

IMPROVEMENT OF ACCURACY IN NON-INVASIVE GLUCOSE MEASUREMENTS (NIGM) USING MID-INFRARED SPECTROSCOPY (MIRS) AND PHOTOACOUSTIC (PA) DETECTION

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Insufficient accuracy is a major limitation in current approaches to NIGM. MIRS offers the potential of a NIGM with improved accuracy as a result of inherently high physical and physiological specificity (1,2) of the method. In earlier experiments with PA detection in MIRS we were able to show that such a system is not significantly influenced by disturbances such as fluid loss, fluid loads, physical activity and age of the individual. We present data towards a system with similar accuracy as current invasive glucose measurement devices.

Methods

Introducing additional features to the measurement and the evaluation of the PA signals, we were able to improve the overall accuracy of the system. To prove the effect on the in-vivo measurement, we compared the glucose values predicted by the MIR PA system to values simultaneously measured with HemoCue® during an oral glucose load in subsequent tests with 5 individuals. Datasets were taken every 5 Min. The results were calculated using PLS cross-validation analysis for each test.

Results:

For the resulting 174 data sets we found a good correlation (r (pearson) = 0,92) and a MARD of 9 %. 91% of the points are in zone A of the error grid.

Conclusion:

The non-invasive MIRS-PA glucose sensor is work in progress. We have added refinements to the hardware and software to overcome the limitations of the system and improve its accuracy. Although the mathematical approach to the calculations using PLS requires further improvement, we believe that our system will be able to achieve an accuracy comparable to that of today's standard glucometers.

