

# Use of Mobile Multispectral Near-Infrared Imaging to Quantify Healing in Hard-to-Heal Diabetic Foot Ulcers: A Case Series

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## Introduction

Diabetic foot ulcers (DFUs) stand as a leading cause of hospitalizations, amputations, and diminished quality of life among individuals with diabetes. Additionally, they significantly contribute to the financial burden on healthcare systems (Armstrong et al., 2020). The primary goal in managing DFUs is to avert severe complications (Chen et al., 2023). Various treatment approaches are employed to expedite DFU healing, including hyperbaric oxygen therapy (HBOT), which has demonstrated effectiveness in addressing non-healing wounds. Nonetheless, there exists variability in its application and resulting outcomes. Debridement, another common practice, is regularly employed to hasten the healing process.

### **Methods**

Utilizing a handheld near-infrared spectroscopy (NIRS) and thermal imaging device (MIMOSA Pro, MIMOSA Diagnostics Inc., Toronto, Canada), this study assessed integration of tissue oxygenation levels and skin surface temperature measurements into the DFU management workflow.

**Patient 1** - a 72-year-old female with a chronic Wagner Grade 1 DFU persisting since March 12th, 2024. In addition to standard wound care, treatments have involved packing tape application and debridement procedures. The patient is on a healing trajectory with a 20% reduction in wound area observed since the initiation of imaging.



NIRS imaging real-time feedback offers valuable insight to the wound care provider regarding the efficacy of the HBOT treatment supporting the use of advanced treatment

Patient 2 - a 47-year-old m	ale with a chronic Wagner (	Grade 1 C	iabetic press
Visit 1   Day 1		2023. In addition to	
Pre- Debridement	Post- Debridement	wound involved	care, treatme d total contac
		(TCC) and det procedures. The pat a healing trajectory reduction in wou observed over two w	
		Tissue Oximetry 0% 100%	√ 15% √ 6 √ 72% √ 9 √ 0% √ 6
		Thermal 73°F 100°F	, 92 ºF , 9 , 95 ºF , 9

NIRS imaging offers valuable insight to the wound care provider regarding the efficacy of the debridement and underscores the healing capacity of the wound.

# **Discussion & Conclusion**

This study explores the incorporation of mobile NIRS imaging as an advanced technique for assessing the healing progress of hard-to-heal DFUs. The imaging device used in this study has shown the ability to produce immediate images, offering valuable insights into tissue perfusion and temperature. This DFU management advancement not only facilitates a comprehensive understanding of wound healing trajectory but also offers real-time feedback to guide immediate interventions, track and document medical necessity, and therapeutic efficacy.

Armstrong, David G., Mark A. Swerdlow, Alexandria A. Armstrong, Michael S. Conte, William V. Padula, and Sicco A. Bus. 2020. "Five Year Mortality and Direct Costs of Care for People with Diabetic Foot Complications Are Comparable to Cancer." Journal of Foot and Ankle Research 13 (1): 16. Chen, Pam, Nalini Campillo Vilorio, Ketan Dhatariya, William Jeffcoate, Ralf Lobmann, Caroline McIntosh, Alberto Piaggesi, et al. 2023. "Guidelines on Interventions to Enhance Healing of Foot Ulcers in People with Diabetes/metabolism Research and Reviews, May, e3644. A special thanks to Anna Khimchenko, PhD, MBA for assisting with this

• HBOT: helps to document therapeutic efficacy, aids in patient compliance by demonstrating improvements to tissue health following each set of dives.

• Debridement: helps to focus on wound bed preparation and guide how much tissue to debride.



NIRS imaging offers valuable insight to the wound care provider regarding the efficacy of the treatment supporting the use of advanced treatment, such as skin substitutes.

