CHAPTER I

INTRODUCTION

Age-related changes in gait parameters have been well documented in the literature (1-10). These changes are thought to be a compensation for decrease gait stability due to degenerative changes followed advanced age (1, 11-14). Previous studies reported distinct changes of gait parameters between young and elders. These specific gait parameters were step length, double-support time, toe clearance and maximal sole inclination. Different gait characteristics have also been reported between elderly persons with and without history of fall. Specifically, several studies have shown that elderly fallers walked with slower speed, shorter step length, longer duration of the support time period, lower toe clearance and sole inclination compared to elderly non-fallers (5-6, 15-21).

One common method to examine the integrity of motor control system is measuring movement variability. Previous work has suggested that measures of gait variability may be more closely related to fall than measures of mean values of gait parameters (22). In healthy young adults, stride to stride fluctuations are relatively small, indicating the accuracy and reliability of the fine-tuned systems that regulate gait (23). In contrast, in elderly people even those with an absence of pathology, it is common to find an increased inconsistency from one stride to the next which caused gait instability (23-24). It has been interpreted that increased gait variability in elders reflects the nervous system declines due to aging. Of the various gait variability parameters that have been studied, stride-to-stride inconsistency (i.e. variability in

stride length and stride time) was shown to reflect gait instability and was also been used to predict fall risk in elders (5, 15, 23, 25-30).

Gait characteristics are generally investigated in the gait laboratory setting using flat surface walkway. Although we encounter inclined walking surfaces regularly and walking on uneven surfaces has been conducted as an activity that is highly associated with falls in elders, little research has been investigated on how gait parameters are modified during these situations. Previous studies in healthy young adults have demonstrated significant changes in biomechanical parameters, specifically, joint kinematics and kinetics, indicating that unique control strategies are required during walking on slope surface (31-37). However, little evidence has been directed towards the examination on how elders' walking patterns are modified in these circumstances.

Therefore, in this present study, there was an interest in investigating the effects of up-and downslope walking on mean and variability of gait parameters in healthy community-dwelling elders. Mean and variability of gait parameters (i.e. step length, double support time, toe clearance, maximal sole inclination, stride length and stride time variability) that indicated to reflect gait instability in elders were examined. It was surmised that during walking on slope surface, these gait parameters would be different from those during walking on level surface. Specifically, they would be modified to accommodate for an increased demand of the slope walking task. The knowledge derived from the present study would provide useful information about the ability to control locomotion in healthy elders when changing surface level. Consequently, clinical implications such as a preliminary knowledge for future investigation may be established.

Research Questions and Hypotheses

Research question

How do slope surfaces affect gait parameters of healthy elderly women?

How do slope surfaces affect gait variability of healthy elderly women?

Hypothesis

When walking on slope surface (both up- and downslope), elders' gait parameters (mean and variability) will change in the direction similar to when they encounter a balance threatening situation. Specifically, step length, double support time, maximal sole inclination will decrease while toe clearance and gait variability will increase compared to when walking on level surface.

Dependent variables

(Definition of each dependent variable was described in the data analysis section)

Gait parameters:

1. Step length
2. Double support time
3. Toe clearance
4. Maximal sole inclination

Gait variability:

1. Stride length variability
2. Stride time variability

Purpose of the study

The purpose of this study was to investigate the effects of up-and downslope walking on mean and variability of gait parameters in healthy elderly women. Specifically, these variables were investigated:

1. Step length
2. Double support time
3. Toe clearance
4. Maximal sole inclination
5. Step length variability
6. Stride time variability

Application advantages

The knowledge derived from the present study will provide useful information about the ability to control locomotion in healthy elderly persons when changing surface level. Consequently, clinical implications such as a preliminary knowledge for future investigation may be established.