

Testing a Multisensor Concept under Simulated Home Use Conditions for non invasive Glucose Monitoring

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Introduction: Numerous techniques for non invasive glucose monitoring (NIGM) are under development. Dielectric spectroscopy (DS) is a promising approach. However, a number of extrinsic and intrinsic factors can affect the measurements. In order to be able to compensate for such factors a novel multisensor concept, including sensors for broad band DS, optical, sweat/moisture, acceleration and temperature measurements has been developed.

Methods: Eight patients with diabetes mellitus (4 T1DM, age 43 ± 9 y; BMI 26.1 ± 2.9 kg/m², duration of diabetes 22 ± 14 y; HbA1c $7.4\pm 0.9\%$ and 4 T2DM patients, 66 ± 2 y; 30.6 ± 1.8 kg/m²; 10 ± 8 y; $6.9\pm 0.3\%$) performed up to four study days. Glucose was administered orally to induce a hyperglycaemic excursion (15 mmol/L). Euglycemia was re-established by s.c. insulin administration. In two of the four study days movements/perturbations were introduced within 10 minute movement blocks (cycling, walking, regular deskwork) randomly distributed through out the day.

In the other two study days in addition to the movement blocks and the oral glucose administration, patients drank 3 litres of water.

Results: For data evaluation a multiple regression analysis was performed to establish a global model including all subjects and a personal model for the individual patient including all study days. They allowed for investigating the effect of perturbations induced on the dielectric characteristics.

With the personal model glucose excursions could be tracked with an R² of 0.71 and an MARD of 17.9%, the global model yielded an R² of 0.6 and an MARD of 21.5% respectively.

Conclusions: These results indicate that under less controlled conditions NIGM can be achieved by a multisensor approach. A parameterisation strategy for the individual patient performs better than a global approach. No detectable effect was found for the water administration on the statistical outcome.