

AB006. Longitudinal effects of an optic nerve injury on behavioural measures of visual functions

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Background: Visual deficits, caused by ocular disease or trauma, can cause lasting damage. However, recent research has focused on neural plasticity as a means to regain visual functions. In order to better understand the involvement of neural plasticity and reorganization in partial vision restoration, we aim to evaluate the partial recovery of a visual deficit over time using two behavioural tests. In our study, a partial optic nerve crush (pONC) serves as an induced visual deficit, allowing for residual vision from surviving cells.

Methods: Visual functions in C57BL/6 mice was measured using two behavioural tests prior to a bilateral pONC, then at various time points after the pONC. In this study, two injury intensities were used: a high intensity pONC with the full force of self-closing forceps, and a low intensity pONC, in which a calibrated space was left between the forceps at the closed position. The two behavioural tests consisted of

the optomotor reflex (OMR) and the visual cliff (VC) tests. The OMR test measures the mouse's tracking reflex in response to moving sinusoidal gratings. The VC test, on the other hand, evaluates exploratory behaviour, by simulating a cliff to observe the animal's sense of depth perception. After the behavioural evaluation, surviving retinal ganglion cells were counted.

Results: The high intensity pONC resulted in a total loss of visual acuity as measured by the OMR test, with no improvement in the following 4 weeks. However, the light intensity pONC showed the same initial loss, but recovery was observed as of day 3, and results in 40–60% recovery after 4 weeks. With the VC test, mice with intact vision will avoid the deep end, opting to spend more time in the shallow end. However, after both high and low intensity pONCs, this preference is no longer observed. Both groups show a return to the shallow end preference at day 14, though the low intensity pONC group showed a stronger preference similar to baseline performance. The percentage of surviving retinal ganglion cells was higher with the low intensity (68%) than with the high intensity (17%) pONC.

Conclusions: There is evidence of visual recovery at the behavioural level following a pONC, though very little recovery was observed following a high intensity pONC, and only with the VC test. Therefore, a certain amount of residual retinal input may be required for recovery at the behavioural level.

Keywords: Optic nerve injury; plasticity; behaviour; visual function

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