SJIF Impact Factor: 7.001| ISI I.F.Value:1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 6 | Issue: 1 | January 2021 - Peer Reviewed Journal

EFFECTS OF ELECTROMYOGRAPHY (EMG) BIOFEEDBACK TRAINING AND MIRROR THERAPY (MT) ON FUNCTIONAL RECOVERY OF HAND IN STROKE SURVIVORS: A COMPARATIVE STUDY

Abhisek Pattanaik[1]
Occupational Therapist, Department of Occupational Therapy, National Institute For Locomotor Disabilities , India

Mr. Jeetendra Mohapatra[2]
Lecturer, Department of Occupational Therapy, National Institute For Locomotor Disabilities India.

Mr. Pankaj Bajpai[3]
Associate Professor, Department of Occupational Therapy, National Institute for Locomotor Disabilities India.

ABSTRACT

TITLE: "Effects of Electromyography (EMG) Biofeedback Training and Mirror Therapy (MT) on Functional Recovery of Hand in Stroke Survivors: A Comparative Study".

DESIGN: *Convenient sampling method.*

SETTING: *Inpatient and outpatient of Department of Occupational Therapy, NILD, Kolkata.*

PARTICIPANTS: *A total of 30 stroke survivors with 10 in each group, AA group (Conventional OT only), AB group (Conventional OT with EMG biofeedback training) and AC group (Conventional OT with Mirror Therapy).*

INTERVENTIONS: *Treatment duration for all three groups is same. Each group receives occupational therapy intervention for 3 months, 3 sessions (each session will be 45 minutes) in a week. In AB group and AC group the subjects received 15 minutes of EMG biofeedback training and mirror therapy respectively in addition to 30-minutes of conventional occupational therapy.*

OUTCOME MEASURES: *Fugl -Meyer Assessment (FMA) – Upper Extremity and Action Research Arm Test (ARAT) are two outcome measures used.*

RESULT: *The current study has shown that EMG-BF training along with conventional occupational therapy resulted in significant improvement of hand function than mirror therapy with conventional occupational therapy and conventional occupational therapy alone.*

CONCLUSION: *The application of EMG-BF training along with conventional occupational therapy resulted in beneficial effects on functional recovery of hand in stroke survivors.*

KEY WORDS: *EMG, Biofeedback, Mirror Therapy, Stroke survivors.*

SJIF Impact Factor: 7.001| ISI I.F.Value:1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 6 | Issue: 1 | January 2021 - Peer Reviewed Journal

INTRODUCTION

Cerebral vascular accident (CVA) or stroke is a vascular acute neurological dysfunction caused by the interruption of blood flow to focal areas of the brain [1]. Stroke as the most common brain disorders is the third cause of death and its consequences continued more than 24 hours. The rate of stroke incidence is about 3 in 100,000 in 3rd and 4th decade of age which increases to 300 in 100,000 people during 8th and 9th decades. Long lasting and disabling consequences mark stroke as the third cause of death due to disease in the world [2].

Sequelae of stroke are often disabilities and global involvement interferes significantly with Activities of Daily Living (ADLs) [1]. Over 85% of stroke patients undergo hemiplegia and more than 69% among them experience functional motor disability of the upper extremities. Functional motor disability noticeably appears in the upper extremities rather than in the lower extremities [3]. The most common stroke related disorders are manifested as hemiplegia, imbalance, in-coordination and spasticity which are especially seen in upper extremities [2]. The upper limbs (UL) are very important to motor functionality and the effective handling, gripping and reaching capability required in most ADLs. Arm functions are impaired in 73-88% of CVA survivors, and 55-75% of them present hemiplegia, resulting in disabilities and restrictions to function [1].

Damage to the middle cerebral artery, which supplies much blood to the brain part in charge of the motor functions of the upper extremities and the hands. Slight recovery of the lower extremities enables functional gait, whereas in the recovery of upper extremity functions, recovery of minute functions (e.g., grasp and manipulation) and that of the distal parts is needed. As a result, the upper extremities look like they have recovered less than the lower extremities. Lang et al. noted that upper extremity motor disability significantly affects stroke patients' performance of activities of daily living, such as having a meal, wearing clothes, or washing one's face. Purposeful movements of the upper extremities require adjustment of the arms and hands, and stroke patients may extend the upper extremities after a stroke but have difficulty in grabbing objects, with considerably reduced manipulation ability and decreased ability to perform purposeful movements. The upper extremity functions of stroke patients play an important role in performing activities of daily living and in coming back to society; as a result, upper extremity functions have been emphasized as an important element in humans [3].

