

An observational study on debridement treatment for chronic wounds using a novel hyperspectral imaging device

Dr. Perry Mayer³, MD, Amy Lorincz¹, MSc, Robert D. J. Fraser^{1,2}, MN RN, Dr. Jose L. Ramirez Garcia Luna¹, MD, PhD

¹Swift Medical, Toronto, Canada, ²Arthur Labatt Family Faculty of Nursing, Western University, Canada, ³The Mayer Institute, Hamilton, Canada



Introduction

Objective

Acquire hyperspectral images (HSI) of chronic wound tissue before and after the debridement of chronic wounds to gain greater insight into what is being removed during the procedure.

Background

- Chronic wounds are highly prevalent and can significantly diminish the quality of life of patients and impose a financial burden on both patients and the health care system
- To stimulate the healing process in chronic wounds, debridement is a common treatment which includes the removal of necrotic tissue, foreign debris, bacterial growth, wound bed tissue, or callus from wounds
- Debridement treatment requires considerable expertise to differentiate healthy from unhealthy tissue
- HSI has the potential to discriminate between healthy and unhealthy tissue types to guide debridement
- Debridement elicits an inflammatory reaction in tissues to advance the healing process
- Photographic imaging of wounds in the visible light spectrum is considered the standard of care as it not only allows registration of the evolution of the wound, but also has demonstrated to improve the patient's perception of the injury and enhances adherence to treatment
- Digital Infrared Thermography (IRT) produces a temperature map of the photographed surface
- IRT imaging allows monitoring of skin surface temperature distribution in a non-invasive and non-contact manner and is used to detect inflammation and perfusion in the human body
- Several molecules in the human body exhibit autofluorescence, this phenomenon is used in clinic to identify bacterial contamination or infection of wounds
- Detection of bacterial contamination or infection through fluorescence imaging is emerging as a novel point-of-care imaging modality to assess wound healing and their complications
- Swift Medical's wound monitoring technology provides an automated, non-contact method for measurement of wound size, temperature, and bacterial presence using the everyday smartphone and an attached pocket-sized device

Methodologies

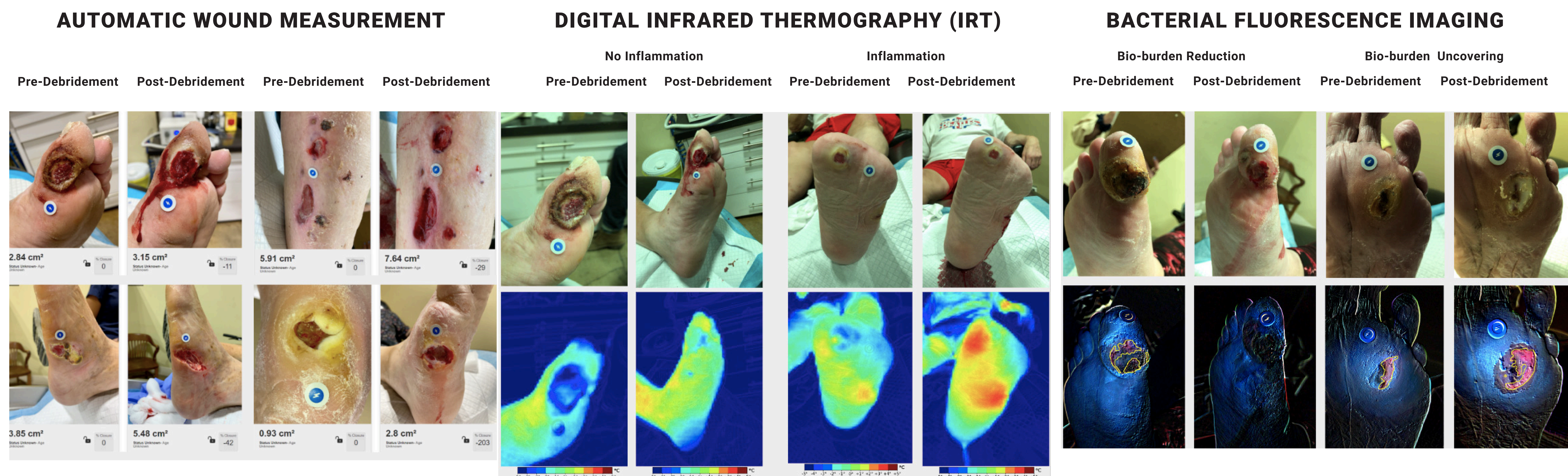
- HSI images were collected from 30 patients with chronic wounds larger than 1cm² that required debridement treatment. The clinician performing the procedure was blinded to the HSI imaging
- Images were acquired before and after debridement treatment
- The ensuing dataset of images was analyzed to determine the types of tissues that are being removed during the debridement process
- Healthcare professionals were asked to obtain:**
 - Images of the patient's wound using the Swift Skin and Wound (SSW) app (Swift Medical, Canada) installed on a smartphone
 - HSI images of the patient's wound using the Swift Ray 1 (Swift Medical, Canada) paired to a smartphone (static condition)
- Images of the patient's wound were captured during three steps of debridement treatment for each patient:**
 - Image wound before treatment
 - Image wound after cleaning or non-surgical debridement treatment
 - Image wound after surgical debridement treatment (if applicable)

Automatic wound measurement, thermal imaging, and bacterial fluorescence imaging are all acquired using the pocket-sized Swift Ray 1 attached to a smartphone seen on the left



Results

The Swift Skin and Wound (SSW) and Ray 1 device were used to acquire images before and after debridement treatment to observe change in patients with chronic wounds.



- Debridement results in a larger wound (+0.84 cm² or +17.5%)
- Wound size increments ranged from +10 to +200%
- Debridement creates inflammatory reaction in most patients
- Removal of the callus leads to removal of "coldspots"
- Debridement reduces bacterial bio-burden
- But most often, it uncovers deep pockets of bacteria

SWIFT

Discussion

- From this initial data collection, we have observed that debridement increases the size of wounds initially by removing unhealthy tissue, creates an inflammatory response in healthy tissue, and helps assess changes in bacterial bio-burden
- Future research includes the assessment of:**
 - percentage of the wound bed removed during debridement
 - percentage area containing bacterial load that represented the total wound bed
 - percentage of cold spot tissues removed
 - percentage of hypoxic tissues removed
 - tissue types pre- and post-debridement
- Leveraging industry-best technology, contact-less thermal, bacterial, and wound measurements can be made, thereby providing more information to clinicians to guide debridement decisions
- In summary, HSI can be a useful tool to improve debridement decisions for clinicians by adding additional information regarding inflammation and bio-burden that is not visible to the naked eye

References

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