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Noninvasive current stimulation improves sight in patients with optic nerve damage

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It has long been thought that blindness after brain lesions is irreversible and that damage to the optic nerves leads to permanent impairments in everyday activities such as reading, driving, and spatial orientation. A new study published in Elsevier's *Brain Stimulation* suggests that treating such patients with low levels of non-invasive, repetitive, transorbital alternating current stimulation (rtACS) for 10 days (30-40 min per day) significantly reduces visual impairment and markedly improves vision-related quality of life.

The results of this study showed that treatment with rtACS resulted in an average of 41% shrinkage of the visual field loss. The rtACS-treated patients show significantly improved visual field sizes, which was not seen in patients who received sham treatment. Actively treated patients confirmed that their "general vision" was improved. In the sham-group, visual fields and estimates of subjective visual functioning remained largely unchanged.

"Our findings are important because they show that partial blindness can be reversed. We show for the first time that partial blindness can be reduced by a short-lasting therapeutic procedure using non-invasive electrical current stimulation," states Dr. Bernhard A. Sabel, researcher and senior author of this study

A group of 42 patients with visual impairments following optic nerve damage participated in the study. Patients were randomly assigned to either a control condition with sham stimulation or rtACS given with an

alternating current stimulation device (EBS Technologies GmbH, Kleinmachnow, Germany) with electrodes positioned near the eyes. The length of the daily treatment session (both rtACS and sham-treatment) varied between 10 to 20 min for each eye, i.e. max 40 min. The optic nerve lesions were treated long after the early recovery phase (mean lesion age 5.5 yrs). Both patients and the experimenter evaluating the vision parameters were unaware to which treatment arm the patients belonged. The study's idea was to enhance visual system plasticity by increasing synaptic strength of residual cells in the partially damaged visual system and thus improve any residual visual capacity. The study documents a considerable activation potential of residual vision following optic nerve damage. Current pulses administered to the eye in a non-invasive manner might be able to unveil this plasticity.

The researchers were particularly interested to learn if rtACS has an effect on self-estimated visual and health-related functioning as assessed by quality of life questionnaires (e.g., the National Eye Institute Visual Function Questionnaire, NEI-VFQ). Vision parameters and patient reported outcomes were collected before and after the 10-day treatment course.

The findings of this study are not only of interest to basic scientists, showing that the adult visual system is more modifiable than was previously thought, but may also help develop new therapies for patients with visual field loss. Improving vision in a subjectively meaningful way is a clinical achievement that reduces the suffering of the partially blind.

Additional studies are now underway to document in patients with visual dysfunction the neurobiological basis of the rtACS effects. Furthermore, a clinical trial with larger patient groups is currently underway to replicate these findings. Finally, the use of rtACS for the treatment of hemianopia after stroke is now being explored as well.

More information: This article is "Noninvasive transorbital alternating current stimulation improves subjective visual functioning and vision-related quality of life in optic neuropathy" (doi:10.1016/j.brs.2011.07.003) by C. Gall, S. Sgorzaly, S. Schmidt, S. Brandt, A. B. Fedorov, B. A. Sabel. The authors are affiliated with the University of Magdeburg, Charité Campus Mitte, Berlin, and EBS Technologies GmbH, Kleinmachnow, Germany. The article appears in Brain Stimulation, Volume 4, Issue 4, October 2011, Pages 175-188