Comparison between the Effect of Different Durations of Cryotherapy and Stretching on Hamstring Flexibility

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Abstract

Background: The hamstring is a biarticular postural muscle that flexes the knee, extends the hip, and plays a role in activities, such as walking, running, climbing stairs, and jumping. Hamstring shortening is associated with a high incidence of muscle strain, patellofemoral pain, and poor gait. Precooling and static stretching have been used to increase connective tissue viscoelasticity and improve muscle flexibility. Studies have shown that the application of ice may provide improvements in hamstring flexibility over heat or stretching alone. However, insufficient scientific data exist regarding the effectiveness of different durations of cooling combined with static stretching on muscle flexibility.

Methods: To help explore the effects of different durations of cryotherapy and stretching on muscle flexibility, four experimental conditions of cold pack applications were compared on different days with two days in between the experimental conditions. The purpose of this study was to compare 5, 10, 15, and 20 minutes of cold pack application followed by hamstring stretching on muscle flexibility in 25 healthy subjects. A randomized within-subjects design was used to compare the changes before and immediately after cold pack application and stretching in popliteal angle measurement. Stretching was conducted for 30 seconds and repeated three times.

Results: Analysis of variance revealed a significant main effect for time demonstrated in an increased popliteal angle measurement. All groups showed significant differences in the popliteal angle measurement before and after cold pack administration. Additionally, although 15 minutes resulted in the highest measured popliteal angle among the four conditions, the post hoc test showed that this change was statistically significant from 5 and 10 minutes but not from 20 minutes.

Conclusion: The results infer that short cold pack application has limited effectiveness in altering muscle flexibility and that durations of 15 and 20 minutes are better employed for superior outcomes.

Keywords: Cold pack; Popliteal angle; Static stretch; Treatment duration

Abbreviations: ROM: Range of Motion; HML: Hamstring Muscle Length; PA: Popliteal Angle; CP: Cold Pack

Introduction

The hamstring is a biarticular postural muscle composed laterally from the biceps femoris longus and brevis, while semimembranosus and semitendinosus compose the medial muscle mass. The hamstring is most active in the transition from swing to stance during gait cycle. It works to flex the knee and extend the hip, and depending on the muscle mass contracted, i.e., medial or lateral, knee flexion can be

Given that the four different tests were conducted on different days, baseline equivalence was tested to ensure similarity of the PA measurement before conducting the trial. Mauchly's test of sphericity indicated that the assumption of sphericity had not been violated, $\chi 2(3)=0.578$, and $p=0.631$, indicating no significant difference between the baseline (pre-intervention) knee measurement in any of the four conditions.

All groups displayed a mean increase in ROM under the four durations of cryotherapy, although the magnitude of this change varied between the groups (Table 2).

	5 minute	**10 minute**	**15 minute**	**20 minute**
Mean intervention of pre-intervention PA (°)	148.4	149.16	149.6	149.64
Mean reading of post-intervention PA (°)	154.08	158.54	164.58	163.6
Minimum change in the PA measurement (°)	-8	-4	0	0
Maximum change in the PA measurement (°)	17	34	57	

tolerance [31]. In the current study, using a CP for as little as 5 minutes resulted in an average increase of 3.8% in PA. These results were in agreement with those of Park et al. [32] who reported a favorable gain in muscle length after 3 minutes of CP application. The increase in ROM after the application of CPs could be due to the decrease in the uncomfortable sensation associated with muscle stretching, hypoalgesic effect of cooling, increase in the pressure pain threshold, and reduction in stretch sensitivity [32,33]. The cooling agent and decrease in tissue temperature may have facilitated all these aforementioned conditions.

Interestingly, some participants in the current study experienced

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