Multisensory integration for the control of balance and walking

Wednesday Feb 5th, 2014 - 3:00-5:00pm

Description: The principal goal of this session is to familiarize participants with current research that has advanced our understanding of multisensory control of posture and walking, to identify overlapping conclusions that produce generalizable principles, and to present suggestions for how contemporary knowledge may be applied to clinical practice. In this session we will present some of the research that has demonstrated how multisensory integration modifies motor responses in postural control and walking. Recent scientific studies using motor learning principles and more complex models of sensorimotor control have revealed that even traditionally viewed sensory systems, such as the vestibular system, may be involved in a complex integration of information from several sensory pathways. This more sophisticated understanding of sensory processing and its impact on the multisegmental body alters our understanding of causality and treatment of instability during functional movements. The development of virtual reality and other applied technologies has contributed to research in understanding the affect of multisensory processes on motor control and has suggested new approaches for the assessment and treatment of individuals with balance and locomotor deficits.

Speakers: Bradford McFadyen, (CIRRIS/Laval Univ., Quebec City, Canada)
Emily Keshner (Temple University, Philadelphia PA),
Anne Galgon (Temple University, Philadelphia PA)

I. Introduction to session (Galgon)
   a. OBJECTIVES:
      Upon completion of this course, you will be able to discuss the advancements and limitations of current research on multisensory processing, and use the evidence to:
      i. improve assessment and treatment of postural control
      ii. Improve assessment and treatment for control of locomotion.
      iii. support new interventions for patients with balance and locomotor deficits.

II. Impact of Multisensory Integration on Balance Control (Keshner)
   a. Postural Behaviors are modified with multisensory integration Complexity of Postural Control pathways
      i. Impact of multi-sensory inputs on posture control
      ii. Sensory weighting vs. Integration
      iii. Attention and selection of sensory signals
   b. Changes with aging and stroke
      i. What does compensation look like when particular signals are diminished or unreliable?
      ii. Augmenting sensory signals to improve balance
   c. Can balance control be learned?
      i. Virtual Reality as a training tool
      ii. Combining VR with robotics
III. Impact of multisensory processing on locomotion (McFadyen)
   a. Basic Evidence for normal locomotor mobility
      i. Complexity of the multi-sensory pathways for locomotion
      ii. Environment related adjustments required of normal locomotor mobility
          and relation to sensory information
          1. Anticipatory Locomotor Adjustments ALAs
          2. Reactive Locomotor Adjustments RLAs
          3. Executive functioning demands of ALAs/RLAs
             a. Planning/attention
   b. Population specific Evidence of deficits in locomotor mobility (Acquired Brain Injury)
      i. Traumatic Brain injury
         1. Issues of severity
         2. Deficits in ALA/RLA and executive functioning
         3. Diagnoses and decisions of return to function
      ii. Stroke
         1. Issues of severity
         2. Deficits in ALA/RLA and executive functioning
         3. Diagnoses and decisions of return to function
   c. Use of technology to aid research in locomotor deficits and apply to
      assessment/intervention
      i. Wearable Sensors
      ii. Virtual Reality

IV. Integration of research into clinical practice (Galgon)
   a. Practical application to examining sensory process and executive functioning
      during postural and walking activities
      i. Identifying and measuring sensory and attention deficits
      ii. Identifying impact on motor adjustments during standing and ambulation
   b. Practical application to interventions that address sensory processing deficits in
      individuals with balance and walking limitations
      i. Providing rich environmental (sensory) experiences during practice
         1. Virtual Reality versus Natural Environments
         2. Varying difficulty based on severity of deficits
      ii. Intensity of practice to optimize function

V. Panel discussion and questions and answers (Keshner, McFayden, Galgon)
References:


