



## Research Article

### **EFFECTIVENESS OF MIRROR THERAPY CONTAINING FUNCTIONAL TASKS ON UPPER EXTREMITY MOTOR FUNCTIONS AMONG PATIENTS WITH STROKE**

Penina Langhu<sup>1</sup>, P.Mangala Gowri<sup>2</sup>, P.Thenmozhi<sup>3\*</sup>

<sup>1</sup>M.Sc(N) Student, Saveetha College of Nursing, SIMATS, Chennai, India

<sup>2</sup>Principal, Saveetha College of Nursing, SIMATS, Chennai, India

<sup>3</sup>Associate Professor, Saveetha College of Nursing, SIMATS, Chennai, India

\*Corresponding Author Email: thenmozhi.sethu@gmail.com

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#### **ABSTRACT**

**Introduction:** Stroke is a leading cause of disability and continuous care and long-term rehabilitation therapy is essential to prevent complication and to regain the motor function. There are various types of rehabilitation program for improving the functional disabilities. One amongst is the Mirror therapy, which is a non-pharmacological and inexpensive method of treatment. **Methods:** Quasi experimental research design was adopted to conduct the study with 60 samples who met the inclusion criteria at Saveetha Medical College and Hospital. Samples were selected by convenience sampling technique. The pre-test assessment was done by using the Fugl-Meyer Assessment. Mirror therapy containing functional tasks was administered for 30 minutes per day for two weeks for the study group. The control group received routine care. Post assessment was done at the end of 14<sup>th</sup> day of intervention for both the groups. **Results:** Among the patients in the experimental group, pre-test and post-test values were compared (Paired t test) and observed statistically significant ( $p < 0.001$ ) improvement in motor function, sensation, passive joint motion and joint pain of the upper extremity and also found significant ( $p < 0.001$ ) difference between the experimental and control group by unpaired t test. **Conclusion:** The study findings concluded that Mirror Therapy containing functional tasks is effective in improving the upper extremity motor functions among patients with stroke who are hemiplegic and has hemiparesis without any side effects.

**Keywords:** Mirror therapy, functional tasks, stroke, motor functions, upper extremity.

#### **INTRODUCTION**

Stroke is a leading cause of acquired disability in adults. It is estimated that there will be 23 million first ever strokes and 7.8 million stroke deaths in 2030.<sup>1</sup> It occurs when the blood supply to part of the brain is suddenly interrupted or when a blood vessel in the brain bursts, spilling blood into the spaces surrounding brain cells. A stroke can cause lasting brain damage, long-term disability, or even death.<sup>2</sup> Stroke accounted for about one third of cardiovascular deaths (5.7 million deaths) and 46.6 million Disability Adjusted Life Years (DALYs) globally.<sup>3</sup> The cumulative incidence of stroke ranged from 105 to 152/100,000 persons per year, and the crude prevalence of stroke ranged from 44.29 to 559/100,000 persons in different parts of the country during the past decade. These values were higher than those of high-income countries.<sup>4</sup> The estimated adjusted prevalence rate of stroke ranged 84-262/100,000 in rural and 334-424/100,000 in urban areas. The incidence rate is 119-145/100,000 based on the recent population-based studies.<sup>5</sup> In Tamilnadu, the prevalence of stroke patient was 257/197596, one out of 769 population affected by stroke. Males are more affected than females, and hypertension was predominant cause of stroke.<sup>6</sup> The prevalence of stroke or hemiplegia due to any cause is 56.9 per 100,000.<sup>7</sup>

Depending on parts of the brain affected, stroke can cause mild weakness to hemiparesis and hemiplegia. National Stroke Association reported that 9 out of 10 stroke survivors have some degree of paralysis immediately following a stroke. Although hemiplegia and hemiparesis are serious handicaps, physical rehabilitation may help to improve the movement of affected

limb. A continuous care and long-term rehabilitation therapy is essential for stroke clients to prevent complication and to regain the motor function and be able to do the activities. There are various rehabilitation methods practiced for improving upper extremity motor function, such as exercise training of the paralysis arm, functional electric stimulation, bilateral arm training and robotic assisted rehabilitation. Most of the treatment protocols are expensive and time consuming and requires one to one manual interaction with therapist for several weeks or months, which may be difficult for the patients. Some of the studies have suggested that mirror therapy is a simple and inexpensive method. Most importantly, it is patient-directed treatment that improves the upper extremity function.

