

# Impact of Mirror Therapy Techniques with Conventional Therapy to Facilitate Hand Functions and Adl`S in Post Stroke Survivor

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## *Abstract*

**BACKGROUND:** Rehabilitation of the hemiplegic arm after stroke represents a major challenge especially in hand functioning and ADL training.

**OBJECTIVE:** To evaluate impact of Mirror therapy in Stroke patient to improve hand functioning and ADL's.

**METHOD:** Experimental study design, this study was conducted at Institute of Physical Medicine and Rehabilitation, DOW University of Health Sciences. We recruited 25 hemiplegic patients through convenience sampling techniques; inclusion criteria for present study was stroke (1 year), age 30-60 both male and female, Manual muscle Test Grade at shoulder is 3, modified Ashworth scale is at +2, No severe cognitive impairment (MMSE score >24). and exclude patient with Sensory impairment in U.E, TBI, modified Ashworth is at 3 and 4, Visual and Auditory Impairment, Psychological/Perceptual Disorder. All patients were assessed by Fugal-Meyer Assessment Upper Extremity (FMA-UE) for Motor function, Functional Independence Measurement (FIM) for Activities of Daily Living (ADL's) and Modified Ashworth scale (MAS) scale for muscles spasticity before and after the intervention. They received both conventional occupational therapy and modified mirror therapy program, followed for 12 sessions (40-45 minutes per day thrice a week). Protocol followed in modified Mirror Therapies are active range of motion exercises along with task oriented activities

**RESULT:** Subjects for modified Mirror Therapy group in addition to conventional therapy shows that there is a significant improvement in baseline FMA mean, standard deviation  $27.4 \pm 1.13$  after treatment FMA mean, standard deviation  $43.57 \pm 9.6$  with p value 0.0001.

There is a significant improvement in baseline FIM score from 35.9 mean, standard deviation 8.5 to FIM after treatment score to 48.92 mean, 9.9 standard deviation, markedly change in the spasticity of upper limb. (P=0.025)

## **CONCLUSION:**

Modified Mirror Therapy in addition to conventional rehabilitation program was found to provide additional benefits in upper extremity motor recovery bilateral coordination and hand manipulation in stroke patients.

**Keywords:** Physical Rehab, Mirror Therapy, ADL's, FMA-UE

## I. INTRODUCTION

Upper-limb paralysis is the most common symptom in stroke patients. It restricts functional activities and more than 50% of hemiplegic patients experience long-term or permanently impaired arm function after stroke caused by upper limb paralysis. In this regard, upper-limb function is critical for the performance of detailed tasks, and thus, its therapeutic importance should be emphasized during rehabilitation programs. Upper extremity disorders after stroke can result from weakened or stiff muscles. These disabilities can include decreased motor ability and restriction in the functional use of the paretic upper extremity, resulting in weakening or paralysis of the muscles, abnormal muscle tone, associated reaction, problems with the musculoskeletal system, and coordination disorder. [3] Hemiplegic damage to upper-extremity function has critical effects on the ability to perform independent activities of daily living. [8] Stroke has been one of the leading causes of disability both in Pakistan and around the globe. It is also the world's 3<sup>rd</sup> most cause of mortality. [2] The estimated annual incidence of stroke in Pakistan is 250 per 100,000 populations, which is projected to an estimate of 350,000 new cases every year. A recent study conducted in the urban slums of Karachi (the largest metropolitan city of Pakistan) estimated a 21.8% life-time prevalence of stroke and/or transient ischemic attack (TIA) in individuals aged 35 years and older. [3] However most of the treatment protocols for the paretic hand are either expensive or labor intensive and require manual interaction by the therapists for several weeks, which makes the provision of intensive treatment for many patients difficult. It has been suggested that Mirror Therapy is a simple, inexpensive and, most importantly, patient directed treatment that may improve upper extremity function. As in Pakistan, Mirror Therapy is not commonly used, so we want to introduce modified Mirror Therapy with conventional therapy for the better improvement for stroke survivors. Incorporating modified Mirror Therapy into the conventional program at the early stages of treatment and applying it for a long period might be even more beneficial for improving hand function

