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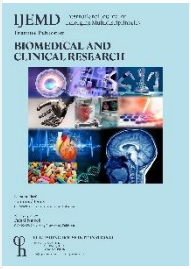

In Chronic Stroke, The Effect of Action Observation And An Accelerated Skill Acquisition Program- An Experimental Study

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Abstract

Action observation therapy is comprised of action observation session which is followed by repeating the action performed by the patient. Action observation performed by others activates motor cortex which is attributed to the function of mirror neuron system (MNS). Accelerated skill acquisition program (ASAP) is a modern motor training method that combines motivation, skills, and capacity. The objective of this study is to find the effect of action observation execution and Accelerated Skill acquisition Program enhancing the function of upper extremity in chronic stroke. Experimental Design**,** study type is Pre and post test and sample method is convenient Sampling. Participants comprising of 30 subjects divided into Group A and B. Group A received Action observation therapy and Accelerate skill acquisition program along with conventional therapy and Group B or the control group received conventional physiotherapy. Department of Physiotherapy. Modified Sphygmomanometer, Wolf Motor Function Test and Fugl Meyer Assessment. The mean pre-test(143.8) and post-test value (166.73) of MSM ($p<0.05$) shows statistical significance in grip strength in Group A. The mean pre-test (35.133) and post-test (50.5333) values of WOLF ($p<0.05$) shows statistical significance in improving hand motor ability in Group A subjects. Mean pre-test (16.333) and post-test values (19.73) ($p<0.05$) shows statistical significance in increased hand function in GROUP A. This study concludes that Action observation execution combined with accelerated skill acquisition program has an effect on improving hand function when assessed on Fugl Meyer Assessment, Wolf motor function test and Modified Sphygmomanometer.

Keywords: Accelerated Skill Acquisition Program, Action Observation Therapy, Chronic Stroke, Conventional Therapy, Physiotherapy.

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1. Introduction

A stroke is a disease in which the oxygen and nutrients supplied to the brain are blocked, causing brain tissues to be damaged and, in severe cases, leading to death [1]. The most common type is middle cerebral artery syndrome, which has a greater impact on the upper extremity (UE) than the lower extremity (LE) [2]. Around one-third of stroke survivors have significant motor deficits in the acute stage, while the other half has some degree of physical impairment [3].

The MCA is the largest of the three major arteries that supply the brain with oxygen and nutrients. It provides blood to the frontal, temporal, and parietal lobes' lateral (side) portions. The sensory functions of the arms, throat, hands, and face are controlled by the frontal, temporal, and parietal lobes. Functional disabilities caused by MCA stroke include paralysis, coordination problems, Memory problems and abnormal muscle tone, all of which impair the body's functional movements and reduce the motor ability of the paralyzed arm, causing difficulties with daily living activities [4]. A loss or restriction of function in muscular control, movement, or mobility is classified as a motor impairment [5].

Because paresis, or muscle weakness, is recognized as a major factor in stroke-related disorders, muscle strengthening and endurance exercise are commonly recommended [6]. Exercise programs should begin early, be vigorous, and be planned with the active participation of patients to increase motor learning and minimize functional deficits [7]. Several neuro-rehabilitative therapies have been proposed to treat motor weakness following a stroke [8].

According to previous study, mental rehearsal and simple observation, as well as actual execution, recruit the motor regions of the human brain [9]. Neural activities associated with the observation are elicited in the motor related cortical region. It gets activated during motor perception and constitutes of mirror neuron system. The mirror neuron system gets activated on performing purposeful goal oriented activities.

The hypothesis that seeing others' actions can activate cortical areas involved in motor execution is supported by evidence, which is attributed to the mirror neuron system's function (MNS). During action observation (AO) and execution, the MNS is a sort of neuronal substrate that discharges (AE). The MNS is also associated with a number of human tasks, including motor planning, motion imitation language, and emotion identification. An AO session is usually followed by a session of mimicking the observed activity in AOT [10].

