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Original Research Article

Effect of Unimanual Versus Bimanual Training on Impairment, Disability and Quality of Life Among Post Stroke Individuals: A Comparative Study

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ABSTRACT

Background: Stroke is a significant global health issue caused by sudden interruptions in blood flow to the brain, leading to neurological dysfunction that can result in ischemic or hemorrhagic conditions. Effective rehabilitation approaches, such as unilateral and bilateral training, play a vital role in restoring upper limb function and overall recovery through targeted neural adaptations. Evaluation tools like the (SIS) provide critical insights into post-stroke recovery and improvements in quality of life, underscoring the need for comprehensive care and early intervention in managing this complex medical condition.

Aim: To find out the effectiveness of unimanual and bimanual training on impairment, disability, and quality of life among post stroke individuals.

Study design: comparative study

Method: Firstly, ethical clearance was taken from the committee for comparative study. Samples were collected by lottery allotment sampling method. Thirty participants were selected based on inclusion and exclusion criteria. The details of the treatment were explained and written consent was taken from the participants. Experimental group treated with unimanual training and bimanual training for 5 days a week for 4 weeks.

Outcome measure: Stroke impact scale

Results: Data was analysed using SPSS Version29. According to statistical analysis, improvement seen in group B compared to group A.

Conclusions: Bimanual training showed greater effective in impairment, disability and quality of life compared to unimanual training.

KEYWORDS: Bimanual training, Unimanual training, stroke impact scale, quality of life, stroke.

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INTRODUCTION

"Rapidly evolving clinical manifestations of a global or focal impairment of neurological function, with manifestations lasting 24 hoursor more or resulting in deaths, with no apparent cause other than of vascular origin," according to the World Health Organization (WHO) define the condition known as stroke [1].

Stroke is a medical emergency that can result in death, complications, and irreversible brain damage [2].

Strokes disrupt circulation to the brain and leads to death of cells that impair body functions resulting in death [3].

A stroke is described as an abrupt beginning of neurological dysfunction brought on by a disruption in cerebral circulation, with accompanying manifestations that indicate involvement of specific brain regions. This may be the result of a hemorrhage or ischemia, which is a lack of blood supply brought on by thrombosis or embolism [2].

According to epidemiological studies conducted in 2013, India has a stroke incidence rate of 147 to 922 per 100,000 people. Due to motor impairment of the afflicted upper extremity, 70%–80% of stroke survivors have reduced activities of daily living (ADLs) [4].

The most prevalent deficit following a stroke is impairment in upper limb motor function, impacting about 75% of patients [5].

One of the main causes of functional impairments and a decline in the standard of living for individuals in developed nations is stroke. For example, it is widely known that even after several months of rehabilitation, monohemispheric cerebral vascular accident (CVA) causes significant chronic restrictions of upper-limb use and manual dexterity, among other disorders. Specifically, it has been demonstrated that CVA-induced spasticity causes a notable slowing down of unimanual motions, changes multipoint coordination, and reduces the smoothness and segmentation (multiple peak velocity) of reaching and grasping actions. Additionally, in the (apparently intact) ipsi-lesional leg, there has been a decline in muscle strength, a slowing down, and impaired dexterity. Since most activities of daily living involve using both hands, bimanual coordination impairments brought on by CVA lesions present an extra challenge for stroke patients [6].

The majority of people who survive a unilateral stroke have lifelong disabilities, to operate their opposite side's muscles. Particularly, important daily tasks requiring bimanual coordination, like driving or buttoning a shirt, are severely impacted by impairments in the motor and sensory functions of the contralesional upper limb (UL), which stroke victims learn to compensate for by using their nonparetic hand more frequently. After a stroke, regaining bimanual coordination is crucial to getting better at daily tasks [7].

Unilateral motor training and bilateral motor training are two prominent rehabilitation techniques used currently. Training aimed at the afflicted limb alone is known as unilateral training [5].

Strong ipsilateral activation was seen during sequence and chord motions, with the left hemisphere exhibiting particularly high activation during left-hand movements. Both right-handed and, to a lesser extent, left-handed people showed this trend. The tapping condition resulted in less noticeable ipsilateral activation [8].

Participants engaged in a variety of unimanual motions. In the initial trial, subjects had to move in three different ways. A single finger has to be moved repeatedly to complete one task. Creating movement sequences with four fingers was needed for a second task. Three-finger key presses, similar to playing chords on the piano, were required for each response in a third task that was created to be as difficult as the sequence task but without its sequential elements [8].

Practicing to use both hands simultaneously to grip and move an object while using each hand for a separate task is known as bimanual practice [2].

Bimanual training has been shown recently to be a potential tool that can improve stroke patients' functional upper limb recovery [6].

