Supplementary Materials

Supplementary Materials and Methods

Study subjects and animal welfare

Thirty-two healthy young rhesus macaques (*Macaca mulatta*) (16 males, 16 females) were purchased from the Kunming Primate Research Center, Chinese Academy of Sciences (Yunnan, China). The monkeys were 2.1–2.5 years old (2.35±0.03 years; mean±SD), thus approximating primary school-aged children (6–7.5 years) and mimicking the vulnerable stage of ocular development.

Before the experiment, all monkeys were reared in a semi-open indoor-outdoor environment under natural sunlight. Each colony had an outdoor stainless-steel cage (2.67 m length) connected to an indoor room (2.61 m wide, 2.46 m long, and 2.58 m high). The monkeys could enter and leave the outdoor cage and indoor room at will. All rearing and experimental procedures were reviewed and approved by the Institutional Animal Care and Use Committee (IACUC) of the Kunming Primate Research Center (Approval Number: IACUC20029) and were in strict compliance with the National Care and Use of Animals Guide approved by the National Animal Research Authority (China) and the National Institutes of Health Guide for the Care and Use of Laboratory Animals (USA).

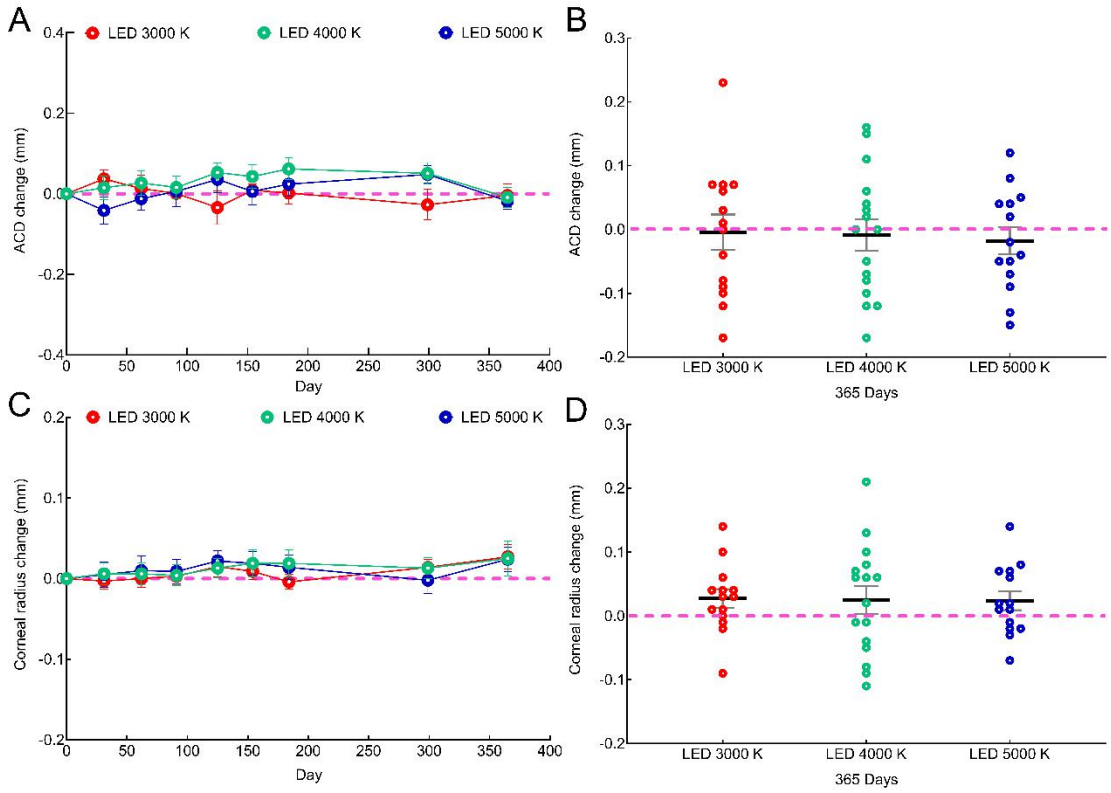
Data collection

For data collection, each monkey was first anesthetized with ketamine (intramuscular administration, 20–25 mg/kg, Jiangsu Zhongmu Beikang Pharmaceutical Co., Ltd., China) and acepromazine maleate (intramuscular administration, 0.15–0.20 mg/kg, Shanghai Aladdin Biochemical Technology Co., Ltd., China). Ocular axial length, corneal curvature radius, and anterior depth were then measured using an optical biometer (IOLMaster, Carl Zeiss Meditec, Germany). Immediately after measurements, tropicamide phenylephrine eye drops were administered (Mydrin-p, Santen, Osaka, Japan) in each eye 5 min apart for mydriatic and ciliary anesthesia, and refractive examination was performed 20 min later using a computerized autorefractor (KR-800, TOPCON Medical Systems Inc., Japan). Due to the similarity between monkey and human eyes, measurement of monkey eyes using optical biometry and computerized autorefractometry has been proven feasible and effective (Hung et al., 2012; Lin et al., 2019; Ostrin et al., 2012). During the later stage of light exposure, each group, except the LED 4 000 K group, had one subject withdrawn from the experiment due to health reasons (diarrhea).

