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Effectiveness of Action Observation Therapy versus Motor Relearning Program on Upper Extremity Function among MCA Stroke Survivors

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Abstract: ***The upper limb paralysis is a common and undesirable consequence of all types of stroke that leads to functional limitations such as dressing, bathing, self-care, writing etc. Even though there are many rehabilitation methods to improve upper limb function, it is necessary to investigate an effective method to improve upper extremity function for stroke survivors. Aims and Objectives: To compare the effect of Action Observation Therapy and Motor Relearning Program in improving motor function, handgrip strength and functional activity of upper extremity in MCA stroke patient. Methodology: Thirty MCA stroke patients were assessed and selected on the basis of inclusion and exclusion criteria and divide equally into two groups, Group A and Group B. Each group consists of 15 subjects. Group A received Action Observation Therapy and Group B received Motor Relearning Program 1 hr a day, 6 days/week for 8 weeks. The outcome measures were assessed using Fugal Meyer score for upper extremity, Upper Extremity Function Test, Modified Sphygmomanometer Test. Result: In comparison between groups, the calculated value for motor function is 4.11 with p<0.05. The Group B shows greater significance in motor function through MRP intervention. And the calculated value for functional activity is 2.09 with p<0.05. The Group A shows greater significance in functional activity through AOT intervention. The calculated value for handgrip strength is 0.437 with p>0.05. In handgrip both group shows almost similar improvement. Conclusion: The motor function improved better in motor relearning group and functional activity of UE gain improvement in action observation group. In handgrip rehabilitation both interventions are effective.***

Keywords: Action Observation Therapy; Motor Relearning Program; motor function; functional activity; handgrip

1. Introduction

The stroke defined by WHO is “rapidly developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than of vascular origin”[1]. Stroke is the third commonest cause of mortality and fourth leading cause of disease burden in world wide[2]. Major risk factors for stroke are Hypertension, Heart disease and Diabetes Mellitus[3]. Major contributory factor in cerebrovascular disease is Atherosclerosis. Cerebral infraction or tissue death occurs due to thrombi which is leads to ischemia or occlusion of an artery[4]. The global burden of stroke could substantially reduce through targeted interventions that reduce BP, smoking, promote physical activity and a healthy diet[5]. The middle cerebral artery syndrome (MCA) is the most common site of occlusion in stroke. The most common characteristics of MCA syndrome are contra lateral spastic hemiparesis and sensory loss of the face, upper extremity (UE), and lower extremity (LE), with the face and UE more involved than the LE. The left MCA have aphasia and right MCA have perceptual deficits (unilateral neglect, anosognosia, apraxia and spatial disorganization and homonymous hemianopsia)[3].The most disabling consequence of stroke is UE motor impairment which limits the independent living of a person[4]. For the successful execution of everyday activities the co-ordinate movements of UE are necessary. Upper extremity rehabilitation is a challenging, various therapeutic strategies are designed and however the best method to improve upper limb function is still not clear. Here discussed about two interventions which were more beneficial for the betterment of UE impairment.

Action observation therapy (AOT) is based on mirror neuron system and mirror neuron are a particular type of neurons that discharge when an individual performs an action[6]. When an individual observe another individual performing an action or activity, the neurons that encode the action is activated in the observer’s cortical motor system. It refers to mirror neurons and there is a correlation between different mirror neurons. They were named as Mirror Neuron System (MNS). The MNS could be activated through imitating action and its excitability could be increased. This could promote the patients to acquire new motor skills. So, learning by imitating can improve the motor function [7].

Motor relearning program (MRP) focuses on task specific learning through effective use of feedback and practice to improving motor control and focusing on the relearning of daily activities[8]. This therapy increases the functional use of weaker extremity through massed practice of functional activity. There are four steps in motor relearning programme: Analysis of the task, Practice of missing component, Practice of task and Transference of training[9].

