Beyond the Numbers: Visualizing Temperature Gradients in Wounds

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Introduction

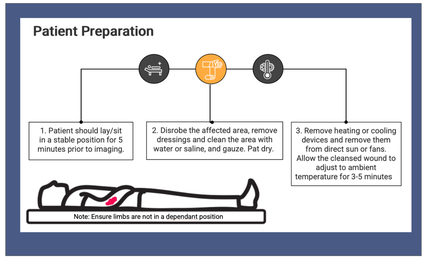
Infrared Thermography (IRT) offers a number of advantages to palpation of single point temperature measurement (thermometry) such as:

- **Enhanced assessment capabilities**: IRG provides non-invasive methods to visualize thermal gradients in skin and wound assessment, providing more detailed information than traditional thermometry by capturing thousands of temperature points within a single image.
- **Greater Area of Comparison:** Thermometry provides a single point of measurement, or is used to measure the difference between two individual sites, which provides less information that IRT and is more at risk of error due to sampling techniques.
- **Visual Pattern Recognition**: IRT enables visualization of temperature providing richer information about changes in the underlying tissues (e.g., inflammation, potential infection, lack of circulation).

Objective

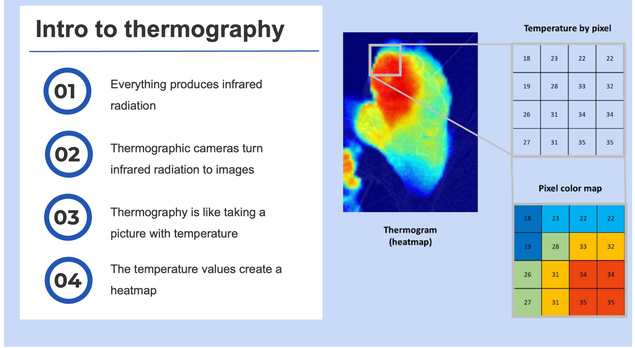
- To review approaches to visual inspection of thermography images highlighting patterns learned to screen IRT images using a series of clinical case studies.

Methodology



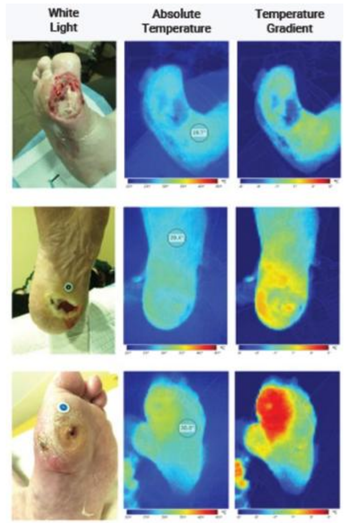
Images were collected with the Swift Ray 1 (Swift Medical Inc., Toronto, Canada) during a clinical trial approved by Pearl IRB (#2022.576).

Patients consented to the use of there images and data for the research study and educational use.



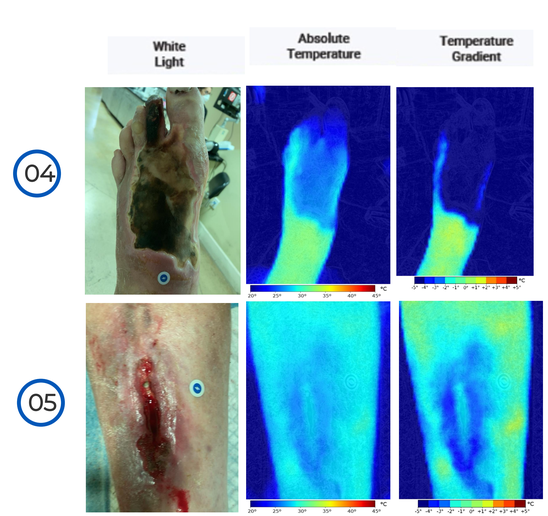
Results

Inflammation



- **Case 1: Non inflamed wound**. Wound bed cooler than surrounding healthy tissues & even temperature within and around the wound bed.
- **Case 2: Inflamed wound.** Wound bed warmer than surrounding healthy tissue & increased asymmetrical temperatures in the periwound area.
- **Case 3: High inflammation/suspected infection.** Wound significantly warmer than surrounding healthy tissue & periwound area shows signs of high temperature increase.

Perfusion



- **Case 4: Poor Perfusion**. Visible ischemia leading of the foot and 2nd digit & significantly lower temperature across the 1st ,2nd ,3rd and 4th digits.
- **Case 5: Normal Finding.** Wound bed appears cooler than periwound area. Even temperature distribution around the periwound area.

Clinical Challenge

Review the wounds below to visually assess. Which wounds are you most concerned about? Scan the QR Code Below to See the thermal images and practice reviewing IRT.

Discussion

IRT is a promising tool in wound care that provides detailed thermal gradients that can guide clinical decision-making beyond palpation or thermometry. IRT can assist clinicians in detecting subtle changes in wound status, that may signal inflammation, infection, or lack of perfusion allowing earlier intervention. However, IRT in wound care remains underutilized due to the need for standardized protocols, comprehensive education, and integration with clinical workflows and electronic documentation.

Future research should gather more data across wound types (e.g., diabetic foot ulcer, venous leg ulcers, pressure injuries). This data can help refine interpretation of thermal patterns for wound healing, and allow computer-vision automation to assist clinicians.

References

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