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The influence of light administration on interpersonal behavior and affect in people with mild to moderate seasonality

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ABSTRACT

Bright light is used to treat winter depression and may also have positive effects on mood in some healthy individuals. However, there is little information on how bright light treatment influences social behavior. We performed a cross-over study in winter comparing the effects of morning bright light administration with placebo (exposure to negative ions) on mood and social behavior in 38 healthy people with mild to moderate seasonality. Each treatment was given for 21 days with a washout period of 14 days between treatments. An event-contingent recording assessment was used to measure mood, and social behavior along two axes, agreeable-quarrelsome and dominant–submissive, during each 21-day treatment period. During treatments, participants wore a combined light-sensor and accelerometer to test this method for adherence to light treatment self-administered at home. Data were analyzed using multilevel modeling. Bright light improved mood but increased quarrelsome behavior and decreased submissiveness. Data from the light monitor and accelerometer suggested that 21% of the participants did not adhere to bright light treatment; when this group was analyzed separately, there was no change in quarrelsomeness or mood. However, results for individuals who followed the procedure were similar to those reported for the whole sample.

1. Introduction

Seasonal changes in mood and behavior occur both among individuals with psychiatric illnesses (Fossey and Shapiro, 1992) and among those who are healthy (Golder and Macy, 2011). Patients who suffer from seasonal affective disorder (SAD) or "winter depression" experience hypersomnia, increased appetite (particularly carbohydrate craving), weight gain, lack of energy and loss of interest in socialization as well as depressed mood. These symptoms develop in fall and winter and fully remit during the spring and summer. Epidemiological surveys using retrospective questionnaires or diagnostic interviews demonstrate that prevalence rates of SAD in the general population are between 1.2% and 9.7% in North America (Kasper et al., 1989b; Levitt and Boyle, 2002; Levitt et al., 2000; Magnússon and Axelsson, 1993; Rosen et al., 1990), and that SAD is most commonly diagnosed in women of reproductive age (Chotai et al., 2004; Levitt et al., 2000; Rosen et al., 1990). In an epidemiological study Kasper et al. (1989b) found that over 90% of their sample experienced some degree of change in mood and behavior during the winter months, and one-third of these individuals reported mild dysfunction and vegetative symptoms similar to individuals with SAD, while falling short of the diagnostic criteria for major depression. In a similar study 85% of the sample reported seasonal variations in mood and behavior (Grimaldi et al., 2009). This condition was described as a subsyndromal form of seasonal affective disorder (S-SAD). As a result, seasonality has been considered part of a human norm occurring along a continuum, with individuals with clinical diagnosis of SAD at one end and individuals experiencing no seasonal influences at the other.

Bright light therapy is a common treatment for SAD. Treatment recommendations for SAD include 30 min of light exposure at an intensity of 10,000 lx administered immediately upon awakening, or 1 to 2 h of treatment duration at 2500 lx (Lewy et al., 2007; Terman and Terman, 2005). Control treatments for bright light therapy are often light of similar intensity to indoor lighting. However, light at a level commonly found indoors (≤300 lx) is a potentially flawed control since patients can easily distinguish between light of less than 300 lx and greater than 2500 lx, and will presumably assume that bright light will be more helpful in reducing their symptoms (Rosenthal et al., 1984). Low-density negative ions are a better control for bright light that has been used recently, and like light, are an environmental factor. Four randomized controlled trials with large sample sizes have demonstrated that low-density negative ions emitted from a negative ion generator are less effective than either high-density negative ions or bright light for treating winter depression (Eastman et al., 1998; Goel and

Abbreviations: SAD, seasonal affective disorder; S-SAD, subsyndromal seasonal affective disorder; HRSD, Hamilton Rating Scale for Depression; SIGH-SAD, Hamilton Rating Scale for Depression Seasonal Affective Disorder Version; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders Fourth Edition; SPAQ, Seasonal Pattern Assessment Questionnaire; BDI, Beck Depression Inventory; GSS, Global Seasonality Score.

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Etwaroo, 2006; Terman and Terman, 2006; Terman et al., 1998). As participants in light studies can be told that negative ions can raise mood and that they will be exposed to negative ions (without being told that they are at low level), this treatment is a plausible control treatment for bright light, which is more believable than room level light.

Given the common occurrence of seasonal changes in mood and behavior similar to, but less severe than, those associated with SAD, several studies have examined the effect of light administration on mood in healthy individuals. A number of studies (Avery et al., 2001; Kasper et al., 1989a, 1990; Partonen and Lönnqvist, 2000) found that bright light (2500 lx) improved mood and vitality in healthy individuals, who reported experiencing winter changes in their mood and behavior, but considered such fluctuations as normal seasonal experiences. However, other studies found no beneficial effect of light (Bauer et al., 1994; Genhart et al., 1993; Rosenthal et al., 1987). One possible explanation for the inconsistent results is the relative insensitivity of the scales sometimes used. Studies often used the Hamilton Rating Scale for Depression (HRSD)-SAD version (SIGH-SAD) (Williams et al., 1992). This scale included items for vegetative depressive symptoms to measure levels of SAD symptomatology. As this scale is designed for use in patients, healthy individuals usually have low baseline scores. Another drawback relating to the use of self-report questionnaires such as SIGH-SAD as an outcome measure is that participants usually answer the questionnaire before the treatment and after the end of the treatment trial. Their answers are subject to retrospective bias and are likely to be influenced by both the timing of the assessment and events that happened that day (Moskowitz and Young, 2006).

