Effect of Neurofeedback Facilitation on Poststroke Gait and Balance Recovery
A Randomized Controlled Trial

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Study Question
Among patients with subcortical stroke, does neurofeedback facilitation of the supplementary motor area SMA with functional near-infrared spectroscopy–mediated neurofeedback (fNIRS-NFB) improve gait and balance recovery?

What Is Known and What This Paper Adds
Neurofeedback is a neuromodulation technique that uses brain activity feedback to teach patients how to regulate their neural activity. A previous study suggested that SMA facilitation with fNIRS-NFB may improve postural control in healthy individuals. This study provides Class III evidence that for patients with gait disturbance from subcortical stroke, neurofeedback facilitation of the SMA improves 3-meter Timed Up and Go (TUG) test scores at a 4-week postintervention.

Methods
For this double-blind clinical trial, the investigators recruited 54 adults with mild-to-moderate hemiplegic gait disturbance secondary to first-ever subcortical stroke that had occurred >12 weeks earlier. Mean age (SD) is 61.2 (11.3) and baseline 3-meter TUG test time is 33.5 (27.0) seconds. Recruitment occurred through 2 hospitals in Osaka between November 2013 and January 2016. A computer-generated sealed envelope method was used to randomize participants to real (n = 28) or sham (n = 26) fNIRS-NFB–based SMA neurofeedback facilitation while viewing gait- and balance-related motor imagery. Neurofeedback sessions occurred thrice weekly for 2 weeks. For participants undergoing real neurofeedback, the fNIRS signals contained cortical activation information. The primary outcomes were from-baseline improvements in TUG test scores achieved at a 4-week postintervention timepoint.

Results and Study Limitations
At a 4-week postintervention, the mean from-baseline improvement in TUG test scores was greater in the real neurofeedback group than in the sham neurofeedback group (12.84 ± 15.07 seconds vs 5.51 ± 7.64 seconds; between-group difference, 7.33 seconds, 95% CI, 0.83–13.83 seconds). The participants reported no neurofeedback-related adverse events. The present study’s limitations include a short follow-up period, potentially limited generalizability to patients with severe poststroke impairments, and possible inadvertent unblinding for patients receiving sham neurofeedback.

Registration, Study Funding, and Competing Interests
This study was funded by the Japan Agency for Medical Research and Development and was registered with the UMIN Clinical Trials Registry (UMIN000010723). Some authors report having a patent pending and receiving personal fees and funding from healthcare companies and the Osaka Medical Research Foundation for Intractable Diseases. Go to Neurology.org/N for full disclosures.

Figure TUG Time Improvements
From-baseline TUG time improvements for patients who received real (blue) or sham (red) neurofeedback. Abbreviations: PRE, baseline; #W, #week follow-up.

A draft of the short-form article was written by M. Dalefield, a writer with Editage, a division of Cactus Communications. The corresponding author(s) of the full-length article and the journal editors edited and approved the final version.