Reaching, gripping, transferring, and maybe manipulating an object, for example, before releasing the grip. After each watched activity, patients physically do the same action, and sessions are repeated every day. In ischemic stroke patients, AO therapy can result in considerable gains in upper limb movement over a four-week period, according to studies [11].

In stroke patients, mirror neuron activation paired with a traditional stroke physiotherapy programme improves lower-extremity motor recovery and motor performance. In chronic stroke patients, a six-month exercise programme with AO improved functional recovery and functional use of a damaged upper limb. In chronic stroke patients, exercises with action observation showed promise in rehabilitating the damaged upper limb. (Angela Cristina de Lim et.al 2020 Reaching and grasping are both performed by the upper extremity, and disease affecting one frequently affects the other (Shumway-Cook & Woollocott, 2012). Delayed movement times, loss of capacity to adjust to changing task demands, and slower reaction times are all examples of motor control issues [12].

According to the Copenhagen Stroke Study, 32% of stroke patients had severe arm paresis at the time of admission, whereas 37% had mild paresis. Despite extensive rehabilitation, the arm remained completely non-functional in 13% of cases (Foley et al., 2013) [14]. The MCA is the largest and most commonly injured cerebral artery in cerebrovascular accidents [14]. The MCA is the largest of the three main arteries that supply the brain with oxygen and nutrients. The sensory functions of the arms, throat, hands, and face are controlled by the frontal, temporal, and parietal lobes [15]. In comparison to either AO or MI instructions alone, there is now solid evidence that combined AO + MI instructions elicit greater activity in motor areas of the brain (Jonathan R. Emerson, 2018).
AO is a method of systematic observation in which the brain uses the mirror neuron system to match a seen action to its muscular counterparts (MNS) [16]. It is accomplished by task-oriented training, greater capacity through impairment reduction, and increased self-confidence through the patient's active participation in task selection, problem solving, and decision-making.

Aim Of The Study: To find the Effect of Action-Observation-Execution and Accelerated Skill Acquisition Program Enhancing Function in chronic Stroke.

Need for the Study: There is a lack of studies in finding the Effect of Action Observation Execution and Accelerated Skill Acquisition Program Enhancing Function in chronic Stroke. There are only few studies done on the Effect of Action Observation Execution and Accelerated Skill Acquisition Program Enhancing Upper Extremity Function. So this study is to find the effect of both AOE and ASAP in chronic stroke.

Materials and Method

Participants and data source: The data were collected by using an outcome measures Modified Sphygmomanometer (MNS), Wolf Motor Function Test and Fugl Meyer Assessment. Experimental research design was used with Pre and post test. The study was conducted in MGM School of Physiotherapy, MGM Medical College and Hospital, Aurangabad, Maharashtra, India – 431005. Population of the Study was 30 Subjects, with Duration of the Study 6 weeks for intervention and overall 10 month to complete the entire study. Non probability purposive sampling technique was used for sample collection.

Inclusion Criteria: All the Subjects with age group of 45 to 65, both male and female who are affected with middle cerebral artery for more than 6months were included.
Exclusion Criteria: Subjects with visual neglect, hemi spatial neglect, severely restricted movement in shoulder and elbow, sensory loss, cognitive impairment, were excluded.
Outcome Measures: The outcome measures used were Modified Sphygmomanometer (MNS), Wolf Motor Function Test and Fugl Meyer Assessment.

Procedure: Informed consent was taken from the subjects before the study. Subjects were taking under no.1 were assigned to Group A (n=15), and those falling under no.2 were assigned to Group B (n=15). Physical examination and vital signs was assessed for all the subjects before the study. Intervention was performed 6 weeks that is one session per day for 4 days in a week. The subjects were evaluated using

Modified Sphygmomanometer for grip strength, Fugl-Meyer Assessment of Sensorimotor Function for motor activities of hand, wolf Motor Function Test for motor ability of hand before and after intervention.

Group A Intervention: Group A received Action Observation Execution, Accelerated Skill Acquisition Program and conventional physiotherapy.

