Effect of combinations of passive and active warming on muscle temperature and sprint performance

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Introduction

Muscle temperature (T_m) has a significant effect on muscle function, force and power production [1], hence the adoption of warm up procedures before power based events. In the majority of sprint or power based events there are periods of maximal activity interspersed with periods of low or no activity, during which T_m may decline, adversely affecting subsequent performance. We have previously shown that T_m will decline during 30 minutes of inactivity following the completion of a warm up, and that the use of passive external heating between warm up completion and sprint cycling performance reduces T_m decline and improves peak power output [2]. The aim of the present study was to follow on from our first T_m study and determine whether, apart from using the electrical heating between warm up and event, there is an additional benefit of using the electrical heating during warm up completion on muscle temperature and subsequent measures of sprint cycling performance. The secondary goal was to look at the efficacy of a redesigned heating system covering a larger area of muscle than in [2].

Methods

Following familiarisation with the test protocol, on three separate occasions, 10 male cyclists (age 23.5 ± 3.4 years, height 1.80 ± 0.04 m, body mass 73.7 ± 0.7 kg; mean ± S.D.) completed a standardised 15-minute intermittent sprint based warm up on a cycle ergometer in standard cycle shorts, followed by 30 minutes of passive recovery before completing a 30-second maximal sprint test. Warm up was completed either with (HH) or without (SH) additional external electrical heating. During the passive recovery all participants donned a tracksuit top, with the specially designed trousers incorporating electrical heaters used in both SH and HH conditions. The control group wore a standard tracksuit ensemble throughout recovery (CONT). Muscle temperature was measured at 2-minute intervals throughout the recovery period at a depth of 2 cm in the *vastus lateralis* using an indwelling T_m probe. Mean, relative and absolute peak power output were determined during the 30 second maximal sprint test. All procedures were first approved by the Loughborough University Ethical Advisory Committee.

Results

T_m declined exponentially during CONT but did not fit the exponential model for either SH or HH. ΔT_m was reduced in HH vs CONT from minute 20 of the recovery (p<0.05) and minute 28 for SH vs CONT (p<0.05). Mean power (4%) and both relative (11%) and absolute (11%) peak power output were improved in SH (p<0.05) and HH (p<0.05) compared to CONT. There was no additional benefit of HH on T_m or power output compared to SH.

Conclusion

These data confirm our previous results and show that the use of external passive heating will reduce the decline in T_m during rest, and improve mean, relative and peak power output. The

additional finding of an increased mean power is possibly attributable to the additional area of heating coverage compared to [2]. It is recommended that athletes involved in intermittent sprint activities consider the use of passive heating during rest to maintain T_m and improve performance.

References

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2. Faulkner SH, Ferguson RA, Gerrett N, Hupperets M, Hodder SG, Havenith G: **Reducing Muscle Temperature Drop Post Warm-up Improves Sprint Cycling Performance**. *Med Sci Sports Exerc* 2012 Aug 29. [Epub ahead of print]