Efficacy of a Novel Cooling Vest during Heat Exposure in Persons with Spinal Cord Injury

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***Objective*— To determine the efficacy of a smart cooling vest (CV) in minimizing the expected rise in T_{core} during a heat challenge.**

***Learning Objectives*— Describe the effects of heat exposure on core body temperature in persons with tetraplegia. Explain how thermoregulation is affected after spinal cord injury. Discuss potential bioengineering interventions to mitigate thermos-dysregulation in persons with spinal cord injury.**

***Design*— Repeated measures design**

I. Background

Spinal cord injury (SCI) interrupts motor, sensory, and autonomic pathways, impairing homeostasis of many bodily functions, including thermoregulation. After SCI, interruption of cutaneous vasodilation, sweating, and impaired mobility limit the ability to dissipate body heat during heat exposure or physical activity. Thermodysregulation causes warm seasonal temperatures to become an environmental barrier to persons with SCI above T6 (Hi-SCI).

II. Methods

A feedback-controlled CV, that uses conduction and evaporation to dissipate body heat, was developed and studied in nine participants with Hi-SCI (NLI: C7-T4, AIS: A, B). On two separate, randomized visits, participants had 15-minutes of baseline thermoneutral exposure (27°C), donned the CV or a T-shirt (NCV), followed by up to 120-minutes of heat challenge (35°C). Outcomes, T_{core}, trunk skin temperature (T_{sk} Chest+Back), upper and lower extremities (U&LE) sweat rate, U&LE cutaneous vascular conductance (CVC), and thermal sensation ratings were measured at baseline and post heat challenge.

III. Results

The CV condition compared to the NCV condition (baseline-heat challenge) demonstrated no increase in T_{core} (-0.1 ± 0.5°C vs. 0.9 ± 0.4°C, respectively; $p < 0.001$), a decrease in T_{sk} Chest + Back (-6.9 ± 2.9°C vs. 2.0 ± 1.1°C, respectively; $p < 0.001$), and improved thermal sensation (0.4 ± 1.3 vs. 2.4 ±1.3, respectively; $p = 0.008$). U&LE sweat rates and U&LE CVC were not different between conditions.

IV. Conclusion

Use of the smart CV, during a heat challenge in persons with Hi-SCI, improved maintenance of T_{core} and thermal sensation.

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