Action Observation Execution: In this, patients were asked to sit comfortably on the chair at a distance of 2 meters away from laptop screen and place their affected arm on a table. During the presentation of a video clip, patients were asked to sit relaxed in front of the laptop screen and observe it. Before therapy the task was explained to the subjects and the subjects are asked to carefully observe the action, and asked to pay attention to the details of presented actions (tasks). A video of Flexion and extension of wrist, ulnar deviation, movements of fingers, catch and release of small bottle, screwing of a narrow-mouthed bottle cap, grasping and release of a spoon are recorded from straight angle, superior, medial and lateral view was shown to patients and asked to observe. In 12min of video observation, each motor act is divided into 4 stages; 3 min for each of the motor act stage, each stage of action is shot from straight angle, superior medial and lateral view. Subject observes totally 12 minutes of video for a complete motor action and then the video is stopped and the patient is asked to perform the same action for 8 minutes dividing each motor act into 2 minutes. Objects utilized in the video clip were available during the execution phase to facilitate the process. During the execution phase, the patients were instructed to perform the observed motor act to the best of their abilities. They were told, however, that the treatment focuses on observing the action rather than executing it. As a whole, AOE rehabilitation session takes half an hour for a task. The training session was conducted 4 days a week for 6 weeks.

ACTION OBSERVATION EXECUTION PROTOCOL

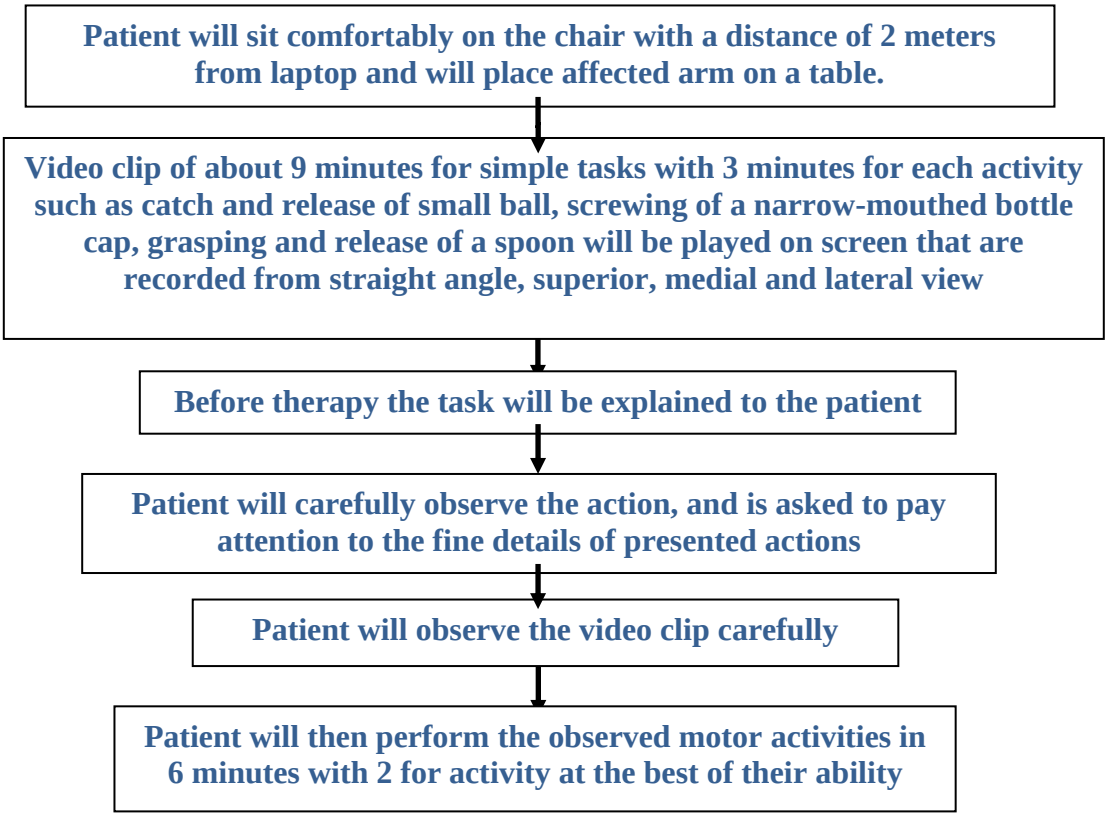

Diagram (flowchart) 1: showing protocol for action observation execution

Accelerated Skill Acquisition Program: Subjects were told about task regarding their involvement with therapist during the task and the subjects were asked to do the tasks in the way therapists explains them to do through active participation. Subjects are given a task and in that performance level is checked to determine key impairments like movement restrictions and inability to perform the task are noted and movement break down points like subject cant able to perform the whole movement at once are noted, rest breaks was taken to complete the task are also noted down.

Conventional Therapy: Conventional therapy included sensory motor re-education, active and passive range of motion exercises for hand, weight bearing exercises, muscle strengthening exercises, mobility training. Conventional therapy was conducted for 1hour per session, 4 day a week for 6 weeks.

Group B Intervention: For Group B Conventional Therapy was administered as explained earlier in Group A procedure.

Statistical Analysis: The raw data from 30 subjects was used to compute and assess the responses frequency. The collected data was tabulated and analyzed by using IBM SPSS version 24.0 software. After collection of data, data were checked out thoroughly for completeness then edited, coded and entered into SPSS 24 version. Descriptive statistics such as percentage, frequency, mean, and standard deviation were

