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Visual evoked spike discharges of retinal ganglion cells with photoelectric dye-coupled polyethylene film

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Purpose

In blind people with retinal diseases such as retinitis pigmentosa, although photoreceptor cells are dead, other retinal neurons are still alive, and ganglion cells can send visual information to the brain. Okayama University-type retinal prosthesis (OURePTM) is a novel type of retinal prostheses, so called photoelectric dye-coupled thin film retinal prosthesis. The dye-coupled film generates electric potential in response to light. In this study, spike discharges were recorded from mouse retinal ganglion cells to test whether the dye-coupled film would trigger spike discharges in response to the light stimulus.

Methods

The retina was isolated from wild-type C57BL/6J mice. The dye-coupled film was placed on the glass bottom of the recording chamber, and the isolated retina was overlaid on the film (ganglion cell layer up). The retina was continuously superfused with oxygenated artificial cerebrospinal fluid. Spike discharges were recorded from ganglion cells using a tungsten electrode attached to the amplifier. Flash-light stimuli were presented with a LED, and L-AP4 was bath applied to suppress ON responses of ganglion cells originated from photoreceptors of ganglion cells. The plain film was also used in the control condition.

Results

In the control condition, with the plain film, ON responses were observed at the onset of light stimuli. During the application of L-AP4 ON responses were suppressed. ON responses recovered after washout of L-AP4. In the test condition, with the dye-coupled film, ON responses from ganglion cells remained during application of L-AP4.

Conclusions

With the plain film, ON responses were suppressed by L-AP4, and recovered after washout. This result indicates that our experimental condition is physiologically appropriate for evaluation of the efficacy of the dye-coupled film. With the dye coupled film, ON responses were remained during application of L-AP4 suggesting that the dye coupled film could work as retinal prostheses which could trigger spike discharges of ganglion cells without photoreceptors.

Layman Abstract (optional): Provide a 50-200 word description of your work that non-scientists can understand. Describe the big picture and the implications of your findings, not the study itself and the associated details.

