused by inflammation, optic nerve compression (due to tumors or intracranial hemorrhage), congenital anomalies, or Leber's hereditary optic neuropathy. Eight patients had more than one cause of optic nerve atrophy.

The groups were randomized so that 45 patients underwent 10 daily applications of ACS for up to 50 minutes per day over a two-week period and 37 patients received sham stimulation. The only difference between groups before treatment was that the stimulation group included more men than the sham group; no other differences were found, including age of the lesion or visual field characteristics. ACS was applied with electrodes on the skin near the eyes. Vision was tested before and 48 hours after completion of treatment, and then again two months later to check if any changes were long-lasting.

Patients receiving ACS showed significantly greater improvements in

perceiving objects in the whole visual field than individuals in the sham-treated group. Specifically, when measuring the visual field, a 24% improvement was noted after treatment in the ACS group compared to a 2.5% improvement in the sham group. This was due to significant improvements in the defective visual field sector of 59% in the ACS group and 34% in the sham group which received a minimal stimulation protocol. Further analyses showed improvements in the ACS group at the edges of the visual field. The benefits of stimulation were found to be stable two months later, as the ACS group showed a 25% improvement in the [visual field](#) compared to negligible changes (0.28%) in the sham group.

Patient safety measures were maintained at a high level, in line with previous studies. Current flow was assessed using sophisticated computer simulation models. No participants reported discomfort during stimulation, although temporary dizziness and mild headaches were reported in rare cases.

The study results are in line with previous small sample studies in which efficacy and safety were observed. Those studies revealed that well-synchronized dynamic brain functional networks are critical for vision restoration. Although vision loss leads to de-synchronization, these neural networks can be re-synchronized by ACS via rhythmic firing of the ganglion cells of the retina, activating or "amplifying" residual vision. Dr. Sabel added that "while additional studies are needed to further explore the mechanisms of action, our results warrant the use of ACS treatment in a clinical setting to activate residual vision by brain network re-synchronization. This can partially restore vision in patients with stable vision loss caused by optic nerve damage."

In summary, [vision loss](#), long considered to be irreversible, can be partially reversed. There is now more light at the end of the tunnel for patients with low vision or blindness following glaucoma and optic nerve

damage.

More information: "Alternating current stimulation for vision restoration after optic nerve damage: a randomized clinical trial," by Carolin Gall, Sein Schmidt, Michael P. Schittkowski, Andrea Antal, Géza Gergely Ambrus, Walter Paulus, Moritz Dannhauer, Romualda Michalik, Alf Mante, Michal Bola, Anke Lux, Siegfried Kropf, Stephan A. Brandt, Bernhard A. Sabel, published by *PLOS ONE*.

Provided by Otto-v.-Guericke University Magdeburg

Citation: Current stimulation of the brain restores vision in patients with glaucoma and optic nerve damage (2016, June 29) retrieved 2 May 2024 from <https://medicalxpress.com/news/2016-06-current-brain-vision-patients-glaucoma.html>

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