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Original Research Article

INTER RATER RELIABILITY OF MODIFIED TARDIEU SCALE TO QUANTIFY THE SPASTICITY IN ELBOW FLEXORS IN PATIENTS WITH CEREBRO VASCULAR ACCIDENT

Suresh Kumar T *[1], Leo Rathinaraj A.S [2], Jegannathan A.[3].

*[1] Associate Professor, Maharashtra Institute of Physiotherapy, Latur, Maharashtra, India.

[2] Lecturer, Department of Physical Therapy, COAMS, University of Hail, Saudi Arabia.

[3] Professor, MAEER's Physiotherapy College, Talegaon, Pune, Maharashtra, India.

ABSTRACT

Background: Spasticity is best described as 'a motor disorder characterized by a velocity dependent increase in tonic stretch reflexes with exaggerated tendon jerks, resulting from hyper excitability of the stretch reflex. The MTS determines the passive range of movement (PROM) at different movement velocities, with the relative difference between a slow and a fast velocity passive stretch determining the dynamic component of the muscle contracture. there are very limited studies on reliability on MTS.

Methodology: 60 Patients with age group of 40 to 65 year will be selected for the study . The patient will be explained about the study and procedure. All subjects were tested by two examiners. Subjects were at rest at least ten minutes before the test. Standardized resting limb positions are followed for elbow flexor measurements.

Results: Correlation coeffient R1 value is 0.914, R2 value is 0.936 , R2-R1 value is 0.962 and MTS value is 0.907.these values suggest there is strong correlation from rater 1 and Rater 2

Conclusion: Inter-rater reliability for elbow flexors were very good forR1, R2, R2-R1, AND MTS score.

KEY WORDS: Spasticity, Modified Tardieu Scale, Stroke, Hemiplegia, Upper Limb Function.

Address for correspondence: Dr. Suresh Kumar T, Associate Professor, Maharashtra Institute of Physiotherapy, Latur, Maharashtra, India. **E-Mail:** sureshphysio2000@gmail.com

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INTRODUCTION

Stroke is one of the leading causes of death and disability in India. The estimated adjusted prevalence rate of stroke range, 84-262/100,000 in rural and 334-424/100,000 in urban areas. There is also a wide variation in case fatality rates with the highest being 42% in Kolkata [1].

At least 85% of stroke patients experience hemiplegia and upper-extremity function of at least 69% of patients is damaged [2]. People who sustain a stroke have upper extremity impairment and most of them do not regain functional use of their paretic upper limb, which can make them dependant in their activities of daily living. It results in the reduction in quality of life. Hemiplegic damage to upper-extremity function has critical effects on the ability to perform independent activities of daily living [3]. The recovery of proximal joints functions are often faster than distal joints. Activities of daily living are much limited due to failure of recovery of distal joints even though regaining of strength and coordination at proximal joints has

occurred. Thus recovery of hand function is a critical component in stroke rehabilitation [4].

Spasticity is best described as 'a motor disorder characterized by a velocity dependent increase in tonic stretch reflexes with exaggerated tendon jerks, resulting from hyper excitability of the stretch reflex [5]. This definition suggests that the abnormality underlying spasticity is hyper excitability of the stretch reflex, both tonic and phasic components, which can result in an increased resistance to passive movement [6].

Measurement of spasticity can be done by clinical and laboratory methods. The currently used clinical measurement tools for spasticity are the Ashworth and Modified Ashworth scales (MAS) [7], but their validity has been questioned as they do not measure velocity-dependent aspect of spasticity [8,9]. Vattanasilp *et al.* also described Ashworth scale as a grading of muscle stiffness, which is unable to differentiate' between 'the neural and peripheral contributions [10].

Commonly used clinical tools for assessment of spasticity/muscle tone are the Ashworth/ Modified Ashworth Scale (AS/MAS), Tardieu/ Modified Tardieu Scale (TS/MTS), Composite Spasticity Index (CSI), etc [11].

The validity of the MAS in terms of spasticity assessment is questionable, as it does not address the velocity-dependent phenomenon, but is a sum of neural and non-neural components to passive movement [12]. However, a significant positive correlation has been found between the AS scores and neural components in stroke patients, whereas no consistent correlation has been found between AS scores and non-neural components . Results concerning reliability of the MAS remain equivocal [13].

In 1954, Tardieu *et al.* developed a clinical scale, known as Tardieu Scale, to measure the spasticity which was further modified by Held and Peierrot-Deseilligny [14] and was later modified by Boyd and Graham, presently known as Modified Tardieu Scale (MTS) [15].

The MTS determines the passive range of movement (PROM) at different movement velocities, with the relative difference between a slow and a fast velocity passive stretch determining the dynamic component of the muscle contracture [16]. With the MTS, two resulting joint angles are measured by goniometer which include the R1 angle which is the 'angle of catch' after a fast velocity stretch and the R2 angle defined as the passive joint range of movement following a slow velocity stretch [17].

METHODOLOGY

60 Patients with age group of 40 to 65 year will be selected for the study and screened through inclusion and exclusion criteria. The inclusion criteria are medically stable acute stroke subjects at least one month of onset, age group between 45 to 85 years, both male and females are included and MMSC more than 24. The exclusion criteria were Un co-operative patients, History of pain or surgery in the elbow joint, Previous history of TIA patients on tone modifying drugs (baclofen, Diazepam etc) andAny other orthopedic, Neurologic, Cardio respiratory conditions that affects the outcome of the study. The patient will be explained about the study and procedure. Consent of the patient will be taken. The study passed through ethical committee before starting of the study

All subjects were tested in the same position for both the tests. Subjects were at rest at least ten minutes before the test. Standardized resting limb positions are followed for elbow flexor measurements . Goniometer is used to measure range of motion and the equipment was rounded to 1 degree for accuracy. Placement of goniometer for measurement of angle of muscle reaction R1and R2 was adapted.

