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Article

Correlation Between Upper Extremity Range of Motion and Fugl Meyer Upper Extremity Scale in Stroke Patients

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Abstract

BACKGROUND: Stroke is a common cardiovascular disease. Severe headache and neck pain can occur in hemorrhagic or ischemic stroke. Restriction of normal functional movements occurs in stroke due to spasticity with development of abnormal posture of limbs. **OBJECTIVE:** To determine correlation between Range of motion (ROM) of shoulder, elbow and wrist joint in all degree of freedom and fugl Meyer upper extremity scale (FM-UE) in 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 fugl Meyer assessment scale (FM-UE). Correlation analysis was done through SPSS version 21. **RESULTS:** Spearmen correlation analysis was done through SPSS version 21. The result of study indicates that value of r was (0.883-0.885) for shoulder flexion, (0.835-0.862) for shoulder extension, (0. 887-891) for shoulder abduction, (0.817-0.835) for shoulder internal rotation, (0.827-0.861) for shoulder external rotation, (0.873-0.881) for elbow flexion, (0.303-0.318) for elbow extension, (0.826-0.858) for forearm supination, (0.837-0.873) for forearm pronation, (0.759-0.802) for wrist flexion, (0.731-0.794) for wrist extension, (0.675-0.727) for radial deviation, (0.643-0.694) for ulnar deviation and (0.881-0.901) for thumb abduction. **CONCLUSION:** This study concluded that there was strong correlation between range of motion (ROM) of shoulder, elbow and wrist joint in all degree of freedom and Fugl Meyer upper extremity scale (FM-UE) in stroke patients. This study also determined that there was moderate correlation between FM-UE scale and range of elbow extension.

Keywords: upper extremity; neurodynamics; stroke

Introduction

Stroke is a common cardiovascular disease. Severe headache and neck pain can occur in hemorrhagic or ischemic stroke[1]. Homonymous hemianopsia occurs with lesions of primary visual cortex or optic chiasma (Posterior cerebral artery distribution). 26 percent of stroke patients have visual defects. Loss of vision occurs in the contra lateral half of each visual field corresponding to hemiplegic side; nasal half of one eye and temporal half of other eye[2]. Muscle fibers atrophy occurs in stroke due to change in muscle composition, mostly decrease in fast fibers and increase in slow fibers occur. Due to type II fibers loss, difficulty to initiate and produce rapid movement develops[3].

Restriction of normal functional movements occurs in stroke due to spasticity with development of abnormal posture of limbs. Painful spasm develops due to spastic posture which leads to the development of contractures[4]. Apraxia is common in stroke in case of damage of left hemisphere than right and occurs in combination with aphasia[5]. In stroke active movement toward the affected side occurs with the strong extremity which leads to postural imbalance resulting in fall[6]. Ulcers and skin breakdown occurs due to ischemic damage and skin necrosis. 14.5 percent of the stroke

patients develop skin ulcers. The breakdown of skin from pressure, friction and shearing force over the bony prominences (e.g. ischial tuberosity) occur[7].

Fugl Meyer upper extremity score of 0-66 for motor performance was used. Validity of Fugl Meyer assessment scale for upper extremity is 0.757[8]. Reliabilities for passive shoulder flexion and extension is good (.98 for flexion and .94 for extension). Reliability for passive Shoulder Abduction is 0.67. Reliability for passive shoulder rotation ranged from .93, for medial rotation using a small Goniometer, to .99, for lateral rotation using a large Goniometer[9].

Modalities and splinting are also effective in reducing tone. Ice packs are used to reduce spasticity. Passive manual technique is used to increase range. Limb is moved into the lengthened range combined with gentle rotation. Samar M. Hatem et al in 2016 concluded that strengthening exercises are effective for improving upper extremity function in stroke patients and different techniques can be combined together. [10]

Neurodynamics technique can be slider and tensioner. One ended slider technique uses movements of the body to move the neural structures to one end of the neural system. In two-ended sliders tension is applied at one end of nervous system and released at the other end resulting in neural tissue sliding towards the starting point. One ended tensioner is applied in outer range as increase in neural tension occurs at the outer range of neurodynamic test. In two-ended tensioner tension is applied on both ends of neural tissue to elongate it. Greater tension is produced at both ends of neural tissue as compared to one ended technique. Present research investigated the correlation between upper extremity range of motion and Fugl Meyer upper extremity scale (FM-UE) used to assess upper extremity performance in stroke patients.

