THE ALTERATIONS TRAJECTORY OF CENTER OF MASS WHEN NEGOTIATING OBSTACLES WITH DIFFERENT HEIGHTS IN THE OLDER ADULTS

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INTRODUCTION

Over 20 percent of people over 65 years old and living in the community fall each year. The age-related changes in postural control and falls in the older adults remain unclear. Tripping by an obstacle is one of the activities that cause falls most frequently in the elderly (Lin, 2002). A better knowledge in the alterations of the postural performance in the elderly is important for studying the falling problems. The trajectory of center of mass (COM) of the body has been used to represent the capability of the human's static or dynamic postural control (Chou, 2001). The aim of this study was to investigate the strategy on the adjustment of the body COM when negotiating the obstacles with different heights in the elderly.

METHODS

Twenty-two community-dwelling elders aged over 65 (77.58±5.92 years old) were recruited with informed consent. Thirty-nine reflective markers were then placed on the body for each subject. A seven-camera motion analysis system was used to collect the kinemetic data, and a 15-linkage human model was used to calculate the trajectory of whole body's COM. The subjects were then asked to walk with their self-selected paces and perform stepping over the obstacles with four different heights (0, 10, 20, 30 % of leg length). Maximum movement ranges, velocities, and accelerations of the body's COM trajectories were extracted as dependent variables. Repeated ANOVA was used to compare the variables between heights with significance level of 0.05.

RESULTS AND DISCUSSION

The sway of body COM in medial-lateral (ML) and up-down (UD) directions increased with the obstacle heights. The results agreed with Latughton's study that suggested the larger ranges of motion in the swing leg increased the body sway. The forward (F) maximal velocity had not

significantly trend with the obstacle conditions, it might mostly depend on the subject preferred pace. The maximum velocities in UD directions increased significantly with obstacle heights while in backward (B) direction, meaning minimum forward velocity decreased with the obstacle heights (Fig. 1). These results suggested that the elder subjects would slow down the progression significantly to accommodate the higher obstacle conditions.

Corresponding results were found in the maximal acceleration in the FB and UD directions, which increased with the heights to achieve the changes in maximal velocities. The alterations of maximum velocities seemed revealing the strategy when cope with the obstacles. The maximum acceleration demonstrated a high level of changes in COM trajectory, implied the rapid response of postural control were required during obstacle-crossing.

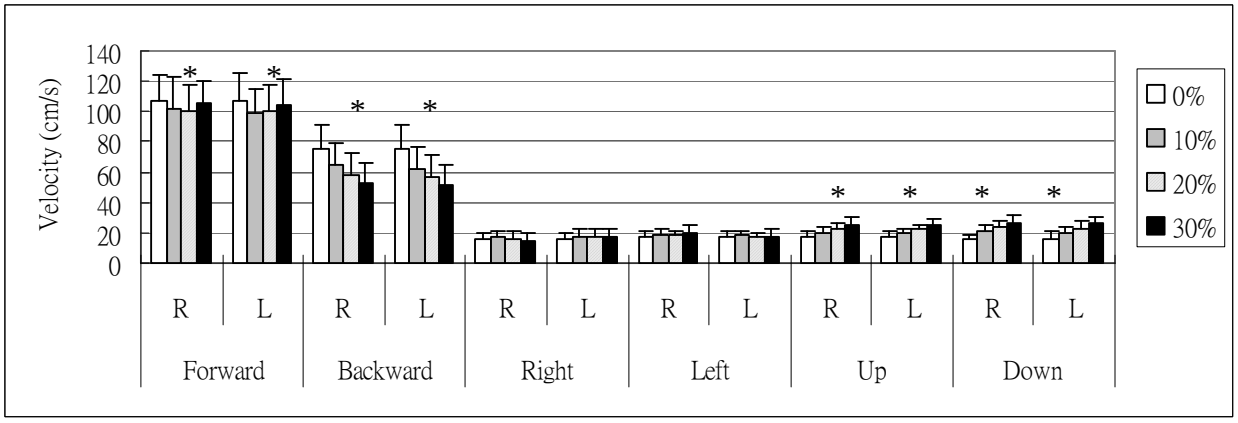

Figure 1: The maximum velocities in six different directions when crossing the obstacles with different heights in the elderly. (R: right leg leading, L: left leg leading)

SUMMARY

The older adults had a raised and rapid changed COM trajectory adopting with the higher obstacle, resulting a more unstable condition and increased the risks of fall. To cope with this challenging but frequent activity, the elderly should be suggested to increase their muscle strength of lower extremities and dynamic motor control.

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