Use of Mobile Multispectral Near-Infrared Imaging to Evaluate Efficacy of Hyperbaric Oxygen Therapy for Treatment of Diabetic Foot Ulcers: A Case Series

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Introduction

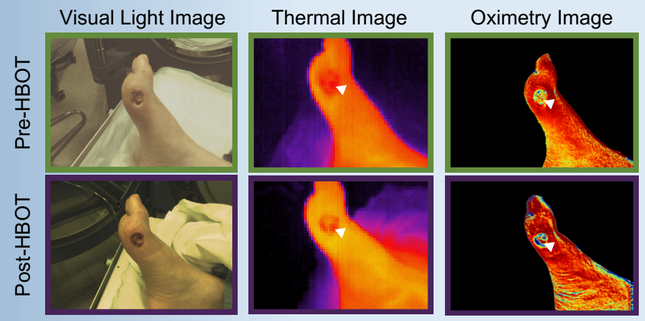
Hard-to-heal wounds often exhibit reduced tissue oxygen levels (Jain et al. 2006). Hyperbaric Oxygen Therapy (HBOT) has demonstrated the ability to enhance oxygen supply to such wounds, promoting healing. Transcutaneous Oximetry (TcPO2) has been employed for patient selection and monitoring treatment response during HBOT (Kaur et al. 2012; Bowen, Treadwell, and Goodwin 2016). However, TcPO2 has limitations, including variability in healthy individuals, sensitivity to positioning, and patient discomfort. This study explores the use of mobile multispectral near-infrared spectroscopy (NIRS) imaging to improve the assessment of HBOT efficacy in healing of diabetic foot ulcers (DFU).

Methods

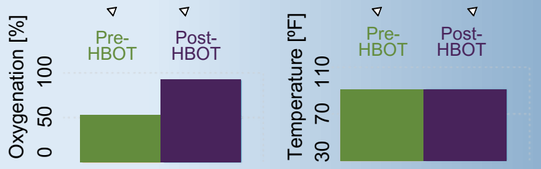
This study observed individuals in an outpatient setting who underwent Hyperbaric Oxygen Therapy (HBOT) for a DFU. An FDA 510(k) cleared hand-held mobile multispectral near infrared imaging device (MIMOSA Pro, Mimosa Diagnostics Inc., Toronto, Canada) was used to measure temperature and tissue oximetry. Prior to HBOT, multispectral near infrared images were collected. Once imaged, the individual then received HBO treatment. After treatment, the individual's DFU was imaged again. Differences in tissue oximetry and temperature measurements between the images were measured to detect change.

Results

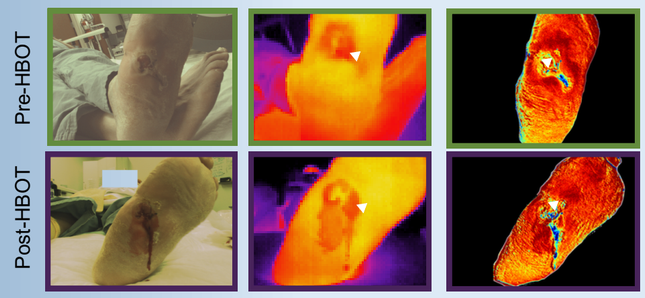
The case series illustrates a significant enhancement in tissue oxygenation after HBOT, identifying patients with a potential to benefit from HBOT. Utilizing mobile multispectral NIRS imaging, particularly in diabetic foot ulcer cases, provides a powerful tool for showcasing therapeutic efficacy.



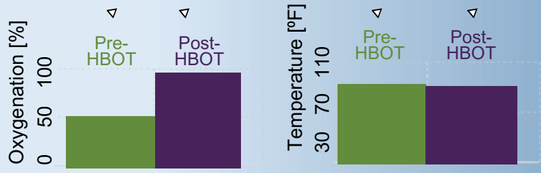
Patient 1 - a 76-year-old male with a chronic non pressure DFU persisting since November 7th, 2023.In addition to standard wound care, treatments have involved application of skin substitutes and HBOT.



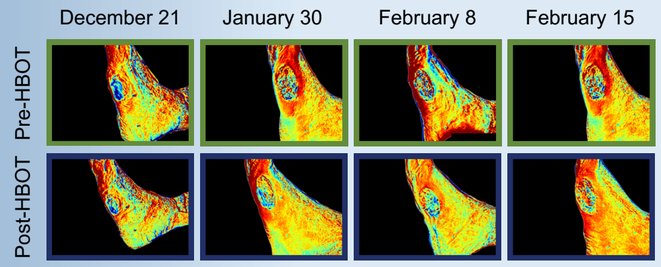
Oxygenation in the wound increased by 50% and in the peri-wound by 13% following HBOT. The patient is responding well to the treatment and is on the healing trajectory.



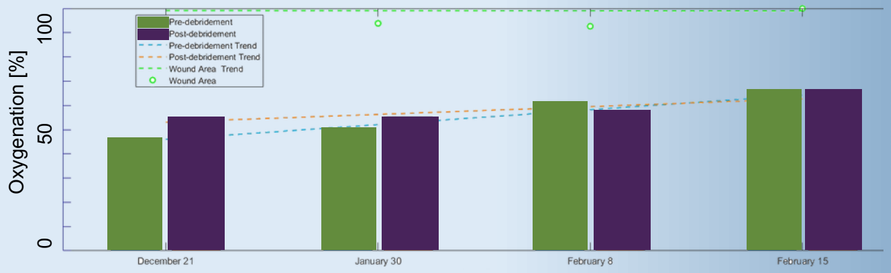
Patient 2 - a 69-year-old male with a chronic DFU (Wagner Grade 3) persisting since August 3rd, 2023. In addition to standard wound care, treatments have involved HBOT, total contact casting (TCC) and debridement.



Oxygenation in the wound increased by 44% following HBOT. The patient is responding well to the treatment and is on the healing trajectory.



Patient 3 - a 81-year-old male with a chronic non pressure DFU persisting since December 5th, 2023. In addition to standard wound care, treatments have involved Endoform, Hydrofera Blue, Gauze dressing and HBOT.



Oxygenation in the wound area was increasing following HBOT. The patient is responding well to the treatment and is on the healing trajectory.

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Discussion

The findings underscore the versatility of mobile multispectral NIRS imaging in patient qualification for HBOT, documentation of therapeutic efficacy, and active patient engagement throughout their treatment journey. Mobile multispectral NIRS imaging emerges as a promising tool to refine and optimize HBOT programs, streamline clinical decision-making, enhance patient engagement, and contribute to the comprehensive documentation of therapeutic efficacy.

References

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