

THE INFLUENCE OF DIRECTIONAL COMPRESSION TIGHTS ON MUSCLE FUNCTION DURING THREE CONSECUTIVE DAYS OF ALPINE SKIING

John G. Seifert ¹, Heidi Nunnikhoven ¹, Ronald W. Kipp ², Michael Decker ^{3,4}

¹ Montana State University, Bozeman, MT, USA

² Squaw Valley Race Team, Olympic Valley, CA, USA

³ Rocky Mountain Consortium for Sports Research, Edwards, CO, USA

⁴ University of Denver, Denver, CO, USA

Keywords: directional compression tights, EMG, muscle activity

Introduction. Fatigue can lead to poor skiing performance and increases the risk for injuries. As fatigue progresses, there is a shift from co-loading of legs to predominately loading of the outside leg (Kröll et al., 2011). It has been proposed that compression apparel attenuates fatigue related changes in motor unit recruitment (Wang et al., 2016). Previous research demonstrated that directional compression tights (DCT) resulted in improved muscle activity and skiing distance over a no tights (NT) condition during one day of alpine skiing (Snyder et al, 2018). However, the question is posed as to how DCT would influence skiing over multiple days. The purpose of this study was to compare performance and muscle activity responses of expert skiers during multiple days of skiing when wearing DCT and NT.

METHODS. Four expert level skiers completed this crossover study comparing DCT (Opedix, Scottsdale, AZ) to NT. All skiers free skied for 3 consecutive days under each treatment. A minimum of 7 days separated treatments. EMG was collected from gluteus medius (GM), gluteus maximus (GX), and vastus lateralis (VL) muscles of the right leg. EMG data was collected at the beginning and end of the day during ski days 1 and 3 for each treatment. Measurement runs consisted of skiers completing 10 double turns within a 13- turn course. Gate distance for turns was 15x4 m and was set on firm, groomed snow. EMG data was assessed via root mean square analysis (Delsys, Boston, MA). Vertical meters skied during the free skiing segments were measured via GPS (Polar RC3, Lake Success, NY). 30 minutes was given each day for a standardized lunch break. A Wilcoxon Signed-Rank non-parametric test was used to statistically analyze data.

RESULTS. Skiing with DCT resulted in significantly greater vertical meters skied over the three days than NT (day 1: 6348 \pm 918 vs. 5653 \pm 920 m; day 2: 6583 \pm 794 vs. 5749 \pm 1012 m; day 3: 6778 \pm 803 vs. 4620 \pm 583 m; $p=.04$). Muscle activity generally improved for DCT by about 11% from pre to post skiing on days 1 and 3 but decreased by about 12% when wearing NT. Regardless of the day, DCT resulted in greater activity for GM and VL than with NT ($p=.04$ and $p=.02$). No differences were observed for GX between or within treatments.

DISCUSSION AND CONCLUSIONS. Wearing DCT resulted in improved muscle function and vertical meters skied over three consecutive days of skiing in recreational skiers. These results may have been due to improved ability to maintain body position over the skis. The maintenance of VL and GM activities for DCT throughout skiing may be indicative of being able to utilize more energy or resistance to fatigue in DCT. Reduced VL and GX activities for NT may be indicative of a more upright stance. The increased activity of the GM along with the low VL activity on day 3 may indicate more valgus movement of the knee when skiing with NT.

REFERENCES.

- Kröll, J., Müller, E., Seifert, J. G., & Wakeling, J. M., 2011, Changes in quadriceps muscle activity during sustained recreational alpine skiing. *Journal of Sports Science and Medicine*, 10(1), 81-92.
- Snyder, C., Becker, J., & Seifert, J.G., 2018, The Influence of Directional Compression Tights on Muscle Activity and Performance in Recreational Alpine Skiers. ACSM. Minneapolis, MN.
- Wang, X., Xia, R., & Fu, W. J., 2016, Reduced muscle activity during isokinetic contractions associated with external leg compression. *Technology and Health Care*, 24, S533-S539. doi:10.3233/thc-161179.

Acknowledgements: To Rocky Mountain Consortium for Sports Research for funding of this pilot project.