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Comparisons of circadian phase shift by morning light exposure in children and middle-aged adults

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INTRODUCTION

It has been reported that melatonin suppression, which is one of the non-image forming function such as circadian phase shift, in children is greater than that in adults (Higuchi, 2014 and Eto, 2021). Therefore, circadian phase shift effects by light exposure may be also greater in children. However, there are no studies that directly compare the circadian phase shift by light exposure between children and adults. In this study, the circadian phase advances by morning light exposure in primary school children were compared with that in middle-aged adults.

METHOD

Subjects

Fifteen healthy primary school children
(Mean age, 9.9 ± 1.5 years, 27% boy)

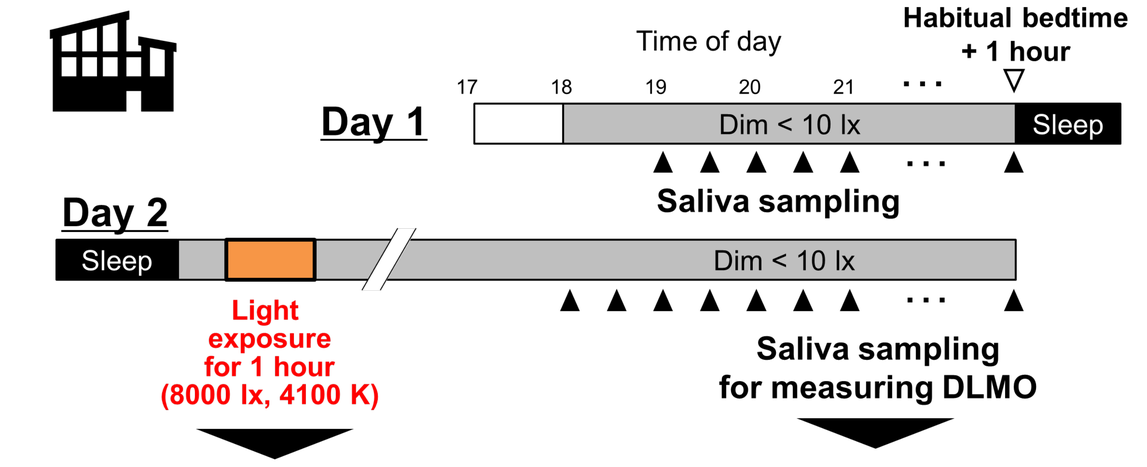
Fifteen healthy middle-aged adults
(Mean age, 44.4 ± 5.6 years, 47% Male)

Protocol

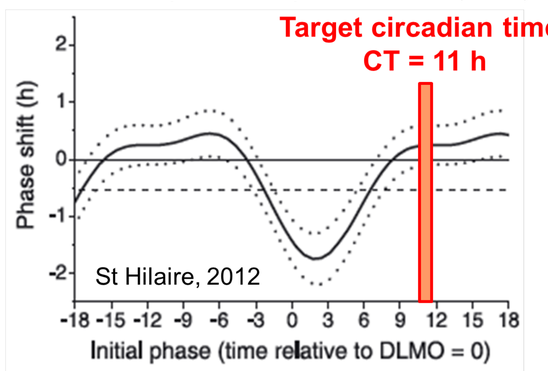
- **Questionnaire** (for estimating circadian phase)
  Children: CCTQ (children's chronotype questionnaire)
  Adults : MCTQ (Munich chronotype questionnaire)

- **Home session** (7 days before laboratory session)
  Maintain habitual sleep-wake schedule for 7 days.
  Recording in sleep diary by themselves.

- **Laboratory session** (1 night and 2 days)
  Two circadian phase assessments.
  Light exposure in the morning.

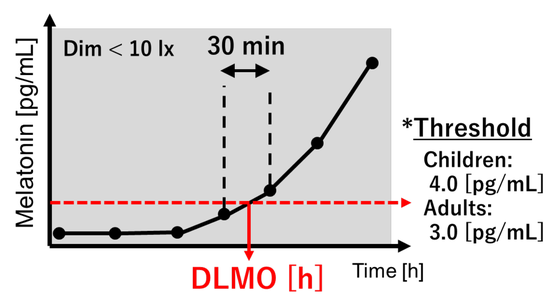


Based on phase response curve (PRC)



Initial phases in Day 1 were estimate from MSFsc evaluated by CCTQ or MCTQ.

