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## ORIGINAL ARTICLE

**COMPARATIVE STUDY OF EFFECT OF TENS WITH PASSIVE STRETCHING VS ELECTRIC MUSCLE STIMULATOR WITH PASSIVE STRETCHING ON SPASTICITY OF BICEPS BRACHII MUSCLE IN STROKE PATIENTS**

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## Abstract

**Background and purpose:** To analyze the effect of TENS & Electric Muscle Stimulator when combined with passive stretching on spasticity of biceps brachii muscle in stroke patients. **Method:** 40 male & female subjects with stroke aged in between age 50-65 years are included in study on basis of inclusion criteria were conveniently assigned with 20 subjects in each group. Group A received TENS with passive stretching & Group B received Electric Muscle Stimulator with passive stretching. After assessment & evaluation of patients on day 1, MAS was recorded. Treatment was given 30 min. daily for 5 days a week for 6 weeks. **Result:** The data was analyzed through Wilcoxon signed rank test for comparing the pre and post values of MAS with in both the groups and Mann Whitney Test for comparison of data between the two groups. Results of this study show that the Electric Muscle Stimulator when combined with passive stretching are much more effective in reducing spasticity of biceps brachii muscle in stroke patients. **Conclusion:** This study provides evidence that both the intervention programs are effective in improving spasticity of biceps brachii muscle of stroke patients but Electric Muscle Stimulator with passive stretching is more beneficiary for the patients.

**Keywords:** Spasticity, Stroke, TENS, Electric Muscle Stimulator, Passive Stretching, Modified Ashwarth Scale.

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## INTRODUCTION

A stroke is caused by the interruption of the blood supply to the brain, usually because a blood vessel bursts or is blocked by a clot. This cuts off the supply of oxygen and nutrients to the brain, causing damage to the brain tissue. Stroke is a clinical syndrome divided into two broad categories i.e. (1) Ischemic Stroke (2) Hemorrhagic Stroke that defines its pathophysiology<sup>1</sup>.

Stroke is a global health problem. It is the second commonest cause of death and fourth leading cause of disability worldwide. Approximately 20 million people each year will suffer from stroke and of these 5 million will not survive<sup>2</sup>.

The onset of spasticity is highly variable and can occur in the short-, medium- or long-term post-stroke period<sup>3</sup>. TENS has recently been applied to decrease spasticity and improve balance and gait in stroke patients.

Electric Muscle Stimulator has been shown to increase the circulation to skin and muscle. Electrical Muscle Stimulation has been used to increase strength and endurance in partially and fully paralyzed muscle. Stretching, the process of elongation is one of the currently used techniques in the physical management of spasticity<sup>4,5</sup>

Manual stretching is more difficult to standardize but suits clinical practice better. Stretching may change the muscle's viscoelastic, structural & excitability properties<sup>6,7</sup>.

**Research Question:** Out of two techniques used in this study i.e. TENS with passive stretching and Electric Muscle stimulator with passive stretching; which technique has considerable good effect on reducing the spasticity of biceps brachii?

**Aim of the study:** Aim of this study is to investigate either TENS when combined with Passive stretching or Electric Muscle stimulator when combined with passive stretching, Which technique is more beneficiary to reduce the spasticity of Biceps brachii in stroke patients.

### Objectives of the study:

- Literary study of stroke.
- To compile a literature on biceps brachii muscle in detail.
- To compile literature of TENS, Electric Muscle stimulator & passive stretching in detail.
- Effect of TENS with passive stretching Vs Electric Muscle stimulator with passive stretching on spasticity of Biceps brachii in stroke.

### Null Hypothesis

There will be no significant difference between the effect of TENS and Electric Muscle Stimulator combined with Passive Stretching on Spasticity of Biceps brachii muscle after stroke.

### Purpose /Relevance Of Selection Of Topic:

The purpose of study is to find out which method has better efficacy in reducing spasticity of muscles. And to apply the better approach in daily clinical scenario to provide benefits to patients having spasticity after stroke<sup>8</sup>.

