Clinical Accuracy of Non-Invasive Glucose Monitoring for Ex-Vivo Artificial Pancreas

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Diabetes is a serious worldwide epidemic that affects a growing portion of the population. While the most common method for testing blood glucose involves finger pricking, it is painful and inconvenient for patients. This study's purpose was to compare the glucose collected non-invasively from tears to capillary blood drawn from 10 diabetic and non-diabetic patients. Moreover, this study assessed the clinical accuracy of a non-invasive tear glucose monitoring system using a Clark's Error Grid Analysis (EGA), and tested if such a relationship is individualized or universal. Capillary blood, right, and left eye tear fluid were collected and analyzed by a glucometer circuit built by the researcher. Capillary blood was also analyzed by a commercial glucometer and used as the reference in the EGA. After producing linear regressions for predicting glucose values from the voltages, the clinical accuracy of the non-invasive system was determined to be universally acceptable. A Pearson correlation was also computed and showed a significant correlation ($p<0.001$) between the commercial glucometer values and the predicted glucose from left, as well as from right tear fluid. The results did support the original hypothesis; the clinical accuracy of the non-invasive tear glucose monitoring system is universal such as in a commercial glucometer. This significant result suggests that the coupling of a non-invasive glucose monitoring system, a system that detects the glucose in tears, along with an insulin pump is promising as an ex-vivo artificial pancreas treatment. By employing this ex-vivo artificial pancreas, many of the complications associated with frequent hyperglycemia and hypoglycemia events may be avoided, in addition to a higher quality of life.

Awards Won:

Fourth Award of $500