SYNOPSIS

KEY POINT SUMMARY

OBJECTIVES

The objective of the study was to measure the impact of dynamic lighting as compared to conventional lighting on patients with severe dementia in relation to their emotions, agitation, melatonin levels, and circadian rhythm.

Bright Light Delights: Effects of Daily Light Exposure on Emotions, Restactivity Cycles, Sleep and Melatonin Secretion in Severely Demented Patients

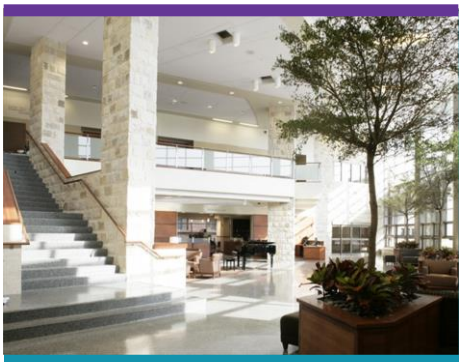
Münch, M., Schmieder, M., Bieler, K., Goldbach, R., Fuhrmann, T., Zumstein, N., Vonmoos, P., Scartezzini, J.-L., Wirz-Justice, A., Cajochen, C., 2017 | *Current Alzheimer Research*. Volume 14, Issue 10, Pages 1063-1075

Key Concepts/Context

Exposure to sufficient light on a daily basis is important for individuals to maintain their health. Studies have shown that light has an effect on heart rate, body temperature, human behavior, mood, body hormones, genes, and cognitive ability. Moreover, adequate exposure to daily light stabilizes the body's circadian rhythm. This study evaluated the impact of dynamic versus conventional artificial lighting on severely demented patients living in a nursing home.

Methods

The study was conducted over an eight-week period during October-December 2012 at a nursing home in Switzerland. A total of 89 patients were divided into two groups based on the amount of light exposure: high and low light. The groups included 31 men and 58 women between the ages of 55 and 95 from nine different wards. They were divided into the high light group (17 men, 27 women) and the low light group (14 men, 31 women). The study and its procedures were approved by the local IRB. As pre-established lighting conditions at the nursing home dictated, dynamic lighting systems were located in nine day-rooms and conventional lighting was in 12 day-rooms. The patients spent time in their assigned living rooms that had windows, with only two exceptions. Moreover, the patients were able to walk outside for exposure to natural light exposure. Ambient illumination measurements were taken daily at different times in the living rooms.



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The study was completed using questionnaires completed by staff members, daily observation, wrist activity monitors, and collected saliva and blood samples. The procedures were conducted according to the following:

Questionnaires – Initially an assessment questionnaire of the patients' cognitive ability was carried out using the Severe Mini-Mental Status Evaluation (S-MMSE). In addition, two other questionnaires were completed weekly: the Change in Advanced Dementia Score (CADS) and the Cohen Mansfield Agitatory Inventory (CMAI). The CADS was used to assess the patients' independence during daily activities while the CMAI measured their aggressive and agitated states. A fourth questionnaire on the Quality of Life for Severe Dementia (QUALID) was completed twice during weeks 4 and 8.

Observed Emotion Rating Scale (OERS) – Distinct momentary facial expressions as well as body language were observed daily. The observers timed five different emotions in the patients they were assigned to: pleasure, general alertness, anger, sadness, and fear.

The data from the questionnaires and the observations were digitized and analyzed using mixed linear regression models with the factors patient group, gender, and time of day.

Rest-activity Cycles – Wrist-monitors were used to measure daily activities under different illuminations in one-minute intervals. The data was downloaded weekly and evaluated for accuracy in 24-hour periods. The following circadian rhythm variables were analyzed: inter-daily stability (IS), inter-daily variability (IV), and relative amplitude (RA). The collected data was evaluated using non-linear regression analysis.

Saliva Samples – To determine changes in melatonin concentration in each patient, samples were collected during week 8 toward the end of the study. Patients provided six samples with the first taken six hours before bedtime and repeated every hour. The samples were then frozen and sent for analysis

Findings

The questionnaire scores for the S-MMSE were low, demonstrating that the patients who participated in the study were severely cognitively impaired. For the CADS results, there were no significant differences between the two light groups regarding physical mobility and independence; however, the numbers were higher for men in both groups. The SMAI scores showed higher agitation for men than women without any change being reported for the high light group. For the QUALID, the quality of life was higher in the high light group for both men and women. The OERS showed time dependency changes in emotions during the 820 hours of observation. Anger emotions were higher in the evenings, while pleasure emotions were higher during the day. The high light group showed significantly

higher overall numbers for pleasure and alertness. The rest-activity cycles data results showed significantly higher activity for men in both groups between 10:00 a.m. and 8:00 p.m. The melatonin concentration data in both groups did not yield any conclusive results and was contradictory at times.

The authors explained that more than 60% of patients in the dynamic light group benefitted from the higher illumination during the daytime. About 40% of the patients in the control group showed positive results from exposure to daylight through windows or from being outside. In general, higher daily light exposure resulted in positive emotions, increased alertness, and higher quality of life in the severely demented patients. On the other hand, the circadian amplitude reduction was more pronounced in men than in women during the day for the lack of sufficient light exposure.

Limitations

The study compared the effect of dynamic and normal artificial lights on patients with severe dementia; nevertheless, no evidence was found to support positive results regarding either one. To further confuse the issue, patients in the two groups were exposed to natural light during the study period. The authors admitted that they could not separate whether the effects they found between the two light groups were because of dynamic lighting or daylight exposure, rendering the findings inconclusive.

Design Implications

The authors parsimoniously concluded that higher light levels and longer exposure times had a positive effect on patients with severe dementia. As noted, this was possibly related more to daylight exposure than dynamic lighting, since the higher positive scores were recorded during the day. The dynamic lighting system was not shown to be superior to conventional lighting; therefore, no recommendations were made. On the other hand, the study did not discuss any particular design elements or methodology regarding the increase of natural light exposure.