

Short Note

A Portable Light Source for Bright Light Treatment

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Summary: A novel, portable, inexpensive bright light source is described. This unit, which has been demonstrated to exhibit physiological effects similar to those of the more conventional light boxes, offers a less restrictive home treatment for patients with seasonal affective disorder and sleep disorders. **Key Words:** Light-hat—Melatonin—SAD—Sleep disorders.

Artificial bright light has previously been demonstrated to shift the phase of disordered biological rhythms that occur in jet lag, shift work, delayed sleep phase syndrome, and seasonal affective disorders (SAD) (1-3). Some authors have attributed this therapeutic response to the ability of bright light to suppress nocturnal melatonin concentrations and thereby correct the disordered rhythm(s) (4). Others have regarded the melatonin rhythm simply as a biological marker for estimating the phase of the circadian pacemaker or for estimating the suppressive effect of light on rhythm amplitude (see reference 5 for review).

The conventional bright light source used in such studies consists of eight Vita-Lite fluorescent tubes encased within a box (size, 129 × 71 × 18 cm) with a Plexiglas diffuser (total weight, 23.5 kg) (6). Because of its size and weight, such a unit is severely restricting for both research and therapeutic uses. For bright light therapy, several subjects are either confined to one source at the same time (conventionally early morning) or, due to the cost of manufacture, only a limited number of subjects can be supplied with units for use in their own homes. However, even in the latter case the size

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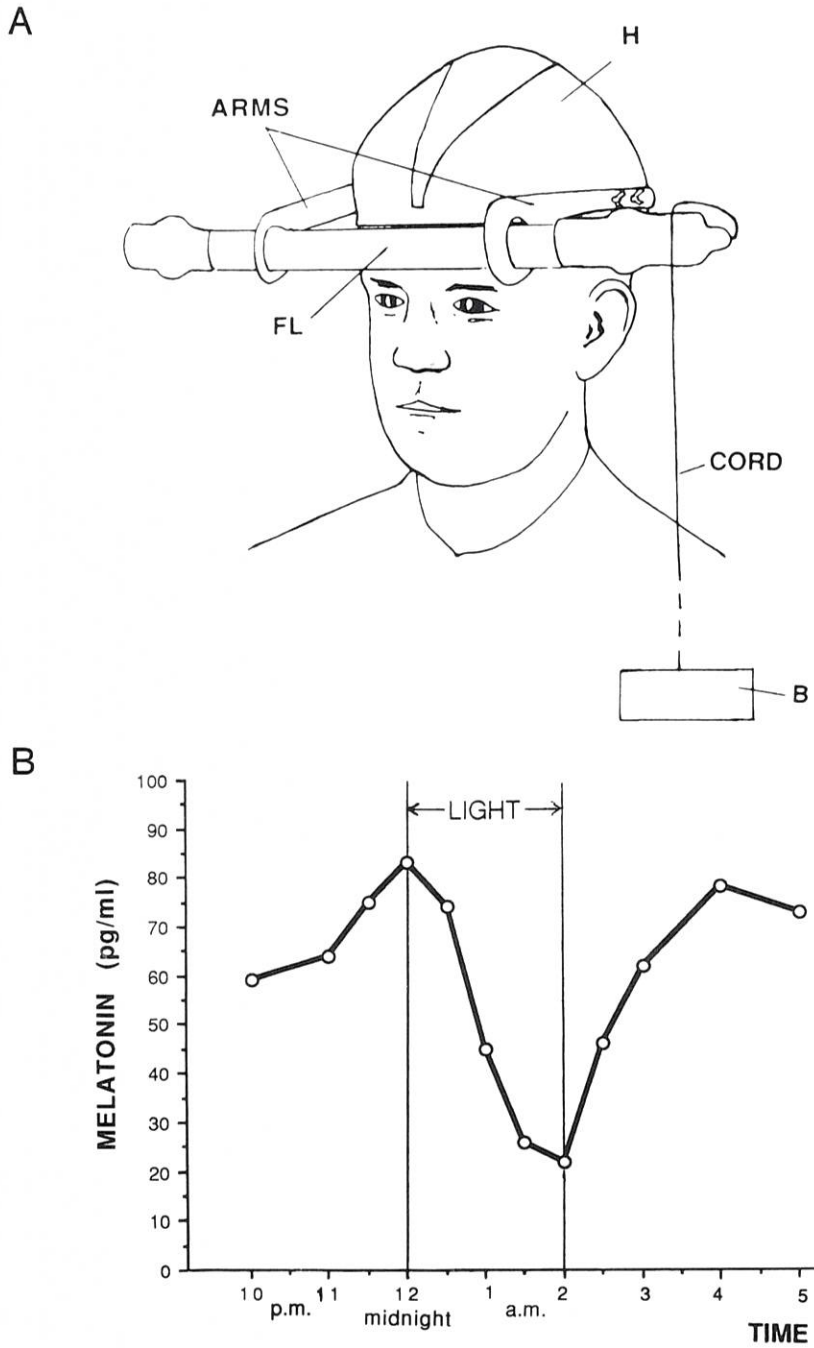