For the recovery of upper extremity functions in stroke patients, diverse treatment methods are being studied [3]. EMG biofeedback training and mirror therapy are two effective treatment methods in rehabilitation that take pride of place in the recovery of these stoke survivors [1].

Biofeedback is an overlooked modality that therapist can use for neuromuscular re-education, relaxation techniques and behavioural modification. General term "Biofeedback" refers to those procedures or techniques that are used to provide an individual with an auditory or visual cue or feedback to learn and gain volitional control over a physiological response. Biofeedback equipment provides the individual with an external mechanism for monitoring a specific physiological function and response and through instant feedback, allows the individual to attempt to control or modify the behaviour or response. The primary use of biofeedback in rehabilitation field is in the form of sEMG or surface electromyography feedback for muscle re-education and training [4].

Mirror therapy (MT) may be a suitable alternative because of its low cost and simplicity. In MT, the patient sits in front of a mirror placed in the mid-sagittal plane. When looking into the mirror, the patient sees the mirror reflection of the intact limb as if it were the affected one. The movement of the intact limb gives the patient the illusion of which inputs are perceived through the affected limb behind the mirror. Substantial evidence has demonstrated the immediate efficacy of MT on motor recovery in people with stroke [5].

There are many studies conducted either on EMG biofeedback training or mirror therapy effectiveness on improving hand function in stroke survivors. But the present study is aimed at comparing the effectiveness of both the programmes to find out which one is better in improving hand function in stroke survivors. This type of study was not yet done in the past as per the search in the literature.

AIM AND OBJECTIVES

AIM

- To evaluate and compare the effectiveness of the EMG biofeedback training and mirror therapy on hand function in stroke survivors.

OBJECTIVES

- To find out the effectiveness of the EMG biofeedback training on hand function in stroke survivors.
- To find out the effectiveness of the mirror therapy on hand function in stroke survivors.

SJIF Impact Factor: 7.001| ISI I.F.Value:1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 6 | Issue: 1 | January 2021 - Peer Reviewed Journal

HYPOTHESIS

EXPERIMENTAL HYPOTHESIS

The EMG biofeedback training is more effective than the mirror therapy in improving hand function or vice-versa in stroke survivors.

NULL HYPOTHESIS

EMG biofeedback training and mirror therapy are equally beneficial in improving hand function in stroke survivors.

MATERIALS AND METHODS

METHODOLOGY

Study type: Comparative study
Study area: Inpatient and outpatient of Department of Occupational Therapy, NILD, Kolkata
Study population: Stroke Survivors
Study period: 12 months.
Sample size: 30 stroke survivors
Sample Design: Convenient sampling method with random allocation of stroke survivors recruited from DOT. Subjects are randomly allocated into 3 groups (AA, AB, AC) having 10 each.
AA Group: Conventional Occupational Therapy only
AB Group: Conventional Occupational Therapy withEMG biofeedback training
AC Group: Conventional Occupational Therapy with Mirror Therapy

[Total 30 slips were taken in which 10 slips were denoted with letters EMG, 10 slips with letter MT, and other 10 slips with OT, where letters EMG stands for Electromyography biofeedback, letters MT denotes Mirror Therapy and letters OT stands for Conventional Occupational Therapy only. All slips were mixed thoroughly in a container and then a lottery was drawn by the subjects (blind flooded) without replacement of slips. In doing so, we make sure that in successive drawings each of the remaining population had the same chance of being.]

Study design: Pre-test / post-test experimental design consisting of the comparison of hand function in stroke survivors, between the groups (AA-AB), (AA-AC) and (AB-AC)

INCLUSION CRITERIA [2, 13]

1. Stroke diagnosed by physician
2. At least six months passed from incidence of stroke
3. Both male and female subjects are selected
4. Age group 40 yrs to 60 yrs
5. Interested in participating in the study
6. No history of treatment by mirror therapy and biofeedback

EXCLUSION CRITERIA [2, 5, 13, 14]

