



## TO STUDY THE INSTANT EFFECT OF PASSIVE AND ACTIVE STRETCHING ON ELBOW FLEXOR SPASTICITY IN STROKE SURVIVORS.

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### ABSTRACT

**Background:** The purpose of this study was to assess the effect of passive and active stretching on elbow flexor spasticity in stroke survivors.

**Method:** 30 subjects stroke with elbow flexor spasticity were included in this study. The age between 40-80 years. Subjects were selected by simple random method and allocated into 2 groups, for group A passive stretching and for group B active stretching of elbow flexor. Before and after the treatment subjects were assessed and analysed with Modified Ashworth scale for (elbow flexor) and Goniometry Range of motion (Elbow extension).

**Result:** Pre and post treatment protocol was analysed using Wilcoxon matched-pairs test and Mann-whitney test for Modified Ashworth Scale and paired t-test and unpaired t-test for goniometry. This analysis showed that no significant difference in tone of elbow flexor muscle ( $p=0.7857$ ) and no significant difference in ROM of elbow extension ( $p=0.4400$ ).

**Conclusion:** Present study concluded that both passive stretching and active stretching showed significant relief of pain, reduce muscle tone and improvement in range of motion. It showed extremely significant improvement in range of motion statistically and clinically and thus facilitated the outcomes. Overall there was no significant difference found between groups.

**KEYWORDS :** Passive stretching, Active stretching, Elbow flexor, Elbow extension.

### Introduction

Stroke is defined as the sudden loss of neurological function caused by an interruption of the blood flow to the brain. Neurological deficits must be present for at least 24 hours to be classified as stroke. 1(pg.645,646) An estimated 102,000 deaths which represented 1.2% of total deaths in India. In India prevalent cases of stroke was estimated that a total of 1,083,500 cases of stroke would be present giving a prevalence in the total population (982 million) of 110.34/100,000.<sup>2</sup>

Stroke is classified as ischemic stroke and hemorrhagic stroke. There are many risk factors for stroke, non-modified and modified. Non-modified where age, gender, low birth weight, genetic factors and modified where hypertension, cigarette smoking, diabetes, atrial fibrillation, diet and nutrition, obesity, infection. 1(pg.647) Signs and symptoms of stroke includes severe headache, fatigue, difficulty in walking, dizziness, trouble in balance and problem in co-ordination, confusion, difficulty in speaking or understanding the language, disturbance in vision, weakness are present in the face, arm, leg on one side or both the side of body. Flaccidity is present in motor functions of the affected side of the body. In recovery stages flaccidity is replaced by the development of spasticity (hypertonicity), hyperreflexia and mass pattern of the movement (synergy). 90% of cases emerges spasticity in antigravity muscles. 1(pg.670) Spasticity has been defined as "a motor disorder characterized by a velocity-dependent increase in muscle tone with increased resistance to stretch. 1(pg.169) In stroke, spasticity results in a tightly fist hand with elbow flexed and held tightly against the chest or a stiff extended knee with plantarflexed foot. 1(pg.670) To measure the spasticity Modified Ashworth scale is used because it gives satisfactory clinical measure to upper limb spasticity. 3 Stroke is characterised by upper motor neuron syndrome including spasticity were considered to be major determinant of these motor impairment. 4 In other words, spasticity and flexor spasms of UMN syndrome are due to hyperactive spinal reflexes. 5 In the management of stroke, problem is to control of spasticity in patients with spasticity. 5 Several studies of electromyography have shown that the reflex mediated increase in muscle tone reaches its maximum between 1 and 3 months after stroke. Resistance increases to movement due to intrinsic changes of the muscle after 3 months. 4 Spasticity is hypertonia due to hyperexcitable tonic stretch reflexes. Speed of

the muscle stretch and other positive UMN signs distinguishes spasticity from rigidity. 6 Spasticity is neural in origin, muscle cell and extracellular matrix contribute to structural changes of soft tissue. Consequences of spasticity are limitations in movement and pain. 7 It is very difficult to assess the influence of spasticity in stroke patients, because degree of spasticity may change according to the position of subject and task being performed. 7

