

# A Comparative Study on the Effect of Types of Focus of Attention on Upper Limb Function Training in Subjects with Stroke

## Stroklı Hastalarda Üst Ekstremitte için Dikkat Odaklanma Tiplerinin Etkisinin Karşılaştırmalı Çalışması

Imrana Khatoon<sup>1</sup>, Nusrat Hamdani<sup>1</sup>, Majumi Noohu<sup>2</sup>

<sup>1</sup>Jamia Hamdard, Department of Physiotherapy, New Delhi, India

<sup>2</sup>Jamia Millia Islamia, Centre for Physiotherapy & Rehabilitation Sciences, New Delhi, India

### ABSTRACT

**Objective:** This study was done to find out which type of focus of attention is better for improving function after stroke. It was pre-test post test experimental study of 3 weeks duration conducted in physiotherapy department of a super specialty hospital in New Delhi.

**Methods:** Thirty chronic stroke patients recruited for the study were randomly assigned to two groups. Group 1 trained with external focus of and group 2 trained with internal focus of attention Each group given three weeks functional training for 30 minutes, 5 days in a week. Subjects were evaluated by Fugl-Meyer scale and Action Research Arm test.

**Results:** There was a significant difference between the groups in Fugl-Meyer score and no significant difference in ARAT score (composite scores) and its subscale scores after training. A within group analysis showed that both group 1 and group 2 did differ significantly on Fugl-Meyer score and ARAT score (composite score) and its subscales except gross movement before and after the training.

**Conclusion:** The findings of the study suggests that it will be better to use external focus of attention while training for functional activities.

**Keywords:** Focus of attention, motor learning, stroke rehabilitation

### ÖZET

**Amaç:** Bu çalışmanın amacı, stroktan sonraki fonksiyonel düzelme için hangi dikkate odaklanma tipinin daha etkili olduğunu saptamaktır. Yeni Delhi 'de konuya özel bir hastanenin fizyoterapi bölümünde ,3 hafta süreyle pre-test ve post-test deneysel çalışma şeklinde uygulanmıştır.

**Yöntemler:** Kronik stroklı 30 hasta randomize olarak 2 gruba bölündü. İlk gruba eksternal dikkat odaklanma, 2. gruba ise internal odaklanma çalışması uygulandı. Her bir gruba 3 hafta süreyle, haftada 5 gün, 30 dakika fonksiyonel deneme şeklinde idi. Hastalar Fugl-Meyer skala ve Omuz Aktivite Araştırma Testi (ARAT) ile değerlendirildi.

**Bulgular:** Fugl-Meyer skorunda gruplar arasında belirgin fark saptandı, ARAT skorunda ve alt gruplarında uygulama sonrası belirgin fark yoktu (bileşik skor). Grup içi analiz 2 grup arasında Fugl-Meyer 'de belirgin fark, ARAT 'da ise, alt gruplardaki kaba motor hareketler dışındaki aktivitelerde fark saptandığını ortaya koydu.

**Sonuçlar:** Çalışmanın sonucu, fonksiyonel aktivite çalışmasında eksternal dikkat odaklanmasının daha etkili olduğunu göstermiştir.

**Anahtar sözcükler:** Dikkat odaklanması, motor öğretimi, strok rehabilitasyonu

Corresponding Author  
Yazışma Adresi

Majumi Noohu

Jamia Millia Islamia, Centre for  
Physiotherapy & Rehabilitation  
Sciences, New Delhi, India

E-mail: mnoohu@jmi.ac.in

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## Introduction

Stroke will cause a variety of deficits such as changes in the level of consciousness, impairments of sensory, motor, cognitive, perceptual and language functions (1). Only about 15% of those suffering from severe stroke recover hand function. Limitation in the use of upper limb have been shown to greatly contribute to diminished self reported well – being 1 year following a stroke (2). Hand motor deficit is an important aspect of stroke disability as hand is the principal means of interacting with people and objects in environment. It has important function during all three phases of upper extremity function i.e. reaching, grasping and manipulation (3).