A proposed therapy for the rehabilitation of the paretic arm's motor function and restoration of a normal quality of life is bimanual training [9].

The term "bilateral muscle training" (BMT) refers to a variety of bilateral training methods that all involve using both upper limbs simultaneously during recovery. Three primary points served as the foundation for advanced arguments supporting BMT: 1) the presence

of neurally-mediated dependencies between limbs; 2) interhemispheric interactions and bimanually triggered activation of similar neural distributed networks in both hemispheres; and 3) evidence of training-related brain plasticity. Facilitating and enhancing the paretic limb's rehabilitation has been the main goal of BMT techniques [6].

Bimanual training is just as effective as other forms of treatment for upper limb deficits and activity restrictions [3].

Bimanual symmetric (BS) tasks (folding a towel, putting on a hat) and bimanual asymmetric (BA) tasks (unscrewing a bottle cap, stirring marbles in a bowl) were among the tasks. Two unimanual (Uni) tasks were reaching for a bottle and reaching across midline for a spoon [8].

There are literature which proves the effect of unimanual and bimanual task on hand function, isometric contraction, handiness, ipsilateral motor activation, sensory motor activation, however, there is limited literature showing the effect of unimanual task on disability, impairment, and quality of life among post stroke individuals.

The Stroke Impact Scale (SIS) is a self-report questionnaire designed specifically for assessing quality of life following a stroke in related to health and disability [12].

In eight domains—strength, memory and cognition, emotion, communication, (instrumental) activities of daily living (ADL/IADL), mobility, hand function, and participation—it evaluates the self-reported impact of stroke [12]. Furthermore, general perceived recovery since the stroke's beginning is measured using a visual analogue scale with a range of 0 to 100.Each domain's items are all rated on a Likert scale ranging from 1 to 5. Except for three questions from the emotion domain (3f, 3h, and 3i), higher item scores indicate a lower amount of difficulty experienced with the task. To calculate the emotion domain score, the scores for these three item scores should be reversed (6 - item score) [12].

MATERIALS AND METHODOLOGY

Type Of Research - Interventional study

Study Design - Comparative study.

Sample Design - Convenient sampling.

Study Population - Post stroke individual.

Sample Size - 30 participants

[Group A -15 participants, Group B – 15 participants]

Group A - Unimanual training.
Group B - Bimanual training.

Study Setting -[Center across visnagar]

Nootan collage of physiotherapy, sankalchand Patel University, visnagar – 384315

Rotary club, visnagar.

Dr. Deep's advance physiotherapy and fitness, visnagar.

Niramaya physiotherapy center, visnagar.

Study Duration –6 months.

Treatment Duration - 4 weeks.

Materials Required

· Pen
· Paper
· Laptop
· Consent form
· Stroke impact scale questionnaire
· Armrest and backrest Chair
· Assessment paper
· Table
· Two glasses
· Bowl
· Bottle
· Spoon
· Shirt
· Rajma
· Water
· Towel

Outcome Measures: Stroke impact scale

Sampling Procedure: This research was accepted by the ethical committee of nootan collage of physiotherapy, sankalchand Patel University, visnagar. Participants were selected based on criteria (Inclusion & Exclusion criteria). The whole procedure was clearly explained to all the participants and their consent was taken and use a convenience sampling method divided the 30 participants into two groups.

Data Collection Procedure: The research was done after approval by the ethical committee of nootan collage of physiotherapy. We had

included individual who is diagnosed with stroke by neurophysician.

First, all participants was asked about the study processes and the participants will be asked to give their written consent and permit participation in this study. Then, the exercise would be demonstrated on a model for a better understanding for the patient.

The study population was 30 participants who are suffering from stroke.

The participants were selected on the basis of the inclusion and exclusion criteria.

The participants were randomly allocated (Lottery method) into two groups:

Group A (n =15) with unimanual training and group B (n = 15) with bimanual training.

Before intervention and end of 4 weeks of intervention, the patient was undergone evaluation with help of stroke impact scale.

Intervention:

Unimanualtraining

Duration: 1 hour, 5 days a week for 4 weeks.

Patient position: Patient is sitting on chair.

Therapist Position: Besides of the patient.

Procedure:

The therapist begins by explaining the entire procedure to the patient. First, the patient holds a spoon and uses it to scoop out dry rajma. Second, they hold a glass and drink the water. Third, the patient grasps the glass and attempts to supinate the forearm. Fourth, they reach for a bottle and reach across the mid-line for a spoon. Lastly, they attempt to wipe the table. Each task is practiced for five min-utes in two sessions.

Bimanual Training:

Duration: 1 hour, 5 days a week for 4 weeks.

Patient Position: Patient is sitting on chair.

