BRIEF REPORTS

The Effect of Adjunctive Light Therapy on Ameliorating Breakthrough Depressive Symptoms in Adolescent-Onset Bipolar Disorder

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Seven adolescents or young adults (aged 16 to 22 years) who met DSM-III-R criteria for bipolar disorder were treated for persistent depressive symptoms (greater than three weeks) with adjunctive light therapy (10,000 lux given twice per day). Patients were evaluated using the Beck Depression Inventory (BDI) and Symptoms Check List (SCL-58). Three patients showed a marked response of greater than 70% decrease of their baseline score. Two patients had a moderate decrease (40% to 74%) and two patients obtained mild to no response. There were no reported side-effects. Paired *t*-tests done on pre- and post-BDI scores (pre mean = 21.2 sd +/- 10.0; post mean = 11.1, sd +/- 8.8; paired $t = 4.31$; $p > 0.0051$) and pre- and post-SCL-58 scores above baseline of 58 (pre mean = 57.4, sd +/- 24.4; post mean = 28.7, sd +/- 18.6; paired $t = 5.50$; $p > 0.0015$) showed significant improvement. These preliminary results indicate that some bipolar adolescents with breakthrough depressive symptoms could benefit from light therapy as an adjunct to their continued thymoleptic treatment.

Key Words: light therapy, depression, bipolar disorders

INTRODUCTION

Bright light treatment is increasingly finding useful applications in psychiatry. Relatively effective, inexpensive and demonstrating minimal side-effects (Rosenthal et al 1984; Lam et al 1989; Magnusson and Kristbjarnarson 1991; Terman JS et al 1990; Blehar and Lewy 1990; Blehar and Rosenthal 1989; Schwitzer et al 1990; Terman M et al 1990; Kanter et al 1991), it may offer a potentially attractive option to pharmacotherapy in responsive patients, particularly in the treatment of seasonal affective disorder (SAD).

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The use of bright light therapy in nonseasonal major depressive disorder (MDD) has been less extensively studied. Preliminary work with one day trials of bright light given for 1 h (Kripke et al 1983) or for 7 h (Dietzel et al 1986) showed significant responses. Subsequent trials with nonseasonal MDD have shown mixed results. The first trial of bright light *versus* dim red light given from 05:00 h to 06:00 h and from 09:00 h to 10:00 h showed a nonsignificant trend for improvement (Kripke 1985). A trial comparing the response of SAD *versus* nonseasonal depressed patients to phototherapy reported a response in the patients with SAD but no response in patients with nonseasonal depression (Yerevanian et al 1986). However, this trial was conducted with nonseasonal

depressed inpatients on multiple medications and SAD outpatients recruited by advertising. Subsequent work showed no difference between bright and dim light therapy given for one week to nonseasonal depressed patients (Volz et al 1990), but both groups did, in fact, show a significant improvement when analyzed individually. This study also used inpatients and may have been complicated by one of the difficulties in light therapy research which is the design of an appropriate placebo. A study of the effects of light therapy given in the evening (20:00 h to 23:00 h) reported a 20% reduction in Hamilton Depression Rating Scale scores over one week, which was comparable to the response expected from the use of antidepressants (Kripke et al 1992). The decision to switch to a trial of evening light therapy (Kripke et al 1989) was secondary to a lack of response to a preliminary trial of light therapy given from 05:00 h to 06:00 h and from 21:00 h to 22:00 h and to a suggestion from Lewy et al (1985) that patients who are melancholically depressed display a phase advance. Of significant note is a report of the successful use of light therapy as augmentation treatment in antidepressant nonresponders (Levitt et al 1991). All these studies have used light intensities of 2,000 lux to 3,000 lux.

