THE EFFECT OF AGE AND FALLS HISTORY ON MECHANICAL RESPONSES TO ELECTRICALLY EVOKED CUTANEOUS REFLEXES DURING WALKING

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INTRODUCTION

Age-related changes in human biomechanics and motor control quantifiably alter locomotor activities throughout the lifespan [1]. For example, aging is related to differences in the pattern of muscle activity and joint torque during walking [2] as well as changes in reflex sensitivity during posture and locomotion [3,4]. Studies of reflexes have proven invaluable for understanding functional responses to sensory stimulation during locomotion, as well as to characterize deficits in control [5]. For example, in healthy young subjects, it has been observed that reflex responses result in coordinated neural and mechanical outcomes that serve important regulatory functions during human locomotion [6]. That is, reflexes originating from cutaneous nerves of the foot have been shown to assist with obstacle avoidance during the swing phase of walking while reflexes from muscle afferents in the lower limb have been associated with important stance phase corrections [6,7]. In the elderly, there is a noticeable decrease in the contribution of muscle afferent reflexes during the stance phase of walking [4]. This may reflect changes in central control that result in altered neural and mechanical responses to perturbations [4]. Therefore, the study of reflex responses during locomotor activities in the elderly may be useful to establish mechanisms of age related neuromechanical changes and present potential markers for deterioration in functional ability related to fall risk. While there has been some research on muscle afferent reflexes in the elderly, a neuromechanical investigation of cutaneous reflexes has only been conducted in young adults using simple single-axis kinematics at the ankles and knees [6]. Additionally, there is no known research quantifying neuromechanical reflex responses to electrical stimulation in older adults with a fall history. Therefore we intend to quantify 3D mechanical changes in cutaneous reflex responses during locomotion in 3 adult groups; young, older with no fall history (>70) and older with a history of falls. We hypothesize that mechanical outcomes will be largest in the young group, diminished in the healthy elderly group and further diminished in the elderly group with a history of falls.

METHODS

Three age groups will be involved: younger adults (19-40), older adults (70+) and older adults with a history of falls (2 or more falls in the past year). Cutaneous reflexes will be evoked during walking by stimulation of the superficial peroneal (SP) and tibial (Tib) nerves during separate trials [8]. Muscle activity will be gathered with a tethered EMG system (P511, Grass Technologies). Kinematic measures (joint and segment kinematics, spatio-temporal gait parameters and centre of mass (COM) motion) will be gathered utilizing a 3D motion analysis system (Vicon Motion Systems). Analysis will involve comparison between the 3 participant groups as well as between cycles with stimulation (intervention) and cycles without (control) for biomechanical, reflex and background EMG measures. Statistical analysis will involve repeated measures ANOVA with post hoc analysis to determine main effects of phase of gait, group and their interactions.

REFERENCES