Compression garments in sportswear: case studies to explore the effect of body type, tactile sensation and seam position in garments

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Abstract

Compression garments are becoming a staple garment amongst athletes and fitness enthusiasts in recent times mainly to support their muscle and boast their chance of performing better in their chosen activity. The market for compression garments especially for women's apparel is on a rise compared to menswear. This paper discusses significant factors that influence the design and development of compression base layer garments. One of the main areas that affect the comfort of these garments is tactile sensation whilst wearing the garment during an intense activity. In addition, compression garments aids in blood circulation and improve the clearance of blood lactate levels, and has different effect on type of body type, particularly the maximum oxygen uptake of the athlete when wearing compression tops compared to normal tops. It could be noted from previous observations that the pressure applied by compression garments at the seam position was less compared to other zones of the garment. This paper highlights the series of research conducted in the form of case study, to understand the performance as well as the need to consider various factors during apparel development:

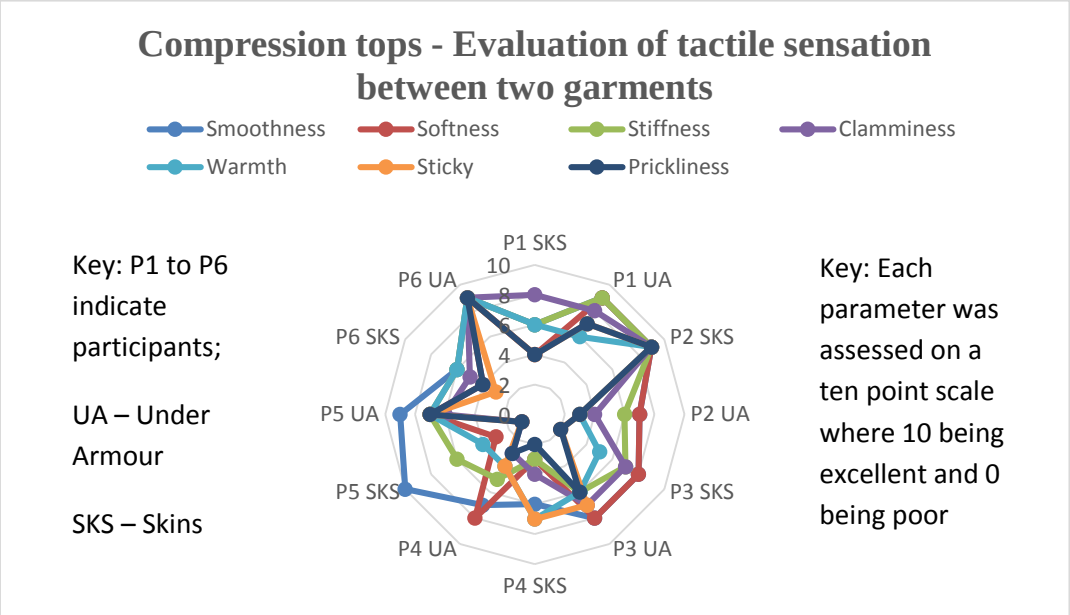
- The performance of compression garments on different body types – endomorph, mesomorph and ectomorph (base layer tops)
- Tactile sensation of base layer compression garments using a garment specific questionnaire from wearer trials (football)
- The effect of seamless compression tights for cyclists compared to garments with seams

Outcomes from these researches inform specific garment development and inferences are drawn in the context of making suitable recommendations to develop a knowledge-base in this area. It was concluded that these factors (tactile sensation, body shape, and seams) were vital during the design and development of compression garments for sportswear for a wider market.

Keywords: compression garments, tactile sensation, pressure measurement, body shape, wearer trials, VO_2 max, apparel development, and seamless base layers.

Case Study 1: Tactile sensation of base layer compression garments

Tactile sensation of clothing have been widely described by Das and Alagirusamy (2011) in improving comfort. Importance of evaluating garment performance using various subjective parameters is critical in garment development particularly sportswear. In this case, the importance of tactile sensation have been examined using two commercially available compression garments Skins (SKS) and under armour (UA). The main purpose of this research is to understand various subjective parameters of garments using consumer perception which would enable designers to user requirements in design and development of compression tights. A questionnaire was developed specifically to address various five key factors such as **tactile sensation** (smoothness, stiffness, clamminess, stickiness and prickliness); **garment fit** (feeling of second skin, allow body movement, closeness of garment); garment design (seam position, neckline, and arm hole); **garment aesthetics** (style, shape); **comfort** (while wearing the garment and during wear); **overall satisfaction** (design of the garment and style). Participants were footballers who play 5-a-side tournaments. The participants were asked to respond after viewing the garment and after wearing the garment for 60 minutes during training.



It can be inferred from the above chart that six participants responded to the questionnaire, it was evident that participants were content with Under Armour compared to the Skins tops. Participants also reported that garment fit was excellent in Under Armour compared to Skins. This could be attributed to the fact that Skins had more fabric components compared to Under Armour resulting in poor comfort. Participants also indicated that garment fit and comfort were essential.

