UNIVERSITY OF ALBERTA
FACULTY OF MEDICINE & DENTISTRY

BME SEMINAR

Department of Biomedical Engineering

Date: 2017 Aug 23, Wednesday
Time: 12:00 PM (Noon)
Venue: 1-075 Research Transition Facility

"Seated Balance: A New Tool for Assessment and Training"

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Abstract:

Tools that effectively assess and train dynamic seated balance are critical for enhancing functional independence and reducing risk of secondary health complications in the elderly and individuals with neuromuscular impairments. The objective of this thesis research was to devise and validate a novel tool for the assessment and training of dynamic seated balance. An instrumented wobble board was designed and constructed to: (1) elicit multidirectional perturbations in seated individuals; (2) quantify seated balance proficiency; and (3) provide kinematics-based vibrotactile feedback. Interchangeable curved bases were designed to elicit modular levels of seated instability in all tilt directions. An embedded, inertial measurement unit was used to estimate the tilt angle and direction, whereas eight vibrating tactors displayed feedback cues on the sitting surface. A microprocessor encoded the vibrotactile stimulation based on the wobble board's tilt angle and speed. After performing a technical validation study to compare kinematic wobble board measurements against a gold-standard motion capture system, twelve non-disabled participants performed a dynamic sitting task using the wobble board.

Posturographic analyses in time and frequency domain as well as stabilogram diffusion analyses were used to characterize seated balance for three different conditions: (1) with eyes open and closed; (2) with two different levels of seated instability; and (3) with vibrotactile feedback on and off. Our results demonstrate that the tilt angle measurements were highly accurate throughout the range of wobble board dynamics. Furthermore, the posturographic analyses for the dynamic sitting task revealed that the wobble board can effectively discriminate between the three conditions of perturbed balance, demonstrating the potential for the wobble board to serve as a clinical tool for the assessment and training of seated balance. Vibrotactile feedback decreased the amplitude, speed, and centroidal frequency of wobble board tilt, demonstrating its potential for use as a balance training tool. Unlike similar instrumented tools, the wobble board is portable, requires no laboratory equipment, and can be adjusted to meet the user's balance abilities. While future work is warranted, this study contributes to the knowledge of assessment and training techniques for seated balance. Obtained findings will aid in effective translation of such techniques to a clinical setting, which has the potential to enhance diagnosis and prognosis for individuals with seated balance impairments.

All Are Welcome