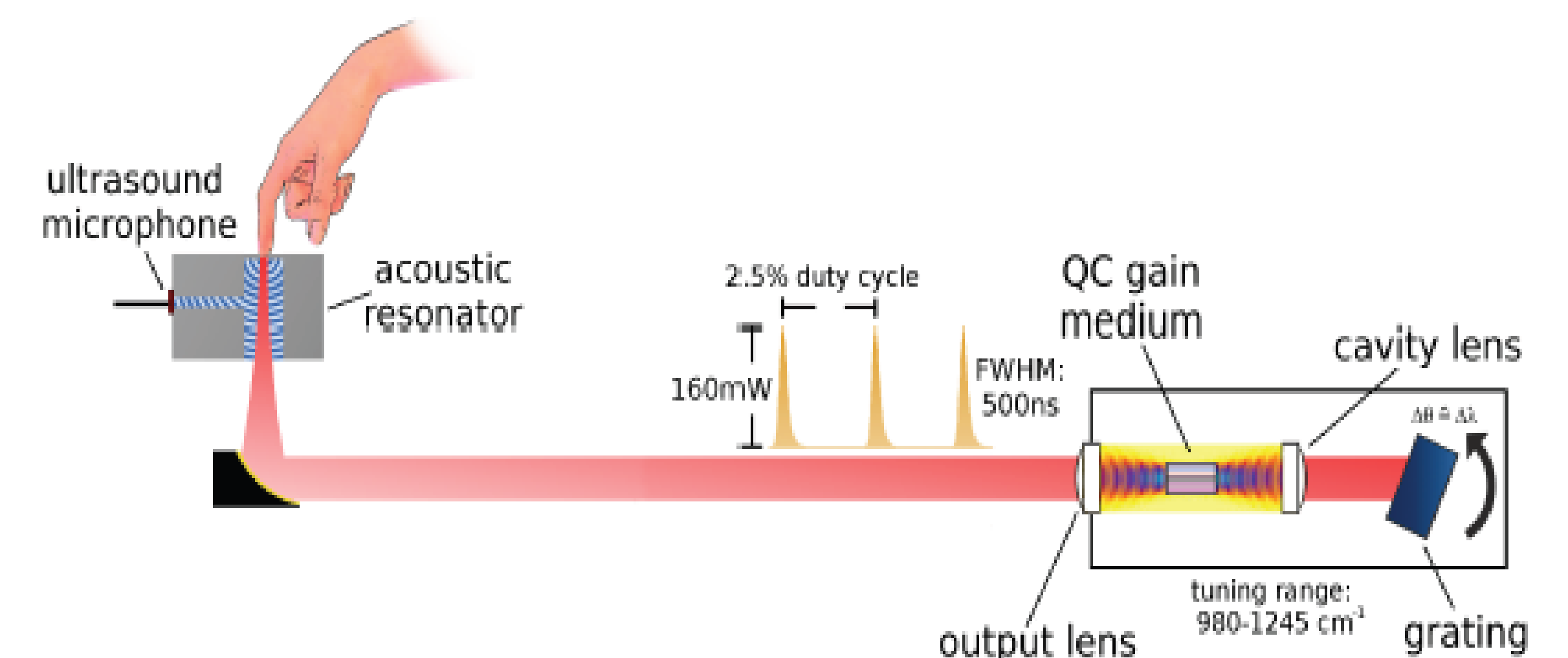


Fig 1: Schematic design of the measuring system

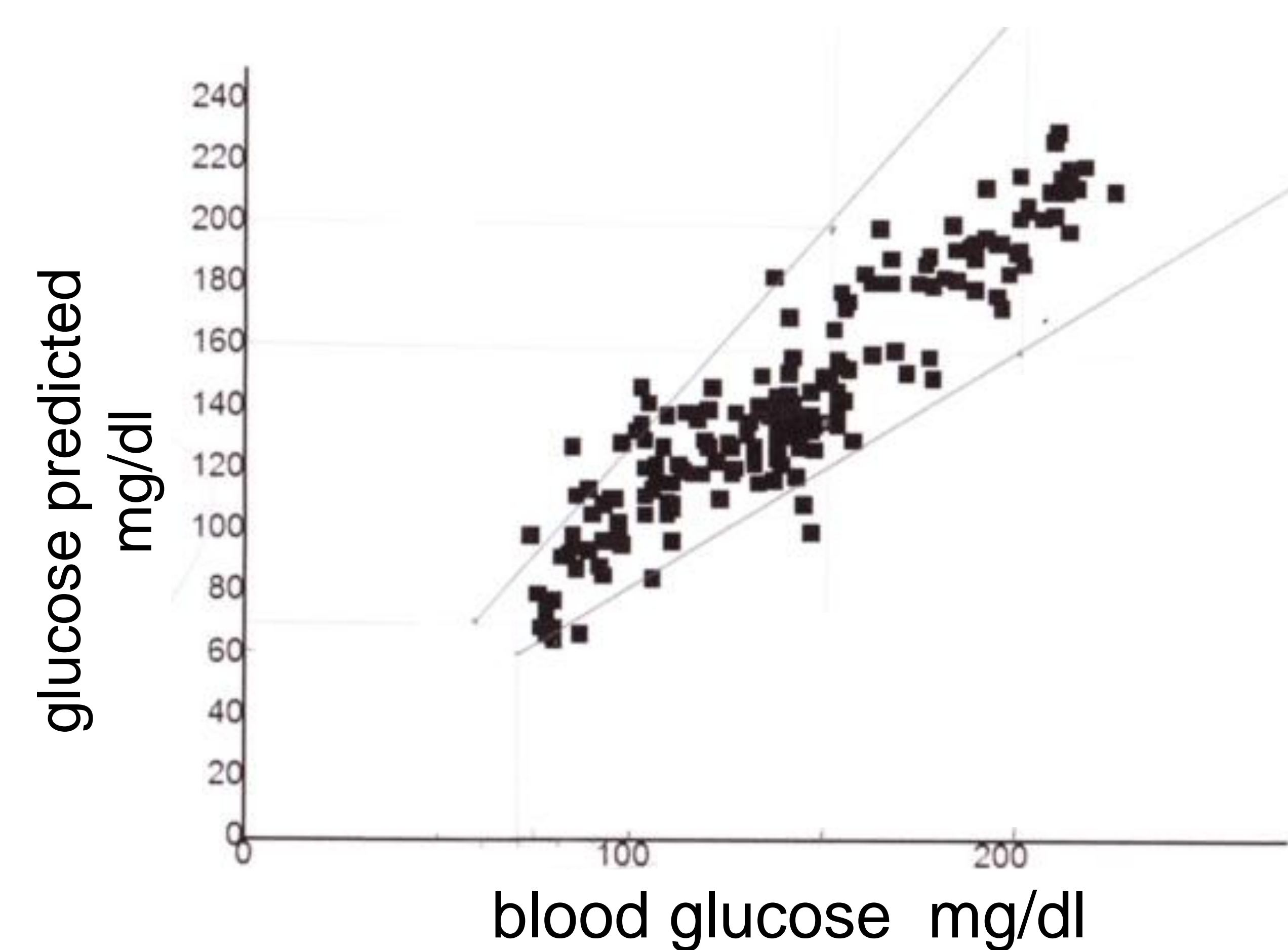


Fig. 2 : Correlation between blood glucose and MIRS-PA results based on PLS cross-validation

1. H.v.Lilienfeld-Toal, M.Weidenmüller, A.Xhelaj, W.Mäntele *Vibrational Spectroscopy* 3 (2005), 209-215 2. M.Pleitez, T.Lieblein, A.Bauer, O.Hertzberg, H.v.Lilienfeld-Toal, W.Mäntele *Analytical chemistry* 85 (2013), 1013-1020