ORIGINAL RESEARCH PAPER
Volume - 13 | Issue - 03 | March - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

A PROSPECTIVE RANDOMIZED CONTROL TRIAL ON THE EFFECTIVENESS OF HAND-ARM BIMANUAL INTENSIVE TRAINING (HABIT) ON HAND DEXTERITY AND ARM MOTOR FUNCTION IN ACUTE STROKE SUBJECTS

Neurophysiotherapy

Dr. G. Manjunatha PG 2ND year, MPT, Neurology, College of Physiotherapy, SVIMS
Dr. G. Kameswari* MPT, Neuro, Tutor College of Physiotherapy, SVIMS *Corresponding Author
Dr. V. Sri Kumari MPT, Neuro, Ph.D., Associate Professor, College of Physiotherapy, SVIMS
Dr. K. Madhavi MPT, Cardio-thoracic, Ph.D. Principal, College of Physiotherapy, SVIMS

ABSTRACT

Background: Hand Arm Bimanual Training therapy (HABIT) therapy is one of the new interventions in hand rehabilitation following stroke based on the principle of Neuroplasticity. This study aims to evaluate the effectiveness of hand-arm bimanual intensive training on hand dexterity using a nine-hole peg test and motor function using the Fugal Meyer upper extremity scale. **Materials And Methods:** A single-blinded simple randomized controlled trial was performed allocating 30 subjects to a experimental group and control group by simple random sampling. The experimental group received Habit therapy protocol daily for 1 hour, 5session with follow-up to 3 weeks and the control group received conventional physiotherapy exercise patients for 1 hour. Pre and post-test evaluation of hand function were done by using the nine-hole peg test for hand dexterity; and the Fugel Meyer upper extremity scale for arm motor function. **Results:** The group was found to be moderately effective in the performance of NHPT with a t-value of 4.10with a significance of $p<0.006$ and highly effective in the performance of FMUE with a tvalue3.96 and presented high significance with a P value< 0.011compared to the conventional group. **Conclusion:** HABIT therapy was found as an effective intervention method to improve hand dexterity and arm motor function in acute stroke patients with the results showing improvement in hand dexterity and arm motor function when compared to conventional physiotherapy exercises alone.

KEYWORDS

Stroke, Hand-arm bimanual intensive training, Nine-hole peg test, Fugal Meyer upper extremity scale.

INTRODUCTION

In stroke, the brain may experience a lack of oxygen due to a blockage or rupture in the blood vessels that supply blood to the brain. If the cerebral deficit lasts for more than 24 hours, it can lead to sensory, cognitive, and motor impairments such as balance, gait, coordination, and hand impairment. These impairments can cause a decrease in functional activities.[1]

In 2019, stroke cases were more common among males (77.0 million) than females (66.0 million) globally. The incidence and prevalence rate of stroke was higher among females, with 6.4 million incidences and 56.4 million prevalence, compared to males with 5.8 million incidences and 45.0 million prevalence. in India, A recent systematic review, consisting mainly of cross-sectional studies, estimated the incidence of stroke in India to be between 105 and 152 per 100,000 people per year.[2,3] The current prevalence rate in India varies from 44.54 to 150/1000007. the most important step for evaluating upper limb impairment in the shoulder joint is internal rotation and adduction of the shoulder, the elbow is flexed, the forearm is pronated, the wrist is flexed, metacarpophalangeal joint flexion rather than proximal interphalangeal joint flexion.[4]

There are three main functional consequences of stroke on the upper limb: (1) learned non use, (2) learned bad use, and (3) forgetting as determined by behavioral analysis.[5]

Learned nonuse**:** At first, a person may not use a limb due to weakness, paralysis, or sensory loss. As time passes, this nonuse can become a habit, even if the person is capable of moving the limb and this learned behavior is called "learned nonuse." Learned bad use: When the paretic limb is forced to move, weakness, sensory impairments, and pain can prevent "normal" movement, and compensatory strategies are used to complete the task.[6]