This approach was introduced by Ramachandran and coworkers for arm amputees, where the mirror image of the intact arm was used to stimulate its amputated counterpart. By this procedure, illusory perception was induced and phantom

pain in the “virtual” limb was often relieved. In Mirror Therapy, patients being in front of mirror. When looking into the mirror the persons sees his own reflection, this creates a visual illusion thus enhance his motivation to improve his functioning. Research has focused on the mechanisms that underline the effects of Mirror Therapy. [1] Others suggested that Mirror Therapy might be the form of visually guided motor imagery. Mirror illusions increases activity in percuneus and posterior cingulated cortex areas associated with awareness of self and spatial attention. Studies have been found effectiveness of intense Mirror Therapy in stroke patients resulted in significant recovery of grip strength, hand movement of paretic arm, steady and accuracy of arm movements, increase in Fugal Meyer assessments score, improvement in speed and hand dexterity, improvements in hand functions instroke patients, improvements in motor recovery in distal plegic, improvement in Ashworth scale, self-care items of the FIM instrument and Mirror Therapy combined with conventional stroke rehabilitation program.[1] In post stroke that are hemiplegic loss of hand function is a major source of impairment, frequently preventing effective occupational performance and an independent participation in daily life. There is an increasing evidence that MT might be an effective method to support recovery from Hemiplegia beyond more established Rehabilitation procedures based on active or passive movement execution.[1]Therefore, this study is with research question whether the Mirror Therapy has an effect on functional hand recovery to improve ADL’s in subject with sub-acute stroke. Hence the purpose is to find the effectiveness of Mirror Therapy in stroke patients to improve ADL’s (Activities of daily living).RCT is designed to evaluate the potential beneficial effect of viewing in the mirror image of upper limb on recovery in patients with stroke. It is hypothesized that there will be a significant effect of Mirror Therapy in rehabilitation field to make patients independent in their ADL’s in stroke.

**II. METHODOLOGY**

Voluntary consent was filled by the participants and approval from DOW University of Health Sciences, IPM&R and OJHA campus were taken prior to study. This study was conducted on 25 adult hemiplegic patients consisting of 17 male and 8 female patients of 30-60 years with sub-acute stroke. Duration of intervention was of 3days in a week completed in 2 months. Duration of each session consist of 45 minutes

**2.1 Inclusion Criteria**

- Onset to 1 year post stroke.
- No severe cognitive impairment (MMSE score >24).
- No visual impairment.
- Muscle grade at shoulder 3
- Modified Ashworth scale score between 1 to 2.

**2.2 Exclusion Criteria**

- Sensory impairment in U.E
- TBI

- Modified Ashworth scale between 3 to 4
- Visual and Auditory Impairment
- Psychological/Perceptual Disorder
- Shoulder with subluxation

**2.3 Assessment Tools**

Table (1) Individual demographic data

<b>FM:</b>
The Fugal-Meyer Assessment to measure the extent of motor and sensory impairment of U.E.
<b>FIM:</b>
(Functional Independence measure) to measure the level of ADL’s (Activities of daily living)
<b>MAS:</b>
(Modified Ashworth Scale) to measure the spasticity of muscles
<b>MMSE:</b>
(Mini-Mental state examination) to measure the cognitive impairment.

**III. INTERVENTION**

After these basal evaluations were performed, the patients underwent 40-45 minutes of a conventional along with modified Mirror Therapy program for 3 times a week for 12 sessions. This program consist of neuro-developmental facilitation techniques organized specifically for each patient, range of motion exercises, stretching exercises and including flexion, extension of shoulder, elbow, fore-arm, wrist and fingers of the paretic upper extremity. The patient was seated on the chair and table along with the mirror (length: 74 inches, breadth: 94 inches and distance between patient and mirror: 60 inches) in front of them. The therapy performed with periodic flexion, extension movements of shoulder, elbow, fore-arm, wrist and fingers of the paretic side



Activities

S.NO	ACTIVITIES	PURPOSE
1	Cones	Bilateral co-ordination, grasp, release, ROM
2	Thera-band with dowel	ROM, strength, bilateral co-ordination and grasp
3	Hand physio ball	Hand grip, strength, grasping and releasing.
4	Hand cycle	Bilateral co-ordination, hand grip.
5	Theraputty	Isolated fingers movement, strength.
6	Dowel	Bilateral coordination, grasping, releasing.

