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Is bright light therapy effective in treating depression in adults with seasonal affective disorder?

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A SELECTIVE EVIDENCE BASED MEDICINE REVIEW

In Partial Fulfillment of the Requirements For

The Degree of Master of Science

In

Health Sciences – Physician Assistant

Department of Physician Assistant Studies
Philadelphia College of Osteopathic Medicine
Philadelphia, Pennsylvania

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Abstract

OBJECTIVE: The objective of this selective EBM review is to determine whether or not “Is bright light therapy effective in treating depression in adults with seasonal affective disorder?”

STUDY DESIGN: A systematic EBM review of two randomized controlled trials and one randomized crossover trial published between the years 2011 and 2015, all in English language.

DATA SOURCES: All three studies were published in peer-reviewed journals found using PubMed and selected based on relevance to the clinical question and evaluating POEMS.

OUTCOMES MEASURED: The outcomes measured were reduction in depressive symptoms and severity using the Structured Interview Guide for the Hamilton Depression Rating Scale and the Beck Depression Inventory Scale II.

RESULTS: Reeves et al. found that there was a statistically significant difference in reduction of depressive complaints in individuals with SAD exposed to bright light therapy compared to those exposed to dim red light with a p-value of 0.02 (*J Nerv Ment Dis.* 2012;200(1):51-5). Rohan et al. found that in individuals with SAD, depression severity and remission improved when exposed to light therapy, however no significant difference was seen between these individuals and those exposed to CBT, with a p-value of 0.30 for depression remission and a p-value of 0.13 for depression severity (*Am J Psychiatry.* 2015;172(9):862-869. doi:10.1176/appi.ajp.2015.14101293). Meester et al. found that in individuals with SAD, depressive complaints decreased when exposed to standard bright light therapy, however no significant difference was seen between these individuals and those exposed to low intensity blue light, with a p-value of >0.05 (*BMC Psychiatry.* 2011;11:17. Published 2011 Jan 28. doi:10.1186/1471-244X-11-17).

CONCLUSION: The results of all three trials show that bright light therapy is a promising method for treating depression in adults with seasonal affective disorder, however further research is required to assess whether it is any more effective than other methods currently being used.

INTRODUCTION

Seasonal affective disorder (SAD) is defined as a condition where individuals undergo recurrent major depressive episodes based on a characteristic seasonal pattern. SAD most commonly affects individuals during the fall and winter months, with remission during the spring and summer seasons. Common symptoms someone suffering from SAD will present with are very similar to those seen in major depressive disorder, including changes in appetite, sleep disturbances, fatigue and decrease in energy, as well as decreased activity or enjoyment in things that usually bring pleasure.¹

Seasonal affective disorder affects between 1-10% of the population and is four times more likely to occur in women compared to men.² The prevalence of this disorder in North America increases with latitude, with a higher rate of seasonal affective disorder occurring in Alaska (9%) compared to Florida (1%).³ The exact number of healthcare visits for SAD is unknown, however in 2016, the CDC reported that the percent of physician office visits with depression indicated on the medical record was 9.3%.⁴ It is hard to estimate how many people seek treatment for SAD, as research has found that half of the time, depression is not detected during healthcare visits, even if the patient is feeling depressed.⁵ Likewise, the direct total healthcare cost for SAD has also not been identified. However, a study conducted in 2015 from Greenburg and colleagues estimated that \$210.5 billion is spent each year on major depressive disorder, of which SAD is a subset.⁶

While the exact cause of SAD has not yet been identified, it is thought that neurotransmitters, hormones, genetics, dysfunction of the circadian rhythm and psychosocial factors all play a role.⁷ Specifically, serotonin levels are thought to play a major part in the development of SAD, as winter months show the lowest rate of serotonin turnover in the human

brain and serotonin is thought to be responsible for helping with mood balance.⁷ As sunlight starts to diminish during the fall, there is a corresponding decrease in serotonin activity, and therefore a dysregulation in balancing mood.³ A 2014 study by McMahon et al. found that in individuals affected by SAD, there were higher levels of SERT, “a protein that assists with transportation of serotonin from the synaptic cleft to the presynaptic neuron.”⁸ The higher the SERT levels, the lower the serotonin activity, and the greater the likelihood of developing depression.