## METHODOLOGY

**Study Design:** The study design is Experimental in nature.

**Sample size:** 40 male & female having biceps spasticity after stroke with mean age of 58.65 were selected for the study and were divided to Group A & Group B by convenient method.

### Study setting:

- OPD of Shree Baba Mastnath college of physiotherapy, Asthal Bohar, Rohtak
- Apex plus super specialty Neuro Hospital, Rohtak
- Holy Heart Hospital Rohtak.

### Selection Criteria

#### Inclusion criteria:

- Patient diagnosed with Either sided hemiplegia
- Patients with stroke from 6 months to 2 years.
- Both Male & Female subjects are included.
- Age 50-65 years .
- Patients with MAS score 2 or less than 2 are included in study.

#### Exclusion criteria:

- Patient with Psychiatric disorders
- Non co-operative patients
- Neurological impairments other than hemiplegia
- Cognitive impairment
- Perceptual impairment
- Visual impairment
- Hearing impairments
- Any previous upper limb fracture

### Procedure:

40 chronic stroke patients, having biceps brachii spasticity, who met all the inclusion criteria, with mean age 58.65 years, after ethical committee approval. All the participants were given verbal instructions for the procedure and informed consent form was obtained from each one of them, prior to the participation in the study. Study was divided in to two groups Group A receiving TENS with passive stretching and Group B receiving Muscle stimulator with Passive stretching.

#### Group A

Group A was given TENS with passive stretching to biceps brachii muscle. Procedure for TENS with passive stretching With the subject in supine- lying, TENS (with 30 minutes, 2-10 Hz frequency,& patient tolerable intensity) was given at Biceps Brachii muscle by placing +ve Electrode over origin of muscle and -ve Electrode over insertion of muscle along with three passive stretches with duration of 30 second each simultaneously for 5 days a week for 6 weeks.

#### Group B

Group B was given Electric Muscle Stimulator with passive stretching to biceps brachii muscle. Procedure for Electric Muscle Stimulator with passive stretching With the subject in supine lying, Electric Muscle Stimulator (with 30 minutes, 20-50 Hz frequency & patient tolerable intensity) was given at Biceps Brachii muscle by placing +ve Electrode over origin of muscle and -ve Electrode over insertion of muscle along with three passive stretches with duration of 30

second each simultaneously for 5 days a week for 6 weeks.

At 0 sessions, pre treatment Modified Assessment Scale (MAS) scores for each group were obtained. Total sessions of treatment were 30 as the study was 5 days a week for 6 weeks. On the last session again post treatment MAS scores for each group were obtained & compiled.

#### Population:

The population of the study constitutes the male and female patients of biceps brachii spasticity after stroke from following hospitals:

List of Hospitals is as follows:

- OPD of Shree Baba Mastnath college of physiotherapy, Asthal Bohar, Rohtak
- Apex plus super specialty Neuro Hospital, Rohtak
- Holy Heart Hospital Rohtak.

**Sampling Method:** Convenient sampling was done.

#### Variables

##### INDEPENDENT VARIABLE

- Transcutaneous Electrical Nerve Stimulation
- Electric Muscle Stimulator
- Passive Stretching

##### DEPENDENT VARIABLE

- Modified Ashworth Scale (MAS).

#### Instrumentation

- Transcutaneous Electrical Nerve Stimulation
- Electric Muscle Stimulator

#### Data Analysis

**Wilcoxon Sign Rank Test** has been performed to compare the data within the groups.

**Mann Whitney Test** has been performed for comparing Data between the two groups from 0 to 30<sup>th</sup> session of study. Significance level has been selected as 0.05.

