



Effect of early physiotherapy intervention on hand function in acute stroke patients

¹Priyanka A Kale, ²Dr. Sharda Bhalerao, ³Dr. Neha Singh, ⁴Ruchita K Shah, ⁵Charmi C Mehta

^{1, 4, 5} BPT Intern, Dr. APJ Abdul Kalam College of Physiotherapy (PIMS), Loni, Maharashtra, India

^{2, 3} Assistant Professor, Department of Neuro-Physiotherapy, Dr. APJ Abdul Kalam College of Physiotherapy, PIMS Loni, Maharashtra, India

Abstract

Background: Reduced upper extremity function is one of the most common impairment after stroke and is associated with disruption to efficient and accurate reach and grasp function. These upper limb impairments include difficulty in moving and coordinating the arms, hands, and fingers, often resulting in difficulty carrying out daily activities such as feeding, dressing, and grooming. Hence, it is important to start with early Physiotherapy to improve hand function in acute stroke patients.

Materials and Methods: The study included 30 participants, which were categorized into two groups with 15 participants in each group. They were given conventional Physiotherapy along with additional hand exercises (Group A) and conventional Physiotherapy (Group B) for 7 days 2 session per day for 1 hour.

Result: Significant improvement was detected after the intervention in hand grip strength measured by Hydraulic Hand Dynamometer ($p < 0.0003$) and hand function measured by Jebsen Hand Function Scale ($p < 0.0194$) when compared between the groups.

Conclusion: Early Physiotherapy intervention was extremely significant in both the groups but when compared between the Groups, Group A (Experimental) showed more significant improvement in hand function in acute stroke patients.

Keywords: acute stroke, hand function, hydraulic hand dynamometer, jebsen hand function scale

Introduction

Stroke is defined by the World Health Organization (WHO) as a clinical syndrome consisting of “rapidly developing clinical signs of focal disturbance of cerebral function, lasting more than 24 hours or leading to death with no apparent cause other than that of vascular origin [1]. Stroke is one of the leading causes of death and disability in India. The estimated adjusted prevalence rate of stroke range, 84-262/100,000 in rural and 334-424/100,000 in urban areas. The incidence rate is 119-145/100,000 based on the recent population based studies [2]. Hemiplegia is a common effect of brain injury or stroke, which may have significant impact on upper limb function [3]. Three quarters of strokes occur in the region supplied by the middle cerebral artery. As a consequence, the upper limb will be affected in a large number of patients [4].

Reduced upper extremity function is one of the most common impairments after stroke and has previously been reported in approximately 70-80% of patients in the acute stage [5]. More than half of the people with upper limb impairment will still have problems many months to years after stroke [6, 7]. These upper limb impairments include difficulty in moving and coordinating the arms, hands, and fingers, often resulting in difficulty carrying out daily activities such as feeding, dressing, and grooming [6, 8]. Patients with initial arm impairment, have 50% problems with arm function four years post stroke [6, 9]. These arm motor impairments are associated with anxiety and poorer perception of health-related Quality of life and subjective well-being [6, 10-13]. This leads to secondary changes which includes adaptive changes to muscle

length, which result in alterations of the length-tension curve of the muscle [14, 18], joint stiffness and pain [15, 18], and muscle atrophy. When patients are unable to use their affected arm, they compensate either by using the intact arm more, which can lead to learned nonuse [16, 18], or by using the affected arm as best they can, by learning abnormal compensatory movement strategies in the process, which can be difficult to change later [17, 18]. It is associated with disruption to efficient and accurate reach to grasp function [19].

Functional recovery of the arm includes grasping, holding, and manipulating objects, which requires the recruitment and complex integration of muscle activity from shoulder to fingers [4]. Majority of recovery occurs within the first 3 to 6 months, but there is some disagreement over the importance and extent of later improvement [20-22]. There are varying degrees of spontaneous improvement in arm paresis over the first 6 months after stroke. The degree of improvement at 6 months is best predicted by the motor deficit at one month despite standard rehabilitative interventions in the ensuing 5 months [23]. Whilst a proportion of patients will recover some degree of useful function in their upper limb following a stroke, for many the limb effectively becomes a passive object to be cared for either by the individual themselves [3].

