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## COMPARE THE EFFECTS OF STATIC STRETCH AND WARM UP EXERCISES VERSUS STATIC STRETCH ON HAMSTRING TIGHTNESS AMONG STUDENT POPULATION

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### ABSTRACT

**Objectives:** The purpose of the study was 1) To find the effect of warm-up exercise and static stretch on the flexibility of Hamstring muscles among student population and

2) To compare the efficacy of static stretch with and without warm-up exercise on hamstring length.

**Methods:** Thirty volunteer subjects (ages 18-23 years) with limited Hamstring length were assigned to two groups: (1) static stretch, (2) static stretch and warm-up. The Static stretch group consisted of one repetition of static stretch per a day for 30 sec duration, 5 times a week for 6 weeks. Stair climbing for 10 minutes is given as Warm up before the stretching in group (2). Hamstring length was measured pre intervention and post intervention using the active knee extension (AKE) test. Data were analyzed using a student paired t test and a chi square test to find out the difference between the groups.

**Results:** Group 1 & 2 showed a significant increase in hamstring length between pre intervention and post intervention measurements. After 6 weeks, Group 2 had a mean increase of 22.14° and group 1 had a mean increase of 15.1° in AKE. Both of these groups did show a significant decrease (22.14° and 15.1°, respectively) in hamstring muscle length. However Group 1 and 2 did not differ significantly from each other. **Conclusions:** A significant increase in hamstring length when using static stretching. The addition of a warm-up exercise prior to stretching does not appear to significantly increase the effectiveness of static hamstring stretching.

**Keywords:** flexibility, lower extremity, muscle length, stretching, warm-up.

### INTRODUCTION

Hamstring Injuries are one of the most common musculotendinous injuries in the lower extremity<sup>4</sup>. Reported factors that contribute to hamstring injuries include the lack of muscle extensibility, improper warm up, fatigue and poor body mechanics<sup>10</sup>. Lack of Hamstring Flexibility is the single most important characteristic of hamstring Injuries<sup>23</sup>.

Static stretching is one of the safest and most commonly performed stretching methods used to increase muscle length<sup>18</sup>.

The Literature supports that a static stretch of 30 sec at a frequency of one repetition per day, five days a Week for 6 weeks is sufficient to increase muscle length<sup>3</sup>.

A warm up is different from static stretch, but it can include in stretching. In most sports or physical activities, stretching exercises have been included as a part of a warm up routine that includes a substantial movement. Active warm up can include stretching or may be based on other kinds of movement. An active warm up will reduce injury, though not necessarily it includes stretching. The active part of the warm up is what

really prepares the muscles for activity by increasing blood flow and temperature<sup>1,11</sup>.

Warm up and stretching are advocated by clinicians to increase muscle length and performance and to limit muscle injuries<sup>1</sup>. There is insufficient evidence that warm-up exercises alone or followed by a stretch will significantly increase flexibility<sup>1</sup>.

Wenosol *et al* (2004) stated that an active warm up before PNF stretching appears to be the most effective treatment to increase hip range of motion. Active warm up reduces the resistance to stretch there by increases the range of motion<sup>12</sup>.

ZAKAS A *et al* (2003) stated that warm up exercises are equally effective in increasing range of motion compared to warm up and stretching<sup>16</sup>.

Willford *et al* compared the effects of jogging for 5 min before stretching with stretching alone and also found no significant differences. 5 minute warm- up is relatively short, however and they gave no guidelines for warm up<sup>14</sup>.

In many situations especially recreational activities a muscle is forced to stretch beyond its normal active limits. If the muscle does not have enough elasticity to compensate for this additional stretch, the musculotendinous units may be injured, In order to attain good flexibility the extensibility of the muscle are very essential<sup>3</sup>. Physical therapist has used many different methods of stretching to improve flexibility. But no studies are available to evaluate the effects of warm up with static stretching to enhance ROM at knee.

Research is limited on the effects of static stretching and is controversial on the combined. Effects of warm-up activities and static stretching on muscle lengthening.

The purpose of this study was

1. To compare the efficacy of static stretch with and without prior warm up exercise on Hamstring length.

2. To find the effect of warm-up exercise and static stretch on the flexibility of Hamstring muscles among student population.

## MATERIAL AND METHODS

50 male students were examined in which 35 students found to have hamstring tightness. In which 4 students dropped from the study because of personal reasons and one subject was absent continuously more than 4 stretching's.

All the students between the age group of 18 to 23 years (Mean age 20.2 years) at Swatantra Institute of Physiotherapy & Rehabilitation, Rajahmundry, formed the population of this study. Subjects were selected by Active knee Extension test (A.K.E)<sup>21</sup> for measurement of Tight Hamstring muscles.

Subjects Age, height and weight were matched. Informed consent was taken from all the Subjects.