Mirror therapy is a form of motor imagery in which a mirror is used to convey visual stimuli to the brain through observation of one's unaffected body part as it carries out a set of movements.<sup>8</sup> Mirror therapy technique utilizes the mirror-illusion which is created by the movement of sound limb that is perceived as the paretic limb. The neural cells are responsible for the organization of movements and these systems of neurons help in reorganizing of the damaged-brain and in enhancing the motor control. The mirror neurons activated during the observation of movement through the mirror therapy. These neurons exhibit plasticity among healthy individuals. Therefore, in hemiparetic subjects, observing movements through mirror therapy may exploit the mirror neuron system.<sup>9</sup>

Practicing of mirror therapy early after the stroke is a promising method in improving the motor function of the paralytic limbs.

Mirror therapy helps in enhancing faster or quicker regaining of the functional level of hand and it reduces the period of rehabilitation programme. Mirror therapy is also very simple which can also be practiced at home with the help of the family or the caregivers which can ease the burden of the long-term health care expenses, which will help in improving functional disabilities and adding a quality of life. Many research studies have shown the effectiveness of mirror therapy among stroke patients.<sup>10</sup> Hence the investigators had made the observation with the hypothesis of improvement in the level of motor functions after administration mirror therapy containing functional tasks in experimental group than control group.

## METHODS

A Quasi experimental pre-test and post-test design was adopted to conduct the study among patients with stroke. It was conducted at Saveetha Medical College hospital Chennai, after obtaining formal permission from the hospital authority. The investigators explained about the study and obtained the informed consent from the participants. Sixty samples who met the inclusion criteria were selected by using convenience sampling technique and were allocated into experimental group (n=30) and control group (n=30). The inclusion criteria were patients with the age group between 50 to 75 years of both the sex, patients who had upper extremity motor impairment with hemiplegia or hemiparesis for less than one year and patients who were in stage II, III and IV in Brunnstrom motor recovery scale. Patients who had poor cognitive function, visual deficit and perceptual deficit, severe contracture in the affected limb, fracture on paretic extremities were excluded from the study. The demographic variables were collected by interview method using structured questionnaire. The pre-test assessment was done by using the Fugl-Meyer Assessment. Mirror therapy containing functional tasks was administered for 30 minutes per day and 7 times a week for two weeks for the study group. The participants were taught how to do the tasks on the first day and the simple task like flexion, extension, counting fingers were given for 3 days and followed by the complex tasks like picking up a coin, drawing a shape were given for 3 days. The control group received routine care. At the end of 14<sup>th</sup> day of intervention a post assessment was done by using Fugl-Meyer Assessment for both the experimental and control groups. Data were analyzed using SPSS statistical package.

## RESULTS

The present study findings observed that majority 21(70%) of the participants were male in the age group of 50 – 69 years, 17(56.67%) had paresis on the left side and 26(86.67%) had ischemic stroke. With regards to motor function in terms of motor impairment, sensation, passive joint motion and joint pain of experimental and control group pre-test is depicted as frequency and percentage in Table 1. More than 80% of the participants had severe motor impairment, 50% of the participants had mild to moderate sensory sensation and more than 60% of them had hypomotility to no movement with no pain to mild pain.

Within the experimental, the effectiveness of mirror therapy containing functional tasks was analyzed by paired 't' test revealed that there is significant difference in the mean value of pre-test and post-test and found statistically significant at the level of  $p < 0.001$  revealing that the intervention was found effective in improving the motor function, sensation, passive joint motion and joint pain of the upper extremity. Post-test level of motor function of upper extremity between the experimental and control group was compared by unpaired 't' test and found statistically significant difference at the level of  $p < 0.001$  which shows that

there is a difference between the experimental and control groups in level of motor function of the upper extremity after the mirror therapy.

Chi-square test reveals that age had shown statistically significant association with post-test level of motor function among stroke patients at  $p < 0.05$  level. With regard to sensation, type of stroke had shown statistically significant association with post-test level of sensation among stroke patients at  $p < 0.05$  level. Considering the passive joint motion, education and type of stroke had shown statistically significant association with post-test level of passive joint motion among stroke patients at  $p < 0.00$  level. With respect to joint pain, sex had shown statistically significant association with post-test level of joint pain among stroke patients at  $p < 0.05$  level respectively as shown in Table 4.

## DISCUSSION

The motor impairment can be caused by a cerebrovascular accident which affects the motor neurons whereby leading to motor impairment of the patients. Motor impairment can also cause loss or reduce of the sensation in the affected side of the body and when there is a damaged in the pathway of sensation in the brain it can even cause pain in patients with stroke. In the present study, the motor function impairment was assessed in terms of motor function, sensation, passive joint motion and joint pain. The study findings shows the impairment in all the aspects in both experimental and control group. The motor impairment was found high in the motor function and passive joint motion than the sensation and joint pain. The present study findings is supported by Jin-Young Park et al who concluded in the study that (20%) patients had moderate motor impairment and (80%) patients had severe motor impairment.<sup>11</sup> Another study revealed that 56.7% of clients had flaccidity no voluntary movement on upper limb motor functions among patients with stroke.<sup>12</sup> In a study conducted by Lee et al, it showed that 72% has severe motor impairment of the upper limb among chronic stroke patients.<sup>13</sup> In the present study, it showed that majority of the patients with stroke had severe motor impairment in the upper limb. Comparison to the other studies it is observed that majority of the patients with stroke with hemiparesis or hemiplegia had severe motor impairment. It may be due to the advanced age as most of the participants were of older age group. It can also be due to the lack of exercise or immobility of the affected limbs after stroke. Similarly, a study showed that majority of the patients had moderate motor impairment of the upper and lower extremity among patients with acute stroke.<sup>14</sup>

