Kinematic performance of the paretic and non-paretic limbs after stroke during a goal-directed reaching task

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Target locations in goal-directed reaching tasks may alter people's task-specific perceived self-efficacy. In particular, people post-stroke had greater reaching self-efficacy for targets placed closer and ipsilateral to the reaching hand in a previously validated laboratory-based paradigm. Research in other populations has indicated that self-efficacy can mediate motor task performance [Stevens et. Al, 2012; Mullen et al., 2012]. We are interested in determining if target locations also affect performance.

We hypothesized that targets previously shown to elicit higher self-efficacy would also elicit better kinematic performance, as measured by the curvature of reaching movements in people post-stroke. Increased movement curvature has been attributed to reduced shoulder and elbow coordination (i.e., increased functional impairment).

Six participants post-stroke performed a reaching task. Ten targets (diameter: 3cm) were distributed in the reaching workspace egocentric to the participant at 5 directions ipsilateral to the reaching hand (0, 45, 90, 135, and 180 degrees), and at two extents (13.5 and 27.0cm). Participants placed their hands at a central "home" position (also of diameter 3cm) and then reached to each of the 10 targets 10 times per hand, in a pseudo-random order. Electromagnetic tracking sensors placed on the participants' index fingers were used to capture each reach. A reach was defined as the trajectory of the finger from movement onset (leaving the home position) to offset (arriving at the target).

Curvature was quantified by the reach path ratio (RPR), defined as the actual distance travelled divided by the straight line path from movement onset to offset. RPRs greater than 1 indicate increased curvature, and decreased performance.

For near targets, differences between paretic and non-paretic RPR become pronounced at 90 degrees and higher, with larger RPRs for the paretic limb. For far targets, differences become pronounced at 45 degrees and higher, with larger RPRs for the paretic limb. Across all participants, RPR was greater for close targets, and greater for the paretic limb. A two way ANOVA indicated a significant effect of extent ($F(1,299) = 211.89$, $p<0.001$) and limb ($F(1,299) = 211.89$, $p<0.005$), but no significant interaction ($F(1,299) = 1.57$, $p = 0.212$).

Findings indicate that increased coordination may be required for reaching to close targets during goal-directed reaching. Future analyses will investigate correlations between performance and self-efficacy on the goal-directed reaching task.