IV. STATISTICAL ANALYSIS

The data was analyzed using SPSS version 20. Statistical analyses were performed on the data obtained from all patients and there were no missing data. Demographic data of the patients were compared at baseline using PAIRED SAMPLE TEST

V. RESULT

The study participants were recruited from August 2017 to February 2018. Patients participated in all treatment sessions. No adverse event was noticed during treatment. Demographic and clinical characteristics of the 25 patients are presented in table 1. The mean age of subjects was 48 years. Among all the participants 17 (68%) were males and 8(32%) were females and majority of them were right-side paretic.

Subjects for modified Mirror Therapy group in addition to conventional therapy shows that there is a significant improvement in baseline FMA mean, standard deviation  $27.4 \pm 1.13$  after treatment FMA mean, standard deviation  $43.57 \pm 9.6$  with p value 0.0001.

There is a significant improvement in baseline FIM score from 35.9 mean, standard deviation 8.5 to FIM after treatment score to 48.92mean, 9.9 standard deviation

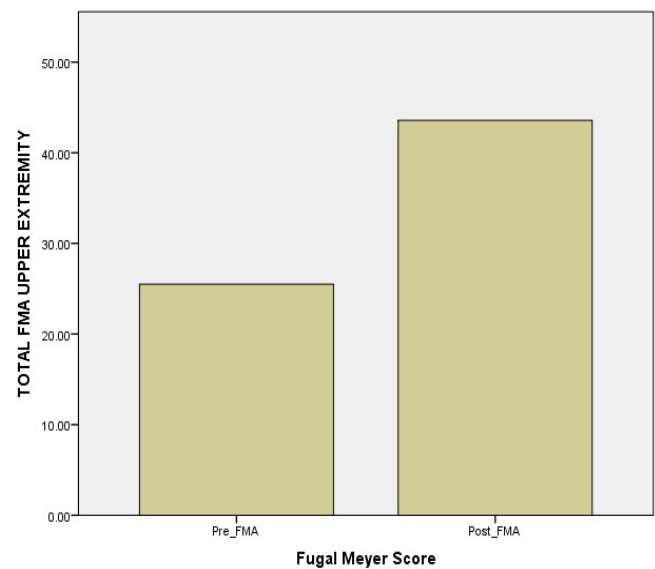
Pre and post values of modified Ashworth scale to measure the spasticity of the upper limb that is shows the markedly change in the spasticity of upper limb.(P=0.025)

Table 2: Comparison between the mean values of the scores of FMA base line and after treatment

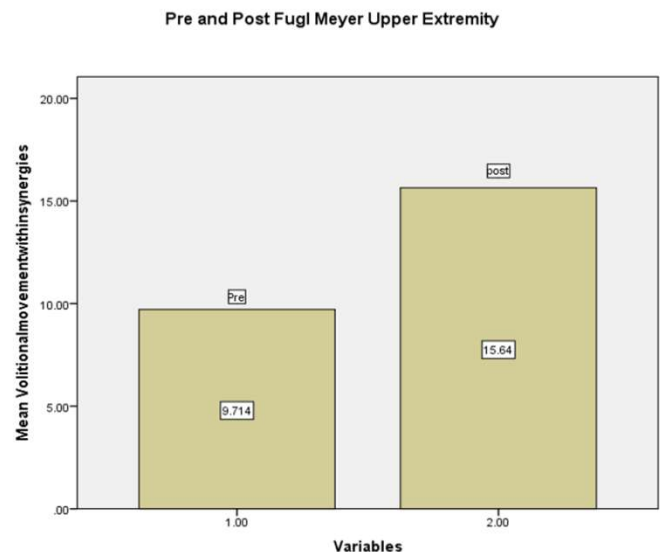
Dimensions	Modified Mirror Therapy in addition to conventional therapy Mean (SD)
	Volitional movement within synergies
Base line	10.1
Post treatment	16
	Volitional movement mixing synergies
Baseline	2.7
Post treatment	4.7
	Volitional movement with little or no synergy