Methods

It was a randomized control trial. Sample size was 41. After taking informed consent from the patients, data was collected from DHQ Hospital Jhelum and patients were randomized through tossing a coin (simple randomization) to experimental and control group. Hemiplegic stroke patients with age 40 to 60 years were recruited for this study. Conventional treatment (stretching and range of motion exercises[15]) 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 day[16], 3 days per week for 6 weeks. 0, 3rd and 6th week assessment was done through goniometry and Fugl Meyer upper extremity scale (FM-UE). 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.

Results

Spearman correlation analysis was done through SPSS version 21. The result of study indicates that value of r was (0.883-0.885) for shoulder flexion, (0.835-0.862) for shoulder extension, (0.887-0.891) for shoulder abduction, (0.817-0.835) for shoulder internal rotation, (0.827-0.861) for shoulder external rotation, (0.873-0.881) for elbow flexion, (0.303-0.318) for elbow extension, (0.826-0.858) for forearm supination, (0.837-0.873) for forearm pronation, (0.759-0.802) for wrist flexion, (0.731-0.794) for wrist extension, (0.675-0.727) for radial deviation, (0.643-0.694) for ulnar deviation and (0.881-0.901) for thumb abduction and p-value was <0.01 which indicates that there was strong correlation between range of motion (ROM) of shoulder, elbow and wrist joint in all degree of freedom and Fugl Meyer upper extremity scale (FM-UE) for upper extremity performance in stroke patients except elbow extension in which value of r was (0.303-0.318) and p-value was >0.05 at 0, 3rd and 6th week which indicates that there was moderate correlation between FM-UE and range of elbow extension.

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. Mean and standard deviation of the FM-UE scale and ROM:.

Scales	Mean± standard deviation		
	0 week	3 rd week	6 th week
FM-UE scale	27.10 ±14.878	28.71±15.875	30.61±16.944
Shoulder Flexion	109.63±61.931	112.15±62.764	115.41±63.004
Shoulder Extension	18.88±13.550	19.56±14.094	20.90±14.630
Shoulder abduction	101.46±60.881	103.85±61.890	106.93±62.153
Shoulder Internal rotation	40.00±30.249	40.61±30.364	42.44±30.175
Shoulder external rotation	41.22±35.791	42.05±36.228	43.71±36.599
Elbow flexion	101.27±52.924	102.85±53.555	105.49±52.877
Elbow extension	3.00±5.809	3.00±5.809	2.51±5.202
Forearm supination	41.95±31.138	42.71±31.577	44.39±32.505
Forearm pronation	49.27±35.046	50.20±35.372	52.41±35.264
Wrist flexion	31.95±26.002	33.93±26.759	36.73±27.069
Wrist extension	23.66±21.448	24.95±22.201	27.10±22.587
Radial deviation	5.34±6.211	5.56±6.434	6.41±7.096
Ulnar deviation	6.51±8.032	6.73±8.280	7.71±8.835
Thumb abduction	33.29±23.548	35.20±24.479	38.27±25.335

FM-UE = Fugl Meyer upper extremity scale, ROM = Range of motion, Data is presented as Mean± standard deviation.

Table 3. Spearman’s correlation coefficient (r) and p value between FM-UE and ROM:.

Scales		FM-UE scale	
		r	p
Shoulder Flexion	0 week	0.883	<0.01
	3 rd week	0.886	<0.01
	6 th week	0.885	<0.01
Shoulder Extension	0 week	0.835	<0.01
	3 rd week	0.847	<0.01
	6 th week	0.862	<0.01
Shoulder Abduction	0 week	0.887	<0.01
	3 rd week	0.891	<0.01
	6 th week	0.891	<0.01
	0 week	0.817	<0.01

