

Comparison of Repeated Task Oriented Training for the improvement of motor function with mirror Therapy and Conventional Treatment on upper limb in patients with stroke - A Randomized Controlled Trial (RCT)

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ABSTRACT

Background: This study's goal is to illustrate how mirror treatment can be used with someone who has upper-extremity hemiparesis three months after suffering a cerebrovascular accident (stroke). These patients frequently fail to use their affected upper extremity to its full extent, possibly as a result of the "learned nonuse phenomenon". On each weekday of the 9-day intervention period, the patient performed tasks with the paretic upper extremity for 6 hours while being closely watched.

Methods: Study population was patients from Mayo hospital Lahore. Study design was Randomized Controlled Trial. RCT: 34 patients who met the requirements for inclusion were examined in this study. Before beginning any physical examination, each participant in this study gave their written, informed consent. Patients were divided equally into two groups. The Wolf Motor Function Test and the Numeric Pain Scale were used to measure pain and motor function on the first day. Group A received treatment using mirror therapy, whereas Group B received traditional care.

Results: Mirror therapy was significantly effective in lowering pain and boosting functional activity in stroke patients, as evidenced by the comparison of the pre- and post-treatment scores on the NPRS and WMFT for groups A and B.

Practical Implication: Stroke leads to multiple dysfunctions depending upon severity of lesion. It may decrease the range of motion and leads to functional dependency or disability. Physical therapy is important in the management of stroke including Strengthening, Stretching, ROMs and Manipulation and Mirror Therapy. This study provided an opportunity to share my personal experience with community. This study was conducted purely in clinical setting of Physiotherapy Department Mayo Hospital, Lahore.

Conclusion: The study has proved that mirror therapy is more effective when combined with conventional treatment in management of stroke as compared to only use of conventional treatment.

Keywords: Task oriented training, Motor function, Mirror therapy, conventional therapy, stroke, RCT

INTRODUCTION

Cerebral Ischemia is the most common cause of adult disability and is typically followed by a significant loss of motor function. According to public health statistics, stroke cases have been rising in Thailand. The majority of stroke patients who receive rehabilitation experience improved function, but the improvement varies greatly from patient to patient. About 80% of stroke patients make it through the acute stage. Despite the fact that most patients recover their capacity to walk, 30% to 66% of survivors are no longer able to utilize the arm that was injured¹. A new or recurrent stroke affects more than 730 000 Americans each year, with related direct and indirect health care costs of \$35 billion and \$21.8 billion, respectively. After a stroke, up to 85% of the 566 000 survivors experience hemi paresis which causes impairment of an upper extremity. Between 55% and 75% of survivors continue to have functional limitations in their upper extremities three to six months later, which is associated with a lower health-related quality of life². It is challenging to provide intense care for all patients because the majority of treatment procedures for the paretic upper extremity are labor-intensive and necessitate 1-to-1 manual engagement with therapists for several weeks³. To put it another way, the right hemisphere becomes more active when a right hand is utilized but is interpreted as a left hand (and vice versa). Because the first three months after a stroke are when recovery mechanisms are thought to be most noticeable⁶.

Mirror therapy has been proposed as a straightforward, low-cost, and most crucially, patient-directed treatment that may enhance upper-extremity function. Mirror therapy (MT) has been suggested as an alternative and may be advantageous. By using this technique, phantom pain in the "virtual" leg was frequently eased as well as illusory sensations. MT was also proposed as a treatment for chronic hemiparesis following a stroke^{4,5}.

Patients with stroke receive mirror treatment, which entails moving the unimpaired limb while seeing its mirror reflection overlaid over the (unseen) impaired limb. This creates the illusion that the injured limb can move more freely⁷. Observing a mirror image of the moving hand appears to facilitate excitability of the primary motor cortex, according to functional brain imaging studies of healthy people⁸.

Motor recovery following a stroke is thought to depend in part on the reorganization of motor functions in the immediate vicinity of the stroke site (ipsilesional), however other brain regions in the damaged hemisphere may also play a role⁹. Additionally, the bilateral inferior parietal area, the supplementary motor area, and the premotor cortex may all become active while an individual is performing motor activities^{10,11}.

