Design and validation of a foldable and photovoltaic wide-field epiretinal prosthesis.

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Objective. Our goal is the development of a foldable and photovoltaic wide-field epiretinal prosthesis to restore a large visual field.

Materials and Methods. Using solution processes and micro-fabrication techniques, we designed a retinal prosthesis based on polydimethylsiloxane (PDMS) as shell material, embedding photovoltaic pixels made of conjugated polymers. The prosthesis is shaped with a molding technique.

Results. Inspired by intra ocular lenses, we designed a foldable and wide-field epiretinal prosthesis capable of achieving a wireless photovoltaic stimulation of retinal ganglion cells. Here we show that within a visual angle of 46.9 degrees, it embeds 2215 stimulating pixels, of which 967 are in the central area of 5 mm. It is foldable to limit the scleral incision during implantation and it has a hemispherical shape to remain in tight contact with the retina. We also demonstrate that the prosthesis is not cytotoxic, while accelerated ageing shows a lifetime of at least 2 years. Moreover, it fulfills optical and thermal safety requirements. Last, the flexibility of the fabrication process may allow the production of the hemispherical prostheses adjusted to the real eye curvature of the patient. These advances provide a solution towards the improvement of both visual acuity and visual field in blind patients.

Discussion. We documented a foldable and photovoltaic wide-field epiretinal prosthesis with a remarkable increase in its retinal coverage and in the number of stimulating pixels.

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