Non-Invasive Glucometer

Jonathan Ims, Biomedical Engineering, University of Rhode Island
BME 281 Second Presentation, November 20, 2012 <jonathan_ims@my.uri.edu>

***Abstract*—The most reliable and easiest way in present day to test a human's blood glucose level (BGL), is by pricking a finger. Grove Instruments™ is looking to change that in the near future by releasing a non-invasive glucometer. The glucometer is accurate and is time efficient by taking 20 seconds to provide one's BGL.**

I. Introduction

Diabetes Mellitus effects over 25 million people in the United States and the key to keep this disease from causing damage to the human body is blood glucose control. Currently, the best way to test a human's BGL is by pricking a finger and take the reading directly from the blood. Unfortunately, there are a couple of issues with this method. First, it is suggested that an individual test their BGL four times a day, but statistics show that on average an individual only tests 1.6 times a day. Second, pricking of the finger can be painful, messy, annoying, and costly.

Recently, Grove Instruments™ has fabricated a new non-invasive devise for testing a human's BGL. The device uses near-infrared (NIR) spectroscopy to read the BGL. Grove Instruments™ solved the problems with using NIR, water interference and low sound to noise ratio, which did not allow glucose detection. For NIR to detect glucose in the blood Grove Instruments™ invented the "optical bridge." Also, this instrument is accessory free, battery dependent, and small enough that it can fit into front pocket of a t-shirt.

II. Methods

For the device to function properly and give accurate readings, the grey slot of the device (see picture above) must be placed over high blood flow area, such as the finger or the earlobe. Unlike most other non-invasive instruments that have been produce to test BGL, this instrument does not take readings from an alternative site or fluid. It takes a real-time BGL from the blood using light. Grove Instruments™ conducts 40 in-house clinical sessions a week.

III. Results

The current international standard requires glucometers to differ from the blood standard by less than 20% before the instruments is released to the public for mass usage. The data from the clinical trials shows that Grove's device has a mean average relative difference (MARD) of 8 to 12%. Grove Instruments™ has maintained this MARD for the past two years.

IV. Discussion

Grove's non-invasive glucometer is the first true non-invasive device that has a shot of making it to mass production for human usage. Compare to other non-invasive devices, Grove's device meets all standards and takes reading from the blood, not interstitial fluid. Interstitial fluid is not the ideal for BGL testing mainly because; interstitial fluid does not change simultaneously or have a constant relationship with BGL. Due to the "optical bridge" Grove's device can use NIR to collect real-time BGL data from an individual, instead of collecting data from interstitial fluid. Also, the "optical bridge" allows for the data to be collected from key places such as the finger tip or earlobe. It is this "optical bridge" that separates Grove's device from all other non-invasive devices.

The other key aspect to this device is the time it takes to produce a result, 20 seconds or less. That is quicker than an individual can prick their finger and take a reading; making Grove's device more time efficient, cleaner, and less painful than the current state of BGL testing. By having this device as a means of BGL testing, the average number of times a day an individual checks their BGL should move closer to the recommended four times a day.

References

[1] Ferrai, M. Mottola, L. and Quaresima, V. Prinicples, Techinques, and Limitations of Near Infared Spectroscopy. *Canadian Journal of Applied Physiology* 29(4): 463-487, 2004.

[2] Grove Instruments. *About Grove Instruments.* <http://www.groveinstruments.com/about.html>.

[3] Grove Instruments. *Clinical Preformance*. <http://www.groveinstruments.com/clinicalperformance.html>.

[4] Grove Instruments. *Grove Technology*. <http://www.groveinstruments.com/grovetechnology.html>.

[5] Pogoreic, Deanna. "Bloodless Glucometer Uses Light to Check Blood Sugarr in 20 Seconds or Less." *MedCity News.* 6/28/2012. <http://medcitynews.com/2012/06/bloodless-glucometer-uses-light-to-check-blood-sugar-in-20-seconds-or-less/>.

[6] Thompson, G. and Dalkin, A. Blood Glucose. *WebMD*. 7/5/2011. <http://diabetes.webmd.com/blood-glucose>.