Therapist Position: Besides of the patient.

Procedure: The therapist begins by explaining the entire procedure to the patient. First, the patient holds one cup with their unaffected hand, initially filled with water, and another cup with their affected hand, both hands held up on the table. They're instructed to pour the water from the non-affected hand to the affected hand, then from the affected hand to the non-affected hand. Second, the patient folds the towel lengthwise and is asked to roll it with both hands up to the towel's end. Third, the patient attempts to button a shirt. Fourth, they try unscrewing a bottle lid. Lastly, they attempt to fold laundry. Each task is practiced for five minutes in two sessions.

Bimanual Training:

Duration: 1 hour, 5 days a week for 4 weeks.

Patient Position: Patient is sitting on chair.

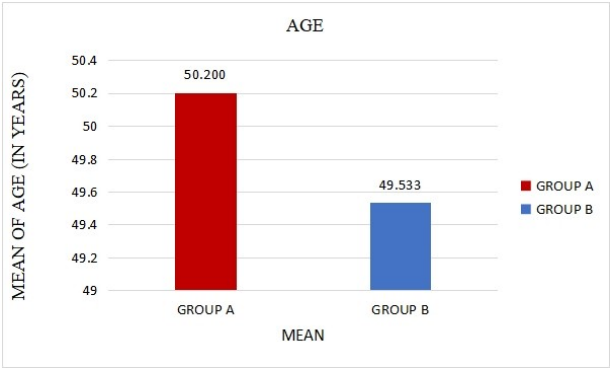
Therapist Position: Besides of the patient.

Procedure: The therapist begins by explaining the entire procedure to the patient. First, the patient holds one cup with their unaffected hand, initially filled with water, and another cup with their affected hand, both hands held up on the table. They're instructed to pour the water from the non-affected hand to the affected hand, then from the affected hand to the non-affected hand. Second, the patient folds the towel lengthwise and is asked to roll it with both hands up to the towel's end. Third, the patient attempts to button a shirt. Fourth, they try unscrewing a bottle lid. Lastly, they attempt to fold laundry. Each task is practiced for five minutes in two sessions.

RESULT & INTERPRETATION

Table 1: Mean age of participants in Group A and Group B.

Demographic Details		Group A	Group B
Age	Mean	50.2	49.533
	SD	±5.821	±5.488

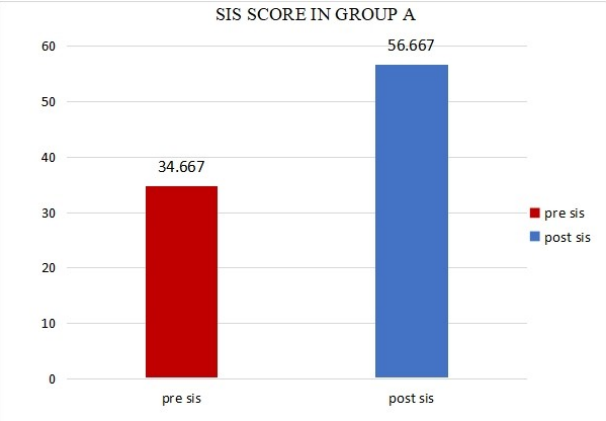


Mean Age of participants in Group A and Group B: The mean age of participants in Group A (50.20 years) and Group B (49.53 years) show that the two groups are generally

similar in age, despite a slight numerical difference.

Table 2: Intragroup comparison of pre and post- treatment SIS(stroke impact scale) for Group A:

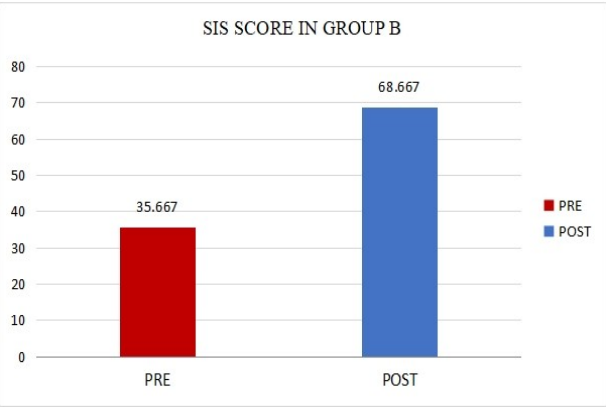
Outcome	Pre-Treatment		Post-Treatment		t-value	p-value
	Mean	SD	Mean	SD		
SIS	34.667	5.164	56.667	4.879	23.129	0



Intragroup comparison of pre and post-treatment SIS(stroke impact scale) for Group A: An intragroup comparison of pre-post-treatment SIS Score in Group A, where the p-value is < 0.05. A statistically significant difference was found between the pre and post-treatment SIS scores, with a significant improvement in SIS scores after treatment.

