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Light Therapy for Seasonal Affective Disorder In a Clinical Office Setting

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Abstract

Objective—To determine predictors of response to light therapy (LT) for seasonal affective disorder, winter version, in a clinical office setting for patients with a spectrum of seasonality, defined by the Seasonal Pattern Assessment Questionnaire (SPAQ).

Method—A retrospective review was done of charts of 51 patients who had been treated with a 1-week light therapy intervention. Patient self-rated scales applied in a standard manner were used to measure clinical progress. The Beck Depression Inventory (BDI) with added atypical features was used as the primary outcome variable. Sleep patterns were analyzed and the effect of psychotropic medications on outcome was determined. Seven point scales were used to assess expected response and global response. The importance of having LT set up and available in an office setting was evaluated. Retrospective degree of disability was measured based on the SPAQ degree of problem. The severity of the depressive episode was determined based on BDI score at entry.

Results—Seasonality (how a patient's symptoms vary as a function of the season of the year), degree of disability based on the SPAQ, and severity of depressive episode at entry based on the BDI predicted response to LT. Greater severity at baseline based on BDI score predicted less chance of attaining full remission within 7 days of treatment compared with patients with lower severity scores at entry on the BDI. Sleep patterns relative to a fixed treatment time of 7 AM did not predict LT response. Light therapy was effective on its own, and the results were mixed as to whether adding LT to an existing antidepressant medication produced superior results.

Conclusion—Degree of seasonality can be used as a predictor of response to LT and may be clinically useful when suggesting that patients consider a trial of LT.

Keywords

light therapy; seasonal affective disorder; “winter blues;” Seasonal Pattern Assessment Questionnaire; melatonin; Morningness-Eveningness Questionnaire; Beck Depression Inventory

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INTRODUCTION

Seasonal affective disorder (SAD) is a subcategory of mood disorders characterized by a pattern of mood symptoms that occur at particular times of the year. The *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition, Text Revision* (DSM-IV-TR) includes a seasonal pattern specifier that can be applied to a major depressive episode (MDE) in bipolar I disorder, bipolar II disorder, or major depressive disorder, recurrent.¹ A seasonal pattern of symptoms implies that: a) there is a regular temporal relationship between MDEs and a particular time of the year (ruling out seasonally-related psychosocial stressors), b) full remissions also occur at a characteristic time of the year; c) within the last 2 years, MDEs have occurred that demonstrate these temporal relationships, and no nonseasonal MDEs have occurred, and d) over the person's lifetime, seasonal MDEs substantially outnumber nonseasonal MDEs.¹

Seasonal changes of mood can occur on a *spectrum*, ranging from those considered within the normal range to mood changes that are significantly beyond the normal range. The mild to moderate range of such mood changes can be classified as subsyndromal SAD (SSAD), sometimes referred to as "the winter blues." If seasonal mood symptoms are in the moderate to severe range, a diagnosis of full SAD is made. SSAD tend to affect sleep and energy especially, with some degree of effect on mood. In contrast, SAD is characterized by a full array of more severe symptoms, including effects on mood.²⁻⁴

There are two major types of seasonal affective disorder. *Winter depression* is by far the more commonly known and researched presentation. The usual symptoms in this group include hypersomnia, hyperphagia, carbohydrate craving, and weight gain in winter.^{2,5,6} Winter depression has a more clearly defined trigger of lack of light, and light is more clearly therapeutic. Latitude had been shown to affect the incidence of SAD and SSAD, with a higher prevalence in locations that are further from the equator in the northern hemisphere.^{7,8} In contrast, *summer depressions* are more likely than winter depressions to have endogenous vegetative symptoms, with decreased appetite and decreased sleep. In summer depressions, the triggers are less clear; light and heat may be triggers and cold and/or dark may be therapeutic.⁹ In the literature and lay press, the term SAD tends to be used to refer to the winter depression almost exclusively, and in the rest of this article, the terms SAD and SSAD are used to refer to the winter version of this disorder.