#### RESULT

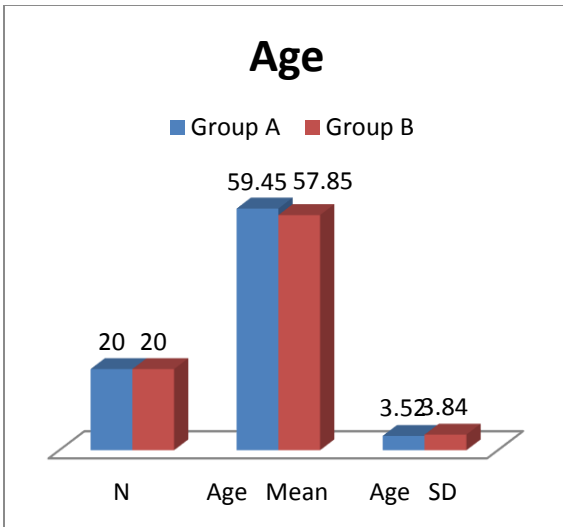
##### Demographic data analysis:

Group	N	Male	Female
A	20	14	6
B	20	15	5

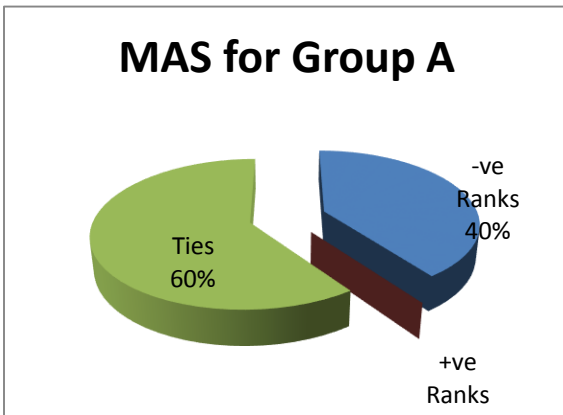
**Table 1.** Males and Females in Group A and Group B

Group	N	Age Mean	Age SD
A	20	59.45	3.52
B	20	57.85	3.84

**Table 2.** Comparison between mean ages of Group A and Group B



**Graph 1.** Comparison of pre and post MAS scores for Group A By willcoxon Sign Rank Test



**Graph 2.** MAS for Group A  
 p<0.05 Significant (S), p>0.05 Non-significant (NS)

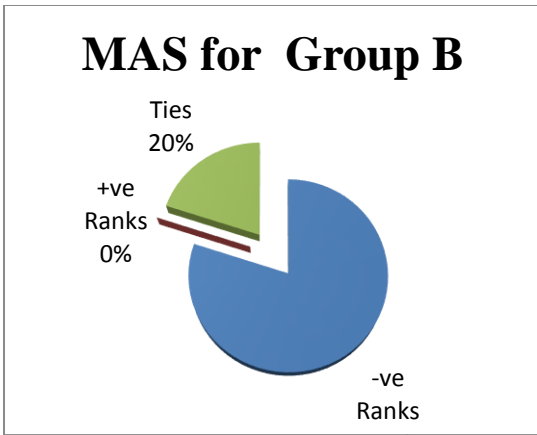
Table shows the comparison of the pre and post MAS scores for Group 1 using the Wilcoxon signed- rank test. The Median value for pre test was 2 and post test was 1.5. The Wilcoxon test value for pre and post test comparison of MAS scores was 0, which was found statistically significant at p<0.05.

Wilcoxon Signed Rank Test	MAS for Group B
-ve Ranks	16
+ve Ranks	0
Ties	4
Ranks (+/-)	136
Wilcoxon Test 'T'	0
Table value at 0.05	29
Result	S

**Table 3.** Comparison of pre and post MAS scores for Group B by Willcoxon Sign Rank Test

Wilcoxon Signed Rank Test	MAS for Group A
-ve Ranks	8
+ve Ranks	0
Ties	12
Ranks (+/-)	36
Wilcoxon Test 'T'	0
Table value at 0.05	8
Result	Significant