Case study 2: The performance of compression garments on different body shapes – endomorph, mesomorph and ectomorph (base layer tops)

Male body types are implicitly labelled as: endomorph; mesomorph; and ectomorph. Figure 1 illustrates ectomorph shapes are characterised by being tall, lean builds with little excess body fat. Mesomorph's are a medium build and have a more athletic frame with broad shoulders and a narrow waist. Whilst endomorph shapes have a wider frame and generally more fat. As previously noted the most common body shapes in a population are affected by many factors including race, gender and life style (Le Pechoux and Ghosh, 2002). The performance of compression garments on various body types were not discussed previously, hence this study intends to explore the performance of garments using physiological measurements. In this study two male and two female participants were randomly selected for each body shape. The participants were asked to wear the compression tops and use treadmill (Bruce protocol), which increases the gradient and speed gradually. The participants sign a consent form before commencing the wearer trial. Various physiological measurements were recorded including heart rate, blood lactate level, and oxygen intake. The results were presented in the Table 1. It can be observed that participants in different body type perform differently. One of the important indicators is the VO_2 max, wearing compression garments could enhance oxygen delivery to the exercising muscles. VO_2 max for mesomorph participants were higher than ectomorph, which could be attributed to their athlete's training and fitness level.

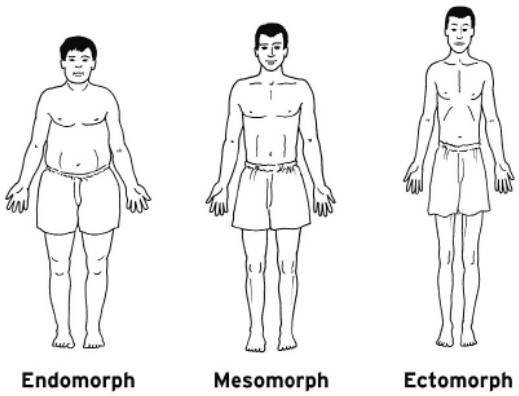


Figure 1 Type of body shapes

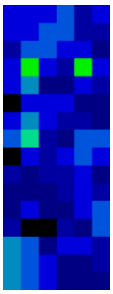
Table 1 Physiological measurements: Wearer Trials

Body Types	Parameters	Female	Male
Ectomorph	VO_2 (lit/min)	1.24	2.505
	VO_2max (ml/min/kg)	26.00	40.50
	Distance traversed (m)	701.35	879.16
	Time taken (mm:ss)	12.50	16.50
Mesomorph	VO_2 (lit/min)	2.73	3.5155
	VO_2 max (ml/min/kg)	49.50	50.50
	Distance (m)	981.10	1048.56
	Time (mm:ss)	16.00	10:19
Endomorph	VO_2	2.50	5.55
	VO2max	25.00	60.00
	Distance	646.86	1112.76
	Time	12.50	16.56

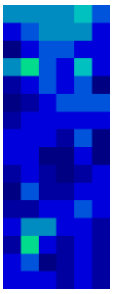
Case study 3: The effect of seamless compression tights for cyclists compared to garments with seams

Driller and Halson (2013) highlighted that wearing lower body compression garments during endurance cycling may assist in performance, perhaps through enhanced blood flow and/or redistribution of blood flow as evidenced by a lower mean heart rate during fixed-intensity

exercise. In this study two different garments were worn by the participant as shown in the images below. It can be inferred that pressure applied by the seamless tops were more uniform and consistent compared to garments with seams. In addition, the blood lactate levels were marginally lower in seamless garment compared to garments with seam.

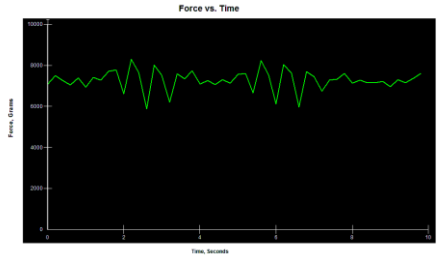


Regular kit (with seam)

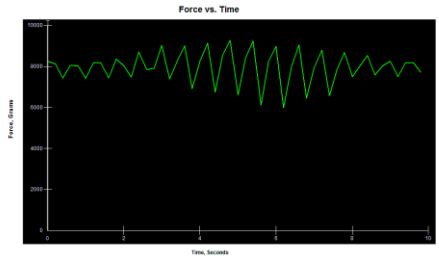


Ccompression kit (Seamless)

Pseudo colur chart

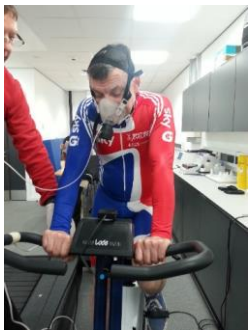


The force (8000 – 6000 g) induced by the regular garment (with seams) in front thigh during pedalling the bicycle was not consistent and highest pressure



The force (6000 - 9000g) applied by the compression tights (seamless) in front thigh during pedalling the bicycle was more consistent and marginally higher than the regular kit

It could inferred that seamless garments apply pressure more uniformly and consistently and was marginally better than the garments with seams.



Cyclist with normal seam kit

Cyclist with seamless compression tights

References

1. Das, A. and Alagirusamy, R., (2011), Improving tactile comfort in comfort in clothing, Eds. Song, G., ISBN 978-1-84569-539-2, Woodhead Publishing Co. Ltd.

2. Le Pechoux, B. and Ghosh, T.K., (2002), Textile Progress: Apparel Sizing and Fit, Vol. 32, Number 1, The Textile Institute, Manchester, UK.

3. Driller, M.W., and Halson, S.L., (2013), The Effects of wearing lower body compression garments during a cycling performance test, International Journal of Sports Physiology and Performance, 2013, 8, 300-306