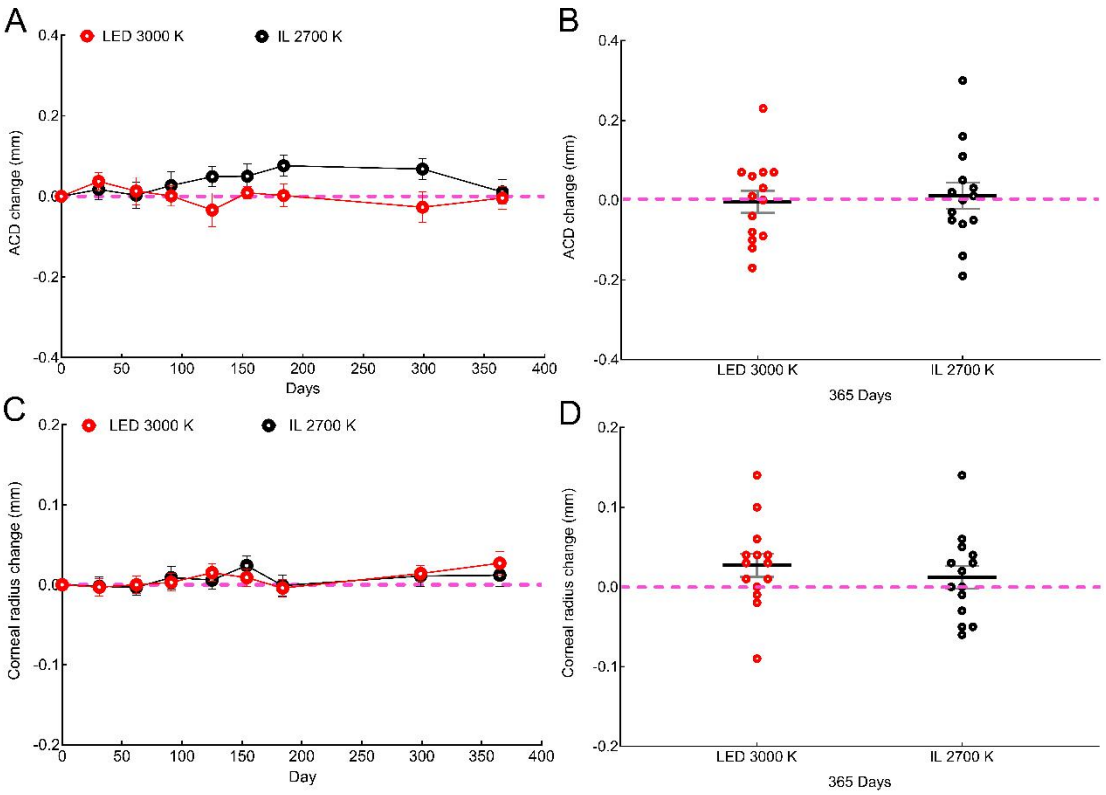
Results

At the end of the experiment, the changes in anterior chamber depth in the LED 3 000 K, LED 4 000 K, and LED 5 000 K groups were −0.022±0.141, −0.009±0.099, and −0.018±0.079 mm, respectively (Figure S1B), which were not significantly different (repeated measures ANOVA: $F_{2, 19}$=0.051, P=0.950). In addition, over the whole experimental period, the three different LED lights had no significant effect on the growth trend of the anterior chamber depth (GLMM: $F_{2, 373}$=2.978, P=0.052) (Figure S1A). Compared with the increase in axial length, the increase in anterior chamber depth was minimal. Thus, the increase in ocular axial length was mainly due to growth of the vitreous cavity.

At the end of the experiment, the changes in the corneal curvature radius in the LED 3 000 K, LED 4 000 K, and LED 5 000 K groups were 0.027±0.054, 0.025±0.087, and 0.024±0.055 mm, respectively, which were not significantly different (repeated measures ANOVA: $F_{2, 19}$=0.007, P=0.993) (Figure S1D). The three LED lights had no significant effect on the change trend in the corneal curvature radius over the whole experimental period (GLMM: $F_{2, 375}$=1.719, P=0.181) (Figure S1C). Similar results were obtained for the IL (2 700 K) experiment (Figure S2).



Supplementary Figure S1. Changes at last measurement and development trends of anterior chamber depth (ACD) and corneal curvature radius in three groups of juvenile monkeys under three different CCT LED lighting conditions. There were no significant differences in trends and changes in ACD and corneal curvature radius among the three groups. (**A**) and (**C**): Trends in ACD and corneal curvature radius during whole experimental period. (**B**) and (**D**): Changes in ACD and corneal curvature radius from last measurement at end of experiment. Data are presented as mean±*SEM*.