Spasticity can be managed by variety of methods, including electrical stimulation, vibration, muscle tapping, massage, and stretch. Among them, stretch has been extensively used in clinics because it is safe, convenient and economical. 1(pg.684)

Stretching involves the application of manual or mechanical force to elongate structures that have adaptively shortened and are hypomobile. Effects of stretching are to improve muscle elongation, viscoelastic changes affecting muscle extensibility, reduce muscle soreness, tightness, spasm, increase muscle tone, reduce pain, prevents contractures. 1(pg.422) Stretching is process of elongation and currently used technique in the physical management of spasticity. 7 Tension is applied on soft tissue structures during stretching. Stretching may change the muscle's viscoelastic structural and excitability properties. In treatment of spasticity stretching is given may be to normalise muscle tone, to reduce pain and to improve function. Amount of tension that is applied to structures is the intensity of stretch, which not only can be different in the force level but can also be kept either constant or can be varied. 7

There are several stretching techniques have been described but there are three common stretching techniques are mostly used in treatment of spasticity such as static stretching, active self stretching, proprioceptive neuromuscular facilitation, ballistic stretching. 8,1 Also there are some common stretching modalities are used in the treatment of spasticity like splinting, casting and orthotic techniques. 7 Stretching is more complex when it commonly combined with another technique like passive movement and the use of both the techniques in spasticity. so that whether stretch is only applied at the end range of motion or if retaining a limb with spasticity in certain position, not at the end range but with resistance, is a stretch. 7

Passive stretching and active stretching techniques are easy to implement and are useful as home exercises when it compares with other stretching technique. Passive stretching technique is featured by addition of stretch stimulation on muscle contraction independent of the subject and active stretching increases the flexibility of tight muscles while concomitantly improving the function of antagonistic muscles. New active stretching technique named as dynamic range of motion . A contraction by the antagonist muscle causes the joint crossed by the agonist muscle to move through the full range of motion at a controlled, slow pattern, it takes advantage of reciprocal innervation. <sup>10</sup> There is study which shown that dynamic range of motion stretching technique is less effective than passive stretching.<sup>11</sup> But it was not an accurate comparison of stretching techniques because their study had different stretching conditions, like different stretch elongation times.<sup>10</sup>

Active stretching is may be effective than passive stretching because it is technique in which joint is manually moving through its range of motion to reduce spasticity and restores movement and function. The effect of the passive stretching is depend on the ability of the physiotherapist. <sup>12</sup> At least 20 -30 seconds of stretch with four to five repetitions can be given in passive stretching technique whereas low load prolonged stretching of 15 to 30 minutes can be applied by using mechanical pulleys, weights and orthotic devices .<sup>1</sup>(pg422) Active stretching may be more effective because there is active involvement of the subject and stretching it simultaneously strengthen the antagonist muscle. <sup>13</sup> It increases flexibility by a neurological mechanism. A actively stretched muscle moved to the end range , muscle spindle sensitivity may reduce and inhibits the Golgi tendon organs by holding the muscle in this position.<sup>14</sup>

The mechanism of the stretching is it alters the neural activity by minimizing the muscle spindle activation and reflex contraction of the muscle being stretched. The activation of GTO with inhibition of stretched muscle by maintaining the position at maximal end range.<sup>1</sup>(422) Thus the various types of stretching techniques are used to reduce spasticity but the evidence for the specific effective stretching technique in management of spasticity remains insufficient.<sup>10</sup>

**Materials and methodology**

Population: Subjects who diagnosed with spasticity in elbow flexor muscles after stroke. The criteria for inclusion were: age between 40-80 years and both male and female, subjects who have grade 1-2 of spasticity according to modified Ashworth scale. Subjects were excluded if they have more than grade 2 of spaticity and subjects with bilateral stroke condition.

