



## Effects of Upperlimb Rehabilitation on improve motor function and self care activities among affected upper limb post stroke patients at SRM Neuro OPD,Kattankulathur

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### ABSTRACT:

**Objective:** The aim of this study is to effectiveness of Upper limb Rehabilitation on improve motor function and self care activities among post stroke patients. **Design:** A Quasi Experimental Pre-test Post-test Control Group Design. **Participants:** Subjects diagnosed with affects upper limb among post stroke survivors between 30-60. **Setting:** SRM Neuro OPD,Kattankulathur (Week-0) A total of 50 participants were randomized in to Experimental and Control groups.1<sup>st</sup> week –Pre-test measurement and demographic variables were taken for all participants **Intervention:** (2-11 weeks) Experimental group received Upper Arm exercise training were performed 3 days a week for 10 weeks. Control group received routine care . 12th week – Post-test measurement were given as per pre-test **Outcome Measures-** Action Research Arm test (ARAT), were evaluating the improvement of upper limb nerves movement and activity **Results:** Experimental group had shown significant improvement compared to Control group. Action Research Arm test (ARAT), Grading Scale score were all increased apparently in the Experimental group (P<0.001) compared to Control group. **Conclusion:** Present study suggests that Upper Arm exercise training may induce an immediate effect that improves upper limb motor function and activity of daily living among affects upper limb stroke patients.

**Keywords:** Effectiveness, Action Research Arm test , Upper extremity, Motor function, Activities of daily living and Post stroke patients.

### I. INTRODUCTION

The use of Action Research Arm test in stroke rehabilitation is based on the assumption that symmetrical bilateral movements activate similar neural networks in both hemispheres, promoting neural plasticity and cortical repair that result in improved motor control in the affected limb. According to an ICMR report, there were 9.3 lakhs of stroke cases in the year 2004 and majority of them were less than 45 years (1). In India, the prevalence of stroke varies in different regions from 40 to 270 per 1 lakh population (ICMR). It was done in the year of 2015. Annual incidence of 1.6 million cases is predicted in India within the year 2050 (2). The World Health Organization estimated that 80% of stroke cases will occur in India and China. A study evaluated that the effectiveness of bilateral vs. unilateral upper limb-therapy and it was affected by severity of paresis. The review included the results from 9RCTs.pooled analyses of 452 patients were conducted for the Fugl-Meyer Assessment, Action Research Arm test (ARAT),Motor Assessment Scale(MAS)and Motor Activity log(MAL) (3).Over all severity categories, unilateral training was superior when outcome assessed using ARAT scores, but they were no differences in scores, but there were no differences in improvement between groups of either severe or moderate patients on MAS or FMA scores, suggesting both training approaches were effective(4,5). 25 chronic patients with mild to moderate paresis were randomized to receive;1.coupled protocol to EMG-triggered stimulation and bilateral movement (n=10);2.EMG-triggered stimulation and unilateral movement (n=10);or(3)control (n=5).All participants



completed 6 hours of rehabilitation during a 2-week period according to group assignments. Motor capabilities of the wrist and fingers were evaluated. Patients in the bilateral training group moved more blocks on the box and block test compared to the other groups (6). 106 acute stroke patients (2-4 weeks post stroke) were randomized to receive bilateral arm training (n=56) or unilateral arm training (n=50). The supervised training was provided for 20 minutes 5x/week x 6 weeks. The main outcome measure was the Action Research Arm Test (ARAT), which was assessed before/after treatment and at follow-up (18 weeks). Additional outcomes assessed included the Rivermead Motor Assessment upper-limb scale, Nine-Hole Peg Test (9HPT), the Modified Barthel Index, Hospital and Depression Scale, and Nottingham Health Profile. While subjects in both groups improved over time, there were no significant differences in the change scores in short-term improvement (0-6 weeks) on any measure. At follow-up (0-18 weeks), the only significant between-group difference was a change in the 9HPT and ARAT pinch section, which was lower, indicating less recovery for the bilateral training group (7). A study conducted a systemic review and meta-analysis of strength training on upper-limb strength function and ADL performance following stroke. They identified 14 studies in total. Six studies (306 subjects) evaluated the effect on grip strength. There was a significant effect associated with training (standardized mean difference = 0.95, CI 0.05 to 1.85,  $p=0.04$ ). Two trials assessed other measures of strength with conflicting results (8). Strength training was found to improve motor function of the impaired upper extremity in one high quality RCT, however upper limb improvements were not observed relative to task related training in another study. Supplementing strength training with transcranial direct current stimulation has not been observed to have a significant effect on voluntary dynamic strength. Strength training may help improve grip strength following stroke (9).

