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Effectiveness of Mirror Therapy to Improve Upper Extremity Motor Function in Stroke Patients at Selected Hospitals of Guwahati, Assam

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Abstract: ***Background: Stroke is becoming an important cause of premature death and disability in low income and middle-income countries like India.1 According to Guwahati Neurological Research Centre study (2018) shows that 54, 890 persons are affected by stroke every year in Assam and more than a Lakh in the Northeast.2 Mirror therapy is relatively new therapeutic intervention that focuses on moving the unimpaired limb.3 Aim: To assess the effectiveness of mirror therapy to improve upper extremity motor function in stroke patients. Methods: Quasi experimental (Non randomized control group design) was used to select sample 30 experimental and 30 control group by convenient sampling technique at Guwahati Medical College and Hospital, Guwahati, Assam. The experimental group received mirror therapy for 25 minutes per day for continuously 7 days. Control group received routine care without mirror therapy. To evaluate the upper extremity motor function, Fugl Meyer Assessment tool was used. Assessment was performed twice, on first day before intervention and on 8th day after intervention. Result: Results revealed that mean pre-intervention score was 29.33±15.82 and in post-intervention mean score was 38.97±20.07 with mean difference was 9.63. The effectiveness of mirror therapy was tested using paired t test with obtained t value is (t=8.165) was statistically significant at p<0.05 level. Conclusion: The study concludes that there was significant difference in post intervention score of mirror therapy on upper extremity motor function in stroke patients among experimental and control group.***

Keywords: Effectiveness, Mirror therapy, Upper extremity motor function, Stroke patient

1. Introduction

Stroke or cerebral vascular accident, is the sudden death of brain cell due to inadequate blood flow. The WHO clinically defines stroke as the rapidly developed clinical signs and symptoms of focal neurological disturbance lasting more than 24 hours, or leading to death with no apparent cause other than of vascular origin.4

The paralytic upper limb is a common and undesirable consequence of stroke that increases activity limitation. A number of interventions have been published evaluating the effect of various rehabilitation methods in improving upper extremity control and functioning. Mirror therapy is a relatively new therapeutic intervention which is simple, inexpensive and most importantly patient directed treatment that focuses on moving the unimpaired limb. It was first introduced by Ramachandran and Roger Ramachandran to treat phantom limb pain after amputation. More than half of people with upper limb impairment after stroke will still have problems many months to years after stroke. Thus improving upper arm function is a core element of rehabilitation.5

In stroke patients, this mirror therapy helps in performing movements of unimpaired limb while watching its mirror reflection superimposed over the (unseen) impaired limb, thus creating a visual illusion of enhanced movement capability of the impaired limb. Mirror therapy uses mirror visual feedback which increases neural activity in areas involved with allocation of attention and cognitive control.6

2. Objectives

- To assess the upper extremity motor function in stroke patients before intervention with mirror therapy.
- To evaluate the effectiveness of mirror therapy on upper extremity motor function among stroke patients in experimental group.
- To compare the post interventional score of mirror therapy on upper extremity motor function among experimental and control group.

3. Literature Survey

Kannan V, Justin C, et. al (2018) conducted a study on "Clinical prevalence of stroke in a tertiary care hospital in Southern India". The study includes all the Stroke patients admitted in Government Rajaji Hospital and Madurai Medical College, Madurai during the period of 01 January 2018 to 31 December 2018. A total of 1168 patients were taken into study, there were 779 males and 389 females. There were a total of 848 ischemic stroke patients (72.60%), when compared to 320 hemorrhagic stroke patients 27.39%. Anterior circulation stroke prevalence was higher (88.27%) when compared to posterior circulation stroke. A total 498 patients (42.63%) belonged to the age group of 40 to 60 years. This study concludes that there is an inadequate data regarding the prevalence of stroke in India and decade old data indicates that there is an increasing prevalence. Hence the study reviewed the current prevalence of stroke in a tertiary care centre in southern Tamil Nadu.7

Kamalakannan S, Gudlavalleti ASV, et. al (2017) conducted a study on "Incidence & prevalence of stroke in India" All population-based, cross-sectional studies and cohort studies from India which reported the stroke incidence rate or cumulative stroke incidence and/or the prevalence of stroke in participants from any age group were included. Electronic databases (Ovid, PubMed, Medline, Embase and IndMED) were searched and studies published during 1960 to 2015 were included. A total of 3079 independent titles were identified for screening, of which 10 population-based cross-sectional studies were considered eligible for inclusion. Given the heterogeneity of the studies, meta-analysis was not carried out. 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. The study concludes that a paucity of good quality epidemiological studies on stroke in India emphasizes the need for a coordinated effort at both the State and national level to study the burden of stroke in India. Future investment in the population-based epidemiological studies on stroke would lead to better preventive measures against stroke and better rehabilitation measures for stroke-related disabilities in the country.8

