COMPARISON OF EFFECTIVENESS OF TASK-ORIENTED PHYSICAL THERAPY APPROACH WITH CONVENTIONAL PHYSICAL THERAPY FOR UPPER LIMB FUNCTION IN STROKE PATIENTS

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ABSTRACT:

BACKGROUND: After stroke, the capacity and excellence of motor activities of a paretic upper limb has proved to increase by Motor Relearning Programme (MRP). The technique focuses on functional activities which work on neuroplasticity.

OBJECTIVE: To examine the effects of MRP versus conventional therapy (CT) in improving upper limb (UL) functions in stroke survivor and implementing the findings into daily practice.

METHODOLOGY: A randomized controlled trial was conducted at the northwest general hospital from April 2017 to December 2017. Seventy subjects with stroke were selected on the bases of inclusion and exclusion criteria for the study. Participants were randomly allocated to groups i.e. the treatment group and the control group. Participants in the conventional group were provided rehabilitation for 2 hours with general physiotherapy exercises. The MRP group subjects were provided with task-oriented training (MRP). To quantify the functional level of the paretic upper limb, sub-scales of the Motor Assessment Scale (MAS) were administered for upper limb function; post-treatment scores after 4 weeks compared with a baseline assessment.

RESULTS: The results showed that the subjects in experimental group were significantly enhanced with upper arm function and hand activities i.e. $P<0.001$ than the subjects in control group, which stresses that MRP could improve the UL motor activities after stroke in sub-acute subjects.

CONCLUSION: The treatment group was meaningfully better-quality than the conventional group, which put emphasis on that MRP could improve the upper limb motor activities after stroke subjects as compare to CT.

Keywords: Conventional Physiotherapy, Motor assessment scale, Motor relearning program, Stroke, Upper limb motor function.

INTRODUCTION:

A cerebrovascular accident (CVA), also known as a stroke, is defined as "a sudden neurological deficit caused by the blockage or rupture of an artery to the brain, lasting for more than 24 hours." There are two types of strokes: hemorrhagic and ischemic stroke. Hemorrhagic strokes occur due to the rupture of vessels in the brain, making them more destructive and frequent compared to other types. Ischemic strokes result from the blockage of vessels in the brain and account for approximately 80% of all strokes.[1] In the geriatric population, stroke is one of the leading causes of disability, affecting physical, social, and emotional well-being.[2] The worldwide prevalence of stroke is approximately 500-600 per 100,000 populations per year, with an incidence of 179 per 100,000. In Kashmir, the prevalence is 143 per 100,000 population.[3]

Stroke poses a significant health threat globally. Around 25,000-30,000 individuals are diagnosed with stroke yearly in Sweden. It is the country's third most common cause of death, with high blood pressure, smoking, diabetes, heart diseases, vascular diseases, and hypercholesterolemia being risk factors for stroke. Ischemic stroke, accounting for 85% of all stroke cases, primarily affects the middle cerebral artery (MCA) and cerebral hemispheres due to occlusion.[4]

Different physiotherapy techniques have been used in stroke rehabilitation. A comparison between the Bobath and MRP techniques revealed that individuals treated with MRP had shorter hospital stays compared to those treated with Bobath (mean 21 days versus 34 days, p = 0.008). Both groups demonstrated improvement in Motor Assessment Scale (MAS) and Stroke Motor Evaluation Scale (SMES), but the MRP group showed significantly better improvement in motor function. There were no differences between the groups in terms of life quality (NHP) and the use of orthotic devices.[5]

A review study conducted from 1950 to November 2012 focused on randomized clinical trials comparing the task-oriented practice to traditional care for improving motor impairment and activity post-CVA. Fifty percent of the studies confirmed statistically significant results for task-oriented practice. The findings indicated that increased task-oriented practice after a stroke may lead to reduced upper limb impairment and improved motor activities.[6]

Another study investigated the impact of a motor relearning program (MRP) on motor impairment in reaching patterns among stroke patients. The results demonstrated a significant increase in EMG amplitudes of affected muscles and reaching performance scale in the group that received MRP in addition to conventional physical therapy.[7]

An RCT was conducted to compare MRP with the Bobath approach, and the results indicated that "the Motor relearning program is more effective than the Bobath approach in early improvement of Activities of Daily Living (ADLs) and ambulation in Acute Stroke Rehabilitation".[8]

A matched-pair randomized controlled trial study was carried out at an outpatient rehabilitation center in Hong Kong to examine the significance of MRP in enhancing physical function and task performance for stroke patients. The study's findings revealed that task-oriented training or a "Motor relearning program" was more effective than conventional therapy.[9]

There is a literature gap concerning motor relearning training for stroke rehabilitation, and this study aims to fill that gap by identifying an effective treatment option for stroke. The study aims to examine the effects of MRP versus conventional therapy (CT) in improving upper limb (UL) functions in stroke survivors and incorporating it into daily practice.

