

RESEARCH SPOTLIGHT

BRAIN MODULATION FOR NEURORECOVERY

Cerebellar deep brain stimulation for chronic post-stroke motor rehabilitation:

a **phase I trial**. In August 2023, Baker et al. published a study in *Nature Medicine*, that focused on evaluating the safety and feasibility of Deep Brain Stimulation (DBS) in the dentate nucleus area in promoting chronic, moderate to severe upper extremity hemiparesis caused by ischemic stroke. This study was a **signal-arm investigation**, including 12

participants, revealed **no significant perioperative or stimulation-related adverse events**. Participants showed a median improvement of 7 points on the UE-FM assessment. Those with partial preservation of distal motor function surpassed the minimal clinically important difference in improvement, showing a **median increase of 15 points on the UE-FM assessment**. Importantly, functional improvements were strongly associated with cortical reorganization evidenced by increased metabolism on the affected hemisphere. Overall, results support the safety and feasibility of using DBS on the cerebellar dentate nucleus as a promising approach for enhancing late-stage neuroplasticity to facilitate functional recovery. **The study justifies a next step of phase II study with a sham control group and large sample size.**

Baker, K. B., et al (2023). Cerebellar deep brain stimulation for chronic post-stroke motor rehabilitation: a phase I trial. *Nature Medicine*, 1-9.

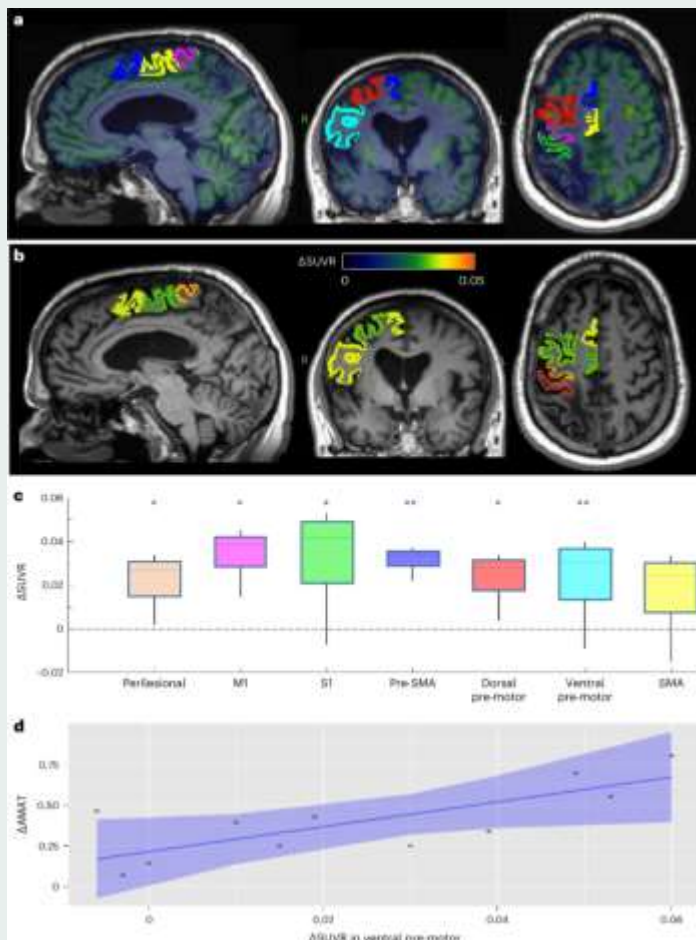


Fig. 4: Change in brain metabolism associated with DN-DBS combined with rehabilitation and relationship to treatment-related changes in arm function.

Upcoming Events

100th American Congress of Rehabilitation Medicine

30 Oct - 2 Nov 2023, Atlanta, GA, USA

<https://conference.acrm.org/>

Society for Neuroscience

11-15 November 2023, Washington, D.C, USA

<https://www.sfn.org>

World Stroke Congress

9-13 October 2022, Toronto, Canada

<https://worldstrokecongress.org/>

The International Neuromodulation Society

11-16 May 2024, Vancouver, Canada

<https://ins-congress.com>

The 13th World Congress for Neurorehabilitation

22-25 May 2024, Vancouver, Canada

<https://wfnr-congress.org>

The 18th World Congress of the International Society of Physical and Rehabilitation Medicine

1- 6 June 2024, Sydney, Australia

<https://isprm.org/events/isprm2024/>

Young WFNR

Join the Young WFNR SIG by contacting the Chair of the WFNR Young WFNR Special Interest Group, Dr. Elia Fischer, elialuca.fischer@insel.ch

