

A randomized control trial comparing the effects of motor relearning programme and mirror therapy for improving upper limb motor functions in stroke patients

Shafqatullah Jan¹, Aatik Arsh², Haider Darain³, Shehla Gul⁴

Abstract

Objective: To compare the effectiveness of motor relearning programme with mirror therapy in upper limb motor functions of stroke patients.

Methods: The randomised control trial was conducted in Rafsan Neuro Rehabilitation Centre, Peshawar, Pakistan, from June to December 2017, and comprised stroke patients who had Mini Mental State Examination score over 24. Participants were randomly allocated into treatment and control groups. The treatment group underwent a Motor Relearning Programme, while the control group received Mirror therapy. Upper limb sub-scales of the motor assessment scale were used as data collection tool. SPSS 20 was used for data analysis.

Results: Of the 66 subjects, 46(69.7%) were males and 20(30.3%) were females. The overall mean age was 55.44±9.21 years. Left hemiplegia was found in 31(47%) subjects, while 33(53%) had right hemiplegia. Each of the two groups had 33(50%) subjects. There were significant differences between pre-treatment and post-treatment mean scores of upper arm functions, hand function and advance hand activities of the two groups ($p < 0.05$ each). All the three variables significantly improved in the treatment group compared to the control group ($p < 0.001$).

Conclusions: Motor Relearning Programme and Mirror therapy were found to be effective in improving upper limb motor functions of stroke patients, but the former was found to be more effective than the latter.

Keywords: Motor relearning programme, Mirror therapy, Physical therapy, Stroke.
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Introduction

Stroke is one of the leading causes of disability and mortality and is associated with incredible financial cost and human suffering.¹ Approximately 88% of stroke survivors begin their lives at home and majority of them face permanent disability.² About 5.5 million people died due to stroke in which around 20% cases are reported in South Asia.³ In spite of decrease in the occurrence of the stroke in the Western populace, burden of stroke in South Asia population has been increased in the last few decades.^{3,4} Literature search revealed that no population-based epidemiological study has been conducted which reported true incidence of stroke in Pakistan. The expected stroke cases in Pakistan are 250/100,000, translating to 350,000 new cases each year.³⁻⁵

More than 4.7 million stroke survivors have motor disability; amongst them 30% to 66% has upper limb disability.^{1,6} Reduction in upper extremity motor functions affects abilities of an individual to carry out different tasks of daily life, which is probably going to decrease independence and increase burden of care.^{7,8} Around 85% of stroke population suffers from initial arm weakness which exists in 55-75% of patients even after 3 to 6 months (9, 10). But full restoration of hemi-paretic upper extremity happens in just 5-20% of stroke subjects.^{9,11} Hemi-paretic upper extremity causes reduction of capacity to carry out different types of functional tasks like reaching, grasping and manipulation that may lead to difficulty in activities of daily life.⁹

Different studies have utilised different types of intervention and varied duration of therapy to determine effectiveness of these interventions in promoting recovery in upper limb functions. The main therapeutic approaches for the rehabilitation of upper limb functions in stroke patients are Proprioceptive Neuromuscular Facilitation

¹Department of Physiotherapy, Pakistan Institute of Prosthetics and Orthotics Peshawar, ²Department of Physiotherapy, Paraplegic Centre Peshawar, ³Institute of Physical Medicine and Rehabilitation, Khyber Medical University, Peshawar, ⁴Department of Health Sciences NCS University System, Swabi.

Correspondence: Aatik Arsh. e-mail: aatikarshkmu@yahoo.com

(PNF), Brunnstorm, Bobath therapy, the Motor Relearning Programme (MRP), Constrained Induced Movement Therapy (CIMT) and Mirror therapy (MT).^{12,13} Despite the fact that MRP and MT is commonly used by physical therapist in clinical settings for improving upper limb functions in stroke patients, yet evidence regarding their effectiveness is scarce in literature. Therefore, there was a dire need to determine the effectiveness of MRP and MT in improving upper limb motor functions in stroke patients. The current study was planned to compare the effectiveness of MRP with MT in upper limb motor functions of stroke patients. The hypothesis was that there will be significant difference in the effect of MRP and MT in improving upper limb motor functions of stroke.

Subjects and Methods

The randomised control trial (RCT) was from June to December 2017 conducted in Rafsan Neuro Rehabilitation Centre (RNRC), Peshawar, Pakistan.. After ethical approval was obtained from the ethics committee the Khyber Medical University, Peshawar the sample size was calculated by using an online calculator¹⁴ with the target to achieve 80% power in the trial with the confidence level of 95% exposed-to-unexposed ratio of 1. Male and female unilateral stroke patients diagnosed with haemorrhagic or ischaemic stroke and referred to RNRC aged 40-60 years and with Mini Mental State Examination score over 24 were included using consecutive sampling after informed consent was obtained from each of them. Patients with co-morbidities and/or medical complications due to which they were unable to follow the rehabilitation protocols were excluded.

Before randomisation, the subjects underwent a full neurological assessment and cognitive assessment. Envelopes containing information sheets and data collection tools were equally numbered with half labelled group A, the treatment group, and group B which had the controls. These labelled papers, folded in such a manner that the labelling was not visible, were placed in a container. Patients who fulfilled the eligibility criteria and were willing to participate were requested to pick one envelope for assigning them into either of the groups.

Table-2: Comparison of variables in control and treatment groups.

