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# COMPARISON OF POST 24 HOURS EFFECT OF COOLING AND SUSTAINED PASSIVE STRETCHING AS TREATMENT TECHNIQUES FOR REDUCTION OF SPASTICITY IN HEMIPLEGICS USING H-REFLEX

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## ABSTRACT

**Background:** Studies have shown that alpha motor neurons (αMN) serving skeletal muscles are hyperexcitable in presence of spasticity and can be activated by inputs that would normally evoke a response. There is activation of gamma motor neurons (gMN) for the degree of αMN activation thus to analyze its effect on spasticity, H reflex is used. Various modalities are used to reduce spasticity, cooling and sustained passive stretching is two of them. Studies have been conducted to find out efficacy of each but a comparative study to find out post 24 hours effect of them has not been performed. **Objectives:** To find out Post 24 hours effects of application of cooling and sustained passive stretch on reduction of spasticity using H reflex and comparing the two techniques to find out which is more effective. **Method:** Thirty patients (male=21, female=09) were selected between the age group 40-70 years with spastic hemiplegia due to cerebrovascular accident. The average time since the onset of hemiplegia was 9.23±8.36 months and the patients were selected for the study from the OPD of physiotherapy department, they were divided into two groups with 15 patients in each group The affected side of the patient was considered as Study group A Cooling was given and Study group B Sustained Passive Stretching was given along with routine rehabilitation. H reflex was used as outcome measure to test spasticity in all the patients at pre and post 24hrs. **Results**: Our study did not find any statistically significant difference between cooling and sustained passive Stretching for reducing the hypertonicity in triceps surae muscles ($p<0.05$). **Conclusion:** It is concluded that Cooling and Sustained passive stretching both are equally effective in reducing spasticity of tricep surae muscles in patient with hemiplegia.

**Key words:** Spasticity, Cooling, Sustained Passive Stretching, H-reflex.

## INTRODUCTION

The Global Burden of disease study described a measure that integrates the sum of life-year lost due to premature mortality and year lived with disability adjusted for severity, the so-called disability –adjusted life years (DALY). In 1999 cerebrovascular disease accounted for 50 million DALY worldwide, representing 3.5% of all DALY[1,2]. Projection to year 2020 show that 61 million DALY are likely to be lost due to cerebrovascular disease each year, and of these 52 million (84%) will be in the developing country. The global population aged over 65 year is increasing by 9 million a year. By 2025 there will be more than 800 million people over 65 year of age in the world; two-third of them will be living in developing countries. Many people had to live with disability developed with spasticity[3]. Jun Kimura (1983)[4] reported that direct evaluation of tone is subjective and erroneous, thus an indirect method using H reflex can be used. They considered the amplitude of H and M and a ratio

of maximum amplitude of H to maximum amplitude of M wave (Hmax/Mmax ratio) as a measure of excitability of the motor neuron pool. The purpose of the study was to find which treatment technique helps in longer reduction of Spasticity, Cooling or Sustained passive stretching. Various modalities are used to reduce spasticity, Cooling and sustained passive stretching are two of them. Studies have been conducted to find out efficacy of each but a comparative study has not been performed on post 24 hour's effect of them. Thus at our Institute we, undertook this study to compare the effects of cooling and Sustained passive stretching.

**Aim and objective:** To find out the Post 24 Hours Effect of Cooling and Effects of Sustained passive Stretching as Treatment Techniques for reduction of Spasticity in Hemiplegics

## METHODOLGY

### Materials

Electro diagnostic EMG machine (RMS EMG EPMK ΠI) was used to Study the M wave and H reflex. Surface electrodes were used as pick up, Stimulating and earth electrodes. Ice cubes wrapped in a thin cloth were used to cool the surface of the calf. Goniometer was used to measure the range of motion. Dynamic ankle splint was used to stretch the Tendo Achilles.

