Artery Research
Vol. **25**(**S1**); 2019, *p.* S167
DOI: https://doi.org/10.2991/artres.k.191224.152; ISSN 1872-9312; eISSN 1876-4401
https://www.atlantis-press.com/journals/artres

P126 Characterization of Skin Temperature Changes in Response to Photobiostimulation Using Thermal Imaging: A Thermo-Anatomical Correlation

Oshrit Hoffer[1], Neta Rabin[1], Lilach Gavish[2], Moshe Halak[3], Ortal Haim[1], Yuval Shayovitz[1], Simon Shkilevich[1], Benjamin Gavish[4], Yair Zimmer[1], Zehava Ovadia-Blechman[1,*]

[1]*Afeka Tel-Aviv Academic College of Engineering, Tel-Aviv, Israel*
[2]*Hebrew University of Jerusalem, Jerusalem, Israel*
[3]*Department of Vascular Surgery, Sheba Medical Center, Ramat-Gan, Israel*
[4]*Yazmonit Ltd., Jerusalem, Israel*

ABSTRACT

Background and Objective: Infrared Thermal Imaging (ITI) is a noninvasive method to measure skin temperature (ST). The latter is determined by the microcirculatory blood flow and ambient temperature. Photobiostimulation has been shown to increase blood flow. The objective was to characterize the spatial and temporal changes in ST, in response to photobiostimulation using ITI.

Methods: A randomized-controlled clinical study with 20 healthy subjects (30 ± 8 years old, 10:10 male:female). Subjects were irradiated with either red (630 nm, 55 mW/cm^2) or near-infrared (830 nm, 70 mW/cm^2) light-emitting diodes for 5 minutes [min] over the wrist area. Thermal images of the hands were captured every minute before, during, and 20 min after irradiation. The ST change from baseline (ΔST) of each of five anatomical regions (wrist, palm center, arch [surrounding vascular arches], proximal phalanx, distal phalanx) was measured. Subjects who responded to photobiostimulation (ΔST ≥ 0.5°C) were included in this analysis. Mean measurement changes were modeled by ΔST = A * (1−exp[−time/tau]), to which non-linear regression was applied with the adjustable parameters of amplitude(A) and characteristic rise time (tau).

Results: Photobiostimulation caused ST increase that initiated during irradiation, reached a plateau during follow-up, and fitted the model by $R > 0.9$ for all regions. Following the anatomical path of the blood supply, from the wrist to the distal phalanx, the ΔST amplitude(A) increased while tau decreased: Mean ± SE for wrist ⇒ center ⇒ arch ⇒ proximal phalanx ⇒ distal phalanx: A = 1.03 ± 0.08 ⇒ 1.7 ± 0.03 ⇒ 2.1 ± 0.03 ⇒ 3.0 ± 0.05 ⇒ 3.4 ± 0.05, and tau = 7.9 ± 1.7 ⇒ 6.2 ± 0.4 ⇒ 5.7 ± 0.3 ⇒ 5.6 ± 0.3 ⇒ 4.3 ± 0.3, respectively.

Conclusion: Using ITI, a thermo-anatomical association in response to photobiostimulation was established. Thermal imaging may be used for quantitative characterization of blood re-distribution in response to vasoactive interventions with potential for vascular diagnostics.

*Corresponding author. Email: zehava@afeka.ac.il