Group	Upper arm function		p-value	Hand functions		p-value	Advance hand activities		p-value
	Pre	Post		Pre	Post		Pre	Post	
Treatment group	3.3±0.6	5.5±0.5	0.01	2.6±0.6	4.7±0.5	0.00	1.6±0.5	4.2±0.6	0.003
Control group	3.2±0.6	4.9±0.5	0.00	2.5±0.6	4.2±0.5	0.00	1.8±0.5	3.8±0.6	0.02

The treatment group received MRP for a period of 6 weeks, 3 days per week, 2-hour session per day. The activities performed in this group were different types of task-specific exercises, including reaching and manipulation, practising wrist flexion / extension with holding objects, training of pronation / supination, opposition of thumb, and bimanual exercises with the paretic upper limb. All activities were started with the simple task and with less repetition, and were progressed to complex or by increasing number of repetitions. The control group received MT for a period of 6 weeks, 3 days per week, 2-hour session per day. The activities performed in this group were active limb movements in the presence of a mirror. All the participants were assessed pre-treatment and post-treatment using three upper limb (UL) sub-scales of motor assessment scale; upper arm functions, hand movements and advanced hand activities.

Data was analyzed using SPSS 20. Data was checked for normality using Shapiro-Wilk test and then mean and standard deviation (SD) were calculated for numerical variables while frequencies and percentages were calculated for categorical variables such as gender and side of hemiplegia. Because data was normally distributed, Independent sample t test was performed to analyse the difference between the two groups, and paired t test was used for within group analysis. P<0.05 was considered significant.

Results

Of the 66 subjects, 46(69.7%) were males and 20(30.3%) were females. The overall mean age was 55.44±9.21 years. Left hemiplegia was found in 31(47%) subjects, while 33(53%) had right hemiplegia. Each of the two groups had 33(50%) subjects (Table 1).

Table-1: Demographic information and Clinical characteristics of Participants.

Variable	Treatment group	Control group	p-value
Age	54.67±7.131	56.21±9.12	0.134
Gender			
Male	21 (63.6%)	25 (75.8%)	0.331
Female	12 (36.4%)	8 (24.2%)	
Hemiplegic side			
Left	15 (45.5%)	16 (48.5%)	0.611
Right	18 (54.5%)	17 (51.5%)	

Table-3: Outcome comparison of control and treatment groups.

Variables	Post treatment group	Mean±SD	p-value
Post Treatment upper functions	Treatment group	5.5±0.5	0.00
	Control group	4.9±0.5	
Post treatment hand movement	Treatment group	4.7±0.5	0.00
	Control group	4.2±0.5	
Post treatment advance hand activities	Treatment group	4.1±0.6	0.00
	Control group	3.4±0.6	

In both the groups, there were significant differences between pre-treatment and post-treatment mean scores of all the three variables ($p < 0.05$ each) (Table 2).

The mean scores in all three variables improved significantly in the treatment group compared to the control group. (Table 3).

Discussion

Stroke is considered to be the 3rd most common cause of disability and mortality throughout the world.^{15,16} The impairments associated with stroke often have negative impact on stroke survivors, family and society.¹⁷ A number of physiotherapy approaches have been used for the rehabilitation of stroke patients, including MRP and MT. In the current study, MRP was compared with MT followed for six weeks in 66 stroke subjects, showing that MRP had beneficial affect over MT in the rehabilitation of upper limb motor functions of stroke patients ($p < 0.001$). The mean age of subject in current study was 55.44 ± 9.21 years, while the age of participants in studies previously conducted on stroke patients ranged 40-60 years.¹⁸⁻²⁰ In contrast to the present, the reported previous studies had limited differences in the male-female ratio.^{19,20} Effectiveness of MRP in improving upper limb and hand motor functions is supported by previous studies.^{18,21} In accordance with our results, previous studies also reported effectiveness of MT.^{9,22,23} However, literature search revealed few studies which compared MRP and MT. One such study analysed the effects of MRP and MT in stroke patients.¹⁸ The sample size of that study was 12, while in the current study the sample size was 66. The results of the earlier study did not support the results of the current study, because it did not reveal that one treatment was effective over the other and the results were not significant ($p > 0.005$). This can be because of fact that the sample size of the trial was small, and also because the treatments were followed for a very short time.

The results of the current study are supported by literature.^{2,19-21}

A study supported our results after evaluating the efficacy

of MRP for hand function in 40 chronic subjects affected with cerebrovascular accident (CVA).¹⁹ Similar to the current study, both the interventions were followed for 6 weeks and it concluded that MRP was significantly more effective than Bobath therapy in improving hand grip strength and ulnar deviation ($p = 0.0001$) and to decrease spasticity ($p > 0.005$).¹⁹

Likewise, the results of a trial were similar to those of the present study, and it stressed the importance of MRP in upper limb motor functions of stroke patients in 20 stroke subjects in which both the interventions were followed for six weeks. Both MRP and thermal stimulation were effective in improving upper limb motor functions, but MRP proved more effective than thermal stimulation ($p < 0.001$).²⁰

Due to time limitation and non-availability of stroke patients in rehabilitation settings, there are some limitations in the present study. First, the sample size was small and that is why generalisability of results is questionable. Secondly, time for follow-up of patients was limited due to which long-term effects of treatment protocols were not reported. Moreover, the current study is an unregistered RCT. Clinical trials with large sample size and long follow-up are recommended.

Conclusions

MRP and MT were found to be effective in improving upper limb motor functions of stroke patients, but the former was more effective than the latter.

Disclaimer: The study is based on an MS thesis submitted to the Khyber Medical University, Peshawar, Pakistan.

Conflict of Interest: None.

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