A pilot study investigating the predictive capacity of strength, synergy, spasticity, and passive range of motion on reaching function in chronic moderate to severe hemiparetic stroke

Rebecca Dugan, SPT, Qianyun Meng, SPT, Arek Solawa, SPT, Amanda Tay, SPT
Faculty Preceptors: Michael D. Ellis, PT, DPT, Grace C. Bellinger, MS

Background

- Flexor spasticity and elbow extension strength may not contribute to reaching function.
- These findings warrant an expanded investigation to increase the generalizability of the predictive model.
- Identifying the most predictive impairments affecting reaching function will inform stroke rehabilitation and guide the delivery of targeted restorative interventions.

Participants

- 9 participants (6 males, 3 females; 55.5 ± 12.1 years old, 8.0 ± 3.5 years post-stroke, 29.6 ± 8.4 Fugl-Meyer score)
- Written consent obtained from all participants for Northwestern IRB-approved study

Methods

- Reaching function and impairments measured quantitatively using kinematics/kinetics and EMG (Figs. 1 & 2)
- Reaching function - reaching distance against gravity (Fig. 3)
- Isometric strength for elbow extension & shoulder abduction - normalized to unaffected arm (Fig. 4)
- Flexion synergy - emergence and take-over thresholds (Fig. 5)
- Flexor spasticity - EMG during following onset of elbow extension (Fig. 6)
- Elbow extension PROM (Fig. 7)
- Multiple linear regression calculated to predict reaching function

Results

- Reaching function against gravity for the sample ranged from 0-100% with n=4 at 100%.
- Original Model
  - A non-significant regression equation was found. 
  \[ F(5,3) = 2.65, \ p = 0.23, \ R^2 = 0.82. \]
  - Reaching distance was only correlated with synergy and shoulder abduction strength.
- Second model dropping non-correlated variables was significant. 
  \[ F(3,5) = 5.43, \ p=0.05, \ R^2 = 0.77. \]

Discussion and Conclusions

- Flexor spasticity and elbow extension strength may not contribute to reaching function.
- These findings warrant an expanded investigation to increase the generalizability of the predictive model.
- Identifying the most predictive impairments affecting reaching function will inform stroke rehabilitation and guide the delivery of targeted restorative interventions.

Acknowledgements

- We would like to thank the participants of the study.
- This work was supported by the Department of Physical Therapy and Human Movement Sciences at Northwestern University.