Approximately half of the patients remain permanently disabled despite the completion of rehabilitation. Deficits are especially prevalent in the hand, and these physical limitations directly affect activities of daily living (ADL). An important issue in hand rehabilitation in stroke patients has been, how to regain the best function. Since the improvement of hand

function is a major goal of stroke rehabilitation, it is important to identify appropriate measures to determine functional recovery.

There are numerous scales, assessments tools and tests that have been described to examine qualitative properties in patients with stroke [24]. Hand grip strength can be quantified by measuring the amount of static force that the hand can squeeze around a Hydraulic Hand Dynamometer [25]. The Jebsen Hand Function Scale is used to assess broad aspects of hand function commonly used in activities of daily living using standardized tasks. It was designed for children ages >6 years and adults who have impairments in the hand(s). It consist of tasks simulated activities of daily living. There are 7 items (subscales): writing, simulated page turning, picking up small common objects, simulated feeding, stacking checkers, picking up large light cans, and picking up large heavy cans. Scales for all items are times in second's Maximum time allotted for per subtests are 120 seconds [26].

Early predictors for hand function of the paretic limb should therefore inform treatment plans targeted at effective recovery and better prognosis. Rehabilitation protocols should be aimed at modifying neural plasticity to improve motor performance and maintain the interactions between them. Different approaches of hand exercises have been described and practiced for improving hand function in stroke. The key principles of stroke rehabilitation include accelerated early rehabilitation, a functional approach targeted at task-oriented activities and intense practice [24].

Hence, we hypothesized that early Physiotherapy is effective in improving hand function in acute stroke patients.

Material and Methodology

Research Design: The research design used for the study was experimental study

Source of Data: The source of data was patients admitted in Department of Medicine, Pravara Rural Hospital, PIMS, Loni, Taluka - Rahata, District- Ahemdnagar-413736, Maharashtra

Type of Data: The data was collected by the primary investigator

Place of Study: The study was conducted in Dr. A.P.J. Abdul Kalam college of Physiotherapy, Pravara Institute of Medical Sciences

Duration of Study: The study was conducted from August 2017 to November 2017

Intervention Period: Participants received training for 1 hour, 2 sessions/day for 1 week.

Participants: Both Males and Females were included for the study

Sample: The sample included participants who fulfilled the inclusion and the exclusion criteria and were willing to participate

Sample Size: The sample size was 30

Sampling Design: Convenient Sampling

Equipment: Hydraulic Hand Dynamometer

Selection Criteria

Inclusion Criteria: Healthy young individuals both Males and Females who were willing to participate within the age group of 40-80 years, acute stroke patients with involvement of middle cerebral artery, spasticity grade 1-2 according to Modified Ashworth Scale, intact cognitive function according to MMSE score >30 and ability to control sitting posture were included in the study.

Exclusion Criteria: Individuals with recurrent stroke any other musculoskeletal, cardiovascular and neurological condition affecting the hand function were excluded in the study.

Intervention

The 30 participants were divided in two groups, experimental and control group i.e. Group A and Group B respectively. They were evaluated for their hand function and grip strength using Hydraulic Hand Dynamometer. The participants in Group A received conventional Physiotherapy exercises and additional hand exercises and Group B received conventional Physiotherapy for 1 hour, 2 sessions/day for 1 week. The group A i.e. experimental group received hand exercises using peg board, theraputty, stress ball and table top exercises to improve grip strength and hand function. The conventional Physiotherapy exercises like active/passive range of motion exercises, strengthening exercises, weight bearing exercises, stretching for upper limb and hand were given.



Fig 1: Peg Board



Fig 2: Theraputty



Fig 3: Stress Ball



Fig 4: Table Top

Data analysis interpretation and result

Table 1: Demographic profile of all participants

Demographic Characteristics	
Age	40-80 years
Gender	Number Of Participants
Males	15
Females	15

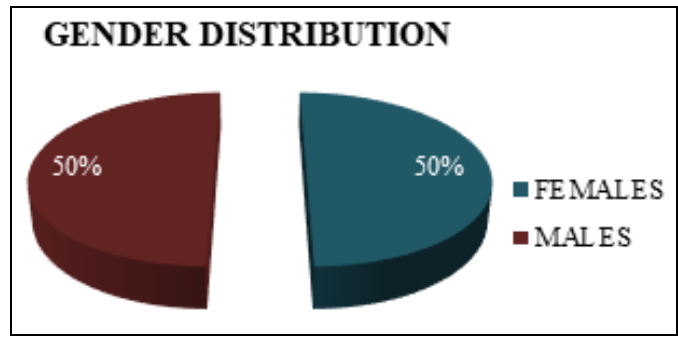


Fig 1: Represents demographic representation

Result no 1: The above pie diagram shows that there were 30 participants in which 15 were females and 15 were males