In acute stroke patients, the following rehabilitation approaches have been studied and were recommended: muscle strengthening exercises, constraint-induced movement therapy, mirror therapy, passive neuromuscular electrical stimulation, repetitive transcranial magnetic stimulation, transcranial direct current stimulation, SSRI and NARI antidepressants, and botulinum toxin.[7]

Hand-arm bimanual intensive training is a bimanual rehabilitation approach that addresses the impairments that are specific to the upper extremity in hemiplegic subjects which had demonstrated positive outcomes.[8] The HABIT approach also includes increasing the complexity of the functional activities that necessitate using both hands and repetitions to achieve functional goals.[9] The goal is to provide sufficient practice intensity in performing bimanual activities.

Need Of The Study

Studies are lacking in exploring the effects of HABIT therapy on hand function and limited studies on the evaluation of arm motor function in acute stroke subjects.

The present study considered depression in the inclusion criteria and is designed to meet the limitations of the previous studies by evaluating the effect of HABIT therapy on hand dexterity, and arm motor function of upper extremity in subjects with acute stroke.[10]

Aim Of The Study

To determine the effectiveness of hand, arm bimanual intensive training on hand dexterity and arm motor function in subjects with acute stroke subjects.

Objectives Of The Study

1. To Evaluate the effectiveness of hand-arm bimanual Intensive Training on Hand Dexterity using the "Nine Hole Peg Test" (NHPT).
2. To Evaluate the effectiveness of hand-arm bimanual Intensive Training on Arm motor function using "The Fugel Meyer upper extremity scale" (FMUE).

MATERIALS AND METHODS:

MATERIALS.

2 plastic bottles, Shirt buttons (20), one rupee coin (10), One small book (the minimum it should be 20 pages)

Inclusion Criteria

- Stroke with a duration of < 3 months
- Age:40-65 years
- No severe cognitive impairment (MMSE>24 scores)
- No excessive spasticity of affected upper extremity (MAS<2)
- NIHSS with a score of <15
- PHQ9 questionnaire score <9

Exclusion Criteria

- No hand fractures
- Epilepsy
- Cardiac pacemakers
- Shoulder hand syndrome
- Intracranial implants
- Recurrent stroke

METHODS:
30 participants were randomly allocated to either a control group (n=15) or an experimental group (n=15). After that consent was taken from the subject The experimental group received a HABIT therapy protocol for one hour, five sessions a week, for three weeks The control group received conventional physiotherapy exercise for one hour, ten sessions a week.

Study Intervention
- Research design: Simple Randomized Trail
- Sampling technique: Purposive sampling
- Sample size: 30
- Study settings: Neurology ward, General ward, and Ayurvedic
- Study duration: 4 weeks
- Study period: 9 months

Treatment Duration
- Total hours: 18 hours
- Weekly: 6hours /week
- Daily: 1hour
- Cycles: 5cycles /day
- Each repetition:15-20 times (constitute in one cycle with total performance)
- Each task performance time: 10 minutes with 2 minutes of relaxation time.

Treatment Protocol:
subjects were instructed to perform all the exercises following the given commands under supervision

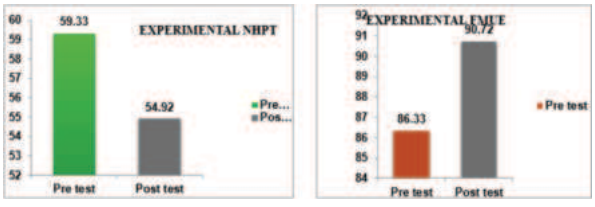
Experimental group	Control group
A) TASK: To lift and pick up the two bottles, reach forward and upward to move them." , ,	Hand and finger exercises Thera putty exercises a) Finger hook b) Finger extension C)Finger Spread d)Finger scissors e) Finger pinch
B) TASK: To practice dressing clothes of different shapes, sizes, including buttoned clothing.	Shoulder exercises Flexion, extension, and rotation exercises
C)TASK: To Pick up 20 coins from the purse	Treatment duration: First session: 20 Repetition Next session: 15 Repetition 3 sets
D)TASK: hold the book with one hand and turn 20 pages using the affected hand."	

