The Impact of Mobile Wound Monitoring - The Power of NIRS Imaging Technology: Case Series

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Objective

Explore the utility of mobile multispectral near-infrared spectroscopy (NIRS) imaging in understanding the factors contributing to the healing potential of various wound types.

Introduction

In recent years, the rising populations in rural and outlying areas have faced challenges in accessing to healthcare 1. This is especially true for patients dealing with chronic or hard-to-heal wounds. We understand that there are many underlying physiological factors which may impact the ability of a patient to heal, including the perfusion of the tissues in and around the wound. Many of our patients are unable to access in-hospital and outpatient diagnostics that support the use of advanced modalities to aggressively treat these challenging wounds. This study explores how mobile NIRS and thermal imaging technology can potentially transform evidence-based wound care. By utilizing data easily obtained with NIRS imaging we aim to develop and guide treatment plans which may result in improved patient outcomes, cost savings through more efficient resource allocation and improved workflow.

Methods

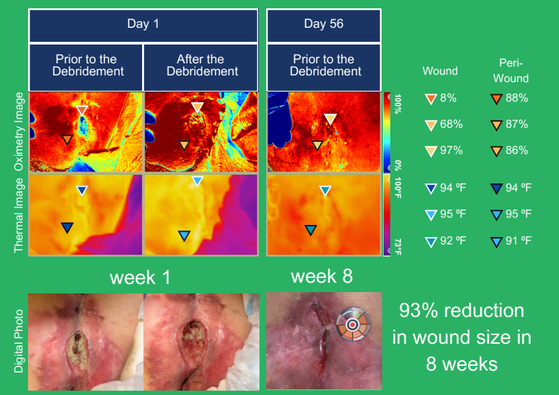
Employing an FDA 510(k) cleared handheld mobile NIRS and IR thermal imaging device (MIMOSA Pro, MIMOSA Diagnostics Inc., Toronto, Canada), this study is presenting four cases to exemplify the added value of NIRS imaging in documenting improvements and evaluating the clinical significance of interventions. The cases presented here involve patients facing "limited access to care," encompassing those residing in rural and outlier areas, as well as individuals dealing with transportation or other logistical barriers hindering access to other forms of diagnostic and therapeutic interventions.

Discussion

For mobile wound care providers, having access to meaningful diagnostic data in a practical, timely and efficient manner can greatly impact our ability to provide the right care to the right patient at the right time. The ability to use a pocket-sized device to capture tissue oxygenation can be a very useful tool in the treatment of a wide variety of patients with different wound etiologies. The immediate feedback provided by the NIRS imaging allows us to quickly assess the healing potential of our patients, the efficacy of our interventions and supports the use of advanced treatment modalities to maximize patient outcomes. The use of NIRS imaging in the mobile setting could be valuable tool as we strive to develop data-driven methodologies and protocols to address the ever-growing population of patients with chronic or hard-to-heal wounds.

RESULTS

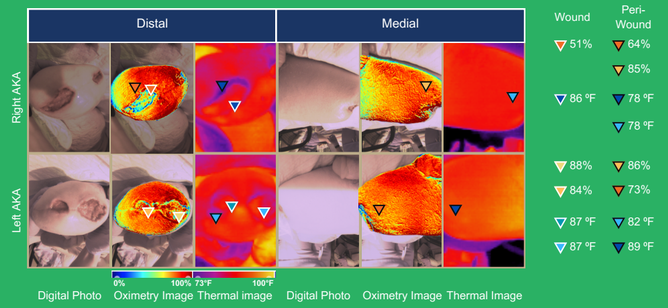
Case 1: After returning home from a hospitalization due to a mechanical fall, the 96-year-old female diagnosed with a stage 3 sacral pressure injury (PI) of unknown duration was referred to mobile wound care services. Following conservative sharp debridement performed at the bedside, information from a handheld NIRS imaging indicates excellent perfusion to both the wound bed and the surrounding tissue.



93% reduction in wound size in 8 weeks

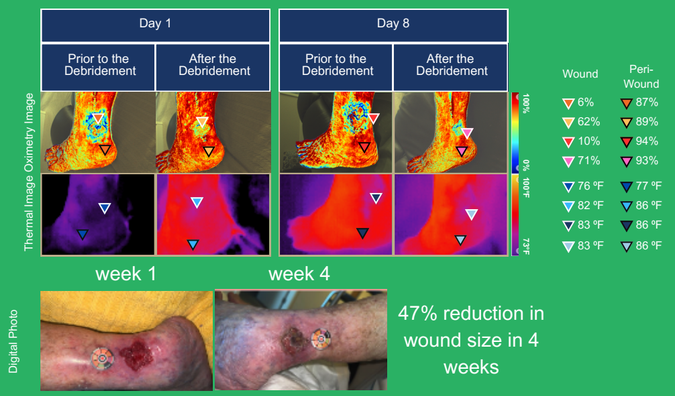
NIRS imaging real-time feedback offers valuable insight to the wound care provider regarding the efficacy of the debridement and underscores the healing capacity of the wound, supporting the use of advanced treatment modalities.

Case 2: A 60-year-old tetraplegic male underwent bilateral above-the-knee amputation (AKA) due to severe PAD, with failed attempts to revascularize. He suffers from severe bilateral iliac disease, raising concerns about healing potential in the areas of surgical dehiscence which developed in the distal remaining limbs. This patient lives in a rural area and has additional sacral PIs which limit his ability to travel to obtain more standard diagnostic studies such as a CT angiography to assess his peripheral circulation.



NIRS imaging is able to show us that this patient has adequate perfusion to the tissue in and around the wounds to support aggressive treatment with continued sharp debridement to address the senescent areas of the wound base and margins as well as the initiation of advanced modalities such as allografting to facilitate healing.

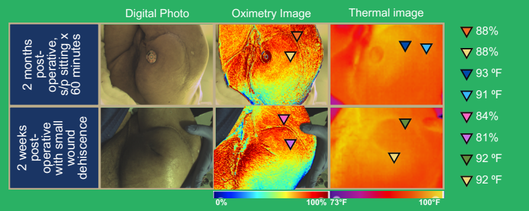
Case 3: 90-year-old female with severe PAD and a history of an open ulcer on the left lateral ankle persisting for over a year. The ABI of the left lower extremity (LLE) measures 0.2, indicating significant arterial insufficiency. Considering the pronounced stenosis and occlusion in the vessels of the LLE, particularly the posterior tibial artery (PTA), it would not typically be advisable to take an aggressive approach to wound healing.



47% reduction in wound size in 4 weeks

With the use of the NIRS imaging we can see that the collateralization that has happened in the LLE is providing the wound and surrounding tissue with enough perfusion to support conservative sharp debridement as well as other advanced treatment modalities.

Case 4: 44-year-old tetraplegic male, previously with a stage 4 PI to the left ischium, underwent multiple unsuccessful rotational flap reconstructions over the past two years. In January 2024, the patient underwent a third flap reconstruction attempt. Despite a minor superficial wound dehiscence following initial dressing removal, which resolved over approximately six weeks, the patient's recovery progressed.



During the early stages of rehabilitation, NIRS imaging was instrumental in monitoring the perfusion of the muscle flap and the area affected by wound dehiscence. Subsequent to wound closure, as the patient initiated a gradual seating protocol, the NIRS device continued to demonstrate adequate perfusion of the flap, even after the patient remained seated in an upright position for 60 minutes. This crucial information enabled the healthcare team to extend the patient's sitting duration without concerns regarding tissue ischemia and potential recurrence of the wound.

Bibliography

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