J. Phys. Ther. Sci.
27: 1499–1501, 2015

Original Article

The effects of mirror therapy with tasks on upper extremity function and self-care in stroke patients

Youngju Park, MS, OT[1)], Moonyoung Chang, PhD, OT[2)*], Kyeong-Mi Kim, PhD, OT[2)], Duk-Hyun An, PhD, PT[3)]

[1)] *Department of Rehabilitation Science, Graduate School of Inje University, Republic of Korea*
[2)] *Department of Occupational Therapy, College of Biomedical Science and Engineering, Inje University: 197 Inje Street, Gimhae, Gyeongsangnam-do 621-749, Republic of Korea*
[3)] *Department of Physical Therapy, College of Biomedical Science and Engineering, Inje University, Republic of Korea*

Abstract. [Purpose] The purpose of this study was to determine the effects of mirror therapy with tasks on upper extremity unction and self-care in stroke patients. [Subjects] Thirty participants were randomly assigned to either an experimental group (n=15) or a control group (n=15). [Methods] Subjects in the experimental group received mirror therapy with tasks, and those in the control group received a sham therapy; both therapies were administered, five times per week for six weeks. The main outcome measures were the Manual Function Test for the paralyzed upper limb and the Functional Independence Measure for self-care performance. [Results] The experimental group had more significant gains in change scores compared with the control group after the intervention. [Conclusion] We consider mirror therapy with tasks to be an effective form of intervention for upper extremity function and self-care in stroke patients.

Key words: Mirror therapy, Stroke, Upper extremity function

(This article was submitted Nov. 25, 2014, and was accepted Jan. 20, 2015)

INTRODUCTION

A paretic upper extremity (UE) is a common consequence of a stroke[1)]. UE function is essential in most activities of daily living (ADLs), and therefore UE motor recovery can help maintain independence and improve the quality of life for stroke victims[2)]. There are several evidence-based treatments for poststroke UE recovery[3)]. Most treatments for improving the paretic upper limb are labor intensive and need one-on-one interaction with a therapist for several weeks[4)]. But mirror therapy (MT) is a simple, inexpensive, and patient-directed treatment that may provide better UE capacity[1)].

In MT, the patient observes the movement of the unaffected hand in a mirror and is given the impression that the affected hand is moving. This delusion may activate a hemispheric cortical motor network that accelerates recovery[3)]. Several studies have demonstrated beneficial effects on motor function, ADL, and unilateral neglect in stroke patients[5–9)]. However, existing MT programs consist of simple forearm supination and pronation, wrist flexion and extension, and finger flexion and extension movements. These programs are limited in terms of being able to improve UE motor function[10)].

Previous studies have emphasized the development of MT programs with interesting tasks and tasks useful in daily life. Stevens and Stoykov[11)] reported a significant improvement in UE and ADL as a result of MT with tasks in stroke survivors. However, theirs was a case study that provided short-term treatment and did not suggest task activities in detail. In this study, our aim was to investigate with more subjects the effect of MT with tasks on UE function and self-care in stroke patients. We hypothesized that MT with tasks would significantly improve paretic UE motor functioning and self-care performance.

SUBJECTS AND METHODS

The 30 stroke patients recruited in this study were referred by the Department of Rehabilitation Medicine of B Hospital. The patients were required to meet the following inclusion criteria: (a) had a stroke identifiable by computerized tomography (CT) or magnetic resonance imaging (MRI), (b) had no cognitive dysfunction that would interfere with the study purpose as indicated by a Korean Mini-Mental State Examination score [MMSE-K]>24[12)], (c) had no perceptual disorder or unilateral neglect that would have interfered with the study purpose as indicated by the Motor-free Visual Perception Test [MVPT][13)], (d) were 3 months post stroke, and (e) had a Brunnstrom score between stagesI–IV for the UE[14)]. Candidates were excluded if they (a) had aphasia, (b) had vision or hearing disorders, or (c) had had MT previ-

*Corresponding author. Moonyoung Chang (E-mail: myot@inje.ac.kr)

