A Study of the Effects of a Video-Observed Home Exercise Program on Improving the Motor Skills of Chronic Stroke Patients

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Purpose The present study aimed to examine the effects of a home exercise program using video observation on the motor skills of chronic stroke patients. ***Methods*** A total of twelve chronic stroke patients were selected as research subjects, and were divided into two groups of six: a video-observed group and a self-exercise group. A video-observed exercise program was performed for 30 minutes, five times a week for four weeks, and the balance of the subjects was measured before and after administering the BT4, BBS, 10MWT, DGI and ABC scale. ***Results*** In the BT4, the video-observed group showed an increase in limits of stability and a significant difference was found between the groups ($p<0.05$), and moreover, a significant difference between the groups was observed in the DGI ($p<0.05$). However, there were no significant differencesfound between the groups during the BBS, 10MWT, ABC scale ($p>0.05$). ***Conclusion*** The video-observed home exercise program is effective in improving the subjects' balance and motor skills and builds their confidence to carry out daily activities. Therefore, action observation training is thought to be effective as home exercise program for chronic stroke patients and should be considered as a long-term rehabilitation program.

Key words Video observation group, Self-exercise group, Stroke

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I. Introduction

Mirror neurons were first observed in the F5 region of the premotor cortex of a monkey when its cerebral cortex was stimulated with a microelectrode[1)], and these neurons in the premotor cortex become active when the monkey moves, thinks about an action or observes an action.[2)] In addition, mirror neurons are activated by visual stimuli[3)] and become more active during the observation of goal-directed movements or moving objects than simple movements .[4)]

While observing an action, patients imagine themselves to be doing the action. And the stimulated areas in the cerebral cortex of the patients during the action imagination are similar to those in the cerebral cortex during the actual action. For stroke patients whose premotor cortex is damaged, imaging an action is helpful in restoring the damage to the premotor cortex and the video-observed exercise program is useful in improving their functional disorders.[5)] In particular, chronic stroke patients require much assistance with daily activities due to functional disorders and most of them prefer receiving rehabilitation treatment at home with family.[6)] Moreover, it is cheaper for stoke patients to receive outpatient rehabilitation treatment than receiving inpatient rehabilitation treatment.

After an 8-week home exercise program, the balancing ability of chronic stroke patients was shown to have improved. Although there is an increasing need for a systematic home exercise program for chronic stroke patients, there is still a lack of research on and guidelines for such program.[7)] Hence, a home exercise program is needed for chronic stroke patients to carry out daily activities, independently and action observation training is deemed appropriate for a home exercise program. A video-observed exercise program

will help improve the physical functions of stroke patients by activating mirror neurons with visual stimuli.

The present study aims to investigate the effects of a video-observed home exercise program on the balancing ability, gait function and specific balance confidence of chronic stroke patients.

II. Materials and Methods

1. Study Subjects and Period

The present study was performed on 12 chronic stroke patients who received outpatient rehabilitation treatment at Hospital B in Suwon city. These study subjects were randomly divided into two groups of six: a video-observed group and a self-exercisegroup. They were selected from those who scored more than 24 points in MMSE-K and more than 2.24 points in Vividness for movement imagery question (VMIQ); were able to walk 10 meters independently without assistance; did not have any hearing, visual and orthopedic disabilities; and were willing to take part in the present study and filled out the consent form. The present study was carried out from August 24 toOctober 28 2015.

2. Experimental Methods

The video-observed home exercise program consisted of modified gait tasks and weight-bearing exercise of Park Hye-ryung (2012) and Noh Hyun-jung (2011).[8,9] In a quiet environment at home, the subjects sat down and watched video clips. The video clips were about moving a chair to sit, stretching an arm to play quoits, standing on a single leg to play quoits, completing an obstacle course, walking sideways, walking backwards and tandem walking. After the subjects watched the video for fifteen minutes, they performed a 15-minute exercise.

The self-exercise group performed the active exercise of upper and lower limb joints, exercise of symmetric weight bearing and exercise of forward and backward walking. The patients in each group received 30-minute sessions of outpatient physical and occupational therapies twice a week for four weeks, and their Limits of Stability (LOS) and balancing ability were evaluated using a balance trainer (BT4) and BBS, respectively.

The Dynamic Gait Index (DGI) was used in evaluating the patients' dynamic balance, and a 10-meter Walking Test (10MWT) was conducted to assess their gait speed and number of steps. In addition, the Activities-specific Balance Confidence Scale (ABC scale) was used to investigate the balance confidence of the patients.

3. Analytical Methods

In the present study, a statistical program, PASW/PC ver. 20.0 for Windows was used to analyze the used data and to test hypotheses. Moreover, for the purpose of this study, empirical analysis methods were controlled beforehand after which Analysis of Covariance (ANCOVA) was performed. The statistical significance of empirical analysis in the present study was set at $p<0.05$.

III. Results

1. ANCOVAs were performed on the results of the Balance Trainer (BT4), BBS, DHI, 10MWT and ABC scale of the video-observed group and the self-exercise group.

