Pilot study Relationship Between Force Control & Perception, Motor Performance, & Sensory Processing

Virginia W. Chu[1], Sheena Davis, Nouran Hussein Amin, OTD[2], Mahira Ali

[1]*Virginia Commonwealth University, Richmond, VA, USA;* [2]*United States*

DOI: 10.5014/ajot.2023.77S2-PO25

Date presented: April 21, 2023

Primary Author and Speaker: Virginia W. Chu, virginiawtchu@gmail.com

Children who struggle with sensory processing and motor coordination often also have difficulty with force gradation, e.g. touching too hard, breaking things. However, we are limited in ways to measure deficits in force gradation (the ability to control and perceive forces). The purpose of this study is to quantify force control and perception and its relationship with sensorimotor performance. This descriptive study recruited 31 children (4-5yo: n=12, 6-8yo: n=9, 9-12yo: n=10) and 12 adults (18-50yo) from a community sample. Individuals with movement disorders were excluded. Participants completed force control and perception tests: bilateral force matching (BFM); active resistive force control (ARFC); and weight change detection (WCD). BFM assessed the ability to match forces produced in one hand to the other. ARFC assessed the ability to resist subtle forces applied by the Haptic Master (HM) to the hand. WCD assessed the ability to detect a change in the weight simulated by HM. Motor performance was assessed using Bruininks-Oseretsky Test of Motor Proficiency II (BOT-II) short-form. Parents of child participants completed the Sensory Processing Measure (SPM). One-way ANOVA was used to examine differences in the force measures (BFM, ARFC, WCD) with age. Linear correlations were used to examine the relationship between the force measures (BFM, ARFC, WCD), BOT-II and SPM. We saw significant differences between age groups for ARFC ($p<.001$) and WCD ($p=.002$), but not for BFM ($p=.273$). BOT-II significantly correlated with BFM ($p=.001$), ARFC ($p<.001$), and WCD ($p=.005$). SPM correlated with BFM ($p=.007$), but not with ARFC and WCD. Our results showed that our measures of force control and force perception correlated with motor and sensory outcomes. Our assessments can be further developed for clinical use to allow occupational therapists to better understand and assess the deficits underlying the struggle with force gradation, allowing for more targeted interventions.

References

Chu, V. W. T. (2020). Pilot study to measure deficits in proprioception in children with somatodyspraxia. *American Journal of Occupational Therapy, 74*(5), 7405345010p1–7405345010p10. https://doi.org/10.5014/ajot.2020.040709.

Proske, U., & Gandevia, S. C. (2012). The proprioceptive senses: their roles in signaling body shape, body position andmovement, and muscle force. *Physiological Reviews, 92*(4), 1651–97. https://doi.org/10.1152/physrev.00048.2011.

Smits-Engelsman B.C.M., Westenberg, Y., & Duysens, J. (2003). Development of isometric force and force control in children. *Cognitive Brain Research, 17*(1) 68-74. https://doi.org/10.1016/S0926-6410(03)00081-8.