Table 1. MT with tasks program

Tasks	Directions (cm)
1. Reach to press a switch[19]	Switch placed 30 cm in front of patient. Reach to press it with the palm.
2. Reach to grasp a cone[15]	Cone placed 30 cm in front of patient. Reach to grasp it (diameter 5.0 cm, height 18.0 cm).
3. Grasp a small bean bag[15]	Small bean bag placed in the middle of the table. Grasp and release it (diameter 6.0 cm).
4. Grasp a cup[11]	Cup placed in the middle of the table. Grasp and release it (diameter 8.0 cm, height 10.0 cm)
5. Lift a plastic bottle[19]	Lift and put down a plastic bottle in the middle of the table (diameter 6.5 cm, height 15.0 cm).
6. Lift a cup[11]	Cup placed in the middle of the table. Lift and put down it (diameter 8.0 cm, height 10.0 cm)
7. Put coins into the hole in a money box[15]	Money box and 10 coins placed in the middle of the table. Hold the 10 coins in the palm, and then put them into the in the money box with the thumb and index finger.
8. Pick up and place Baduk stones in the plam[15]	10 Baduk stones placed in the middle of the table. Pick up the stones and place them in the palm with the thumb and index finger.

ously. This research was approved by the Inje University's Institutional Review Board. Each subject was informed of the purpose of this study, and they all consented to participate in this study.

Patients were randomly assigned to either the experimental group (n=15) receiving MT with tasks or the control group (n=15) receiving a sham therapy. The MT with tasks program was composed of eight tasks (Table 1) and was administered 5 days/week for 6 weeks. During the MT with tasks program, participants were seated close to a table on which a mirror was set vertically in the center. The affected arm was placed behind the mirror, and the unaffected arm was placed in front of the mirror. The experimental group practiced eight tasks with the unaffected arm while they were looking in the mirror. The control group performed the same eight tasks but used the nonreflecting side of the mirror.

The Manual Function Test (MFT) is used to assess UE motor function and action ability after a stroke[15]. Self-care performance was measured using the Functional Independence Measure (FIM)[16]. In this study, we used the self-care items of the FIM: eating, grooming, bathing, dressing-upper body, dressing-lower body, and toileting.

Demographics and clinical characteristics of the subjects were evaluated using descriptive statistics. The independent t-test was used to compare differences between the groups. The paired t-test was used to compare change scores within groups from baseline to 6 weeks. Statistical analyses were conducted using PASW Statistics 18.0, and the significance level was $p<0.05$.

RESULTS

There were no significant differences between the groups based on demographics and clinical characteristics of the subjects ($p<0.05$) (Table 2). At baseline, there were no significant differences between groups in the MFT and FIM self-care scores ($p<0.05$). After the intervention, both groups showed a significant improvement. Comparison of the changes in the MFT and FIM self-care scores from baseline to 6 weeks between groups revealed significant improvement in the experimental group ($p<0.05$) (Table 3).

Table 2. Demographics and characteristics of subjects

Characteristics	Experimental group (n=15)	Control group (n=15)
Gender		
Male/female	8/7	7/8
Paretic side		
Right/left	6/9	7/8
Lesion type		
Ischemic/hemorrhagic	9/6	8/7
Age (years)	58.3±12.9[a]	61.7±10.8
Duration (months)	7.9±7.5	8.7±7.3
MMSE-K score	26.7±1.5	26.2±1.4
Brunnstrom stage	3.0±0.9	2.9±1.0

MMSE-K: Korean Mini-Mental State Examination
[a]Mean±SD. *$p<0.05$

DISCUSSION

We aimed to identify the effect of MT with tasks on UE function and self-care in stroke patients. We recruited subjects who had had a stroke 3 months previously[17] to decrease the bias on natural recovery and who had Brunnstrom scores between stages 1 and 4 for the UE[1].

MT programs need to be developed because simple exercises for the hand offer limited improvement of UE motor function[10, 15, 18]. In a previous study, some tasks were used depending on the individual's ability and experiences in MT[11]. MT with tasks that rely on common ADLs can affect a patient's motivation during the period of treatment. Eventually, subjects would concentrate and participate in the program more actively, leading to improved UE motor recovery and self-care. For the MT with tasks program in this study, eight tasks were selected from part of a previous study on MT with tasks and a study that had previously been used to improve UE function in stroke patients[11, 15, 19]. The content validity of MT with tasks programs was then revised and verified twice under the hypothesis that the programs would affect UE motor recovery and self-care.

Our results showed that the experimental group had significant gains in change scores for UE function and self-care compared with the controls after the intervention. Similar

Table 3. Upper extremity function and self-care scores for the experimental group and control group

	Experimental group n=15		Control group n=15	
	Before	After	Before	After
MFT	25.6±12.4[a]	49.4±16.9[*†]	26.7±10.9	37.3±11.4[*]
FIM	17.1±5.9	24.5±5.7[*†]	17.3±6.4	20.0±5.0[*]

MFT: Manual Function Test, FIM: Functional Independence Measure
[a]Mean±SD. [*]Significant difference within group at <0.05. [†]Significant difference between groups at <0.05

findings were reported previously for the effects of MT with tasks on UE motor recovery and self-care[1, 5, 6, 10, 11]. Our study also showed significant differences in UE function and self-care within groups. The control subjects received additional rehabilitation services, and this might be one reason why the control group also showed significant changes.

