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Fabrication and Evaluation of Magnetic Microactuators for Implantable Self-Clearing Glaucoma Drainage Devices

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ABSTRACT

According to the World Health Organization, glaucoma is the second leading cause of blindness in the world. It currently affects more than 2.7 million people in the United States alone and over 79.6 million people worldwide are estimated to be inflicted by this debilitating disease by 2020. Glaucoma patients are often characterized with elevated intraocular pressure (IOP) and are treated with implantation of glaucoma drainage devices (GDD) to maintain optimum IOP. Although initially effective at delaying glaucoma progression, contemporary GDD often lead to numerous complications and only 50% of implanted devices remain functional after 5 years. Biofouling is seen to be one of the leading cause for the failure of GDDs. In order to overcome biological blockage, we propose a self-clearing glaucoma drainage device using integrated magnetic microactuators. Here we report on the maskless photolithographic fabrication results of magnetic microactuators to be integrated into a bespoke GDD. The maskless photography enabled rapid prototyping of microdevices using low-cost materials in contrast to conventional lithographic methods. The fabricated devices were able to produce maximum deflection of 57.9 degree at magnetic field strength of 32.6 kA/m. The static response of the fabricated devices was compared with the theoretical data.

KEYWORDS

Glaucoma, bioMEMS, magnetic microactuator, implantable devices, glaucoma drainage device, biofouling.

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