Base line	3.0
Post treatment	4.5
	Wrist
Baseline	3.5
Post treatment	7.1
	Hand
Baseline	1.6
Post treatment	3.3
	Grasp
Baseline	3.8
Post treatment	7.9

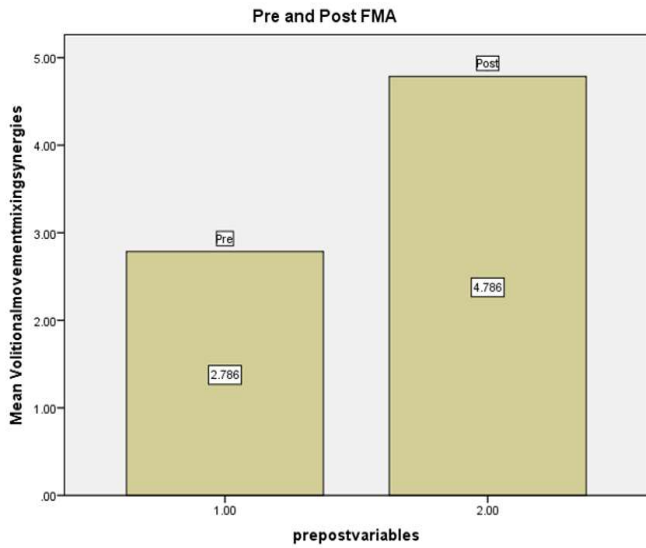
Graph 1 shows the total pre and post mean in FMA upper extremity score.



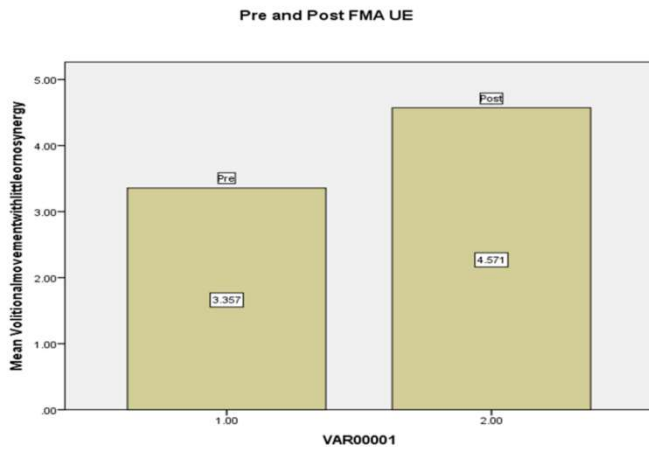
Graph 2 shows pre and post mean difference in volitional movement within synergies.



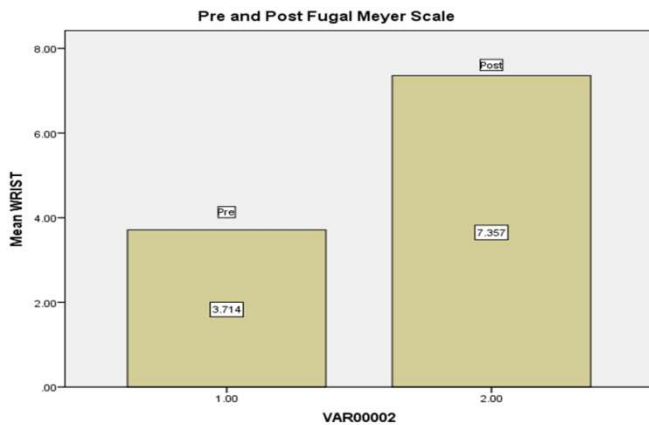
Graph 3: Shows pre and post mean difference involitional movement mixing synergies.



