Robotically Driven Error Augmentation Training Enhances Post-Stroke Arm Motor Recovery

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Abstract

Error Augmentation training using a robotic interface is thought to promote motor recovery by enhancing proprioceptive feedback, which motivates and challenges patients to optimize their performance during training. Here, we investigated the effectiveness of robotic Error Augmentation training on motor recovery after a stroke, compared to standard robotic training in a null field. Post-stroke patients were randomly assigned to one of two groups: a study group (n=9) that was trained on a 3D robotic system applying Error Augmentation forces, and a control group (n=7) that carried out the same protocol in null field conditions. The robotic rehabilitation intervention was applied in addition to the standard rehabilitation protocol of the rehabilitation center. Error Augmentation training increased clinical scores compared to standard robotic training by 266% on the Motor Assessment Scale, and 88% on the Fugl-Meyer scale. The Motor Assessment Scale scores were significantly correlated with the Fugl-Meyer scores (p=0.03, r=0.541). There were more movement errors on the initial trials of the game sequence using the DeXtreme robotic device with Error Augmentation compared to trials with no force field. This difference vanished however after 10 trials. Error Augmentation training decreased the number of movement units and jerkiness compared to the control treatment. These findings suggest that Error Augmentation training may enhance motor performance possibly through motor adaptation.

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