Non invasive Glucose Monitoring – Next steps in an approach to address perturbing effects in an IS based monitoring technique

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Numerous reports describe the use of non invasive glucose monitoring techniques mostly in an in-vitro setting or under controlled in-vivo conditions. Impedance spectroscopy (IS) is such a technique. Glucose level changes cause alterations in the electrolyte balance. The resulting changes in AC and DC conductivity can be analyzed using IS. However, additional external/physiological factors can effect the measurement as well and impact on the signals registered. In our previous works various potentially perturbing parameters have been investigated, such as blood flux (LDF), the impact of environmental/body temperature changes or the effect of different arm positions. These parameters were studied in groups with either a combination of patients with Diabetes type 1/2 (D) and/or healthy subjects (ND). Recently we reported on the effect of changing ambient temperature on skin thickness (ST) and microvascular blood flow in D and ND subjects. In both groups, ST and LDF significantly declined during decreasing room temperature (ST: ND -0.06±0.11 vs. D -0.09±0.13 mm; n.s.; LDF: ND -41±49 vs. D -46±51 AU; n.s.). In our most recent study the relation between perfusion characteristics and the impedance behaviour was investigated. Skin perfusion in the lower forearm was controlled using an arm cuff by applying various pressure levels. An IS based differential sensor was used to measure impedance of the skin and underlying tissue, which featured the ability to achieve different penetration of the electromagnetic fields (EMF) into the various tissue layers. It was found that the IS sensor part with smaller penetration depth has a reduced response to perfusion changes compared to the part with deeper penetration. This indicates that further quantitative and qualitative analysis of the interaction of EMF with specific layers will help in the characterisation of the biological system. This can help to further advance improvements in approaches for continuous glucose monitoring with sensitivities to perfusion changes.