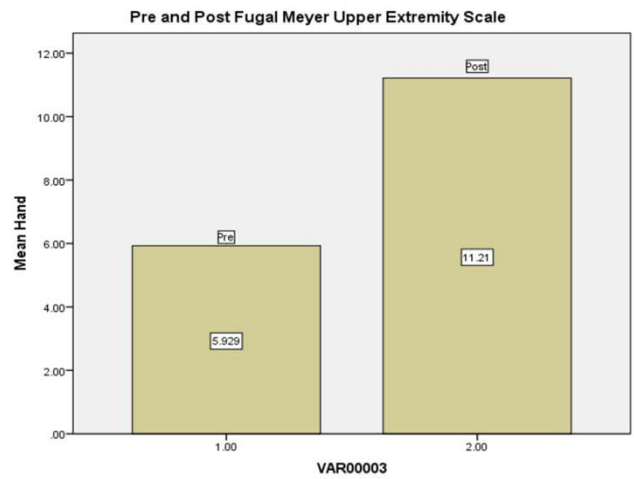
Graph 4 : Shows pre and post mean difference in volitional movement with little or no synergy



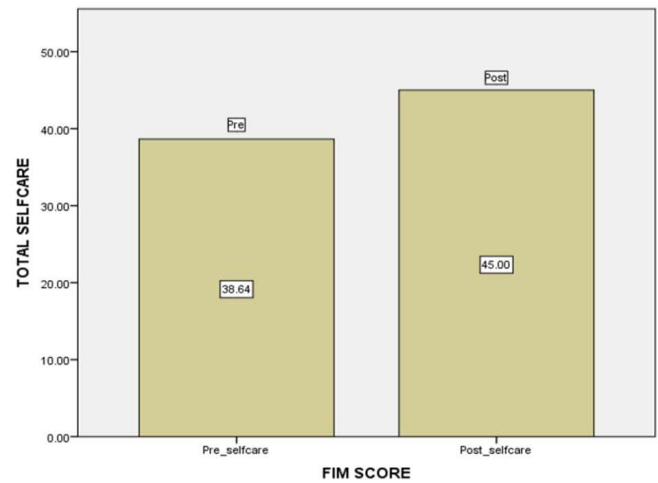
Graph 5: Shows pre and post mean difference in wrist movement.



Graph 6 :Shows pre and post mean difference in hand movement

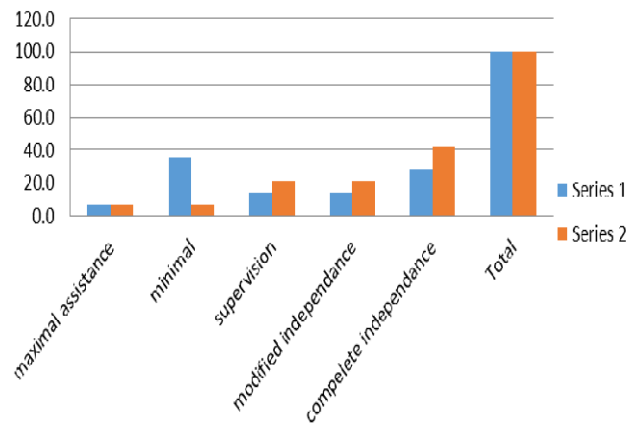


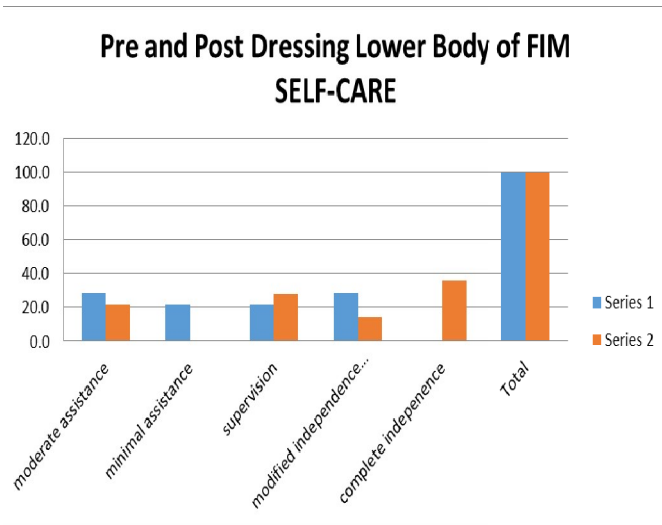
Graph 7 :Shows total pre and post % difference between self-care score of FIM.