The video-observed group showed a significant difference ($p<0.05$) of the left LOS in the BT4 while there was no significant difference ($p>0.05$) between the two groups in the BBS. In the DHI, an average value of the video-observed group was higher than that of the self-exercise group, indicating a significant difference ($p<0.05$). However, there was no significant difference between the groups during the 10MWT ($p>0.05$). Moreover, no significant difference was found between the groups on the ABC scale ($p>0.05$) (Table 1).

IV. Discussion

The aim of the present study was to investigate the

Table 1. ANCOVA analysis BT4, BBS, DHI, 10MWT, ABC of each group (N=12)

	Group	M	SD	F	p
LOS-front	SE-group(n=6)	0.74	1.101	0.162	0.698
	VO-group(n=6)	1.55	1.132		
LOS-back	SE-group(n=6)	4.98	0.701	0.344	0.574
	VO-group(n=6)	5.44	1.475		
LOS-left	SE-group(n=6)	3.16	2.125	6.90*	0.047
	VO-group(n=6)	4.68	1.05		
LOS-right	SE-group(n=6)	4.91	0.401	0.235	0.641
	VO-group(n=6)	4.42	1.386		
BBS	SE-group(n=6)	40.6	10.114	0.442	0.525
	VO-group(n=6)	47.5	7.396		
DGI	SE-group(n=6)	14.8	9.654	5.778*	0.034
	VO-group(n=6)	17.17	6.555		
10MWT(time)	SE-group(n=6)	19.00	7.106	0	0.983
	VO-group(n=6)	18.33	8.733		
10MWT(step)	SE-group(n=6)	24.00	6.964	0.351	0.57
	VO-group(n=6)	25.33	9.331		
ABC	SE-group(n=6)	1184.00	366.374	0.67	0.437
	VO-group(n=6)	1118.33	461.841		

*p<.05
VO-group: video-observe group
SE-group: self-exercise group

effects of a home exercise program that has action observation training on the motor skills of chronic stroke patients. Rehabilitation treatment to improve the motor skills of stoke patients is very important and the treatment that stimulate the cerebral cortex of mirror neurons for the improvement of motor skills is quite useful for chronic stroke patients. The mirror neurons become active when observing an action or doing the observed action in person, and such exercise is beneficial to chronic stroke patients in improving their physical functions if performed in parallel with traditional rehabilitation treatment .[9)]

In addition, the action observation training helps patients learn new exercises, and the cerebral cortex of mirror neurons become more active when there is an observational model .[10)]

When comparing the results of the group who watched videos and the group who performed general gait exercises, the group that watched videos showed even more improvement in the dynamic balance and walking ability.[11)] Furthermore, the video-observed program is known to help improve the balancing and walking abilities of stroke patients and to be effective in stimulating the brain.[12)]

Also in the present study, the video-observed program was used and was shown to have improved the balancing and walking abilities of chronic stroke patients. Therefore, the findings of the present study are in line with those of the previous studies as greater improvement was observed in the balancing and walking abilities of the video-observed group than that of the self-exercise group.

In the BBS, the subjects whose scores had been below 40 points saw an increase of 6-7 points while

the subjects whose scores had been between 40-50 points and above 50 points saw increases of 3 points and 2 points, respectively, which, in turn, indicates clinical significance.[13] In other words, the chronic stroke patients of the video-observed group in the present study saw an increase of scores on the BBS from 41.5±9.87 to 47.5±7.39 after the program. Though the increase was not statistically significant in comparison with that of the self-exercise group, it is thought to be clinically significant.

The exercise to maintain the range of motion of joints, stretching exercise, weight-bearing exercise composed the home exercise program, and it enhanced the upper limb functions of chronic stroke patients and had positive impact on their ability to carry out daily activities.[14] In addition, when stroke patients performed the home exercise program for eight weeks, they saw an improvement in their abilities to walk and carry out daily activities and a drop in the plasma cholesterol level, and also had more self-esteem. Hence, it is seen that the home exercise program affects the improvement of physical and psychological functions of stroke patients.[15]

The present study had the same findings as in the previous studies that the home exercise program improved the physical functions of chronic stroke patients. What is more, the home exercise program is very important to chronic stroke patients since they have less time for intensive rehabilitation treatment from their outpatient rehabilitation treatment, unlike acute stroke patients who receive intensive rehabilitation treatment at an early stage.

V. Conclusion

In the BT4, Limits of stability increased among the video-observed group, and a significant difference was found between the groups ($p>0.05$). In addition, there was a significant difference between the groups in the DGI ($p<0.05$). However, there were no significant differences between the groups in the BBS, 10MWT and ABC scale ($p>0.05$).

The video-observed home exercise program helps improve the balancing and walking ability, and such improvement builds the patients' confidence to carry out daily activities. Therefore, the program is thought to be effective as a home exercise program for chronic stroke patients, and action observation training is appropriate as a home exercise for chronic stroke patients.

In addition, the motor skills of stroke patients were thought to have improved as their mirror neurons were activated with visual stimuli. However, the present study has limitations due to a small number of research participants, a short research period and an inadequate structure of the home exercise program. Hence, it is hoped that in the future there will be diverse research on the structure of home exercise programs.

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