Measurement of Tissue Oxygenation and Temperature in Chronic Wounds Treated with Cyclical Pressurized Topical Oxygen Therapy

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Objective

To assess healing of wounds treated with Cyclical pressurized topical oxygen therapy (CPTOT)* using a novel multispectral near-infrared spectroscopy (NIRS) imaging device. Topical oxygen therapy has been shown to increase tissue oxygenation and sustain it over time, resulting in reduced infection, improved angiogenesis, and the formation of higher tensile strength collagen during wound healing. 1–3 Cyclical pressurized topical oxygen therapy (CPTOT) combines high concentration oxygen delivery with therapeutic level cyclical compression, which reduces edema, improves wound bed perfusion, and allows more efficient oxygen diffusion, nutrient exchange, and removal of inflammatory factors.

Methods

This retrospective case series included subjects with chronic ulcers who underwent treatment with CPTOT and evaluation with multispectral NIRS. A point-of-care multispectral NIRS imaging device** was used to measure tissue oxygenation (StO_2) and temperature. CPTOT was self-administered by the patients in their own homes.

Case 1 involves a 55-year-old male smoker, with a left lateral diabetic foot ulcer, present for 3 months.

Case 2 involves a 76-year-old female with a right, medial ankle, late effect radiation wound, complicated by lupus and chronic venous insufficiency, present for 5 years.

She had been receiving CPTOT for one year prior to the imaging shown in Figures 2a-2c., and her wound volume had decreased by 95% during that time. Her wound at the start of CPTOT treatment is shown in Figure 2a. NIRS imaging depicts the final 12 weeks of healing.

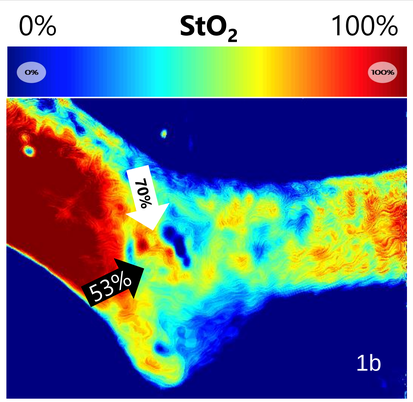
Results

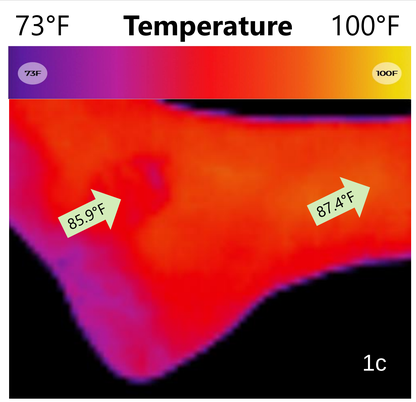
NIRS data provided objective measures of increases in StO_2, allowing for quantitative assessment of oxygen delivery to the tissue.

References

1. Gordillo GM, Sen CK. Evidence-Based Recommendations for the Use of Topical Oxygen Therapy in the Treatment of Lower Extremity Wounds. doi:10.1177/153473460933514 9
2. Gordillo GM, Roy S, Khanna S, et al. Topical oxygen therapy induces vascular endothelial growth factor expression and improves closure of clinically presented chronic wounds. doi:10.1111/j.1440-1681.2008.04934.x
3. Fries RB, Wallace WA, Roy S, et al. Dermal excisional wound healing in pigs following treatment with topically applied pure oxygen. doi:10.1016/J.MRFMMM.2005.02.023

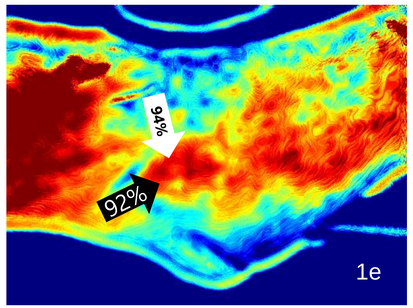
*TWO2, AOTI, Inc., Oceanside, CA
**MIMOSA Pro; MIMOSA Diagnostics, Inc., Toronto, ON
Poster assistance by Melodie Blakely, DPT, MS, CWS, Dir. Market Access, Value and RWE, AOTI Inc.

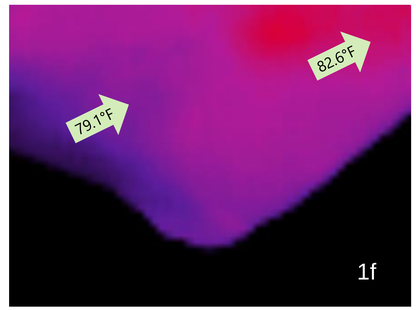




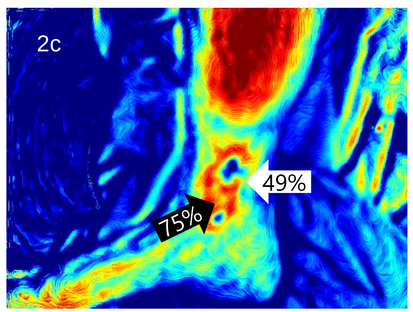
Figures 1a-1c: Start of CPTOT and NIRS imaging.
Figure 1c: No increase in temperature within wound compared to control site.

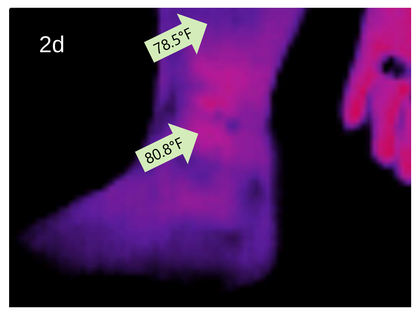
Note: Reviewing the visual images of wound bed oxygenation with the patient convinced him to try to stop smoking.



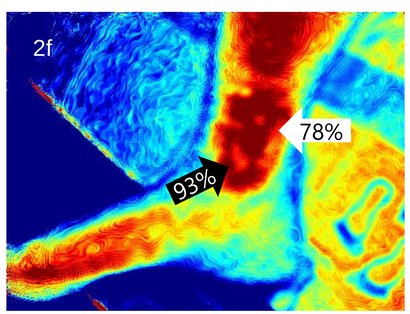


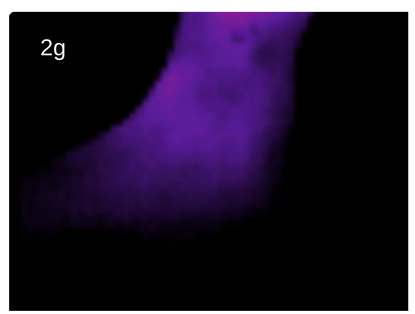
Figures 1d-1f: Week 5.
Figure 1d: Wound closed.
Figure 1e:
Black arrow - 39% increase in StO_2
White arrow - 24% increase in StO_2
(tissue oxygenation within wound bed)
Figure 1f: No increase in temperature within wound compared to control site.





Figures 2b-2d: Start of NIRS imaging
Figure 2d: Thermal image shows 2.3°F (1.3°C) increase in wound bed compared to control site. Possible sign of inflammation.





Figures 2e-2g: Week 12 of NIRS imaging
Figure 2e: Wound closed.
Figure 2f:
Black arrow - 18% increase in StO_2.
White arrow - 29% increase in StO_2
Figure 2g: Thermal imaging of wound bed is cut-off.