Acute Effect of 30 and 60 Second Static Hamstring Stretch on Knee Flexion Strength

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Abstract. This study was designed to determine if there is a difference in torque produced with a hamstring curl after a 30 second and 60 second passive static hamstring stretch. Our study included 50 participants (13 males, 37 females) between the ages of 20 and 29. Excluded subjects included individuals with a history of surgery on their dominant leg (the leg they kick a ball with) and expecting mothers. The Lido Isokinetic Dynamometer was used to measure torque production (NM) of concentric knee flexion on two separate occasions no more than two weeks apart. The first testing session was performed without a pre-test stretch and the second was performed with a pre-test stretch. Statistical analysis revealed no significant difference in torque production between the 30 second and 60 second static stretching groups.

1. Introduction

For many years stretching has been a controversial issue in regards to its effect on both muscle strength and elongation. Stretching has been used as a warm-up technique to increase joint range of motion, enhance joint performance and aid in the prevention of injuries; however, research has reported that stretching leads to a decrease in peak torque production after completion of a stretching session. Our study was designed to determine if there is a difference in torque production with a hamstring curl after a 30 second and 60 second static hamstring stretch, information that may be beneficial to coaches, health care professionals and the athletes, patients and clients they serve. Peak torque production is important for all athletes, especially high end athletes whose sport requires them to cut, jump, sprint and spin. While it is known through previous research studies that stretching is helpful to these athletes in regards to injury prevention [1], our study will be significant to these individuals in that it will help them to determine the proper duration of stretch to preserve adequate torque production to be successful at their designated sport, while promoting injury prevention.

2. Experiment, Results, Discussion, and Significance

Fifty Wichita State University College of Health Professions students, consisting of 37 females and 13 males, participated in one of two static hamstring stretching groups. The subjects were used as a sample of convenience because the testing was completed in the building where they attended classes.

Participants were excluded if they were pregnant, if they had a history of hip, knee, or ankle surgical repair on their dominant lower extremity or if they were not between the ages of 20 and 29. Prior to participation in the study, participants received an explanation of risks and benefits of the study and procedures to be followed and they all signed a participation consent form approved by Wichita State University's Institutional Review Board.

The participants were divided into male and female participants and then were randomly assigned into one of two groups. They were initially divided by gender to ensure equal representation of both sexes in each group, and as a result our statistical data should be able to be generalized over a larger population. The two groups were divided into a 30 second static hamstring stretch group and a 60 second static hamstring stretch group. There was no control group in our study because each participant acted as their own control by participating in two separate testing sessions. The first session was completed without a pre-test static hamstring stretch and the second session was completed with a pre-test static hamstring stretch. Participants in group one were asked not to discuss the results of their testing with members of group two and the same request was made to group two participants.

The Lido isokinetic dynamometer machine was used to test the concentric hamstring peak torque production (NM) of participant's hamstrings after a stretching session. The strength testing was done on the participant's dominant leg, which was determined by asking each subject which foot they kick a ball with. Participants were assigned to one of two groups; the first group was tested for concentric hamstring peak torque production following a 30 second passive static hamstring stretch and the second group was tested for concentric hamstring peak torque production following a 60 second passive static hamstring stretch.

At the first testing session the participants walked to the isokinetic machine, sat down and were strapped onto the machine in accordance with guidelines distributed by the machine's manufacturer. Individuals were seated so that the joint line of their dominant knee lined up with the axis of the lever arm of the machine. The seat depth to achieve this position was recorded for each participant, so the same depth could be used for the second session. A thigh guard was securely fastened on top of their dominant thigh, and an ankle strap was fastened above the malleoli of their dominant leg. Participants were instructed on the technique of the contraction with the isokinetic machine and verbal cuing was used throughout the testing session to ensure that a proper and safe posture (sit up straight and hold onto the handles on each side of the seat) was maintained. Subjects were encouraged to give maximal effort in both sessions on each repetition. The individuals then completed three submaximal practice repetitions to learn the correct technique and then five maximal contraction repetitions of concentric hamstring contractions in an arc between -20 degrees full extension and 90 degrees flexion at 90 deg/sec with a torque limit of 250 deg/sec. The best peak torque value (NM) of the five repetitions was recorded. Participants were tested using the Concentric/Eccentric 2 program for flexors.

In the second testing session, following stretching intervention of either 30 seconds or 60 seconds of a passively applied static straight leg hamstring stretch, participants walked to the isokinetic machine, sat down and were strapped onto the machine in exactly the same manner as the first testing session. Participants then completed five maximal concentric hamstring contractions at the same parameters of the first testing session. Again the best torque value of the five repetitions was recorded.

Our data was analyzed using a Repeated Measures ANOVA. The statistics showed that there was an overall increase in torque production with stretching as seen in Table 1. Our data showed no significant difference, p = .513, between the 30 second static stretching group and the 60 second static stretching group in regards to increased torque production after stretching intervention. The statistical results for both groups are displayed in Table 1.

Table 1 – Statistical analysis of 30 second and 60 second stretching groups.

	Group	Participants	Mean (NM)	Standard Error (NM)
Testing Session 1	30 seconds	25	99.29[a]	8.13
	60 seconds	25	104.63[b]	8.62
Testing Session 2	30 seconds	24	109.01[c]	8.64
	60 seconds	25	111.53[d]	9.16

- c > a at p = .000
- d > b at p = .000

3. Conclusions

Our results showed that there is no significant difference in peak torque production between a 30 second static hamstring stretch and a 60 second static hamstring stretch. These results are not synonymous with results found by Nelson et. al. [2], Fowels, Sale and MacDougall [3] and others that site reduction in peak torque production comes as a result of stretching interventions. According to our results, stretching for either 30 seconds or 60 seconds, produced an increase in the peak torque production of a muscle.

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1. Marek S.M., J.T. Cramer, A.L. Fincher, L.L. Massey, S.M. Dangelmaier, S. Purkayastha, K.A. Fitz, J.Y. Culbertson. Acute effects of static and proprioceptive neuromuscular facilitation stretching on muscle strength and power output. *J Athl Train*. 40: 94-103. 2005.
2. Nelson A.G., I.K. Guillory, C. Cornwell, J. Kokkonen. Inhibition of maximal voluntary isokinetic torque production following stretching is velocity-specific. *J Strength Cond Res*. 15: 241-6. 2001.
3. Fowles JR, D.G. Sale, J.D. MacDougall. Reduced strength after passive stretch of the human plantarflexors. J Appl Physiol. 89: 1179-88. 2000.