Motor learning is that the degree of performance improvement which depends on the amount of practice (4). It is unclear that there is any motor learning deficits in stroke patients (5). Improvement with rehabilitation increases with the amount of training and relates mostly to the task practiced during therapy. It's being reported that improvement with training was similar before and after the neurological lesion, suggesting that similar learning mechanism was operated with or without injury (6). Instructions are important when teaching motor skills and they are used to teach and refine motor task at all level of skill (7,8). Wulf and Prinz elaborates on effect of different focus of attention on learner performance. (i.e. internal versus external) on learner performance (9). Focusing attention externally (i.e. directing the performer attention to the movement effect) rather than internally (i.e. directed attention of the movement themselves) provide increased enhancement of motor learning and performance (7). Focus of attention is the act of directing attention to information sources or to the objects of an individual attention (10).

But there are lack of literatures available which highlights the effectiveness of external and internal focuses of attention in functional training of patients with stroke. So, this study aims to focused on influence of attention focus effects on upper limb function training in people with stroke.

## Materials and Methods

### Subjects

This study was carried out in 30 chronic stroke patients. The set inclusion criteria for the study were, stroke patients with age of 50-75 first middle cerebral artery stroke, with more than 1 year duration , score of 24 or higher on mini mental status examination(MMSE)(11) and spasticity  $\leq 2$  in modified Ashworth scale (1,2). The study was approved by research and ethical committee of department of rehabilitation sciences,

Jamia Hamdard, New Delhi and all the subjects were briefed about the study and their consent was obtained.

### Design and Setting

It was pre-test post test experimental study of 3 weeks duration conducted in physiotherapy department of a super specialty hospital, in New Delhi. After screening the subjects were assessed with the Fugl-Meyer assessment scale (upper limb component) (13) and action reach arm test (ARAT) (14). After the pre assessment patients were randomly assigned to one of the two groups, group 1 and group 2. Group 1 underwent functional training with external focus of attention and group 2 with internal focus of attention. Both the groups were given three functional task training for half an hour, 5 days a week for three weeks. The tasks used for training were reach, grasp and release the glass, turning the pages of a book and separating the mixture of grains and pulses for first week, second week and third week respectively. During training session instruction was given in both the group based on focus of attention (Table 1). In external focus of attention, the subjects have to focus on the movements and the objects they handle, and in internal focus of attention, subjects have to focus on how they have felt during movement.

### Outcome

After the training period subjects were assessed on Fugl-Meyer assessment scale (the upper extremity section). The Fugl-Meyer assessment has been used extensively as a measure of impairment in studies measuring the functional recovery in stroke patients. It is a three point ordinal scale, total possible score for upper limb was 66. (0= cannot perform, 1= can perform partially 2= can perform fully) another scale used to measure the effect of training in this study was action reach arm test. The scale contains four subscale grasp, grip, pinch and gross movement – comprising 19 items in total. Each item is evaluated on 4 point scale, total possible score is 57. (0= cannot perform any part of the test, 1= perform the test partially, 2= complete the test but take abnormally longer or has great difficulty, 3= perform the test normally).

### Data Analysis

Independent t test was used to compare the pretest and post test values of the outcome measures on Fugl-Meyer assessment scale and ARAT scores between the group and for the baseline measurements. Paired t test was used to analyze the difference within group before after the training. Both the composite scores and subscale scores of ARAT were used in analysis. The significance level was fixed at  $p \leq 0.05$ .