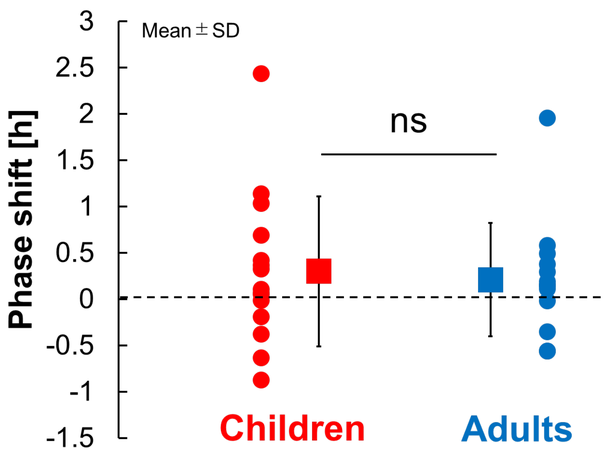
Circadian phases were assessed by salivary dim light melatonin onset (DLMO)



Circadian phase shift
= $DLMO_{day1}$ – $DLMO_{day2}$

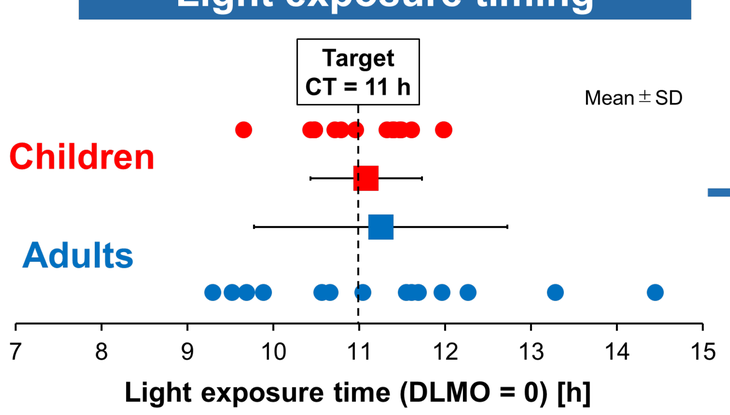
RESULTS and DISCUSSIONS

Circadian phase shift



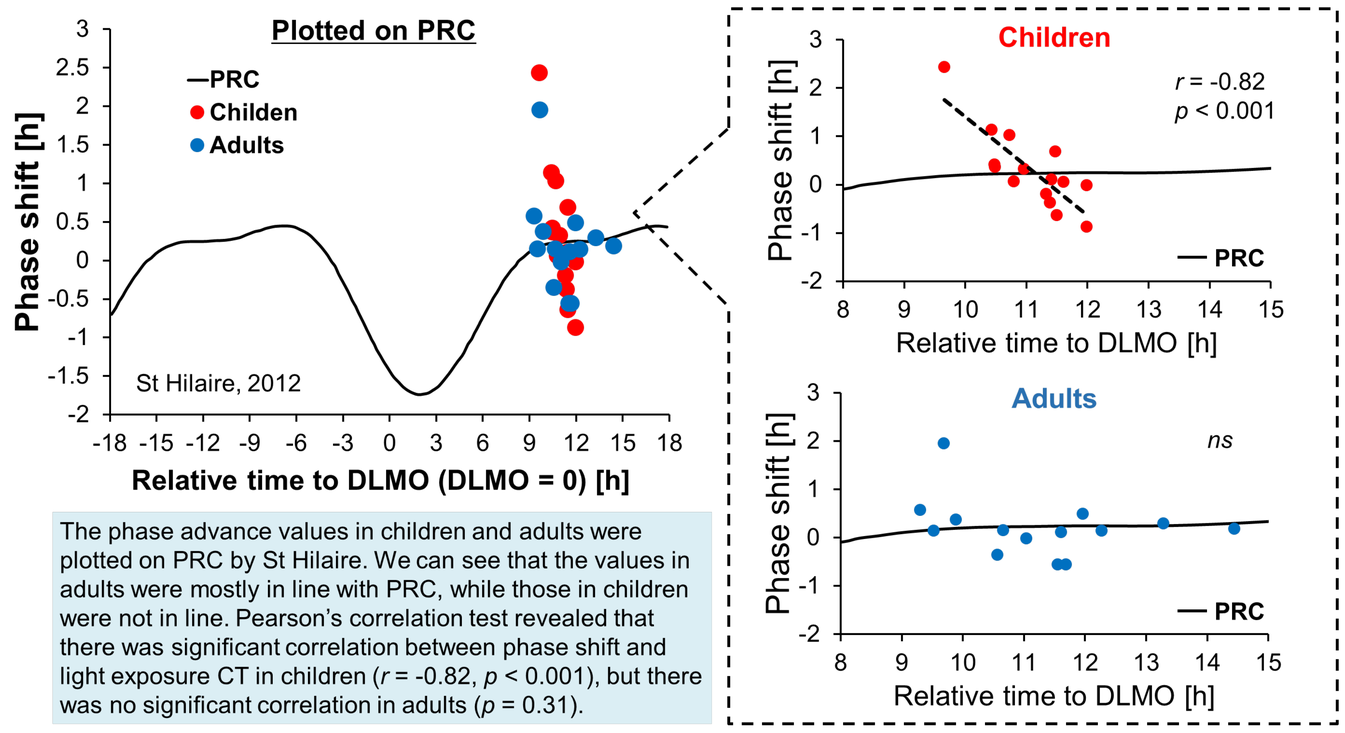
There was no significant difference in phase advance between children and adults (p = 0.73).

