Late nocturnal sleep onset impairs a melatonin shower in young children

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DEAR EDITOR; I read an excellent review written by Reiter [1] with a great interest.

The nocturnal sleep onset time in young children has progressively become later in Japan, and now, nearly half of 3-year-old children fall asleep later than 10 p.m. [2, 3]. The highest nighttime melatonin levels during the whole life span is seen in the early stages of life (1-3 years of age) [4]. Youngsters are flooded by a "melatonin shower", although no one knows its biological significance. My concern about the potential negative physiological consequences of light exposure at an inappropriate time especially during early stage of life is quite similar to that pointed out by Reiter [1]. I hypothesized that children who fall into sleep late in the night receive higher amounts of light than those who fall into sleep early in the night, and thus the melatonin levels of the late sleepers become lower than those of the early sleepers.

To confirm this hypothesis, the relationship between the nocturnal sleep habits and the melatonin levels was examined in youngsters. Since both salivary melatonin concentrations and urinary 6-hydroxymelatonin sulphate (6HMS) excretion rates are reliable indices of serum melatonin concentrations [5], these non-invasively obtained samples were measured. 6HMS concentration was expressed as a function of creatinine excretion [6].

Fifty-six healthy 3-year-old children were studied. Informed consent was obtained from the guardians of each child. The guardians were asked to record sleep logs of the children for 7 consecutive days, and to collect saliva (n=42) or urinary (n=14) samples just after waking in the morning for any of three days during the 7-day period of the recording. Saliva samples were asked to collect before rinsing the mouth. Samples were stored at -20°, and were measured by a radioimmunoassay by a commercial company (SRL LTD.).

Among the 126 salivary samples collected, 109 samples had enough saliva for the assay. Eighty-one samples showed melatonin concentrations of less than 2.8 pg/ml. The mean sleep onset time on the night before the collection of these 81 samples (9:41 p.m.) showed no significance difference from that for the other 28 measurable samples (9:30 p.m.). The mean wake-up time in the morning of the 81 samples with undetectable melatonin levels tended to be later (8:00 a.m.) than that for the 28 measurable samples (7:36 a.m.) (*t-test*, $0.05<p<0.1$).

Among the 28 measurable saliva samples, the average melatonin concentration in the 16 samples with sleep onset times of earlier than 10 p.m. (6.3 pg/ml) tended to be higher than that in the 12 samples with later sleep onset times (4.8 pg/ml) (*t-test*, $0.05<p<0.1$). However, no statistically significant difference was obtained between the 13 samples with wake-up times

of earlier than 7:30 a.m. (5.6 pg/ml) and the 15 samples with later wake-up times (5.7 pg/ml).

Among the 42 urinary samples collected, 38 samples were deserved of measurement. The average urinary 6HMS concentration in the samples with sleep onset times of 11 p.m. or later (178.5 ng/mg creatinine) tended to be lower than that in the samples with earlier sleep onset times (244.0 ng/mg creatinine) (*t-test*, $0.05<p<0.1$). In addition, the average urinary 6HMS level in the samples with wake-up times of 7:30 a.m. or earlier. (262.2ng/mg creatinine) tended to be higher than that in the samples with later wake-up times (208.0ng/mg creatinine) (*t-test*, $0.05<p<0.1$).

The elevation tendency of melatonin in cases with earlier wake-up times is likely to be due to a physiological drop of melatonin levels in the morning by light. However, we found that the average salivary melatonin and urinary 6HMS concentrations in the cases with earlier sleep onset times tended to be higher than that in the cases with later sleep onset times. This finding is consistent with my hypothesis. In recent times, 24-hour-restless social activity has become dominant. Young late sleepers have been found to get less sleep than early sleepers [2, 3]. In addition to this sleep deprivation, according to the current result, young late sleepers are likely to suffer from the lack of a "melatonin shower". Given that melatonin is a free radical scavenger and antioxidant, free radical damage may be aggravated by light suppression of melatonin levels [1].

Young late sleepers might suffer from the higher incidence of cancer later in their lives.

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