NEUROSCIENCE 2014

Presentation Abstract

Program#/Poster#:	734.02/MM32
Presentation Title:	Vestibular contributions to lateral stabilization are bilaterally dependent during split belt walking
Location:	WCC Hall A-C
Presentation time:	Wednesday, Nov 19, 2014, 9:00 AM -10:00 AM
Presenter at Poster:	Wed, Nov. 19, 2014, 9:00 AM - 10:00 AM
Topic:	++D.16.b. Posture and gait: Afferent control
Authors:	***P. A. FORBES**[1], M. VLUTTERS[2], C. J. DAKIN[3], J.-S. BLOUIN[4], A. C. SCHOUTEN[1]; [1]Biomechanical Engin., Delft Univ. of Technol., Delft, Netherlands; [2]Univ. of Twente, Enschede, Netherlands; [3]Univ. Col. London, London, United Kingdom; [4]Univ. of British Columbia, Vancouver, BC, Canada
Abstract:	Vestibular information is critical for maintaining balance during locomotion, and is known to be attenuated with increasing locomotor velocity and cadence. This attenuation is muscle and phase dependent, and is thought to reflect the functional contribution of each muscle to balance control during each stride of the gait cycle. Bilaterally, the vestibular coupling is mirrored relative to the gait cycle as each leg undergoes similar modulation with variation in phase, velocity and cadence. Here, we asked whether the modulation of the vestibular contribution to each limb is bilaterally dependent. By using a split-belt treadmill with asymmetric belt speeds, we can control the locomotion properties of each leg and compare the vestibular modulation to symmetric conditions. We hypothesized that bilaterally symmetric vestibular modulation would indicate leg independent vestibular influence while bilaterally asymmetric vestibular modulation would indicate leg dependent vestibular influence. Subjects were exposed to binaural bipolar stochastic vestibular stimulation (0-25 Hz) during symmetric and asymmetric walking conditions. Symmetric trials were performed at belt speeds of 0.4 and 0.8 m/s and for 10 min. The asymmetric trial was performed at belt speeds of 0.4 and 0.8 m/s for 16 min. Subjects walked with a cadence of 78 steps/min which was easily maintained in both limbs. EMG of the bilateral medial gastrocnemii and

three-dimensional ground reaction force and torques were collected. Only the last 340 strides (~ 9 min of data) were used in the analysis to avoid the adaptation that typically occurs within the first 250 strides (~ 6 min) of asymmetric walking. Significant muscle activity and lateral ground reaction forces ($P < 0.01$) were correlated to the input stimuli in all trials. Stimulus-EMG and -lateral ground reaction force correlations decreased at higher belt speeds during symmetric walking, as previously reported. During the split belt condition, the magnitude of correlations stimulus-EMG and -force were bilaterally asymmetric and different from their symmetric counterparts. During the asymmetric condition correlations decreased for the slow leg, but more closely resembled the responses observed during slow symmetric walking, and increased for the fast leg, but more closely resembled the responses observed during fast symmetric walking. These results indicate that the modulation of vestibular reflexes is dependent upon the specific kinematics of each leg but bilaterally linked to respond to the properties of the locomotion pattern.

Disclosures: **P.A. Forbes:** None. **M. Vlutters:** None. **C.J. Dakin:** None. **J. Blouin:** None. **A.C. Schouten:** None.

Keyword (s): LOCOMOTION

VESTIBULAR

MODULATION

Support: FP7-ICT-2013-10 EMBalance 610454

FP7-PEOPLE-2013-IOF HEADS-UP 624158

NSERC Discovery Grant (JS Blouin)