

Effects of mild- and moderate-intensity illumination on axial length and choroidal thickness in young adults

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Abstract

Purpose : Rearing under high-intensity illumination produces a hyperopic shift in chicks and inhibits the development of form-deprivation myopia in chicks and primates. Recent studies also show that time spent outdoors is protective against the development of myopia in children. In this study, we examined the effects of 120 minutes of exposure to 500 and 1000 lux of bright illumination on axial length and choroidal thickness (ChT) in young adult participants.

Methods : Fifteen participants (mean age, 21.60 ± 2.16 years) with a mean refraction of -0.30 ± 0.39 D were exposed to 500 ($142 \mu\text{W}/\text{cm}^2$) and 1000 ($284 \mu\text{W}/\text{cm}^2$) lux of illumination for 120 minutes in a dark room on two different days, using a pair of custom-made light-emitting glasses. On each day, a series of ocular measurements were performed in the left eye before the light exposure (0 minutes), at 30, 60 and 120 minutes of light exposure, and 30 minutes after light offset to measure recovery. All ocular measurements were repeated on a third measurement day without any light stimulus in darkness (~ 5 lux). Axial length was measured using the Lenstar optical biometer and the changes in the subfoveal ChT were measured using the Cirrus 5000 optical coherence tomographer. Measurements are reported as mean \pm standard error mean and statistical comparisons were made using two-way ANOVA.

Results : Axial length increased significantly across all time points in darkness. Exposure to 500 and 1000 lux of continuous illumination resulted in a gradual and significant reduction in axial length at 30, 60, and 120 compared to darkness (change in axial length at 60 minutes: darkness, $+0.014 \pm 0.003$ mm; 500 lux, -0.007 ± 0.002 mm; 1000 lux -0.010 ± 0.004 mm, $p < 0.001$). Exposure to 500 and 1000 lux of illumination caused a significant thickening of the choroid (change in ChT at 60 minutes: darkness, -0.011 ± 0.006 mm; 500 lux, $+0.006 \pm 0.003$ mm; 1000 lux $+0.008 \pm 0.004$ mm, $p = 0.025$). None of the ocular changes were significantly different between the 500 and 1000 lux illumination levels ($p > 0.05$). All ocular changes recovered to normal within 30 minutes of light offset.

Conclusions : Our results show that exposure to mild- or moderate-intensity illumination can induce a significant reduction in axial length and thickening of the choroid in young subjects. Similar to animal models, these changes were found to be sensitive to the duration of light exposure.

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