Statistical Analysis
The statistical analysis was performed using the "SPSS 26.0 version" software. The data was first entered into a Microsoft Excel spreadsheet, tabulated, and then subjected to statistical analysis. Paired t-tests were used for within-experimental group analysis, whereas unpaired t-tests were used for between-experimental group analysis.

Table -1: Within-group analysis of and post-values of NHPT and FMUE in the experimental group

Categories	N	Mean	SD	t value	Value
NHPT Pre	15	59.33	11.81	5.43	.019
NHPT Post	15	54.92	10.98		
FMUE Pre	15	86.33	17.31	3.41	.004
FMUE Post	15	90.72	18.14		

*Indicates significance at 5%level
In the experimental group, the mean and standard deviation values for hand dexterity were 59.33±11.81 and 54.92±10.98respectively before and after the intervention. The FMUE scores were increased from 86.33±17.31and 90.72±18.14after the intervention.



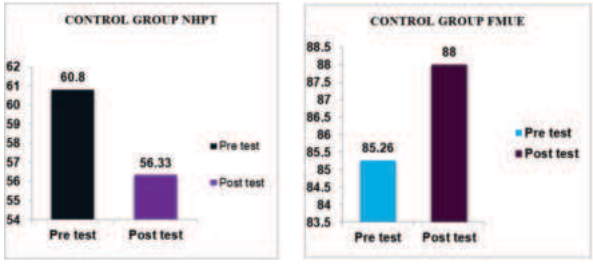
GRAPH -1: This Graph shows the comparison of NHPT and FMUE in the experimental group

Table -2: Within-group analysis of pre and post-values of NHPT and FMUE in the control group

Categories	N	Mean	SD	t value	Value
NHPT Pre	15	60.80	12.14	3.98	.011
NHPT Post	15	56.33	11.27		
FMUE Pre	15	85.26	17.58		
FMUE Post	15	88.00	15.92	3.87	.010

***Indicates significance at 5%level**

In the control group, the mean and standard deviation values for hand dexterity were 60.80±12.14 and 54.92±11.27respectively before and after the intervention. The FMUE scores were increased from 85.26±17.58and 88±15.92after the intervention.



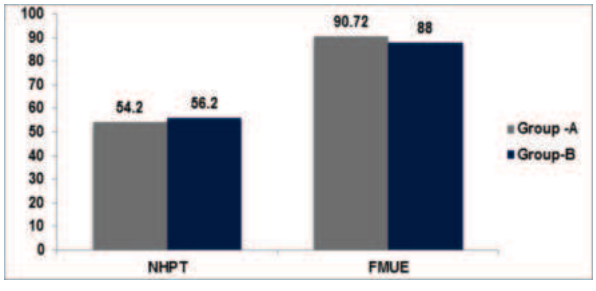
GRAPH -2: This graph shows the comparison of NHPT and FMUE in the control group

Table 3: Between-group analysis of Experimental and control groups by comparison of pretest and posttest values

PARAMETER	GROUPS	Mean	SD	t value	Value
NHPT	Experimental	54.92	10.98	4.10	.006
	Control	56.33	11.27		
FMUE	Experimental	90.72	18.14	3.96	.011
	Control	88.00	15.92		

The group's post-test mean value of 56.33 was increased to 54.92 in the post-test, with a mean difference of 1.41 The results showed a t-value of 4.10 and a significance level of 98%, indicating that the difference was statistically significant (p-value = .006). The difference in the mean of FMUE values between the Experimental group and B was analyzed. The post-test value mean of 88 to a post-test value of 90.72 with a mean difference of 2.72. The results show a t-value of 3.96

The study examining the effectiveness of HABIT therapy on hand dexterity and arm motor function in acute stroke subjects revealed significant mild differences between the control and experimental groups, within the groups in NHPT very mild significant.



