Nature Reviews Neurology **11**, 4 (2015); published online 2 December 2014; doi:10.1038/nrneurol.2014.229

STROKE

Cortical connectivity predicts success of stroke rehabilitation

Loss of motor function is common after stroke, and patients' responses to rehabilitation vary. A new study in *Annals of Neurology* describes how neuroimaging can aid prediction of the outcome of robot-assisted therapy.

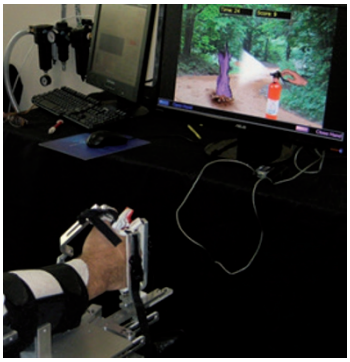
"We tried to identify the strongest and most consistent predictors of response to therapy after stroke," says Steven Cramer, who led the study. Cramer's team recruited 41 patients who had experienced a stroke up to 6 months earlier. The patients underwent a 3-week regimen of robot-assisted therapy focusing on the hand and wrist.

The baseline assessment of the participants covered medical history, cognition, mood and motor function. Structural and functional MRI scans were conducted successfully in 29 of the patients. MRI data were used to assess the size and location of lesions, as well as the functional connectivity between brain regions activated by the movements associated with the robot-therapy task.

Overall, patients demonstrated significantly improved scores on motor rating scales 1 month after therapy, though many patients failed to meet the threshold for meaningful benefit. Bivariate regression revealed that poor responses to robot therapy were associated with damage to the corticospinal tract.

"In this cohort, no person having >63% injury to the corticospinal tract improved to a clinically meaningful extent," explains Cramer. "Confirmation of such an injury threshold could be of high value to guide clinical decision making and research study design."

A multivariate model confirmed the importance of corticospinal integrity to therapy success, and further revealed interhemispheric connectivity to be a key factor. The patients who improved most after rehabilitation had greater functional connectivity between the ipsilesional and contralesional M1 motor cortices at baseline.



Robot-assisted therapy. Image courtesy of S. Cramer.

Eight of the 29 participants had lacunar strokes, which—by definition—produced small lesions. Subgroup analyses suggested that recovery from lacunar stroke was predicted by different variables than for other stroke types, namely the level of activation in ipsilesional M1, and the intrahemispheric connectivity between M1 and the dorsal premotor cortex.

Although the results of this study require validation in larger samples, Cramer concludes that stroke rehabilitation might benefit from a lesion-specific approach. Moreover, the lack of information provided by clinical measures might suggest a needed change in the standard approach to the evaluation of patients.

"Clinical assessments such as medical history and bedside exam were of limited value for predicting treatment response," says Cramer. "Billions of dollars are spent each year in the USA on stroke rehabilitation, and we may be able to bring more science into resource distribution."

Alex Chase

Original article Quinlan, E. B. *et al.* Neural function, injury and stroke subtype predict treatment gains after stroke. *Ann. Neurol.* doi:10.1002/ana.24309