INTRODUCTION

Compression apparel has been reported to have positive effects on performance (Kraemer et al., 1998). Mechanisms to explain the improved performance included change in kinematics, change in blood flow and the damping of soft tissue vibrations. Soft tissue vibrations are important for the energetics of running (Nigg and Wakeling, 2001) since muscle activity is required to damp these vibrations (Boyer and Nigg, 2006). Consequently, damping the soft tissue vibrations through apparel should decrease the muscle activity and, therefore, decrease the needed energy. However, the effect of compression apparel on vibration damping and muscle activity has never been quantified.

The goal of this study was to quantify the effects of compression apparel on (a) the damping of soft tissue vibration and (b) muscle activity during treadmill running.

METHODS

Four young, active subjects (2 females, 2 males) participated in this study. All subjects were free of any injuries at the time of the experiments. Subjects were wearing the test or the control apparel.

Three 3-D accelerometers were taped to the skin overlying the soft-tissue compartments of the triceps surae, quadriceps, and hamstrings soft tissue compartments. EMG signals were recorded for the vastus medialis, gastrocnemius lateralis and biceps femoris muscles with a sampling frequency of 2400 Hz.

The damping coefficient was computed for each step by fitting the acceleration data in the interval 0 to 200ms after heel strike to an exponential decay function.

Muscle activity was computed as the Root Mean Square (RMS) of the EMG activity in the interval 100ms before heel contact to heel contact (pre-activation) and heel contact to 100ms after heel contact (post-activation).

Two apparel conditions were tested: compression and control apparel.

The average damping coefficient was computed for the time interval 0 to 200 ms after heel strike for all steps in each trial. The pre/post-EMG-activity was computed as the RMS-EMG mean of all the steps in each trial.

Each subject was asked to run on a treadmill at five different speeds wearing 3 different shoes. Acceleration and EMG data were recorded and used to determine the speed/shoe combination that produced the highest vibration of the soft tissue.
compartments, which may be related to resonance.

Each subject performed two series of 4 running trials at the speed with the highest acceleration and EMG (resonance) at two different days, wearing the test and the control apparel in different order. Acceleration and EMG data were collected for 1 minute for each trial. In total each subject had to perform 8 trials (4 test, 4 control), corresponding to approximately 90 steps for each trial.

The relative change between test and control condition was calculated as the mean relative change over all three soft tissues for each muscle. This averaging was done since the relative changes for the three soft tissue compartments were similar.

A series of t-tests were used to examine whether the change in damping coefficient and the change in muscle activity due to the compression apparel was significantly different from the control condition.

RESULTS AND DISCUSSION

The compression apparel condition showed an 8% (±2.1%) average increase (p=.05) in the damping coefficient when compared to the control apparel.

There was an 8.2% (±1.8%) average decrease (p=.05) in the muscle pre-activation and a 6.5% (±1.6%) decrease in post-activation values for the compression apparel condition compared to the control apparel (Fig.1).

CONCLUSION

The results showed that the compression apparel increased the damping and decreased the muscle activity. Since the addition of the compression apparel was the only change implemented it is concluded that the compression apparel was responsible for the observed changes in damping and muscle activity.

Figure 1. Normalized pre- and post-EMG-activation (mean and standard deviation) for the compression (white bars) and control apparel (grey bars).

Compression apparel has a positive effect on soft tissue vibration damping and muscle activity in running. It is speculated that these changes may have an effect on performance. However, this speculation requires further investigation.

REFERENCES


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