

Effect of purposeful action observation on upper extremity function in stroke patients

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Abstract. [Purpose] The purpose of this study was to identify the effect of purposeful action observation on upper extremity function in patients with stroke. [Subjects and Methods] Twelve subjects were randomly to either the experimental group or control group. The experimental group underwent occupational therapy and a purposeful action observation program. The control group underwent occupational therapy and placebo treatment in which the subjects performed a purposeful action observation program without actually observing the purposeful actions. The Wolf Motor Function Test was used to measure upper extremity function before and after the intervention in both groups. [Results] Both the experimental and control groups demonstrated improved upper extremity function after the intervention, but there was no significant difference between groups. Compared with before the intervention, the experimental group showed significantly improved upper extremity function after the intervention. [Conclusion] Based on these results, a purposeful action observation program can improve upper extremity function in patients with stroke. In future research, more subjects should be included for evaluation of different treatments.

Key words: Purposeful action observation, Stroke, Upper extremity function

(This article was submitted May 12, 2015, and was accepted Jun. 9, 2015)

INTRODUCTION

In 2013, stroke was the second most frequent cause of death after coronary artery disease, accounting for 6.4 million deaths in Korea¹⁾. Neurologic complications including cognitive, motor, speech, dysphagia, dysesthesia, perceptual, and affective disorders may occur after stroke. Motor disorders occur in nearly 80% of stroke survivors and more than half of stroke patients experience pain and some limitation of the upper and/or lower extremities of the affected side due to hemiplegia²⁾. Upper limb difficulties often predominate, especially affecting function and skill in movement of the hands, limiting motor independence in activities of daily life³⁾. Recently, various treatments, prognoses, and mechanisms of upper limb function restoration have been identified in various fields. One of these treatment methods is action observation training.

Action observation training has a theoretical basis in the mirror neuron system (MNS)⁴⁾, which is the process of observing the actions of other people or models shown in a video. Observing the action affects the same nervous structure as that affected when performing the same action⁵⁾. The mirror neuron system has been reported to be activated

more at the moment of observing a purposeful action versus a simple action, and to be effective if the program uses assignments that are related to events in daily life⁶⁾.

Several previous studies have reported effect of action observation in upper extremity function. For example, one study found that finger abduction increased by observing abduction action using the index and middle fingers of the right hand⁷⁾. Another study reported that dynamic balance and walking ability increased by observing the actions of gait training⁸⁾.

In this study, we applied a purposeful action observation program in patients with stroke and evaluated its effect on upper extremity function. Based on the results of this study we will be suggested use of a purposeful action observation program as a remediating strategy for occupational therapy.

SUBJECTS AND METHODS

Twelve subjects diagnosed with hemiparesis due to stroke participated in this study. A nonequivalent pretest-posttest control group design was used. The purposeful action observation (experimental) and control groups were assigned in a randomized fashion. The experimental group underwent occupational therapy and a purposeful action observation program. The control group underwent occupational therapy and placebo treatment in which the subjects performed the purposeful action observation program without actually observing the purposeful actions. All the subjects agreed to participate in this study and provided written informed consent in accordance with the ethical principles of the Declaration of Helsinki.

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Table 1. Comparison of upper extremity function before and after the intervention between groups

	Experimental group		Control group	
	Before	After	Before	After
WMFT score	32.8 ± 10.8 ^a	39.8 ± 12.2 ^{a,b}	35.6 ± 15.1	42 ± 11.67 ^b

Data are presented as mean ± SD. ^a p = 0.04, comparison of WMFT score before and after the intervention within the experimental group. ^b p = 0.42, comparison of WMFT score between the experimental and control groups.

WMFT: Wolf Motor Function Test

The mediation period of the purposeful action observation program was based on the study by Feys et al.⁹. The purposeful action observation program included activities for feeding, grasping a can, combing hair, drinking water using from a cup, stamping, turning a page, mopping, folding towels, and opening a bottle cap using scissors. The program was applied for 30 minutes per session, 5 sessions per week, for 6 weeks. The program was assessed in terms of assignment composition, selection of difficulty level, and method. The validity of the program also was assessed. Other previous studies were considered during the formulation of assignments for purposeful action observation. The Wolf Motor Function Test (WMFT) was used for measurement of upper extremity function before and after the intervention in both groups. The WMFT is useful for characterizing the motor status of patients with chronic stroke or traumatic brain injury, in terms of severity of upper extremity motor deficit. The inter-test and inter-rater reliability, and internal consistency and stability of the test are high, ranging from 0.88 to 0.98, with most of the values being near 0.95¹⁰.

Data analyses were performed using SPSS version 18.0 software (SPSS, Inc. Chicago, IL, USA). The Mann-Whitney U test was used to evaluate differences between groups. The Wilcoxon signed-rank test was used to compare pre-post within experimental group. The level of statistical significance was set at 0.05 for all analyses.

RESULTS

Comparison of upper extremity function between groups is shown in Table 1. The experimental group demonstrated significantly greater improvement compared with the control group (p < 0.05).

DISCUSSION

The purpose of stroke rehabilitation is to reacquire function. Action imitation is often used as a mediating method in the field of rehabilitation. Action observation training is one particular method of action imitation¹¹. Action observation training is based on the theory of the mirror neuron system, which holds that the same neurologic changes occur when observing, but not performing, an action as when actually performing the action⁵.

The level of difficulty assignment was considered during the selection of purposeful action observation assignments, and patients were motivated by means of selecting their own patient-oriented assignments¹². Two assignments were selected per session and repeated over 1 week; this method

is the same as that used by Feys et al.⁹, which suggested performing the program for 30 minutes per session, 5 sessions per week, for 6 weeks, depending on the rehabilitation mediation period of the stroke patients. If the patient could not perform a difficult assignment, 2 assignments were performed repeatedly during the 6 weeks; as such, the possibility of lack of motivation and concentration on the assignment existed.

The strengths of this study include assessment of the program's validity by professionals, the action observation program assignments being related to activities of daily life by taking previous studies into consideration, and patient motivation, because they were free to choose their own assignments. This study had some limitations, however, as follows: First, generalizing the results may be problematic because the number of subjects was small. Second, this study does not provide information regarding maintenance of upper extremity function after completion of the program.

Future studies should assess purposeful action observation programs using a greater number of subjects to enable generalization of the results. In addition, follow-up studies are needed to determine the degree to which the improved kinematic patterns are maintained after completion of program. Future studies also should examine not only upper extremity function but also the efficiency, angle, and reactivity of such motion.

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