

EFFECTIVENESS OF MIRROR THERAPY WITH AND WITHOUT CONVENTIONAL THERAPY ON UPPER LIMB MOTOR RECOVERY IN PATIENTS WITH ACUTE STROKE

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Abstract:

Background: After a Stroke, paralysis of the arm or leg is common and frequently interferes with daily activities like walking, dressing, or eating. Mirror therapy (MT) is a form of rehabilitation in which a mirror is positioned between the arms or legs to provide the illusion of normal movement in the effected limb. Mirror therapy is an easy to applied intervention for people with stroke. Therapists can apply this intervention with low cost. Only a mirror with an experienced therapist is required to apply this therapy in a clinic and at home. This configuration stimulates many brain areas related to movement, sensation, and pain.

Method: Following a stroke, forty patients with hemiparesis were included (29 males and 11 females, average age 49 years). Twenty patients received Conventional Therapy while also receiving mirror therapy at the same time. And twenty patients received only mirror therapy. For four weeks, each treatment was administered five days a week for 60 minutes each day. The FMA-UE and Brunnstrom both subscale with good psychometric properties indicated high reliability and validity for motor impairment was used to take reading before and after treatment.

Result: After 4 weeks of rehabilitation, both groups had significant improvements, but greater progress was seen in Conventional plus mirror group as compared to only Mirror group. There was a statistically significant increase in the upper extremity recorded by Brunnstrom stages (P value = 0.723 to 0.004). There was also a statistically significant improvement for both groups in FMA-UE scale (Mean = -14.4500 for Mirror Group and -33.100 for conventional plus mirror group). It was clearly seen from these results that, the post-treatment FMA upper extremity score was statistically significantly higher in the CMG than in the MG.

Conclusion: MT is a promising and easy method to improve motor recovery of the upper limb in subacute stroke patients. Combining traditional and mirror therapy is a successful way to help hemiplegic patients regain upper limb motor function.¹ We can therefore, conclude that there is statistically significant difference between the Pre-test and Post-test scores, or between the score before treatment and the scores after treatment. So, we will reject the Null Hypothesis and accept the Alternate Hypothesis, because the treatment administered was EFFECTIVE.

KEYWORDS: Stroke rehabilitation, Mirror therapy, Upper extremity.

1. INTRODUCTION

A stroke is characterized by rapidly appearing clinical symptoms of a focal or generalized disruption of brain function that persists for more than 24 hours or results in death and has no other evident cause other than vascular origin. Hemiplegia manifests as paralysis of both an upper and a lower extremities or one, on one side of the body.¹

Stroke is the 3rd leading cause of years of life lost across the world: age-standardized years of life lost increased by 12.9% (10.6–15.2) from 1990 to 2007 and by 12.1% (9.9–14.1) from 2007 to 2017. Deaths from stroke increased from 5.29 million (5.22–5.40) to 6.17 million (6.04–6.33) across the globe between 2007 and 2017.² The expected stroke cases in Pakistan are 250/100,000, translating to 350,000 new cases each year.³

Hemiplegia caused by a cerebrovascular stroke is a well-known a significant contributor to adult impairment, according to developments in improvement in mortality rates, the amount of acute care, and individuals with post-stroke problems and stroke survivors are fast expanding.⁴

Mirror therapy is a low-cost treatment that uses visual illusion to promote motor recovery. In this therapy, a mirror or mirror box (a mirror mounted on the side of a lightweight enclosure that surrounds the affected arm) is positioned at the mid-sagittal plane, obstructing the impaired extremity from a stroke survivor's view. Subjects are instructed to focus their visual attention on the mirror image of the unimpaired extremity during movement, which creates the illusion of two limbs moving synchronously and symmetrically without deficit.⁵

While the simplicity of mirror box therapy offers an appealing low-cost and portable option for stroke patients, there are important limitations to this treatment.⁵ The mirror therapy was initially developed for alleviating phantom limb pain after amputation and has been applied to stroke rehabilitation in the past two decades. The mirror therapy has gained much attention as a rehabilitation strategy to address patients' arm and hand function following a stroke.⁶

A sensory-based method to stroke rehabilitation known as "mirror therapy" uses mirror visual input to lessen functional damage in hemiparetic arms after the stroke.⁷

In addition, the mirror therapy might be associated with the mirror neuron system and promote reorganization and functional recovery. A growing number of studies have shown that the mirror therapy could be a beneficial approach for enhancing patients' motor and function after stroke.⁶

2. METHODOLOGY

The study was conducted using a randomized, controlled, assessor-blinded methodology. A sample size of 40 patients who acquired hemiparesis were a part of the study. Inclusion criteria for the study were as follows: participants who identified with unilateral hemiplegia brought on by a stroke that started within the previous six months, a Brunnstrom stage for the upper limb between I and IV.

The setting of the study was Farhat Medical center, Sialkot, Punjab, Pakistan. Forty patients with hemiparesis were included (29 males and 11 females, average age 49 years). Twenty patients received Conventional Therapy while also receiving mirror therapy at the same time. And the other group, twenty patients received only mirror therapy. For four weeks, each treatment was administered five days a week for 60 minutes each day.