The possible efficacy of light therapy in treating the breakthrough depression of bipolar disorders, however, remains relatively unexplored. An early case report (Lewy et al 1982) of the use of light therapy to treat a bipolar patient with seasonal cycles has been followed by a number of other case reports described below. Stinson and Thompson (1990) reported poor response in a small group of unmedicated bipolar patients. A study with nonseasonal depressed patients mentioned above (Kripke et al 1992) had included five bipolar patients, all free of medication. The authors noted that the bipolar patients showed a trend, although not significant, for greater benefit with bright light therapy. Bauer (1993) later reported three cases of successful treatment of bipolar patients presenting in a depressed state while on thymoleptic medications with light therapy during the summer months. There has only been one clinical trial which attempted to compare the response of patients with bipolar depression to patients with unipolar depression. All patients were treated during the winter months. All patients were free of medication — a factor which limited the study because all six bipolar patients were bipolar II. The results of this study (Deltito et al 1991) indicated that bipolar patients showed a significant improvement when compared to unipolar patients.

Mood disordered adolescents constitute a group of patients for whom treatment efficacy of a variety of therapeutic activities yet remains to be convincingly demonstrated (Kutcher and Marton 1989; Ryan and Puig-Antich 1986). Psychotherapeutic studies are essentially lacking and psychopharmacologic studies have failed to show a clear-cut superiority of tricyclic antidepressants over placebo in MDD, while raising concern about side-effects profiles (Boulos et al 1991; Puig-Antich et al 1987; Geller 1989; Kramer and Feiguine 1981; Ryan et al 1988). Controlled studies regarding optimal treatment of the depression breakthrough in adolescent bipolar patients have not, to the knowledge of the authors, been published, but the risk of "flipping" such patients into mania with the use of antidepressant medication has been reported (Bunney et al 1972). Literature on adults demonstrates that prophylaxis of depressed mood by thymoleptic medication is generally less effective than the prophylaxis of mania or hypomania (Prien 1983; Prien et al 1984). Thus, the treatment of depression breakthrough in adolescent bipolar patients presents a difficult therapeutic challenge.

Light therapy may be a potentially useful treatment of breakthrough depression in bipolar disorder of adolescence and may avoid both the "manic switch" and the negative subjective side-effects associated with antidepressant medication. This paper reports a one week treatment trial of 10,000 lux combining early morning and evening light therapy in bipolar adolescents and young adults who experience significant breakthrough depressive symptoms as an adjunct to their continuing thymoleptic regime and who chose to try light therapy instead of tricyclic antidepressants.

METHOD

Seven patients with a DSM-III-R diagnosis of bipolar disorder (all had at least one manic and one depressed episode) made on clinical grounds, including a structured interview (Kiddie Schedule for Affective Disorders and Schizophrenia), were treated with light therapy following referral by their primary physician for treatment of persistent (greater than three consecutive weeks) depressive symptoms. A chart review showed that none of the patients met the DSM-III-R criteria for a major depression recurrence. The patients were experiencing subsyndromal breakthrough depressive symptoms. Each patient underwent a similar standardized light treatment protocol. They were treated with 10,000 lux cool-white fluorescent light (Medic Light TM) administered continuously for 45 min to 60 min between 07:00 h and 09:00 h every morning, and for 45 min to 60 min between 19:00 h and 21:00 h every evening. This apparatus emits minimal UV light. The patients sat facing the light source with eyes open reading or doing homework. The maximal distance from the patient to the light source was three feet. A nurse randomly checked each patient three times during each treatment session to ensure that the protocol was being correctly followed. All treatments were administered using identical equipment in the same treatment room of the hospital. Following each treatment, the patients were allowed to resume their daily activity which included attending school or part-time work, and they slept at home. Thus, the hospital was used only for the administration of the treatment. All patients completed a Beck Depression Inventory (BDI) and a Symptoms Check List (SCL) - 58 on the first and seventh treatment days. Following the one-week in-hospital treatment protocol, the patients were allowed to take a light box

home and continue the treatment if they so wished for an additional period.