The study aimed to examine the effects of MRP versus conventional therapy (CT) in improving upper limb (UL) functions in stroke survivors incorporated into daily practice.

METHODOLOGY:

A randomized controlled trial was conducted at the northwest general hospital from April 2017 to December 2017. A study was conducted on a total sample size of 70 participants calculated through an open epi sample size calculator. Participants were randomly allocated into two groups; the control group and the experimental group using the lottery method. All those patients of age between 30-70 years who have first unilateral stroke (affected upper limbs) in between 6 weeks to 1 year presented at NWGH and are willing to participate following study protocols are included. Patients who are unable to respond to instructional steps and have other co-morbidity due to which his/her muscular functions have been disturbed eg. cognitive deficits, unilateral neglect, hemi anesthesia, recently fractured upper limb, inflammatory joint disease, and patients having pain in the paretic upper limb of more than 4 on the visual analog scale were excluded.

All patients underwent a full neurological assessment before allocation in two groups. Group 1 (receiving 4 weeks of motor relearning program) and Group 2 (receiving 4 weeks of conventional physical therapy). The total duration of the study was 6 months; both groups received their respective treatments 5 days a week for two hours per session. Upper limb function of patients with stroke was assessed by using a previously tested "motor assessment scale" at baseline, by experienced physiotherapists, and then after 4 weeks of treatment. The researcher trained the physiotherapist regarding the two techniques and assessment. The data collection tool was the motor assessment scale (MAS). Upper limb function of patients with stroke was assessed by using a previously tested "motor assessment scale". The data was analyzed using SPSS. For continuous data, mean and standard deviation were calculated. While categorical variables like gender, and education level were presented in terms of frequency and percentages. Paired T-test was applied for the pre and post-upper arm functions, hand movements, and advanced hand activities individually for both treatment & control groups. An Independent sample T-test was applied to compare the mean difference (i.e. difference between pre & post-values of scales used) between treatment and control groups.

RESULTS

The study was conducted on 70 patients with stroke randomly allocated in two groups. 35 patients were allocated in task oriented physical therapy group (Treatment group) and 35 patients were allocated in conventional treatment (control group). Regarding the site affected, 54.3% of patients in treatment group had right hemiplegia compared to 51.4% in the control group. (P value 0.811) See Figure 1

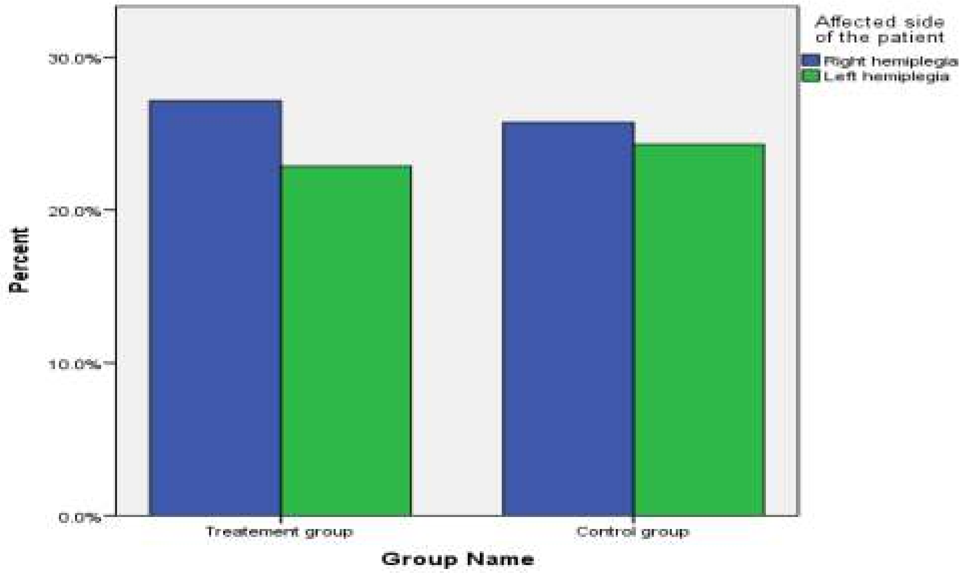

Figure 1: Comparison of site affected

Table 1 explains the paired comparisons regarding the pre and post upper arm functions (p value 0.000), pre and post hand movements check (p value 0.000) and pre & post advanced hand activities (p value 0.000).

