



CORRELATION BETWEEN ACTION RESEARCH ARM TEST AND RANGE OF MOTION IN UPPER EXTREMITY IN CHRONIC STROKE PATIENTS

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ABSTRACT

BACKGROUND:

Stroke leads to neurological deficits, cognitive and musculoskeletal defects. Stroke patients neglect the hemiplegic side and visual neglect also occurs. In stroke, exaggeration of stretch reflex results from abnormal management of sensory input.

OBJECTIVE:

To determine correlation between action research arm test (ARAT) and Range of motion (ROM) of shoulder, elbow and wrist joint in all degree of freedom in chronic stroke patients.

METHODS:

It was a randomized control trial. Sample size was 41. Data collection was done from DHQ Hospital Jhelum. Conventional treatment was applied to control group and conventional treatment with neurodynamics was applied to experimental group, 10 rep/set, 1set/day, 3 days/week for 6 weeks. 0, 3rd and 6th week assessment was done through goniometry and action research arm test (ARAT). Correlation analysis was done through SPSS version 21.

RESULTS:

Spearman correlation analysis was done through SPSS version 21. The result of study indicates that value of r was (0.753-0.772) for shoulder flexion, (0.655-0.609) for shoulder extension, (0.734-0.742) for shoulder abduction, (0.627-0.688) for shoulder internal rotation, (0.585-0.560) for shoulder external rotation, (0.598-0.748) for elbow flexion, (0.088-0.240) for elbow extension, (0.633-0.547) for forearm supination, (0.584-0.649) for forearm pronation, (0.511-0.640) for wrist flexion, (0.561-0.602) for wrist extension, (0.496-0.460) for radial deviation, (0.464-0.459) for ulnar deviation and (0.750-0.783) for thumb abduction.

CONCLUSION:

This study concluded that there was moderate to strong correlation between action research arm test (ARAT) and range of motion (ROM) of shoulder, elbow and wrist joint in all degree of freedom in chronic stroke patients. This study also determined that there was low correlation between ARAT and range of elbow extension.

CONTRIBUTION OF PAPER:

- Present research investigated the correlation of action research arm test (ARAT) with upper extremity range of motion (ROM) and determined that there was moderate to strong correlation between action research arm test (ARAT) and upper extremity range of motion (ROM).
- There were no studies in the past to determine the correlation between action research arm test and upper extremity range of motion in chronic stroke patients.
- Few studies were done which determined the correlation of Action research arm test with other assessment scales like Fugl Meyer assessment scale and mental status scale.

KEYWORDS: Upper Extremity, Neurodynamics, Stroke.

INTRODUCTION

Stroke leads to neurological deficits, cognitive and musculoskeletal defects. Severe burning pain can occur in stroke which may be triggered by pinprick, heat, cold, loud noises, pressure and bright lights¹. Stroke patients neglect the hemiplegic side and visual neglect also occurs². In stroke, exaggeration of stretch reflex results from abnormal management of sensory

input³. If increased excitability of muscle spindle results, greater activation of afferent fibres occurs in patients with spasticity as compared to normal subjects with same velocity and amplitude.⁴
⁵. Neuronal firing rate decreases, reaching time increases, degeneration of alpha motoneurons and abnormal recruitment of motor units occur with the co-activation of agonist and antagonist muscles in stroke⁶. 30 to 36 percent of the stroke patient has



aphasia, 48 to 57 percent has dysarthria and 12 percent has swallowing difficulty (Dysphagia)⁷.

Prolong period of immobilization and inability to perform voluntary movement results in decrease range of movement (ROM) and contractures⁸. Fall risk increases in stroke patients which may be due to somatosensory deficits, balance and visual impairment, confusion, depression (feeling of dependence on others) and attention and perceptual deficits⁹. Difficulty to plan and execute purposeful movement is evident in stroke¹⁰.

There is high reliability for the universal Goniometer (.96 for flexion, .98 for extension) for both active shoulder flexion and extension. Reliability for passive shoulder medial rotation was fairly low, equaling .43 with a small Goniometer and .55 with a large Goniometer¹¹. Reliability of action research arm test is 0.92 - 0.97¹². Local facilitation techniques are used to energize weak muscles and to reduce tone of agonist muscle through reciprocal inhibition. Strengthening exercises can be performed manually or mechanically. Researches prove that strengthening exercises are effective for stroke patients^{13, 14}.