## II. OBJECTIVES

1. Effectiveness of stroke rehabilitation on improve motor function and self care activities among affected upper extremity stroke patients.
2. Effectiveness of stroke rehabilitation on improve motor function and self care activities and their selected demographic variables among affected upper extremity stroke patients.

## HYPOTHESES

H1: There is a significant difference between the stroke rehabilitation and improve motor

function, self care activities among affected upper extremity stroke patients.

H2: There is a significant association between the stroke rehabilitation and improve motor function, self care activities and their selected demographic variables among affected upper extremity stroke patients.

## Theoretical Model

The theoretical framework adapted for this study is based on Orem's Self-Care Deficit Theory (10)

## III. MATERIALS AND METHODS

An evaluate approach with quasi experimental pretest-posttest control group design was adopted for the current study. The target population was right and left hemiplegic stroke who attended in Neuro OPD at SRM Hospital Kattankuladure. The data collection Process done for 6 weeks by using purposive sampling method. The tool is prepared based on the objectives of the study. After obtaining approval and clearance from the Institutional Ethics Committee. 50 subjects who met the inclusion and exclusion criteria were included in the study. Anonymity, confidentiality, and professional secrecy were maintained for all the study subjects. The study was conducted from February 2022 to April 2022. Detailed history of affected upper extremity stroke was obtained. Patients who are able to read and understand and English or Tamil. Age group above 30 to 65. Patients who are visit in SRM Neuro OPD with affected upper extremity. Severe and unstable clinical disorders. Unable to follow bilateral arm training were excluded. Content validity of the instruments was obtained from two medical experts and three nursing experts in the field of medical surgical nursing. The reliability of the tool was elicited by using test-retest method

## Data collection procedure

Ethical permission for conduction of the study was obtained from SRM Neuro OPD. Prior to the collection of data; the investigator introduced self to the patients and established rapport with them. The intervention was explained to the patients and a written consent was obtained prior to initiation of the intervention. The purpose of the study was explained to each subject in the language known to them (Tamil/English). Adequate privacy was ensured throughout the study. **Allocation Baseline assessment and randomization (Week-0).** Totally 50 subjects were enrolled for this study and divided in to two groups with simple randomization method. They have been enrolled for this study after



screening based on inclusion criteria. The subjects were assigned the experimental group received 15 Arm exercise training (n=25) the control group received routine treatment (n=25). Pre-test – (Week-1) Demographic Variables, Action Research Arm test (ARAT) were given. Intervention (Weeks-2-11) Experimental group received 15 Upper Arm exercise for hemiplegic stroke received the period of 20minutes.A total of 3 sessions, per week performed for a period 10 weeks.Compliance assessment via phone calls (week-8) Follow-up.Post-test(Week-12) given same as pre-test. Outcome Measures and Evaluations. The outcome measures in the changes in the affected upper arm function movement of Action Research Arm test (11).

**INSTRUMENTS**

**Section A - Socio demographic:** The data included the demographic variable of Affected upper extremity consisting of age, sex, occupation, family history of stroke and dietary history. **Section B- Upper Arm exercise for affected upper extremity** 1.Seated tabletop ball roll 2. Seated tabletop ball squeeze 3. Seated tabletop bilateral hand squeeze 4. Seated tabletop hand over hand compression 5. Seated tabletop hand over hand rolls 6. Seated tabletop tared glide 7. Seated physic ball rolls 8.Standing phisio ball rolls 9.Standing /seated

pillow squeeze 10.Standing /seated wall pillow squeeze 11.Standing /seated wall wipers 12.Shoulder elevation depression 13.Shoulder compression 14.Wrist compression 15.Mirror Box **Section C- Action Research Arm test (ARAT)** Scale measures the supine, shoulder flexion, and extend elbow to take palm to forehead, sitting, hold extended arm in forwards flexion at 90 degree to body, sitting patient lift arm to above position and standing ,hand against wall. This test is designed to assess the return of function following affected upper limb stroke and neurological impairment.