Arya KN, Pandian S, Vikas, Puri V. (2018) conducted a study on "Mirror Illusion for Sensori-Motor Training in Stroke: A Randomized Controlled Trial" Study was conduct on Functional therapy laboratory of Rehabilitation Institute. Thirty-onechronic poststroke subjects (17 experimental and 14 controls), aged between 30 and 60years, with ≤ diminished light touch in the hand were participated in this study. Outcome measures are test by Semmes Weinstein Monofilament (cutaneous threshold), 2-Point discrimination test (touch discrimination) and Fugl-Meyer Assessment (hand motor recovery). The experimental group received sensory stimulus such as tactile perception and motor tasks on the less-affected hand using mirror box. The control counterparts underwent only dose-matched conventional program.30 sessions with a frequency of 5/week were imparted to the groups. Study shows that Post intervention, there was a significant (P <.004) increase up to 30% positive touch-response for the hand quadrants among the experimental group in comparison to only 13.5% rise for the same among the controls. The cutaneous threshold of the less-affected palm also improved significantly among the experimental subjects in comparison to the controls (P =.04). The result of the study shows that MT may be considered as a promising regime for enhancing cutaneous sensibility in stroke. The mirror illusion induced by MT may be utilized for sensory and motor deficits as well as for the more-affected and less-affected hands.9

Gurbuz, Afsar SI et. al (2016) conducted a study to assess " TheEffectiveness of mirror therapy on upper extremiy motor function in stroke patients". Thirty-one hemiplegic patients were included. The patients were randomly assigned to a mirror (n=16) or conventional group (n=15). The patients in both groups underwent conventional therapy for 4 weeks of 60 minutes/day for 5 days in a week among the stroke patients. The patients were evaluated at the beginning and end of the treatment by using the Brunnstrom stage, Fugl-Meyer Assessment upper extremity score, and the Functional Independence Measure self-care score. There was an improvement in Brunnstrom stage and the FIM self-care score in both groups, but the post-treatment FMA score was significantly higher in the mirror therapy group than in the conventional treatment group. Mirror therapy in addition to a conventional rehabilitation program was found to provide additional benefit in motor recovery of the upper extremity in stroke patients.10

Pradeepha. N (2017) conducted a Quasi experimental study "The effectiveness of mirror therapy upon motor function of upper extremity among stroke patients at Apollo Hospitals, Chennai". The sample size of this study consisted of 60 patients, in that 30 were in experimental group and 30 in the control group. The study subjects were selected using purposive sampling technique. The study included 30 subjects from Apollo Main Hospital and 30 subjects from Apollo Specialty Hospital who satisfied the inclusion criteria. Study shows that there was no significant difference between pretest (M=16.03, SD=3.36) and posttest (M=16.8, SD=4.18) in motor function of upper extremity among stroke patients in the control group, whereas there was statistically significant difference between pretest (M=16.26, SD=4.99) and posttest (M=19.8, SD=5.33) in motor function of upper extremity among stroke patients in the experimental group at $p<0.01$ level.11

Ms. Gokila S (2016) conducted a study to "Assess the effectiveness of mirror therapy to improve upper extremity motor function in stroke patients at PSG Hospitals, Coimbatore". The research design adopted was True experimental pre test post test design. The sample size was 30 stroke patients with impaired upper extremity motor function in PSG hospitals. Purposive sampling technique was used in this study. Patients were randomly assigned into 15 in the intervention group and 15 in the comparison group. Brunnstrom motor recovery scale III and IV stage patients were selected for this study. Fugl-Meyer Assessment tool were used to assess upper extremity motor performance, sensory function, passive joint motion and joint pain. Pre test data were collected on the first day of intervention in both groups using Fugl-Meyer Assessment. Post test I and post test II data were collected at the 7th and 14th day of intervention in both groups using Fugl-Meyer Assessment. Mirror therapy was administered 30 minutes/day and 7 times a week for minimum 2 weeks and maximum till the discharge for intervention group. Sham therapy was administered 30 minutes/ day and 7 times a week for minimum 2 weeks and maximum till the discharge for comparison group. The study result showed that there was a significant improvement in upper extremity motor function involving motor performance, sensory function, passive joint motion and joint pain among stroke patients in intervention group compared with sham therapy group.12

4. Methods/ Approach

Research approach: Quantitative

Research Design: Quasi experimental (Non randomized control group design)

Variables:

- **Independent variables**: In this study, Mirror therapy was independent variable.
- **Dependent variables**: In this study dependent variable was upper extremity motor function in stroke patient.
- **Setting of the study**: The study was conducted in medical ward and neurology ward of Guwahati Medical College and Hospital, Guwahati, Assam

Population:

Target population: In this study target population comprises of all patients who are having upper extremity motor impairement after stroke.