While there is no cure for SAD, there are multiple different treatment options that have been proven to play a role in improving depressive symptoms in affected individuals. One of the most commonly used methods to treat this condition is conventional medication therapy through the use of antidepressant drugs, specifically selective serotonin reuptake inhibitors (SSRIs) and bupropion. Psychotherapy, such as cognitive behavioral therapy and interpersonal psychotherapy, has also been seen to be effective in helping to treat these patients. Other treatment options include electroconvulsive therapy and negative air ionization.⁹

Previous studies have shown bright light therapy to be effective in treating symptoms of SAD due to the fact that light has an effect on serotonin levels and circadian rhythm, both of which are thought to play a role in the pathophysiology of this disorder.⁷ Results of a 2010 study published in the *Journal of Psychiatric Practice* showed that bright light therapy was effective in not only improving depressive symptoms in individuals with SAD, but also helped with depression remission in these patients.¹⁰

Since depression and SAD are becoming more prevalent and the healthcare cost continues to rise, it is essential for healthcare providers to not only be looking out for patients presenting with depressive symptoms, but also important that providers are knowledgeable about different treatment options available, especially those that may be more cost-effective and possibly show

better results. While it was demonstrated in the previously mentioned 2010 study that light therapy can be an effective treatment method for SAD, updated data is necessary to further support this claim. This systematic review evaluates two randomized controlled trials (RCTs) and one randomized crossover study comparing the efficacy of bright light therapy as an appropriate treatment for depression in adults with SAD to other light therapies or psychotherapy treatments.

OBJECTIVE

The objective of this selective EBM review is to determine whether or not “Is bright light therapy effective in treating depression in adults with seasonal affective disorder?”.

METHODS

Research for each study was done via PubMed using the key words “seasonal affective disorder” and “light treatment.” All articles selected were published in English in peer-reviewed journals. Articles were selected based on relevance to my clinical question and if the outcomes of the studies were patient oriented (POEMS). Inclusion criteria included studies published in the last 10 years, involving humans, and based on clinical trials studying individuals with a current diagnosis of major depression with a seasonal pattern. Articles were excluded if they were published before 2008 and not based off of clinical trials.

The studies selected for this EBM review included 2 RCTs and one randomized crossover trial comparing bright light therapy to other treatment options as well as placebos. The population studied included adults with seasonal affective disorder. All three studies used bright light therapy as the experimental intervention. Comparison groups were treated with low intensity blue light, dim red placebo light, or cognitive behavioral therapy-SAD (CBT-SAD). The outcomes measured in each study were the overall improvement of depressive symptoms and severity in patients with

SAD, assessed by participant answers to depression questionnaires. The statistics used in the articles include RBI, ABI, NNT, confidence interval, and p-value.

Table 1. Demographics and Characteristics of Included Studies

Study	Type	#Pts	Age (yrs)	Inclusion Criteria	Exclusion Criteria	W/D	Interventions
Reeves ¹ (2012)	Randomized Crossover Study	79	18-65	Individuals 18-65 years old with a dx of current major depressive disorder with seasonal specifier	Patients with a psychotic disorder, current suicidality, vision problems not correctable by glasses, light sensitivity, overnight workers, illicit drug or alcohol abuse in last year, and any antidepressant or antipsychotic medication use in last 30 days	0	1 hour of bright white light at 10,050 lux and a peak wavelength of 545nm VS dim red placebo light at 42 lux with a peak wavelength of 612nm
Rohan ¹¹ (2015)	RCT	177	>18	Individuals >18 years old, who met DSM-IV-TR criteria for recurrent major depression, with a seasonal pattern, fulfilled SIGH-SAD criteria for a current SAD episode, and not using or stable use of antidepressants	Patients who have ever used light therapy or psychotherapy for depression, have a comorbid axis I disorder requiring treatment, suicidal intent, hypothyroidism, or would be absent for more than a week in March	14	10,000 lux bright light therapy, starting at 30 minutes and reaching a maximum of 2 hours per day over 6 weeks VS two 90-minute sessions per week of CBT for 6 weeks
Meester ¹² (2011)	RCT	23	Standard light: 39.9 +/- 12.7 Blue-enriched light: 41.7 +/- 13.1	Patients meeting the criteria for a major depressive disorder, seasonal pattern, winter type according to the DSM-IV-TR	Not reported	1	10 days of standard light at 10,000 lux for 30 minutes a day VS 10 days of blue-enriched light at 750 lux for 30 minutes a day