30 subjects with age (range 40-80 years, 18 males and 12 females) participated in the study, written consent form was taken. Subjects were divided into two experimental groups through random sampling allocation method. Out of 30 subjects, 15 subjects received passive stretching and remaining 15 subjects received active stretching of elbow flexor muscle. All the subjects were informed about the experimental protocol and risks of the study and gave written consent before their participation. The protocol and the consent form were previously approved by protocol and ethical committee.

**Measurement Procedure:**

The Modified Ashworth scale for elbow flexor muscles and range of motion of elbow extension were performed.

**Modified Ashworth scale**

Tone of elbow flexor muscle has been assessed by Modified Ashworth scale. Subject was lying on his/her back on low level plinth. Physiotherapist position was standing on the affected side in walk standing position. Fast passive movements of the elbow joint were performed by the therapist with fixing the proximal part of the

arm and moving the distal part of the arm. One hand of the therapist were on the acromion process to stabilise the shoulder joint and the other hand of the therapist were grasping the wrist joint to perform fast passive movements of the elbow joint (flexion and extension). While performing the fast passive movement of the elbow joint increase in muscle tone with resistance were found when affected part was moved in extension that is between grade 1 to 2 of modified Ashworth scale.

**Active Elbow extension Range of motion**

To measure range of motion of elbow extension of the affected side, subject was lying on his/her back on low level plinth. Physiotherapist position was standing on the affected side, Active elbow extension range of motion was measured with Goniometer. Fulcrum was placed on lateral epicondyle of the affected arm stationary arm was pointing towards the tip of the acromion process and moving arm was pointing towards the ulnar styloid process. Instructions to the subject was to move the distal arm in extended position actively, while maintaining elbow extension degrees were noted wot goniometer. A positive value of extension is equivalent to flexion.<sup>17</sup>

**Therapeutic protocol**

**Active stretching:-**

Position of the subject was standing position beside the fixed vertical rod. Before asking patient to perform active stretching therapist showed the active stretching technique to patient by performing itself. Instruction was given to the subject by therapist grasp the vertical rod with affected hand at near by 90 degree angle to the rod. Then pull your body away from the rod and the position for 5 minutes. By pulling your body away from the rod immediately you will feel stretch of elbow flexor muscles.

**Passive stretching :-**

Position of the subject was lying on his/her back on low level plinth, therapist position was sitting on plinth to the side according to affected side of subject. Towel fold was placed under the proximal arm of the subject, one hand of the therapist were on acromion process of the shoulder joint to stabilise it and other hand was grasping the subjects affected hand. Slight downward pressure was applied by the therapist and additional pressure was applied by performing wrist extension of the subject for more stretch. Then subject will feel stretch of elbow flexor muscles.

**Statistical analysis**

The data was entered into Microsoft office excel 2010. The data was analysed using instat software. Descriptive statistics were used to analyse baseline data for demographic data. Unpaired t test and Mann-Whitney test was used to find the significance of parameters between pre and post-test and p value less than 0.05 was considered to be statistically significant.

30 subjects were included in the study. 15 subjects (9 males, 6 females) with elbow flexor spasticity were in group A where passive stretching of elbow flexor muscles was given and 15 subjects (9 males, 6 females) with elbow flexor spasticity were in group B where active stretching of elbow flexor muscles was given. Pre analysis was done for all 56 subjects. The descriptive analysis of the study is summarized in table 1. Inter group analysis is done in table 2 and intra group analysis in table 3.

**Table 1: Descriptive characteristics of subjects in the study**

VARIABLES	MEAN + SD	
	Group A	Group B
Age	55.06±8.67	53.13±9.21
No of subjects	15	15
No of Males	9	9
No of Females	6	6
Side affected Right	8	8
Side affected Left	7	7

**Table 2: Inter group analysis comparing pre and post of each group**

N= 30 ( 15 in each group )			Group A	Group B	P value	
Modified Ashworth Scale	Elbow flexor	Median	Pre	2	1+	0.2329
			Post	1	1	0.7857
Range of motion	Elbow extension	Mean+SD	Pre	160.73±7.35	165.33±6.9	0.0882
			Post	168.26±7.01	170.2±6.49	0.4400

Inter group analysis of all variables was done using unpaired t test and Mann-Whitney test. Pre interventional analysis showed no significance for Modified Ashworth Scale for elbow flexor ( p =0.2329), and no significance for elbow extension range of motion ( p = 0.0882) between group A and group B. Post interventional analysis showed no significance for Modified Ashworth Scale for elbow flexor ( p = 0.7857) and wasn't significant for elbow extension range of motion (p=0.4400).