Regarding the effectiveness of mirror therapy in relation to the degree of motor impairment or the length of time since the stroke, however, no firm findings could be made. According to one study, mirror therapy works best for people who have just experienced paralysis due to a stroke¹². A relatively recent method called mirror therapy was initially created to address pain from phantom limbs¹³.

Mirror therapy puts more of an emphasis on visual input than the majority of interventions that use sensorimotor training

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techniques. A device that is positioned between the two arms creates an inverse reflection as the unaffected arm is moved. The mirror of the unaffected arm gives the impression that the injured arm can move more freely¹⁴. Mirror therapy prioritises visual input in contrast to other interventions that use sensorimotor training techniques. A mirror that is positioned in the middle of the two arms produces an inverse reflection as the healthy arm is moved. The unaffected arm's reflection gives the affected arm the appearance of having more movement flexibility¹⁵.

The goal of this study is to determine whether mirror therapy, whether delivered in groups or individually, is more effective than a control intervention at improving upper limb sensorimotor function, activities of daily living, quality of life, and visuospatial neglect in patients with severe arm paresis following subacute stroke. The findings of this review suggest that mirror treatment may be used to enhance upper and lower extremity motor function and motor impairment, as well as daily living tasks for stroke survivors. Mirror therapy might be a useful strategy for easing pain in a subgroup of people who developed complicated regional pain syndrome, type I, following a stroke. The visual illusion of the afflicted limb movement causes the motor cortex to get favourable input.

METHODOLOGY

Study design was Randomized Control trial. Study setting was single centered and data was collected from Physiotherapy Department Mayo Hospital, Lahore. Purposive non-probability sampling technique was used. Study duration was 6months. There were 34 patients. Sample size was calculated by using G Power 3.9.1.4 soft ware.

Inclusion criteria:

Paretic upper limb passively have:

- 90 degree shoulder flexion and abduction
- 45 degree external rotation
- 30 degree at elbow extension

Paretic upper limb actively have:

- 45 degree of shoulder extension
- 30 degree elbow extension
- 10 degree wrist extension
- 10 degree finger extension
- 10 degree thumb abduction adduction

Exclusion criteria

- Children
- Neuromuscular, Neurological Disease
- Orthopedic Disease
- Drug History
- Psychological Disorders
- Cognitive Impairments

Data Collection Procedure: To guarantee enough statistical power, the necessary patient count is determined in advance. The power estimations are based on a previous study that looked at how the WMFT Tool has improved. This indicates that a sample size of at least 34 patients is required.

The experimental group, which received mirror therapy, was randomly assigned to two groups of subjects (n=17).

The control group, which received merely the standard rehabilitation regimen (n=17).

Occupational therapists who were unaware of the research assign patients to one of these groups using a randomly generated number generated by a computer

There were five sessions per week lasting 20 minutes, and each patient received 25 sessions.

The NPRS is reliable and valid instrument to assess pain while WMFT is valid for assessing the improvement in functional performance of patient through Mirror Therapy. Final assessment was based on following Wolf Motor Function Test

Data collection tools: Data was entered and analyzed through SPSS [statistical package for social sciences] version25.0.all qualitative variables were shown in frequency tables and percentages. All quantitative variables were shown in mean +SD along its range maximum to minimum T –test were applied or comparing the mean difference of qualitative variables.

RESULTS

Table 1 depicts the demographic data of study. Group A having 7(41.2%) males and 10(58.8%) females while 10(58.8%) male and 7(41.2%) females enrolled in group B. Age distribution o individuals in Group “A, B” with mean age of Group A were 53.647±9.360, Group B were 56.352±8.536.

Table 3 depicts the Comparison of Numeric pain rating scale and WMFT score of group A has shown that there was significant difference between pre and post treatment score. pretreatment mean WMFT score were 16.588±2.623 and post treatment were 66.235 ± 5.391, with the P value of 0.00, showing that Mirror therapy was significant in reducing pain and increasing functional activity while group B has shown that WMFT score were 16.588±2.623 and post treatment were 39.411±3.103, with the P value of 0.00, showing that conventional treatment was also increase functional activity in patients of stroke but not more than group A.