Light exposure timing



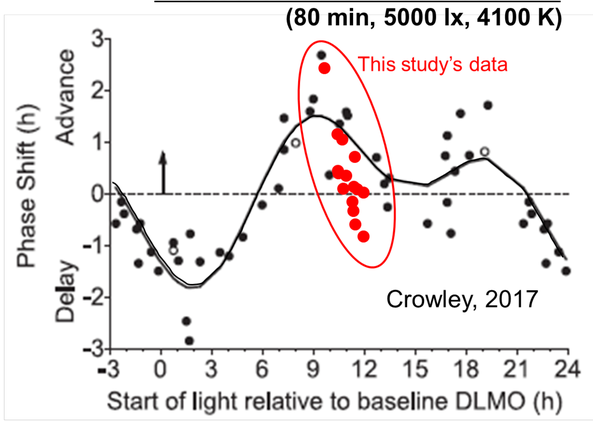
The timing of light exposure, which was targeted at CT=11h, was on average CT=11.1h for children and CT=11.3 h for adults, approximately consistent with CT=11h.
However, the range of timing of light exposure was widely distributed (9.3 – 14.5h). Therefore, we investigated the relationships between phase advance and light exposure timing.

Relationships between phase shift and circadian time of light exposure



The phase advance values in children and adults were plotted on PRC by St Hilaire. We can see that the values in adults were mostly in line with PRC, while those in children were not in line. Pearson's correlation test revealed that there was significant correlation between phase shift and light exposure CT in children (r = -0.82, p < 0.001), but there was no significant correlation in adults (p = 0.31).

Plotted on PRC in adolescents
(80 min, 5000 lx, 4100 K)



Plotting the children's phase shift data in this study on the PRC in adolescents appears to be a better fit than on St Hilaire's PRC.

Summary

- There was no significant difference in phase shift by morning light exposure between school children and middle-aged adults.
- The phase shift values in adults were mostly in line with PRC, but those in children were not in line and significantly correlated with circadian time of light exposure.
- Our findings suggest that the phase response curve in children may differ from that in adults, at least morning portion.

REFERENCES

Higuchi et al., 2014. "Influence of Light at Night on Melatonin Suppression in Children." The Journal of Clinical Endocrinology and Metabolism 99 (9): 3298–3303.
Eto et al., 2021. "Crystalline Lens Transmittance Spectra and Pupil Sizes as Factors Affecting Light-induced Melatonin Suppression in Children and Adults." Ophthalmic & Physiological Optics, 41 (4): 900–910.
St Hilaire et al., 2012. "Human Phase Response Curve to a 1 H Pulse of Bright White Light." The Journal of Physiology 590 (13): 3035–45.
Crowley and Eastman. 2017. "Human Adolescent Phase Response Curves to Bright White Light." Journal of Biological Rhythms 32 (4): 334–44.

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