

# Foam Rollers Show No Increase in the Flexibility of the Hamstring Muscle Group

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## ABSTRACT

**OBJECTIVE:** Recent claims suggest foam rollers are useful in self-myofascial release and are a stretching technique used by health care professionals to treat patients with a variety of soft tissue conditions including muscle tightness. The purpose of this study was to determine if foam rollers are beneficial in gaining range of motion (ROM) in the hamstring muscle group. **DESIGN AND SETTING:** All subjects' ROM was tested prior to the beginning of the stretching protocol. All stretching routines were performed three times a week in the Mitchell Hall athletic training room. Treatment consisted of three-one minute stretching bouts with a one minute rest between each stretch. The control group was instructed to continue with normal activity, but to perform no additional stretching. **SUBJECTS:** Twenty-three male and female college students (ages 18-32) from the University of Wisconsin- La Crosse participated in this study. All subjects were healthy with no history of recent injury. The criterion for subject inclusion was tight hamstrings as defined by a knee extension range of motion less than 80°. **MEASUREMENTS:** Active knee extension measurements were determined using an inclinometer and a Flexometer® before the start of the stretching program, at four weeks and at the conclusion of eight weeks. **RESULTS:** A doubly multivariate repeated measures analysis was used to interpret the data. The statistical significance was set at  $p < 0.05$ . The analysis showed no significant difference ( $p < 0.05$ ) between the treatment and control groups. **CONCLUSIONS:** No increased range of motion was associated with the use of the foam rollers after the eight week study. Therefore, our findings suggest stretching the hamstrings using foam rollers may not be an effective technique for increasing range of motion in this muscle group.

**Key Words:** self-myofascial release, range of motion, active knee extension, inclinometer

## INTRODUCTION

Flexibility is an essential component of injury prevention and rehabilitation.<sup>1</sup> Stretching is important for reducing injuries, increasing performance and improving overall physical fitness.<sup>1,2</sup> Over the years, many different stretching techniques have evolved.<sup>2</sup> Ballistic stretching is the oldest form of stretching and consists of repetitive bouncing motions. Static stretching followed as a technique that involves stretching a muscle to a point of discomfort and holding it at that point for an extended amount of time.<sup>2</sup> A more recent technique involves several types of stretching known collectively as proprioceptive neuromuscular facilitation (PNF). This type of stretching incorporates alternating contractions and stretches and is proven to be effective in improving range of motion.<sup>2</sup>

Several modalities or physical agents have been used in conjunction with stretching to enhance further increases in range of motion. One study found the application of ice increased short term improvement of hamstring flexibility over stretching alone.<sup>3</sup> Research has shown hamstring flexibility can significantly increase when prolonged stretching is used in combination with shortwave diathermy.<sup>4</sup>

The objective of this study was to determine if the use of foam rollers would increase flexibility of the hamstring muscle group determined by an active knee extension test. Manufacturers claim foam rollers can be used for stretching using a "partner free, hands free" technique known as myofascial release. Foam rollers are marketed with the intentions of prevention and management of chronic problems and for rehabilitation purposes.<sup>5</sup>

Myofascial release is a collection of techniques used for the purpose of relieving soft tissue from an abnormal hold of a tight fascia.<sup>2</sup> The physiology behind this technique involves the golgi tendon organ.<sup>5</sup> The pressure associated with myofascial release causes the golgi tendon organ to sense a change of tension in the muscle and responds to this high or prolonged tension by inducing relaxation of the muscle spindles.<sup>5</sup> The source of the pressure when using foam rollers is the individual's body weight.<sup>5</sup>

## METHODS

### *Subjects*

Twenty three healthy college students volunteered to participate in this study (age:  $20.53 \pm 3.71$ , height:  $173.75 \text{ cm} \pm 8.66$ , weight:  $72.75 \text{ kg} \pm 14.06$ ). All subjects read and signed an informed consent form approved by the Institutional Review Board at the University of Wisconsin- La Crosse. Subjects who met the inclusion criteria were randomly assigned to control and treatment groups. Ten subjects were assigned to the control group and thirteen subjects were assigned to the treatment group.

### *Pre-participation Screening*

The criterion for subject inclusion was hamstring tightness defined by active knee extension less than 80 degrees while supine and the hip maintained at 90 degrees of flexion. All subjects were injury free during the time of the study.

