Wireless, stretchable contact lens sensors for intraocular pressure monitoring

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Abstract:

Intraocular pressure (IOP) is an important factor of diagnosing glaucoma clinically because glaucoma is one of the most important causes of blindness. The common way to measure IOP requires the wire connection between a sensor lens on an eye and a detector, which is not suitable for long term monitoring. Therefore, we develop a wireless, stretchable contact lens sensor for real-time IOP monitoring. The wireless sensor system is similar with our previous works [1-2], consisting of a stretchable antenna for monitoring IOP changes and a reader coil for converting IOP changes to electrical signals (Fig.1).

A stretchable antenna with a horseshoe shape is designed to keep the connection between the antenna and soft, moist contact lenses even the lens was dried. The resonant frequency of the antenna lens was shifted by increasing IOP of pig eye ranging from 5 to 50 mmHg, so the contact lens with antenna can be used as wireless IOP sensors. To enhance the sensitivity of IOP sensors, we increased the number of turns of designed antenna. When we used a triple-turn antenna, the sensitivity was up to 45.5kHz/mmHg at the resonant frequency of around 1.39 GHz. In the presentation, we will discuss the details about the experimental setup and the results.

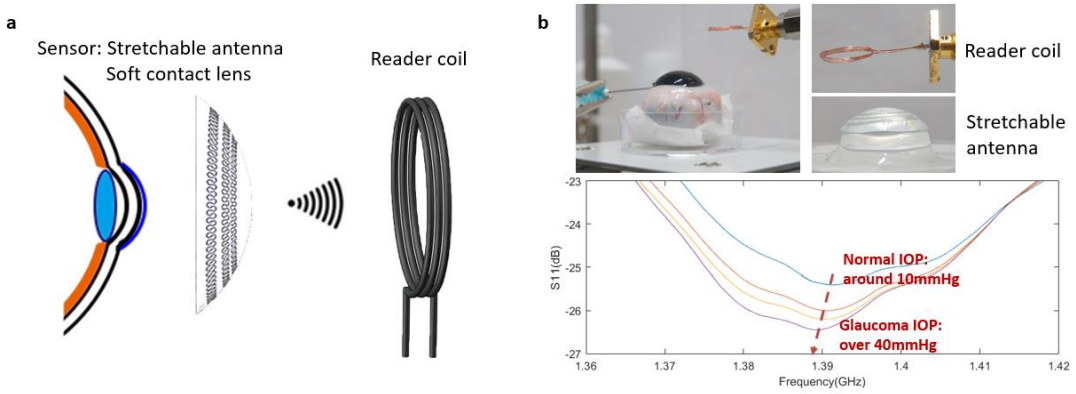

Figure 1. IOP monitoring system using a wireless, stretchable contact lens sensor. **a)** Wireless power transfer (WPT) system from the reader coil to the stretchable antenna on the contact lens. **b)** Optical images and performances of the antenna sensors mounted on pig eye.

Reference:

[1] T. Taiki, et.al, Advanced Materials Technologies, 4, 1800671 (2019).
[2] T. Taiki, et.al, Advanced Functional Materials, 30, 1906225 (2020).