FIG. 1. A: Diagram of portable light unit. H, Helmet; FL, Fluorescent tube; B, Battery. B: Nocturnal plasma melatonin response to bright light via the portable unit in a normal healthy subject.

and weight of the unit restricts the subject to sitting in one place for the 2–3-h session. In this report, we describe the use of a novel, portable, inexpensive bright light source and its effect on nocturnal plasma melatonin levels.

The light source consists of an 8-W, 12-V solid state fluorescent light (Work Lite) designed for home examination of car engines (Aus \$15). The light was mounted on a plastic helmet (Aus \$9) designed for construction site workers (Fig. 1) and was held in place by two plastic arms; the angle of the arms could be adjusted by moving screws on each side so that the light tube was at a level just above the eyebrows. Each hat could be adjusted for individual head size. The total weight of the hat and the light was 0.65 kg. This light produced 1,500–2,200-lx intensity at the supraeyebrow level. Greater intensities can be achieved by lowering the light in line with the eyes. The 15-ft cord supplied with the light was shortened, and a 240-V, 50-Hz on/off switch was installed within easy hand reach when the hat was worn.

This cord was clipped to a battery. For patient use it was important that the battery lasted a minimum of 3 h before recharging but could not explode on excessive recharging. A 12-V battery (Exide; Aus \$30) was chosen despite its weight (1.2 kg). The battery could be carried in a shoulder bag while ambulatory or placed nearby while the subject was sitting or lying down. The battery was charged by a 12-V Gel-cell (Arlec) battery charger, and subjects were instructed to recharge the battery overnight ready for morning use.

As a test of the physiological effectiveness of this light source in humans, one subject (a healthy man 43 years old) was exposed to 2 h of light from midnight. The subject sat reading and was instructed to look ahead or down at his reading material (not to stare directly at the light tube) and glance up at the light for a couple of seconds each minute. Blood was collected at hourly intervals by means as described previously (7) between 2200 and 0500 hours, but half hourly between 2300 and 0300 hours (i.e., just prior to, during, and after the light exposure). Melatonin was measured by radioimmunoassay as described previously (8). As can be seen from Fig. 1, the light produced a steady decrease in melatonin concentrations for the first 1½ h, which then levelled out to give a final suppression of 73% at 0200 hours.

Within 2 h after the light was switched off, melatonin concentrations had returned to prelight levels. Prior to each blood sampling, light intensity readings were taken (Topcon IM-3 digital light meter). This confirmed that the subject experienced 1,500 lx when looking straight ahead and 2,200 lx when looking directly up at the light tube. The portable light source described has proven in initial trials to be successful in terms of treatment efficacy for SAD and sleep disorders and in offering an inexpensive nonrestrictive home treatment unit. Subjects agree that the availability of a portable unit greatly increases their freedom of choice in daily activities carried out during therapeutic sessions.

While the light intensity (1,500–2,200 lx) is lower than that conventionally used in bright light therapy (2,500–3,000 lx), the suppression of nocturnal melatonin is comparable. Our previous studies, where 3,000-lx intensity was used over 1 h, produced 71% suppression of melatonin (9). The portable unit has been designed to permit the use of higher light intensities by lowering the arms holding the light tube, but as a safety precaution such levels will not be employed until ophthalmological examinations can be performed on all subjects. The difference between the usual light box unit and the portable hat is that in the former the subject is instructed to look at the light for a few

seconds each minute whereas in the latter, except for pupil constriction, exposure of the retina to bright light is unavoidable.

A recent report describes a portable head-mounted phototherapy device producing 4,000 lx that is similar to this one (G. Brainard et al., unpublished data). It has been used successfully to treat SAD patients. This report confirmed that such portable light sources can produce physiological effects similar to those of the more conventional light boxes.

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