

Effects of Muscle Temperature on Hamstring Flexibility

Sawyer P, Uhl TL, Yates JW, Mattacola CG, Johnson DL: Division of Athletic Training, University of Kentucky, Lexington, KY

Previous studies have examined the combined effect of increasing tissue temperature and stretching on muscular flexibility. The specific effect of a commonly used modality, a moist heat pack, on flexibility has limited evidence to support its utilization. The purpose of this study was to determine if applying a moist heat pack (MHP) can increase hamstring flexibility.

A 2 (condition) x 5 (time intervals) repeated measures ANOVA on both factors with flexibility as the dependent variable was used to determine the effect MHP has on muscle flexibility. The subject's dominant leg was randomly assigned into one of two conditions. One leg underwent MHP (condition 1) and the subject's opposite leg was used as the control (condition 2). The study was performed in the University of Kentucky's Exercise Physiology Laboratory.

Twenty-seven male subjects (Ht = 178.5 ± 8.6 cm), (Mass = 84.4 ± 18.7 kg), (Age = 21.9 ± 6.3 yrs) volunteered for this study. Subjects had to demonstrate an active knee extension of less than 20° and not suffered a hamstring injury in the previous 6 months.

For condition 1, baseline hamstring flexibility was measured by an active knee extension (AKE) test. The average of three trials represented the measured hamstring flexibility. A 25 gauge indwelling thermistor was inserted to a depth of 2.54 cm to measure muscle temperature of the biceps femoris. After baseline temperature was recorded, two MHPs were placed on either side of thermistor to increase hamstring muscle temperature by 0.4°C above baseline. Upon reaching the 0.4°C muscle temperature threshold the thermistor was removed. Hamstring flexibility post-intervention measurements were performed at 0, 4, 8, and 16 minutes following MHP removal. Condition 2 used the exact same protocol as condition 1 except no MHP was applied to the hamstring muscle. The repeated measures ANOVA found no significant interaction between the MHP leg and the control leg ($F_{3,69} = 2.41$, $p = 0.075$). There was a significant main effect for time ($F_{3,69} = 2.90$, $p = 0.041$). Tukeys post-hoc analysis revealed significantly greater flexibility at 4 minutes compared to 16 minutes post intervention ($p < 0.05$). A Pearson correlation between normalized muscle flexibility and the normalized muscle temperature immediately following MHP removal resulted in an $r = .35$ ($p = 0.098$) for condition 1 and $r = .23$ ($p = 0.28$) for condition 2. The data presented here supports previous research that MHP application does not significantly affect muscle flexibility alone. This is probably due to the inability of a MHP to elevate muscle temperature to a high enough degree. Utilization of a MHP appears to take 20-25 minutes to increase intramuscular temperatures by 0.4°C . Both of these findings should be taken into consideration when applying a MHP to increase muscle flexibility. Based on this study's results, in order to maximize flexibility gains heat packs should be incorporated with some type of stretching.