The upper limb paralysis is a common and undesirable consequence of all types of stroke that leads to functional limitation. The studies has been reported that up to 85% of stroke survivors experience hemi paresis and that 55% to 75% stroke survivor continued to have limitations in upper extremity functioning. Both AOT and MRP have been studied separately to evaluate their respective effectiveness. However, no study has been found comparing the two methods exclusively for hand recovery. Hence main objective of this study is to investigate the effectiveness of

AOT and MRP on hand recovery with a group of post stroke patient.

2. Methodology

The study was designed to determine the effectiveness of Action Observation Therapy versus Motor Relearning Program on Motor function, Handgrip strength and Functional activity of upper extremity among MCA Stroke survivors. Ethical approval was obtained from the Ethical committee of Medical Trust Hospital, Cochin. Thirty subjects (22 males and 8 females, within the age group of 45-75 years) who fulfilled inclusion and exclusion criteria were recruited for the study. The independent variables were Action Observation Therapy and Motor Relearning Program where as the dependent variables were Motor function, Handgrip strength and Functional activity of upper extremity.

Study Design
Two group pre-test post-test comparative study design without control group

Sampling Method
Convenient Sampling

Study Duration
3 months.

Sample Size:
N = 30
15 in each group (Group A and Group B)

Outcome Measure:
- **Motor Function** - Fugal Meyer Assessment Scale –Upper Extremity (To measure sensory motor stroke recovery)
- **Functional Activity** - Upper Extremity Function Test (To assess the upper limb function and functional activities which are performing in daily life)
- **Handgrip Strength** – Modified Sphygmomanometer (To measure the grip strength)

Selection criteria

Inclusion criteria
- Patients diagnosed with a unilateral stroke.
- Patients diagnosed with MCA stroke
- Stroke onset before 1 year
- From 45 – 75 years of age from both gender
- Motor recovery of hand brunnstrom stages 4 and 5.
- Mini mental state examination score>24
- Patients with stable vitals
- Patients who provided informed consent and were willing to participate in the study

Exclusion Criteria
- Patients have severe neglect of the affected part
- Patients having severe spasticity (grade 3 and 4 in modified ashworth scale)
- Patients having apraxia, hemianopsia
- Patients have prominent cognitive deficits and psychiatric disease
- Co morbidities that influenced upper extremity usage or cause severe pain
- Patients having proprioceptive deficits

Sampling Procedure
30 subject (both male and females), age 45- 75 years selected on the basis of inclusion and exclusion criteria from Paravoor Alpha Palliative Care. The subjects are divided equally into two groups, Group A and Group B, each consists of 15 subjects. Group A received conventional therapy along with Action Observation Therapy 1 hr a day, 6days/week for 8 weeks. Group B received conventional therapy along with Motor Relearning Program 1 hr a day, 6 days/week for 8 weeks.

Procedure
The subjects were assessed by neurological assessment and they divided into 2 groups. The study procedures were explained for both groups. Pre-treatment score was taken a day before the treatment session and post treatment score was taken the day after the completion of 8 weeks of treatment session. The outcome measures were assessed using Fugal Meyer score for upper extremity, Upper Extremity Function Test, Modified Sphygmomanometer Test for motor function, functional activity and handgrip strength respectively.

Conventional therapy was given for 30 minutes to both groups include stretching of upper limb which hold for 30 to 60 sec in each and given 3 repetitions, isometrics of upper limb which hold for 10 sec in each, active assisted ROM exercise of upper limb given in10 repetitions and peg board exercises.

In AOT group, patients were performed the 20 activities in 4 sets with the help of video clip, in which one task were practiced in each day for 30 minutes. The activities are arranged according to the increased complexity. After 4 sets of activities, it again repeats. In MRP group patients do the upper limb activities in 30 minutes each day.

3. Results

3.1 Paired 'T' Test (Comparison Within Group)

Analysis of pre test post test values of FMA Upper extremity in Group A (AOT group) shows the calculated value for motor function is 12.56, which is greater than the table value 2.14 with $p<0.05$. Since the significance (p-value) is less than 0.05, we can conclude that there is a significant improvement in motor function in Action observation therapy Group among patients with MCA stroke.

