GAIT STABILITY DURING DIRECTION CHANGE WALKING WITH T-POLES IN THE ELDERLY

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INTRODUCTION: Falls are the leading cause of injury deaths for the elderly and typically occur when this population is forced into an unbalanced condition, such as changing a direction during gait. It is widely accepted that the elderly are more vulnerable to falls due to age-related declines in balance and gait stability (Hahn & Chou, 2003). Therefore, a better understanding of gait stability mechanics during direction changes would be critical in reducing the incidence of falls among the elderly. One of the most insightful ways to assess gait stability is to use the instantaneous orientation of the line that connects the center of pressure (COP) and whole body center of mass (COM). The angles made by the line with respect to horizontal line (COM-COP inclination angles) are characterized by the whole body position with respect to the supporting foot during gait (Chou, 2006). Recently, telescope-style walking poles (T-poles) were deemed effective in reducing elderly fall risk factors (Yoon, 2007); however, the effect of T-poles on gait stability is still unknown. The purpose of this study was to investigate the effects of T-poles on elderly gait stability using COM-COP inclination angles in both straight and direction change during gait.

METHODS: Thirteen healthy elderly participants were medically screened and cleared by a physician prior to participation in the study. All recruited participants had a minimum of 9 months of experience of walking with T-poles (age: 74.2 ± 4.7yrs; height: 165.3 ± 6.7 cm; body mass: 74.3 ± 8.8 kg). Informed consent was obtained from each participant and this study was approved by Institutional Review Board of the University. Each participant was asked to walk with (PW) and without (NW) T-poles at three different turning angles (0˚, 20˚, and 45˚). Each condition was performed at participants' preferred walking speed. The average velocity was 1.6 ± 0.3 m/s. Three successful trials were collected per each walking condition and averaged prior to data analysis. All conditions were balanced and randomized in order. A three dimensional motion analysis were performed with eight 60-Hz video camcorders (Panasonic DVC-15), using a Kwon3D XP (version 4.0) motion analysis Suite (Visol, Inc., Seoul, Korea). A fourteen-segment, rigid-link human body model was used in this study. A two-way (2x3) repeated measure analyses of variance (ANOVA) were employed for this study to determine the significances in both pole conditions and turning angles ($\alpha < .05$).

RESULTS AND DISCUSSION: PW demonstrated significantly smaller medial inclination angles when compared to NW conditions ($p<.05$). There were no significant differences found in both anterior and posterior inclination angles between PW and NW. Medial inclination angles increased significantly as turning angles increased in both PW and NW (45˚> 20˚ > 0˚, $p<.05$). However, the value differences between consecutive turning angles are greater in NW than PW. T-poles had a positive affect on the elderly gait stability, especially, when the elderly are faced with unbalanced situations.

REFERENCES:

Hahn, M.E., & Chou, L.S. (2003). Can motion of individual body segment identify dynamic instability in the elderly? *Clinical biomechanics*, 18, 737-744.

Lee, H.J., & Chou, L.S. (2006). Detection of gait instability using the center of mass and center of pressure inclination angles. *Archives of physical medicine and rehabilitation,* 87, 569-575.

Yoon, S.H., Ryu, J., & Kwon, Y-H. (2007). Kinetic analysis of telescope-style walking poles on elderly gait. *XXIst Congress of International Society of Biomechanics*, Taipei, Taiwan.