Individuals who are sensitive to environmental changes and report SAD symptoms also have high scores for the personality trait of neuroticism (Ennis and McConville, 2004; Enns et al., 2006; Murray et al., 2002). Individuals scoring high on this trait demonstrate a predisposition to submissive and quarrelsome behaviors (Côté and Moskowitz, 1998). Given the importance of social functioning for general well-being, there is a need to assess how bright light influences social interactions, along with affect, in healthy individuals with mild to moderate seasonality.

Moskowitz (1994) developed a method to assess aspects of social behavior in everyday life, using event-contingent recording. This method accurately estimates interpersonal behavior by aggregating social event data, recorded shortly after each social interaction that lasted at least 5 min, accumulated over a 12-day period. Previous studies have demonstrated that this method shows reliability and validity in assessing interpersonal behavior and affect (Moskowitz and Young, 2006), and is sensitive to neurochemical changes. When healthy participants were given tryptophan and placebo in a cross-over design the participants were unable to guess accurately which treatment they were on. Nonetheless, tryptophan decreased quarrelsome behaviors without altering mood (Moskowitz et al., 2001).

Little information exists concerning adherence to bright light therapy by patients or other seasonal individuals. Light therapy has fewer side effects than antidepressants, and side effects are reported as one of the primary reasons patients stop antidepressant treatment. Nevertheless, the procedure can be demanding as patients are required to wake up early and sit in front of a light box for at least 30 min. A follow-up study of 59 SAD patients who participated in a trial of light therapy showed that as many as 19% of patients discontinued using light treatment due to inconvenience (Schwartz et al., 1996). In two SAD studies elapsed time meters were used to record the total time that light boxes had been switched on, and found that the lights were in general turned on when they should be (Michalak et al., 2002, 2007). However, given that light intensity is inversely proportional to the square of the distance from the light source to the observer, researchers would ideally like to know that patients are sitting in front of the light source at the instructed distance for the specific time duration. The fact that a light is switched on does not necessarily mean that the participant is even in the same room as the light. More recently elderly patients with nonseasonal depression were asked to wear light sensors on their wrists during light treatment. Although light measured by the sensor during the planned light exposure was greater during treatment (mean: 247 lx) than in the weeks before treatment (mean: 73 lx) or after treatment (mean: 139 lx), the light intensity was far below that recommended to have a therapeutic effect (Lieverse et al., 2011).

The ideal way to measure light exposure would be with a light monitor worn next to the eye, but this procedure may not be practical. A wrist-worn actigraph that monitors movement and light exposure may be a more informative choice of advice for monitoring adherence in light therapy if participants are asked to keep their wrist above the table on which the light is placed. Nonetheless while two studies mentioned the use of actigraphy and light sensors to monitor activity and daily light exposure, they did not report the results on the adherence to the light treatment (Thorne et al., 2008; Winkler et al., 2005).

The first aim of this study was to examine the possible effect of bright light administration in winter on daily social behavior and mood of healthy people with mild to moderate seasonality. The second aim was to assess whether adherence to bright light administration could be assessed using Actiwatch, a wrist worn device equipped with an accelerometer and a light sensor.

2. Methods

2.1. Participants

This study was approved by the Research Ethics Board of the McGill University Health Centre and carried out in accordance with the Declaration of Helsinki. Participants were recruited from the community in Montreal, Canada (near latitude 45º N) using advertisements in local newspapers and websites. Advertisements included the statements: "Looking for healthy men and women for a study comparing the effects of bright light and negative air ions on how individuals interact with others." People who phoned and expressed interest in the study were given a detailed explanation. If they were willing to participate and were mildly or moderately seasonal according to the Global Seasonality Scale, using criteria given below, they were invited for an interview in the lab. After providing written informed consent, participants were interviewed using the Structured Clinical Interview for DSM-IV, Non-Patient Edition (Spitzer et al., 1995) and completed two questionnaires: the Seasonal Pattern Assessment Questionnaire (SPAQ) (Kasper et al., 1989b) and the Beck Depression Inventory (BDI) (Beck and Steer, 1987). The Global Seasonality Score or GSS is one of the scales in the SPAQ. The SPAQ is a self-report screening instrument for seasonal mood and behavior variations. It has 6 items that measure the intensity of seasonal variations in sleep length, social activity, mood, weight, appetite and energy level. Each item is scored from 0 (no change) to 4 (extremely marked change), for a total GSS range of 0 to 24.

The main inclusion criteria were a GSS score from 6 to 11 both at the initial telephone interview and during the interview in the lab screening, and working at least 30 h per week and not working past midnight. The range from 6 to 11 on the GSS was chosen because 6 was above the mean of 5.4 in an epidemiology study and scores above 11 identify individuals in the clinical range. The range chosen includes about one third of the population (Kasper et al., 1989b). Those working alone were excluded. The requirement to be working with others was to ensure that participants had a range of social interactions. Other exclusion criteria were current or past Axis I disorder according to DSM-IV, determined by the Structured Clinical Interview for DSM-IV, Non-Patient Edition, or self-report of significant medical illness, eye illness, use of psychotropic medication, pregnancy and lactation.

During the winters of 2007 and 2008, a total of 47 individuals passed the screening and began the study. Two women dropped out of the study due to job loss before the completion of the first study period and one woman dropped out after one week of participation due to an