The present study findings revealed that the post-test mean level is higher than the pre-test mean level in the experimental group which proved that there is a significant improvement after the administration of mirror therapy containing functional tasks on upper extremity motor function in the experimental group. The findings of the present study is supported by Snehal and Suvarna who concluded that the mirror therapy containing functional task was found effective in terms of improving the upper extremity functions and activities of daily living in patients with sub-acute stroke.<sup>15</sup> It is also consistent with the findings of Youngju Park et al, who had revealed that there was a significant improvement on upper limb motor functions among patients with stroke after the implementation of mirror therapy.<sup>16</sup>

The present study findings also observed the difference in post-test mean value between the experimental group and control group which proved that there is a significant improvement in the experimental group who had underwent the mirror therapy than the control group. The finding of the present study is consistent with the studies which revealed that there was a better

improvement of motor function in patients with acute stroke in the experimental group compared to the control group after the mirror therapy.<sup>17-18</sup> The study showed greater improvement in the joint pain whereas the present study findings shows better improvement in the motor function and passive joint motion. The difference in the improvement can be because it was done among patients with acute stroke for the supported study. Another study observed that the degree of recovery was greater in the mirror therapy group than the control group on upper extremity motor function among post-stroke patients.<sup>19</sup>

The findings of the present study observed that the age group between 50-69 years had shown higher effectiveness in post-test level of motor function among patients with stroke in the experimental group. With regard to sensation, the demographic variable of type of stroke had shown statistically significant association with sensation among patients with stroke. Considering the passive joint motion, the demographic variables

of education and type of stroke had shown statistically significant association with passive joint motion among patients with stroke. With respect to joint pain, the demographic variables of sex had shown statistically significant association with joint pain among stroke patients. This was supported by Roshini Rajappan et al who concluded that there was an association of motor recovery gain score with selected demographic variable age, education and other systemic diseases. Younger, more educated and no other systemic disease patients were more benefitted from the mirror therapy than others.<sup>20</sup> The limitation of the current study was only to upper extremity with short duration. In future the same study can be focused on the large number of samples with longer period of the intervention and can also be intervened for the lower extremity motor functions. Mirror therapy can be compared with other exercise or rehabilitation programs to determine more reliability and effectiveness of mirror therapy.

**Table 1: Frequency and percentage distribution of pre-test level of motor function of upper extremity among stroke patients in experimental and control group**

Motor Function	Interpretation	Experimental group Pre-test		Control group Pre-test	
		No.	%	No.	%
Motor Impairment	Mild motor impairment	-	-	-	-
	Moderate motor impairment	5	16.67	2	6.67
	Severe motor impairment	25	83.33	28	93.33
Sensation	Normal sensation	6	20.0	6	20.0
	Mild sensory sensation	16	53.33	10	33.3
	Moderate sensory sensation	8	26.67	14	46.67
	Severe sensory sensation	-	-	-	-
Passive Joint Motion	Normal movement	-	-	-	-
	Hypo mobility	10	33.33	6	20.0
	No movement	20	66.67	24	80.0
Joint pain	No pain	16	53.33	14	46.67
	Mild pain	14	46.67	16	53.33
	Moderate pain	-	-	-	-
	Severe pain	-	-	-	-

**Table 2: Effectiveness of mirror therapy containing functional task on motor function of upper extremity in experimental group**

Variables	Pretest		Post Test		Paired 't' Value
	Mean	S.D	Mean	S.D	
Motor function	26.67	4.83	33.40	4.05	t = 15.238 p = 0.001, S***
Sensation	7.87	2.13	8.60	2.09	t = 5.117 p = 0.001, S***
Passive Joint Motion	10.70	2.31	15.57	2.95	t = 24.104 p = 0.001, S***
Joint pain	1.27	1.72	0.47	0.82	t = 4.397 p = 0.001, S***