Table 1: Pre and Post scale readings for the whole study sample (n = 70)

Scale		Mean	Std. Deviation	P Value
	Pre Upper Arm Function	2.50	1.176	< 0.001
	Post Upper Arm Function	4.83	.780	
	Pre Hand Movement	1.94	.740	
	Post Hand Movements	3.17	.932	< 0.001
	Pre Advance Hand Activities	1.64	.660	
	Post Advanced Hand Activities	2.20	.672	< 0.001

We also applied paired T test for the pre and post upper arm functions, hand movements and advanced hand activities individua lly for both treatment & control groups. The difference between both pre & post measurements of above mentioned scales was found statistically significant. Table 2 and Table 3

Table 2: Pre & Post comparison of scales in Treatment group (n = 35)

Scales		Mean	Std. Deviation	P Value
	Pre Uper Arm Function	1.74	.561	
	Post Uper Arm Function	4.69	.676	< 0.001
	Pre Hand Movement	1.66	.591	
	Post Hand Movements	3.26	.886	< 0.001
	Pre Advance Hand Activities	1.57	.608	
	Post Advanced Hand Activities	2.34	.639	< 0.001

Table 3: Pre & Post comparison of scales in Control group (n = 35)

Scales		Mean	Std. Deviation	P Value
	Pre Uper Arm Function	3.26	1.146	< 0.001
	Post Uper Arm Function	4.97	.857	
	Pre Hand Movement	2.23	.770	< 0.001
	Post Hand Movements	3.09	.981	
	Pre Advance Hand Activities	1.71	.710	0.04
	Post Advanced Hand Activities	2.06	.684	

Independent sample T test was applied to compare the mean different (i.e. difference between pre & post values of scales used) between treatment and control groups. In all the three scales used, we observed that the difference was statistically significant with regards to mean difference in the baseline & follow up values in all the parameters except advance hand activities.(Table 4)

Table 4: Comparison of mean difference of scales between both groups

Scales	Group Name	n	Mean	Std. Deviation	P Value
Difference b/w pre & post upper arm functions	Treatment group	35	2.9429	.80231	< 0.001
	Control group	35	1.7143	1.12646	
Difference b/w pre & post hand movements	Treatment group	35	1.6000	.81168	< 0.001
	Control group	35	.8571	.91210	
Difference b/w pre & post advanced hand activities	Treatment group	35	.7714	.91026	0.061
	Control group	35	.3429	.96841	

DISCUSSION

The aim of this research study was to find out the effectiveness of task-oriented physiotherapy in stroke subjects. RCT was conducted on 70 patients with stroke randomly allocated into two groups. 35 patients were allocated to the task-oriented physical therapy group (Treatment group) and 35 patients were allocated to conventional treatment (control group).

Task-oriented training originated from the science of movement and motor learning skills.[10] It is the training of patients using tasks for motor activities and in the end, getting some feedback from the patients.[11] This training is targeted at functional activities through goal-specific training and repetition. The purpose of this training is functional activities instead of limitations, i.e. muscle strengthening. Other terms used that reflect these elements are "repetitive task practice", "repetitive functional task practice", "task-related training", and "task-orientated therapy".[12,13,14]

The current study aimed to investigate the influence of a selected motor relearning program on the level of motor impairment of reaching patterns in stroke patients After a stroke, muscle weakness arises from two sources: mainly from the lesion itself, as a result of a decrease of falling entrances that converge on the final motor neuron population, and thus a reduction in the number of motor units available for recruitment. Since skeletal muscle adapts to the level of use that is imposed on it, secondary weaker sources arise due to a lack of muscle activity and immobility. Contrary to previous opinion, weakness in agonist muscles is not due to spasticity (reflex hyperactivity) in an antagonist muscle group but is a direct result of the reduction of descending motor commands, compounded by disuse and adaptive muscle changes.[15] The interruption of descending paths after stroke results in a decrease in the number of activated engine units, reduced speed of firing of engine units, and reduced synchronization of the motor unit. "These are the factors that cause disorganization of engine power at segment level and underlie the motor control problems that patients exhibit, even when they can generate some force".[16] Loss of muscular dexterity leads to loss of muscle coordination to fulfill the task and environmental requirements. Impaired dexterity has an association with slowness and weakness in the contraction of muscles, there is some evidence that they may be independent phenomena.[17] The most evidence in support of constraint plus intensive motor relearning and meaningful exercise and practice comes from studies of brain reorganization after stroke. Studies showed that there is an association between increased use of the affected limb, improved motor performance, and brain reorganization.[18] Strength training is necessary after a stroke to improve the force-generating capacity and efficiency of weak muscles and to improve functional motor performance. The relationship between strength and re-learning is complex. Motor activity may be improved after a cerebrovascular accident. The reason behind this improvement may be the recovery of functional neurons in the CNS. It can also occur by re-learning functions, "a process that strengthens existing pathways and can lead to new functional or structural changes (neuroplasticity)".[19] Cortical plasticity in humans can be identified by functional MRI. For example, the changes in the body site representation and excitability of the motor cortex have been identified following motor relearning techniques. Therefore, important contributors to functional outcomes are cortical plasticity and its manipulation.[20] In stroke, there is denervation of target neuron centers, which are self-organizing maps (SOMs) within the neuraxis. Compensatory reinnervation occurs within those SOMs by acquiring synaptic sprouts from neurons in the neighborhood. Cognitive systems studies indicate that motor paralysis is due to loss of learning. So treatment or rehabilitation should aim therefore to first restore this learning.[21]