Numerous treatments are thought to be effective for SAD, including antidepressant medications and exposure to light at specific times of the day. However, some data suggest that light exposure at any time of the day is better than no light therapy at all.^{10,11} A few studies have shown a more robust response when light therapy is correctly timed relative to the patient's circadian rhythm, which is often determined by sleep patterns and responses to questions on the Morningness-Eveningness Questionnaire (MEQ).¹²⁻¹⁵ For excellent reviews of the factors involved in chronotherapeutics for mood disorders, readers are referred to three sources: Wirz-Justice et al. 2009,¹⁶ Lam and Tam 2009,¹⁷ and Partonen and Magnusson 2009.¹⁸

Many controlled trials of light therapy have been done. Although excellent consensus guidelines on the treatment of SAD were published in 1999¹⁹ and various predictors of response to light therapy, such as hypersomnia, reverse diurnal variation, afternoon evening slump, and carbohydrate craving, have been identified,²⁰ many clinicians have been individually reticent to use light therapy. This article describes a trial of light therapy in a clinical office setting with patients who displayed a spectrum of seasonality ranging from normal variation to full SAD. This evaluation of response to light therapy in patients with

such a spectrum of seasonal presentations provides new clinically relevant insights into predictors of response to light therapy in an applied practice setting.

METHODS

Patients were individually referred to our light therapy room at the University of Rochester Medical Center, (latitude 43.154N) by clinicians in the community over a period from October, 2001, through October, 2006, for a 1-week daily trial of light therapy. This brief 1-week period, beginning on a Monday and continuing through Sunday, was chosen because it has been shown that light therapy often works very rapidly,² and this model would serve as a community resource to assist patients and providers with the logistics of trying light therapy. If effective, patients would continue LT through their ongoing provider.

Referring clinicians provided information on DSM-IV diagnoses of mood disorders, and whether or not seasonal variation occurred. Nearly all referrals involved patients who were reported to have a clinically determined seasonal pattern of mood changes. However, the Seasonal Pattern Assessment Questionnaire (SPAQ) was also used to more finely classify seasonal patterns in a standardized fashion. The SPAQ, Modified Version^{3,21} was administered at baseline to classify patients as having SAD, SSAD, or normal seasonal variation of moods, based on responses to SPAQ Questions 1 and 2. Question 1 asks about a pattern of feeling worst or best on ten different variables during various months of the year. Question 2 establishes the seasonality of symptoms, asking: "To what degree do the following change with the seasons?": A score of 0 (no change) to 4 (extremely marked change) is ascribed to each of the following six items: sleep length; social activity; mood (overall feeling of well-being); weight; appetite; and energy level. This results in a continuum of possible scores ranging from 0 (no seasonality) to 24 (the most seasonality). Patients who reported a pattern of feeling worse between December and February on Question 1 and who had a seasonality score of 11 or higher on question 2 were classified as having SAD. Patients who reported the same seasonal pattern on Question 1 but had a score of 8–10 on Question 2 were classified as having SSAD. Patients with a seasonal pattern of variation on Question 1 but who had scores of 7 or less on Question 2 were considered to have a normal seasonal variation of mood. Degree of disability from seasonal symptoms was determined on the basis of SPAQ Question 3, which asks "If you experience changes with the seasons, do you feel that these are a problem for you? Responses range from 0 (none) to 5 (disabling). Seasonal food preferences were determined based on patients' responses to Question 6 on the SPAQ, which asks "Do you notice a change in food preference during the different seasons?" with yes = 1 and no = 2.

Other types of baseline information were also gathered. When patients arrived on the first day of treatment (Day 1), the Beck Depression Inventory (BDI),²² with questions about atypical feature added to capture symptoms usually found in SAD,²³ was administered to obtain a baseline value. Atypical features refer to a pattern of hypersomnia, hyperphagia, and weight gain associated with a depressive episode. Severity of the depressive episode at treatment entry was determined by baseline BDI scores: 0–10 (normal moods), 11–16 (mild mood disturbance), 17–20 (borderline clinical depression), 21–30 (moderate depression), 31–40 (severe depression), and over 40 (extreme depression).

The BDI (with atypical features) was also administered on Days, 3, 5 and 7 (Wednesday, Friday, and Sunday, respectively) of the week of light therapy; this was the primary variable used to determine response to LT. Change in BDI scores was calculated as change from baseline BDI (BDI Day 7 minus BDI Day 1). Remission of symptoms was defined as a final BDI at Day 7 ≤ 10.