Selected Recent Publications of Brainmodulation for Neurorehabilitation

ID	TYPE*	TOOL	DISEASE	CITATION
1	1	cTBS	Stroke	Vink, J. J., van Lieshout, E. C., Otte, W. M., van Eijk, R. P., Kouwenhoven, M., Neggers, S. F., ... & Dijkhuizen, R. M. (2023). Continuous theta-burst stimulation of the contralesional primary motor cortex for promotion of upper limb recovery after stroke: a randomized controlled trial. <i>Stroke</i> .
2	1	tDCS	Stroke	Stockbridge, M. D., Elm, J., Teklehaimanot, A. A., Cassarly, C., Spell, L. A., Fridriksson, J., & Hillis, A. E. (2023). Individual Differences in Response to Transcranial Direct Current Stimulation With Language Therapy in Subacute Stroke. <i>Neurorehabilitation and Neural Repair</i> , 15459683231190642.
3	1	VNS	Stroke	Badran, B. W., Peng, X., Baker-Vogel, B., Hutchison, S., Finetto, P., Rische, K., ... & Kautz, S. (2023). Motor Activated Auricular Vagus Nerve Stimulation as a Potential Neuromodulation Approach for Post-Stroke Motor Rehabilitation: A Pilot Study. <i>Neurorehabilitation and Neural Repair</i> , 15459683231173357.
4	1	tDCS	PD	Broeder, S., Vandendoorent, B., Hermans, P., Nackaerts, E., Verheyden, G., Meesen, R., ... & Nieuwboer, A. (2023). Transcranial direct current stimulation enhances motor learning in Parkinson's disease: a randomized controlled trial. <i>Journal of Neurology</i> , 1-9.
5	1	DBS	PD	Sermon, J. J., Olaru, M., Anso, J., Cernera, S., Little, S., Shcherbakova, M., ... & Duchet, B. (2023). Sub-harmonic entrainment of cortical gamma oscillations to deep brain stimulation in Parkinson's disease: Model based predictions and validation in three human subjects. <i>Brain Stimulation</i> .
6	1	TUS	Healthy	Ziebell, P., Rodrigues, J., Forster, A., Sanguinetti, J. L., Allen, J. J., & Hewig, J. (2023). Inhibition of midfrontal theta with transcranial ultrasound explains greater approach versus withdrawal behavior in humans. <i>Brain Stimulation</i> .
7	1	tDCS (4mA)	Healthy	Hsu, G., Shereen, A. D., Cohen, L. G., & Parra, L. C. (2023). Robust enhancement of motor sequence learning with 4 mA transcranial electric stimulation. <i>Brain stimulation</i> , 16(1), 56-67.
8	2	TUS	Stroke	Yüksel, M. M., Sun, S., Latchoumane, C., Boch, J., Courtine, G., Raffin, E. E., & Hummel, F. C. (2023). Low-intensity focused ultrasound neuromodulation for stroke recovery: A novel deep brain stimulation approach for neurorehabilitation? <i>IEEE Open Journal of Engineering in Medicine and Biology</i> .
9	2	TES	Stroke	Turnbull, C., Boomsma, A., Milte, R., Stanton, T. R., & Hordacre, B. (2023). Safety and adverse events following non-invasive electrical brain stimulation in stroke: A systematic review. <i>Topics in Stroke Rehabilitation</i> , 30(4), 355-367.
10	2	TMS	Stroke	Feng, W., Plow, E. B., & Paik, N. J. (2023). Transcranial Magnetic Stimulation for Poststroke Motor Recovery: What We Have Learned. <i>Stroke</i> , 54(8), 1972-1973.
11	2	tDCS+BCI	Stroke	Lima, E. D. O., Silva, L. M., Melo, A. L. V., D'arruda, J. V. T., Alexandre de Albuquerque, M., Ramos de Souza Neto, J. M., ... & Andrade, S. M. (2023). Transcranial Direct Current Stimulation and Brain-Computer Interfaces for Improving Post-Stroke Recovery: A Systematic Review and Meta-Analysis. <i>Clinical Rehabilitation</i> , 02692155231200086.
12	2	NIBS	Neurological disorders	Evancho, A., Tyler, W. J., & McGregor, K. (2023). A review of combined neuromodulation and physical therapy interventions for enhanced neurorehabilitation. <i>Frontiers in Human Neuroscience</i> , 17, 1151218.
13	3	rTMS (RCT protocol)	Stroke	Cho, H., Cha, S., Sohn, M. K., Jee, S., Chang, W. K., Kim, W. S., & Paik, N. J. Investigation of the Efficacy of Low-frequency Repetitive Transcranial Magnetic Stimulation on Upper-limb Motor Recovery in Subacute Ischemic Stroke without Cortical Involvement: A Protocol Paper for a Multi-center, double-blind Randomized Controlled Trial. <i>Frontiers in Neurology</i> , 14, 1216510.
14	3	fNIRS+TMS	Stroke	Chen, S., Zhang, X., Chen, X., Zhou, Z., Cong, W., Chong, K., ... & Shan, C. (2023). The assessment of interhemispheric imbalance using functional near-infrared spectroscopic and transcranial magnetic stimulation for predicting motor outcome after stroke. <i>Frontiers in Neuroscience</i> , 17.
15	3	TMS	Method	Wang, B., Peterchev, A. V., & Goetz, S. M. (2023). Three novel methods for determining motor threshold with transcranial magnetic stimulation outperform conventional procedures. <i>Journal of Neural Engineering</i> .
16	3	VNS	Method	Ruiz AD, Malley KM, Danaphongse TT, Ahmad FN, Mota Beltran C, Rennaker RL, Kilgard MP, Hays SA. (2023). Effective Delivery of Vagus Nerve Stimulation Requires Many Stimulations Per Session and Many Sessions Per Week Over Many Weeks to Improve Recovery of Somatosensation. <i>Neurorehabil Neural Repair</i> . 15459683231197412.