

The Effects of Hippotherapy on Elderly Persons' Static Balance and Gait

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Abstract. [Purpose] The aim of this study was to examine the effects of hippotherapy on elderly persons' static balance and gait. [Subjects and Methods] Twenty-two elderly persons residing in the community were randomly divided into a hippotherapy group and a treadmill group and they conducted exercise for eight weeks. [Results] Step lengths increased significantly, and step time and sway path lengths significantly decreased in both groups. A comparison of sway path lengths after the intervention between the two groups revealed that the hippotherapy group showed larger decreases than the treadmill group. [Conclusion] The results of this study indicate that hippotherapy may improve the static balance and gait of elderly persons residing in the community.

Key words: Elderly, Balance, Hippotherapy

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INTRODUCTION

Balance control is very important for independent activities. Muscle weakening in elderly persons, and the accompanying difficulties they have with daily activities reflect the progress of aging. Balance control ability is hampered by such muscle weakening or such functional restrictions and the risk of falls increases^{1, 2)}. Daily activities may be restricted due to the fear of falls resulting in functional loss, which may further increase the risk of falls. As a result, activities gradually decrease, leading to a deterioration in the quality of life and mental well-being of elderly persons³⁾. If elderly persons have a regular exercise regime, their gait, balance, and muscle strength will improve and their ability to perform exercise will increase, leading to the enhancement of their functional abilities. Therefore, balance training can improve elderly persons' stability and reduce the risk of falls⁴⁾.

Hippotherapy has a long history as a treatment and rehabilitation method and has recently come to the fore as a therapeutic technique for the improvement of balance control. During hippotherapy, the patient not only controls balance through active movements, but also promotes balance control as a response to the horse's movements. The patient is mediated by the horse to control abnormal muscle tones and movement patterns, improve trunk balance control and gait, and enhance balance and sensory

integration⁵⁾. It is hypothesized that hippotherapy can enhance the balance and therefore the functions of elderly people and prevent falls. However, studies of hippotherapy for elderly persons are lacking. Therefore, this study examined the effects of hippotherapy on elderly persons' static balance and gait.

SUBJECTS AND METHODS

This study was conducted with 30 elderly persons residing in the community in Gyeonggi-do (Table 1). The selection criteria for the subjects were as follows: at least 65 years old, no falls within the last year, and no disease that might have affected the hippotherapy. Those who had visual impairment, hearing damage, nervous system or vestibular organ problems, or were unable to understand the nature of the experiment were excluded. All the subjects understood the purpose of this study and provided their written informed consent prior to their participation in the study in accordance with the ethical standards of the Declaration of Helsinki.

The subjects were divided into a hippotherapy group of 15 subjects and a treadmill group of 15 subjects, and training was carried out by both groups in 20-minute sessions, three times per week for 12 weeks. During the training eight subjects decided to pull out of the experiment. In every session of hippotherapy, the horse walked around a 30 m diameter circle 20 times to the right and 20 times to the left in the 20 minutes. In each session, the treadmill training began at a minimum speed 0.1 of km/hour, and subjects progressed to their individual maximum speeds, which they maintained for 20 minutes. To measure subjects' static balance ability before and after the intervention, each subject was instructed to stand on a BPM (software 5.3, SMS Health-

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Table 1. General characteristics of the subjects

	Hippotherapy	Treadmill
Gender (M/F)	5/6	7/4
Age (year)	70.3±3.4	68.5±3.2
Height (cm)	157.9±8.3	162.9±7.4
Weight (kg)	55.7±5.7	55.2±6.6
Mean±SD		

care Inc., UK) while looking straight ahead with his or her eyes open for 30 seconds, and the sway path length was measured. To measure the subjects' dynamic balance ability, their step lengths and step times were measured using an AP1105 (GaitRite CIR, USA). All measurement results are expressed as the mean± standard deviation.

SPSS for Windows (version 18.0) was used to analyze the data. The paired t-test was used to examine pre- and post-intervention differences, and the independent t-test was used to examine differences between the groups. The statistical significance level was chosen as $\alpha = 0.05$.

RESULTS

After the intervention, step lengths increased significantly ($p < 0.05$), and step time and sway path lengths decreased significantly ($p < 0.05$) in both groups. A comparison of sway path lengths after the intervention between the two groups revealed that the hippotherapy group showed larger decreases than the treadmill group ($p < 0.05$) (Table 2).

DISCUSSION

Falls are a cause of disability and the most important cause of injuries related to death among elderly persons. Elderly persons have poorer balance ability than younger adults and thus have a higher risk of falls⁶. They also have shorter step lengths and slower step speeds⁷. These slow steps cause instability and falls and thus step length decreases to compensate for the slow steps⁸. During gait, temporary instability occurs when the body is supported by one foot and balance recovery occurs on the stepping foot to restore the COG (center of gravity) to within the range of the BOS (base of support). Step length increases demonstrate that balance control ability has improved, and balance can be recovered from larger angles when instability increases as the COG moves during gait. Step-speed increases can be regarded as a sign of an increased response to control balance⁷. Therefore, increases in step length and step speed increase the ability to cope with the risk of falls when balance has been lost. Step length increased significantly and step time decreased significantly after eight weeks of intervention in both the hippotherapy group and the treadmill group. Since decreases in step time mean increases in step speed, these results indicate that the risk of falls decreased in both groups.

Liston et al.⁶ found that when postural sway tests were conducted, the elderly persons tested showed lower risks of falls than those who did not undergo the tests and

Table 2. Comparison of pre-test and post-test measurement values

Variable	Group	Pre	Post
Step length (cm)	Hippotherapy	41.1±9.1	48.2±7.0 ^a
	Treadmill	46.8±5.2	55.0±8.9 ^a
Step time (sec)	Hippotherapy	0.7±0.1	0.5±0.1 ^a
	Treadmill	0.7±0.1	0.6±0.1 ^a
Sway length (mm)	Hippotherapy	236.1±36.3	182.6±31.8 ^{ab}
	Treadmill	235.5±31.2	210.6±25.5 ^{ab}

^a, significant difference between pre and post values; ^b, significant difference between Hippotherapy and Treadmill at post-test

those who showed shorter sway path lengths showed lower risks of falls. Fujita et al.⁹ measured postural sway path length in relation to age, and reported that elderly persons showed longer sway path lengths than young adults. The sway path lengths were proportional to age, and age and effective postural control were inversely proportionate to each other. Tucker et al.¹⁰ said that those who experienced many falls showed larger ranges of postural sway and slower, more inefficient balance responses than those who had no experience of falls; thus they had higher risks of falls. Thus, a large range of sway indicates ineffective postural control and a high risk of falls. In this study sway path lengths decreased significantly after eight weeks of intervention in both groups. Therefore, we conclude that both groups gained improvements in static balance, with the hippotherapy group showing larger effects. We believe that this difference is because hippotherapy is composed of more dynamic upward-downward, leftward-rightward, and forward-backward movements of the horse than treadmill exercises, which results in greater promotion of dynamic postural responses.

The limitations of this study include the fact that the number of subjects was small, thus the results cannot be extrapolated to all elderly persons. In addition, the length of time over which the balance and gait abilities of the elderly persons can be maintained after improvement through hippotherapy needs to be evaluated in follow-up tests.

The need for ways to prevent elderly persons' falls and to improve their balance ability is growing as society is aging. Hippotherapy may be an effective method for improving elderly persons' balance abilities and preventing falls.

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