1. Modified Ashworth Scale > 2
2. MMSE < 21
3. Presence of accompanying disorders such as seizure, psychological disorders, hearing or visual problem, or orthopaedic disorders in upper extremities
4. Reflex Sympathetic Dystrophy
5. Severe Shoulder Subluxation
6. Subjects who have received botox injection or acupuncture within past 6 months to the affected upper extremity
7. Subjects taking anti-spasticity medication

OUTCOME MEASURES

- Fugl -Meyer Assessment (FMA) – Upper Extremity[6,9,10]
- Action Research Arm Test (ARAT)[6,7,8]

PROCEDURE

1. Informed consent was obtained from all participants.
2. Based on the inclusion criteria, 30 medically diagnosed stroke survivors was selected for the study and subjects was excluded based on the presence of other pathologies as found from the medical report and exclusion criteria.
3. A general evaluation was done including demographic data, history and functional outcome measures of stroke survivors.
4. As per baseline assessment by outcome measures the stroke survivors were allocated into 3 groups, having 10 in each, randomly using random number table for the study.
5. Each group receives intervention for 3 months, 3 sessions (each session will be 45 minutes) in a week.
6. After 3 months of intervention, a posttest was done using both outcome measures to know whether any improvement is there or not.

INTERVENTION

Treatment duration for all three groups is same. Each group receives intervention for 3 months, 3 sessions (each session will be 45 minutes) in a week. In AB group and AC group the subjects will receives 15 minutes of EMG biofeedback training and mirror therapy respectively in addition to 30-minutes of conventional occupational therapy,

SJIF Impact Factor: 7.001| ISI I.F.Value:1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 6 | Issue: 1 | January 2021 - Peer Reviewed Journal

whereas in AA group subjects receive only conventional OT for 45 minutes.

AA Group: Conventional OT only [2]

- Conventional occupational therapy includes:
  - Muscle stretching
  - Positioning
  - Facilitating normal patterns of movement
  - Facilitator and inhibitory techniques
  - Reflex inhibitory patterns
  - Facilitating higher level reflexes
  - Muscle tone normalization
- All conventional OT will remain same for both 2nd group (AB) and 3rd group (AC).

Figure 10.Facilitating normal patterns of movement

AB Group: Conventional OT with EMG Biofeedback Training [2, 3]

- In EMG biofeedback training, after stabilizing hand on the table with a hand-rest, electrodes will set on the bulk of wrist extensor muscles and lateral epicondyle of humerus.
- Patient will sit in front of monitor and watch the diagram of muscular contraction.
- By adjusting the threshold, if the patient could produce an activity in the extensor muscles above the threshold, music broad-casted from the machine.
- Therefore, he/she could receive appropriate feedback about contraction in the targeted muscle either in visual or auditory signals.
- The ground electrode that prevents electrical interference in the skin will attached to the distal ulna of the ipsilateral wrist.

Figure 12.Electrode Positioning During EMG BF Training

SJIF Impact Factor: 7.001| ISI I.F.Value:1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 6 | Issue: 1 | January 2021 - Peer Reviewed Journal

