

Smart Contact Lens for Intraocular Pressure Monitoring, Drug Release and Disease Biomarker Detection

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Technology description

Summary:

Our contributors demonstrated a new type of contact lens for an optical monitoring of intraocular pressure (IOP) in real-time, drug delivery and disease biomarker detection.

Description:

Glaucoma is a leading cause of irreversible blindness worldwide. Elevated Intraocular pressure (IOP) is the primary known risk factor for glaucoma nerve damage and is caused by a buildup of the aqueous humor. Currently, IOP measurements are used for glaucoma diagnosis and patient monitoring, however, it can fluctuate highly, so occasional IOP measurements in the clinician's office are not always sufficient. The mainstay of glaucoma therapy has been the use of eye drops that either decrease of the aqueous humor or increase the outflow in order to stabilize the IOP. Currently, limited drug penetration and bioavailability to desired area are key issues. This has led to clinician's recommending frequent dosing, resulting poor patient compliance rates and decreased cost effectiveness.

In 2016, FDA approved the marketing of the Triggerfish Sensor, a "smart" lens that may help eye doctors identify the best of the day to measure a patient's IOP. The IOP data is transmitted from the lens wirelessly to a small adhesive antenna placed on the face near the eye. The antenna then transmits the data to a portable recorder worn by the patient. The lens can be worn continuously for one 24-hour period. Data provided allows the doctor to observe peaks in patients' eye pressure, which can vary throughout the day. This information can be used to optimize the type, dosage and timing of glaucoma medications to better control intraocular pressure.

Overall, the current conventional IOP sensors is not capable of delivery of a drug for treatment of glaucoma, and screening techniques have poor sensitive for early primary glaucoma diagnose.

ISU researchers demonstrated a new smart contact lens device that can simultaneously provide continuous IOP monitoring, drug delivery and eye disease biomarker detection. This multifunctional smart contact lens can monitor IOP in real-time, providing a more convenient and faster method with easier fabrication and operation (compared with Triggerfish Sensor), and the IOP data can be transmitted by a smart phone-connected spectrometer. A patient or medical professional can repeatedly measure IOP using the contact lens, and can avoid the use of specialized, expensive tonometry equipment that requires training and expertise. As the method of drug delivery, it can reduce or eliminate the need for conventional topical administration of drugs such as via eye drops,

and can provide more accurate dosing of drugs to the eyes. Further, the lens can detect biomarkers of various diseases, including diseases of the eye (e.g., glaucoma, keratitis and uveitis, and etc.) providing a more convenient method of detecting biomarkers than conventional methods such as collection of tear films and ELISA screening thereof. This is less expensive and faster than conventional biomarker detection methods.

Application area

Next generation systems for diagnosis, monitoring and management of ophthalmic diseases.

Advantages

- Real-time monitoring of IOP with easy fabrication and operation
- IOP data can be transmitted by a smart phone-connected spectrometer
- In-situ non-invasive drug delivery
- Less expensive, faster and convenient biomarker detection for the early diagnosis of various diseases including diseases of the eye

Institution

[Iowa State University](#)

联系我们



叶先生

电话：021-65679356

手机：13414935137

邮箱：yeyingsheng@zf-ym.com