THE GRADUATE COLLEGE OF THE
UNIVERSITY OF OKLAHOMA HEALTH SCIENCES CENTER

ANNOUNCES THE FINAL EXAMINATION OF

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FOR THE DEFENSE OF THE DOCTOR OF PHILOSOPHY DEGREE
GRADUATE COLLEGE
Department of Allied Health Sciences

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Allied Health Building, Room 3025

POSTURAL SWAY VELOCITY AND SITTING ACQUISITION AMONG INFANTS WITH AND WITHOUT THE RISK FOR CEREBRAL PALSY

COMMITTEE IN CHARGE: Thubi H.A. Kolobe PT, PhD, FAPTA; Carol P. Dionne DPT, PhD; Andrew Fagg PhD; Elizabeth Hile PT, PhD; Nicholas Stergiou PhD

ABSTRACT: *Background:* An upright sitting posture is critical for executing daily functional tasks, yet infants with cerebral palsy (CP) struggle to adapt postural reactions to the task of sitting and consequently attain this skill much later than their typically developing peers. The importance of adapting postural adjustments to maintaining independent sitting is widely accepted. While the approach to studying the mechanisms involved in the acquisition of postural control have focused on changes in the displacement of the center of mass and center of pressure, the contributions of rate-related factors particularly velocity, have been overlooked. The overall purpose of my research was to examine the role of changes in postural sway velocity (PSV) in the development of sitting and how it affects adaptation of postural reactions at different sitting developmental stages in infants with and without CP.

Methods: Using a three-part approach, I first conducted an integrative review to examine the role of velocity in the interaction between the mechanics and mechanisms of sitting postural control development. Subsequently, two exploratory cross-sectional studies were conducted to assess the variability and temporal behavior of PSV and its relationships with weight and height in 15 typically developing (TD) infants (3-15 months old) and seven infants with and at risk for CP (9-15 months old), at three developmental sitting stages; prop (P), semi-independent (SI) and independent (I) sitting. The primary measure was a floor embedded force plate and motion sensor markers with the Qualisys^{TM} data acquisition software at 1200Hz sampling frequency.

Results: The review underscored diverse relationships among changes in velocity, musculoskeletal and neuromuscular components of sitting posture development that merited further research. Results of the study with TD infants showed that a PSV threshold (132.782 mm/s) at P sitting was significant for progression to I sitting and a positive relationship between early PSV and onset of postural adjustments at P (R_{ML}=0.972) and SI (R_{AP}=0.962, R_{ML}=0.958) sitting stages. Directionally opposite relationships were found between PSV variability and weight (positive) and height (negative) for both groups at the SI stage.

Conclusions: The findings suggest that during the development of sitting PSV may play a role in transitioning from prop sitting to independent sitting and that for infants at risk for CP, it may serve to distinguish sitters from non-sitters. Because PSV is affected by multiple biomechanical and neuromuscular factors, future studies with larger samples will illuminate the interplay between PSV variability and delayed acquisition of sitting.