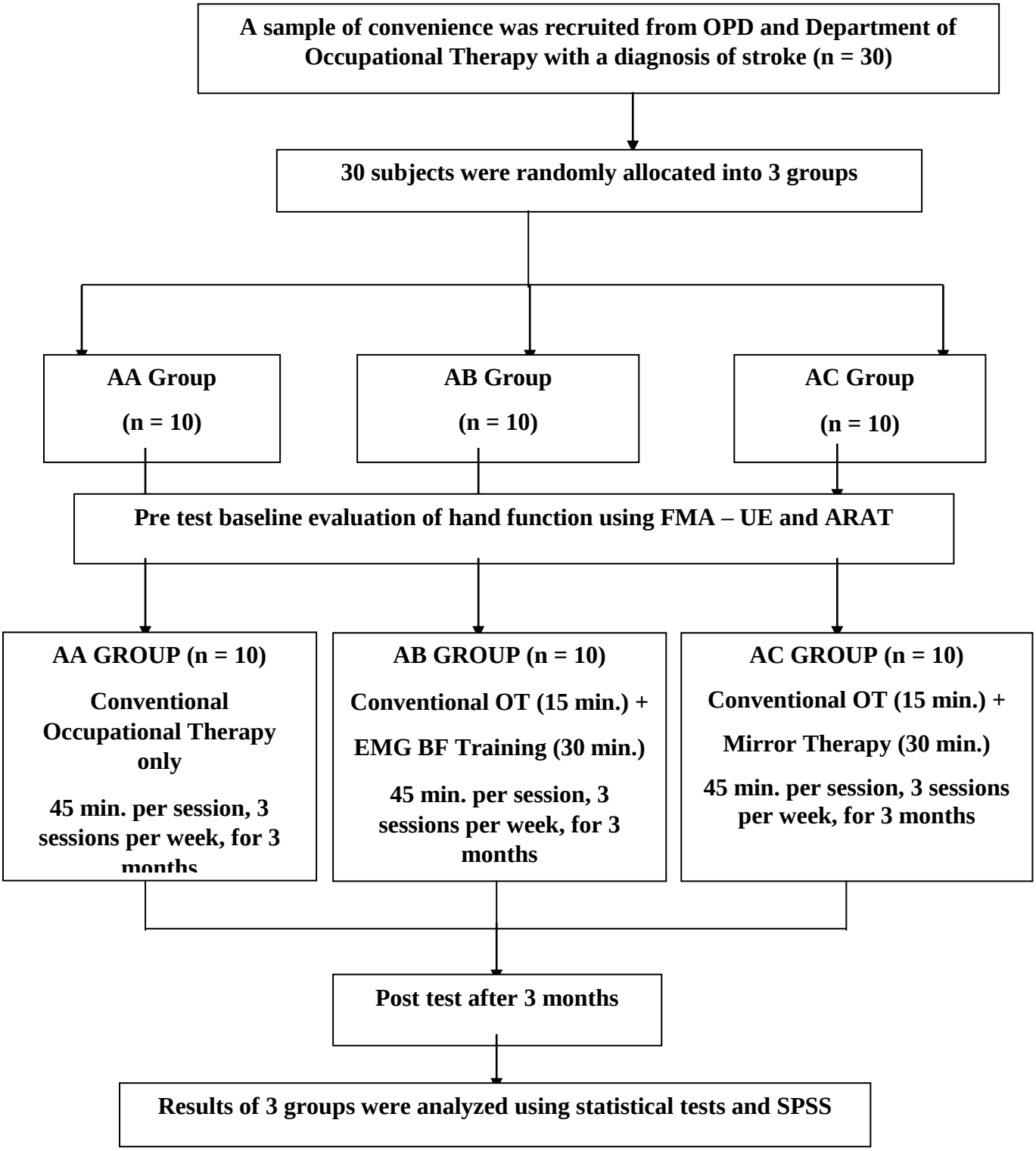
AC Group: Conventional OT with Mirror Therapy [1, 5, 15]

- The intervention was conducted within the regularly scheduled occupational therapy sessions.
- During the MT training, patient will sit close to a table on which a mirror is placed vertically.
- Affected upper limb will place behind the mirror and the unaffected upper limb will place in front of the mirror.
- Patients will orient to watch the reflection of their normal hand on the mirror as it is the affected one, and to perform activities bilaterally.
- Then participants will instruct to look at the reflection of the unaffected hand in the mirror as if it were the affected hand and perform bilateral symmetrical movements as much as possible.
- The activities consisted of
  1. Transitive movements, such as fine motor tasks of squeezing sponges, placing pegs in holes, or flipping a card,
  2. Gross motor tasks of reaching out to touch a switch or keyboard, and
  3. Intransitive movements, including the distal part movement of wrist repetitive extension-flexion or finger opponent and the proximal part movement of forearm pronation-supination.
- The functional tasks planned for the first phase will simple movements, such as forearm pronation-supination and wrist flexion-extension. For the second phase, the patients were asked to perform finger flexion-extension, counting numbers, tapping, and opposing. By the third phase, they were to take on simple manipulating tasks, such as picking up coins and beans, flipping over cards and collecting blocks in a bin. During the fourth phase, they moved on to more complicated tasks of plugging and unplugging pegboards, drawing simple figures, and coloring.

Figure 15.Mirror Therapy Treatment

SJIF Impact Factor: 7.001| ISI I.F.Value:1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 6 | Issue: 1 | January 2021 - Peer Reviewed Journal

FLOW CHART



(Flow chart showing the method of recruitment of patient in 3 groups)

SJIF Impact Factor: 7.001| ISI I.F.Value:1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 6 | Issue: 1 | January 2021 - Peer Reviewed Journal

STATISTICAL ANALYSIS

- SPSS version - 25 was used for statistical analysis.
- **Wilcoxon Signed rank test** was used for within group analysis for non parametric data.
- **Mann Whitney 'U' test** was used for the between group analysis for non parametric data.
- Level of significance was set at $p<0.05$ with 95% confidence interval.

