J. Phys. Ther. Sci.
27: 2739–2741, 2015

Original Article

The influence of horseback riding training on the physical function and psychological problems of stroke patients

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Abstract. [Purpose] The purpose of this study was to determine the influence of horseback riding training on the physical function and psychological problems of stroke patients. [Subjects and Methods] Thirty stroke patients were divided evenly into an experimental group and a control group. Both groups carried out neurodevelopmental treatment. The experimental group additionally performed mechanical horseback riding training for 30 minutes a day, 5 days a week, for 6 weeks. Physical function was evaluated using the Berg Balance Scale (BBS) and the Timed Up and Go Test (TUGT). Psychological problems were assessed using the Beck Depression Inventory (BDI). In order to compare differences within groups between before and after the experiment, the paired t test was conducted. In order to compare differences between groups before and after the experiment, the independent t test was conducted. [Results] In the experimental group, the BBS, TUGT, and BDI showed significant improvements after the intervention. The experimental group's BBS, TUGT, and BDI post-intervention changes were significantly better than those observed in the control group. [Conclusion] According to our results, horseback riding training has a positive effect on the physical function and psychological problems of stroke patients.
Key words: Horseback riding training, Physical function, Psychological problems

(This article was submitted Apr. 30, 2015, and was accepted May 25, 2015)

INTRODUCTION

Stroke is a cerebrovascular event in which a blood vessel of the brain either becomes blocked or ruptured[1)]. The neurological loss is determined by the occurrence area, which may stimulate psychological disorders of anger and depression, and physical function disorders affecting factors such as sensory, exercise, balance, and walking ability[1, 2)]. Stroke may cause posture instability due to weakening of muscular strength and anesthesia, making it difficult to maintain balance[2, 3)]. The loss of balance limits daily activities and the gait of stroke patients[1, 3)]. Depression may occur in cases without a history mental illness and is a common psychological problem among stroke patients[2)]. It is a complication that may occur either acutely or during recovery[4)]. Physical function recovery becomes delayed in patients who have depression, which decreases their quality of life[2, 4)]. Therefore, stroke patients must be comprehensively treated for both physical function disorders and depression.

Horseback riding is receiving attention as a method that preserves function in patients with physical disability or patients with damaged motor ability[5)]. The rhythmical and repetitive movement of the horse stimulates all of the senses in order to rotate the center of the body upwards and downwards and to the left, and right[6)]. It has been reported that this is similar to the movement pattern of the pelvis when a person is walking[5, 6)]. Horse-riding movements increase physical function, improving muscular strength, agility, balance, weight support, coordination, and blood circulation[5–8)]. They also have a positive influence on psychological problems, including self-esteem, pride, motivation, and space perception[5–8)]. Moreover, it has been reported to help the physical recovery of patients who have cerebral palsy, multiple sclerosis, stroke, and spinal cord damage[7–10)].

Many studies of horseback riding have been conducted, but there is still insufficient information about how horseback riding influences physical and psychological functions. Thus, the purpose of this study was to find out how horseback riding influences physical and psychological function, as well as to suggest an effective treatment.

SUBJECTS AND METHODS

This study selected 30 stroke patients as subjects and divided the patients into two groups: 15 (8 males and 7 females) in the experimental group, and 15 (8 males and 7 females) in the control group. Subjects with no visual disability, no orthopedic diseases in the upper or lower limbs,

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who scored more than 24 points in Mini-Mental State Examination (MMSE), and who were able to walk more than 10 meters using auxiliary equipment were selected. All the participants were informed about the research purpose and provided their informed consent before the experiment. The study protocol was approved by the Institutional Review Board of Seonam University and was conducted in accordance with the ethical principles of the Declaration of Helsinki. The general characteristics of the subjects are shown in Table 1. The experimental group had an average age of 68.4.1±2.1 years, an average height of 168.6±7.1 cm, an average weight of 71.2±3.2 kg, and an average time since stroke onset of 11.5±2.1 months. The control group had an average age of 67.0±3.2 years, an average height of 169.2±3.1 cm, an average weight of 70.6±5.6 kg and an average time since stroke onset of 12.1±3.1 months.

Both groups received neurodevelopment treatment for 30 minutes every day, 5 times a week, for a total of 6 weeks. Additionally, the experimental group performed mechanical horseback riding training for 30 minutes every day, 5 times a week, for a total of 6 weeks. Horseback riding equipment (JOBA EU7800, Panasonic Inc., Japan) was used for the study. Horseback riding equipment delivers 5 types of movements (twisting, up-down sliding, front to back slide, front to back roll, and left to right roll) to simulate three-dimensional movement. This study conducted parts of courses and whole body courses using the software installed on the horseback riding equipment. Based on the level, adaptability, and motor ability of the subjects, they were asked to start at level 1 and continue to level 4. The subjects were able to control their posture while using the horseback riding equipment by holding onto the handles with their hands and by maintaining proper posture.