Analysis of pre test post test values of FMA Upper extremity in Group B (MRP Group) shows the calculated value for motor function is 13.12, which is greater than the table value 2.14 with $p<0.05$. Since the significance (p-value) is less than 0.05, we can conclude that there is a significant improvement in motor function in Motor Relearning Program Group among patients with MCA stroke.

Analysis of pre test and post test values of upper extremity functional index in Group A shows the calculated value for

functional activity is 8.45, which is greater than the table value 2.14 with p<0.05. Since the significance (p-value) is less than 0.05, we can conclude that there is a significant improvement in functional activity in Action Observation Therapy Group among patients with MCA stroke.

Analysis of pre test and post test values of upper extremity functional index in Group B shows the calculated value for functional activity is 10.58, which is greater than the table value 2.14 with p<0.05. Since the significance (p-value) is less than 0.05, we can conclude that there is a significant improvement in functional activity in Motor Relearning Program Group among patients with MCA stroke.

Analysis of pre test post test values of modified sphygmomanometer test in Group A shows the calculated value for handgrip strength is 14.44, which is greater than the table value 2.14 with p<0.05. Since the significance (p-value) is less than 0.05, we can conclude that there is a significant improvement in handgrip strength in Action Observation Therapy Group among patients with MCA stroke.

Analysis of pre test and post test values of modified sphygmomanometer test in Group B shows he calculated value for handgrip strength is 14.44, which is greater than the table value 2.14 with p<0.05.Since the significance (p-value) is less than 0.05, we can conclude that there is a significant improvement in handgrip strength in Motor Relearning Program Group among patients with MCA stroke.

Table 1: Paired 'T' Test values

PAIRED 'T' TEST (WITHIN GROUP)		GROUP A (AOT group)			GROUP B (MRP group)		
OUTCOMES		FMA-UE	UEFI	MST	FMA-UE	UEFI	MST
MEAN	Pre-test	39.66	34.93	34.06	33.86	33.13	32.20
	Post-test	45.13	38.66	44.60	42.60	35.80	43.26
S. D.	Pre-test	3.33	2.43	5.16	4.34	2.50	3.54
	Post-test	4.03	2.46	4.79	5.48	2.70	5.52
Table 'T' value		2.14					
Calculated 'T' value		12.56	8.45	14.44	13.12	10.58	11.31
p value		p < 0.05	p < 0.05	p < 0.05	p < 0.05	p < 0.05	p < 0.05

3.2 Independent 'T' Test (Comparison Between Group)

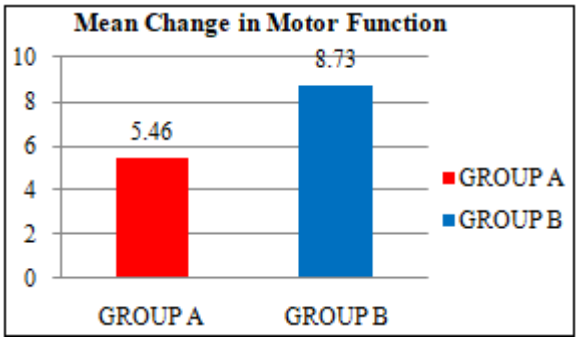
Analysis of motor function in group A and group B shows the calculated value for mean change of motor function is 4.11, which is greater than the table value 2.04 with p<0.05. The Group B shows greater change in motor function through MRP intervention, which is statistically significant when compared with other group. Since the significance (p-value) is less than 0.05, conclude that there is a significant improvement in motor function through Motor Relearning Program among patients with MCA stroke.