Case vignettes

Case 1

Ms. C.S. is a 21-year-old woman who had her first onset of mania at the age of 15. Over the course of her illness she has had four manic episodes requiring hospitalization, but has most recently been relatively euthymic for one year. She is maintained on carbamazepine (serum level 30 μmol/L to 40 μmol/L) and lithium carbonate (serum level 0.6 mmol/L to 0.8 mmol/L). A year earlier, she had experienced a decrease in her mood over the winter months and met DSM-III-R criteria for major depression — bipolar type. At that time she was treated with desipramine, 150 mg per day, with good results, but complained of difficulties with side-effects — especially dry mouth and blurred vision. When her mood lowered again this year, she experienced significant interpersonal and academic difficulties, and opted for a trial of adjunctive light therapy rather than antidepressant medication because of her concern about side-effects.

Case 2

Ms. K.A. is a 20-year-old female with a history of organic rapid cycling bipolar disorder. Her first manic episode occurred four years earlier following a closed head injury sustained in an automobile accident. The accident also left her with residual left-sided weakness and clumsiness. She had experienced two episodes of mania and an episode of depression that required hospitalization. She had been stabilized on carbamazepine at a serum level of 40 μmol/L to 50 μmol/L and had maintained herself relatively euthymic. She has been out of hospital for the past three years. She had experienced yearly seasonal lows in her mood, which had met the criteria for a major depression. However, apart from two hospital admissions, these episodes were generally not severe enough to require hospitalization. She could not tolerate the anticholinergic side-effects of a variety of antidepressants previously prescribed, and, in the past, had opted for "riding out" the low mood. This year her mood symptomatology was worse than in the past, making it necessary for her to drop out of school temporarily because of problems with her concentration. She agreed to a trial of light therapy.

Case 3

Mr. P.C. is a 22-year-old male with a four-year history of schizoaffective disorder — bipolar type. He had been hospitalized four times for mania and three times for depression. His clinical course has been complicated by substance abuse (alcohol and marijuana). Previous depressive episodes had been treated with a variety of tricyclic antidepressants in addition to ongoing thymoleptics. Treatment was consistently limited by equivocal therapeutic response and multiple side-effects including dry mouth, tremor, restlessness, dizziness and nausea. Additionally, his first hospitalization had been for a manic episode onsetting some four weeks after beginning treatment for MDD with desipramine. Most recently, he had been maintained on lithium carbonate (serum level 1.0 mmol/L to 1.1 mmol/L), perphenazine (32 mg per day) and procyclidine (5 mg three times per day) but was becoming increasingly isolated from his peers and was experiencing difficulties getting along with the other residents of the group home in which he was living. He chose light therapy over yet another trial of antidepressants because of previously experienced side-effects.

Case 4

Ms. G.D. is an 18-year-old female with a one-and-a-half-year history of bipolar disorder. Prior to her diagnosis, she had undergone outpatient treatment for depressed mood which included weekly psychotherapy and trials of imipramine and fluoxetine. She was referred to hospital following an apparent fluoxetine-induced manic episode which developed subsequently into a rapid cycling bipolar disorder. Thymoleptic treatment (valproic acid — serum level 400 μmol/L to 495 μmol/L) had resulted in effective control of manic symptomatology. Most recently, she had been relatively well but a depressive episode recurred. She had been depressed and irritable and was experiencing considerable social and school difficulties. She had read about light therapy and wondered if it would be helpful to her.

Case 5

Mr. C.S. is a 20-year-old male with a three-year history of bipolar illness. Prior to being treated at the hospital centre, he had four manic and four depressed episodes. Attempts to treat him with lithium and carbamazepine were not successful. For the past three years he has been maintained on valproic acid (serum level 788 μmol/L) with addition of perphenazine on occasion. This treatment has resulted in good control of manic symptomatology. Previous depressive breakthroughs have been treated with fluoxetine with good response. This was associated, however, with significant side-effects including nausea and diarrhea and a possible hypomanic switch. Recently, he developed depressed mood with easy onset of fatigue and hypersomnia. A trial of light therapy was suggested.

Case 6

Ms. M.K. is a 19-year-old female. She was originally treated for depression at age 18 with imipramine. Following this, she had a manic episode. She was treated with valproic acid (serum levels 350 μmol/L to 550 μmol/L) with good control of manic symptomatology. She continues to experience breakthrough depressive symptoms. Most recently, she experienced depressed mood with crying spells, hypersomnia and irritability. She found the symptoms very incapacitating, and a trial of light therapy was suggested.