RESULTS

DESCRIPTIVE STATISTICS

A total no of 30 subjects with stroke were enrolled in the study and all completed the study with 10 subjects each in 3 groups, AA group, AB group and AC group. The mean age of the subjects in AA group was 49.50 years (SD ± 4.905), in AB group was 51.10 years (SD ± 7.534) and in AC group was 48.80 years (SD ± 6.408). Total participant characteristics are shown in table No.2.

Table 2.Demographic characteristics of stroke survivors in AA group, AB group and AC group.

SL. NO.	BASELINE CHARACTERISTICS	AA GROUP	AB GROUP	AC GROUP
1	No. of subjects	10	10	10
2	Age range	40 – 60	40 – 60	40 – 60
3	Mean age (SD)	49.50 (±4.905)	51.10 (±7.534)	48.80 (±6.408)
4	Sex ratio (M : F)	7 : 3	8 : 2	7 : 3
5	Mean FMA-UE (SD) (PRE-TEST)	61.70 (±10.636)	61.00 (±9.475)	59.20 (±9.402)
6	Mean ARAT (SD) (PRE-TEST)	26.20 (±5.329)	28.40 (±5.562)	27.20 (±7.815)

To find out whether the groups are homogeneous or not, a nonparametric test i.e. Mann-Whitney U test was used. The table below shows that there was no significant difference between 3 groups which means the groups were homogeneous.

Table 3.Shows equal distribution of stroke survivors in AA and AB, AB and AC, AA and AC.

	AA & AB		AB & AC		AA & AC	
	Z VALUE	p VALUE	Z VALUE	p VALUE	Z VALUE	p VALUE
GENDER	-0.503	0.615	-0.503	0.615	0.000	1.000
AGE	-0.379	0.705	-0.722	0.470	-0.493	0.622
FMA UE	-0.114	0.909	-0.569	0.569	-0.947	0.344
ARAT	-1.103	0.270	-0.838	0.402	-0.076	0.939

The FMA-UE scale shows significant improvement in hand function in stroke survivors in all 3 groups having **$p < 0.05$** within group analysis by using Wilcoxon Sign Rank Test. One pretest and one posttest were done using the FMA-UE scale. **Table - 4** below shows significant improvement in hand functions within FMA-UE pretest (61.70 ± 10.636) and FMA-UE posttest (62.50 ± 10.575) in AA group. The AB group shows significant improvement in hand function FMA-UE pretest (61.00 ± 9.475) and FMA-UE posttest (79.40 ± 6.535). Also the AC group shows significant improvement in hand function FMA-UE pretest (59.20 ± 9.402) and FMA-UE posttest (60.70 ± 9.238).

SJIF Impact Factor: 7.001| ISI I.F.Value:1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 6 | Issue: 1 | January 2021 - Peer Reviewed Journal

Table 4.Comparison of pre and post test score of FMA-UE Scale in AA, AB and AC.

GROUP		Z VALUE	p VALUE
AA GROUP	FMA-UE	-2.271	.023
AB GROUP	FMA-UE	-2.812	.005
AC GROUP	FMA-UE	-2.714	.007

The ARAT scale shows significant improvement in hand function in stroke survivors in all 3 groups having **p < 0.05** within group analysis by using Wilcoxon Sign Rank Test. One pretest and one posttest were done using the ARAT scale. **Table - 5** below shows significant improvement in hand functions within ARAT pretest (26.20 ± 5.329) and ARAT posttest (26.90 ± 5.666) in AA group. The AB group shows significant improvement in hand function ARAT pretest (28.40 ± 5.562) and ARAT posttest (38.80 ± 5.692). Also the AC group shows significant improvement in hand function ARAT pretest (27.20 ± 7.815) and ARAT posttest (28.80 ± 7.772).

Table 5.Comparison of pre and post test score of ARAT Scale in AA, AB and AC.

GROUP		Z VALUE	p VALUE
AA GROUP	ARAT	-2.121	.034
AB GROUP	ARAT	-2.825	.005
AC GROUP	ARAT	-2.549	.011

In **Table – 6** between group analysis of FMA-UE scale and ARAT scale showed a statistically significant difference between AA and AB on post test (p = 0.001, p = 0.001 respectively), AB and AC on post test (p = 0.000, p = 0.008 respectively). Whereas in AA and AC on post test (p = 0.405, p = 0.649 respectively), which implies statistically not significant.