Table 3: Intragroup comparison of Pre and Post-Treatment SIS (stroke impact scale) for Group B

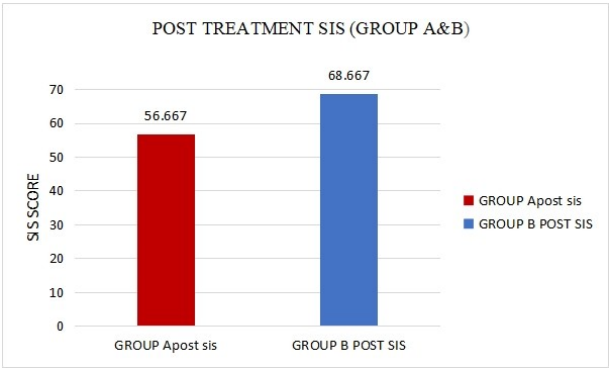
Outcome	Pre-Treatment		Post-Treatment		t-value	p-value
	Mean	SD	Mean	SD		
SIS	35.667	6.114	68.667	6.227	40.417	0



Intragroup comparison of pre and post-treatment SIS(stroke impact scale) for Group B: An intragroup comparison of pre-post-treatment SIS Score in Group B, where the p-value is < 0.05. A statistically significant difference was found between the pre and post-treatment SIS scores, with a significant improvement in SIS scores after treatment.

Table 4: Inter-group comparison of Post-Treatment SIS (stroke impact scale)

N = 30	Group A (Mean ± SD)	Group B (Mean ± SD)	t-value	p-Value
SIS	56.667±4.87	68.667±6.114	44.238	0



Inter-group comparison of SIS (stroke impact scale): An inter-group comparison of SIS after 4 weeks. A statistically significant difference ($p<0.05$) in SIS Score was found between Groups A and B groups after 4 weeks.

DISCUSSION

Stroke is a debilitating condition that significantly impacts the daily activities and functional abilities of survivors. Upper limb impairment is frequently observed in most individuals affected, requiring an extended period for rehabilitation and recovery.

To find out the effectiveness of unimanual and bimanual training on impairment, disability, and quality of life among post stroke individuals.

The study was conducted to identify the effect of unimanual versus bimanual training on impairment, disability, and quality of life among individuals post-stroke, specifically those aged 35 to 60 years.

For our study, we divided the 30 participants into two groups, Group A (unimanual training) and Group B (bimanual training), each containing 15 individuals. We used a convenience sampling method based on the inclusion and exclusion criteria. Following that, a general physical examination and demographic information were used to evaluate each participant. In this study, pre- and post-outcome measures were assessed using the Stroke Impact Scale. This procedure applied to both group A and group B.

In the study, the Stroke Impact Scale questionnaire was used as an outcome measure. The result showed significant changes in pre and post treatment stages.

According to Dr. Harpreet singh et al for recovery of functional motor performance, unimanual training appears less beneficial than bimanual practices [2].

In our study, the mean ages of participants in Group A (50.2 years) and Group B (49.53 years) show that the two groups are generally similar in age, despite a slight numerical difference.

In our study, the gender distribution within the groups shows a marked difference; Group A has a higher proportion of male participants (6 females to 9 males) compared to Group B (8 females to 7 males).

In our study, before receiving unimanual training, the patients (SIS score 34.667); following treatment, the patients SIS score was 56.667.

In our study, before receiving bimanual training, the patients (SIS score 35.667); following treatment, the patients SIS score was 68.667.

On the basis of our result, the effect of unimanual versus bimanual training on impairment, disability, and quality of life among individuals post-stroke. Thus, the alternative hypothesis is accepted.

CONCLUSION

The study demonstrated that bimanual training, involving the simultaneous use of both hands, was significantly more effective in reducing impairment and disability, as well as enhancing quality of life, compared to unimanual training alone. it was found that unimanual training alone may not sufficiently improve bilateral coordination. Consequently, the findings suggest that upper limb rehabilitation programs should integrate bimanual techniques to effectively achieve task-related goals and optimize functional outcomes.

Limitation of the study: The study's small sample size of 30 participants, with 15 in each group (unimanual Group, n = 15 and bimanual Group, n = 15), limits its ability to generalize findings to the entire stroke population, necessitating cautious interpretation of the results. Another limitation is that longer follow-up of stroke patients is needed.

Future recommendations of the study: The present study acknowledges that future studies are required to enable a better understanding of the effect of unimanual and bimanual training along with conventional therapy for post stroke patients. For future studies, a large sample size can be taken.

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Conflicts of interest: **None**

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