Graph-3: Between-group Analysis

RESULTS:
A study was conducted to investigate the effect of habit therapy on hand dexterity and arm motor function in individuals who had recently experienced a stroke. The study found that there was moderate significance between the control and experimental groups.

DISCUSSION
Hand dexterity is the skillful use of one's hands to grip and manipulate objects in a coordinated manner. It is important for activities of daily living that involve grasping, holding, and reaching. After an acute stroke, it can affect various muscles in the wrist, elbow, and shoulder, potentially reducing hand strength and movement velocity. [10] The experimental group was treated with HABIT therapy, Thera putty exercises, and shoulder ROM exercises whereas the control group was treated with Thera putty and shoulder exercises. The experimental

group and control group both have shown statistically significant differences between pre and post-values of NHPT and FMUE. However, the experimental group subjects have shown mild higher significance when compared to the control group.

The experimental group showed mild improvement compared to the control group followed by the HABIT intervention representing a physiological mechanism that bilateral training with consistent motor learning bilateral hand training enhances the rebalancing of corticomotor excitability from the influence of interlimb coupling, and bilateral priming mechanism that is represented by an improved movement harmony and amplitudes of the affected hand. [11]

Previous studies evaluated NHPT and JHFT to measure hand dexterity in sub-acute stroke subjects and concluded that subjects were able to complete the NHPT 21.04% faster and the JHFT 19.35% faster followed by the HABIT therapy . The above study findings of the experimental group NHPT values support the present study experimental group results with a t-value of 5.43 and p-value of .019.[12]

Another study evaluated FMUE in sub-acute and chronic stroke subjects who underwent HABIT therapy demonstrated significant improvement in FMUE scores compared to the control group (51.7 ± 6.44 vs. 43.5 ± 5.6, $P < 0.001$). This suggests that improvement in HABIT therapy may be associated with positive outcomes in terms of functional motor abilities, emphasizing it as an effective intervention.[13]

Depression is one of the factors that restricts participation in exercise and causes the prolongation of the rehabilitation phase in stroke subjects. By emphasizing motor principles and continuous monitoring of the affected hand during task performance, HABIT therapy training was issued to monitor and treat depression in patients with acute conditions.[14]

This study found that the HABIT therapy group had comparatively moderate improvement in arm motor function and mild improvement in hand dexterity suggesting that HABIT therapy is one of the effective treatments for stroke patients than conventional physiotherapy exercises.

CONCLUSION

HABIT therapy was found to be an effective intervention method to improve hand dexterity and arm motor function in acute stroke patients. The results showed improved hand dexterity and arm motor function compared to conventional physiotherapy exercises alone.

Limitations

- The sample size is small.
- Fatigue levels not evaluated.
- This study no longer follows up

Recommendations

- The study can be done with a large sample.
- Next follow-up studies to take BP inclusion criteria.
- The study can be done with Good peaceful environmental conditions.

Acknowledgments:

1) My gratitude and obeisance to Dr. K, Madhavi, MPT (CT), PhD, Professor, College of Physiotherapy, SVIMS, Tirupati.
2) My flow of thanks to Dr. G. Kameshwari, MPT (Neuro) College of Physiotherapy, SVIMS, Tirupati
3) My obeisance to my guide Dr. Srikumari, MPT(neuro), Ph.D., Asstcioate. Professor, College of Physiotherapy, SVIMS, Tirupati.
4) I am grateful to Grandhi Gowri Manasa and Vedam Leela Madhavi for their invaluable guidance and assistance that helped me complete my study.