### *Active Knee Extension Pre-testing Procedures*

The fibular head and lateral malleolus were marked with a pen and a marking was made half way between the two bony landmarks on the tibial crest using a tape measure (cm). The inclinometer was secured with Powerflex® at the marking on the tibial crest. Active knee extension (AKE) measurements were taken with the subject starting in supine with the test hip at 90 degrees of flexion measured using a Flexometer® and 90 degrees of knee flexion measured using an inclinometer, while the other leg remained resting flat on the treatment table. Examiner one assisted with maintaining the hip at 90 degrees of flexion by monitoring the Flexometer® and counteracting any undesired flexion/extension of the hip while the subject was instructed to perform an AKE at which time the second examiner recorded the angle reading on the inclinometer (Figure 1). This procedure was repeated three times and the average was used in the statistical analysis.



**Figure 1:** Active Knee Extension Testing Procedure

### *Foam Roller Protocol*

Three days a week, throughout the eight week study, subjects performed three stretching repetitions, with one minute of rest between each repetition. The treatment group received visual and verbal instructions by the examiners on how to properly perform the rolling technique. Each repetition consisted of one minute of continuous rolling of the hamstrings on the foam roller, from the ischial tuberosity to the posterior knee (Figure 2 and 3). During rolling the subject sustained terminal knee extension and used arms for support. The foam roller's dimensions were 45 cm in length with a 15 cm diameter. Stop watches were used to time each stretching and resting bout. The control group was instructed to continue with normal activity, and to avoid additional stretching beyond their normal regimen.



**Figure 2:** Foam roller at ischial tuberosity



**Figure 3:** Foam roller at posterior knee

*Mid and Post Testing Measurements*

Midway through the protocol period experimental measurements were taken using the same procedure performed during the pre-test. Post test measurements were taken following the eighth week using the identical AKE testing procedures.

*Statistical Analysis*

A doubly multivariate repeated measures ANOVA of variance was used to determine differences between the treatment and control group, as well as the pre and post testing measurements.

**RESULTS**

A doubly multivariate repeated measures ANOVA of variance revealed no significant difference in the interaction between the treatment and control group’s pre and post-measurements ( $P = 0.104$ ). Both groups had significant increases in range of motion (ROM) for both the dominant ( $P < 0.0005$ ) and the non-dominant leg ( $P < 0.0005$ ). The pre-ROM measurement revealed no significant difference between the treatment and control groups for the dominant ( $P = 0.243$ ) and non-dominant leg ( $P = 0.294$ ). Results are shown in Table 1.

**Table 1:** Descriptive Statistics

	Gender	Group	Mean ROM	Standard Deviation	N
Dominant Leg-Pre	Male	Treatment	54.6	8.26	5
		Control	60.25	13.3	4
		Total	57.11	10.46	9
	Female	Treatment	57.13	14.6	8
		Control	62.5	4.72	6
		Total	59.43	11.44	14
Dominant-Leg Post	Male	Treatment	65.6	9.32	5
		Control	60	13.39	4
		Total	63.11	10.93	9
	Female	Treatment	66.13	10.34	8
		Control	70	11.35	6
		Total	67.79	10.54	14
Non Dominant Leg-Pre	Male	Treatment	61.8	10.8	5
		Control	64.5	8.5	4
		Total	63	9.35	9
	Female	Treatment	62.38	12.45	8
		Control	69.33	14.07	6
		Total	65.36	13.13	14
Non Dominant Leg-Post	Male	Treatment	70.4	9.02	5
		Control	64.75	8.18	4
		Total	67.89	8.64	9
	Female	Treatment	76.25	10.44	8
		Control	77.5	15.14	6
		Total	76.79	12.14	14

## DISCUSSION

The results of this study revealed that foam rollers were an ineffective technique for increasing hamstring flexibility over an eight week time period. Although our study showed gains in ROM in the treatment group, these values were insignificant when analyzed with the control group. The results were inconsistent with manufacturer claims and the physiology behind the stretching technique. This study may have revealed different outcomes with an increase in sample size. Active knee extension test measurements pre and post may have increased in accuracy if the time of day tested remained constant. Although the treatment group was required to record their individual stretching sessions, additional monitoring by the researchers may have been beneficial.

A few alterations in the experimental design may have enhanced this research study. Generally before stretching a ten to fifteen minute warm up session is suggested. Our participants did not warm up prior to the start of each stretching session. An alternative method of using the foam rollers is to find an area of tenderness and maintain body weight over this point until discomfort begins to diminish, and repeat over other sensitive areas. When all target areas are free of pain the subject continues rolling to maintain relaxation of the area.

## CONCLUSION

This study revealed no significant difference in the interaction between the treatment and control group's pre and post-measurements. The results of this study suggest foam rollers are an ineffective technique for increasing hamstring flexibility over an eight week time period. Further research is needed to determine if foam rollers are an effective tool in increasing range of motion in the hamstring muscle group.

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