### Inclusive Criteria

- 1) Males of Age between 18 to 22 years.
- 2) Subjects without any musculo skeletal disorders.
- 3) Subjects with tight Hamstrings (Measured by Active knee Extension test).
- 4) Subjects who are not undergoing any physical fitness training program.

### Exclusive Criteria

- 1) Previous history of hip or knee or spine injuries.
- 2) Any contractures or deformities.
- 3) Subjects having Neuro muscular disorders
- 4) Subjects having Cardio vascular disorders.
- 5) Any subjects missing 4 days without stretching
- 6) Subjects involving in any other physical fitness program

## STUDY DESIGN

Study was experimental longitudinal design

Subjects were randomly assigned to two groups following the initial measurement of hamstring flexibility. Subjects assigned to group –I (N=15, x age = 20 .4 range 18-23 years) served as control group and performs static stretching and did not perform any warm up exercises

Group II served as a experimental group and performed static stretching and warm up exercise for 10 min (N=15, x age = 19.93 range 18-23 years)

Subjects in group – II performed stretching 5 times a week for 6 weeks one repetition per day for 30sec duration.

Groups	No of subjects	Treatment
Group I (Control)	15	Static stretch
Group II (Experimental)	15	Static stretch & Warm Up

The dependent variable was hamstring length and it was measured in degrees using the AKE test as described by Gajdosik and Lustin<sup>12</sup>. Pre stretch AKE ROM was measured on all subjects. Following interventions AKE ROM measured immediately. The Investigator was blinded to the measurements.

**Measurement Procedure**

**Subject Position for AKE(Active Knee Extension Test) Testing:**

With Subjects lying on their left sides, the greater trochanter of the right femur, lateral femoral condyle and lateral malleolus of right fibula were identified and marked with black felt – tip marker to help ensure proper alignment for Goniometric measurements<sup>25</sup>. Subjects were positioned supine on an examination table with the hip flexed to 90<sup>0</sup> as measured by a Goniometer. 90<sup>0</sup> of hip flexion was maintained throughout AKE measurements either by cross bar or by the assistant. The investigator ensured that the distal anterior thigh maintained contact with the cross bar for all AKE measurements

throughout the AKE procedure, the left hip remained at 0<sup>0</sup> of flexion<sup>5</sup> .

A Goniometer placed lateral side of the knee stationary arm towards the femur and movable arm towards the fibula<sup>5,20</sup>

If the Knee flexion is more than or equal to 30 degree from full extension then the test is positive for hamstring tightness<sup>5</sup>

AKE testing performed three times and measurements were noted in both pre and post treatment. Mean of the measurements were taken<sup>1</sup>.

**Instrumentation**

- 1) Universal Goniometer: Measurements were performed using a double armed, protractor made of transparent plastic to measure degrees in 1<sup>0</sup> increments
- 2) Stop watch
- 3) Pillows
- 4) Straps
- 5) Stairs
- 6) Marker Pen
- 7) Adjustable couch
- 8) Pen and Note book
- 9) Cross bar.

**Static stretching**

Static hamstring stretches by standing erect with the left foot planted on the floor and pointing straight ahead (no hip internal or external rotation) The right hamstring muscle were stretched by placing the right calcaneal aspect on an elevated surface (high enough to cause a gentle stretching sensation in the posterior thigh) with the knee fully extended and toes pointed to the ceiling (again no hip internal or external rotation) the subjects then flexed forward from the hip, maintaining the spine in a neutral position while reaching the arms forward until a gentle stretch was felt in the posterior thigh. Once this position was achieved the stretch was sustained for 30 sec<sup>24, 6, 20, 15</sup> .

### Warm Up Procedure

Stair climbing for 10 minutes is given as Warm up before the stretching in group II<sup>1</sup>. Here intensity of warm up is not calculated they climb at their normal cadence.

Immediately followed by warm up static stretching for 30 sec is given. Stretching procedure as same as group one<sup>1</sup>.

Performance of each stretching session by each subject was supervised and recorded on an attendance sheet to document compliance to the program. If a subject failed to attend a scheduled session, stretch was given the following rest day. Any subject missing four days without stretching was eliminated from the study (One subject dropped from group II and no subject from I group) After 6 weeks all the subjects were re-tested using the same procedures used in the initial pre test for AKE. Testing two days after the last day of stretching and the final measurement

### OUTCOME SCALE

Universal Goniometer<sup>13</sup> to measure the flexibility of Hamstring Muscle by Active Knee Extension Test

### STATISTICAL ANALYSIS

The data was analyzed using student paired “t” test for finding the difference between the range of motion before and after the Treatment.

A chi-square test was used to find out the significance between two groups.

