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In Vivo Intraocular Pressure Measurements Using A Miniaturized Nano-Photonic Sensor Implant

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Purpose: We have been developing a nanophotonic pressure sensor whose optical resonance is directly related to intraocular pressure (IOP). Bench testing has demonstrated sensor near-infrared (NIR) reflectance to accurately track pressures from 0-50 mmHg. The current study examined sensor performance following implantation into rabbit eyes for up to one month.

Methods: The nanophotonic IOP sensor is a micro-/nano-fabricated 800-micron-diameter silicon microcavity flanked on one side by a flexible silicon-nitride membrane embedded with reflective gold nanodots. Sensors were attached to acrylic intraocular lenses (IOL) and implanted into the eyes of New Zealand White rabbits following lens phacoemulsification. Sensor-resonance signatures carrying IOP information were obtained 2 inches away from the eye right after sensor implantation, and at 2 & 4 weeks. Measurements were also made before and after IOP elevation by intraocular saline injection. TonoVet IOP measurements were made in parallel in all cases for comparison.

Results: In-vivo sensor measurements exhibited excellent signal-to-noise (SNR) ratio of 13 dB at all time points. Sensor-derived IOPs ranged from 6.8 to 7.1 mmHg at 2 and 4 weeks. Concurrent TonoVet IOPs matched all sensor IOPs but were consistently 0.5-3 mmHg higher. Intraocular saline injection right after implantation caused sensor-IOP readings to go from 7.0 to 20.0 mmHg.

Conclusions: A miniaturized nanophotonics-IOP sensor using NIR light as a sensing medium provides in-vivo IOP measurements in rabbits for at least 1 month after implantation. The sensors exhibited good SNR ratio, stability, and tracking of IOP increases.

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Intraocular pressure affects structural glaucoma progression differently in patients of African and European descent

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Purpose: To examine the relationship between intraocular pressure (IOP) and changes in structural progression in open-angle glaucoma (OAG) patients of African (AD) and European descent (ED) after four years.

Methods: 85 patients with OAG (20 AD, 65 ED) were assessed for IOP and optic nerve head (ONH) morphology and retinal nerve fiber layer (RNFL) thickness by Heidelberg retinal tomography 3 HRT3) every six months for a four-year period. Additionally, 80 patients with OAG (18 AD, 62 ED) were assessed for IOP and ONH parameters by optical coherence tomography (OCT) every six months.

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