Visual dysfunction screening in mice after TBI using an optomotor assessment of the optokinetic response.

Scott Ferguson, Benoit Mouzon, Destinee Aponte, Gogce Crynen, Venkatarajan Mathura, Michael Mullan, Fiona Crawford

Introduction:

Our mouse model of repetitive mild TBI (r-mTBI) produces chronic optic nerve pathology and retinal degeneration. In order to assess the visual function of the mice, we have optimized a mechanical optomotor assay to assess the optokinetic response.

Methods:

The optomotor apparatus consisted of a rotating drum containing black and white stripes at varying angular resolutions. Mice were acclimated to the apparatus for a period of 5 minutes in phototopic lighting. Optomotor testing at each resolution consisted of pairs of 2 minute trials with 1 trial in a clockwise rotation followed by 1 trial in a counter-clockwise rotation with an inter-trial time of 30 seconds. Following the completion of the first pair of trials in photopic conditions, lighting was dimmed to scotopic conditions and the mice were allowed to acclimate for a period of 5 minutes followed by another pair of trials. After the completion of all 4 trials the mouse was returned to the home cage and the next mouse was tested. On subsequent days this testing was repeated with the rotation of the drum increased in a range from 2 to 5 rpm. All trials were recorded with Noldus Ethovision XT.

Results:

Optomotor testing and optimization revealed a non-random, quantifiable optokinetic response of the mice which was found by excluding the portions of the trial where the mouse was in motion and by quantifying the angular rate of rotation of the head of each mouse.

Conclusions:

By varying the resolution of the stripes we were able to increase the difficulty of the task and determine the optimal conditions for eliciting an optokinetic response in healthy mice capable of discriminating subtle vision deficits. Varying the rotation rate of the optomotor drum also allowed us to determine the optimal speed for eliciting the optokinetic response. The optimized assay will allow us to accurately assess the functional outcome of potential therapeutics for the treatment of TBI-induced visual dysfunction.