Physical function was evaluated using the Berg Balance Scale (BBS) and the Timed Up and Go Test (TUGT). Psychological problems were assessed using the Beck Depression Inventory (BDI). Measurements were taken both before and after the 6-week intervention. The BBS assesses the functional level of balance. It comprises 14 items, divided into three sections of sitting, standing, and change of posture. Each item is scored from 0 to 4 points, and the maximum possible score is 56. When the score is high, it indicates that balance ability is good. The TUGT assesses functional mobility by measuring the time taken to stand up from a chair, walk forward 3 m, turn around, walk come back, and sit back down on the chair. The BDI assesses the depression level. It comprises 21 items, including emotional, cognitive, motivational, and physiological symptoms. Each item is scored from 0 to 3 points, and the maximum possible score is 63: 0 to 9 points indicates not depressed; 10 to 15 points indicates slight depression status; 16 to 23 indicates mild depression; and 24 to 63 indications severe depression.

SPSS version 12.0 (SPSS, Chicago, IL, USA) was used for the statistical analysis. The general characteristics of the subjects are expressed as the mean and standard deviation using technical statistics. The paired t-test was used to compare the pre- and post-test results of each group. The independent t-test was conducted to compare the changes of the two groups. The statistical significance level used was to α=0.05.

Table 1. General characteristics of subjects

	EG (n=15)	CG (n=15)
Gender (male/female)	8/7	8/7
Age (years)	68.4±2.1[a]	67.0±3.2
Weight (kg)	71.2±3.2	70.6±5.6
Height (cm)	168.6±7.1	169.2±3.1
Paretic side (right/left)	7/8	6/9
Onset (months)	11.5±2.1	12.1±3.1

[a]Mean±SD.
EG: Experimental group, CG: control group

Table 2. Comparison of the results of the BBS, TUGT, and BDI between the experimental and control groups

	Group	Pre	Post	D-Value
BBS	EG	42.2±1.3	45.1±1.3*	2.9±1.1[#]
(Score)	CG	41.0±1.4	41.7±1.3	0.7±1.0
TUGT	EG	18.7±1.2	16.1±1.6*	−2.6±1.8[#]
(Sec)	CG	18.6±0.8	18.2±1.0	−0.4±0.8
BDI	EG	20.6±1.0	18.2±1.9*	−2.4±1.6[#]
(Score)	CG	20.8±1.4	20.2±1.3	−0.6±0.8

[a]Mean±SD.
*$p<0.05$: Paired t-test
[#] $p<0.05$: Independent t-test
D-value: Difference value
EG: experimental group, CG: control group, BBS: Berg Balance Scale, TUGT: Timed Up and Go Test, BDI: Beck Depression Inventory

RESULTS

The changes in BBS, TUGT, and BDI are shown in Table 2. For the experimental group, the BBS, TUGT, and BDI showed significant improvements after the intervention. The experimental group's BBS, TUGT, and BDI showed significantly better improvements than those of the control group.

DISCUSSION

The purpose of this research was to determine how horseback riding training influences the physical function of stroke patients. To assess physical function, the BBS and TUGT were used. In the within group comparison, the experimental group's BBS and TUGT showed significant improvements ($p<0.05$), and the changes in the experimental group's BBS and TUGT were significant compared to their values in the control group ($p<0.05$). Lee et al.[7], Kim and Lee[11], and Han et al.,[12] conducted horseback riding training for stroke patients and reported significant improvements in the experimental group's BBS, similar to the results of this study. Rhythmical and repetitive movement through horseback riding training stimulates the body[7, 13]. When a continuous movement pattern is administered the body muscles are activated in trying to maintain an upright stance while resisting gravity[7, 13]. Learning about the instability of the body, improves the vestibular sense and propriocep-

tion, improving balance ability[5, 13]. Gait speed significantly increased in the experimental group of stroke patients that received horseback riding training in the study of Lee et al[7]. Kim and Lee[11] reported an increase in gait ability as a result of horseback riding training for stroke patients, which is also consistent with the results of this study. The repetitive movements of a horse stimulate proprioception[14]. This stimulates the upper motor nerves through the upper spinal cord[14]. These results demonstrate that horseback riding training helps to increase the physical function of stroke patients.

Depression often occurs as a psychological problem in stroke patients[15]. It is a serious complication that has a negative influence and also affects disability level[15]. The present study showed that horseback riding training influences the psychological state of stroke patients. The BDI was used to measure the psychological state. There was a significance improvement in the BDI of the experimental group ($p<0.05$). The experimental group's BDI also significantly improved compared to the control group ($p<0.05$). Horseback riding training is reported to be effective at widening a subject's one's outlook, breaking free from everyday life, and overcoming depression[16]. Asselin et al.[9] conducted horseback riding exercise for patients with a damaged spinal cord and found that patients' self-esteem increased a similar result to that of the present study. Horseback riding training can also help increase physical function and improve psychological problems. Moreover, it offers a new paradigm for improving patients' quality of life.

One limitation of this study was that the generalization of the results is limited by the small number of subjects. Moreover, the durability of the effect was not confirmed through a follow-up. There was also difficulty in accurate assessment because the assessment tools used in this study were clinical measurements. Future studies should address these limitations by increasing the number of subjects and making long-term assessments to clarify the effect of horseback riding training.

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