SYNOPSIS

KEY POINT SUMMARY

OBJECTIVES

The purpose of the study is to determine the impact of increased light exposure on sleep and circadian rhythms in patients with severe Alzheimer's disease.

Increased Light Exposure Consolidates Sleep and Strengthens Circadian Rhythms in Severe Alzheimer's Disease Patients Increased Light Exposure Consolidates Sleep and Strengthens Circadian Rhythms in Severe Alzheimer's Disease Patients

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Key Concepts/Context

Studies with examined levels of illumination in adults have shown that the average level and the average amount of bright light exposure is lower in the elderly compared to younger adults, particularly in patients who are institutionalized with dementia. Although insufficient light exposure has been implied as a cause of sleep fragmentation, until recently there had been little direct evidence for this correlation. A recent study suggested that daytime light exposure impacts both nighttime sleep consolidation and timing of peak activity level (Shochat et al., 2000). In an attempt to improve sleep in nursing home patients, the current laboratory study exposed patients with mixed types of dementia to 2,500 lux for two hours a day for 10 days either in the morning or in the evening and tested the impact of the bright lighting on sleep and circadian rhythms.

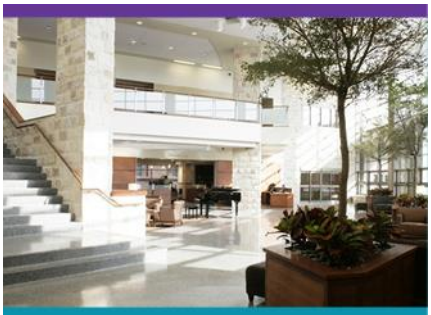
Methods

- Ninety-two patients (63 women) participated in the study. All had lived in the nursing home for a minimum of two months. The mean age of patients was 82.3 years and there was no significant difference in age between men (80.2 years) and women (83.3 years).

- The Actillume recorder (Ambulatory Monitoring, Inc., Ardsley, NY) was used to measure wrist activity. The Actillume, a wrist-mounted device, records both activity level and light exposure. Movement is recorded with a linear accelerometer and a microprocessor. Light is collected via a photosensitive cell. Apollo "Brite-Lite" boxes (Apollo Light Systems, Orem, UT) were used for the light treatment administration. Dim red light was administered with a similarly constructed red light box.
- Three variables were measured: 1) level of illumination, 2) maximum activity level per minute, and 3) mean activity level per minute. Activity data were scored with ACTION 3 software to determine wakefulness and sleep based on both maximum and mean minute-by-minute activity. Mean lux level and number of minutes of bright light exposure were computed.
- Patients were randomly assigned to one of three treatment groups: morning bright light (n = 30), morning dim red light (n = 31), or evening bright light (n = 31). Wrist activity data were collected for three days of baseline, followed by 10 days of treatment (treatment days 1–5 and 6–10) and five days of post-treatment follow-up. Morning bright and dim red light treatments were given from 9:30 a.m. to 11:30 a.m. Evening bright light was given from 5:30 p.m. to 7:30 p.m., as our experience was that the patients were often in bed and asleep by 7:30 p.m. Patients could eat, converse, play cards, watch television, and so on during treatment sessions as long as they remained facing the light box.

Findings

- None of the three light treatment conditions had any significant effect on actigraphically measured sleep or wakefulness during the day or night.
- The duration of the maximum sleep bout at night increased from 64.9 minutes to 88.4 minutes in the morning light group, $t = 2.04$, $p = .05$, and from 71.4 minutes to 95.0 minutes in the evening bright light group, $t = 2.66$, $p = .02$ (see Fig. 2). Changes in the morning dim light group were not significant (107.4 min to 89.0 min).
- During the day, there were no significant differences in length of wakefulness bouts from baseline to treatment days six–10. However, there was a significant change in the mean duration of wakeful bouts from treatment days six–10 to post-treatment follow-up with mean wakeful bout length decreasing from 220.2 to 160.3 minutes in the evening bright light group, suggesting a re-lapse or rebound effect. There were no significant effects of light treatment in lengths of wakeful bouts during the night or on sleep bouts during the day.
- The rhythmicity of the rhythm improved with evening bright light. There was no significant effect with morning bright or morning dim red light. There were no effects of light on any of the other activity rhythm variables.



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Limitations

No limitations were identified in the study.

Design Implications

The study suggests that increased bright light exposure, whether in the morning or in the evening, consolidates nighttime sleep by lengthening the maximum sleep bouts during the night. Also, evening bright light strengthened the circadian activity rhythm. Therefore, various design approaches regarding building orientations, window locations or sizes need to be considered to increase morning and evening (both natural and artificial) bright light exposure of patients.