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Medtech Award 2009

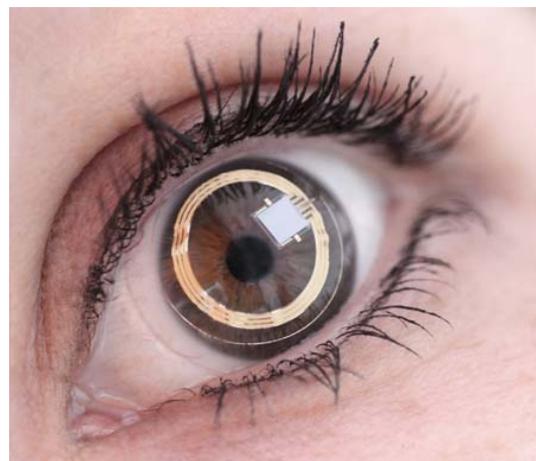
SENSIMED Triggerfish[®]: early warning system for glaucoma

Glaucoma is an insidious eye disease. According to studies conducted by the World Health Organization (WHO), glaucoma is the second leading cause of blindness, affecting roughly 67 million people worldwide. One-tenth of all glaucoma sufferers lose their sight for lack of early diagnosis. Increased intraocular pressure is a strong warning sign. Working within the framework of a CTI-funded project, Sensimed AG has developed a miniature tensometer encapsulated on the surface of a contact lens. Intraocular pressure readings taken by the tensometer are transmitted wirelessly to a measurement station.

Intraocular pressure is a reliable indicator since it causes the cornea to distort like an hourglass to protect the sclera. Dr. Matteo Leonardi from the Lausanne Federal Institute of Technology's Laboratory for Microsystems began looking for ways to measure this indicator. What he came up with was the concept of a tensometer small enough to be placed on a contact lens. He felt that such a sensor could be used to indirectly monitor the spherical deformations of the eyeball online. "The readings are significant since for every 1 mm Hg change in intraocular pressure, there is a corresponding change in the base curve radius of about 3 μm ," explains Leonardi. Although there is currently no cure for glaucoma, reliable monitoring of the condition should enable targeted therapy to slow the progressive shrinkage of the patient's field of vision.

With the support of Professor Philippe Renaud, who heads the EPFL laboratory, the biomedical engineer began developing the concept further. The resulting contact lens contains a microchip with embedded circuitry that acts as a transmitter. The sensor monitors intraocular pressure around the clock and continually transmits the readings to a data storage unit worn around the patient's neck. Signals and energy flow wirelessly between the sensor and data storage unit. The patient's ophthalmologist can then transfer the data to his

or her computer via Bluetooth and generate a chart of the various intraocular pressure readings on the computer screen. The Innovation Promotion Agency CTI provided support for the complex development phases. It also gave Dr. Matteo Leonardi the coaching needed to take Sensimed AG to market. Founded in 2003, his company was awarded the CTI Start-up Label in 2008.



The contact lens can be worn comfortably both day and night without affecting work or sleep. It enables early diagnosis of glaucoma and subsequent targeted therapy.

(Photo by Sensimed)

In a follow-up project, the Sensimed crew called in Professor Cédric Bornand from the University of Applied Sciences, Western Switzerland (HES-SO) to help them calibrate the sensor and process the signals. Professor Hubert Droz from the HES-SO's Arc College in St. Imier began testing contact lens materials and developed a 350 ccm3 silicon injection system to carry out industrial production tests. He also created an industrial spray technique for the contact lenses and encapsulated sensor. Sensimed AG continued to work with Professor Renaud at the EPFL laboratory, who provided them with access to state-of-the-art clean rooms and microtechnology processing equipment.

The development work took place in close cooperation with the world's most renowned glaucoma experts. Professor André Mermoud, who heads the Glaucoma Centre at the Monchoisi Clinic in Lausanne, is one such expert. Considered the "Pope of Glaucoma", he is among of the ophthalmologists who are currently testing the EC-certified Sensimed Triggerfish® early warning system with volunteer glaucoma patients.

Initial experiences have been positive. For the first time, doctors have clear information about intraocular pressure and fluctuations within a 24-hour period. Ophthalmologists are mainly concerned about high intraocular pressure at night, when blood pressure is low and too little oxygen circulates through the blood vessels. Since the contact lenses can be worn all day and night, patients are completely relaxed, which means that the intraocular pressure readings are not skewed by stress factors. This helps doctors to better understand the illness and establish personalised therapy for patients.



Tensometer being placed on a soft contact lens. The tensometer is non-invasive and does not affect the person's vision. The sensor measures intraocular pressure around the clock.

(Photo by Sensimed)

KTI 9847.1 PFLS-LS
"SENSIMED Triggerfish®: a disposable soft contact lens encapsulating MEMS and telemetry technologies to monitor non-invasively intraocular pressure of glaucoma patients continuously over 24 hours."

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