

Triggerfish Glaucoma Monitoring System

Sam Karnes, *Biomedical Engineering, University of Rhode Island*
BME 181 First Presentation, March 4, 2013 <sksamuel0@my.uri.edu>

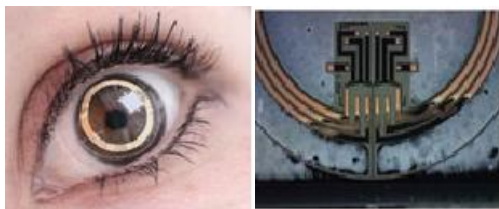
Abstract—Sensimed AG has developed a 24 hour single use contact lens, or Triggerfish, that monitors intraocular pressure changes. It then transmits and records data to later be sent, via Bluetooth, to a doctor's computer. This data can then be used to help detect glaucoma non-invasively while allowing for early treatment.

I. INTRODUCTION

Glaucoma is an irreversible disease that leads to optic nerve damage from increased intraocular pressure, or IOP. This occurs when the aqueous humor fluid is slowed or blocked from its normal flow creating a pressure build up in the eye. This disease is also the second most common cause of blindness in the U.S. due to its difficulty in detection and limited treatment. There are four different types of glaucoma. They are open-angle (chronic), angle-closure (acute), congenital, and secondary. Chronic glaucoma is the most common form. It occurs from the slowing or blockage of this fluid flow over time and requires more monitoring for diagnosis. Unfortunately, it is not easily diagnosed due to the constant changes in IOP and due to the fact that tonometry procedures, or eye pressure exams, only measure the pressure for a few seconds. In addition, there is a case of the disease called normal-tension glaucoma where the IOP is at normal levels making glaucoma almost undetectable. As a result, Sensimed has developed the Triggerfish, a single use contact lens, which records IOP data for a doctor's analysis throughout an entire day. This allows for more diagnoses, more accurate diagnoses, and monitoring of glaucoma treatment efficiency on patients. The progression of the disease can be limited with prescription eye drops and pills to lower IOP if discovered early on. Glaucoma is incurable but the long term monitoring of the Triggerfish system can discover a diagnosis efficiently and save a person's vision.

II. METHODS

The Triggerfish contact lens is made of a silicon hydrogel similar to that of regular lens making it easy to wear. It is also worn with a receiving antenna that can be placed near the eye or somewhere close to the Triggerfish lens. The lens contains strain gauges around the outer edge that read changes in the diameter of the eye and a microprocessor to analyze the data.



When the eye fills with fluid the diameter of the cornea changes and this information is collected by the strain gauge. This data is then processed and sent to the antenna which then sends radiofrequency waves back powering the lens. Once the data is collected it can then be transmitted to a doctor's computer via Bluetooth for a full analysis.

III. RESULTS

Sensimed's device is more accurate than today's current tonometry tests due to its constant 24 hour data collection. The comparable tests only measure the IOP for a few seconds which results in a very minimal amount of data for analysis. It has some undesirable effects such as blurred vision or inflammation and reddening of the eye. These occurred in 82% and 80% of the patients respectively but were mild and tended to go away within 24 hours. The results were also effective for 36 of 40 patients in a trial over a 24 hour period.

IV. DISCUSSION

There are several advantages and disadvantages for Sensimed's Triggerfish lens. The lens provides full day monitoring of a patient's IOP giving doctor's easier diagnoses and better treatment plans for glaucoma. It can monitor IOP of patients with acute glaucoma, or a sudden blockage in the aqueous humor fluid, during medical emergencies. This can allow medical staff to observe a patient's status on the way to the hospital. In addition to these advantages it creates few ethical or social issues because it simply monitors the eye. Unfortunately, the lens can cause irritation and temporary blurred vision when worn. In addition, it is still not approved for sale in the U.S. limiting its availability to patients. In the future this lens could be used as an effective delivery system for glaucoma eye drops and the collected data could also help uncover a cure for glaucoma.

REFERENCES

- [1] "Contact Lens Measures Intraocular Pressure." Contact Lens Headlines RSS. Access Media Group LLC, 11 Feb. 2011. Web. <<http://www.contactlensheadlines.com/6447/triggerfish/>>.
- [2] Gever, John. "Contact Lens Promising in Glaucoma." Contact Lens Promising in Glaucoma. MedPage Today, 13 Aug. 2012. Web. <<http://www.medpagetoday.com/Ophthalmology/Glaucoma/34180>>.
- [3] "Glaucoma." Glaucoma. U.S. National Library of Medicine, 14 Sept. 2011. Web. <<http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0002587/>>.
- [4] Gravitz, Lauren. "Mobile Computing Is Just Getting Started." MIT Technology Review. MIT, 31 Mar. 2010. Web. <<http://www.technologyreview.com/news/418247/glaucoma-test-in-a-contact-lens/>>.
- [5] Houghton, Alison N. "Tonometry." Health Facts. Ebsco, n.d. Web. <<http://www.beliefnet.com/healthandhealing/getcontent.aspx?cid=100915>>.
- [6] "Sensimed Triggerfish." Sensimed Triggerfish | Sensimed. Sensimed AG, 2013. Web. <<http://www.sensimed.ch/en/products/sensimed-triggerfishr.html>>.