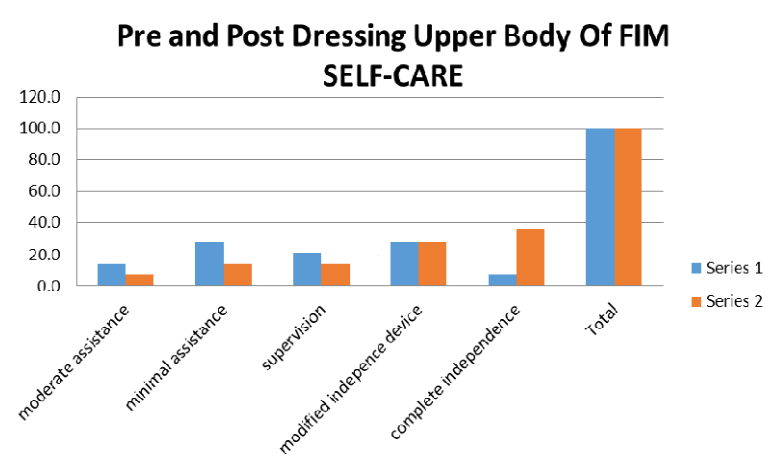
Showing pre and post treatment result in FIM self-care eating score.

### Pre and Post Eating Of FIM Self-Care

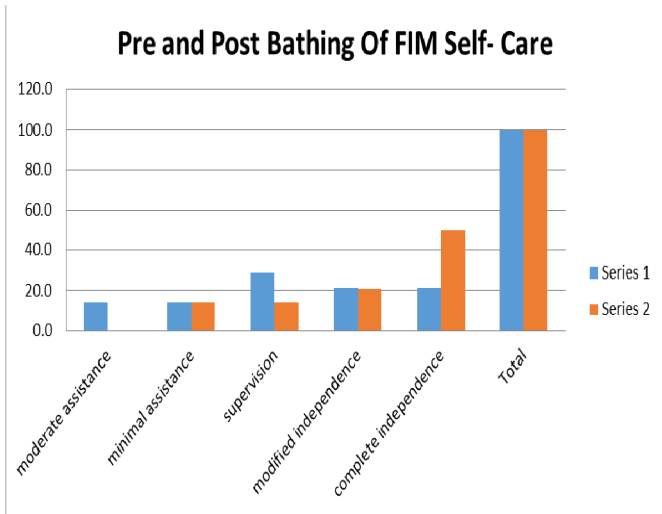




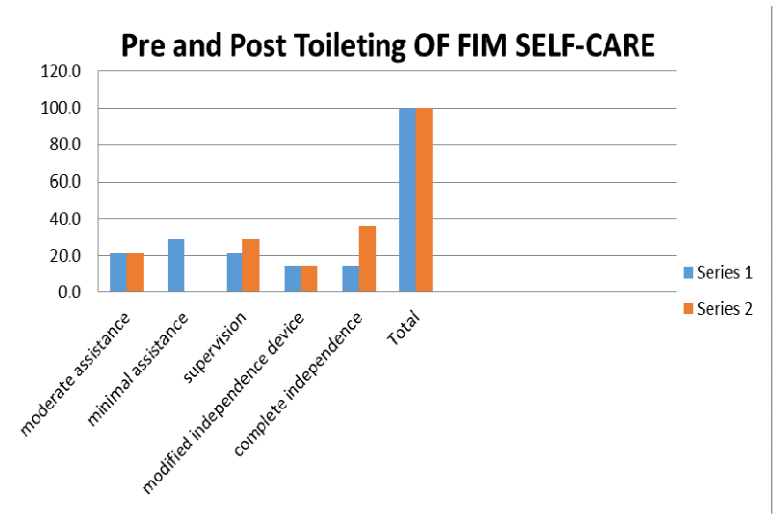
Showing pre and post treatment result in FIM self-care dressing upper body score.