Table 6.Between group comparison of FMA-UE score and ARAT score in AA and AB, AB and AC, AA and AC.

	AA & AB		AB & AC		AA & AC	
	Z Value	p Value	Z Value	p Value	Z Value	p Value
FMA-UE	-3.335	0.001	-3.524	0.000	-0.832	0.405
ARAT	-3.293	0.001	-2.652	0.008	-0.455	0.649

DISCUSSION

The purpose of the present study was to determine the effects of 3 months of EMG-BF training with conventional occupational therapy and mirror therapy with conventional occupational therapy on functional recovery of hand in stroke survivors and to compare whether any of these interventions is more effective over the other.

The findings of the present study revealed that both the EMG-BF group and mirror therapy group improved the FMA-UE score and ARAT score, improved the functional outcome, which says that both the treatment programmes were effective in improving the hand function in stroke survivors.

The findings of the study were consistent with our experimental hypothesis, i.e. EMG-BF after stroke resulted in more beneficial effect on hand function as compared to mirror therapy and conventional occupational therapy.

Comparison of FMA-UE score in AA (Conventional Occupational Therapy) group: The result of the within group analysis shows that there is a statistically significant improvement in UE and hand function post treatment FMA-UE score after 3 months **p = 0.023** having mean value pre-test (61.70 ± 10.636) and post-test (62.50 ± 10.575) suggests that there is no satisfactory improvement in hand function in conventional occupational therapy group post treatment.

Comparison of FMA-UE score in AB (EMG-BF) group: The result of the within group analysis shows that there is a statistically significant improvement in UE and hand function post treatment, FMA-UE score after 3 months **p = 0.005** having mean value pre-test (61.00 ± 9.475) and post-test (79.40 ± 6.535) suggests that there is satisfactory improvement in hand function in EMG-BF group post treatment.

The result of this study is supported by **Ju-Hong Kim** on **2017** who demonstrated that stroke survivors receiving intensive EMG biofeedback showed more significant upper extremity functional recovery than those who only received traditional rehabilitation therapy [3].

SJIF Impact Factor: 7.001| ISI I.F.Value:1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 6 | Issue: 1 | January 2021 - Peer Reviewed Journal

Comparison of FMA-UE score in AC (Mirror Therapy) group: The result of the within group analysis shows that there is a statistically significant improvement in hand function post treatment, FMA-UE score after 3 months **p = 0.007** having mean value pre-test (59.20 ± 9.402) and post-test (60.70 ± 9.238) suggests that there is mild improvement in UE and hand function in EMG-BF group post treatment.

The result of this study is supported by **Ching-Yi Wu** et al on **2013** who demonstrated the application of mirror therapy after stroke might result in beneficial effects on movement performance, motor control and temperature sense, but may not translate into daily functions in the population with chronic stroke [5].

Comparison of FMA-UE score between AA (Conventional Occupational Therapy) and AB (EMG-BF) group: The between group analysis of FMA-UE score showed a statistically significant difference between AA group and AB group on post-test **p = 0.001**. This result suggests that there is a significant difference in improvement of hand function in both the groups. The change in mean score of FMA-UE (pre score – post score) in AA group is 0.80 where as in AB group is 18.40. The difference in scores revealed that the improvement in hand function is quite better in AB group than AA group.

A study by **Tahereh Haji Ahmad** et al on **2013** concluded that biofeedback trained group showed more decrease in spasticity, significant increase in ROM of elbow, wrist and fingers and significant increase in ADL performance. That's why biofeedback in accompanying with routine occupational therapy promised to be more effective in stroke survivors [2].

In our study, EMG biofeedback was used, which enhances hand function of hemiparetic limb promoting motor and functional recovery. In stroke survivors, initiating wrist and finger extension is often difficult because of the flexor synergy in the upper limb and are usually neglected when constituting individual rehabilitation due to its discouraging results in recovery, causing a social stigma but in our study EMG biofeedback training facilitates wrist and finger extensor activity to promote release of objects.