Table 2: Comparison of mean in pre and post intervention of Jebsen Hand Function Scale

JHFS	Mean ±SD		't' value	'p' value	Result
	Pre	Post			
Group A	134.06±47.130	82±27.534	9.542	<0.0001	Extremely Significant
Group B	105.66±17.759	91.4±14.401	4.599	<0.0001	Extremely Significant

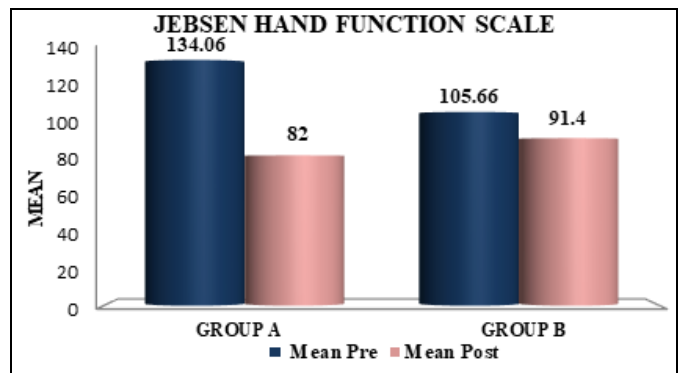


Fig 2: Represents comparison of mean in pre and post intervention of Jebsen Hand Function Scale

Result no 2: Comparison of mean values pre and post intervention using Jebsen Hand Function Scale showed t value for GROUP A 9.542 and t value for GROUP B 4.599 and p value <0.0001 for both groups which is extremely significant.

Table 3: Comparison of mean in pre and post intervention of Hydraulic Hand Dynamometer

HHD	Mean ±SD		't' value	'p' value	Result
	Pre	Post			
Group A	8±4.276	15.86±3.758	13.460	<0.0001	Extremely Significant
Group B	7.33±4.716	12.93±4.350	14.000	<0.0001	Extremely Significant

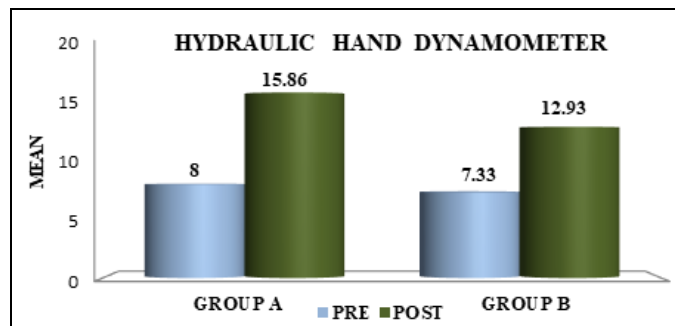


Fig 3: Represents comparison of mean in pre and post intervention of Hydraulic Hand Dynamometer

Result no 3: Comparison of mean values pre and post intervention using Hydraulic Hand Dynamometer showed t value for GROUP A 13.460 and t value for GROUP B 14.000 and p value <0.0001 for both groups which is extremely significant.

Table 4: Comparison of mean in post intervention using Jebsen hand function scale

JHFS	Mean ±SD	't' value	'p' value	Result
	Post			
Group A	82±27.534	2.480	0.0194	Considered Significant
Group B	103.26±18.576			

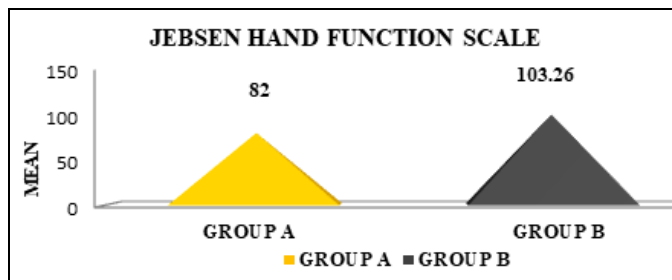


Fig 4: Represents comparison of mean in post intervention of Jebsen Hand Function Scale

Result no 4: Comparison of mean values post intervention using Jebsen Hand Function Scale showed t value 2.480 and p value <0.0194 for both groups which is considered significant.

