REVIEW ARTICLE

Noninvasive Diagnostic Devices for Diabetes through Measuring Tear Glucose

Jin Zhang, Ph.D.,[1] William Hodge, Ph.D., M.D.,[2] Cindy Hutnick, Ph.D., M.D.,[2]
and Xianbin Wang, Ph.D.[3]

Abstract

This article reviews the development of a noninvasive diagnostic for diabetes by detecting ocular glucose. Early diagnosis and daily management are very important to diabetes patients to ensure a healthy life. Commercial blood glucose sensors have been used since the 1970s. Millions of diabetes patients have to prick their finger for a drop of blood 4–5 times a day to check blood glucose levels—almost 1800 times annually. There is a strong need to have a noninvasive device to help patients to manage the disease easily and painlessly. Instead of detecting the glucose in blood, monitoring the glucose level in other body fluids may provide a feasible approach for noninvasive diagnosis and diabetes control. Tear glucose has been studied for several decades. This article reviews studies on ocular glucose and its monitoring methods. Attempts to continuously monitor the concentration of tear glucose by using contact lens-based sensors are discussed as well as our current development of a nanostructured lens-based sensor for diabetes. This disposable biosensor for the detection of tear glucose may provide an alternative method to help patients manage the disease conveniently.

J Diabetes Sci Technol 2011;5(1):166-172

Author Affiliations: [1]Department of Chemical and Biochemical Engineering, University of Western Ontario, London, Ontario; [2]Department of Ophthalmology, Ivey Eye Institute, Schulich School of Medicine, University of Western Ontario, London, Ontario; and [3]Department of Electrical and Computer Engineering, University of Western Ontario, London, Ontario

Abbreviations: (A) acceptor, (a.u.) arbitrary units, (BET) Brunauer-Emmett-Teller, (Con A) concanavalin A, (D) donor, (FITC) fluorescein isothiocyanate, (FMSN) fluorescent mesoporous silica nanoparticle, (FRET) fluorescence resonance energy transfer, (IR) infrared, (NP) nanoparticle, (SiO_2) silica, (TRITC-dextran) tetramethylrhodamine isothiocyanate-dextran, (UV) ultraviolet

Keywords: biosensor, nanomaterials, noninvasive diagnostic device, tear glucose

Corresponding Author: Jin Zhang, Ph.D., Department of Chemical and Biochemical Engineering, University of Western Ontario, London, ON N6A 5B9, Canada; email address *jzhang@eng.uwo.ca*