The subjects were made to sit on a chair with shoulder in adduction for elbow flexors. A universal goniometer was used for the test procedure. The lateral epicondyle of humerus was marked with a marker pen and a point was marked on the acromion process for reference. A line was drawn joining these two points (first line).

The second line was drawn from the radial head to the radial styloid process, after positioning of the axis over the lateral epicondyle of humerus with stabilizing arm along the first line and movable arm along the second line. The goniometer was fixed by two Velcro (2 inch width) around the arm and forearm.

The joint will be moved first with a very slow-

stretching velocity(V1) from elbow flexion to extension to measure the PROM by counting as 1001, 1002, 1003……onwards. During this maneuver, the catch was noted by the rater and R2 is documented. Quality of muscle reaction (MTS scores) ranging from 0 to 4 grades will be rated by the rater at the stretching velocity of V2. At last, the angle of muscle reaction is measured at the point of resistance to the fastest stretching velocity V2 by counting 1, 2, 3…..onwards. The angle of catch (R1) is noted by the observer. Throughout the procedure, the rater will be blinded by covering the goniometer with opaque tape and observer documented all values. This was a double blind study, The test procedure were taken by two raters separately and both are blind about each other's reading.

Statistical Analysis

Table 1: Correlation of R1:

r-value	p-value	Result
0.914	<0.0001	P<0.0001 Strong correlation

Intra-rater Reliability of R1 Value 0.914 shows strong co-relation between Rater I and Rater 2

Table 2: Correlation of R2:

r-value	p-value	Result
0.936	<0.0001	P<0.0001 Strong correlation

Intra-rater Reliability of R2 Value 0.936 shows strong co-relation between Rater I and Rater 2

Table 3: Correlation of R2:

r-value	p-value	Result
0.962	<0.0001	P<0.0001 Strong correlation

Intra-rater Reliability of R2-R1 Value 0.962 shows strong co-relation between RaterI and Rater 2

Table 4: Correlation of MTS Score:

t-value	p-value	Result
R=9.07	<0.0001	<0.0001 Strong correlation

Intra-rater Reliability of MTS score value R=0.907 shows strong co-relation between Rater I and Rater 2.

Table 5: Correlation:

	RATERS	MEAN	S.D	r-value	p-value
R1	1	63.2	20.7	0.19	0.84
	2	64.42	19.74	0.19	0.84
R2	1	110.93	17.37	0.61	0.53
	2	118.18	18.08	0.61	0.53
R2-R1	1	53.8	19	0	1
	2	54.6	19	0	1
MTS	1	1.62	0.57	0.4	0.66
	2	1.7	0.61	0.4	0.66

DISCUSSION

Upper motor neurone syndrome (UMNS) has both "positive" and "negative" signs. Negative signs are weakness, paralysis, impaired dexterity and fatigue. Positive signs are spasticity, spastic co-contraction, associated reactions, enhanced primitive reflexes and spastic dystonia [18]. Spasticity is characterized by a velocity-dependent increase in the excitability of tonic and phasic muscle stretch reflexes [19].

Tardieu's clinical and physiologic observations in the 1950s [20] and the confirmatory studies by Burke et al [21] emphasized the exaggeration of the velocity-dependent muscle reactions to stretch as a common denominator in patients with paresis caused by damage to the central motor pathwa The key strength of the Tardieu Scale is that, in contrast to the Ashworth scale, it includes assessments at two different velocities to discriminate between contracture and spasticity.

It is this feature alone that makes the Tardieu Scale the most clinically relevant assessment of spasticity. The Tardieu Scale has many limitations. Perhaps the most significant limitation is that interpretation of the scale relies on a good understanding of the difference between contracture and spasticity. A second limitation is that some new users may consider the widely available instructions accompanying the scale to be inadequate. Various authors have subsequently explained the scale, and new users will find this additional detail useful [22].

There are many variations of the original scale currently used in clinical practice. All of these variations have the potential to cause confusion. Some clinicians use a 5-point scale rather than a 6-point scale to assess the quality of muscle reaction [23], and some ignore the option of

using V2, instead relying on V3 when assessing at a fast velocity. In addition, others have introduced new terms, namely R1 and R2, to describe the angle of muscle response for V3 and V1, respectively [24].

To achieve a reliable assessment, it is, therefore, necessary to follow a standardized protocol. With the TS the intensity of the muscle tone is scored on a 5- point scale, in which clonus is set to be the highest level of spasticity [25]. The TS compares the angle of appearance of the increased muscle tone at three different movement velocities. A measure derived from the TS, used in the literature [26] as a clinical measure of spasticity, is the 'dynamic component'. This can be calculated as the difference between the joint angle of the passive range of joint movement at a very slow passive stretch (R2) and the joint angle of the catch at a fast velocity stretch (R1). However, the calculated difference adds together the variances of both joint angles, resulting in very wide inter-sessional variations,] as has been demonstrated in a recent study. Inter rater reliability reported by Mehrholz et al for MTS in comparative study of MTS and MAS was moderate to very good (k=0.52-0.87) in severe brain injury adult subject.

CONCLUSION

In this study we are reporting Inter rater reliability of MTS in a population of 30 stroke subjects.

Inter-rater agreement for elbow flexors were very good forR1, R2, R2-R1, AND MTS score.

In this study we used universal goniometer in study as this easy to use, cost effective and widely available in all kinds of setting. We recommend the Modified Tardieu scale can be used for future research purposes.

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Ethical Clearance: This research study is given clearance under Ethical committee headed by Principal, Maharashtra Institute of Physiotherapy, Latur.

Conflicts of interest: **None**

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