Table 5: Comparison of mean in post intervention using Hydraulic Hand Dynamometer

	Mean ±SD	't' value	'p' value	Result
HHD	Post			
Group A	15.866±3.758	4.141	0.0003	Considered extremely Significant
Group B	9.733±4.334			

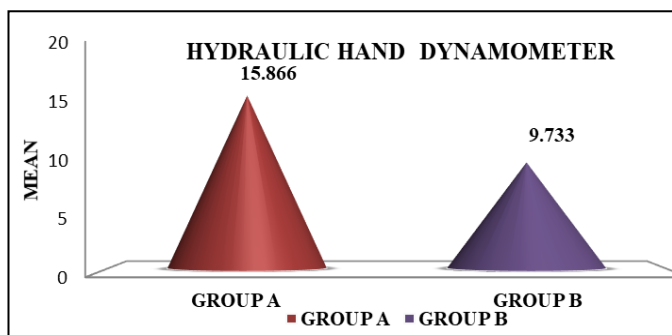


Fig 5: Represents comparison of mean in post intervention of Hydraulic Hand Dynamometer

Result no 5: Comparison of mean values post intervention using Hydraulic Hand Dynamometer showed t value 4.141 and p value < 0.0003 for both groups which is considered extremely significant

Discussion

The present study “Effect of Early Physiotherapy Intervention on Hand Function in Acute Stroke Patients” was conducted in Pravara Rural Hospital and department of Neuro-Physiotherapy of Dr. A. P. J. Abdul Kalam College of Physiotherapy; Loni, Taluka Rahata, District Ahmednagar, Maharashtra, India. Thirty (30) participants were included in this study. The pre-post values were assessed by using Hydraulic hand dynamometer and Jebsen hand function scale. The main purpose of this study was to find out the effect of early Physiotherapy intervention in improving hand function in stroke patients. In this study 15 participants were given conventional as well as additional hand exercises and other 15 participants were given conventional Physiotherapy exercises. The effectiveness between experimental (GROUP A) and control group (GROUP B) was evaluated using the Paired ‘t’ test to compare mean pre and post values of both groups and

Unpaired ‘t’ test to compare mean post values between two groups. The result showed that early Physiotherapy intervention i.e., conventional exercises along with additional hand exercises for 1 hour, 2 sessions/day for 1 week was effective in improving hand function in acute stroke patients. The current study showed that the early Physiotherapy intervention given to both the groups was effective irrespective in terms of reduced hand function and hand grip strength, irrespective of the treatment which was conventional and additional hand exercises. However, Experimental group (Group A) showed extremely significant improvement as compared to control group (Group B) in overall outcomes. These results emphasize the potential beneficial effect of therapeutic interventions for the hand

Conclusion

The present study concluded that Early Physiotherapy Intervention for 1 week with 2 sessions per day for 1 hour is extensively effective in improving hand function, hand grip strength and activities of daily living by increasing the coordination during reach and grasp in acute stroke patients.