A sleep history, including recent average time of going to bed and awakening, was also obtained. From this information, Estimated Dim Light Melatonin Onset (E-DLMO) was calculated from the equation $Y_{DLMO} = 0.91 X_{\text{sleep midpoint [expressed in decimal hours]} + 18.73$.¹² For example, if sleep onset is 11:00 pm and sleep offset is 7:30 AM, the sleep midpoint is 3:15 AM (3.25 expressed as fraction of an hour). $E-DLMO = 0.91 \times 3.25 + 18.73 = 21.69$ (21:41 military time or 9:41 PM conventional time). Although an estimated value, E-DLMO was particularly relevant for determining if our fixed treatment time of 7AM in an office setting was affecting the patient's response relative to his or her usual sleep patterns. The patient's medications were also recorded.

Patients were also asked to rate on a 7-point scale how important it was for them to have light therapy setup and initial supervision in an office setting. The range of choices and scores were: 1) very much important ("I probably would not have tried it otherwise") to 7) very much unimportant ("I definitely would have tried it otherwise"). This question was asked to compare current (2001–2006) importance of office set up of LT compared to earlier unpublished data on patient experience with LT, when it was a newer, less known, less mainstream intervention for patients and clinicians (1993–1997). Patients were also asked on Day 1 how they expected to respond to light therapy (LT), as measured on a 7-point scale. This was the "expected LT response" score. On Day 7, patients were asked how they felt they had responded to LT using the same 7-point scale, and we defined this as "global LT response." The following 7-point scale was used to rate the expected and global response: 1) very much improved, 2) much improved, 3) minimally improved, 4) no change, 5) minimally worse, 6) much worse, 7) very much worse.

Patients received approximately 8000 lux of light for an hour each day in the Light Therapy Room, on Monday through Friday (Days 1–5 of treatment). They were given portable loaner lights for Saturday and Sunday (Days 6 and 7) to use at the same time (7 AM) and the same lux (8000 lux) on the weekend, and were instructed to return lights and forms the following week. The Light Therapy Room was comprised of 14 eight foot Vita-Lite full spectrum bulbs, covered with a Plexiglas filter to filter UV rays. Illuminance in lux was determined by light meter at various distances from bulbs. The loaner light system was a light box from the Sunbox company and lux measurements were provided by the company at various distances from bulbs.

For each patient, a clinical report was prepared and analyzed by the first author (MRP) that classified patients as SAD, SSAD, or having normal variation and provided BDI scores on Day 1, 3, 5, and 7, and percentage decrease in symptoms over the 1-week period. Referring clinicians were given a key that described the meaning of scores on the SPAQ and the BDI as well as explaining the 7-point scale on which patients scored their pre-treatment expectation of response and their post-treatment response. This report served as a clinical record of the patient's trial of light therapy and his or her 7-day response.

Charts from patients treated with light therapy were then retrospectively reviewed in a standardized fashion. Data were obtained in aggregate format and patient anonymity was maintained. This retrospective chart review was submitted to Research Subjects Review Board at the University of Rochester Medical Center and was classified as exempt given its retrospective review of standardized clinical information. All identifiable personal health information was removed.

Data analyses were conducted using SAS version 9.2. Univariate regression analysis was applied to assess the relationship between possible predictors and treatment outcome, measured by change in BDI and global LT response. To obtain robust estimates, methods based on estimating equations were used. Nonparametric Wilcoxon statistics were applied to

compare the treatment effects between those patients who were on antidepressant medication and those who were not. Statistical significance for all tests was set at $p = 0.05$, using two-tailed p values.

RESULTS

Charts from 51 patients were retrospectively reviewed. Of the 51 patients, 38 (74.5%) were female, with a mean age at treatment of 41.8 years (Table 1). Forty patients were determined to have SAD, 4 were diagnosed with SSAD, and 7 had normal seasonal variation of mood based upon SPAQ definitions.

