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ORIGINAL ARTICLES

Noninvasive Polarimetric-Based Glucose Monitoring: An *in Vivo* Study

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Abstract

Background:

Since 1990, there has been significant research devoted toward development of a noninvasive physiological glucose sensor. In this article, we report on the use of optical polarimetry for the noninvasive measurement of physiological glucose concentration in the anterior chamber of the eye of New Zealand white (NZW) rabbits.

Method:

Measurements were acquired using a custom-designed laser-based optical polarimetry system in a total of seven NZW rabbits anesthetized using an isoflurane-only anesthesia protocol. Aqueous humor-based polarimetric measurements were obtained by coupling light through the anterior chamber of the eye. Blood glucose levels were first stabilized and then altered with intravenous dextrose and insulin administration and measured every 3–5 min with a standard glucometer and intermittently with a YSI 2300 glucose analyzer. Acquired polarimetric glucose signals are calibrated to measured blood glucose concentration.

Results:

Based on a total of 41 data points, Clarke error grid analysis indicated 93% in zone A, 7% in zone B, and 0% in zones C and D, with reference concentrations between 93 and 521 mg/dl. Errors in prediction are shown to be related to gross movement of the rabbit during the procedures, incurring time-varying corneal birefringence effects that directly affect the measured polarimetric signal. These effects can be compensated for with appropriate design modifications.

Conclusions:

An optical polarimetry technique was used for *in vivo* physiological glucose monitoring. The technique demonstrated provides a basis for the development of a noninvasive polarimetric glucose monitor for home, personal, or hospital use.

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Abbreviations: (CEGA) Clarke error grid analysis, (NZW) New Zealand white

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