

Effects of Mirror Therapy on Upper Extremity Functions among Hemiplegic Patients: An Experimental Study

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Koushal Dave

Abstract

Background: Hemiplegia is one of the most common and undesirable consequences of stroke. The disability in daily life is of longer duration for paralysis of the upper extremity than the lower extremity. This study was conducted to assess the effectiveness of mirror therapy on upper extremity functions among hemiplegic patients. **Methods:** Quantitative pre-test post-test control group design was used. Hundred patients visiting outpatient department of Dr. R.M.L. Hospital, New Delhi were randomly assigned to either of two groups: experimental group and control group. Subjects in experimental group received mirror therapy along with physiotherapy and subjects in control group received physiotherapy only. Demographic related data was collected and upper extremity functions of hemiplegic patients were assessed by using the Manual Function Test (M.F.T.) tool. Data analysis was done by using STATA 11.1 with level of the significance < 0.05 . **Results:** The mean upper extremity function score was significantly ($p < 0.001$) higher among subjects of experimental group (20.35 ± 4.90) after intervention of mirror therapy with physiotherapy in comparison to subjects of control group (10.65 ± 4.56) who received only physiotherapy. Significant improvement in upper extremity function was found among subjects with brain injury and subjects with higher education level. **Conclusion:** It is concluded that mirror therapy is relatively cheap intervention with notable improvement in upper extremity functions among hemiplegic patients. An improved upper extremity function ultimately creates a positive effect on early recovery of hemiplegic patients' without any complications associated with hemiplegia.

Keywords: Mirror therapy; Hemiplegia; Upper extremity function; Stroke.

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Introduction

Stroke is a global epidemic and an important cause of morbidity and mortality. Stroke remains the leading cause of disability and third leading cause of death among adults in the United States of America.¹ In India, stroke is the second commonest cause of death and the most common cause of

disability.^{2,3} According to a recent study published in the *Journal of stroke*, the prevalence rate of strokes is 84 to 262 per 100,000 populations in rural India and 334 to 424 out of 100,000 populations in cities.⁴ Hemiplegia is one of the most common and undesirable consequences of strokes. It has been reported that up to 85% of stroke survivors experience hemiparesis and 55%-75% continue to have limitations in upper extremity function.⁵

Mirror therapy is a relatively new approach in rehabilitation used in different neurological disorders including stroke.⁶ Mirror therapy is a drug free treatment and has been described in literature to be of benefit to 80% of users, some even report numbers as high as 95%.⁷ 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.⁸ Mirror therapy

Author Affiliation: Lecturer, College of Nursing, Atal Bihari Vajpayee Institute of Medical Sciences (ABVIMS) & Dr. R.M.L. Hospital, Connaught Place, New Delhi 110001, India.

Corresponding Author: Koushal Dave, Lecturer, College of Nursing, Atal Bihari Vajpayee Institute of Medical Sciences (ABVIMS) & Dr. R.M.L. Hospital, Connaught Place, New Delhi 110001, India.

E-mail: kaushal442@gmail.com

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technique utilizes the mirror-illusion which is created by the movement of sound limb that is perceived as the paretic limb.⁹

Altschuler et al.¹⁰ demonstrated improvement of movements in terms of range of motion, speed and accuracy in post stroke patients who underwent mirror therapy. Yavuzer et al.⁶ reported that mirror therapy in addition to a conventional rehabilitation program was beneficial in terms of motor recovery and upper limb functioning. These studies suggest that mirror therapy leads to better functional recovery of the upper extremities than does conventional therapy. Thieme H et al.¹¹ was found to improve activities of daily living, significant positive effect on pain and motor function with mirror therapy. Objective of the study was to assess effectiveness of mirror therapy on upper extremity functions among hemiplegic patients.

