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

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J. Romain[a]*, S. Corona[b], and A. Arfaoui[a]

[a]*Biomechanics laboratory/GRESPI, UFR Staps,University of Reims, Moulin de la Housse BP 1039, 51100 Reims, France;*
[b]*BV Sport, 16 Rue Jean Sebastien Bach, 42000 Saint-Etienne, France;*

Keywords*:* Compression; short; thermoregulation; muscular oscillations.

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 [1,2]. In the literature, the compression influences physiological, biomechanical and thermoregulatory somes are studied. 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 & 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. They showed that had not differences 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 & 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 45min, and 15min of recovery for 2 conditions, CSX short or control short. 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 or control short. Accelerator triaxial was used to collect accelerations data. Sensors were placed on 3 positions: quadriceps femoris, hamstring and tensor fasciae latae.
A statistics analysis was realized with Student t to compare the effects of CSX short and control short.
The numerical data used for input or got as results can be presented in a table (only one table in the paper)

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 [5].

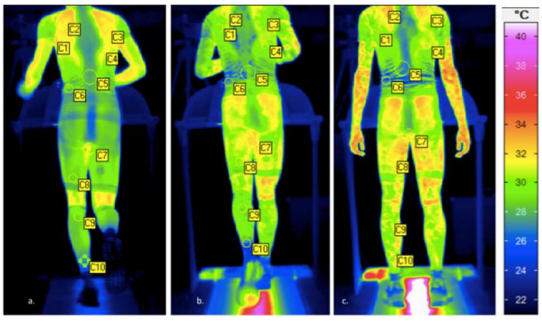

Figure 1 Infrared cartographies of back view of lower and upper limbs (a.t=0, b.t=20, c.t=45)

Table 1 indicates that variations of temperature have significant reductions for hamstring ($p<0,05$) and adductors ($p<0,05$). And variations of humidity

have significant reductions for quadriceps ($p<0,05$), adductors ($p<0,05$) and buttocks ($p<0,005$).

0' → 45'	ΔT (°C)		ΔH (%)	
Position	CSX	Control	CSX	Control
Quadriceps	2,39 ± 1,33	2,64 ± 0,93	29,26 ± 18,16*	33,1 ± 14,43
Hamstring	2,06 ± 1,54*	2,39 ± 1,23	35,29 ± 15,17	35,43 ± 14,63
Adductors	0,47 ± 1,27*	1,14 ± 1,31	29,6 ± 15,29*	38,11 ± 6,68
Gluteal	1,52 ± 1,49	1,38 ± 2,14	27,52 ± 17,45**	34,33 ± 17,5

Table 1 Thermal variation of 4 areas during exercise (*p<0,05; **p<0,005)

Results show that compression garment didn't influence negatively on the performance or the temperature [6] but subjects prefer it (+2 points) in term of perception [7]. CSX have a better evacuation of sweat with 40% on average than control short on exercise.

3.2 Compression selective and muscular oscillations

The CSX 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 [8]. 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 short have not an effect on skin temperature. These results were consistent with previous researches.
However, one may notice that the CSX 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. And, perhaps, compare it 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.

References

[1] Doan& al. "Evaluation of a Lower-Body Compression Garment." Journal of Sports Sciences 08/2003

[2] Bringard A, Denis R, Belluye N, Perrey S. 2006. Effects of compression tights on calf muscle oxygenation and venous pooling during quiet resting in supine and standing positions. Journal of Sports Medicine & Physical Fitness.;46(4):548-554.

[3] Nielsen and Endrusick. "Thermoregulatory Responses to Intermittent Exercise Are Influenced by Knit Structure of Underwear." European Journal of Applied Physiology and Occupational Physiology1990.

[4] Iker L, Nicholas T, Roberto A J. 2016. Heat dissipating upper body compression garment: Thermoregulatory, cardiovascular, and perceptual responses. Journal of Sport and Health Science. 1-7

[5] Arfaoui A, Bertucci W, Letellier T, Polidori G. 2014. Thermoregulation during incremental exercise in masters cycling. Journal of Science and Cycling. V.3(1): 32-40.

[6] Houghton LA, Dawson B, Maloney SK.. Effects of Wearing Compression Garments on Thermoregulation during Simulated Team Sport Activity in Temperate Environmental Conditions. 2009. Journal of Science and Medicine in Sport. 12(2):303-9.

[7] Harnisch M, Klepser A, Classen E, Beringer J, SchmidtA. Influence of Sports Compression Textiles on Endurance Running Performance. 2015. Extreme Physiology & Medicine. 4(Suppl 1): A86.

[8] Abercromby AF, Amonette WE, Layne CS, McFarlin BK, Hinman MR, Paloski WH. 2007. Vibration Exposure and Biodynamic Responses during Whole-Body Vibration Training. Med Sci Sports Exerc. 39(10):1794-800.

***Julien.romain@ etudiant.univ-reims.fr**