**Inclusion criteria:**

- Sample: 30 Hemiplegics patients (21 males and 9 Females)
- Age group: 40 - 70 years
- Onset of hemiplegia: more than 6 months
- All had either internal capsule or MCA territory Infarct.
- All had moderate to severe spasticity (1+ to 2 on modified ashworth scale)
- Patients with unilateral hemiplegia were included.
- Triceps surae was chosen as muscle for study.
- Affected side was considered as study group.

**Exclusion criteria:**

- Unconscious patients.
- Acute flaccid paralysis.
- Any Orthopaedic abnormalities

**Study Design:** Comparative Study

## METHODS

Thirty patients (21 males and 9 females) were selected between the age group 40-70 years with spastic hemiplegia due to cerebrovascular accident. They were divided into two groups with 15 patients in each group. One group received cooling where as other group received sustained passive stretching along with routine rehabilitation. The affected side of the patient was considered as study group. H-reflex was measured at Pre and Post 24 hours of treatment in both the groups.

The patients were selected for the study from the OPD of physiotherapy department. The patients were those with spasticity in lower extremity. Thirty patients showed grade 1+ spasticity and 17 patients showed grade 2 spasticity on Modified Ashworth Scale.

The skin resistance overlying the soleus muscle and tendo Achilles was made as minimal as possible by shaving the area and cleaning it with alcohol. The procedure to elicit the H-reflex usually involves applying a percutaneous electric stimulus to a mixed nerve, which was applied to the posterior tibial nerve in the popliteal fossa. Continuing to increase the stimulus intensity beyond that required for an H-reflex result in direct stimulation of the motor axons and the presence of an M-wave, Hmax and Mmax were also considered.

## STATISTICAL ANALYSIS

For finding the efficacy of each technique, paired t -test was applied. To compare these two techniques unpaired t test was used. A level of significance was set at $p<0.05$.

## RESULTS

In present study both the group showed significant reduction of spasticity in triceps surae muscle as measured by H reflex. Our study found out highly significant reduction in pre and post 24 hours cooling given in study group. H amplitude was t=11.98, p<0.01 which is highly significant. M amplitude was t=10.31, p<0.01 which is highly significant. H latency was t=12.23, p<0.01 which is highly significant. Hmax/Mmax ratio was t=8.9, p<0.01 which is highly significant. M latency was t=0, p>0.05 which is not significant.

Similarly, highly significant reduction of spasticity in triceps surea muscle at pre and post sustained passive Stretching was found: H amplitude was t=11.98, p<0.01 which is highly significant. M amplitude was t=10.31, p<0.01 which is highly significant. H latency was t=12.23, p<0.01 which is highly significant. Hmax/Mmax ratio was t=8.9, p<0.01 which is highly significant. M latency was t=0, p>0.05 which is not significant.

**Table 1: Comparison of pre and post treatment effect of Cooling**

| | Pre | Post |
|---|---|---|
| | **Mean±SD** | MEAN±SD |
| **H amplitude** | 4.34±0.69 | 2.73±0.64 |
| **M amplitude** | 13.33±0.97 | 10±1.30 |
| **H latency** | 36.86±34.70 | 34.70±0.49 |
| **M latency** | 0 ± 0 | 0 ± 0 |
| **Hmax/Mmax** | 0.62±0.087 | 0.57±0.49 |

**Table 2: Comparison of pre and post treatment effect of sustained passive stretching**

| | Pre | Post |
|---|---|---|
| | **Mean±SD** | **Mean±SD** |
| **H amplitude** | 4.34±0.65 | 2.73±0.64 |
| **M amplitude** | 13.33±0.91 | 10±1.30 |
| **H latency** | 36.86±0.42 | 34.70±0.49 |
| **M latency** | 0 ± 0 | 0 ± 0 |
| **Hmax/Mmax** | 0.62±0.087 | 0.57±0.94 |