Materials and Methods

Experimental pretest post-test control group design was used. All hemiplegic patients with upper extremity dysfunction of less than six months and who visited Physiotherapy OPD, Neurology OPD and department of Physical Medicine and Rehabilitation of Dr. R.M.L. Hospital, New Delhi were enrolled. Ethical clearance for the study was obtained from institute Ethics Committee.

Sample and Sampling technique

Total 100 subjects who met the eligibility criteria were randomly allocated to two groups: control group (50) and experiment group (50). Subjects in experimental group received mirror therapy along with physiotherapy and subjects in control group received only physiotherapy.

Participant's Eligibility Criteria

Patients with left or right hemiplegia, normal visual perspective function and normal mental status were included. Subjects with physical disability of upper extremity, quadriplegia, any mental disorder and had recently undergone brain surgery were excluded from this study.

Measures

- (1) *Tool 1:* A structured tool including the demographic and clinical data was prepared to collect data from subjects using interview technique. The tool had 15 items dealing with demographic and clinical data of the subjects.

- (2) *Tool 2: Manual Function Test (MFT):* This is a standard tool to assess upper motor function. It was made in 1987 in Japan by R. Nakamura and S. Moriya. The MFT was developed to examine unilateral upper-limb motor function in hemiplegic patients with paralysis. It includes a task in following categories: arm motion, grasp and pinch, arm and hand activities. The MFT score can range from 0 (severely impaired) to 32(full function).

Various activities like forward (FE) and lateral elevation (LE) of upper extremity, touch the occipital with palm of affected side (PO), touch the dorsum with affected hand (PD), grasp the ball and hold it up, pinch, carry a cube (CC) and peg-board (PP) were performed during MFT. Validity and reliability of MFT is already established with internal consistency and a reliability coefficient of 0.95.

Intervention

The principle of mirror therapy is to use mirror to create a reflective illusion of movement of the affective limb. Sitting position was provided to patients. Face mirror (60 × 30 cm) was placed vertically in saggital plane on desk. The paretic hand was placed behind the mirror and non paretic hand was placed in front of mirror such that reflection of paretic hand creates illusion in patient's head such that his affected hand is responding. The therapy was given to hemiplegic patients twice a week in OPD for 30 days. Patients in experimental group were motivated to perform this exercise daily at home for thirty minutes and follow up was done by providing a diary to each patient for maintaining regularity of mirror therapy.

Procedure for data collection

Data was collected from November 2018 to May 2019. All the hemiplegic patients who visited OPD of Dr. R.M.L. hospital and met the inclusion criteria were enrolled in study. Random assignment to either of the two groups: experimental and control groups was done based on randomization table. A letter explaining the purpose of the study was given to the subjects. Signed informed consent was taken from the subjects. Demographic related data was collected by interview technique using questionnaire. Pre-test assessment of upper extremity function was done by using MFT from both the groups. The Intervention of mirror therapy along with physiotherapy was given to subjects of

experimental group for thirty days whereas control group only received physiotherapy. The therapy was given to hemiplegic patients twice a week for 30 days. Subjects in experimental group were motivated to perform mirror therapy along with physiotherapy for thirty minutes daily at home and follow up was done by providing a diary to each patient for maintaining regularity of mirror therapy. Post-test assessment of both the groups was done using Manual Function Test (MFT) tool after 30 days of follow-up.

Results

Demographic Characteristics

Mean age of the subjects was 55 years in both the groups. Majority of subjects in both the groups were male 65% & 55% respectively. 35%

of subjects had education level of graduation in experimental group whereas in control group 35% subjects had obtained primary level education. Approximately 55% subjects were employed and equal percentage of the subjects in both the groups had monthly income more than ₹10,000. In both the groups, majority of subjects were diagnosed with hypertension followed by brain injury.

Comparison of pretest and post-test upper extremity function scores

Table 1 shows that mean pre-test PO function score (touch the occipital with palm of affected side) in experimental group was 1.35 ± 0.81 and in control group PO score was 0.90 ± 0.64 . GR (grasping) mean function score was 1.40 ± 0.68 in experimental group and 1.95 ± 0.68 control group. In both the groups, PP (peg board) function score was 1.30 ± 0.80 and 0.90 ± 0.71 respectively.

