Effects of a new selective compression garment on thermoregulation and muscular oscillations during exercise

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1. Introduction

The market for compression clothing has developed considerably to manage the demand of athletes who are looking for optimum conditions to improve their performance and recovery (Doan et al. 2003; Bringard et al. 2006). Some studies are worked on the compression influences on physiology, biomechanics or thermoregulation. The effects on cardiovascular and thermoregulatory strain remain equivocal. For thermal regulation, many studies point out interests of compression garments in sport (Doan et al. 2003). Nielsen and Endrusick (1989) have shown that different knitwear structure influences the cutaneous temperature. Iker et al. (2016) studied the effects of an upper body compression garment on thermoregulatory responses during cycling in a laboratory. No differences are showed in thermoregulatory effects during exercise. Some research showed that by wearing compressive equipment, the muscle compression allows a better muscular support and significantly reduce muscular oscillations (Lussiana et al. 2015). The aim of the present study was to determine the effects of a new selective compression garment on thermoregulation and muscular oscillations with the aim of creating a new selective compression shorts.

2. Methods

2.1. Thermoregulation

A crossover control and randomized study was realized on 11 regular sportsmen. Subjects have to run on treadmill with incremented speed between 45 and 15 min of recovery for 2 conditions, CSX short or control short (Jones and Doust, 1996). Thermo-Hygro sensors and Infrared camera are used to collect variations in temperature and humidity during exercise. Sensors were placed on the skin at 4 areas: quadriceps, hamstring, adductors and gluteal. The measurement frequency was 2 data per minute.

2.2. Muscular Oscillations

A crossover control and randomized study was realized on 10 regular sportsmen. Subjects should realize 3 Squat Jump in 2 conditions, CSX short (compression selective on short) or control short. Triaxial accelerometers were used to collect acceleration data. Sensors were placed on 3 positions: quadriceps femoris, hamstring and tensor fasciae latae.

A statistics analysis was realized with Student t-test to compare the effects of CSX short and control short.

3. Results and discussion

3.1. Compression selective and Thermoregulation

The infrared images (Figure 1) were taken during the different phases of exercise. One may notice that the skin temperature increase during exercise. Indeed, exercise increases metabolic heat production and invokes thermal regulatory processes. One can observe that the skin temperature distribution presents hyperthermal spots due to the presence of perforator vessels who reach the surface of skin (Lussiana et al. 2015).

Table 1 indicates that variations of temperature have significant reductions for hamstring (p < 0.05) and adductors (p < 0.05). Variations of humidity have significant reductions for quadriceps (p < 0.05), adductors (p < 0.05) and buttocks (p < 0.005).

Results show that compression garment didn’t influence negatively the performance or the temperature (Houghton et al. 2009) but subjects prefer it (+2 points) in term of perception (Harnisch et al. 2015). CSX shorts have a better evacuation of sweat with 40% on average than control short on exercise.

3.2. Compression selective and muscular oscillations

The CSX short has significant reductions of muscular oscillations than control short for quadriceps (semi-rigid...
knitwear, \( p < 0.05 \) and hamstring (rigid knitwear, \( p < 0.05 \)). TFL has not a significant reduction because its light knitwear allows reducing compression on tensor fasciae latae to avoid iliotibial band syndrome.

Selective compression conceded a break of the vibrations signal with a rupture of its direction of movement (Abercromby et al. 2007). Semi-rigid knitwear allows reducing more muscular oscillations than rigid knitwear unlike the hypothesis. Knitwear structure shows that the pressure is more important for rigid knitwear than semi-rigid. Rigid knitwear does not cover entirely the hamstring.

### 4. Conclusions

The results show that the CSX shorts have not an effect on skin temperature. These results were consistent with previous researches.

However, one may notice that the CSX shorts have significant reductions of muscular oscillations and humidity on the skin during exercise. The perspectives should find a correlation between muscular oscillations and thermoregulation with selective compression short during exercise. Then compare CSX short to another compression short to the extent of finding the best positions for all the meshes. A new CSX short was designed with the results of this study and the K-Taping conception order to respect biomechanics and prevent injuries.

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