Table 1: Descriptive statistical analysis (N=17) experimental & control group

	Experimental Group Mean (SD)	Control Group Mean (SD)
Gender	7/10	10/7
Age	53.6471±9.36043	56.3529±8.53625
Side involved	12(R)/5(L)	5(R)/12(L)

Table 2: Normality of data

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
PRE_GROUP_A	.316	17	.000	.830	17	.005
PRE_TREAT_GRO	.316	17	.000	.830	17	.005
POST_TREAT_GRO	.110	17	.200*	.944	17	.369
POST_TRAET_GROUP	.266	17	.002	.799	17	.002

Table 3 Mean values of Experimental group and the control group

Variables	Experimental Group		Control Group		P value
	Pre value	Post value	Pre value	Post value	
NPRS	8.5882±0.870	3.64 ±0.49	8.58 ±0.870	4.35±0.86	0.00
WMFT	16.58±2.68	66.23±5.39	16.57±2.76	39.41±3.10	0.00

DISCUSSION

In my study, total 34 patients were included. There were two groups of patients each having 17 patients. One group was treated with Mirror Therapy along with conventional therapy and Second group was treated with Conventional treatment only. The patients were treated for three weeks and progression was assessed at the end of treatment. The pain and functional status were assessed by WMFT scale and NPRS scale.

The goal is to improve and restore functional abilities in stroke patients. On the basis of the visual analogue scale (0 signifying no pain and 10 the most intense agony a patient could imagine), the patients' capacity to do tasks was evaluated, as well as changes in pain intensity.

When done correctly, mirror therapy was quite beneficial. It used to make the arms move more and lessen the agony that went along with it. Conventional treatment is thought to have a greater impact if local circulation is improved, muscles are helped, the skin, muscles, or joints are given a positional stimulus, and the right amount of afferent input is given to the brain.

One study looked at the impact of mirror therapy (MT) combined with transcranial direct current stimulation (tDCS) on chronic stroke patients' ability to regain function in their upper extremities. [Subjects] Twenty-seven patients were allocated randomly into an experimental group (14 patients) and a control group at least six months after the stroke's start (13 patients). For 20 minutes, the same activities were done by both groups. For six weeks, this intervention was given to all subjects three times for 45 minutes each. The box and block test (BBT), grip strength, and the Fugl-Meyer assessment (FMA), as well as the Jebsen-Taylor test, all significantly improved for the experimental group after the intervention¹⁶.

The NPRS and Wolf motor function test were employed as the evaluation scales in my investigation. Another study found that 36 individuals with severe hemiparesis brought on by a first-ever ischemic stroke in the region of the middle cerebral artery were included, and that this occurred no later than 8 weeks following the stroke. In a 6-week procedure, they underwent extra therapy for 30 minutes per day, five days per week, with a random assignment to either mirror therapy (MT) or a comparable control therapy (CT). The Fugl-Meyer sub scores for the upper extremities were the primary outcome measures, and they were determined by independent raters using videotape. Patients also underwent neuropsychological and functional¹⁷. But in our study the assessment tool is different. M. Invernizzi and his Coworkers stated in their study the value of adding mirror therapy for upper limb motor recovery of subacute stroke patients: a randomized controlled trial. Patients were randomly allocated to the MT (N.=13) or to the CT group (N.=13). Both followed a comprehensive rehabilitative treatment. In addition, MT Group had 30 minutes of MT while the CT group had 30 minutes of sham therapy. Action Research Arm Test (ARAT) was the primary outcome measures. Motricity Index (MI) and the Functional Independence Measure (FIM) were the secondary outcome measures. Results. After one month of treatment patients of both groups showed statistically significant improvements in all the variables measured ($P < 0.05$). More over patients of the MT group had greater improvements in the ARAT, MI and FIM values compared to CT group ($P < 0.01$, Glass's Δ Effect Size: 1.18). No relevant adverse event was recorded during the study. Conclusion. MT is a promising and easy method to improve motor recovery of the upper limb in subacute stroke patients.

CONCLUSION

MT is a promising and easy method to improve motor recovery of the upper limb in subacute stroke patients³⁵.

