

## MOTOR NEURON DISEASE

# Evaluation of ALS via transcranial magnetic stimulation

A new study has used navigated transcranial magnetic stimulation (TMS) to map cortical projections to the hands in patients with amyotrophic lateral sclerosis (ALS). This technique could facilitate and standardize the measurement of upper limb dysfunction in ALS, which typically relies on clinical examination.

Individual muscles are represented in distinct areas within motor cortex, which can be mapped by targeting an area with TMS and then measuring induced muscle activity with electromyography (EMG). “A previous study had suggested that motor representation maps diminish with ALS disease progression,” says Alexander Chervyakov, the lead author of the study published in *Muscle & Nerve*.

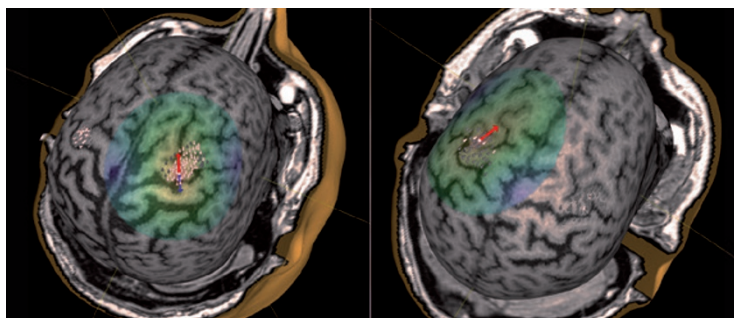
To produce highly detailed maps of the motor cortex, Chervyakov *et al.* located potential targets in the anterior central gyrus using individual MRI scans of 30 participants with ALS, and 24 healthy controls. The researchers then ‘navigated’ an area thought to represent the anterior pollicis brevis muscle, delivering TMS and then measuring evoked potentials via EMG electrodes on the hand.

Motor thresholds—the amount of magnetic stimulation required to produce a criterion level of EMG activity—were significantly increased in patients with ALS, and this insensitivity to stimulation correlated with clinical measures of motor impairment. Furthermore, patients with ALS almost universally showed abnormal cortical maps compared with controls. Estimated volume of the maps was decreased in patients with ALS, and the maps were often discontinuous or patchy. These findings suggest that motor representation maps are a viable biomarker for ALS.

“Another very interesting finding was that in several patients with ALS we observed broadened cortical representations, moving from the anterior central gyrus to the posterior central gyrus and the frontal and temporal parasagittal regions,” says Chervyakov. This spreading could indicate adaptive neuroplasticity in patients adjusting to their disability, Chervyakov suggests.

The researchers are planning to investigate longitudinal changes to cortical maps in patients with ALS, and whether TMS parameters correlate with disease progression and prognosis. These data might shed light on the pathogenetic course of ALS, and would provide further evidence to support the use of TMS for monitoring this disease.

Alex Chase



Despite similar disease duration, two patients with ALS (left and right) show differences in the number of TMS targets in the motor cortex that produced potentials in the hand (white dots) compared with areas that did not produce a response (grey dots). Coloured arrows depict the direction of the magnetic field, and the coloured circle shows the field gradient. Image courtesy of A. V. Chervyakov.

**Original article** Chervyakov, A. V. *et al.* Navigated transcranial magnetic stimulation in amyotrophic lateral sclerosis. *Muscle Nerve* doi:10.1002/mus.24345