Table 1

Results - Light therapy in depressed bipolar adolescents

Case Number	Pre-BDI Scores	Post-BDI Scores	Percent Change (%)	Pre-SCL-58 Score	Pre-SCL-58 Score Above Baseline (58)	Post-SCL-58 Score	Post-SCL-58 Score Above Baseline (58)	Percent Change from Pre-SCL-58 Score Above 58 (%)
1	6	0	100	81	23	60	2	91
2	13	3	77	104	46	69	11	76
3	35	15	57	127	69	96	38	45
4	22	22	0	120	62	98	40	35
5	17	3	82	112	54	75	17	69
6	27	16	41	160	102	111	53	48
7	29	19	34	104	46	98	40	13
Mean	21.2*	11.1*			57.4**		28.7**	
Standard Deviation	10.0	8.8			24.4		18.6	

*Pre- and Post-BDI; paired t-test = 4.31; $p > 0.0051$

**Pre- and Post-SCL-58 score above baseline 58; paired t-test = 5.50; $p > 0.0015$

Case 7

Ms. D.S. is a 16-year-old female with a long history of fluctuating moods since the age of nine, including a suicidal gesture at the age of ten. At the age of 14, she was admitted for a psychotic depression and, after an unsuccessful trial of fluoxetine, she was treated with lithium and perphenazine. Lithium was later changed to valproic acid (serum level 982 µmol/L) which resulted in good control of her mood. Perphenazine was slowly discontinued. Light therapy was suggested following breakthrough depressive feelings associated with sleepiness, irritability, anhedonia and social withdrawal.

RESULTS

The results of the light treatment are presented in Table 1 and in Figures 1 and 2.

Three patients (Cases 1, 2 and 5) showed a marked response (delta BDI and delta SCL-58 greater than 70% of baseline); two patients (Cases 3 and 6) achieved a moderate response (delta BDI and delta SCL-58 of 40% to 70% of baseline) and two patients (Cases 4 and 7) obtained mild to no response, (delta BDI and delta SCI-58 of less than 40% of baseline).

Statistical analysis of the results produced significant findings. Using paired t-tests, the pre- to post-BDI scores (pre mean = 21.2, sd +/- 10.0; post mean = 11.1, sd +/- 8.8; $t = 4.31$; $p > 0.0051$) were compared, along with the pre- to post-SCL-58 scores above the baseline of 58 (i.e., minimum score on scale without any symptoms is 58) (pre mean = 57.4, sd +/- 24.4; post mean = 28.7, sd +/- 18.6; $t = 5.5$; $p > 0.0015$).

DISCUSSION

The results of this study, although preliminary, based on a small sample, and limited because of the exclusive use of self-report scales, indicate that some adolescents and young adults with bipolar disorders who are experiencing breakthrough depressive symptoms may respond to light therapy as an adjunct to their continued thymoteptic treatments. Additionally, positive results, when they do occur, seem to be evident within one week of beginning the treatments, and are not associated with the type of troublesome side-effects often experienced when antidepressant medications are used. Most of the work with patients with nonseasonal depression has been concerned with the less robust responses in patients with nonseasonal depression when compared to patients with SAD. It has been hypothesized that light therapy for one week may be too brief a period when comparing it to the longer period required when treating patients with antidepressants (Lam et al 1989). The literature does have some evidence for a more robust response with bipolar patients (Deltito et al 1991; Bauer 1993). Additionally, although this is the first report of the use of 10,000 lux in nonSAD patients to the knowledge of the authors, there is evidence for a greater response in patients with SAD who are treated with 10,000 lux (Terman JS et al 1990).