REFERENCES:

1) Mr. S. Kamalakannan – Kumaraguru college of liberal arts & science (KCLAS) (2021) Kumaraguru College of Liberal Arts & Science (KCLAS) – Welcome to Where You Want To BE. Available at: https://www.kclas.ac.in/faculties/mr-s-kamalakannan/ (Accessed: 15 February 2024).
2) Panuganti, K.K. (2023) Transient ischemic attack, StatPearls [Internet]. Available at: https://www.ncbi.nlm.nih.gov/books/NBK459143/ (Accessed: 15 February 2024).
3) Feigin VL;Brainin M;Norrving B;Martins S;Sacco RL;Hacke W;Fisher M;Pandian J;Lindsay P; (no date a) World Stroke Organization (WSO): Global stroke fact sheet 2022, International journal of stroke: official journal of the International Stroke Society. Available at: https://pubmed.ncbi.nlm.nih.gov/34986727/ (Accessed: 15 February 2024).
4) Millichap, J.G. (2008) 'Corticospinal dysgenesis and congenital hemiplegia', Pediatric Neurology Briefs, 22(1), p. 6. Doi:10.15844/pedneurbriefs-22-1-6.
5) Roby-Brami, A., Jarrassé, N. and Parry, R. (2021) 'Impairment and compensation in dexterous upper-limb function after stroke. From the direct consequences of pyramidal tract lesions to behavioral involvement of both upper-limbs in daily activities', Frontiers in Human Neuroscience, 15. Doi:10.3389/fnhum.2021.662006.
6) Meng, G. et al. (2018) 'Short-term efficacy of hand-arm bimanual intensive training on upper arm function in acute stroke patients: A randomized controlled trial', Frontiers in Neurology, 8. Doi:10.3389/fneur.2017.00726.
7) Sahu, R.K., Gugnani, A. and Ahluwalia, R. (2022) 'Short-term effectiveness of trunk and bimanual hand training on upper limb motor recovery and function in stroke patients', International journal of health sciences, pp. 10058–10071. Doi:10.53730/ijhs.v6ns1.7384.
8) Bleyenheuft, Y. et al. (2014) 'Hand and arm bimanual intensive therapy including lower extremity (Habit-Ile) in children with unilateral spastic cerebral palsy', Neurorehabilitation and Neural Repair, 29(7), pp. 645–657. Doi:10.1177/ 1545968314562109.
9) Lannin, N.A. et al. (2003) 'Splinting the hand in the functional position after brain impairment: A randomized, controlled trial', Archives of Physical Medicine and Rehabilitation, 84(2), pp. 297–302. Doi:10.1053/apmr.2003.50031.
10) Gladstone, D.J., Danells, C.J. and Black, S.E. (2002) 'The fugl-meyer assessment of motor recovery after stroke: A critical review of its measurement properties', Neurorehabilitation and Neural Repair, 16(3), pp. 232–240. Doi:10.1177/1545968 0240 1105171.
11) Poole J, Whitney S. Assessments of Motor Function Post Stroke. Physical & Occupational Therapy in Geriatrics. 2001 Dec 1;19(2):1–22
12) Gardas S, Lysaght C, Amy Gross McMillan, Kantak S, Willson JD, Charity
13) Galena Patterson, et al. Bimanual Movement Characteristics and Real-World Performance Following Hand Arm Bimanual Intensive Therapy in Children with Unilateral Cerebral Palsy. 2023 Jun 22;.
14) Ferre CL, Brandão MB, Hung YC, Carmel JB, Gordon AM. Feasibility of caregiver directed home-based hand-arm bimanual intensive training: A brief report. Developmental Neurorehabilitation [Internet]. 2014: Shah S, Kale A, Tiwari V. Effect of handarm bimanual intensive therapy on upper limb function in young stroke. Arch Med Health Sci 2022; 10:1058
15) Ali M, van Os HJA, van der Weerd N, Schoones JW, Heymans MW, Kruyt ND, et al. Sex differences in presentation of stroke: A systematic review and meta-analysis. 2022;53(2):345–54.