Grant Information Summary:

Effects of Knee Joint Effusion and Cryotherapy on Lower Chain Function

Practical Implications:

This study demonstrated that cooling the knee joint after a simulated injury restores normal knee kinetics through re-establishing thigh and leg muscle activation. Clinicians should aggressively use joint cryotherapy following joint injury to restore normal lower extremity muscle function.

Background

Arthrogenic muscle response (AMR) is an ongoing reflex inhibition or facilitation of joint musculature following distension or damage to the joint. AMR plays a central role in facilitating and maintaining neuromuscular deficits of the quadriceps following injury, and during joint rehabilitation. AMR also affects joint muscle recruitment levels, potentially altering lower extremity closed kinetic chain function. The extent to which therapeutic interventions affect AMR imposed on lower extremity musculature during a functional task is unknown.

Objective

To quantify lower extremity muscle activation and knee joint kinetics following knee joint effusion and subsequent joint cryotherapy.

Design and Setting

A 3 X 4 factorial design was used to compare treatment groups (normative, effusion/control, and effusion/cryotherapy) across time intervals (pre, post, 30 min, 60 min). This study took place in the biomechanics laboratory at Illinois State University.

Subjects

Forty-five (26 male 19 female) volunteers (age 21±2 yrs, ht 174.8±10.2 cm, mass 78.1±15.4 kg) were randomly assigned to 1 of 3 treatment groups.

Measurements

Lower extremity closed chain average and peak joint torque and power, and average and peak vastus medialis (VM), vastus lateralis (VL), medial hamstrings (MH), and gastrocnemius (G) normalized EMG were collected during a seated leg press at a standard resistance and speed (figure 1). Following baseline measures, 50 mL of saline was injected into the joint capsule (figure 2). After the effusion, all measurements were repeated immediately (post), at 30 min, and at 60 min. In the cryotherapy/effusion group a 1.5 L bag of crushed ice was wrapped to the anterior surface of the knee immediately following injection and removed prior to the 30 min measurement. Subjects in the effusion/control group were prepared with a bag filled with a non-cooling substance of the same weight and texture. The dependent variables were measured at the same time intervals for the normative group.

Results

An overall time X group effect was detected for knee kinetic variables ($F_{24,504}$ =2.228, P =.001) and peak EMG measures ($F_{24,504}$ =2.062, P=.002). A decrease in peak torque (P =.005) and average power (P=.018) at 30 min and peak power (P=.001) at 30 and 60 min post-injection for the effusion/control group relative to the Cryotherapy and normative groups was observed. A decrease in peak VL activity was noted at post (P=.014), 30 min (P=.001), and 60 min (P=.047) intervals in the effusion/control group.

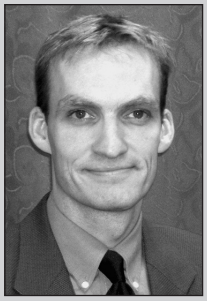
Conclusions

These data suggest that joint cooling helps restore normal joint kinetics following effusion. This is mostly likely due to re-established VL activation from disinhibition of its motoneuron pool.

Figure 1:
Omnikinetic closed chain dynamometer used to measure knee joint kinetic variables.

Figure 2:
Injection of 50mL of sterile saline.

Principal Investigator:



J. Ty Hopkins, PhD, ATC

Assistant Professor
Brigham Young University
Provo, UT 84602-2070
(801) 422-1573
tyhopkins@byu.edu

Publication & Presentation List

NATA Annual Meeting,
Baltimore, MD, June 15-19, 2004

Printing by:

Ellington Printery, Ellington, CT

2952 Stemmons • Dallas, TX 75247
214-637-6282

Supporting and advancing the Athletic Training profession through research and education.