Comparison of FMA-UE score between AB (EMG-BF) group and AC (Mirror Therapy) group: The between group analysis of FMA-UE score showed a statistically significant difference between AB group and AC group on post-test **p = 0.000**. This result suggests that there is a significant difference in improvement of hand function in both the groups. The change in mean score of FMA-UE (pre score – post score) in AB group is 18.40 where as in AC group is 1.50. So when compared to mirror therapy, it was concluded that the improvement in hand function is quite better in AB group than AC group.

Comparison of FMA-UE score between AA (Conventional Occupational Therapy) and AC (Mirror Therapy) group: The between group analysis of FMA-UE score showed a statistically insignificant difference between AA group and AC group on post-test **p = 0.405**. This result suggests that there is a mild significant difference in improvement of hand function in both the groups. The change in mean score of FMA-UE (pre score – post score) in AA group is 0.80 where as in AC group is 1.50. The difference in scores revealed that the improvement in hand function is very negligible in AC group than AA group.

In accord with previous studies and results, we found greater improvement in hand function in EMG-BF training measured by FMA-UE, than mirror therapy and conventional occupational therapy. Thus, **experimental hypothesis is proved and null hypothesis is rejected.**

Comparison of ARAT score between AA (Conventional Occupational Therapy) and AB (EMG-BF) group: The between group analysis of ARAT score showed a statistically significant difference between AA group and AB group on post-test **p = 0.001**. This result suggests that there is a significant difference in improvement of hand function in both the groups. The change in mean score of ARAT (pre score – post score) in AA group is 0.70 where as in AB group is 10.40. The difference in scores revealed that the improvement in hand function is significantly increased in AB group than AA group.

Comparison of ARAT score between AB (EMG-BF) group and AC (Mirror Therapy) group: The between group analysis of ARAT score showed a statistically significant difference between AB group and AC group on post-test **p = 0.008**. This result suggests that there is a significant difference in improvement of hand function in both the groups. The change in mean score of ARAT (pre score – post score) in AB group is 10.40 where as in AC group is 1.60. So when compared to mirror therapy, it was concluded that the improvement in hand function is quite better in AB group than AC group.

Comparison of ARAT score between AA (Conventional Occupational Therapy) and AC (Mirror Therapy) group: The between group analysis of ARAT score showed a statistically insignificant difference between AA group and AC group on post-test **p = 0.649**. This result suggests that there is a mild difference in improvement of hand function in both the groups. The change in

SJIF Impact Factor: 7.001| ISI I.F.Value:1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 6 | Issue: 1 | January 2021 - Peer Reviewed Journal

mean score of ARAT (pre score – post score) in AA group is 0.70 where as in AC group is 1.60. The difference in scores revealed that the improvement in hand function is not much noticeable in AC group than AA group.

It is very necessary to treat hand dysfunction problems in stroke survivors as the hand is the important key to ADL. Although mirror therapy and conventional occupational therapy treatments are one of the treatment strategies, we must consider EMG-BF training to treat more effectively and to achieve more improvement in functional recovery of hand.

CONCLUSION

In this clinical trial, our findings suggests significant improvement in functional recovery of hand in stroke survivors when given EMG biofeedback training with conventional occupational therapy than mirror therapy with conventional occupational therapy and conventional occupational therapy alone. On the basis of the current results, it was also concluded that, the mirror therapy with conventional occupational therapy shows a noticeable better effects on paretic hand in compare to conventional occupational therapy only. But comparison between EMG-BF and mirror therapy revealed that positive effects of EMG-BF is more than mirror therapy.

Though the present study has a few limitations which could be further suggests for future study programmes however, it makes noteworthy contributions to the clinical aspect of treatment of stroke survivors.