used to analyze the data. Subjects were taking under no.1 were assigned to Group A (n=15), and those falling under no.2 were assigned to Group B (n=15), informed consent was in written form.

Data management and storage: Data will be stored for 5 years in a password protected file after completion of the study / after publication on the researcher's personal computer. The organization and analysis of the findings is determined under the following tables and legends. The present chapter was dedicated to the tabulated and statistically analyzed data.

Ethics approval of research

Formal permission from the research committee of the MGM-ECRHS was obtained approval. Approval of the study was obtained from the Ethical Committee for research on human subjects. Permission was obtained from the member secretary MGM-ECRHS, MGM Medical College, Aurangabad. Confidentiality was maintained by using obtained data only for study purposes. Informed consent was taken from the subjects before the study. Subjects were taking under no.1 were assigned to Group A (n=15), and those falling under no.2 were assigned to Group B (n=15), informed consent was in written form.

Clinical Trial Registration: Clinical trial registration is not required as only exercise is given to subjects.

Results

This chapter deals with the analysis and interpretation of findings from the 30 subjects with chronic stroke from MGM medical college and hospital. An Experimental research design was used with Pre and post test. Data collection was done by using Modified Sphygmomanometer (MNS), Wolf Motor Function Test and Fugl Meyer Assessment. Data were collected by face-to-face interview technique. The results were displayed in tables and figures as follows.

Table 1. Pre And Post-Test Mean Values Of Group A In Modified Sphygmomanometer (MSM), WOLF Motor Function Test (WOLF), FUGL MEYER Assessment (FUGL).

Group A	N	Pre		Post		t-test	Sig
		Mean	SD	Mean	SD		
MSM	15	143.8	7.93	166.73	7.603	9.33368	0.001
WOLF	15	35.133	3.09	50.5333	0.9154	19.603	0.000
FUGL	15	15.266	1.9444	23.33	2.899	15.492	0.000

(Table 1 shows that mean pre-test value (143.8) and post-test value (166.73) of MSM with ($p<0.05$) which shows a statistically significant increase in grip strength of the subjects participating in the Group A)

Table1. shows that mean pre-test value (143.8) and post-test value (166.73) of MSM with ($p<0.05$) which shows a statistically significant increase in grip strength of the subjects participating in the Group A. The mean pretest value (35.133) and post-test value (50.5333) of WOLF with ($p<0.05$) which shows a statistically significant improvement in hand motor ability of subjects taking part in the Group A. The

mean pretest value (15.266) and post-test value (23.33) of FUGL with ($p< 0.05$) which shows a statistically significant increase hand function in the group A.

Table 2. Pre And Post-Test Mean Values Of Group B In Modified Sphygmomanometer (MSM), WOLF Motor Function Test (WOLF), FUGL MEYER Assessment (FUGL).