Upper extremity motor recovery was evaluated using Brunnstrom stages. Brunnstrom stage evaluates the motor development of hemiplegic patients. In this test, the recovery process is divided into 6 stages. The upper extremity, arm, and the hand are evaluated separately. The lowest stage is identified as stage I (flaccid, no voluntary movement) and the highest stage as stage VI (isolated joint movement).⁸

The other scale named as Fugl-Meyer Assessment (FMA) upper extremity score was used to evaluate the various dimensions of motor weakness. FMA is a quantitative assessment tool that measures motor recovery after stroke in the shoulder, elbow, forearm, wrist, and hand. Points from 0 to 2 are given to each item according to the

performance on the motor function evaluation (0: Unable to perform, 1: Performs partially, 2: Performs completely). The maximum motor performance score for the upper extremity is 66 points.⁸

These two, FMA-UL and Brunnstrom subscale, both with good psychometric properties indicated high reliability and validity for motor impairment was use to take reading before starting and after 4 weeks.

3. RESULTS

From a pool of 56 patients with sub-acute stroke, a total of 40 inpatients divided into two groups (Mirror Group = 20, Conventional Plus Mirror Group =20) were included in the present study. No patient dropped out from this trial. The mean age of participants in Mirror Group and Conventional plus Mirror Group were 48 ± 5.129 , 50 ± 50.392 years, respectively. Higher percentage of male patients than female patients were enrolled in all groups, 75.00% for CMG, and 70.00% for MG. More comparisons of the demographic characteristics and pre-test scores are presented in Table 1. There were no significant differences among the two groups in demographic characteristics and baseline assessments.

Table 1. Demographic characteristics of the mirror and conventional groups

	Mirror Group (N= 20)	Conventional Plus Mirror Group (N= 20)
Age, (Years) (mean \pm SD)	48 ± 5.129	50 ± 50.392
Gender, (n %)		
Male	14 (70 %)	15(75%)
Female	06 (30%)	05(25%)
Dominant Side, (n%)		
Right	18(90%)	19(95%)
left	02(10%)	01(05%)
Affected side, (n %)		
Right	03(15%)	02(10%)
Left	17(85%)	18(90%)

Table 2. shows the descriptive data and statistical analysis of the patient's functional outcomes according to Brunnstrom Scale. With respect to our primary outcomes, all patients showed significant improvement in Brunnstrom scale: MG (1.5 to 03) And CMG (1.5 to 3.5), as indicated by the significant time effects. Chi-square also showed significant improvements from pre treatment to post treatment: 0.125 to 13.235 respectively. Before treatment, 75% of participants are fall in stage 1 and only 25% of participants are in stage 2, but after treatment that was 70% participants that improved to stage 3 in Mirror group. As far as the Conventional plus mirror group was concerned, 65% participants were in stage 1 and after the treatment, 50%, participants fall in stage 3, 30% in stage 4, while 20% participants were showed great improvement and were at stage 5, after the treatment protocol.

Table 2. Between-group differences of Brunnstrom stage changes.

	Mirror Group (N= 20)	Conventional Plus Mirror Group (N= 20)	Chi Square	P Value
Brunnstrom stages				
Pre-Treatment, median (range) (Stage %)	1.5(1-3) (2=25%, 1=75%)	1.5(1-3) (1=65%, 2=35%)	0.125	0.723
Post-treatment, median (range) (Stage%)	03(2-4) (2=25%, 3=70%, 4=5%)	3.5(2-5) (3=50%, 4=30%, 5=20%)	13.238	0.004

Table 3. shows the descriptive data and statistical analysis of the patient's functional outcomes, according to FMA-UE. With respect to our primary outcomes, all patients also showed significant improvements in FMA-UE as well: MG (Median 15.5 to 29, $P < 0.001$) And CMG (15 to 48, $P < 0.001$), as indicated by the significant time effects. Statistical analysis for paired sample t-test showed ($M = -14.4500 \pm 5.3555$ for mirror group and -33.1000 ± 3.1102 for conventional group respectively).

Table 3. Between-group differences of FMA-UE Score change

	Pre-Treatment, median (range) (High % Score value) (N= 20)	Post-treatment, median (range) (High % Score value) (N= 20)	Mean	Std. deviation	t value	P value
FMA-UE Score						
Mirror Group, Mean median (range) (High % Score value)	14.5500 15.5 (12-19) (12-13=50%, 19=15%, 14-18=35%)	29.0000 29 (21-39) (25-31= 55%, 32-39= 25%, 21-24=20%)	-14.4500	5.355519	-12.06	0.000
Conventional Group, Mean median (range)	14.7000 15 (12-19) (12=20%, 13-16=60%, 18-19=20%)	47.8000 48 (42-55) (45-47=50%, 50- 55=30%, 42-45=20%)	-33.1000	3.110255	-47.59	0.000