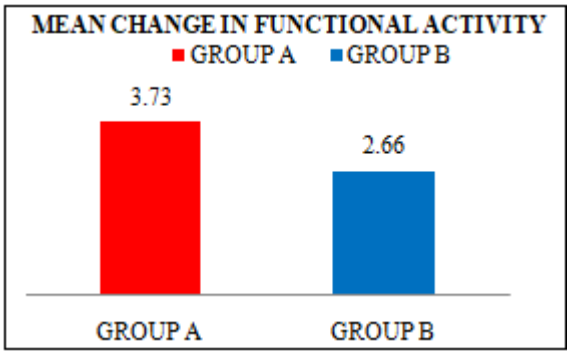
Analysis of functional activity in Group A and Group B shows the calculated value for mean change of motor function is 2.09, which is greater than the table value 2.04 with p<0.05. The Group A shows greater change in functional activity through AOT intervention, which is statistically significant when compared with other group. Since the significance (p-value) is less than 0.05, conclude that there is a significant improvement in functional activity through Action Observation Therapy among patients with MCA stroke.

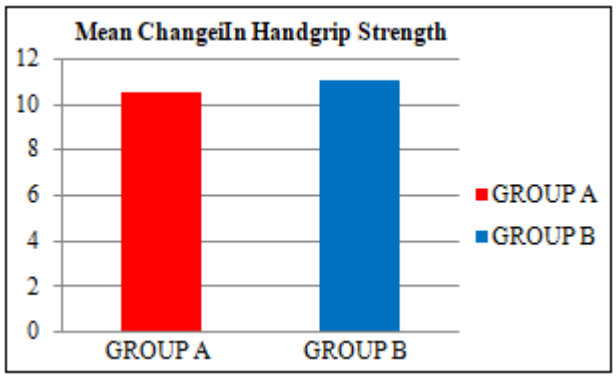
Analysis of handgrip strength in Group A and Group B shows the calculated value for mean change of handgrip strength is 2.09, which is lesser than the table value .437 with p>0.05. Since the significance (p-value) is greater than 0.05, there is no significant difference between the Groups. But in within group comparison both Groups show significant improvement in handgrip strength. So, conclude that in handgrip rehabilitation both interventions are effective among patients with MCA stroke.

Table 2: Independent 'T' Test values

Independent 'T' Test (Between Group)		FMA-UE	UEFI	MST
MEAN	Group A	5.46	3.73	10.53
	Group B	8.73	2.66	11.06
S. D.	Group A	1.68	1.70	2.82
	Group B	2.57	.975	3.78
Table 'T' value		2.04		
Calculated 'T' value		4.11	2.09	0.437
p value		p < 0.05	p < 0.05	p < 0.05







4. Discussion

In MCA territory stroke, upper limb is more involved than the lower limb. After stroke, most of people cannot incorporate their paretic upper limb into daily activity and will eventually discontinue of their day today activities. This study was conducted to know the effect of action observation therapy and motor relearning program in motor function, functional activity, and handgrip strength of upper extremity among MCA stroke patients.

Patients with right and left MCA stroke were assessed and selected for the study who satisfied the inclusion criteria. 30 subject (both male and females), age 45- 75 years taken for the study. Subjects divided equally into two groups, Group A and Group B. Each group consists of 15 subjects. Group A received conventional therapy along with action observation therapy 1 hr a day, 6days/week for 8 weeks. Group B received conventional therapy along with motor relearning program 1 hr a day, 6 days/week for 8 weeks. The outcome measures were assessed using Fugal Meyer score of upper extremity for motor function, Upper Extremity Function Test for functional activity, Modified Sphygmomanometer Test for handgrip strength. In the statistical analysis Students‘t’ test was used for the calculation of the results. Paired‘t’ test was used for the intra group comparison of pre and post test results. Independent‘t’ test was used for the inter group comparison.

While within group comparison, both interventions are showed improvement in motor function, functional activity and handgrip strength. In comparison between groups, the mean change of motor function in AOT Group was 5.46 and in MRP Group 8.73, with ($p< 0.05$). The MRP Group shows greater change in motor function, which is statistically significant when compared with other group. The reason behind the improvement in MRP group is due to the principle of Neuroplasticity. Challenging the brain with different tasks creates new neural connections and intensive exercise leads to improvement in Neuroplasticity[10]. While repeatedly practice one activity neuronal circuits are being formed, leading to better ability to perform the practiced task. Motor recovery after stroke is related to neural plasticity, which involves developing new neuronal interconnections, acquiring new functions, and compensating for impairment of limb.