### RESULTS

In this study all the two groups (n=30) chosen are identical in pre treatment test of knee range of motion before the start of the treatment. Hence values found had no significance between the groups (Table 3 & 4)

In post treatment both groups show drastic improvement in knee range of motion which was measured by active knee extension test (Fig.3).

When comparing both the groups for knee joints range of motion both groups were equally

effective and there was no significant improvement of flexibility in one group over the other (Fig.3)

### DISCUSSION

The results of this study agree with other studies that a static stretch is effective in increasing hamstring length<sup>1, 3, and 9,10,16,17</sup>.

The gain in temporary length may be due to increase in muscular temperature following contraction leads to increased extensibility. For injury prevention warm up with static stretch is effective, if range of motion is the goal static stretch is effective. The gain also may be due to an increase in the tolerance to stretch and may not be due to changes in the structure of the muscle and connective tissue<sup>6</sup>.

When comparing both the groups for knee joints range of motion both groups were equally effective and there was no significant improvement of flexibility in one group over the other<sup>1</sup>.

Clinically warm up and static stretch group showed more improvement of range of motion than the static stretch group. Statistically there was no significant difference between the groups<sup>1</sup>.

Our results support previous findings that stretching increases Flexibility<sup>19, 20, 24</sup>.

Researchers in two studies determined that one 30sec stretch is effective for increasing Hamstring Range of motion. Subjects in these studies stretched 5 times a week for 6 weeks<sup>3,19,24</sup>

This study supports the previous study done by De Weijer VC, Gornaik GC (2003) which states that static stretch and warm up group are equally effective in increasing flexibility and the study was for duration of one day<sup>1</sup>. The result may be due to short duration so in this study duration so in the present study lasted for 6 weeks<sup>3, 19, 24</sup>.

Williford HN, East JB (july-1986) in their study to compare the effect of jogging and stretching versus stretching on flexibility of the muscles. They have concluded that warming the muscle

prior stretching by jogging will not result in significant improvement of joint range of motion evaluated. This result may be due to jogging or less number of repetition of treatment (2 days per week for 9 weeks)<sup>7</sup>.

To eliminate that in this study I have taken stair climbing for 10 minutes as warm up and the duration of the study is 30 sec static stretch one repetition a day for 5 days in a week for 6 weeks<sup>1,3</sup>.

Our results do not support the previous reports that warm up and stretching than stretching alone cause greater Range of motion<sup>22</sup>. Warren et al<sup>9</sup> noted that the greatest increase in residual tissue length in rat tail tendons occurred when low load long duration stretch was performed once the tissues had reached elevated temperatures<sup>8,9</sup>. In our study we used active warm up; if we use passive warm up we may get better results.

One might expect to find that the looser subjects would not increase in flexibility as much as the tighter subjects. In our study however, the warm up and stretching subjects increased in flexibility by almost 23<sup>0</sup> within 6 weeks while stretching group increased by 15<sup>08</sup>. This values show that clinically warm up and static stretch is more effective but statistically this group is not significant may be because of small sample size.

### **Suggestions for future research**

1. In this study intensity of the warm up is not measured. In future research intensity of the warm up should be calculated to get better result.
2. We may get better result by using Electronic Goniometer
3. Which group is effective in maintaining the obtained ROM's? Future research should be done on it.

### **LIMITATIONS**

1. Sample size is small
2. Subjects in control group might have done other exercises with out my knowledge.

3. Used universal Goniometer.

### **CONCLUSION**

The use of static stretch in group I (control group) and warm up exercises and static stretch in Group II (experimental group) resulted in increase in hamstring muscle flexibility. The result of the this study indicated that a 30 sec static stretch was equally effective as 10 minutes stair climbing and 30 sec static stretch in improving knee joint range of motion. The addition of a warm up exercise prior to stretching does not appear to significantly increase the effectiveness of static hamstring stretching. Though the warm up and stretching group is clinically significant statistically it is not significant.

If range of motion is the goal static stretch is helpful. If injury prevention is the goal combination of warm up and static stretch is more effective.

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**TABLE I:  
COMPARISON OF RANGE OF MOTION WITH IN THE GROUP I**

Variables	Group	Mean	S.D.	S. E.	T	Level of significance
Pre test	I	43.7	+_3.65	0.975	15.93	0.05
Post test	I	28.16				

**COMPARISON OF ROM WITH IN GROUP – II**

Variables	Group	Mean	S.D.	S. E.	T	Level of significance
Pre test	II	43.94	+_4.40	1.17	18.92	0.05
Post test	II	21.80				

**TABLE- 2  
COMPARISON OF RANGE OF MOTION BETWEEN TWO GROUPS**

GROUP	Pre test	Post test	Totals
Experimental	44(A)	22(B)	
Control	44(c)	28(D)	