As shown in Table 2, a robust relationship between symptom seasonality (as defined by SPAQ Question 2) and response to LT as determined by the change in BDI score (which has a numeric range of 0 to 63) was observed. Univariate regression analysis suggested that seasonality predicted LT response as measured by the change in BDI (coefficient = 0.767, $p = 0.0002$); i.e., the greater the difference in the patient's symptoms from winter season to summer season on these variables in Question 2 on seasonality, the greater was the chance of a response to LT (Figure 1). (Note that if only the results from the 40 patients with a baseline BDI score ≥ 11 are included in the analysis, the values would be: coefficient = 0.728, $p = 0.0070$.)

Degree of disability (SPAQ Question 3) and LT response as measured by change in BDI score were also observed to have a strong association with degree of disability (retrospective) on the SPAQ predicting change in BDI (coefficient = 3.0, $p = 0.0008$). Severity of the depressive episode at baseline also predicted response to LT as measured by change in BDI score (coefficient = 0.394, $p = 0.0005$), i.e., greater depression at baseline was associated with greater response to light therapy. However, of those patients with less severe episodes at baseline, more attained remission in 7 days (BDI on Day 7 ≤ 10) compared with those with more severe episodes at baseline based on the BDI ($p = 0.004$). This result was clinically expected and similar to results reported by Terman et al. in 1989.²⁴

In our study, the estimated values for dim light melatonin onset (E-DLMO) for SAD, SSAD, and normal variation patients were 21.63, 21.58, and 21.17 (military time as fractions of an hour), respectively, suggesting a numeric trend for greater phase delay of circadian rhythms to be associated with greater seasonality. There was, however, no significant association found between baseline sleep pattern (represented by E-DLMO) and the size of the therapeutic effect of light therapy using a fixed treatment time of 7 AM in our study. The usual wake-up time ranges for each group were SAD = 4AM to 2 PM, SSAD= 6 AM to 9 AM and Normals = 5:30 AM to 12 noon. There was a trend that the later the E-DLMO, the greater the association with carbohydrate craving (Table 1).

The overall remission rate of all subjects after 7 days of LT treatment was 46.9%. We examined whether being on an antidepressant medication along with LT had a more robust effect than LT without antidepressant treatment. Based on the global response scores, the difference between these two groups was significant ($p = 0.02$), signifying a better response when patients received LT plus an antidepressant. Based on change in BDI scores, however, the difference was not significant.

DISCUSSION

The degree of seasonality in reported symptoms can be used as a predictor of the robustness of response to LT, and may be clinically useful when suggesting to patients that they consider a trial of LT. The robustness of response to LT was positively correlated with level

of disability on the SPAQ and severity of depressive episode at study entry as measured by the BDI.

The remission rate after only 7 days of LT was impressive (46.9%). Our study supports the importance of including LT in the clinician's armamentarium for the treatment of SAD and SSAD. Our current study suggests that even those with more disabling cases based on the SPAQ would have tried light therapy without having to have it set up in an office setting. Earlier experience with LT in 1993–1997 suggested that more disabling cases as defined by the SPAQ were strongly associated with needing the first trial of LT set up in a structured office setting ($n = 38$, Kendall Tau $b = 0.35$, $p = 0.009$, M Privitera, unpublished data). The possibility that acceptance of LT for the treatment of SAD is now greater 8 years later (2001–2006) is a tempting explanation for this difference, given the coverage of light therapy in various forms of media. Since motivation is impaired in depression, ambivalence about the proposed treatment may have been more of an issue in compliance earlier in the history of light therapy than currently. Some patients preferred the structure of an office setting, but this was independent of disability severity.

Light therapy was observed to be an effective treatment on its own. There were mixed results on enhanced benefit to receiving an antidepressant medication along with LT, during the short 7-day period of treatment studied. A significant association with enhanced benefit for antidepressant medication plus LT was found based on the global response data, but not by change in BDI score.