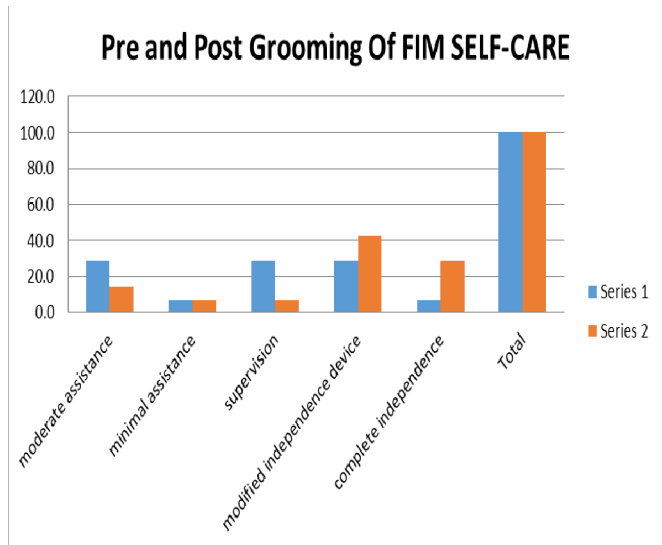
post treatment result in FIM self-care bathing score.



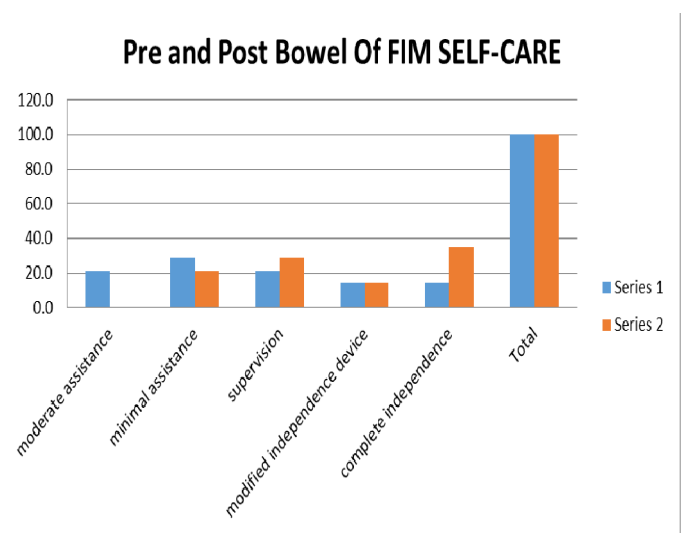
Showing pre and post treatment result in FIM self-care toileting score



Showing pre and post treatment result in FIM self-care grooming score.



Showing pre and post treatment result in FIM self-care bowel score



Showing pre and post treatment result in FIM self-care/bladder score.

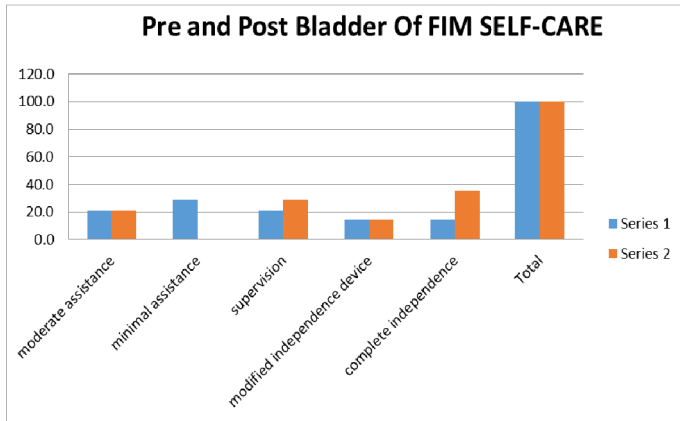
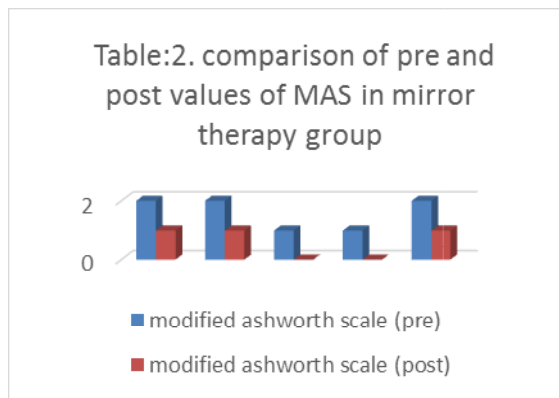