Sample: 60 samples (30 in Control group and 30 in Experimental group).

Sampling technique: Convenient sampling technique.

Inclusion criteria:

- Patients admitted with stroke having upper extremity motor impairment.
- Who are able to understand and obey commands.
- Patients who will be available atleast one week for giving intervention with mirror therapy.

Exclusion criteria:

- Patients who had poor cognitive functions.
- Patients with visual deficit and perceptual deficit.
- Patients with Contracture in affected upper limb.
- Patients who had fracture on stroke affected upper extremities

Description of tool:

The tool used for the study consisted of two (2) tools.

Tool-1

It consist 2 parts:

Part A-Demographic Variables

This proforma was used by the researcher for collecting demographic variables.

It includes 5 items such as
Age, Gender, Education, Residence, Marital status.

Part B-Health related variables

It includes 5 items including,
Types of stroke, Duration of stroke, Stroke affected upper extremities, Dominant side
Any history of co-morbid disease such as (Hypertension, Diabetes Mellitus, Thyroid Disorder, other).

Tool-2

Fugl-Meyer Assessment Tool

Fugl-Meyer Assessment (FMA) scale is an index to assess the sensori motor impairment in individuals who have had stroke. This scale was first proposed by Axel Fugl-Meyer and his colleagues in 1975 as a standardized assessment test for post-stroke recovery in their paper titled "The post-stroke hemiplegic patient" *A method for evaluation of physical performance*.[13] Motor performance scores ranges from 0 to 66.[14]

Score Interpretation

Motor performance

Normal motor function	≥ 63
Mild motor function	55-62
Moderate motor function	33-54
Severe motor function	≤ 32

Section wise scoring

A.	Upper extremity	----------/36
B.	Wrist	----------/10
C.	Hand	----------/14
D.	Coordination / Speed	----------/6
Total A-D (Motor function)		---------/66

Data Collection Procedure:

The data were collected at three phases

Phase 1:

Information regarding demographic variables and health related variables were collected before intervention in experimental and control group. Fugyl Meyer Assessment tool were use to assessed the upper extremity motor function in stroke patient.

Phase 2:

Intervention: In experimental group, mirror therapy was administered 25 minutes/ day for 7 days continuously. In control group, continuation of routine care without mirror therapy.

Steps of mirror therapy procedure:

- Privacy was maintained by using screen.
- During mirror therapy patients were in sitting position on a chair or bed close to the table on which a mirror box was placed vertically and advised to place both the hands on the table.
- The paralytic hand was placed behind the mirror and the non paralytic hand was placed in front of the mirror.
- The patients were advised not to look on the paralytic hand and focus towards the mirror.
- Keep the non paralytic hand flat on the table.
- The investigator demonstrated the each exercise such as: (Wrist flexion and extension, Finger flexion and extension, Finger and thumb abduction, Makes a fist and release, Grasping objects, Single finger movement, Thumb opposition).
- Simultaneously the patients performed the same exercise using the non-paralytic hand in front of mirror.
- During the session, patients were asked to try to do the same movements in the paralytic hand while they were moving the non-paralytic hand.

Materials used:

1) Mirror (25 x 30 cm)
2) Reflex hammer
3) Smiley ball
4) Cylinderical Can

5) A pencil and worksheets
6) Cardiac table
7) Screen

Phase 3: Post test data were collected on 8th day using Fugl-Meyer Assessment tool for both groups to assess the upper extremity motor function.

5. Result / Discussion

Table 1: Frequency and percentage distribution of pre intervention and post intervention level of upper extremity motor function in stroke patients in experimental and control group, N=60

Upper extremity Motor function	Experimental group				Control group			
	Pre Intervention		Post Intervention		Pre Intervention		Post Intervention	
	f	%	f	%	f	%	f	%
Normal motor function	0	0	0	0	0	0	0	0
Mild motor impairment	0	0	9	30	0	0	0	0
Moderate motor impairment	14	46.7	14	46.7	15	50	17	56.7
Severe motor impairment	16	53.3	7	23.3	15	50	13	43.3

Table 1 depicts the frequency and percentage distribution of pre intervention and post intervention level of upper extremity motor function in stroke patients in experimental and control group. Results showed that in experimental group pre-intervention majority 16 (53.3%) of participants had severe motor impairment and 14 (46.7%) had moderate motor impairment where as in post-intervention majority 14 (46.7%) had moderate motor impairment, 9 (30%) had mild motor impairment and 7 (23.3%) had severe motor impairment.

