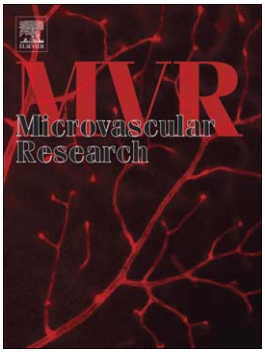

Regarding the quantification of peripheral microcirculation – comparing responses evoked in the in vivo human lower limb by postural changes, suprasystolic occlusion and oxygen breathing

Henrique Silva, Hugo Ferreira, M[a]. Julia Bujan, Luis Monteiro Rodrigues

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Regarding the quantification of peripheral microcirculation – comparing responses evoked in the in vivo human lower limb by postural changes, suprasystolic occlusion and oxygen breathing

Henrique Silva[1,2*], Hugo Ferreira[3], Mª Julia Bujan[4] and Luis Monteiro Rodrigues[1,2]

[1]CBIOS – Universidade Lusófona's Research Center for Biosciences and Health Technologies, Lisboa, Portugal

[2]Pharmacol. Sc Depart – Universidade de Lisboa, Faculty of Pharmacy, Lisboa, Portugal

[3]IBEB - Biophysics and Biomedical Engineering Institute, Universidade de Lisboa Faculty of Sciences, Lisboa, Portugal

[4]Faculty of Medicine, Alcalá de Henares, Madrid, Spain

*Email: monteiro.rodrigues@ulusofona.pt

Abstract

Human skin is an interesting model to explore microcirculation, particularly if using noninvasive technologies such as LDF (Laser Doppler Flowmetry) and tc (transcutaneous) gasimetry and methods as near as possible from the normal physiological state. In this study, we combined those technologies with three classical approaches – leg raising from supine, suprasystolic occlusion (in the ankle), and normobaric oxygen breathing to explore distal peripheral circulation in the foot. These methods are often cited, but a comparative assessment has not been done. The goal of this study was to identify relevant flow related descriptors, method-related advantages and pitfalls, and eventually, to find the best experimental approach. Volunteers (both genders, 22.1 $\pm$ 3.7 y o) were subjected to these methods and variables registered during basal, challenge and stabilization phases. Descriptive and comparative statistics were obtained, adopting a 95% confidence level. All flow-related quantitative descriptors potentially useful for the analysis were identified and compared. As expected, male patients consistently showed higher LDF levels and transepidermal water loss (TEWL) and lower $tcpO_2$ values. However, lower results were recorded in the supine position, suggesting a postural dependence. Both leg raising and suprasystolic occlusion produced a hyperemic response after provocation, although different in magnitude, significantly reducing LDF and $tcpO_2$ during provocation. The oxygen breathing method provided the most patient-friendly protocol, consistently reducing LDF (potentially by the inhibition of production of local vasodilators). TEWL increased during the provocation phase in all protocols, although not significantly. Baseline $tcpO_2$ was found to correlate positively with the peak $tcpO_2$ during oxygen breathing and basal LDF with peak flow during leg raising and suprasystolic occlusion. No statistical correlation between TEWL and LDF could be demonstrated under the current experimental conditions. We conclude that although equally useful considering the purpose, these methods involve very different practicalities and do not provide the same information. Also noteworthy, LDF is a highly sensitive indicator that could be further explored to look deeper into blood flow regulating mechanisms.

Keywords: Microcirculation, LDF, $tcpO_2$, TEWL, hyperoxia