OUTCOMES MEASURED

The studies measured depressive symptoms and severity of patients both pre and post treatment using patient-reported depression scales. Reeves et al. used the Beck Depression Inventory Second Edition (BDI-II) to measure the severity of depressive symptoms of individuals

participating in the study.¹ The BDI-II is a 21-item self-reported measure of a patient's depressive symptom severity. Individuals rank items on a scale of 0-3 based on how they have been feeling for the last 2 weeks.¹ The sum of these numbers equates to the participant's BDI-II score. Reeves et al. administered the BDI-II 3 times in one day (at baseline, after light session one, and after light session two), each time instructing participants "to report on the past two weeks, including today."¹ Rohan et al. also used the BDI-II for outcome measurements, which was administered pre-treatment, mid-treatment (week 3), and post-treatment (week 6).¹¹ Meester et al. measured depressive symptom severity with the Structured Interview Guide for the Hamilton Depression Rating Scale- Seasonal Affective Disorder (SIGH-SAD), which is a 24-item self-rated depression scale that was administered at baseline, at day 8 (after 5th light session), at day 15 (after 10th light session), and at day 22 (1 week after light treatment had ended).¹²

RESULTS

Two RCTs and one randomized crossover trial were conducted to determine if bright light therapy is effective for treating depression in adults with SAD. All three studies included participants over the age of 18 who met the criteria for major depressive disorder with a seasonal pattern. Demographics of participants are included in Table 1.

The Reeves et al. study was a randomized crossover design comparing bright light therapy to dim red placebo light. There were 79 participants included in the study, with 41 being exposed to the experimental bright light first and 38 being exposed to the placebo light first.¹ Before treatment, the severity of each participant's depression was assessed using the BDI-II. Individuals in the experimental group were exposed to 1 hour of bright white light at 10,050 lux and a peak wavelength of 545 nm, while those in the placebo group were exposed to dim red light at 42 lux and a peak wavelength of 612nm.¹ After the first hour, the BDI-II was re-administered, then

participants switched groups. After the second hour, the depression scale was administered again. At the end of the study, zero participants dropped out and everyone was accounted for.¹ Details of compliance were otherwise not discussed in the article. A mixed-model crossover analysis was conducted to control for “within-subject correlation and assess whether the light effect differed by order of light exposure. This was accomplished by including an interaction of light group by order of light administration.”¹ The interaction was removed if it was found to be insignificant. A p-value of ≤ 0.05 was used to determine statistically significant differences between treatment groups. A borderline interaction effect was determined, but was not statistically significant ($p=0.07$).¹ When this effect was removed from the model and the light effects were grouped together over the 2 hours, bright light showed to have a significantly greater effect on reducing depressive symptoms compared to dim red light after the second period, with a p-value of 0.02, as shown in Table 2.¹

Table 2. Results of Reeves et al. Study Comparing Bright and Red Light Therapy

	Baseline	First Period		Second Period	
	Mean (SE)	Mean (SE)	p	Mean (SE)	p
BDI	Bright light first: 23.1 (9.0) Red light first: 26.2 (11.0)	Bright light: -2.78 (0.80) Red light: -2.08 (0.82)	0.54	Bright light:-2.40 (1.05) Red light: 0.34 (0.46)	0.02

The Rohan et al. study was a RCT with 2 arms comparing individuals with SAD treated with bright light therapy (BLT) versus cognitive behavioral therapy-SAD (CBT-SAD) for 6 weeks, starting the first week of February.¹¹ The intent-to-treat sample consisted of 177 patients randomly assigned to either the BLT or CBT group. In the light therapy group, 89 individuals were exposed to bright light set at 10,000 lux.¹¹ Individuals started out being exposed to 30 minutes of light as soon as they woke up. The daily dose of light was increased by 15 minutes each week, reaching a maximum of 2 hours/day, over the course of 6 weeks.¹¹ Two participants were unable to tolerate the minimum dose of 30 minutes of light therapy, so they ended treatment at 15-minutes of