In control group pre-intervention 15 (50%) of participants had severe motor impairment and 15 (50%) had moderate motor impairment where as in post-intervention majority 17 (56.7%) had moderate motor impairment and 13 (43.3%) had severe motor impairment.

A similar study conducted by Jothisubbulakshmi MD et al. (2016) on to "Assess the effectiveness of mirror therapy on upper limb motor functions among patients with stroke admitted in Rajib Gandhi Government General Hospital" found that, In pretest, experiment clients are having, 66.7% of flaccidity no voluntary movement and 33.3% are having Hyperplexia emergence of spasticity and synergies. In control group clients, they are having 56.7% of flaccidity no voluntary movement and 43.3% are having Hyperplexia emergence of spasticity and synergies. Statistically there is no significant difference between experiment and control group. It was confirmed using chi square test. This study support the present study findings.**1**[5]

Table 2: Effectiveness of mirror therapy on upper extremity motor function among stroke patients in experimental group, N= 30

Experimental Group	Mean	SD	Mean Difference	t test value	df	p value
Pre-Test	29.33	15.82	9.63	8.165	29	0.001**
Post-test	38.97	20.07				

****p<0.01 level of significance**

Table 2 depicts the effectiveness of Mirror Therapy on Upper Extremity Motor function among stroke patients in Experimental group. Findings showed that mean pre-intervention score was 29.33±15.82 and in post-intervention mean score was 38.97±20.07 with mean difference was 9.63. The effectiveness of mirror therapy was tested using paired t test with obtained t value is (t=8.165) was statistically significant at p<0.05 level. Result revealed that mirror therapy was effective in improving the upper extremity motor function among stroke patients in experimental group. A similar study conduct by Pradeepha. N et al. (2017) " Effectiveness of mirror therapy upon motor function of upper extremity among stroke patients" found there was no significant difference between pretest (M=16.03, SD=3.36) and posttest (M=16.8, SD=4.18) in motor function of upper extremity among stroke patients in the control group, whereas there was statistically significant difference between pretest (M=16.26, SD=4.99) and posttest (M=19.8, SD=5.33) in motor function of upper extremity among stroke patients in the experimental group at p<0.01 level. This shows that providing mirror therapy helps in improving motor function of upper extremity among stroke patients.1[1]

Table 3: Comparison of post interventional score of mirror therapy on Upper extremity motor function among stroke patients in experimental and Control group, N=60 (30+30)

Comparison Post-test	Mean	SD	Mean Difference	t test value	df	p value
Experimental Group	38.97	20.07				
Control Group	27.13	9.665	11.83	2.909	58	0.005*

***p<0.05 level of significance**

Table 3 depicts the comparison of post interventional score of mirror therapy on Upper extremity motor function among stroke patients in experimental and Control group. Findings showed that in experimental group mean post-intervention score was 38.97±20.07 and in control group mean post-intervention score was 27.13±9.665 with mean difference was 11.83. The comparison between experimental and control group was tested using unpaired t test with obtained t value (t=2.909) was statistically significant at p<0.05 level. Findings revealed that there was significant difference in post intervention score of mirror therapy on Upper Extremity Motor Function in Stroke patients among Experimental and Control group. Hence hypothesis H1 is accepted.

The findings of the present study was supported by the study conducted by Jothisubbulakshmi D on a study to "Assess the effectiveness of mirror therapy on upper limb motor functions among patients with stroke admitted in Rajiv Gandhi Government General Hospital, Chennai" (2016). In post test, experiment 30.0% of clients had voluntary movements within synergy, 53.3% clients had isolated

voluntary movements, spasticity and synergies decline and 16.7% clients had increasing voluntary control, coordination. In control, 43.3% of clients have flaccidity no voluntary movements, 26.7% hyperplexia emergence of spasticity and synergies and 30% voluntary movements within synergy. Statistically there was a significant difference between experiment and control group. It was confirmed using chi square test.1[5]

6. Conclusion

Mirror therapy is an non invasive procedure it is an effective, inexpensive and non pharmacological measure for improving upper extremity motor function in stroke patients. This study was intended to assess the effectiveness of mirror therapy to improve upper extremity motor function in stroke patients at selected hospitals of Guwahati, Assam. After administration of mirror therapy, findings showed that mean pre-intervention score was 29.33±15.82 and in post-intervention mean score was 38.97±20.07 with mean difference was 9.63. The effectiveness of mirror therapy was tested using paired t test with obtained t value is (t=8.165) was statistically significant at $p<0.05$ level. Result revealed that mirror therapy was effective in improving the upper extremity motor function among stroke patients in experimental group. The findings of the study conclude that mirror therapy was effective in improving the upper extremity motor function among stroke patients in experimental group.

7. Recommendation

- A similar study could be conducted in rehabilitation centers and community setting.
- The similar study can be conducted in larger group of population.

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