Group B	N	Pre		Post		t-test	Sig
		Mean	SD	Mean	SD		
MSM	15	146.466	8.069	152	6.324	7.461	0.06
WOLF	15	35.6	3.39	42.2	4.601	9.053	0.07
FUGL	15	16.333	2.22	19.73	2.15	9.73	0.07

(Table 2 shows the mean pre-test value (146.466) and post-test value (152) of MSM with ($p>0.05$) which shows a statistically significant increase in grip strength of the subjects participating in the Group B)

Table2. shows the mean pre-test value (146.466) and post-test value (152) of MSM with ($p>0.05$) which shows a statistically significant increase in grip strength of the subjects participating in the Group B. The mean pre-test value (35.6) and post-test value (42.2) of WOLF with ($p>0.05$) which shows a statistically significant improvement in hand motor ability of subjects taking part in the Group B. The mean pre-test value (16.333) and post-test value (19.73) of FUGL with ($p>0.05$) which shows a statistically significant increase hand function taking part in the Group B.

Table 3. Post-Test Mean Values Of Group A And Group B In Modified Sphygmomanometer (MSM), WOLF Motor Function Test (WOLF), FUGL-MEYER Assessment (FUGL).

	N	GROUP A		GROUP B		t-test	Sig
		Mean	SD	Mean	SD		
MSM (post)	15	166.733	7.6	152	6.32	7.7	0.000
WOLF (post)	15	50.33	0.91	42.2	4.601	6.65	0.000
FUGL (post)	15	23.33	2.91	19.73	2.15	6.75	0.000

(Table 3 shows the comparison of post-test values between group A and group B)

GRAPH –I Post-Test Mean Values Of Group A And Group B In Modified Sphygmomanometer (MSM), WOLF Motor Function Test (WOLF), FUGL-MEYER Assessment (FUGL)

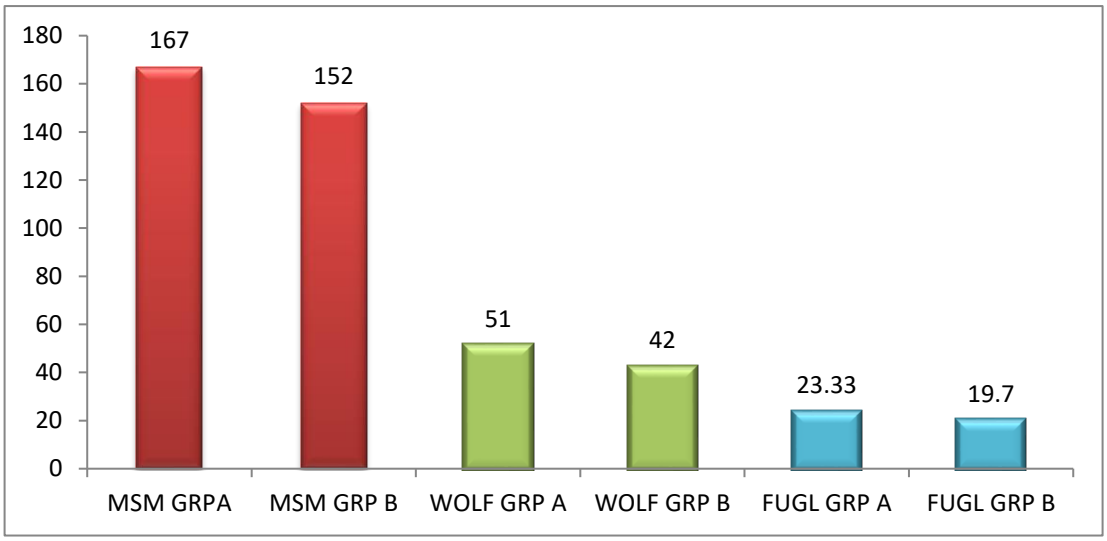

Table3. And graph I shows the comparison of post-test values between group A and group B. The table infers both groups show significant improvement in hand function but group A show more significant results than in group B, there is significant increase in grip strength and hand functions with ($p \leq 0.05$) level.