Table 1: Comparison of pre-test and post-test MFT scores of upper extremity function in experimental and control group

UEF	Pre-test score		Post-test score	
	Experimental group (Mean \pm SD)	Control group (Mean \pm SD)	Experimental group (Mean \pm SD)	Control group (Mean \pm SD)
FE	1.85 ± 0.74	1.80 ± 0.83	3.90 ± 0.71	2.05 ± 0.68
LE	1.65 ± 0.81	1.50 ± 0.68	3.55 ± 0.75	1.65 ± 0.67
PO	1.35 ± 0.81	0.90 ± 0.64	2.95 ± 0.68	1.05 ± 0.82
PD	0.90 ± 0.71	0.60 ± 0.82	3.10 ± 0.64	0.55 ± 0.75
GR	1.40 ± 0.68	1.95 ± 0.68	2.50 ± 0.68	2.05 ± 0.68
PI	1.10 ± 0.64	1.30 ± 0.86	2.55 ± 0.82	1.60 ± 0.75
CC	1.05 ± 0.68	1.15 ± 0.67	2.40 ± 0.82	1.35 ± 0.81
PP	1.30 ± 0.80	0.90 ± 0.71	3.40 ± 0.99	0.95 ± 0.75

UEF: Upper extremity function, FE- Forward elevation of the upper extremity, LE -Lateral elevation of upper extremity, PO- Touch the occipital with palm of affected side, PD - Touch the dorsum with affected hand, GR - Grasp the things, PI - pick up things, CC - pick wooden cubes, PP - Peg board.

Mean post-test LE (lateral elevation of upper extremity) function score in experimental group was 3.55 ± 0.75 as compared to control group 1.65 ± 0.67 . PD (touch the dorsum with affected hand) function score was 0.55 ± 0.75 in control group and 3.10 ± 0.64 in experimental group. Post-test PP (peg board) mean function score was 3.40 ± 0.99 in experimental group whereas 0.95 ± 0.75 in control group.

Upper extremity function score of FE (Forward elevation), LE (Lateral elevation), PD (Touch the dorsum with affected hand), PP (Peg board) were significantly improved in experimental group after intervention of mirror therapy along with physiotherapy compared to control group.

Effects of mirror therapy on upper extremity function

As shown in Fig. 1, mean pre-test upper extremity

function score was 10.60 ± 4.74 and mean post-test upper extremity function score was 20.35 ± 4.90 after intervention of mirror therapy along with physiotherapy among subjects of experimental group with $p < 0.001$. Whereas, in control group mean pre-test upper extremity function score was 10.10 ± 4.66 and mean post-test upper extremity function was 10.65 ± 4.56 with physiotherapy ($p=0.058$). Significance effect of mirror therapy along with physiotherapy on upper extremity function score was seen in experimental group ($p < 0.001$). Thus, mirror therapy along with physiotherapy has highly significant effect in improving upper extremity function among hemiplegic patients compared to physiotherapy.

Study results also found that subjects in the age group of 26 to 35 years had significantly higher ($p < 0.004$) upper extremity function score than the older age group. Moreover, the subjects with

higher educational status had comparatively better upper extremity function than the lower educational status. Subjects with brain injury showed significantly higher ($p < 0.001$) upper

extremity function score after intervention of mirror therapy 16.00 ± 3.84 than the subjects with disorders like spinal injury, diabetes and hypertension.