The patients in this study were not evaluated using DSM-III-R or Rosenthal criteria for Seasonal Affective Disorder. Therefore, it cannot be determined if the outcome is related

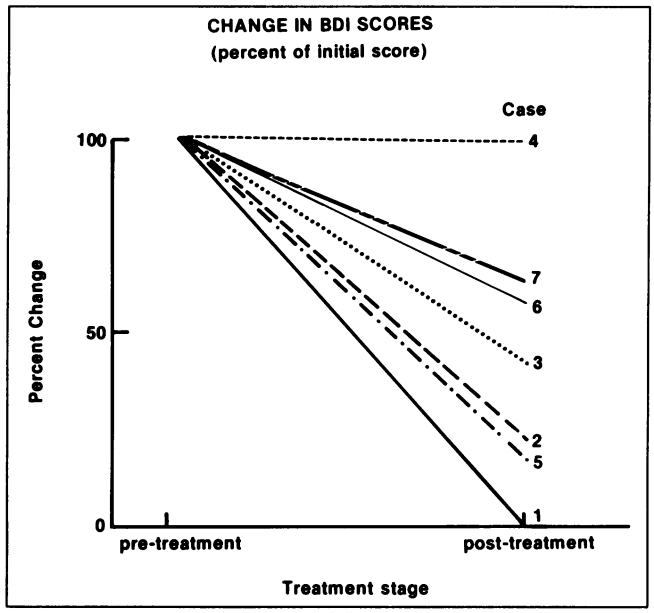

Fig. 1. Change in BDI scores (percent of initial score).

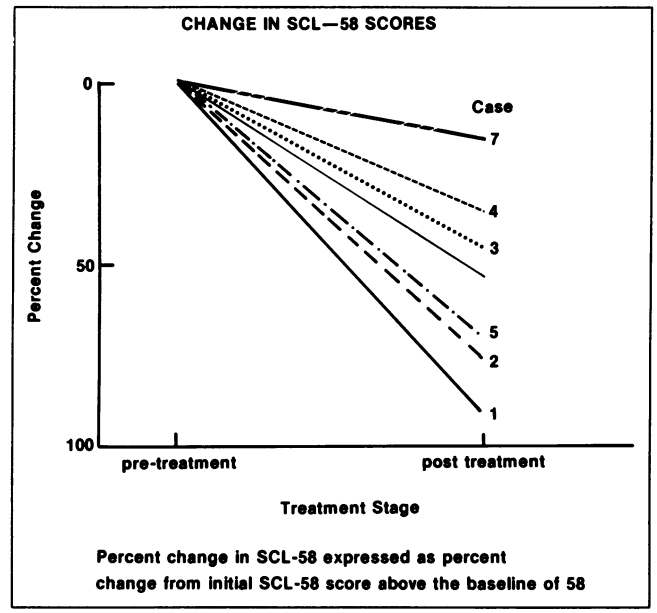

Fig. 2. Change in SCL-58 scores.

to a seasonal pattern (DSM-III-R) in their bipolar disorder. Future studies should account for this. All patients clearly met DSM-III-R criteria for Bipolar I, had previously required medication for the treatment of their illness and were medicated at the time of treatment with light therapy. As the protocol in this study was established for clinical purposes in the unit, light therapy was applied as needed whether during the summer or winter months. There have been reports that many patients with SAD suffer from mild summertime hypomanias (80% to 90%) and may be from the spectrum of bipolar disorders, but full-blown manic episodes are rare (six percent to seven percent) (Thase 1989; Blehar and Lewy 1990). These reports have been complicated by the use of Research Diagnostic Criteria (RDC), which are more lenient when diagnosing hypomania, and by the fact that the diagnosis is made retrospectively, with the differentiation of hypomania *versus* improvement form depression being difficult (Blehar and Lewy 1990). Prospective studies and a review of patients used in trials do not support these results (Blehar and Lewy 1990).

The results of this study add to the currently available literature on the treatment of bipolar patients with light therapy. Stinson and Thompson (1990) found a 30% response rate in a small group of adult patients with bipolar depression. Their population was not comparable to that presented above because, in addition to the age difference, their patients were unmedicated and more properly met SAD-bipolar type criteria than bipolar disorder — depressive episode. The bipolar patients in two studies with a positive response were unmedicated (Kripke 1992; Deltito et al 1991) and in one trial were all bipolar II (Deltito et al 1991). Bauer (1993) specifically confined the treatment to the summer months and obtained a response in three bipolar adult patients on thymoleptics. They followed their patients for seven weeks and noted response after one to three weeks of treatment with 2,500 lux for 2 h in the morning.