**Table 4.** Comparison of pre and post MAS scores for Group A by Willcoxon Sign Rank Test



**Graph 3.** MAS for Group B

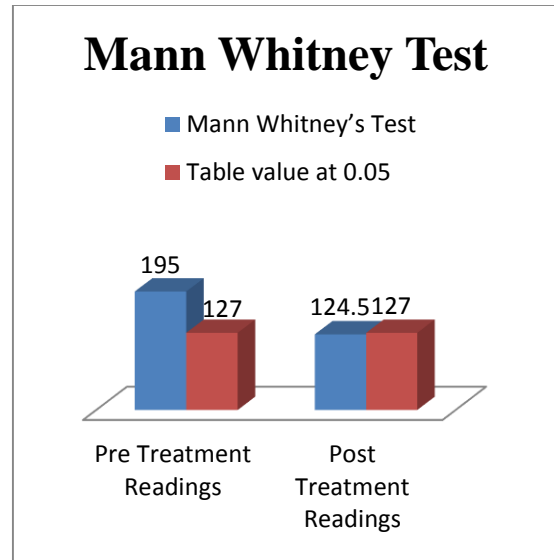
p<0.05 Significant (S) ,p>0.05 Non-significant (NS)

Table 5 shows the comparison of the pre and post MAS scores for Group 1 using the Wilcoxon signed- rank test. The Median value for pre test was 2 and post test was 1. The Wilcoxon test value for pre and post test comparison of MAS scores was 0, which was found statistically significant at p<0.05.

**Comparison of MAS scores between Group A and Group B by Mann Whitney Test**

Mann-	Pre	Post
<b>Mann</b>	195	124.5
<b>Whitney's</b>		
<b>Table</b>	127	127
<b>value at</b>		
<b>0.05</b>		
<b>Result</b>	Non Significant	Significant

**Table 5.** comparison of Group A and B pre-post treatment



**Graph 4.** Comparison of Group A and B pre-post treatment

p<0.05 Significant (S), p>0.05 Non-significant (NS)

**Pre treatment Values Comparison by Mann Whitney Test**

The value of Mann Whitney test for Pre test comparison between Group 1 and Group 2 was 195 which is more than table value at 0.005 that is 127, so there is no significant difference between pre treatment values of MAS Scores at p<0.05.

**Post Treatment Values Comparison By Mann Whitney Test**

The value of Mann Whitney test for Pre test comparison between Group 1 and Group 2 was 124.5 which is less than table value at 0.005 that is 127, so there is significant difference between post treatment values of MAS Scores at p<0.05.

### Comparison of Mean, Median, Mode for Groups A With respect to Pre Treatment & Post Treatment MAS Scores

	Group A		% Age
	Pre Treatment	Post Treatment	
<b>Sum of Values</b>	35	30.5	12.85
<b>Mean</b>	1.75	1.525	12.85
<b>Median</b>	2	1.5	25
<b>Mode</b>	2	2	00

**Table 6:** Group A pre-post treatment

### Comparison of Mean, Median, Mode for Groups B With respect to Pre Treatment & Post Treatment MAS Scores

	Group B		% Age
	Pre treatment	Post treatment	
<b>Sum of Values</b>	35	24	31.42
<b>Mean</b>	1.75	1.2	31.42
<b>Median</b>	2	1	50
<b>Mode</b>	2	2	00

**Table 7:** Group B pre-post treatment

## DISCUSSION

The current study was carried out on 40 subjects with 20 subjects in each group diagnosed with Biceps Brachii Spasticity after stroke.