Stroke rehabilitation programs should include meaningful, repetitive, intensive, and task-specific movement training in an enriched environment to promote neural plasticity and motor recovery [11]**.** In MRP the patients were involved in identifying their own missing-components of performance. The selection of the remedial tasks used for training was target those missing- components. Training in the functional tasks followed through on the same missing components. The training thus became more anticipatory for the patients and hence was more self-initiated, targeted and effective [12]. The previous studies have also proved that motor relearning program was more effective on improvement of motor functions in upper limb among MCA Stroke subjects [13]. But in action observation therapy they only imitate the activity but they do not train the missing component. May be this is the reason for the more improvement occur in motor function in MRP Group.

In comparison between groups, the mean change of functional activity in AOT Group in was 3.73 and MRP Group was 2.66, with ($p< 0.05$). The AOT Group shows greater change in functional activity, which is statistically significant when compared with other group. The reason behind improvement in AOT group is due to the activation of mirror neuron system. The Action observation therapy (AOT) is based on mirror neuron system, which are a particular type of neurons that discharge when an individual performs an action, as well as when a similar action done by another individual[5]. Previous studies suggest that observation and execution of action share common neural substrates and that action observation produces an increase in the excitability of the corticospinal pathway. When the subjects are cued to make a finger movement by a symbolic cue or modelled finger movements, they are faster to respond to the modelled action. Imitation has consisted of matching observed movements to pre-existing motor schemata, that is, to motor actions already part of the motor repertory of the person who observe the action.

A stroke patient may have lost a significant portion of the brain tissue supporting the neural circuits associated with the execution of movements. Here is the use of observation/execution matching and motor imitation, which could provide a re-assembly of the incomplete (but not totally lost) networks. First is that the distributed networks for motor imitation involve multiple sensory inputs (visual and proprioceptive), making it possible to activate the system using different inputs. And also, the widespread distributed nature of the network suggests many anatomical and physiological options for obtaining proper activation. Second is that activation of the network for observation/execution matching produces an increase in the excitability of the corticospinal path even in the absence of overt movements. Third is that the network is strongly associated with learned, ecologically valid movements. Through watching and imitating action, the MNS could be activated and it could promote the patients to acquire new motor skills [12].The task involved in the AOT are very close to daily activities of life. During each rehabilitation session, patients are observe a specific object-directed daily activities presented through a video clip on a computer screen and has to perform the observed motor action at the best of his/her ability. The AOT more related to functional activities, it may be the reason for improvement in functional performance of patients in AOT than MRP.

Grip strength is an important indicator of an individual's hand function and one of the pathologies that greatly affect grip strength is the MCA stroke. While considering comparison between groups of the third outcome, the mean change of handgrip strength in AOT Group was 10.53 and MRP Group was 11.06, which is statistically not significant ($p>0.05$). But in within group comparison both Groups show significant improvement in handgrip strength. For stroke patients, by observing the training movement, mirror neurons which control the same action could be activated and its excitability could be increased. The ability of mirror neurons to complete the training was therefore improved. So learning by imitating can improve the motor function [12]. After an injury, the damaged brain will utilize surviving structures and networks that can generate some form of motor signal to spinal cord motor neurons. There is some experimental evidence that physical therapy techniques are associated with changes in the activity of brain areas and improved transmission in the cortico spinal pathways. Motor training results in performance improvements that are associated with reorganization[13]**.** MRP has components involving the hand and fingers and also in AOT the activities are more oriented to hand so, both interventions are help to improve handgrip.

Result of study indicates that patients with MCA stroke benefited from both interventions, Motor Relearning Program and Action Observation Therapy. In paired t test both group shows significant improvement in motor function, functional activity and handgrip strength. However, the motor function improved better in motor relearning group than the action observation group and functional activity of UE gain improvement in action observation group than the other group. But statistical analysis shows no better significant between groups for handgrip strength. So, both interventions are effective in improving handgrip strength of chronic stroke patients.