The use of light therapy in young patients has been previously reported. Rosenthal et al (1986) described a positive response to 2,500 lux of light for 2 h to 4 h per day in children with SAD. Mghir and Vincent (1991) reported the successful treatment of an adolescent with a seasonal pattern to her MDD with bright light delivered for 1 h each morning. Sonis et al (1987) reported that adolescents with SAD responded to 2,500 lux of light delivered in the evening while adolescents with MDD did not. Neither their SAD nor MDD groups, however, were receiving concurrent pharmacotherapy.

In this study, 10,000 lux was used instead of 2,500 lux which may provide optimal therapeutic effect with shorter treatment application (Terman JS et al 1990). All previous reports of light therapy in nonseasonal depressed patients had used 2,000 lux to 3,000 lux with mixed results. The trial in this study used a longer application schedule than the standard 30 minutes for 10,000 lux because these requirements were established for patients with SAD. There has been some suggestion that nonseasonal disorders may respond less robustly (Lam et al 1989) and, therefore, longer exposure periods have been recently attempted (Kripke et al 1992) in order to achieve higher efficacy. As positive response has been reported with evening bright light therapy in nonseasonal depressed patients, which included a trend to greater response among five bipolar patients in that report (Kripke et al 1992), and a positive response has been reported in bipolar

II patients with morning bright light therapy (Deltito et al 1991), both morning and evening bright light therapy were chosen in order to maximize possible response. The light therapy used in this study was given, however, in addition to ongoing thymoleptic treatment and, thus, the results cannot be extrapolated to unmedicated patients.

A possible confounding factor in all studies of the use of light therapy in nonseasonal depression is the possibility of sleep deprivation. The evidence for partial sleep deprivation seems to indicate that the mode of action is REM sleep deprivation (Vogel 1975; Vogel et al 1975), which would suggest that REM sleep deprivation during the last third of the night may have an antidepressant effect. To the knowledge of the authors, the procedures that have shown clear antidepressant effect are total sleep deprivation, partial sleep deprivation (allowing 3 h to 4 h of sleep), phase advance of sleep (i.e., sleeping between 17:00 h and 01:00 h) and awakening during REM sleep (Wehr 1990). Because the patients in this study were expected to arrive at the hospital between 07:00 h and 08:00 h, the effect of any sleep deprivation would have been minimal. Their sleep pattern should not have approximated any of the above patterns as a result of participation in this protocol. Specific sleeping patterns were not monitored as all patients slept at home. Another possible confounding factor in the patients in this study would be the increased exposure to ambient light as the protocol may have extended morning hour ambient light exposure.

None of the patients in this study reported any adverse events during their treatment with light therapy. Despite this fact, there have been reports of light therapy precipitating hypomanic or manic episodes in patients (Schwitzer 1990; Kantor 1991; Kripke et al 1992), and close monitoring is, thus, required. Concerns regarding possible ocular damage by bright light therapy have also been raised. Acute phase studies with ocular monitoring for 2,500 lux given for up to 2 h per day have shown no untoward effects (Blehar and Lewy 1990). A study of 10,000 lux given for 30 min per day also reported no effects (Terman JS et al 1990). There have been no studies of 10,000 lux given for greater than 30 min. There is concern that many psychiatric medications (tricyclics and tetracyclics) could act as photosensitizers and could increase the risk of eye damage (Terman M et al 1990). Known lithium-induced toxicity to the retina may also be exacerbated by exposure to light (Terman M et al 1990). Thus, precautions should be taken when exposing patients to light therapy if they are on any of these medications.

A study using a placebo control group and a longer follow-up period in order to assess relapse rates would add useful information to the evaluation of this preliminary report.

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