Title: Functional activity monitoring through embedded sensors in a modified ride-on toy car

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Background/Purpose
Children with developmental disabilities often have associated motor and sensory deficits that result in abnormal posture and decreased functional movement. This decrease in functional movement limits independence in daily activities and social participation. The World Health Organization’s International Classification of Functioning, Disability and Health (ICF) (2001) describes these abnormalities in posture as impairments, and the resulting decrease in normal movement as functional activity limitations. These functional activity limitations, especially mobility, can result in the delay of a child’s cognitive, social, emotional, and motor skill development measured as motor milestone attainment. Currently a child’s impairments and functional activity levels are measured by assessments using parent interviews or through visual observation by physical therapists. These types of assessments provide qualitative data. There is increasing pressure to use quantitative data to make evidence based clinical intervention decisions by healthcare professionals as well as reimbursement organizations. This case presentation describes a novel idea to collect such data to determine the efficacy of intervention in improving functional activity, strength and endurance resulting in increased mobility time.

Case Presentation
This project seeks to determine impairment and functional activity improvement, such as strength, endurance and mobility of a child with spina bifida, through quantitative analysis. Bilateral lower extremity function in standing with self-directed power mobility was monitored for improvement. The increase in function was determined by two factors, endurance in standing and weight shifting through the balls and heels of the feet. The improvement in the child’s lower extremities gives insight into the function measures of walking and weight-bearing. To accomplish this goal, pediatric physical therapy students and mechanical and electrical engineering students designed and fabricated a modified ride-on toy car with embedded sensors. The ride-on car was modified from its original condition to fit the needs of the child for seating support, foot plates and activation switches. Sensors were embedded in the ride-on toy to collect data that assisted in monitoring lower extremity function over a time span of 6 months.

Outcome
Data collection for the time span has shown improvements in endurance and has shown preliminary results in changing weight-bearing status. Over the 6 months span the physical therapist determined functional activity improvement of the child. Thus far, the implications of this project suggest that a parallel conclusion may be drawn from the data collected through the ride-on car to the data presented in the physical therapy analysis. The quantitative data analysis can confirm the qualitative data analysis.