Title: Kinematic Assessment of Reaching Movements in School-Aged Children with Down Syndrome (DS)

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Introduction: Down Syndrome (DS) is a genetic disorder with significant motor impairments such as delayed acquisition of motor milestones, low muscle tone, as well as poor coordination and postural control. Specific movement impairments such as poor reaching and manipulation of objects could negatively impact a child’s ability to freely explore and learn from the environment. In the current study, we were interested in the kinematic analysis of goal-directed reaching movements in school-aged children with DS.

Methods: Ten children with DS between 6 and 14 years of life, and an additional ten IQ matched typically developing (TD) children were observed during the study. The task included children reaching for two objects with different size, i.e. a small penny and a large circular disc, and transferring them to a different end location. For half of the trials, the end location was an object with a wide opening, i.e. an open-topped box, and required children throw the penny and the disc in the box (labeled as throw trials). For the remaining trials, the end location was an object with a narrow opening, i.e. a piggy bank and hence, required children to precisely fit the penny and the circular disc into the piggy bank slot with precision (labeled as fit trials). A 3-dimensional video-motion analysis system (Vicon Inc.) with a sampling rate of 100 Hz was used to record the hand movements of children. Three reflective markers attached to a partial hand glove was worn on each hand to collect the kinematic data such as position, velocity, and acceleration for each hand. For the current abstract, we are reporting on the hand velocity data from the study.

Results: Children in both the DS and the TD group had slower hand velocities for the fit trials compared to the throw trials, which can be explained by the nature of the task. The fit trials required greater control and coordination of hand movements to fit the objects in a narrow opening, and hence all children slowed down during the fit trials compared to the throw trials. In terms of group differences, children with DS had slower hand velocities compared to TD children for both the fit and the throw trials while using the small and the large object, indicating that children with DS could have slowed their hand movements to improve their accuracy while completing the task.

Discussion: Children with DS have slower hand velocities regardless of the nature of task, i.e. the fit and the throw trials. These results have highlighted an important aspect of motor learning in the DS population, i.e. children with DS perform online problem solving or corrections of their movements while executing an action by using strategies such as slowed movements and longer movement times compared to TD children who are probably doing pre-planning of their movements. We are currently working on analyzing the acceleration data, as well as determining the role of overall motor and cognitive abilities of children assessed using standardized tests on the reaching task performance.

References: