RAMAN-BASED NONINVASIVE CONTINUOUS GLUCOSE MONITORING (CGM)

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The importance of monitoring blood glucose cannot be overemphasized considering the increasing population of diabetics worldwide and the associated costs. However, the painful lancing process of obtaining blood drops by finger-stick hinders people from actively monitoring blood glucose levels. Recently, minimally invasive continuous glucose monitoring (CGM) sensors have become popular alone or in combination with close-loop insulin pump among type I diabetes (T1D) patients. However, subcutaneous insertion, skin irritation caused by imbedded wire, and adhesive are barriers. High operating cost also limits the adoption of these devices.

Noninvasive glucose monitoring has been a technology in high demand to provide people in need with pain-free, convenient, and continuous or as frequent measurements as necessary. Over the past decades, a variety of technologies have pursued this long quest. Among many, Raman spectroscopy has been recognized as a promising method. Raman spectra have distinctive spectral features, specific for target molecules. For in vivo transdermal Raman spectroscopy, acquired Raman spectra contain information on glucose molecules from the interstitial fluid. Although these reports have claimed the diagnostic capability of the Raman system, the absence of the characteristic Raman peaks and true prospective prediction have been criticized. Here, we present experimental data that may finalize the long debate. We present the results of direct observation of glucose-specific Raman peaks in swine glucose clamping experiments. From the measured spectra, we confirm the presence of the glucose signal and the linearity between intensities of the glucose Raman peaks and the reference glucose concentrations. Prospective prediction was achieved by simply tracking glucose Raman peak intensities.