**Figure. 1**

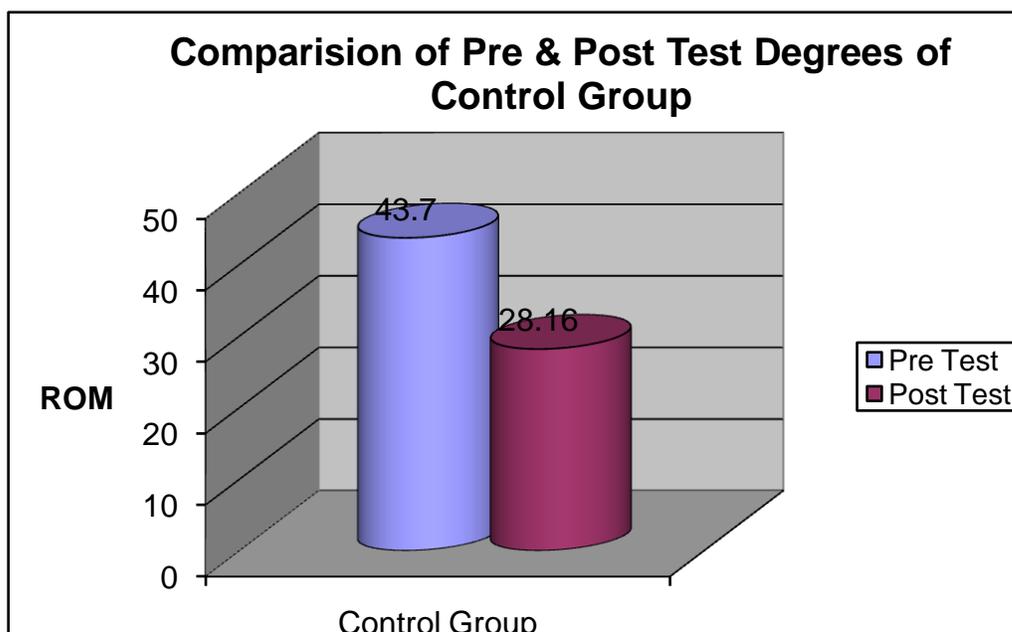


Figure 2

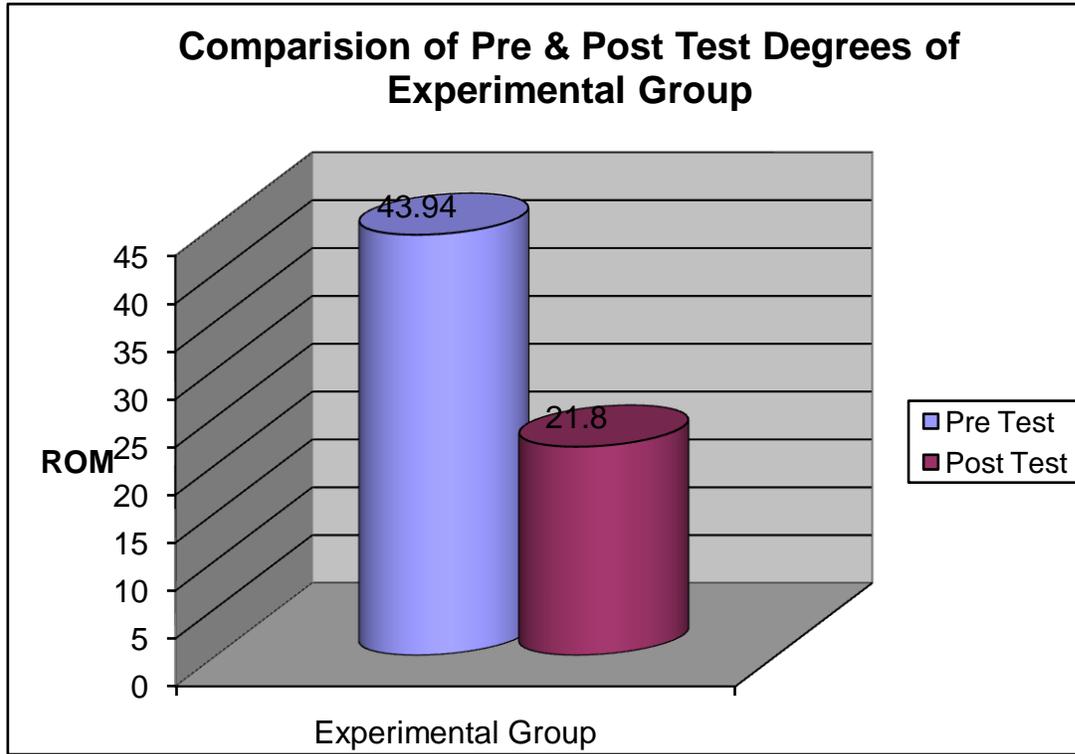


Figure 3

