INTRODUCTION

Directional compression garments are designed to exert a perpendicular force on the underlying tissues to create an increased pressure gradient within the tissue [1]. Two recent studies reported that in competitive alpine skiers, directional compression results in reduced muscle activation and increased fatigue resistance [2, 3]. It is not known whether the beneficial effects of directional compression are limited to competitive skiers, or if similar changes in muscle activation would be observed in recreational skiers.

The purpose of this study was to examine changes in muscle EMG patterns throughout a day of skiing for a recreational skier technically proficient in using the carving technique when skiing with and without a lower body directional compression garment. In the compression condition, we hypothesized lower EMG intensities (RMS) at the end of the day for vastus lateralis (VL), adductor longus (AL), rectus femoris (RF), gluteus medius (GMed), and gluteus maximus (GMax) muscles.

METHODS

The subject was a 54-year-old, female, retired alpine ski racer who competed on the World Cup circuit from 1979-1990, and has coached 20 plus years, bringing a unique background and technical proficiency with the carving technique to this study.

The participant skied two days, two weeks apart, first with directional compression tights (Opedix Kinetic Health Gear, Denver, CO, USA) and the second without. Bipolar surface EMG electrodes (Trigno, Delsys Inc, MA, USA) were placed on the right leg over the VL, AL, RF, GMed, and GMx muscles. A gyroscope (Motion Sensor, Electronic Realization, Bozeman, MT, USA) mounted to the back of the boot was used to define turns and ski edge angle at 100 Hz.

Two measurement runs on were taken on each assessment day, one in the morning and one in the afternoon. A course of 12 turns around brush gates, set with 12 m between gates was used for the measurements. Between measurement runs the participant skied their choice of runs throughout the ski area. On the second testing day, this exact sequence of ski area runs was replicated. A 2x2 repeated measures ANOVA was used to compare morning and afternoon turn times and RMS for the compression and non-compression conditions (significance level of 0.05).

RESULTS AND DISCUSSION

No difference in turn times was found between conditions. RF and GMed both demonstrated a main effect of condition, with average RMS values being lower in the compression condition than the non-compression condition (p < 0.0001, p < 0.005). For all other muscles, there were no changes.

A decrease in muscle activation for skiers in compression garments was previously observed [2,3]. Our findings are consistent with these results for RF and GMed. GMed activity is part of the steering phase of the carving technique and a lower average RMS value in this muscle may be directly related to the decrease in edge angle. In the compression condition, we observed a strong decrease in RMS for RF muscle and not for VL. Previous studies have shown a decrease mean frequency in VL and RF as associated with skiing fatigue [4].

CONCLUSIONS

A retired world cup skier was observed for two full days of skiing. When wearing directional compression, a decrease in average RMS activity in rectus femoris and gluteus medius was observed. Average peak edge angle also decreased by 4.6% in the compression condition, although this value was not tested for statistical significance. No differences in turn duration or in time of day were observed. Further investigations are necessary to determine the effects that decreased muscle activity due to directional compression garments may have on skier fatigue.

REFERENCES


ACKNOWLEDGMENTS

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Table 1: Mean peak RMS values throughout the turn for time of day and compression conditions

<table>
<thead>
<tr>
<th>RMS (mV)</th>
<th>RF AM*</th>
<th>RF PM*</th>
<th>GMed AM*</th>
<th>GMed PM*</th>
</tr>
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<tbody>
<tr>
<td>Compression</td>
<td>0.00204</td>
<td>0.0165</td>
<td>0.0284</td>
<td>0.0268</td>
</tr>
<tr>
<td>± 0.00281</td>
<td>± 0.00375</td>
<td>± 0.00952</td>
<td>± 0.01036</td>
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</tr>
<tr>
<td>No Compression</td>
<td>0.0287</td>
<td>0.0267</td>
<td>0.0444</td>
<td>0.358</td>
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<tr>
<td>± 0.00499</td>
<td>± 0.00334</td>
<td>± 0.01097</td>
<td>± 0.00628</td>
<td></td>
</tr>
</tbody>
</table>

* Difference observed at p < 0.05