Supplementary Figure S2. Effects of conventional incandescent lamp (IL, 2 700 K) and LED 3 000 K light exposure on anterior chamber depth (ACD) and corneal curvature radius in juvenile monkeys. There were no significant differences in trends and changes in ACD and corneal curvature radius between groups. (**A**) and (**C**): Trends in ACD and corneal curvature radius during whole experimental period. (**B**) and (**D**): Changes in ACD and corneal curvature radius from last measurement at end of experiment. Data are presented as mean±*SEM*.

Supplementary Table S1. Age, ocular optical parameters, and light parameters of four experimental groups. Ocular optical parameters were measured at baseline (0 day), 184 days, and 365 days of experiment. There were no significant differences among baseline data of experimental groups.

	IL 2700 K		LED 3000 K		LED 4000 K		LED 5000 K	
Age and number	844 ± 38 days, n=8		844 ± 38 days, n=8		844 ± 38 days, n=8		844 ± 38 days, n=8	
Intensity Lux (human) (W/m^2)	504 ± 9 lx (3.42 ± 0.07 W/m^2)		500 ± 9 lx (1.49 ± 0.03 W/m^2)		512 ± 7 lx (1.48 ± 0.02 W/m^2)		500 ± 7 lx (1.50 ± 0.02 W/m^2)	
	Baseline (0 day)							
	OD	OS	OD	OS	OD	OS	OD	OS
Axial length (mean ± SD, mm)	18.83 ± 0.55	18.82 ± 0.52	18.83 ± 0.56	18.84 ± 0.55	18.82 ± 0.96	18.84 ± 0.93	18.82 ± 0.40	18.82 ± 0.42
Corneal curvature radius (mean ± SD, mm)	6.51 ± 0.23	6.50 ± 0.21	6.49 ± 0.26	6.48 ± 0.26	6.46 ± 0.27	6.46 ± 0.27	6.47 ± 0.11	6.45 ± 0.10
Anterior Chamber Depth (mean ± SD, mm)	3.36 ± 0.15	3.38 ± 0.17	3.46 ± 0.19	3.44 ± 0.15	3.45 ± 0.33	3.44 ± 0.35	3.41 ± 0.17	3.42 ± 0.23
Refractive Error (S.E. mean ± SD, D)	0.65 ± 0.41	0.76 ± 0.49	0.33 ± 0.81	0.58 ± 0.35	0.42 ± 0.36	0.39 ± 0.27	0.54 ± 0.35	0.66 ± 0.62
	Midpoint of the experiment (184 days)							
	OD	OS	OD	OS	OD	OS	OD	OS
Axial length (mean ± SD, mm)	19.10 ± 0.56	19.09 ± 0.55	19.09 ± 0.52	19.10 ± 0.55	19.19 ± 1.05	19.16 ± 1.00	19.18 ± 0.42	19.16 ± 0.43
Corneal curvature radius (mean ± SD, mm)	6.52 ± 0.22	6.49 ± 0.20	6.49 ± 0.26	6.47 ± 0.26	6.50 ± 0.32	6.46 ± 0.26	6.47 ± 0.09	6.48 ± 0.10
Anterior Chamber Depth (mean ± SD, mm)	3.42 ± 0.11	3.47 ± 0.09	3.40 ± 0.17	3.50 ± 0.14	3.50 ± 0.32	3.53 ± 0.29	3.46 ± 0.20	3.41 ± 0.21
Refractive Error (S.E. mean ± SD, D)	0.37 ± 0.55	0.26 ± 0.36	0.33 ± 0.81	0.03 ± 0.88	-0.03 ± 0.32	0.17 ± 0.27	0.05 ± 0.28	0.20 ± 0.60
	End of the experiment (365 days)							
	OD	OS	OD	OS	OD	OS	OD	OS
Axial length (mean ± SD, mm)	19.25 ± 0.60	19.24 ± 0.57	19.16 ± 0.64	19.13 ± 0.62	19.32 ± 1.02	19.31 ± 0.98	19.24 ± 0.41	19.22 ± 0.45
Corneal curvature radius (mean ± SD, mm)	6.52 ± 0.22	6.54 ± 0.20	6.50 ± 0.28	6.52 ± 0.27	6.50 ± 0.32	6.47 ± 0.29	6.46 ± 0.10	6.47 ± 0.07
Anterior Chamber Depth (mean ± SD, mm)	3.33 ± 0.17	3.41 ± 0.12	3.49 ± 0.16	3.410 ± 0.29	3.42 ± 0.34	3.46 ± 0.34	3.35 ± 0.21	3.42 ± 0.28
Refractive Error (S.E. mean ± SD, D)	-0.19 ± 0.40	-0.13 ± 0.60	0.06 ± 0.46	0.25 ± 0.58	-0.48 ± 0.60	-0.38 ± 0.59	0.02 ± 0.67	-0.05 ± 0.75

OD = right eye; OS = left eye

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