MIRROR Therapy is more effective when combined with conventional treatment in management of stroke as compared to only use of conventional treatment.

Limitations: Sample size is too small. Subjects could not be followed up after the study. Duration of the study was short, and the strict inclusion criteria used in the present study limit the generalizability of the results to all stroke population. Patients were included in the study only from one setting. So it is difficult to generalize results to other clinical settings

Ethical permission: Permission was granted by IRB start this research.

Competing interests: There are no competing ideas declared by the authors.

REFERENCES

- Bonaiuti D, Rebasti L, Sioli P. The constraint induced movement therapy: a systematic review of randomised controlled trials on the adult stroke patients. *Europa medicophysica*. 2007;43(2):139.
- Blanton S, Wilsey H, Wolf SL. Constraint-induced movement therapy in stroke rehabilitation: perspectives on future clinical applications. *NeuroRehabilitation*. 2008;23(1):15-28.
- Prange GB, Jannink M, Groothuis-Oudshoorn C, Hermens HJ, IJzerman MJ. Systematic review of the effect of robot-aided therapy on recovery of the hemiparetic arm after stroke. 2009.
- Ramachandran VS, Rogers-Ramachandran D, Cobb S. Touching the phantom limb. *Nature*. 1995;377(6549):489-90.
- Dohle C, Kleiser R, Seitz RdJ, Freund H-J. Body scheme gates visual processing. *Journal of neurophysiology*. 2004;91(5):2376-9.
- Stevens JA, Stoykov MEP. Using motor imagery in the rehabilitation of hemiparesis. *Archives of physical medicine and rehabilitation*. 2003;84(7):1090-2.
- Garry M, Loftus A, Summers J. Mirror, mirror on the wall: viewing a mirror reflection of unilateral hand movements facilitates ipsilateral M1 excitability. *Experimental brain research*. 2005;163(1):118-22.
- Thirumala P, Hier DB, Patel P. Motor recovery after stroke: lessons from functional brain imaging. *Neurological research*. 2002;24(5):453-8.
- Nelles G, Spiekermann G, Juepner M, Leonhardt G, Müller S, Gerhard H, et al. Reorganization of sensory and motor systems in hemiplegic stroke patients: a positron emission tomography study. *Stroke*. 1999;30(8):1510-6.
- Weiller C, Chollet F, Friston KJ, Wise RJ, Frackowiak RS. Functional reorganization of the brain in recovery from striatocapsular infarction in man. *Annals of Neurology: Official Journal of the American Neurological Association and the Child Neurology Society*. 1992;31(5):463-72.
- Luft AR, Forrester L, Macko RF, McCombe-Waller S, Whittall J, Villagra F, et al. Brain activation of lower extremity movement in chronically impaired stroke survivors. *Neuroimage*. 2005;26(1):184-94.
- Dohle C, Püllen J, Nakaten A, Küst J, Rietz C, Karbe H. Mirror therapy promotes recovery from severe hemiparesis: a randomized controlled trial. *Neurorehabilitation and neural repair*. 2009;23(3):209-17.
- Altschuler EL, Wisdom SB, Stone L, Foster C, Galasko D, Llewellyn DME, et al. Rehabilitation of hemiparesis after stroke with a mirror. *The Lancet*. 1999;353(9169):2035-6.
- Thieme H, Morkisch N, Mehrholz J, Pohl M, Behrens J, Borgetto B, et al. Mirror therapy for improving motor function after stroke. *Cochrane database of systematic reviews*. 2018(7).
- Floel A, Cohen LG. Recovery of function in humans: cortical stimulation and pharmacological treatments after stroke. *Neurobiology of disease*. 2010;37(2):243-51.
- Cho H-S, Cha H-g. Effect of mirror therapy with tDCS on functional recovery of the upper extremity of stroke patients. *Journal of physical therapy science*. 2015;27(4):1045-7.
- Brunetti M, Morkisch N, Fritzsche C, Mehnert J, Steinbrink J, Niedeggen M, et al. Potential determinants of efficacy of mirror therapy in stroke patients—A pilot study. *Restorative Neurology and Neuroscience*. 2015;33(4):421-3.