5. Conclusion

Both group shows significant improvement in motor function, functional activity and handgrip strength. However, the motor function improved better in motor relearning group than the action observation group and functional activity of upper extremity gain improvement in action observation group than the other group. But statistical analysis shows no better significant between groups for handgrip strength. So, both interventions are effective in improving handgrip strength of chronic stroke patients. So, these are a major contribution to the rehabilitation part of stroke. AOT and MRP are used alone with conventional therapy are included in the UE rehabilitation.

6. Future Scope

- The treatment sessions of the study should be increased. It may lead to better and valuable result.
- A follow-up study could ensure the long-term effect of the treatment program.
- Future studies can be done with large group and longer follow up.
- Another outcome measuring tools can be used.
- The duration of study should be increased; thereby it may leads to better and valuable results.
- Future studies could examine the combined effect of AOT and MRP.
- A large sample size should be taken to improve the consistency of result.
- Blinding could improve the reliability of the outcome.

References

[1] Thomas Truelsen, Stephen Begg , Colin Mathers "The global burden of cerebrovascular disease"; 2006 ; Cerebrovascular disease 21-06-06 Global Burden of Disease 2000
[2] Manjari Tripathi and Deepti Vibha Review Article on Stroke in Young in India. SAGE-Hindawi Access to Research Stroke Research and Treatment Volume 2011, Article ID 368629, 6 pages
[3] Susan B. O'Sullivan; PHYSICAL REHABILITATION, sixth edition; stroke, pg no: 645-647, 651
[4] Batool S, Soomro N, Amjad F, Fauz R "To compare the effectiveness of constraint induced movement therapy versus motor relearning programme to improve motor function of hemiplegic upper extremity after stroke". Pak J Med Sci 2015;31(5):1167-1171.
[5] K Venkata Swathi Krishna, V Hema Soujanya, G Geethika, P Sai Sunil and P Priyanka Stroke its types & risk factors: An overview The Pharma Innovation Journal 2018; 7(7): 767-772
[6] V. Rajmohan and E. Mohandas "Mirror neuron system" Indian journal of psychiatry Giacomo Rizzolatti 'The mirror neuron system and its function in humans'. Anat Embryol (2005) 210: 419-421.
[7] Preeti Gazbare1, Tanuja Mahajan2, Tushar Palekar3, Manisha Rathi4, Shilpa Khandare5 Comparison of Motor Relearning Programme With Proprioceptive Neuromuscular Facilitation on Upper Limb Function In Stroke Patients IJSRE Volume 05 Issue 05 May 2017
[8] Suneel kumar immadi , Kiran Kumar Achyutha Dr. Amaranth Reddy Krishna Priya Tatakuntla The effectiveness of the motor relearning approach in promoting physical function of the upper limb after a stroke. Int J Physiother. Vol 2(1), 386-390, February (2015)
[9] Iris Zavoreo1 Vanja Ba[I]-Kes1 Vida Demarin2; Stroke And Neuroplasticity Periodicum Biologorum UDC 57:61 VOL. 114, No 3, 393–396, 2012 CODEN PDBIAD ISSN 0031-5362
[10] Naoyuki Takeuchi and Shin-Ichi Izumi Review Article Rehabilitation with Poststroke Motor Recovery: A Review with a Focus on Neural Plasticity Hindawi Publishing Corporation Stroke Research and Treatment Volume 2013, Article ID 128641, 13 pages
[11] Jibi Paul comparative study on the effect of task oriented motor relearning program and thermal stimulation over upper limb motor function among stroke subjects. Int J Physiother. Vol 1(4), 227-232, October (2014) ISSN: 2348 – 8336
[12] Jianming Fu, MMa, Ming Zeng, MMa, Fang Shen, MMa, Yao Cui, MMb, Meihong Zhu, BMa,Xudong Gu, MMa, Ya Sun, BMa ; Effects of action observation therapy on upper extremity function, daily activities and

motion evoked potential in cerebral infarction patients Medicine (2017) 96:42(e8080)

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