

Ryan T. Myers, Ph.D.¹, Gordon B. Hirschman, M.Eng.¹, Jennifer Johansson, M.S.², Kristian DiMatteo, M.S.¹, Michaelina Dupnik, B.S.¹, Ryan Binette, B.S.¹, Brianna Rozell, B.S.², Craig Kelly, B.S.², and Todd Farrell, Ph.D.²

¹ Vivonics, Inc., Bedford, Massachusetts

² Liberating Technologies, Inc., Holliston, Massachusetts

Background

- The daily use of a prosthetic socket often results in excessive heat and perspiration that can lead to residual limb *skin issues* and *decreased use* of the prosthesis due to discomfort
- Vivonics, Inc. and Liberating Technologies, Inc. (LTI) have developed a *socket integrated active cooling system* that provides needed heat removing capabilities to address this issue (Fig. 1)

Methods

- The system was evaluated on multiple transtibial amputee human test subjects
 - Baseline limb temperatures were recorded
 - The subject walked on a treadmill at a self-selected speed for 10 minutes
 - After walking, each subject was seated and remained sedentary for approximately 30 minutes
- Two randomized (order) conditions
 - The cooling device was turned on (experimental) at the onset of walking
 - The device was left off (control) for the entire test

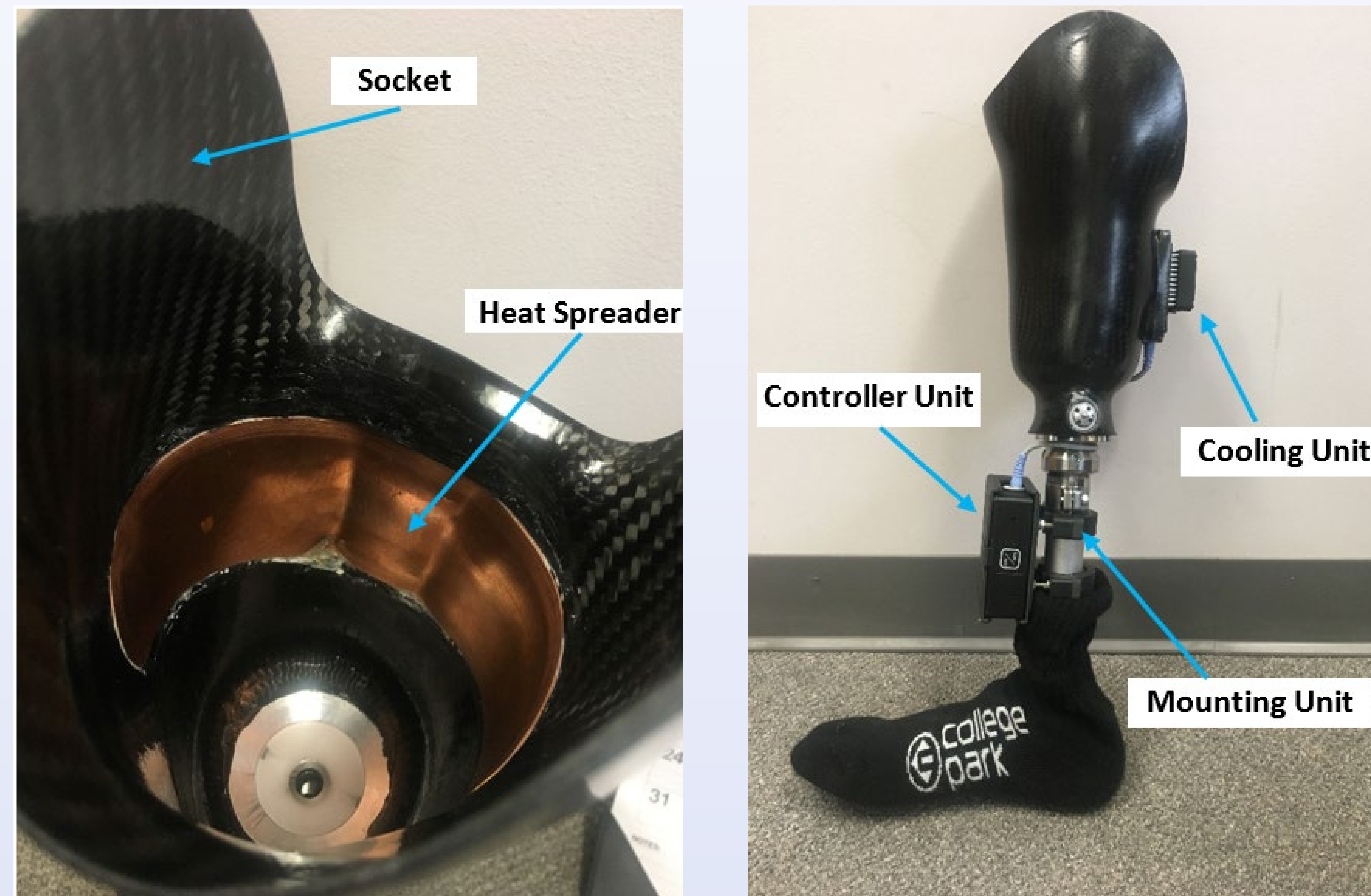


Fig. 1 – Intra-socket Cooling Element (ICE) system

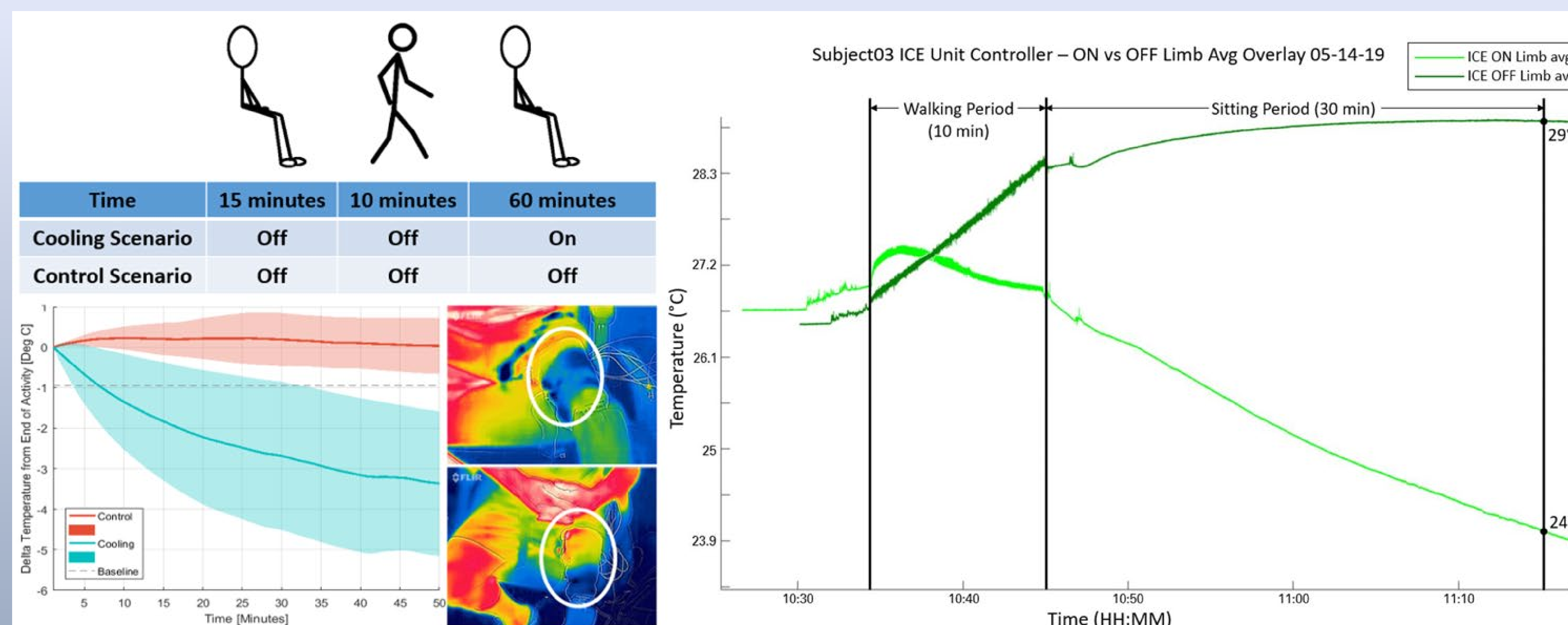


Fig. 2 - Data was collected from a 'control' condition with the ICE system turned OFF (Red) and an 'experimental' condition with the ICE system active (Blue) during the 60 minutes sitting portion of the test (left-bottom). The difference between the cooled and non-cooled socket is even more profound when each condition is evaluated throughout bouts of effort as well (right).

Results

- Control condition: All test subjects did not return to baseline
- Experimental condition:
 - 5°C of cooling was achieved for subject with pin suspension (Fig. 2)
 - Cooling for the subject with suction suspension was ~1.25°C [subsequent improvements require testing]
- The average power consumption would likely be sufficient for daily use

Conclusions

- The ICE system is a viable means of heat management for amputees with pin socket types
- Re-testing is required to verify performance in suction suspension types
- The ICE system is scheduled for take home testing in 2020
- Clinical trials for skin condition prophylaxis/treatment are planned

Acknowledgements

This material is based upon work supported by the US Army under Contract No. W81XWH-17-C-0005. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the US Army.

Contact Information

Ryan T. Myers
585-613-5349
rmyers@vivonics.com
Vivonics, Inc.
Bedford, MA 01730