**Table 3: Intra group analysis comparing pre-pre post-post of each group**

Group	Group A	Group B
Pre Median	2	1+
Post Median	1	1
p value	0.0005	0.0039
Group	Group A	Group B
Pre intervention (Mean±SD)	160.73±7.35	165.33±6.9
Post intervention (Mean±SD)	168.26±7.01	170.2±6.49
P value	<0.0001	<0.0001

Intra group statistical analysis revealed extreme significance (p=0.0005, <0.0001, <0.0001) and very significance (p=0.0039) between pre and post intervention for all the groups using Wilcoxon matched-pairs test and paired t test. The result shows there is increase in range of motion and reduction in muscle.

## Discussion

The purpose of present study was to find out the instant effect of passive and active stretching on elbow flexor spasticity in stroke survivors.

In Stroke survivors, most of the time subjects may not able to maintain their tone of muscles or able to reduce tone in spasticity. Stretching helps to elongate the muscle, improve range of motion, reduces muscle- soreness, tightness, spasm, reduces risk of injury or soreness, reduce pain. So, that it helps the subjects to become independent for daily activities.

Passive stretching gives effect by altering neural activity by minimizing muscle spindle activation and reflex contraction of the muscle being stretched. Also autogenic inhibition of the muscle is by activation Golgi tendon organs. But the effect of the passive stretching is also depends on ability of the therapist. Also some studies shows that muscular performance decreased after static stretching.

Active stretching has main advantage of active involvement of the subject , so the active involvement of the subject with spasticity gives better result due to simultaneously strengthen the antagonist muscle. It increases flexibility by a neurological mechanism.a Actively stretched muscle moved to the end range , muscle spindle sensitivity may reduce and inhibits the Golgi tendon organs by holding the muscle in this position.

30 subjects diagnosed with spasticity after stroke (Hemiplegia) of

age between 40-80 years approaching to KIMSDU participated in the study. Pre-intervention and post intervention outcome measures for spasticity and range of motion was done by Modified Ashworth Scale and Goniometry.

The statistical improvement in Modified Ashworth Scale and Goniometry was seen in this study.

This study states that age groups with 40-60 are more affected as compared to 60-80.

Intragroup comparison (within group) was analysed statistically using Wilcoxon matched-pairs test for Modified Ashworth Scale and paired t-test for goniometry and intergroup comparison (between group) was analysed statistically using Mann-whitney test for Modified Ashworth Scale and unpaired t-test for goniometry.

Intragroup comparison (within group) was analysed statistically using Wilcoxon matched-pairs test for Modified Ashworth Scale. This shows that there is significant difference of group A (P=0.0005) and there is not significant difference of group B (P=0.0039) and for goniometry using paired t-test shows that there is an extremely significant difference of group A (<0.0001) similarly there is an extremely significant difference of group B (<0.0001). But in intergroup comparison (between group) was analysed statistically using Mann-whitney test for Modified Ashworth Scale. This shows that pre-interventional values, there was not significant difference of group A and group B (P=0.2329) and for goniometry using unpaired t-test shows that not significant difference of group A and group B (0.0882). While on comparing with post interventional values, the results between two groups using Mann-whitney test for Modified Ashworth Scale revealed that there was no statistical difference seen with p value (0.7857) for goniometry using unpaired t-test shows that there was no statistical difference seen with p values(0.4400).

This study shows that passive stretching and active stretching are both effective manoeuvres on elbow flexor spasticity in stroke survivors.

Thus, there was significant improvement in subjects who underwent passive stretching and active stretching.

## Abbreviations –

MAS : Modified Ashworth Scale  
ROM: Range of Motion  
GTO: Golgi tendon organs

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