The limitations of this study include the inability to generalize the results to all types of stroke victims and the lack of follow-up. Further studies are necessary to evaluate MT with tasks in comparison with conventional MT in order to determine which method is more effective on UE function and self-care in stroke patients.

REFERENCES

1) Yavuzer G, Selles R, Sezer N, et al.: Mirror therapy improves hand function in subacute stroke: a randomized controlled trial. Arch Phys Med Rehabil, 2008, 89: 393–398. [Medline] [CrossRef]
2) Heyes CM, Foster CL: Motor learning by observation: evidence from a serial reaction time task. Q J Exp Psychol A, 2002, 55: 593–607. [Medline] [CrossRef]
3) Liepert J: Evidence-based therapies for upper extremity dysfunction. Curr Opin Neurol, 2010, 23: 678–682. [Medline] [CrossRef]
4) Prange GB, Jannink MJ, Groothuis-Oudshoorn CG, et al.: Systematic review of the effect of robot-aided therapy on recovery of the hemiparetic arm after stroke. J Rehabil Res Dev, 2006, 43: 171–184. [Medline] [CrossRef]
5) Altschuler EL, Wisdom SB, Stone L, et al.: Rehabilitation of hemiparesis after stroke with a mirror. Lancet, 1999, 353: 2035–2036. [Medline] [CrossRef]
6) Sütbeyaz S, Yavuzer G, Sezer N, et al.: Mirror therapy enhances lower-extremity motor recovery and motor functioning after stroke: a randomized controlled trial. Arch Phys Med Rehabil, 2007, 88: 555–559. [Medline] [CrossRef]
7) Dohle C, Püllen J, Nakaten A, et al.: Mirror therapy promotes recovery from severe hemiparesis: a randomized controlled trial. Neurorehabil Neural Repair, 2009, 23: 209–217. [Medline] [CrossRef]
8) Bae SH, Jeong WS, Kim KY: Effects of mirror therapy on subacute stroke patients' brain waves and upper extremity functions. J Phys Ther Sci, 2012, 24: 1119–1122. [CrossRef]
9) Ji SG, Cha HG, Kim MK, et al.: The effect of mirror therapy integrating functional electrical stimulation on the gait of stroke patients. J Phys Ther Sci, 2014, 26: 497–499. [Medline] [CrossRef]
10) You SJ, Hwang KC, Kim HJ, et al.: An effect of mirror therapy on upper extremity function and activities of daily living in patients with post-stroke hemiplegia. J Korean Soc Occup Ther, 2011, 19: 25–37.
11) Stevens JA, Stoykov ME: Simulation of bilateral movement training through mirror reflection: a case report demonstrating an occupational therapy technique for hemiparesis. Top Stroke Rehabil, 2004, 11: 59–66. [Medline] [CrossRef]
12) Kwon YC, Park JH: Korean version of Mini-Mental State Examination (MMSE-K). Part I: Development of the test for the elderly. J Korean Neuropsychiatric Assoc, 1989, 28: 125–135.
13) Bouska MJ, Kwanty E: Manual for application for the Motor-free Visual Perception Test to the adult population. California: Academix, 1983.
14) Sawner K, Lavigne J: Bruunstrom's Movement Therapy in Hemiplegia: A Neurophysiological Approach. Philadelphia: JB Lippincott, 1992.
15) Paik YR, Kim SK: A task-oriented approach consisting of modified constraint-induced movement therapy (m-CIMT) and bimanual activity effects on upper extremity function and activities of daily living (ADL) in stroke patients. J Korean Soc Occup Ther, 2010, 18: 79–94.
16) Granger CV, Cotter AC, Hamilton BB, et al.: Functional assessment scales: a study of persons with multiple sclerosis. Arch Phys Med Rehabil, 1990, 71: 870–875. [Medline]
17) Olsen TS: Arm and leg paresis as outcome predictors in stroke rehabilitation. Stroke, 1990, 21: 247–251. [Medline] [CrossRef]
18) Woo HS, Chang KY, Park WK: The effects of mirror therapy on the hand function recovery in chronic stroke patients. J Korean Soc Occup Ther, 2011, 19: 93–103.
19) Jung JH, Cho YN, Chae SY: The effect of task-oriented movement therapy on upper extremity, upper extremity function and activities of daily living for stroke patients. J Rehabil Res, 2011, 15: 231–253.