

Evaluation of Skin Temperature in Cold Sensitivity after Hand Fracture

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Purpose

The mechanisms related to abnormal cold sensitivity after hand trauma remain unknown. Previous studies have indicated no relationship between vascular responses and cold sensitivity. Many of these studies utilized cold water immersion and evaluated post-exposure skin temperatures. The purpose of this study was to evaluate skin temperature responses with cold air exposure using continuous temperature monitoring in patients with cold sensitivity following hand fractures and uninjured control subjects.

Methods

- Study sample included: Adult patients more than 3 months after hand fractures and uninjured control subjects (age- and sex-matched)
- Using a validated protocol, cold air exposure was produced in a climate laboratory (1°C for 20 minutes) with baseline and rewarming periods (20 minutes) at room temperature.
- Continuous skin temperatures were monitored with thermistor tips in direct skin contact on the dorsum of each middle phalanx on both hands. Temperature data were collected with a data logger during baseline, cold exposure and rewarming.
- Statistical analyses evaluated the relationships between the injured and uninjured digits.
- Prospective study; Research Ethics Board approval

Results

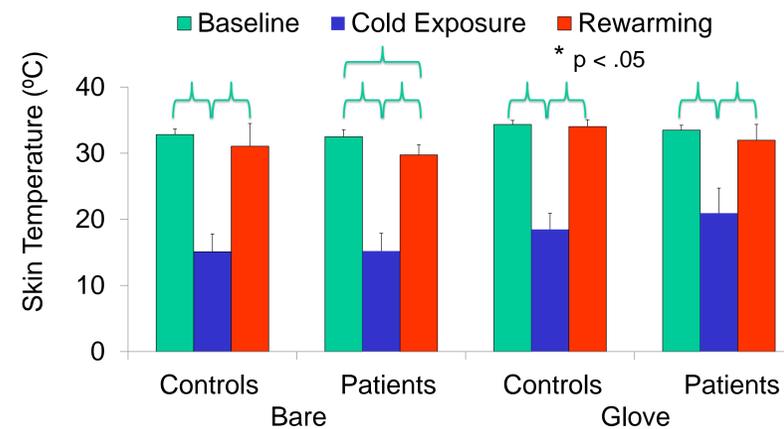
Subjects:
 Patients with hand fractures (n = 3)
 Mean age 34 ± 12yrs
 Controls (n = 3; age- and sex-matched controls)

Injuries included hand fractures:
 distal phalanx (n = 2)
 middle phalanx (n = 3)

Results

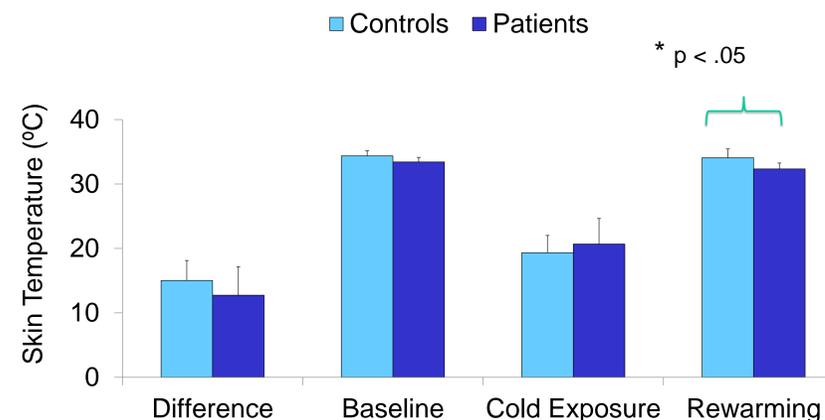
Evaluation of Skin Temperature at Baseline, Cold Exposure & Rewarming

Skin temperatures in patients and controls (both hands) changed significantly ($p < .0001$) from baseline ($32.2 \pm 2.5^\circ\text{C}$) to cold exposure ($17.9 \pm 4.5^\circ\text{C}$) and rewarming ($31.2 \pm 3.3^\circ\text{C}$) in all groups. In patients with bare hands, rewarming temperatures were significantly lower compared to baseline.



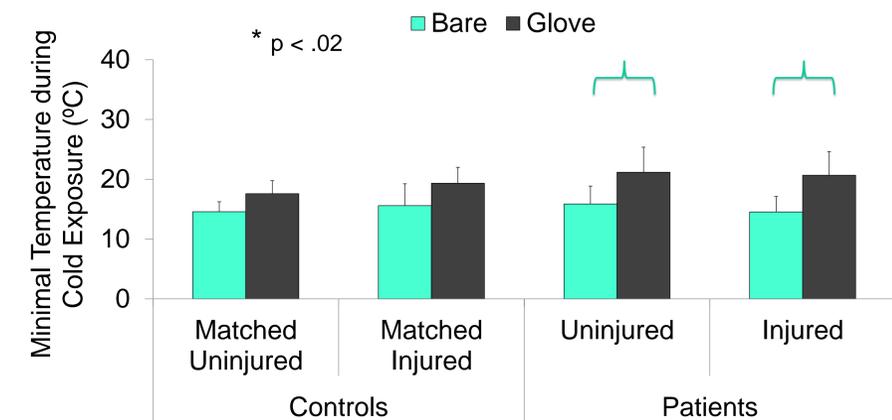
Comparison of Patient Injured Digits vs. Control Matched Digits with Glove Warming Condition

With the glove warming, the rewarming skin temperatures of the patients' injured digits were significantly lower compared to matched control digits. There were no statistical differences at baseline, cold exposure or difference between baseline and cold exposure in this small study sample.



Comparison of Cold Exposure Temperatures with Bare Hand and Glove Warming Conditions

Using fingerless gloves for warming, patients had significant increases in skin temperature at baseline and the lowest temperature during cold exposure. There were no statistically significant differences between patients and control subjects.



Conclusion

Our preliminary data indicated variability in the cold air responses following hand fractures with the greatest temperature changes observed in distal phalanx fractures. In patients with hand fractures, rewarming was compromised following cold exposure and gloves provided improved return of skin temperatures in the rewarming period. These results indicate that cold air exposure with continuous temperature monitoring may identify subtle physiologic changes associated with cold sensitivity. Future study is needed to evaluate skin temperature changes in a larger sample of patients and the relationship to self-report in cold sensitivity following hand trauma.

Disclosures

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Hand & Upper Extremity Program