morning-only light sessions daily.¹¹ After 6 weeks, participants were encouraged to continue light therapy until May, however were not monitored. In the CBT group, 88 individuals were exposed to two 90-minute sessions per week of CBT-SAD for 6 weeks. CBT-SAD uses traditional cognitive behavioral therapy and adapts it to target SAD and improve individual's abilities to cope with winter darkness and changes in weather.¹¹ The BDI-II was administered to participants before treatment, mid-treatment, and after treatment. One participant withdrew from the light therapy group and thirteen participants withdrew from the CBT-SAD group. Seven of the thirteen who withdrew from the CBT-SAD group did not attend any sessions, while the other six attended anywhere from 2-7 sessions. Only 22 participants in the CBT-SAD group attended all 12 sessions.¹¹ No further discussion of compliance was mentioned. The conductors of the study were able to obtain data from the 1 individual who withdrew from the BLT group and from 9 individuals who withdrew from the CBT-SAD group.¹¹

A Pearson's chi-square test and a 95% confidence interval (CI) were used to compare the difference in depressive symptom ratings between treatment groups as well as the number of individuals in remission after each treatment. As seen in table 3, the mean change in depressive symptoms from baseline was 16.2 for the BLT group and 14.5 for the CBT-SAD group.¹¹ A significant reduction in depressive symptoms was seen over the course of the study in participants in both treatment groups ($p < 0.001$), however, no significant difference was seen between groups ($p = 0.13$). The 95% CI for the 1.0-point difference between groups post-treatment was -1.3-3.3.¹¹

Table 3. Comparison of Bright Light Therapy and CBT-SAD Effectiveness on Reducing SAD Depressive Symptoms Measured by the BDI-II, conducted by Rohan et al.

Group	Mean BDI-II Score (SE)	Mean Change from Baseline (SE)	p-value	95% CI
Light Therapy	Pre-treatment: 23.4 (8.4) Post-treatment: 7.2 (6.0)	16.2	Main effect of time: <0.001	-1.3-3.3
CBT-SAD	Pre-treatment: 22.7 (9.3) Post-treatment: 8.2 (6.7)	14.5	Main effect of treatment: 0.13	

In terms of depression remission, a participant was considered in remission if their BDI-II score was ≤ 8 post-treatment.¹¹ Table 4 shows that 63.6% of individuals in the light therapy group achieved remission, while 56.0% of individuals in the CBT-SAD group achieved remission. The difference in depression remission between groups was determined to be insignificant, with a p-value of 0.30 and a 95% CI of -22.5-7.1.¹¹

Table 4. Comparison of Bright Light Therapy and CBT-SAD Effectiveness on Achieving Depression Remission Measured by the BDI-II, conducted by Rohan et al.

Group	Posttreatment Remission	p-value	95% CI for Difference Between Treatments
Light Therapy	63.6%	0.30	-22.5-7.1
CBT-SAD	56.0%		

The data from the study was used to calculate the number needed to treat (NNT) for depression remission which was 14, as shown in table 5. This indicates that for every 14 people treated with BLT, one more person will have remission of SAD compared to if they had been treated with CBT-SAD.

Table 5. Statistical Analysis of Rohan et al. Study on the Efficacy of BLT in Achieving Depression Remission in Individuals with SAD

NNT	RBI	ABI
14	-0.136	-0.076

The Meester et al. study was a randomized control trial with 2 arms including an experimental group exposed to standard bright light therapy (SLT) and a control group exposed to blue-enriched light therapy (BELT) at a lower intensity.¹² The sample included 23 participants, however after a few days of light treatment, 1 person dropped out, leaving 22 participants. In the experimental group, 3 men and 8 women were treated with SLT at 10,000 lux for 30 minutes a day for 10 days over the course of 2 weeks, with weekends excluded.¹² In the control group, 2 men and 9 women were treated with BELT at 750 lux for 30 minutes a day for the same number of days.¹² Individuals in each group started day 1 with a baseline measurement of depression severity

using the SIGH-SAD. The SIGH-SAD was then administered again after the 5th light session, after the 10th light session, and 1 week after treatment had ended. A responder to treatment was defined as a participant whose depressive symptoms improved by at least 50%.¹² No details regarding compliance were discussed throughout the literature.