**STATISTICAL ANALYSIS**

The data obtained from the study was computed using a frequency distribution to describe the demographic characteristics and chi-square test was carried out to find the homogeneity. Both parametric and non parametric test were done for the effectiveness of arm excercise for affected upper limb .Mean and median were used for statistical analysis by means of parametric and nonparametric tests.Two-way RM ANOVA with Bonferroni multiple comparison test were used for comparison of pre and post test difference from between and within groups. A probability of 0.05 or less was taken as statistically significant. The analysis and plotting of graph were carried out using Sigma Plot 13.0 (Systat Software Inc.,USA).

**IV. Results**

**Table 1 :**Comparison between the Experimental and Control groups as regard Socio Demographic data (N=50)

| Demographic variables | Experimental Group(25) |            | Control Group (25) |            |
|-----------------------|------------------------|------------|--------------------|------------|
|                       | Frequency              | Percentage | Frequency          | Percentage |
| 1. Age in years       |                        |            |                    |            |
| 1. 30-40              | 2                      | 9%         | 2                  | 8%         |
| 2. 41-50              | 3                      | 21%        | 3                  | 20%        |
| 3. 51-60              | 5                      | 30%        | 6                  | 33%        |
| 4. 61-70              | 15                     | 40%        | 14                 | 39%        |
| 2. Sex                |                        |            |                    |            |
| 1.Male                | 18                     | 71%        | 21                 | 80%        |
| 2.Female              | 7                      | 29%        | 4                  | 20%        |
| 3. Occupation         |                        |            |                    |            |
| 1.Working             | 21                     | 85%        | 22                 | 90%        |
| 2.Non working         | 4                      | 15%        | 3                  | 10%        |



|                             |    |     |    |     |
|-----------------------------|----|-----|----|-----|
| 4. Family history of stroke |    |     |    |     |
| 1.Father                    | 14 | 40% | 13 | 40% |
| 2.Mother                    | 6  | 30% | 7  | 31% |
| 3.Sibling                   | 3  | 20% | 4  | 24% |
| 4.Paternal grand parent     | 2  | 10% | 1  | 5%  |
| 5.Maternal grand parent     | 0  | -   | 0  | -   |
| 5. Dietary History          |    |     |    |     |
| 1.Non-Vegetarian            | 20 | 86% | 22 | 90% |
| 2.Vegetarian                | 5  | 14% | 3  | 10% |

Table-1 reveals that the Demographic variables of Patients indicated that 40% of the patients in experimental and 39% were in control group in the age group 61-70. In the experimental group 71% were in male 29% were in female, whereas in the control group 80% in male 20% in female. In the experimental group 85% were working, 15% were non-working whereas in the control group 90% were working 10% were non-working. Family history of stroke 40% of them had fathers in the experimental and control group respectively. 86% and 90% were non –Vegetarian in the experimental and control group.

