Notice of the Final Oral Examination
for the Degree of Master of Science

of

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BA (University of Victoria, 2014)

“Instrumenting the Clinical Test of Sensory Interaction and Balance: A Comparison of Different Measure of Balance”

School of Exercise Science, Physical and Health Education

Thursday, April 23, 2020
9:30am
Remote defense

Supervisory Committee:
Dr. Sandra Hundza, School of Exercise Science, Physical and Health Education, University of Victoria (Co-Supervisor)
Dr. Marc Klimstra, School of Exercise Science, Physical and Health Education, UVic (Co-Supervisor)
Dr. Stuart MacDonald, Department of Psychology, UVic, (Outside Member)

External Examiner:
Dr. Jodie Gawryluk, Department of Psychology, UVic

Chair of Oral Examination:
Dr. Andrew Rowe, Department of Mechanical Engineering, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies
Abstract

BACKGROUND: Balance is integral to an individual's ability to stand and walk, often deteriorates with age and has been identified as one of the major risk factors for fall risk. The Clinical Test of Sensory Interaction and Balance (CTSIB) has been shown as a valid tool to characterize postural sway during quiet standing to serve as a measure of balance control and this measurement can be reflected as either Centre of Pressure (COP) and Centre of Mass (COM) in different kinematics forms including acceleration, velocity and displacement. In addition, within the kinematics of acceleration, velocity and displacement, there is an array of metrics, such as maximal sway, sway mean, sway standard deviation and area of an ellipse that can be calculated to quantify postural sway. It is currently not clear which of these potential measures and metrics of postural sway are best suited to differentiate balance performance between the CTSIB trials.

RESEARCH QUESTION: Which metrics and measures of postural sway are best suited to differentiate balance performance between the CTSIB trials?

METHODS: Thirty-nine community-dwelling older adults’ (70+) completed the six trials of CTSIB. We determined the capacity of displacement and velocity of COP [COPFPd and COPFPv, respectively] measured by a force plate and velocity and acceleration of COM [COMIMUa, and COMIMUv, respectively] measured with inertial measurement unit (IMU), as well as displacement of COM [COMPend]) measured with a Pen-tail to differentiated the balance performance between trials of CTSIB by using repeated measures analysis of variance conducted across all metrics and the six trials of CTSIB separately for each measure for main effects for trial and significant interactions between trials and metrics. Post hoc analysis was conducted on significant interactions (p < 0.05) for main effects and interactions using Tukey’s Honest Significant Difference test. Effect sizes for comparisons between significant trials were calculated using Hedge’s G.

RESULTS: All ANOVA’s for each kinematic measure yielded significant main effects for trial, metric and trial by metric interactions. Out of 135 comparisons, the number of significant differences between CTSIB trials was seen in COPFPd (56), followed by COMIMUv (54), COPFPv (48), and COMIMUa (28). For COMPend 6 out of a possible 45 significant difference between CTSIB trials.

DISCUSSION: This study is the first to compare different measures and metrics across trials of the CTSIB to characterize unique features of postural sway. Importantly, all the measures were capable of detecting differences between trials of the CTSIB. Further, the differences between Trials 1-5 and 1-6, and AoE metrics, were sensitive to more differences between trials across all measures. Finally, AP and ML metrics had the largest effect size across trials.