Strengths of this study are that results were obtained in a clinical population and mirrored an operationally simple format of attempting to do light therapy in a clinical office setting. Another strength is looking at seasonality as a *continuous spectrum* and not as a dichotomous phenomenon. Weaknesses of the study include that the results are solely based on self-reported measures without direct clinician interviewing, and that there was no opportunity to clinically clarify the difference between a possible robust response on the BDI but not on the 7-point global response scale or vice versa. Other weaknesses include the fact that DSM-IV diagnoses were supplied by external referring clinicians without the opportunity for verification by a retrospective chart review, and that there was no control group, just patients with a spectrum of seasonality.

Based on evidence in the literature, LT may also show promise of antidepressant efficacy in nonseasonal depression, especially when provided in the morning and during the first week of treatment as an adjunctive strategy in responders to sleep deprivation.²⁵ Our study had only 4 patients who showed normal seasonal variation on SPAQ and had an entry level BDI ≥ 11 , so no contributory conclusions can be drawn from our study on this issue.

LT is a useful and rapid treatment for SAD and SSAD and should be more routinely used in clinical settings. Perhaps the intuitively simple concept of degree of seasonality defined on the SPAQ (measuring how different the patient's mood is on the basis of seasonal changes) may be useful to the clinician in deciding upon a trial of LT.

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Figure 1. Change in BDI versus seasonality

LT: light therapy; SPAQ: Seasonal Pattern Assessment Questionnaire; BDI: Beck Depression Inventory

Delta Beck is baseline BDI minus final BDI at Day 7, reflecting antidepressant effect of LT. Seasonality was rated based on SPAQ Question #2, with possible scores ranging from 0 (no symptoms changes across the seasons) to a possible score of 24 (the most extreme changes of symptoms with seasons).

Description of the patient sample.

Table 1

Population	Gender		Average Age ^d	Expected Response ^b	Global Response ^b	E-DLMO ^c	Food Preference ^d
	Male n(%)	Female n(%)					
All	13 (25.5)	38 (74.5)	41.8	2.4	2.6	21.56	1.2
SAD	10 (25.0)	30 (75.0)	42.0	2.3	2.6	21.63	1.2
SSAD	0 (0.0)	4 (100)	39.5	2.0	1.7	21.58	1.3
Normal variation	3 (42.9)	4 (57.1)	41.3	3.1	3.3	21.17	1.7

^a Age at treatment represented in years, average of group.

^b Results on 7-point scale, average per group: 1 = very much improved, 2 = much improved, 3 = minimally improved, 4 = no change, 5 = minimally worse, 6 = much worse, 7 = very much worse.

^c Estimated dim light melatonin onset (E-DLMO) calculated from sleep onset and wake data presented in military time using the equation $Y\text{ DLMO} = 0.91 X\text{ sleep midpoint}$ [expressed in decimal hours] + 18.73

^d Food preference: 1 = Yes, 2 = No, represented as average per group

Table 2

Multiple factors in response to light therapy: Univariate regression analyses

Relationship	Coefficient	Standard Error	p Value
Seasonality and LT response			
SPAQ #2 to predict change in BDI overall/if entry BDI ≥ 11	0.767/0.728	0.208/0.257	0.0002/0.0070
SPAQ #2 to predict Global LT Response overall/if entry BDI ≥ 11	-0.038/- 0.060	0.030/0.034	0.2000/0.0922
Severity, degree of disability and LT response			
Baseline episode severity (BDI) to predict change in BDI	0.394	0.114	0.0005
Degree of disability (SPAQ) to predict change in BDI	3.001	0.895	0.0008
Degree of disability (SPAQ) to predict Global result	0.038	0.123	NS
Baseline episode severity (BDI) to predict Global result	-0.001	0.016	NS
Importance of 1st trial of LT to be done in office setting			
Degree of disability (SPAQ) to predict importance	-0.108	0.281	NS
Severity of episode (baseline BDI) to predict importance	-0.021	0.032	NS
Baseline sleep pattern & LT response at 7AM treatment time			
E-DLMO to predict change in BDI	0.7208	0.7394	NS
Expected response & LT response			
Expected response to predict change in BDI	-1.8495	1.6058	0.2494
Expected response to predict Global response	0.3690	0.1974	0.0616

LT: light therapy; SPAQ: Seasonal Pattern Assessment Questionnaire; BDI: Beck Depression Inventory (with added atypical features); E-DLMO: estimated values for dim light melatonin onset