Neurodynamics technique has 4 levels from 0 to 3. At zero level neurodynamic testing contraindicated. At Level 1 (Limited Examination) Full neurodynamic tests are not completed. It is performed within range to avoid provocation of symptoms. This test is performed when there is severe pain, symptoms can easily be provoked and neurological deficit is present. At Level 2 (Standard Examination) neurodynamic tests are performed to a comfortable production of symptoms and if clinically appropriate tests can be taken to their end range otherwise it's not necessary to perform the test to end range. This test is performed when symptoms are not easily provoked; patient is stable and there are no neurological symptoms¹⁵.

RESULTS

Table 1: Demographic data of the 41 chronic stroke patients

Characteristics	Value
Age of patient (years)	51.98± 7.425
Sex (male/female)	18/23
Stroke type, (Ischemic /Hemorrhagic)	34/7
Paretic side (right/left)	25/16

Table 2: Spearman's correlation coefficient (r) and p value between ARAT and ROM:

Scales		ARAT	
		r	p
Shoulder Flexion	0 Week	0.753	<0.01
	3 rd Week	0.758	<0.01
	6 th Week	0.772	<0.01
Shoulder Extension	0 Week	0.655	<0.01
	3 rd Week	0.642	<0.01
	6 th Week	0.609	<0.01
Shoulder Abduction	0 Week	0.734	<0.01
	3 rd Week	0.752	<0.01

At Level 3a (Examination- Sensitization) Increase magnitude of force applied to the nervous system it involves adding the known sensitization maneuvers to standard tests. Level 3b (Examination- Sequencing) involve greater localization of forces. At Level 3c (Examination- Multistructural) Forces applied to the nervous system need to be more multistructural. At this level multiple structures are tested simultaneously. At Level 3d (Examination) Symptomatic position or movement is utilized. Neurodynamic movements are added to sensitize¹⁵. Present research investigated the correlation between upper extremity range of motion and action research arm test (ARAT) used to assess upper extremity performance in chronic stroke patients.

METHODS

It was a randomized control trial. Sample size was 41. After taking informed consent from the patients Data collection was done from DHQ Hospital Jhelum and patients were randomized through tossing a coin (simple randomization) to experimental and control group. Chronic stroke patients with age 40 to 60 years were recruited for this study. Conventional treatment (stretching and range of motion exercises¹⁵) was applied to control group and conventional treatment (stretching and range of motion exercises) with neurodynamics was applied was patients allocated to experimental group, 10 rep per set, 1set per day¹⁶, 3 days per week for 6 weeks. 0, 3rd and 6th week assessment was done through goniometry and action research arm test (ARAT). Correlation analysis was done through SPSS version 21.

ETHICAL APPROVAL

Ethical approval for the study was obtained from Research Ethical Committee of Riphah College of Rehabilitation Sciences, Riphah International University, Islamabad.



	6th Week	0.742	<0.01
Shoulder Internal Rotation	0 Week	0.627	<0.01
	3rd Week	0.701	<0.01
	6th Week	0.688	<0.01
Shoulder External Rotation	0 Week	0.585	<0.01
	3rd Week	0.671	<0.01
	6th Week	0.560	<0.01
Elbow Flexion	0 Week	0.598	<0.01
	3rd Week	0.655	<0.01
	6th Week	0.748	<0.01
Elbow Extension	0 Week	-0.088	>0.05
	3rd Week	-0.117	>0.05
	6th Week	-0.240	>0.05
Elbow Supination	0 Week	0.633	<0.01
	3rd Week	0.697	<0.01
	6th Week	0.547	<0.01
Elbow Pronation	0 Week	0.584	<0.01
	3rd Week	0.664	<0.01
	6th Week	0.619	<0.01
Wrist Flexion	0 Week	0.511	<0.01
	3rd Week	0.568	<0.01
	6th Week	0.642	<0.01
Wrist Extension	0 Week	0.561	<0.01
	3rd Week	0.604	<0.01
	6th Week	0.602	<0.01
Wrist Radial Deviation	0 Week	0.496	<0.01
	3rd Week	0.549	<0.01
	6th Week	0.460	<0.01
Wrist Ulnar Deviation	0 Week	0.464	<0.01
	3rd Week	0.560	<0.01
	6th Week	0.459	<0.01
Thumb Abduction	0 Week	0.750	<0.01
	3rd Week	0.797	<0.01
	6th Week	0.783	<0.01