Discussion

The purpose of this study was to see if an Action-Observation-Execution and Accelerated Skill Acquisition Program could improve function in chronic stroke patients. This can result in action sensing and execution. The purpose of the action observation and expedited skill learning program is to use the Mirror Neuron System mechanism to help chronic stroke patients regain upper extremity function. The neurons in the brain are separate and provide a matching mechanism for observation and execution. [17]

The neural system converts the sensory information i.e. the action performed by others into a specific movement pattern. The decryption of the observation by the observer then occurs and behavior is facilitated. The system the encodes the movement into meaningful actions with purpose. [18]

Mei-Hong Zhu et al.(2015) showed that In stroke patients, action observation treatment improves upper extremity motor function, performance, and activities of daily living while also reducing upper extremity spasticity. [19]

This current study was conducted between two groups, Group A(Experimental) and Group B(Control), the experimental group received action-observation execution (AOE) with accelerated skill acquisition program (ASAP) along with conventional physiotherapy whereas; Control group received conventional physiotherapy.

In this study the grip strength of the hand was assessed by using modified sphygmomanometer. Group A (166.7) showed significant changes with $p \leq 0.001$ and Group B (152) showed the non-significant changes with $p \leq 0.06$. In Paired t-Test analysis, $p \leq 0.05$ Group A. This shows that for modified sphygmomanometer

readings in the Paired t test for the Group A shows a significant change in grip strength in chronic stroke i.e. within the group. Therefore this displays that there is significant change between experimental group and control group. Thus it states that Group A has significant improvement in grip strength than Group B.

The upper limb motor function of hand carried out by hand assessment of wolf motor function test (WOLF), in paired t Test analysis, it shows that for wolf motor function test in the paired t Test for the group A (50.3) there is a significant change with $p \leq 0.001$, hence it implies hand function is improved. In t test, for the group B (42.2) there is non-significant change with $p \leq 0.07$. Therefore this shows that group A has significant improvement after treatment in motor activities of the hand, however group A (experimental group) shows a greater improvement than group B (control group). Mei-Hong Zhu et al.(2015) showed that wolf motor function test readings were significantly improved for upper extremity function after giving accelerated skill acquisition program.

For motor assessment of the hand is carried out by hand assessment of Fugl-Meyer assessment, In Paired t Test Analysis, group A (23.33) shows significant change with $p \leq 0.001$,for Fugl-Meyer assessment and whereas group B(19.73) shows non-significant change with $p \leq 0.07$. So in paired t test for both the groups there is a significant changes in Group A only, hence it implies hand function is improved in experimental group compared to control group. Therefore this shows that group A shows significant improvement after treatment in motor activities of the hand, however group A (experimental group) shows a greater improvement than group B(control group) Mei-Hong Zhu et al.(2015) showed that FMA readings were significantly improved for upper extremity function after giving Accelerated Skill Acquisition Program. [20-25]

So this study proves that there is increase in hand function using Action Observation Execution, Accelerated Skill Acquisition Program and conventional physiotherapy than giving only conventional physiotherapy for subjects with chronic stroke. [26-30]

2. Conclusion

This study concluded that action observation execution combined with accelerated skill acquisition program has an effect on improving hand function when assessed using Fugl-Meyer Assessment, Wolf Motor Function test and Modified Sphygmomanometer in stroke patients.

Limitations

- Only upper limb was included.
- The training session was less per week.
- This intervention can be given along with mirror therapy.

Recommendations

- Larger sample size.
- All age group people have to be diagnosed with chronic stroke was recommended in further studies.

- Long term effects are recommended with similar study intervention can be given for lower limb and trunk.

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Conflict Of Interest: The authors clearly declare that they have no conflicts of interests.

Authors' Contribution: P.K. Mahaseth designed the study, performed the statistical analysis, supervised the data collection, and drafted the paper. T. Kaur and A. Choudhary helped in data collection whereas R. Malani, and Aparna Choudhary reviewed the paper, and approved the final version. Furthermore, all the authors contributed for the study.

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