

## The effects of two different physiotherapy methods on hamstring muscles flexibility

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**Abstract.** The aim of the study was to compare the effects of hamstring stretching exercises used with superficial and deep heat applications on the flexibility of the hamstring muscles. Methods: Evaluation was done in a physiotherapy unit in Pamukkale University, School of Physical Therapy and Rehabilitation during the scholastic year 2006. In this study, 28 participants (7 females and 21 males) were included. All participants were divided into two groups randomly. Participants in the Group I performed static stretching exercises for the hamstring muscle after the ultrasound application (10 min). Participants in the Group II performed the same stretching exercises following hot-pack application (20 min). The static stretching exercises were performed by the participants for 45 seconds and three times per day for the six weeks. The flexibility of the hamstring muscles was evaluated with a standard manual goniometry before and after the physiotherapy program.

Results: A significant improvement in the flexibility of the hamstring muscles was found in both groups. However no significant difference regarding the amount of flexibility of the hamstring muscle between the groups. Conclusions: The results of this study suggest that using superficial or deep heat applications before static stretching exercises shows positive effects to increase flexibility of hamstring muscles. But, there is no superiority on each others.

**Key words:** *hamstring muscle, static stretching, physiotherapy.*

### Introduction

Flexibility, which is one of the important components of physical appropriateness, includes artificial movement, range of motion, stretching ability of the muscle and the muscle flexibility (1,2,3).

When dynamic and static exercises and proprioceptive neuromuscular facilitation (PNF) methods in the improvement of muscle flexibility are compared, though all the three techniques are reported to improve the flexibility, a more relaxation of the muscle is reported by means of autogenic and reciprocal inhibition in PNF method (4,5).

Along with the practiced stretching exercises, the other variables affecting the flexibility are; (joint/articulation) structures, the biomechanical features of the joint, the structural features of the muscles, neurophysiologic circumstances (muscle mass, capsule, flexibility of tendons, the interior and mutual coordination), age, physical environment, exercise level and healing (6,7).

The viscoelasticity features of the tissue affects the tension on muscle-tendon. The elastic deformation of muscle-tendon unit during the

tensioning is dependant on the amount of the tensioning or loading. A long with that, viscose deformation is dependent on the applied tensions speed. When held on the muscles and the tendons for a long time in a stable position, reductions in tension level occur, therefore relaxation is retrieved. The force applied during the tensioning is transmitted to the muscle fibers by means of the connective tissue and reaches to the extracellular matrix by membrane. Subsequently passing through the sarcomer to the intracellular molecule and after transmitted to the contractile section of the myofibril and relaxation is achieved (8).

Flexibility is in the center of interest for the coaches, sport researchers and physical therapists because it is a major element in increase meant of sportive performance, prevents of injuries and rehabilitation.

The loss of flexibility leads to the corruption at posture, the increase of tension and ache, decreasement of inactivity and the deterioration of balance and coordination. Therefore the increasement of flexibility is important for the body mechanic (1,2).

Beside the stretching exercises to increase flexibility, methods like ice, deep and surface heat agents, ion transfer are used. Positive results are found out in the researchers studying the functionality of the static tensioning and deep heat combination on the tendon (9,10). The static tensioning practiced repeating at different intervals is expressed to increase the flexibility (11).

Especially the inadequate flexibility of hamstring muscle groups plays a preparatory role in the muscle injuries. Simple therapeutic practice for increasing hamstring flexibility may results in the decrease of the risk of injury that has an injury back ground or the ones who have hamstring flexibility under the average (8,12).

This study is planed to find out the effect of long- time static hamstring tensioning exercise using surface and deep hacking agents on hamstring muscle elasticity.

#### Materials and methods

We conducted this study in Pamukkale University, School of Physical Therapy and Rehabilitation in Denizli, Turkey during the scholastic year 2006. Healthy volunteers with a mean age of  $22,58 \pm 3,45$  years were enrolled for descriptive purposes to determine which predictor variables deviated from normal. Exclusion criteria for healthy subjects were: (1) having any neurological, musculoskeletal, psychiatric, acute or chronic disease, (2) having any visual, hearing, cognitive and communication problem. Subjects were divided two groups randomly. The demographics belonging to the 7 females and 21 males subjects included in the study are illustrated in Table 1.

1.5 watt/cm<sup>2</sup> dosage ultrasound for ten minutes to the Group I and hot-pack for 20 minutes to the Group II were applied. Each participant performed static stretching exercises on hamstring muscles for 3 times during session, 5 days in a week for 6 weeks. The subjects in both groups performed the stretching during the exercise; the hip was kept in flexion (90°) position and than, knee extension was performed by the participants, actively till the participants feel intolerable tightness and pain behind knee and through the posterior of the thigh. At this point, the participants were asked to hold this position for 45 seconds. After that, they were allowed to relax and to prefer themselves for another exercise. Before and after the 0-6 week's physiotherapy program, a standard manual goniometry was used

to measure flexibility of the hamstring muscles of the participants by the same trained physiotherapist under standardized conditions. All subjects were advised to rest and relax before test. The range of extension of the knee point was measure and the best score was recorded in degree.

All subjects were informed about the study, the measurements and gave informed consent for participation. Descriptive statistics (mean±SD) were given for each continuous variable. To find the difference regarding the means of variables between the groups, the Paired sample t-test was used. Significant was set at 5% level. The statistical analysis was performed using by statistical package program.