(High % Score value)						
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Results of the paired sample t-test shows that mean score differs before treatment (M=14.5500, SD =2.70429) for mirror group and (M= 14.7000, SD=2.17885) for conventional plus mirror group and similarly after taking treatment (M=29.000, SD =4.5422) for mirror group and (M=47.800,SD=3.548) for conventional plus mirror group respectively, at the 0.05 level of significance, $t(19) = -11.94354$ for Mirror group and $t(19) = -47.593$, for conventional plus mirror group, $n=20$, for each group, $p < 0.05$, 95% CI for mean difference: -16.95646 to -11.943540 for mirror group, and -34.55564 to -31.66434, for CMG, $r = -0.030$, for mirror group and $r = 0.496$ for CMG. On average, the weight was about -14.45000 for mirror group and -33.10000 for CMG, points greater than before the treatment.

4. DISCUSSION

This study not only provide the effectiveness of mirror therapy alone but also the effectiveness of mirror therapy with combination of conventional therapy to correlate the results of these two types of valid therapy protocols. So, we were able to identify and particularly calculate the amount of effect added by the mirror therapy to with conventional.

A study explored the effects of mirror therapy on upper limb motor functions among patients with hemiplegia. The study found that adding of MT to a conventional stroke rehabilitation program provides more progress in the upper limb motor functions and pain perception than conventional therapy alone.⁹ Another recent study discovered that using MT helped stroke patients' motor function significantly.¹⁰

The positive impact of MT on hemineglect serves as additional evidence of how it influences attentional processes. It's interesting to note that Ramachandran and his colleagues initially suggested alleviating hemineglect by going the opposite way around. By holding up a mirror to the patient's undamaged side, they hoped to raise awareness of the diseased side.¹¹

MT, when combined with bilateral arm training, was found to increase the visual or mental imagery feedback, which facilitates upper limb motor function. This improvement in upper limb motor function may give rise to functional improvements in the control of the paretic upper limb.¹²

Participants in the MT group had bilateral arm training as well as repetitive visual simulations of their nonparetic hand engaging in activities based on in-hand manipulation and a variety of grab patterns. Pictures where it looked that the paretic hand was performing these tasks because they were mirrored. Similar to the results of this investigation, a prior study,¹³ that combined task-oriented rehabilitation and mirror treatment found that the MT group experienced better improvements in movement performance than the control group.

Our findings are consistent with the findings of a prior study on subacute stroke patients, which suggested that early implementation of MT might help patients restore upper extremity function.¹⁴ From the time of the stroke until study recruitment, it took an average of 4 weeks. In a prior study, the application of MT at 8 weeks after stroke led to functional gains.¹⁵

The results of our study also revealed that in the experimental group, there was a strong correlation between control rehabilitation and mirror treatment in terms of increasing upper limb motor capabilities. In addition to a conventional rehabilitation program, the most well - accepted was mirror therapy, which was more beneficial for upper limb motor functions among hemiplegic patients.

Youngju et al. indicated that during the treatment period, MT with tasks that rely on common ADLs may affect the motivation of a patient. Subjects would eventually concentrate and participate more actively in the program, resulting in improved recovery and self - care of the UE motor.¹

The greater improvement in the motor performance of the distal limb in the MT group may be related to the findings of previous studies, which reported that the effect of MT on motor performance appears to be most evident for those patients who have no distal function at the beginning of the therapy. This has significant clinical

implications because most stroke rehabilitation therapies, such as constrained-induced movement therapy and biofeedback, can lead to functional improvements only when there is partial preservation of distal motor function before starting therapy.¹⁶

The theory describe that neurological and functional recovery occurs especially in the first 6 months after stroke, where most of improvement occurs in the first 6 weeks.¹⁷ Predictors of motor recovery in the upper extremities include the severity of extremity paralysis at the time of commencement and the moment when hand movements start. If the upper extremities are completely paralyzed at the time of the attack and there is no grasping capacity 4 weeks later, the prognosis for returning to meaningful hand function is low.¹⁷

Finally, there was some evidence that MT might lessen discomfort. To assess the impact of MT on pain, further research is necessary because the level of evidence is insufficient.¹⁸

5. CONCLUSION

We can therefore conclude that there is statistically significant difference between the Pre-test and Post-test scores, or between the weight before treatment and the weight after treatment. So, we will reject the Null Hypothesis and accept the Alternate Hypothesis, because the treatment administered was EFFECTIVE.

Moreover, the results of this research study, it could be concluded that mirror therapy is effective in improving functions of the hand, and it is advisable to consider it in the rehabilitation programs of chronic stroke patients for a better outcome.

Abbreviations

MT: Mirror Therapy, **CMT:** Conventional plus Mirror Therapy,

FMA-UE: Fugl Meyer Assessment-Upper Limb **MG:** Mirror Group

Conflict of interest

There was no conflict of interest.

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Data availability

Data will be provided on demand by corresponding author. akramzeeshan933@gmail.com

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