Shoulder Internal Rotation	3 rd week	0.826	<0.01
	6 th week	0.835	<0.01
Shoulder External Rotation	0 week	0.827	<0.01
	3 rd week	0.840	<0.01
	6 th week	0.861	<0.01
Elbow Flexion	0 week	0.873	<0.01
	3 rd week	0.877	<0.01
	6 th week	0.881	<0.01
Elbow Extension	0 week	-0.303	>0.05
	3 rd week	-0.299	>0.05
	6 th week	-0.318	>0.05
Elbow Supination	0 week	0.826	<0.01
	3 rd week	0.841	<0.01
	6 th week	0.858	<0.01
Elbow Pronation	0 week	0.837	<0.01
	3 rd week	0.852	<0.01
	6 th week	0.873	<0.01
Wrist Flexion	0 week	0.759	<0.01
	3 rd week	0.775	<0.01
	6 th week	0.802	<0.01
Wrist Extension	0 week	0.731	<0.01
	3 rd week	0.755	<0.01
	6 th week	0.794	<0.01
Wrist Radial Deviation	0 week	0.675	<0.01
	3 rd week	0.689	<0.01
	6 th week	0.727	<0.01
Wrist Ulnar Deviation	0 week	0.643	<0.01
	3 rd week	0.659	<0.01
	6 th week	0.694	<0.01
Thumb Abduction	0 week	0.881	<0.01
	3 rd week	0.884	<0.01
	6 th week	0.901	<0.01

FM-UE = Fugl Meyer upper extremity scale, ROM= Range of motion, Data is presented as spearman rho = r and p value. Significant correlation <0.01, Significant correlation <0.05, Non significant correlation >0.05.

Discussion

The results of this study suggest that there was strong correlation between range of motion (ROM) of shoulder, elbow and wrist joint in all degree of freedom and Fugl Meyer upper extremity scale (FM-UE) in stroke patients. This study also determined that there was moderate correlation between FM-UE scale and range of elbow extension. This study shows resemblance with some aspects of literature review as Santana et al determined the effect of neurodynamics on range of motion of shoulder joint in all degree of freedom and concluded that neurodynamics was effective to increase range of motion of shoulder joint in stroke patients which it do so by reducing muscle tension[13].

Wei, Xi-Jun et al concluded that there was high correlation among Fugl Meyer assessment scale, action research arm test and motor status scale and low to moderate correlation between modified ashworth scale and other assessments applied in 27 stroke patients using robotic training as intervention[14]. The current study determined the correlation between Fugl Meyer upper extremity scale and range of motion of upper extremity (shoulder, elbow and wrist joint motions in all degree of freedom). This study was performed on 41 stroke patients and neurodynamics was applied as intervention, this study concluded that there was strong correlation between FM-UE scale and upper extremity ROM. This study also determined that there was moderate correlation ($r = 0.303-0.318$) between FM-UE scale and range of elbow extension.

Kang Ji et al did study on 20 stroke patients and determined that dynamic neural mobilization technique was effective to increase cortical activity in brain[15] which leads to neuroplasticity. The current study concluded that there was strong correlation between FM-UE scale and upper extremity ROM. This study also determined that there was moderate correlation ($r = 0.303-0.318$) between FM-UE scale and range of elbow extension.

DJ Gladstone et al determined that Fugl Meyer assessment scale is highly recommended clinical tool for assessment of motor recovery in stroke patients[16]. The current study determined the correlation between Fugl Meyer upper extremity scale and range of motion of upper extremity (shoulder, elbow and wrist joint motions in all degree of freedom) applied in 41 stroke patients and concluded that there was strong correlation between FM-UE scale and upper extremity ROM. This study also determined that there was moderate correlation ($r = 0.303-0.318$) between FM-UE scale and range of elbow extension.

Conclusion

This study concluded that there was strong correlation between range of motion (ROM) of shoulder, elbow and wrist joint in all degree of freedom and Fugl Meyer upper extremity scale (FM-UE) in stroke patients. This study also determined that there was moderate correlation between FM-UE scale and range of elbow extension.

Supplementary Materials: The following supporting information can be downloaded at the website of this paper posted on Preprints.org.

Funding: No

Informed Consent: Informed consent was taken from the patients and after taking informed consent from the patients, they were randomized to experimental group and control group.

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

Conflict of Interest: No

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