By Willcoxon Sign Rank test: In group A, the total sum of MAS values of Pretreatment was 35 and post treatment was 30.5. The difference was 12.85 %, mean of pretreatment is 1.75 and post treatment was 1.52. The Difference was 12.85% and out of 20 subjects only 8 subjects had –ve ranks means their MAS scores reduced after treatment, remaining 12 subjects were in ties group means their MAS score remains same as before treatment. There was no subject in +ve rank. The W-value is 0. The critical value of W for N = 8 at  $p \leq 0.05$  is 3. Therefore, the result is significant at  $p \leq 0.05$ . In group B, the total sum of MAS values of pretreatment was 35 and post treatment was 24. The difference was 31.42 %, Mean of pretreatment was 1.75 and post treatment was 1.2. The difference was 31.42% and out of 20 subjects, 16 subjects twice of group A have –ve rank means their MAS scores reduced after treatment, remaining 4 subjects had same MAS score as before treatment. There was no subject in +ve ranks. The Z-value was -3.5162. The p-value was 0.00044. The result is significant at  $p \leq 0.05$ . The W-value is 0. The critical value of W for N = 16 at  $p \leq 0.05$  is 29. Therefore, the result is significant at  $p \leq 0.05$ .

By Mann Whitney test: Pre treatment Z-Score was 0.1217. The p-value is 0.90448. The result was not significant at  $p \leq 0.05$ . The U-value was 195. The critical value of U at  $p \leq 0.05$  was 127. Therefore, the result was not significant at  $p \leq 0.05$ . It shows there was no significant difference between the pre treatment data of both the groups. Post treatment, Z-Score was 2.0288; the p-value was 0.04236. The result was significant at  $p \leq 0.05$ . The U-value was 124.5. The critical value of U at  $p \leq 0.05$  was 127. Therefore, the result was significant at  $p \leq 0.05$ . It shows

there was significant difference between the post treatment values of both the groups. The above values state that the Group B receiving Electric Muscle Stimulator combined with passive stretching had shown more significant improvement in reducing spasticity at  $p < 0.05$  as compared to the Group A, who had received TENS with passive stretching.

Franek A, Turczynski B, and Opara J (1988) studied on decreasing the spasticity in 44 patients with traumatic damage to the spinal cord; 35 non-electrically stimulated spastics were used as controls. They found that electrical stimulation procedure leads to a long-lasting reduction in spasticity, an increased range of passive and active movements<sup>9, 10</sup>. Bakhtiyar AH, Fatemy E (2008) also intervene electrical stimulation to reduce the planter flexor spasticity 40 stroke patients (aged from 42 to 65 years) with ankle plantar flexor spasticity to investigate the therapeutic effect of electrical stimulation. The mean change of plantar flexor muscle tonicity measured by the Modified Ashworth Scale and their conclusion showed that electrical stimulation combining with other technique reduced spasticity effectively in stroke patients. Salm A, Veltink PH, Ijzerman MJ, Groothuis-Oudshoorn KC, Nene AV, Hermens HJ(2006) in Comparison of electric stimulation methods for reduction of triceps surae spasticity in spinal cord injury. Ten patients with a complete SCI were recruited from the outpatient population of the rehabilitation hospital. All subjects had American Spinal Injury Association grade A impairment scores, except for one, who had grade C. The patients had no voluntary triceps surae contractibility. Stimulation of the agonist

provided a significant reduction in the MAS compared with the placebo approach ( $P < .001$ ). They concluded Triceps surae stimulation reduces the MAS for that specific muscle which also in favour of current study. These studies strengthen the present study by showing the reduction in MAS scores of the subjects.

## CONCLUSION

The researcher had concluded that Electric Muscle Stimulator with Passive Stretching is more effective in reducing spasticity of Biceps Brachii muscle as compared to TENS Combined with passive stretching.

### Limitations of the study:

- Sample size was relatively small.
- Severe cases of upper limb spasticity (MAS>2) were not included.
- Relatively shorter duration of intervention and lack of follow up sessions.

**Future scope of the study:** Spasticity is a major disabling factor among hemiplegic patients which needs to be managed to improve their functional outcome. The current study found Electric Muscle Stimulator with Passive Stretching and TENS with passive Stretching are effective in reducing the Biceps Brachii Spasticity.

Future studies can evaluate:

- the effectiveness of Electric Muscle Stimulator with passive Stretching for lower limb spasticity
- spasticity caused due to neurological conditions other than hemiplegia.



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