#### Results

In this comparative study which was planned to compare two different physiotherapy techniques, twenty eight healthy subjects were studied. The results taking before and immediately after the physiotherapy program were analyzed. Significant differences between measurements before and after the physiotherapy program were found in both groups ( $p \leq 0.05$ ). Results are demonstrated in Table 2. However, no significant difference regarding the amount of flexibility of the hamstring muscle between the two groups ( $p \geq 0.05$ ).

#### Discussion

Thermal adjoins are frequently used to increase the effect of stretching exercise practiced to improve flexibility<sup>13</sup>. But there is not much study about superficially thermal modalities unified with hamstring stretching exercise in literature. For that reason; to find out the difference on hamstring muscle flexibility using deep and superficially heat adjoins, we planed this study. Whether there is any difference in the increase of hamstring flexibility in groups applied ultrasound static stretching after using 10 minutes for 5 days per week and for 6 weeks, and applied hot-pack for 20 minutes, was studied. Reid and McNair searched the effect of long term stretching programs on knee extension movement capacity on 43 schoolbag participants (12). They were randomly divided into 2 groups. The first group was applied 3 times hamstring muscle stretching for 30 seconds per a day, 5 days per a week and six weeks. The second group was not applied stretching as a control groups. As a conclusion, the meaningful increase ( $p < 0.05$ ) of knee

extension movement capacity in the group applied stretching was observed.

A meaningful increase ( $p < 0.001$ ) of knee extension capacity after treatment of hamstring muscle stretching was observed in our study (Table 2).

Davis and colleagues compare the effects of active stretching static stretching and proprioceptive facilitation techniques on hamstring muscle stretching on 19 participants between the age 21-35 (14).

A meaningful difference on hamstring muscle flexibility evaluated with knee extension degree ( $p < 0.05$ ) of group applied single stretching for 30 seconds, 3 days per week and 4 weeks, was observed (Table 2).

Bandy, Irions and Briggler (16) pointed out that static stretching exercises are more effective than dynamic stretching exercise in their study applied to compare the effect of static and dynamic exercises on hamstring muscle flexibility. We also have chosen hamstring static stretching exercises in our studies. Because of static exercises are more effective than dynamic exercises in reducing tension of muscle tendons unit.

There are still arguments about the length of static tensioning exercises and in order to find the best length of the time lots of studies are made and lots of ideas were introduced. Bond and Irion applied 15, 30 and 60 seconds of tensioning to participating groups in their study (4). Thus found out that 30 and 60 seconds of tensioning are more effective but when compared mutually there is no differences.

Madding, Wong & Hallum proved that there is no difference between 15 seconds and 2 minutes of static tensioning exercises and a 15 second tensioning is as effective 2 minutes tensioning (15,16).

In another study Feland, Myrer & Schulthies applied a 15, 30 and 60 seconds of tensioning exercises and reported that 60 second tensioning exercise makes more improvement in hamstring muscle flexibility than 15 and 30 second exercises

(17). We also used the 60 second tensioning exercises because we considered them to be more effective.

Are the surface deep heat agents used before the tensioning exercises effective in increasing the effectiveness or the elasticity? Lots of studies are made considering this idea.

Taylor, Waring & Brashear proposed the idea that enough hamstring muscle length could be obtained without using superficial thermal modalities (18). Funk, Swank & Adams applied 30 seconds static tensioning after application of 20 minutes hot pack to a group and only a static tensioning to the after group in a study with 30 university students (19). As a result, after the moist hot pack application the students could tolerate the tensioning hamstring muscles in a moderate way and with less prejudice but in name of increasing the hamstring elasticity, there were no difference between two applications at all. Sawyer, Uhl & Mattacola, and friends also got similar results as Funk, Swank & Adams (19,20). Belyea, Sigg studied with 27 participants to reach the effect of deep-heat, cold exercises on hamstring muscle flexibility 3 different treatment programs were applied to the participants (13). There were passive stretching, thermal ultrasound and cold applying. A meaningful difference in every 3 treatment ( $p < 0.001$ ) was observed before treatment and after treatment but when the treatments compared with each other, there was not much meaningful difference ( $p > 0.05$ ).

We also had results parallel with the results in literature. We observed a statistical difference ( $p < 0.001$ ) in the group applied ultrasound before static hamstring stretching or hot pack, before and after treatment on hamstring flexibility. But, when treatment groups were compared there was no difference between them as in the literature (Table 2). At the end of this study we decided that deep or moist heat agent used for preparing heating before hamstring muscle stretching exercises, were not better to increase hamstring muscle flexibility. Moist or deep heat agent can be used before exercises to tolerate stretching exercises.

Table 1: Physical characteristic of the participants

Variable	Group I (n=15) Mean ± SD	Group II (n=13) Mean ± SD
Age (year)	22.68±3.78	22.46±3.15
Height (cm)	174.06±7.77	168.53±8.28
Weight (kg)	70.93±15.30	62.07±10.16
BMI (kg/ m <sup>2</sup> )	23.33±4.29	21.73±2.21

Table 2: Comparison of the results before and after physiotherapy program

Hamstring Muscles	Group I			Group II		
	Mean ± SD*	t	p	Mean ± SD*	t**	p
<b>Right Side</b>						
Before and after treatment	26.47±10.78	9.51	0.0001	18.31±15.27	4.32	0.001
<b>Left Side</b>						
Before and after treatment	30.20±10.41	11.23	0.0001	19.00±13.22	5.18	0.0001

\* The knee joint degrees are showed as Mean ± SD

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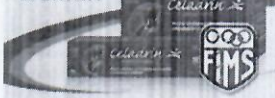
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