Table:Shows the initial and final assessment difference between the pre and post values of modified Ashworth scale to measure the spasticity of the upper limb that shows markedly change in the spasticity of upper limb.(P=0.025)



VI. DISCUSSION

This present study is carried out to find the effectiveness of modified Mirror Therapy in addition to conventional therapy for hand rehabilitation in stroke patients. The number of subjects included in study was 25 and were included under the criteria of the outcome measure i.e. FIM, FMA, ASHWORTH, MMSE and included from Dow university IPM&R and OJHA. The therapy protocol was given for 12 sessions, thrice a week.

According to statistical analysis a significant difference was found in base line score for FMA, FIM and ASHWORTH. Some participants showed mild spasticity at baseline, as measured by modified Ashworthscale. Atthe end of 4 weeks of intervention; there was significant improvement in the participants in UE hand functionality.

Before applying techniques during research, the subjects were not able to manipulate objects with hands and have difficulty in grasping and releasing objects.. And also have difficulty in doing bilateral activities.

Based on the present result the modified Mirror Therapy in addition to conventional therapy showed a significant improvement in FIM self-care activities. Subjects were able to perform their ADLs mostly are on minimum or supervision

scale. The bilateral upper limbtraining in modified mirror therapy using visual feedback improved paretic upper extremity performance of activities of daily living.

The degree of functional recovery of the upper extremity greatly affects the estimation and determination of the degree of assistance necessary to perform the activities of daily living and the level of independence after stroke. In particular, many tasks in the activities of daily living required the use of UE, patients who cannot use their hand become to experience physical and mental distress. Stroke patients with serious UE paralysis sometimes shows repulsion against physical approaches focused on the recovery of paretic extremity functions and these phenomena sometimes becomes a secondary problem in achieving efficient recovery processes.

Several underlying mechanisms for the effect of mirror therapy on motor recovery after stroke have been proposed. For example, Altschulet suggested that the mirror illusion of a normal movement of the affected hand may substitute for decreased proprioceptive information, thereby helping to recruit the premotor cortex and assisting rehabilitation through an intimate connection between visual input and premotor areas. Stevens and Stoykov suggested that mirror therapy related to motor imagery and the mirror creates visual feedback of successful performance of the imagined action with the impaired limb. Motor imagery itself, the mental performance of a movement without over execution of this movement, has proven to be potentially beneficial in the rehabilitation of hemiparesis.

In a recent review, Carson<sup>31</sup> explored the potential for bilateral interactions to occur in various brain regions, giving rise to functional improvements in the control of the paretic limb when movements are performed in a bimanual context. He suggested that when the non-paretic limb engaged during motor training, crossed facilitatory drive from the intact hemisphere will give rise to increased excitability in the homologous motor pathways of the paretic limb, facilitating recovery of function.

VII. STUDY LIMITATIONS

Limitation of this study is the patients met specific selection criteria; hence, the findings cannot be generalized to all stroke patients.

In addition, patients with visual-field defects and hemi-neglect were excluded from this study

VIII. CONCLUSION

In this research of acute stroke patients hand functionality improves after mirror therapy in addition to rehabilitation program conventional directly after 2 months of therapy and have affects on self-care activities, whereas mirror therapy has also effect on spasticity

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