\*\*\*p<0.001, S – Significant

**Table 3: Comparison of post-test level of motor function of upper extremity between experimental and control group**

Variables	Experimental Group		Control Group		Unpaired 't' Value
	Mean	S.D	Mean	S.D	
Motor function	33.40	4.05	27.20	3.85	t = 6.076 p = 0.001, S**
Sensation	8.60	2.09	7.43	1.75	t = 2.338 p = 0.05, S*
Passive Joint Motion	15.57	2.95	11.17	1.49	t = 7.283 p = 0.001, S**
Joint pain	0.47	0.82	1.47	1.63	t = 2.996 p = 0.05, S*

\*\*p<0.001, \*p<0.05, S – Significant

Table 4: Association of post - test level of motor functions among stroke patients with their selected demographic variables in the experimental group

Motor function							
Demographic Variables	Moderate motor Impairment		Severe motor impairment		Chi-Square Value		
	No.	%	No.	%			
Age in Years							$\chi^2 = 7.232$ d.f=2 p = 0.027 S*
41 – 50	5	16.7	-	-			
51-60	7	23.3	14	46.6			
61-70	2	6.7	2	6.7			
Level of sensation							
Demographic Variables	Normal sensation		Mild sensory sensation		Moderate sensory sensation		Chi-Square Value
	No.	%	No.	%	No.	%	
Type of stroke							$\chi^2 = 6.563$ d.f=2 p = 0.038 S*
Ischemic stroke	8	26.7	10	33.3	6	20.0	
Hemorrhage stroke	-	-	6	20.0	-	-	
Passive joint motion							
Demographic Variables	Normal movement		Hypomobility		No movement		Chi-Square Value
	No.	%	No.	%	No.	%	
Education							$\chi^2 = 16.875$ d.f=4 p = 0.002 S***
Illiterate	2	6.7	8	26.7	2	6.7	
Primary	-	-	10	33.3	-	-	
High school	6	20.0	2	6.7	-	-	
Type of stroke							$\chi^2 = 17.500$ d.f=2 p = 0.001 S***
Ischemic stroke	4	13.3	20	66.7	-	-	
Hemorrhage stroke	4	13.3	-	-	2	6.7	
Joint pain							
Demographic Variables	No pain		Mild pain		Chi-Square Value		
	No.	%	No.	%			
Sex							$\chi^2 = 6.429$ d.f=1 p = 0.011 S*
Male	11	36.7	10	33.3			
Female	9	30.0	-	-			

\*p<0.05\*\*\*p<0.001, S – Significant

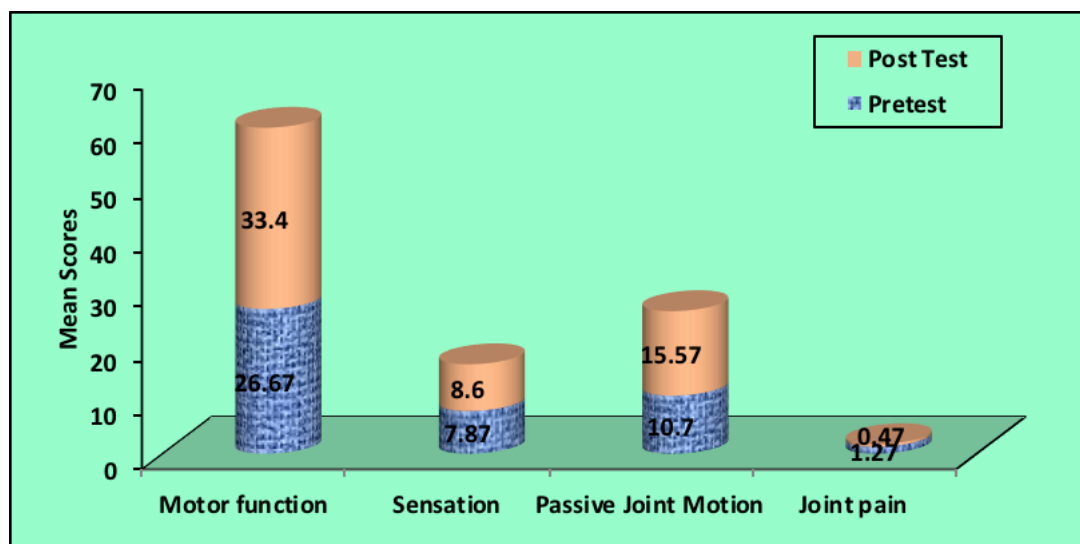


Figure 1: Comparison of pre-test and post-test mean score of motor function of upper extremity in experimental group.

**CONCLUSION**

This study indicates that Mirror Therapy containing functional tasks is a simple non pharmacological and cost effective method. It is effective in improving the upper extremity motor functions among patients with stroke who are hemiplegic and has hemiparesis. The selected patients became familiar and comfortable to practice. From the result of the study, it was

concluded that mirror therapy containing functional tasks has no side effects and it is an easy method which can be practice at home too.

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