**Table 2 :** Comparison of Action Research Arm test among experimental and control group (N=50)

| Parameters  | Groups                       | Mean    | SD   | Median Percentile | P- Value | Statistical Inference |
|---|------------------------------|---------|------|-------------------|----------|-----------------------|
| Action Research Arm Test (ARAT) - A)<br>(Supine, shoulder flexion)<br>Flex and extend elbow to take palm to forehead  | Control group pre-test       | 5.96    | 1.53 | 6.0(5.0-7.0)      | P< 0.001 | Greater Significant   |
|   | Control group post-test      | 12.57** | 4.45 | 12.0(8.0-15.75)   |          |                       |
|   | Experimental group pre-test  | 6.20    | 1.36 | 6.0(5.0-7.0)      |          |                       |
|   | Experimental group post-test | 20.24** | 1.74 | 20.0(19.0-22.0)   |          |                       |
| Action Research Arm Test (ARAT) - B).<br>Sitting, hold extended arm in forwards flexion at 90 degree to body and sitting, patient lifts arm to above position | Control group pre-test       | 5.07    | 1.32 | 5.0(4.0-6.0)      | P< 0.001 | Greater Significant   |
|   | Control group post-test      | 12.56*  | 3.94 | 13.0(9.0-16.0)    |          |                       |
|   | Experimental group pre-test  | 5.11    | 1.63 | 5.0(4.0-6.0)      |          |                       |
|   | Experimental group post-test | 17.08** | 1.70 | 17.0(16.0-18.0)   |          |                       |
| Action Research Arm test (ARAT) - C).<br>Standing hand against wall   | Control group pre-test       | 3.65    | 1.42 | 4.0(2.0-5.0)      | P< 0.001 | Greater Significant   |
|   | Control group post-test      | 6.22*   | 1.74 | 7.0(5.0-7.75)     |          |                       |
|   | Experimental group pre-test  | 4.22    | 1.12 | 4.0(4.0-5.0)      |          |                       |
|   | Experimental group post-test | 7.27**  | 1.26 | 7.5(6.0-8.0)      |          |                       |
| Action Research Arm test (ARAT) (Total components Action  | Control group pre-test       | 14.74   | 3.12 | 14.0(13.0-17.75)  |          | Greater Significant   |
|   | Control group                | 31.40*  | 9.56 | 32.0(22.0-39.75)  |          |                       |



|  |                              |         |      |                 |          |
|--|------------------------------|---------|------|-----------------|----------|
| Research Arm test Upper arm function ) | post-test                    |         |      |                 | P< 0.001 |
|  | Experimental group pre-test  | 15.54   | 3.12 | 14.0(13.0-17.0) |          |
|  | Experimental group post-test | 44.61** | 3.32 | 46.0(42.0-46.0) |          |

t and P values are by Two-way RM ANOVA Boneferroni multiple comparison test on pre test to post test of t and P value were shown greater significance for the experimental group over the control group (P < 0.001).  
 \*\* Significantly different from the respective control group

**Table 3 :** Within-group comparison for Arm exercise for affected upper extremity (N=50)

| S. no | Parameter   | Paired test                     | t-test value | P-value |
|-------|---|---------------------------------|--------------|---------|
| 1.    | Group -A(AEAUE)<br>1.Seated tabletop ball roll<br>2. Seated tabletop ball squeeze<br>3. Seated tabletop bilateral hand squeeze<br>4. Seated tabletop hand over hand compression<br>5. Seated tabletop hand over hand rolls<br>6. Seated tabletop tarred glide<br>7. Seated physioball rolls | Control group (Pre to Post)     | t = 13.201   | < 0.001 |
|       |   | Experimental group(Pre to Post) | t = 27.857** | < 0.001 |
| 2.    | Group-B(AEAUE)<br>8.Standing physic ball rolls<br>9.Standing /seated pillow squeeze<br>10.Standing /seated wall pillow squeeze<br>11.Standing /seated wall wipers<br>12.Shoulder elevation depression<br>13.Shoulder compression<br>14.Wrist compression<br>15.Mirror Box                   | Control group (Pre to Post)     | t = 16.867   | < 0.001 |
|       |   | Experimental group(Pre to Post) | t = 26.907** | < 0.001 |

t and P values are by Two-way RM ANOVA Boneferroni multiple comparison test Within group comparison for (AEAUE)-A and (AEAUE)-B- on pre test to post test of t and P value were shown greater significance for the experimental group over the control group (P < 0.001).  
 \*\* Significantly different from the respective control group (Within group)