References

1. Parmar P, Sumaria S, Hashi S. CLINICAL FOCUS-STROKE-Classification and diagnosis. Clinical Pharmacist. 2011; 3(7):200.
2. Pandian JD, Sudhan P. Stroke epidemiology and stroke care services in India. Journal of stroke. 2013; 15(3):128.
3. Ashford S, Slade M, Malaprade F, Turner-Stokes L. Evaluation of functional outcome measures for the hemiparetic upper limb: a systematic review. Journal of rehabilitation medicine. 2008; 40(10):787-95.
4. Feys HM, De Weerd WJ, Selz BE, Steck GA, Spichiger R, Vereeck LE *et al.* Effect of a therapeutic intervention for the hemiplegic upper limb in the acute phase after stroke. Stroke. 1998; 29(4):785-92.
5. Persson HC, Parziali M, Danielsson A, Sunnerhagen KS. Outcome and upper extremity function within 72 hours after first occasion of stroke in an unselected population at a stroke unit. A part of the SALGOT study. BMC neurology. 2012; 12(1):162.
6. Pollock A, Farmer SE, Brady MC, Langhorne P, Mead GE, Mehrholz J *et al.* Interventions for improving upper limb function after stroke. The Cochrane database of systematic reviews. 2013, 11.
7. Franceschini M, La Porta F, Agosti M, Massucci M. Is health-related-quality of life of stroke patients influenced by neurological impairments at one year after stroke?. European journal of physical and rehabilitation medicine. 2010; 46(3):389-99.
8. Wyller TB, Sveen U, Sjødring KM, Pettersen AM, Bautz-Holter E. Subjective well-being one year after stroke. Clinical rehabilitation. 1997; 11(2):139-45.
9. Sveen U, Bautz-Holter E, MARGRETHE SODRING KA, BRUUN WYLLER TO, Laake K. Association between impairments, self-care ability and social activities 1 year after stroke. Disability and rehabilitation. 1999; 21(8):372-7.
10. Nakayama H, Jørgensen HS, Raaschou HO, Olsen TS. Recovery of upper extremity function in stroke patients:

- the Copenhagen Stroke Study. *Archives of physical medicine and rehabilitation*. 1994; 75(4):394-8.
11. Langhorne P, Legg L. Evidence behind stroke rehabilitation. *Journal of Neurology, Neurosurgery & Psychiatry*. 2003; 74(suppl 4):iv18-21.
 12. Lai SM, Studenski S, Duncan PW, Perera S. Persisting consequences of stroke measured by the Stroke Impact Scale. *Stroke*. 2002; 33(7):1840-4.
 13. Broeks GJ, Lankhorst GJ, Rumping K, Prevo AJ. The long-term outcome of arm function after stroke: results of a follow-up study. *Disability and rehabilitation*. 1999; 21(8):357-64.
 14. Gossman MR, Sahrman SA, Rose SJ. Review of length-associated changes in muscle: experimental evidence and clinical implications. *Phys Ther*. 1982; 12:1799-1808.
 15. Caillet R. *The Shoulder In Hemiplegia*. Philadelphia, Pa: Davis, 1980.
 16. Taub E. Overcoming learned non-use: a new approach to treatment in physical medicine. In: Carlsoson JG, Seifert AR, Birbaumer N, eds. *Clinical and Applied Psychophysiology*. New York, NY: Plenum Press; 1994, 185-220.
 17. Carr J, Shepherd R. *A Motor Relearning Programme For Stroke*. 2nd ed. Oxford, UK: Heinemann Medical, 1987.
 18. Lincoln NB, Parry RH, Vass CD. Randomized, controlled trial to evaluate increased intensity of physiotherapy treatment of arm function after stroke. *Stroke*. 1999; 30(3):573-9.
 19. Pelton T, van Vliet P, Hollands K. Interventions for improving coordination of reach to grasp following stroke: a systematic review. *International Journal of Evidence- Based Healthcare*. 2012; 10(2):89-102.
 20. Skilbeck CE, Wade DT, Hewer RL, Wood VA. Recovery after stroke. *Journal of Neurology, Neurosurgery & Psychiatry*. 1983; 46(1):5-8.
 21. Andrews K, Brocklehurst JC, Richards B, Laycock PJ. The rate of recovery from stroke-and its measurement. *International rehabilitation medicine*. 1981; 3(3):155-61.
 22. Bard G, Hirschberg GG. Recovery of voluntary motion in upper extremity following hemiplegia. *Archives of physical medicine and rehabilitation*. 1965; 46:567.
 23. Krakauer JW. Arm function after stroke: from physiology to recovery. In *Seminars in neurology* Copyright© 2005 by Thieme Medical Publishers, Inc., 333 Seventh Avenue, New York, NY 10001, USA, 2005; 25(04):384-395.
 24. Gündüz OH, Bayindir Ö. *Hand Function in Stroke*. In *Hand Function*. Springer New York, 2014, 107-114.
 25. Massy-Westropp NM, Gill TK, Taylor AW, Bohannon RW, Hill CL. Hand grip strength: age and gender stratified normative data in a population-based study. *BMC research notes*. 2011; 4(1):127, 2014, 107-114
 26. Poole JL. Measures of hand function: Jebsen Hand Function Test (JHFT). *Arthritis care & research*. 2011; 63(S11).