Assessing Tissue Perfusion Using Near Infrared Spectroscopy Following Pulsed Electromagnetic Field Therapy
Erica E. Tassone¹, Nicole L. Jacobsen¹, Meredith R. Smith¹, Jonathan A. Niezgoda², Sandeep Gopalakrishnan², Jeffrey A. Niezgoda²
¹Regenesis, Scottsdale, AZ; ²Kent Imaging, Calgary, Canada

**Background**

Near-infrared spectroscopy (NIRS) has been used both to evaluate tissue oxygen saturation (S\(_{\text{O}_2}\)) and as a putative method for assessing perfusion in superficial tissue. Near-infrared light penetrates ~2-3 mm into the skin and is differentially absorbed by oxygenated (HbO\(_2\)) and deoxygenated hemoglobin (Hb) in blood. Pulsed electromagnetic field (PEMF) therapy is a non-invasive therapy approved to treat pain\(^4\), inflammation, and edema. PEMF therapy is hypothesized to induce vasodilation and enhance tissue perfusion.

**Experimental Design**

Patients underwent 30 minutes of PEMF therapy to one lower extremity. Limbs were imaged with the SnapshotNIR camera (Kent Imaging, Calgary, Canada) to measure S\(_{\text{O}_2}\) before and immediately after PEMF treatment, then at defined timepoints.

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<th>PEMF treatment</th>
<th>Time (minutes)</th>
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**Diseased Patients**

**Case 1**: 36-year-old male with history of venous insufficiency and lower extremity leg ulcers. Images show a significant increase in S\(_{\text{O}_2}\) following a single 30 min PEMF treatment. The improvement in S\(_{\text{O}_2}\) persists for 120 min post therapy. * ulcer as landmark for comparison.

**Case 2**: 60-year-old female with history of Reynaud's Disease received a single 30 min PEMF treatment. Images show a significant increase in S\(_{\text{O}_2}\) that persists for 45 min post therapy.

**Healthy Patient**

**Case 3**: Healthy 21-year-old female shows slight augmentation in S\(_{\text{O}_2}\) following a 30 min PEMF treatment. The S\(_{\text{O}_2}\) increase subsides within 15 min of the end of treatment.

**Conclusions**

- NIRS is a novel imaging technique that allows for immediate, non-invasive assessment of tissue oxygenation and perfusion.
- Immediately following PEMF therapy, S\(_{\text{O}_2}\) and perfusion were enhanced in the lower extremities of healthy and diseased patients.
- Sustained increases in S\(_{\text{O}_2}\) were observed for up to 120 min after PEMF treatment in a patient with preexisting vascular deficits.
- S\(_{\text{O}_2}\) returned to baseline values within 15 minutes of PEMF treatment in a healthy patient.
- PEMF therapy is a promising therapeutic strategy for increasing perfusion.
- There is potential to explore the use of PEMF therapy for treatment of diabetic peripheral neuropathy and chronic wounds.

**Acknowledgements**

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1. Sordillo LA et al., J Biomedical Optics, 2014
3. Niezgoda JA et al., Advances in Skin and Wound Care, 2014.