**Table 4 :** Between-group comparison for Arm exercise for affected upper extremity (N=50)

| S. no | Parameter   | Paired test                     | t-test value | P-value |
|-------|---|---------------------------------|--------------|---------|
| 1.    | Group -A(AEAUE)<br>1.Seated tabletop ball roll<br>2. Seated tabletop ball squeeze<br>3. Seated tabletop bilateral hand squeeze<br>4. Seated tabletop hand over hand compression<br>5. Seated tabletop hand over hand rolls<br>6. Seated tabletop tarred glide | Control group (Pre to Post)     | t = 0.542    | 0.589   |
|       |   | Experimental group(Pre to Post) | t = 15.458** | < 0.001 |



|   |  |                                 |             |         |
|---|--|---------------------------------|-------------|---------|
|   | 7. Seated physioball rolls   |                                 |             |         |
| 2.  | Group-2 (AEAUE)<br>8.Standing physic ball rolls<br>9.Standing /seated pillow squeeze<br>10.Standing /seated wall pillow squeeze<br>11.Standing /seated wall wipers<br>12.Shoulder elevation depression<br>13.Shoulder compression<br>14.Wrist compression<br>15.Mirror Box | Control group (Pre to Post)     | t = 0.079   | 0.937   |
|   |  | Experimental group(Pre to Post) | t = 9.955** | < 0.001 |
| t and P values are by Two-way RM ANOVA Boneferroni multiple comparison test<br>Within group comparison for (AEAUE)-A and (AEAUE)-B on pre test to post test of t and P value were shown greater significance for the experimental group over the control group (P < 0.001).<br>** Significantly different from the respective control group (Between group) |  |                                 |             |         |

**Table 5** : Shows that the Association between Post-test of Socio Demographic Variables and Upper limb Rehabilitation among Experimental and Control groups (N=50)

| Demographic Variables      | Socio Demographic Variables and Acupuncture treatment |    |                      |               |    | Chi-square & P-Value |                      |
|----------------------------|---|----|----------------------|---------------|----|----------------------|----------------------|
|                            | Experimental Group                                    |    | Chi-square & P-Value | Control Group |    |                      | Chi-square & P-Value |
|                            | N   | P  |                      | N             | P  |                      |                      |
| 1.Age in years             |   |    |                      |               |    |                      |                      |
| 1. 30-40                   | 1   | 5  | 4.177<br>>0.05       | 2             | 20 | 4.187<br>>0.05       |                      |
| 2. 41-50                   | 7   | 30 |                      | 6             | 25 |                      |                      |
| 3. 51-60                   | 17  | 65 |                      | 16            | 50 |                      |                      |
| 4. 61-70                   | 0   | -  |                      | 1             | 5  |                      |                      |
| 2.Sex                      |   |    |                      |               |    |                      |                      |
| 1.Male                     | 20  | 85 | 0.027<br>>0.05       | 23            | 90 | 0.025<br>>0.05       |                      |
| 2.Female                   | 5   | 15 |                      | 2             | 10 |                      |                      |
| 3.Educational status       |   |    |                      |               |    |                      |                      |
| 1.Elementary               | 2   | 10 | 2.395<br>>0.05       | 1             | 5  | 2.465<br>>0.05       |                      |
| 2.High School              | 3.5   | 20 |                      | 6             | 25 |                      |                      |
| 3.Higher Secondary         | 9   | 30 |                      | 12            | 40 |                      |                      |
| 4.Degree                   | 10.5  | 40 |                      | 6             | 30 |                      |                      |
| 4.Occupation               |   |    |                      |               |    |                      |                      |
| 1.Working                  | 12.5  | 50 | 0.58<br>>0.05        | 12.5          | 50 | 0.54<br>>0.05        |                      |
| 2.Non working              | 12.5  | 50 |                      | 12.5          | 50 |                      |                      |
| 5.Monthly family income    |   |    |                      |               |    |                      |                      |
| 1.<5000                    | 3   | 25 | 4.387<br>>0.05       | 5             | 20 | 4.286<br>>0.05       |                      |
| 2.6,000-10,000             | 8   | 30 |                      | 7             | 30 |                      |                      |
| 3.>11,000                  | 14  | 45 |                      | 13            | 50 |                      |                      |
| 6.Family history of stroke |   |    |                      |               |    |                      |                      |
| 1.Father                   | 17  | 70 | 4.178<br>>0.05       | 16            | 60 | 4.234<br>>0.05       |                      |
| 2.Mother                   | 6   | 20 |                      | 7             | 30 |                      |                      |
| 3.Sibling                  | 2   | 10 |                      | 2             | 10 |                      |                      |
| 4.Paternal grand parent    | 0   | 0  |                      | 0             | 0  |                      |                      |
| 5.Maternal grand parent    | 0   | 0  |                      | 0             | 0  |                      |                      |



|                    |    |    |       |    |    |       |
|--------------------|----|----|-------|----|----|-------|
| 7. Dietary History |    |    |       |    |    |       |
| 1.Non-Vegetarian   | 23 | 95 | 0.344 | 24 | 96 | 0.322 |
| 2. Vegetarian      | 2  | 5  | >0.05 | 1  | 4  | >0.05 |