The findings of this study were supported by Carr and Shepherd who said that, following a brain lesion affecting the motor system, an immediate need is to help the patient regain the ability to activate paretic muscles and generate force.[7] Task training involves many repetitions under constrained conditions as a means of increasing muscle contractility and strength and laying down a pattern of coordination. Repetitive exercise may be as critical to motor relearning following stroke as it is for healthy individuals learning to play the piano. It is assumed that repetitive practice of a particular movement may drive brain reorganization which appears to be a process of motor learning. However, repetitive practice of the same movement may not be sufficient for promoting skill. Also, our results were confirmed by clinical research that has shown that effort applied in strength training does not increase spasticity (reflex hyperactivity), associated movements, co-contraction, or resistance to passive movement. On the other hand, not only does strength training result in increased muscle strength following stroke, but also improved functional performance and decreased spasticity, for example, a decrease in resistance to passive movement, stretch reflex hyperactivity, and co-contraction. The evidence is mounting that repetitive, task-oriented strength training is effective following a stroke. It is also likely that practice and training, by improving aspects of motor control such as the timing of muscle activations, would result in decreased abnormal co-contraction. There seems little doubt that active exercise and training provoke efficacious changes in motor control.[7] This work also can be supported by Miller and Light who found that regular vigorous exercise has positive effects on muscle mass and strength, postural stability, prevention of falls, joint flexibility, and increase bone density in responses to exercise.[22] The avoidance of strength training in patients with muscle weakness who are also lacking in fitness is very likely, therefore, to have a significant negative impact on functional outcomes after stroke. Moreover, the findings of the current study agreed with the study of Chan et al., who carried out a study on 52 outdoor subjects with either a hemorrhagic or thrombotic cerebrovascular accidents who received 18 sessions in 6 weeks of either the conventional therapy program or motor relearning program and the effect was measured by the Berg Balance Scale and the Functional Independence Measure (FIM) The results showed that patients in the motor relearning group showed significantly better performance on all when compared with the control group. So, a motor relearning program or task-oriented training was found to be better for promoting recovery in terms of the function of cerebrovascular accident subjects. Both "chronological" and "functional-based concepts" are important in applying the "task-oriented training" or "motor relearning approach" to the rehabilitation of cerebrovascular accident subjects.[23] Also, it was indicated that physiotherapy with task-oriented strategies represented by a motor relearning program, is preferable to physiotherapy with facilitation/inhibition strategies, such Bobath program, in the rehabilitation of CVA patients.[24] Limitations of this study include a small sample size of 70 stroke patients, potentially limiting generalizability, and a lack of long-term follow-up, restricting the assessment of sustained effects. Larger sample sizes and longer-term evaluations are needed to strengthen the findings regarding the effectiveness of task-oriented physiotherapy in stroke patients.

CONCLUSION

The treatment group showed significant improvement in terms of functional outcomes as compared to the conventional group which reflects the effectiveness of MRP in the enhancement of upper limb motor activities in stroke patients as compared to CT.

REFERENCES

1.Duthey B. Priority Medicines for Europe and the World: A public health approach to innovation. WHO Background paper. 2013;6.

2.Nagaraja D, Gurumurthy S, Taly A, Subbakrishna K, Rao BS, Sridhararama RB. Risk factors for stroke: relative risk in young and elderly. Neurology India. 1998;46(2):183.

3.Hart CL, Hole DJ, Smith GD. Comparison of risk factors for stroke incidence and stroke mortality in 20 years of follow-up in men and women in the Renfrew/Paisley Study in Scotland. Stroke. 2000 Aug;31(8):1893-6.