**Table 1.** Instruction given to the subjects during training.

Group	Instruction for the first week of task (Grasp and release the glass)	Instruction for the second week of task (Turning the pages of a book)	Instruction for the third week of task (Separating the mixture of grains and pulses)
<b>Group 1 (External focus of attention)</b>	<p>Look at the object carefully for few seconds.</p> <p>Concentrate on shape and size of the glass. While moving your hand concentrate on direction towards the glass.</p> <p>After every ten trials focus on the direction and look at the glass.</p>	<p>Look at the book carefully for few seconds.</p> <p>While moving your hand concentrate on direction towards the book and book thickness.</p> <p>Concentrate on turning one page at a time.</p> <p>Concentrate on the direction in which pages are open.</p> <p>After every ten trials focus on the direction and look at the book</p>	<p>Look at the mixture of grains on the table carefully.</p> <p>While moving your hand concentrate on the direction and force needed to hold the grain particles.</p> <p>After every trials focus on mixture of grains and direction of movement</p>
<b>Group 2 (Internal focus of attention)</b>	<p>Flex your elbow and abduct your shoulder until your hand reach to the height of the table.</p> <p>Pay attention to the flexing and extending of your elbow.</p> <p>Pay attention to flexing your fingers, keep thumb opposite to all four fingers, grasp the object.</p> <p>Extend all the finger and release the object. During every ten trials focus on how your and hand feel before and during the grasp.</p>	<p>Flexed your elbow and abduct your shoulder until your hand reach to the height of the table.</p> <p>Pay attention to the flexing and extending of your elbow.</p> <p>Pay attention to your finger movement, index finger turn the pages of the book.</p> <p>During every ten trials focus on how your hand, finger before and during the turning the pages in book.</p>	<p>Flex your elbow and abduct your shoulder until your hand reach to the height of the table.</p> <p>Pay attention to flexing and extending your elbow.</p> <p>Pay attention to flexing your finger and keep thumb opposite to index finger</p> <p>Concentrate on making proper grasp with index finger and thumb holding the grain particle between the two.</p> <p>Concentrate on the movement of fingers, hand, wrist and elbow during putting the grains separately.</p> <p>During every ten trials focus your hand , wrist and finger before holding and after separating the grains.</p>

## Results

Two groups were compared on demographic variables and base line scores. Both the groups consisted of 15 subjects each with 10 males and 5 females in group 1 and 9 males and 6 females in group 2. The groups did not differ significantly on the measures, such as age, time post stroke, MMSE score and modified Ashworth score (Table 2). The age (mean  $\pm$  SD), duration post stroke (mean  $\pm$  SD) , MMSE score (mean  $\pm$  SD) and modified

Ashworth scale score ( mean  $\pm$  SD) of both groups is tabulated in Table 2.

Similarly Fugl-Meyer score and ARAT score (composite score) and its subscales (grasp, grip, pinch, gross movement ) also didn't show any significant difference between the groups before training.(Table 3). There was a significant difference between the groups in Fugl-Meyer score and no significant difference in ARAT score (composite scores) and its subscale scores after training

**Table 2.** Comparison of demographic variables scores between the groups.

Variables	Group 1 n=15 (Mean±SD)	Group 2 n=15 (Mean±SD)	t value	p value
Age ( years)	61.13 ± 6.43	63.33 ± 6.72	- 0.91	0.36
MMSE	27.06 ± 1.90	27.26 ± 1.83	-0.29	0.77
Duration post stroke ( months)	14.66 ± 3.13	14.73 ± 2.52	-0.06	0.94
Modified Ashworth scale score	1.26 ± 0.32	1.20 ± 0.36	0.52	0.94

**Table 3.** Between group comparison of Fugl-Meyer scale , ARAT and its subscales.

Variables		Group 1 Mean ± SD	Group 2 Mean ± SD	t value	p value
Fugl- Meyer	Pre intervention	41.66 ± 1.49	42.53 ± 1.24	1.7	0.09
	Post intervention	50.00 ± 1.60	48.40 ± 1.72	2.63	0.01
ARAT(Composite)	Pre intervention	44.00 ± 5.20	44.06 ± 3.05	-0.04	0.96
	Post- intervention	49.46 ± 4.99	47.80 ± 2.67	1.13	0.26
ARAT(Grip)	Pre intervention	14.86 ± 2.38	14.60 ± 2.09	0.74	0.32
	Post intervention	17.13 ± 1.06	16.26 ± 1.43	1.87	0.07
ARAT(Grasp)	Pre intervention	9.73 ± 1.48	9.40 ± 1.29	0.65	0.51
	Post- intervention	10.86 ± 1.12	10.33 ± 1.04	1.34	0.19
ARAT(Pinch)	Pre intervention	11.46 ± 1.76	11.40 ± 1.40	0.11	0.91
	Post intervention	13.40 ± 1.95	12.33 ± 1.29	1.76	0.08
ARAT (Gross movement)	Pre intervention	8.46 ± 0.74	8.66 ± 0.61	-0.80	0.42
	Post- intervention	8.73 ± 0.45	8.93 ± 0.25	-1.47	0.15

(Table 3). The pre and post training, mean ± SD of Fugl-Meyer score , mean ± SD of ARAT score (composite score) and mean ± SD, of subscale scores of ARAT (grasp, grip, pinch and gross movements) of both groups is given in Table no 3.