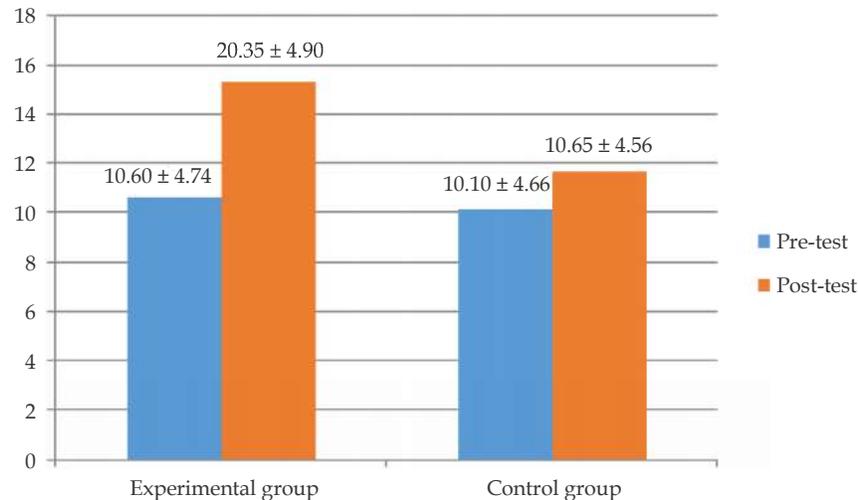


Fig. 1: Comparison of upper extremity function score of experimental and control group.

Discussion

Mean pre-test upper extremity function score was 10.60 ± 4.74 and post-test upper extremity function score was 20.35 ± 4.90 after intervention of mirror therapy along with physiotherapy among subjects of experimental group ($p < 0.001$). Whereas, in control group mean pre-test upper extremity function score was 10.10 ± 4.66 and mean post-test upper extremity function was 10.65 ± 4.56 with physiotherapy ($p = 0.058$). Significance effect of mirror therapy along with physiotherapy on upper extremity function score was seen in experimental group ($p < 0.001$).

The findings of this study were also supported by Zeng W, Guo Y, Wu G, Liu X, Fang Q. (2018)¹² conducted study to evaluate the mean treatment effect of mirror therapy on motor function of the upper extremity in patients with stroke. A moderate effect of mirror therapy on motor function of the upper extremity was found.

These findings were congruent to the findings of the study conducted by Choi HS, Shin WS, Bang DH (2019)¹³ mirror therapy using gesture recognition for upper limb function, neck discomfort and quality of life after chronic stroke. Mirror therapy is an intervention that improves upper-extremity function, neck Bai discomfort, and quality of life in patients with chronic stroke.

The above findings were similar to the study conducted by Bruchez R, Jequier Gyax M, Roches S, Fluss J, Jacquier D, Ballabeni P et al. (2016)¹⁴ to determine the efficacy of mirror therapy in children with hemiparesis. Significant improvements was found in grasp strength, pinch strength, upper limb function in terms of accuracy and fluency as well as daily performance.

Limitation

Study involved only subjects who visited OPD, conducted in single setting with small sample size.

Implications

Nursing practice: Mirror Therapy can be used as an adjuvant therapy to improve the upper extremity functions among hemiplegic patients. Nurses in the OPD settings can be encouraged to use mirror therapy for hemiplegic patients to improve upper extremity function.

Nursing administration: Facilities should be made available in hospital settings for using Mirror Therapy for hemiplegic patients visiting OPD to improve their upper extremity functions. In-service education should be conducted for the nursing personnel as well as for the other hospital staff to utilize rehabilitative intervention like mirror therapy to improve the upper extremity function among hemiplegic patients.

Nursing research: Nurses can conduct further research on the effect of Mirror Therapy on upper extremity functions in all the other settings of the hospital with larger sample size.

Conclusion

Based on the findings of the present study it is concluded that upper extremity functions were improved after intervention of mirror therapy along with physiotherapy among hemiplegic patients. Mirror therapy could be used as an acceptable intervention and alternative to medications for patients when appropriate.

Recommendations

A multicentre study with a larger sample size can be undertaken. Intervention of mirror therapy can be given for longer period of time and duration. Effectiveness of Mirror Therapy may be assessed in other clinical areas of hospital.

Conflict of Interest

Authors declare no conflict of interest

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