As seen in table 6, by day 22, individuals in the SLT group had, on average, a 16.7 point reduction in their SIGH-SAD depression score, while those in the BELT group had an average reduction of 19.4 points.¹² A two-tailed alpha level of 0.05 was used to determine statistical significance between treatment groups. While results showed a statistically significant decrease in depressive symptoms in participants from both the SLT and BELT groups ($p < 0.001$), there was no significant difference seen between groups ($p > 0.05$).¹²

Table 6. Comparison of Standard Light Therapy and Blue-Enriched Light Therapy Based on Average Depression Scores Measured by the SIGH-SAD, conducted by Meester et al

Condition	N	Day 1 (SD)	Day 22 (SD)	Change from Baseline	Responder N	p-value
SLT	11	25.6 (6.3)	8.9 (6.8)	16.7	8	Main effect of time: < 0.001 Main effect of condition: > 0.05
BELT	11	25.4 (6.9)	6 (4.0)	19.4	11	

The data from the study was used to calculate the NNT which was -3, as shown in table

7. This indicates that for every 3 people treated with SLT, one fewer will have remission of SAD compared to if they were treated with BELT.

Table 7. Statistical Analysis of Meester et al. Study on the Efficacy of SLT in Improving Depressive Symptoms of SAD

NNT	RBI	ABI
-3	.273	.273

DISCUSSION

The studies discussed in this systematic review suggest that bright light therapy is effective in treating depression in adults with seasonal affective disorder. All 3 studies found the decrease in depressive complaints from pre and post treatment of individuals exposed to bright

light therapy to be statistically significant with p-values <0.05 .^{1,11,12} However, 2 out of the 3 studies found that while bright light therapy was effective in reducing depressive symptoms, it was no more effective than other forms of treatment for SAD, including CBT-SAD, as demonstrated by Rohan et al. or blue-enriched light of lower intensity as demonstrated by Meester et al.^{11,12}

All three studies had their limitations as well. Reeves et al. used a crossover study design to conduct their research which may have lead to carryover effects of each treatment.¹ Also, there was a significant difference in baseline POMS-D scores for the participants in each group, with a p-value of 0.04.¹ While this was not the outcome of interest studied in this systematic review, it is a depression scale, indicating a significant difference in depressive symptoms between groups at the start of the study. Recruitment methodology may have also affected outcomes as individuals were recruited from advertisements in newspapers rather than from clinical treatment programs, resulting in a sampling error.¹

The limitation of the Rohan et al. study was that they used a single site to conduct their CBT-SAD therapy, with only one principal investigator employed to review the audiotaped sessions.¹¹ Using a more diverse group of sites where participants could chose to attend their CBT-SAD sessions may have helped with result accuracy and eliminating bias. Also, the sample size was limited in racial diversity, with the majority of the participants being Caucasian.¹¹

Meester et al. used a small sample size ($n=22$) to conduct their study which could have affected the results.¹² Also, no placebo condition was included in this study due to the difficulty in creating a “real placebo condition for visible light treatment.”¹² This means that the similarities in depression score responses between both treatments groups could be seen as a “placebo effects

only.”¹² Additionally, no exclusion criteria were listed for this study. Other factors such as family problems and comorbid conditions, which play a major role in depression were not accounted for.

In terms of limitations of this EBM review, the lack of double-blind randomized controlled trials conducted assessing the efficacy of bright light therapy as a treatment for SAD could have led to biased research. Length of treatment also differed significantly between studies, putting limitations on the results presented. Follow-up of patients was insufficiently long for both the Reeves et al. study (2 hours) and the Meester et al. study (22 days).^{1,12} Side effects from bright light therapy including headaches, insomnia, and light sensitivity are also factors that should be taken into account when considering this as a treatment option for SAD patients. Access to treatment and insurance coverage were not issues presented in any of the literature chosen for this review.

CONCLUSION

Based on the articles reviewed for this systematic EBM paper, bright light therapy is effective in treating depression in individuals with SAD. All three studies discussed above showed a statistically significant decrease in depressive complaints of individuals with SAD who were treated with bright light therapy. That being said, these studies show that it may not be more effective than low-intensity light or other treatment options currently available for treating SAD. Bright light therapy may be a good cost-effective alternative for individuals who do not want to take medication for depression or are unable to attend therapy sessions. However, due to the limitations of these studies, future research is needed to further investigate the efficacy of bright light therapy as a main treatment option for individuals with SAD. In order to help strengthen results, future studies can aim to include larger sample sizes, sufficiently long treatment and follow-up times, and conduct studies in a double-blind fashion.

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