Recovery of dopaminergic amacrine cells after strobe light stimulation in developing rat retina

Soo-Jin Song, Jung-A Shin
Department of Anatomy, Ewha Womans University College of Medicine

Recently, concerns have been raised about the impact of strobe light on human health and life. Sources of strobe light include amplitude–controlled flashing lights, light emitting diodes, and computer monitors, which can lead to visual discomfort, headaches, and poor visual performance. In addition, strobe light affects the number of dopaminergic amacrine cells (DACs) in development retina and retinal dopamine levels. DACs serve as the sole source of retinal dopamine, and dopamine release from the retina is regulated by light exposure following a circadian rhythm. The aim of this study is to determine whether changes of dopaminergic amacrine cells by strobe light are recoverable after stopping strobe light during retinal development. From eye–opening (postnatal 2 weeks), the control group was reared under continuous light and the experimental group was reared under strobe light for 2 weeks. After postnatal 4 weeks, continuous light was given to all animals for recovery. After that, immunohistochemistry and western blot for tyrosine hydroxylase (TH), and high–pressure liquid chromatography (HPLC) for dopamine and 3,4–Dihydroxyphenylacetic acid (DOPAC) were performed at postnatal 4, 6, 8 and 10 weeks. The number of type I and type II TH–immunoreactive (TH–IR) cells across the entire retina was counted to determine if the changes of DACs were recovered. In rats reared in continuous light, the number of type I TH–IR cells decreased slightly and maintained at a constant level, whereas in rats reared in strobe light, type I TH–IR cells rapidly decreased at postnatal 6 weeks and then increased after postnatal 8 weeks. After that, a level similar to the number of type I TH–IR cells in rats reared with continuous light was observed. In addition, the number of intermediate–sized TH–IR cells was increased at postnatal 8 and 10 weeks, and dopamine level was decreased a postnatal 8 weeks in strobe–reared rats. However, the levels of DOPAC and TH protein did not differ between rats reared in both continuous and strobe light. This suggests that changes of DACs by visual environment are reversible and can recover after discontinuation of stimuli. The work was supported by the Basic Science Research Program through the National Research Foundation of Korea (NRF–2017R1C1B1011306).

Keywords: Retina, Strobe light, Development, Dopaminergic amacrine cell, Tyrosine hydroxylase

신정아 | 이화여자대학교 의과대학 · sja@ewha.ac.kr