REFERENCES

1. *Candice Simões Pimenta de Medeiros, Sabrina Gabrielle Gomes Fernandes, Johnnatas Mikael Lopes, Enio Walker Azevedo Cacho, Roberta de Oliveira Cacho. Effects of mirror therapy through functional activities and motor standards in motor function of the upper limb after stroke.*
2. *Tahereh Haji-Ahmad, Hojjat Allah Haghgoo, Ebrahim Pishyareh, and Akbar Biglarian. The Effect of Biofeedback Therapy on Hand Function and Daily Activities in Stroke Survivors. Zahedan J Res Med Sci. 2015 October; 17(10):e2204.*
3. *Ju-Hong Kim. The effects of training using EMG biofeedback on stroke patients' upper extremity functions. The Journal of Physical Therapy Science.*
4. *Mary Vining Radomski, Catherine A. Trombly. Occupational Therapy for Physical Dysfunction. 6th edition. Page – 566.*
5. *Ching-Yi Wu, ScD, OTR, Pai-Chuan Huang, ScD, OTR, Yu-Ting Chen, MS, OT, Keh-Chung Lin, ScD, OTR, Hsiu-Wen Yang, MS, OT. Effects of Mirror Therapy on Motor and Sensory Recovery in Chronic Stroke: A Randomized Controlled Trial. Archives of Physical Medicine and Rehabilitation.*
6. *Katherine Salter PhD (cand.), Nerissa Campbell PhD, Marina Richardson MSc, Swati Mehta PhD (cand.), Jeffrey Jutai PhD, Laura Zettler MSc, Matthew Moses BA, Andrew McClure MSc, Rachel Mays BSc (cand.), Norine Foley MSc, Robert Teasell MD. 20 outcome measures in stroke rehabilitation.*
7. *Nuray Yozbatiran, PT, PhD, Lucy Der-Yeghiaian, MA, OTR/L, and Steven C. Cramer, MD. A Standardized Approach to Performing the Action Research Arm Test.*
8. *Action Research Arm Test. www.strokecenter.org.*
9. *Fugl- meyer assessment of physical performance. Adapted from leaps manual of procedures.*
10. *FUGL-MEYER ASSESSMENT UPPER EXTREMITY (FMA-UE) Assessment Of Sensorimotor Function. Fugl-Meyer AR, Jaasko L, Leyman I, Olsson S, Steglind S: The Post-Stroke Hemiplegic Patient. A Method for Evaluation Of Physical Performance. Scand J Rehabil Med 1975, 7:13-31.*
11. *Mini Mental State Examination (MMSE). www.medicine.uiowa.edu.*
12. *Modified Ashworth Scale. www.rehabmeasures.org.*
13. *Naeme Hajializade, Mehdi Abdolvahab, Hosein Bagheri, Mahmood Jalili, Ahmad Reza Baghestani, Ebrahim Entezari, Mahboobe Mandegari. The effect of task-based mirror therapy on upper limb functions and activities of daily living in patients with chronic cerebrovascular accident: A randomized control trial. Journal of Basic and Clinical Pathophysiology.*
14. *Sneha S. Khandare, R. M. Singaravelan, Subhash M. Khatri. Comparison of Task Specific Exercises and Mirror Therapy to Improve Upper Limb Function in Sub-acute Stroke Patients. ISOR Journal of Dental and Medical Sciences.*
15. *Kil-Byung Lim, MD, Hong-Jae Lee, MD, Jeehyun Yoo, MD, Hyun-Ju Yun, MD, Hye-Jung Hwang, MPH. Efficacy of Mirror Therapy Containing Functional Tasks in Post-stroke Patients. ARM Annals of Rehabilitation Medicine.*
16. *Wanees M. Badawy. Effect of Task-Oriented Exercises on Improving Hand Function in Sub-acute Stroke Patients: A Randomized Controlled Trial. International Journal of Chem-Tech Research.*
17. *Haylie Liegel, OTS. There is strong evidence to support the use of mirror therapy to improve upper extremity motor recovery in patients with chronic CVA (greater than 6 months) compared with conventional therapy alone. The evidence does not support the use of mirror therapy to improve self-assessed ADL performance in this population.*

SJIF Impact Factor: 7.001| ISI I.F.Value:1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 6 | Issue: 1 | January 2021 - Peer Reviewed Journal

18. *Susan B. O' Sullivan, Thomas j. Schmitz, George D. Fulk. Physical Rehabilitation. 6th Edition. Page – 645.*
19. *Judi Edmans. Occupational Therapy and Stroke. 2nd Edition. Page – 1.*
20. *Jose Biller. Stroke in Children and Young Adults. 2nd Edition. Page – 1.*
21. *NeuroTrac™ Electrode Placement Manual.*
22. *S.M. Rayegani, MD, S.A. Raeissadat, MD, L. Sedighipour, MD, I. Mohammad Rezazadeh, PhD, M.H. Bahrami, MD, D. Eliaspour, MD, and S. Khosrawi, MD. Effect of Neurofeedback and Electromyography Biofeedback Therapy on Improving Hand Function in Stroke Patients. 2014.*