**Table 3: Between group comparison of cooling and sustained passive stretching**

| | Mean±SD | Mean±SD | t-Value | P | Result |
|---|---|---|---|---|---|
| *H AMPLITUDE* | 5.12±0.65 | 5.12±0.65 | 0 | P>0.05 | N.S |
| **M amplitude** | 13.33±0.97 | 13.33±0.97 | 0 | P>0.05 | N.S |
| **H latency** | 36.86±0.40 | 36.86±0.40 | 0 | P>0.05 | N.S |
| **M latency** | 0 ± 0 | 0 ± 0 | 0 | P>0.05 | N.S |
| **Hmax/Mmax** | 0.62±0.087 | 0.62±0.087 | 0 | P>0.05 | N.S |

## DISCUSSION

Our study has shown that cooling and sustained passive Stretching used, as treatment techniques for reduction of Spasticity both are highly effective in temporarily reducing the hypertonicity in triceps surae. Cryotherapy can temporarily decrease spasticity, two mechanisms are proposed to act sequentially to produce this effect: first, a decrease in gamma motor neuron activity and, later, decrease in afferent spindle and Golgi tendon organ activity. A decrease in the integrated electromyography (EMG) activity has been

observed within a few second of the application of cold to the skin, these change are thought to be related to decrease in the activity of the gamma motor neurons as a reflex reaction to stimulation of the cutaneous cold receptors[5,6]. Price R et al[7] (1993) concluded that cold facilitates alpha-motoneurons and inhibits gamma-motoneurons. Consequently, for these effects to result in spasticity reduction, the net effect of gamma inhibition must exceed that of alpha facilitation. If these mechanisms operate simultaneously, spasticity tests, which incorporate muscle spindle activation, would be sensitive to gamma inhibition and would reveal cold-induced spasticity reduction, H-reflex tests of the monosynaptic reflex arc that bypass the spindles would detect the alpha facilitation, resulting in elevated H-reflexes[4,8,9]. Krause BA et al (2000) their study showed that cold application reduces spasticity. Patients with UMN lesion were taken, as sample showed reduction in clonus and spasticity with ice water immersion at 15°c after 10 minutes of cooling and his study found there was facilitation of motor neurone pool[6]. The effect of Sustained passive stretching could be on the Ib afferent fiber and the Golgi tendon organ would be fired while the calf muscle is stretched. Then the impulse would be transmitted by the type Ib afferent fiber through the interneuron thus, inhibiting the αMN. Another possibility is the type II afferent fiber: in this case, the muscle spindle of the calf muscle would be fired while the muscle is stretched. The impulse would be transmitted by the type II afferent fiber through the spinal cord, thus, inhibiting the neuron excitability of αMN. An obvious decrease of spasticity was observed after a single session of passive stretching treatment. Similarly, H/M ratio was measured in our study showed increased in it prior to Cooling and Sustained passive Stretching given in both study groups and there was highly significant reduction in H/M ratio after treatment. Comparing the H/M ratio of the triceps surae in study group significant correlation was found in the present study in muscle tone. We believe that the H/M ratio is a neurophysiological expression, but the others (passive range of motion) may be influenced by the elasticity of the muscle. (Nishikawa T, 2002)[10] triceps surae can improve the range of motion of the ankle joint and the motor neuron excitabilities. Jun Kimura (1983**)** reported that direct evaluation of tone is subjective and erroneous, thus an indirect method using H reflex can be used. They considered the amplitude of H to maximum amplitude of M wave Hmax/Mmax ratio as a measure of excitability of the motor neuron pool. He found that the ratio increased with spasticity, thus H reflex was used to measure the spasticity indirectly. Similar results were shown by our study Hmax/Mmax ratio increased with spasticity and showed significant reduction after use of both the treatment techniques[2]. This is a safe and economical method for treating stroke patients. However, this treatment standing for a long time may not be suitable for all patients.

## CONCLUSION

It is concluded that Cooling and Sustained passive stretching are equally effective in reducing spasticity in hemiplegics.

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