ARAT= Action research arm test, ROM= Range of motion, Data is presented as spearman rho = r and p value.

Significant correlation <0.01,

Non significant correlation >0.05

The result of study indicates that value of r was (0.753-0.772) for shoulder flexion, (0.655-0.609) for shoulder extension, (0.734-0.742) for shoulder abduction, (0.627-0.688) for shoulder internal rotation, (0.585-0.560) for shoulder external rotation, (0.598-0.748) for elbow flexion, (0.088-0.240) for elbow extension, (0.633-0.547) for forearm supination, (0.584-0.649) for forearm pronation, (0.511-0.640) for wrist flexion, (0.561-0.602) for wrist extension, (0.496-0.460) for radial deviation, (0.464-0.459) for ulnar deviation and (0.750-0.783) for thumb abduction and p-value was <0.01 which indicates that moderate to strong correlation between action research arm test (ARAT) and range of motion (ROM) of shoulder, elbow and wrist joint in all degree of freedom in chronic stroke patients except elbow extension in which value of r was (0.088-0.240) and p-value was >0.05 at 0, 3rd week and 6th week which indicates that there was low correlation between ARAT and range of elbow extension.

DISCUSSION

The results of this study suggest that there was moderate to strong correlation between action research arm test (ARAT) and range of motion (ROM) of shoulder, elbow and wrist joint in all degree of freedom in chronic stroke patients. This study also determined that there was low correlation between ARAT and range of elbow extension. This study shows resemblance with some aspects of literature review as Nowak et al determined that brain regenerate itself by increasing axonal sprouting which results in neuroplasticity in brain in response to environmental demands¹⁷. Jeong Kang et al concluded that neurodynamics is effective to accelerate nerve conduction velocity and improve function in upper extremity in 10 stroke patients¹⁸.

Wei, Xi-Jun et al determined that fugl Meyer assessment scale, motor status scale and modified ashworth scale had higher



responsiveness to robotic training in chronic stroke patients and action research arm test had lower responsiveness. He concluded that Fugl-Meyer assessment scale and mental status scale would be the best choice to evaluate functional improvement in stroke patients using robotic training as intervention and had high correlation with action research arm test¹⁹. The current study determined that there was a moderate to strong correlation between action research arm test (ARAT) and range of motion (ROM) of upper extremity in 41 chronic stroke patients using neurodynamics as intervention. This study also determined that there was low correlation ($r = 0.088-0.240$) between ARAT and range of elbow extension.

Ratanapat Chanubol et al determined the correlation between ARAT and box and block test in 40 sub acute stroke patients and concluded that there was strong correlation between ARAT and box and block test²⁰. The current study determined the correlation between ARAT and ROM in upper extremity in 41 chronic stroke patients using neurodynamics as intervention and concluded that there was a moderate to strong correlation between action research arm test and range of motion in upper extremity in chronic stroke patients.

Katherine E. Lang determined the responsiveness and validity of action research arm test in acute stroke patients and determined that action research arm test is a valid and responsive tool in acute stroke patients²¹. Present research investigated the correlation of action research arm test (ARAT) with upper extremity range of motion (ROM) and determined that there was moderate to strong correlation between action research arm test (ARAT) and upper extremity range of motion (ROM).

CONCLUSION

This study concluded that there was moderate to strong correlation between action research arm test (ARAT) and range of motion (ROM) of shoulder, elbow and wrist joint in all degree of freedom in chronic stroke patients. This study also determined that there was low correlation between ARAT and range of elbow extension.

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CONFLICT OF INTEREST: No

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