

Effect of hand-cycling technique on skin temperature of individuals with spinal cord injury

Inmaculada Aparicio-Aparicio¹, Lukas Verdeber², Jose I. Priego-Quesada¹, Carlos Sendra-Pérez¹, Joaquín M. Marzano-Felisatti¹, José Luis Sánchez-Jiménez¹

¹ Research Group in Sports Biomechanics (GIBD),
Universitat de València, Valencia, Spain

² Motor Control, Cognition and Neurophysiology, Chemnitz
University of Technology, Chemnitz, Germany
Email: inmaculada.aparicio@uv.es

Summary

The study analyzed the effect of pedaling technique on skin temperature (Tsk) in individuals with spinal cord injury (SCI). Ten participants completed incremental tests on an arm-crank ergometer using both symmetric and asymmetric pedaling techniques in separate sessions. The results suggest that pedaling techniques do not affect Tsk in individuals with SCI during an incremental test.

Introduction

Tsk is a key factor in thermoregulation, particularly in individuals with SCI, due to impairments in physiological functions (e.g., loss of sweat capacity and peripheral vasodilation), which affect Tsk and hinder heat dissipation from the body to the environment [1]. In this context, the biomechanical components of sports technique can influence physiological demands (e.g., VO_2 consumption) [2], suggesting that pedaling techniques in hand-cycling may impact physiological variables such as Tsk. The aim of this study was to analyze the effect of symmetric and asymmetric hand-pedaling techniques on the Tsk of individuals with SCI.

Methods

Ten volunteers with complete SCI (7 males, 3 females; 48.1 ± 4.3 years; 40.4 ± 18.2 kg; 170 ± 10 cm) visited the laboratory twice, each involving an incremental test on an arm-crank ergometer (SciFit Pro1, SCIFIT Systems Inc., Tulsa, USA). They used a symmetric pedaling technique in one session and an asymmetric technique in the other, with randomized order. Both tests took place at the same time of day. In both visits, first, the participants remained for 10 min sitting in their own wheelchair in a resting state for thermal room adaptation [3]. After that, they conducted the test. The initial resistance for participants was 5W and the resistance was increasing 3W each 30 seconds continuously. Participants should maintain self-selected mean rotation between 50-80 rpm. The main researcher supports the participant to maintain the cadence during the test. The test was until exhaustion, or when the mean rotation was under 30rpm.

Tsk was measured with an infrared camera (FLIR E54, FLIR Systems Inc., Wilsonville, USA) on the non-dominant upper arm before and after the test. Mean temperature was analyzed using thermographic software and an emissivity of 0.98

(ThermaCam Researcher Pro 2.10, FLIR Systems, Wilsonville, USA). The study was approved by the Ethics Committee of the University of Valencia (register number 1994739).

Results and Discussion

No statistical differences were observed in Tsk between pre and post moments in any of the conditions: symmetric (30.5 ± 1.1 vs. 30.1 ± 1.6 ; CI95%: -0.9 to 0.01; $p = 0.09$) and asymmetric (29.6 ± 2.8 vs. 30.2 ± 1.8 ; CI95%: -0.9 to 3.9; $p = 0.70$) (Figure 1). The variation in Tsk, calculated as the difference between post and pre moments, did not present differences between the symmetric and asymmetric pedaling techniques (-0.4 ± 0.7 vs. 0.6 ± 3.0 ; CI95%: -0.7 to 1.1; $p = 0.63$).

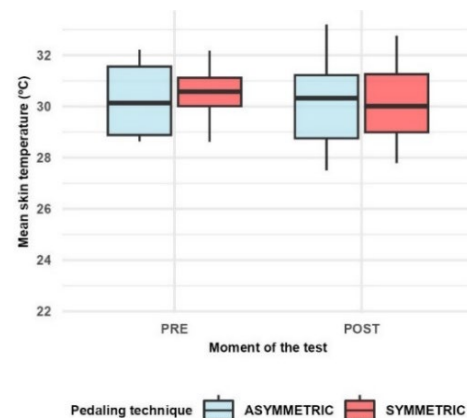


Figure 1: Mean skin temperature before and after exercise in each pedaling technique.

A reduction of Tsk was shown at different regions of interest during an arm crank graded exercise test in previous studies [4]. Probably with more participants more differences between techniques would be found.

Conclusions

The pedaling technique used during an incremental test on an arm-crank ergometer did not affect the Tsk on individuals with SCI.

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