4.Brogårdh C. Constraint Induced Movement Therapy: influence of restraint and type of training on performance and on brain plasticity. Samhällsmedicin och rehabilitering. 2006.

5.Langhammer B. Bobath or Motor Relearning Programme. Clinical Rehabilitation. 2001;15(4):446.

6.Bosch J, O'Donnell MJ, Barreca S, Thabane L, Wishart L. Does task-oriented practice improve upper extremity motor recovery after stroke? A systematic review. ISRN Stroke. 2014;2014.

7.Mansour WT, Elsayed E, Fayez ESM. Efficiency of Selected Motor Relearning Program on Electromyographic Activity of Reaching Pattern in Stroke Patients.

8.Bhalerao G, Kulkarni V, Doshi C, Rairikar S, Shyam A, Sancheti P. Comparison of Motor Relearning Program Versus Bobath Approach At Every Two Weeks Interval for Improving Activities of Daily Living and Ambulation in Acute Stroke Rehabilitation. International Journal of Basic and Applied Medical Sciences. 2013.

9.Chan DY, Chan CC, Au DK. Motor relearning programme for stroke patients: a randomized controlled trial. Clinical Rehabilitation. 2006;20(3):191-200.

10.Schmidt RA, Lee TD. Motor Control and Learning: A Behavioral Emphasis. Human Kinetics. 2005.

11.Teasell RW, Foley NC, Salter KL, Jutai JW. A blueprint for transforming stroke rehabilitation care in Canada: the case for change. Archives of physical medicine and rehabilitation. 2008;89(3):575-8.

12.French B, Leathley MJ, Sutton CJ, Mcadam J, Thomas LH, Forster A, et al. A systematic review of repetitive task training with modelling of resource use, costs and effectiveness. Health Technology Assessment. 2008;12(30):1-117.

13.Carr JHS, Roberta B. A motor relearning programme for stroke. 1982.

14.Bayona NA, Bitensky J, Salter K, Teasell R. The role of task-specific training in rehabilitation therapies. Topics in stroke rehabilitation. 2005;12(3):58-65.

15.Kawakami K, Tanino G, Tomida K, Kato Y, Watanabe M, Okuyama Y, et al. Influence of increased amount of exercise on improvements in walking ability of convalescent patients with post-stroke hemiplegia. Journal of physical therapy science. 2016;28(2):602-6.

16.Persson CU, Hansson P-O, Lappas G, Danielsson A. Physical Activity Levels and Their Associations With Postural Control in the First Year After Stroke. Physical Therapy. 2016;96(9):1389.

17.Gok H, Geler-Kulcu D, Alptekin N, Dincer G. Efficacy of treatment with a kinaesthetic ability training device on balance and mobility after stroke: a randomized controlled study. Clinical Rehabilitation. 2008;22(10-11):922-30.

18.Sutbeyaz ST, Koseoglu F, Inan L, Coskun O. Respiratory muscle training improves cardiopulmonary function and exercise tolerance in subjects with subacute stroke: a randomized controlled trial. Clinical Rehabilitation. 2010;24(3):240-50.

19.Mehrholz J. Effect of Constraint-induced Movement Therapy on Upper Extremity Function 3 to 9 Months after Stroke: The EXCITE Randomized Clinical Trial. Physioscience. 2007;3(2):89-90.

20.Shi YX, Tian JH, Yang KH, Zhao Y. Modified constraint-induced movement therapy versus traditional rehabilitation in patients with upper-extremity dysfunction after stroke: a systematic review and meta-analysis. Archives of physical medicine and rehabilitation. 2011;92(6):972-82.

21.Langhammer B, Stanghelle JK, Sunnerhagen KS, Khan CM, Oesch PR, Gamper UN, et al. Re: 'Potential effectiveness of three different treatment approaches to improve minimal to moderate arm and hand function after stroke—a pilot randomized controlled clinical trial'. Clinical Rehabilitation. 2012;26(8):758-60.

22.Kalra L, Dale P, Crome P. Improving stroke rehabilitation. A controlled study. Stroke. 1993;24(10):1462-7.

23.Ifejika-Jones NL, Harun N, Peng H, Noser EA, Grotta JC, Francisco GE. The interaction of aspiration pneumonia with demographic and cerebrovascular disease risk factors is predictive of discharge level of care in the acute stroke patient. American Journal of Physical Medicine & Rehabilitation. 2012;91(2):141-7.

24.Woodford HJ, Price C. Electromyographic biofeedback for the recovery of motor function after stroke. Stroke. 2007;38(6):1999-2000