Table-7 reveals that there was significant association between Socio Demographic Variables with the post-test and Upper limb Rehabilitation among Experimental and Control groups in relation to Age, Sex, Educational status, Occupation, Monthly family income, Family history of stroke and Dietary history.

### V. DISCUSSION

This study was conducted to find out the effects of upper limb rehabilitation among patients. Present study was aimed to improve arm function among affected upper extremity stroke. After post test the study group had greater significant improvement compared to the control group. A study was conducted a review examining modified CIMT compared with traditional rehabilitation strategies. The results from 13RCTs (278) patients were included. The mean differences in scores favoured patients in the CIMT group of the following outcome measures : FMA (7),ARAT(14.2) FIM(7) and the motor activity log (amount of use:0.78),suggesting that the treatment can be used to reduce post stroke disability. The authors noted that none of the included RCTs included information on compliance with the study protocol. Furthermore ,the study did not differentiate between different stroke phases as the analysis combined patients from acute to chronic stages (12,13,14,15) . Mirror Therapy is a technique that uses visual feedback about motor performance to improve rehabilitation outcomes. A study says that the mirror therapy, patients place a mirror beside the unaffected limb, blocking their view of their affected limb and creating an illusion of two limbs which are function normally(. It is believed that by viewing the reflection of the unaffected arm in the mirror, this may act as substitute for the decreased or absent peripheral and peri operative input to the affected arm (16,17,18). The effectiveness of mirror therapy was evaluated recently in a Cochrane review (19,20).The results from 14RCTs (567 subjects) were included. Modest benefit of treatment was reported in terms of motor function, but the treatment was reported effect was difficult to isolate due to the variability of control conditions. Improvement in performance of ADLs(SMD=0.33,95% CI 0.05 TO 0.60,P=0.02),pain (SMD=1.1,95% CI -2.10to 0.09,p=0.03)and neglect (SMD=1.22,95% CI 0.24 TO 2.19,P=0.01)were also noted. Yoon et al.(2014)RCT(7)sample size 84 experimental design intervention E1;CIMT+Mirror therapy E2;CIMT,C;Control conventional therapy the main outcome result -Box and Block test(+),Nine Hole peg test(+),Grip strength(+),Bunnstrom

stages(+),Wolf motor function test(+) Modified Barthel index (+).There is level 1a evidence that mirror therapy in combination with other therapies or delivered alone may improve motor function following stroke(21,22).

A study report says that there are 2 million strokes every year and 6 million are living with disability (ICMR, 2006). In general, most of the stroke affected survivors have difficulty in doing activities of daily living. Stroke affects many on limbs viz., the motor function, balance, walking, motor integration, speech, communication and sensory awareness. These impairments may result in persistent disability(23,24).

### VI. CONCLUSION

From the above it is clear evidence suggests that upper arm exercise training is more effective in improving motor function and self care activities. In summary, different comparisons, upper arm rehabilitation arm training regimens and disease stages showed opposite results on efficacy of post stroke . Upper arm exercise training is effective in improving motor function and activities of daily living among stroke patients. Current study shows that the different was found to be statistically significant at P<0.001 level which indicates the post intervention upper arm training is effectiveness among affected upper arm post stroke patients.

### Recommendation

The Grading of Recommendations Assessment, Development and Evaluation (GRADE) system was often used to evaluate the quality of evidence. A similar study can be undertaken on a larger scale for more valid generalization. The study can be replicated in different settings. It can be conducted with different audio visual aids like video films, filmstrips on involvement care of affects upper extremity stroke .

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### Conflicts of Interest

There are no conflicts of interest

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