A within group analysis showed that both group 1 and group 2 did differ significantly on Fugl-Meyer score and ARAT score (composite score) and its subscales except gross movement before and after the training (Table 4).

## Discussion

This study provides important information about efficacy of focus of attention training in the affected upper extremity in stroke patients. The results of the study suggest that functional training with instruction based on external focus of attention leads better improvements in upper extremity function. In this study improvement in relation of upper limb motor function is demonstrated by an increased in Fugl- Meyer Motor assessment scale in the group with external focus of attention group. As we know that verbal instruction comprises an important element

of clinical practice. The key finding that emerges from the study is that, external focus of attention is more beneficial than internal focus of attention in motor training in stroke patients. The findings of the present study agree with those previous findings that demonstrated significant relationship between instruction and motor learning in adult with and without neurological impairment. It was reported that reaching movement were faster, more forceful, and smoother when externally focused instruction were given (15).

The findings that movement improvements occur from inducing an external focus have been explained by the 'constrained action hypothesis' (16,17). This states that directing a person's attention to their movements (with internal focus) causes conscious motor control. This is suggested to constrain the motor system and disrupt automatic control processes. In contrast, focusing on the movement effect (with external focus) reduces a person's ability to actively intervene in their control processes and consequently enables faster efficient automatic movements. Another suggestion explaining the improved performance seen under external focus conditions, is that

**Table 4.** Within group comparison of Fugl-Meyer scale scores, ARAT and its subscale.

Group	Variables	Pre-intervention values (Mean ± SD)	Post-intervention values (Mean ± SD)	t value	p value
Group 1	Fugl- Meyer	41.66 ± 1.49	50.00 ± 1.60	-16.53	0.001
	ARAT (Composite)	44.00 ± 5.20	49.46 ± 4.99	-10.42	0.001
	ARAT (Grip)	14.86 ± 2.38	17.13 ± 1.06	-4.69	0.001
	ARAT (Grasp)	9.73 ± 1.48	10.86 ± 1.12	-5.26	0.001
	ARAT (Pinch)	11.46 ± 1.76	13.40 ± 1.95	-6.43	0.001
	ARAT (Gross movement)	8.46 ± 0.74	8.73 ± 0.45	-1.74	0.10
Group 2	Fugl- Meyer	42.53 ± 1.24	48.40 ± 1.72	-10.82	0.001
	ARAT (Composite)	44.06 ± 3.05	47.80 ± 2.67	-11.82	0.001
	ARAT (Grip)	14.60 ± 2.09	16.26 ± 1.43	-6.16	0.001
	ARAT (Grasp)	9.40 ± 1.29	10.33 ± 1.04	-6.08	0.001
	ARAT (Pinch)	11.40 ± 1.40	12.33 ± 1.29	-5.13	0.001
	ARAT (Gross movement)	8.66 ± 0.61	8.93 ± 0.25	-1.74	0.10

there are smaller demands on working memory (18,19). The 'conscious processing hypothesis' (20) proposes that explicit knowledge about the movement impedes motor performance and places increased load on working memory. In relation to attentional focus it has been suggested that more working memory is required when inducing an internal focus, as information from both body movement and salient features in the environment needs to be processed, whereas with external focus, only information from the environment is used (18).

The externally focused instructions directed visual attention toward object that were relevant for shaping the desired motor action ( for example " concentrate on the size of book"). In contrast internal focus attention emphasized proprioception feedback ( for example "concentrate on finger movement and flexing and extending of your elbow") . Although both proprioception and vision contribute to control of coordinated movement , researchers Kelso (21) and Magill (22) have shown that individuals spontaneously attend more to visual information than to proprioception during motor process.

Focus of attention is clinically feasible and simple to be incorporated in therapy program irrespective of the task being trained. So focus of attention can be a component during functional training of stroke subjects. Even though this study was carried out in urban area the methodology we used and selection of materials is such that the results can be used in area with limited resources as well. Studies should be done in different patient population such as acute, sub acute stroke patients and on long term effects of focus of attention. Main limitation of the study was its small sample size.

## Conclusion

The findings of the study suggests that it will be better to use external focus of attention, that is the subjects have to focus on the movements and the objects they handle during functional training.

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