THE COLOR PREFERENCES OF TREATMENT RESISTANT DEPRESSED PATIENTS: A PILOT STUDY

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ABSTRACT

A pilot study was conducted to evaluate the effectiveness of color light therapy as a treatment modality for individuals with treatment resistant depression. A secondary objective of the study was to determine the color preferences of the individuals and to assess whether the color preferences changed as a function of treatment. Pre and post measures of depression using the PHQ-9 found a significant decrease in depression after color light therapy ($t(9) = 5.13$, $p < .01$). Pre- and post-treatment measures of color preferences found significant changes in the preferences, with an increase of green ($t(9) = -2.53$, $p < .05$) and a decrease in blue ($t(9) = 2.58$, $p < .05$).

Our world is full of color and many individuals feel that color influences and/or reflects our mood. Schools choose colors that they think will stimulate and enhance learning. Hospitals choose colors that are soothing and relaxing. Restaurants choose colors that are stimulating. Pink rooms have been reported to calm agitated individuals.

In the literature and in general conversations colors are frequently used to describe emotions such as 'green with envy', 'red with rage' and being 'in the blues' when depressed. The term 'feeling blue' is frequently interchangeable with depression and has been in common use for a number of years. In fact the noun *blues,* meaning "low spirits", was first recorded in 1741 (Christine Ammer, 1997)[1] and may come from **blue devil,** a 17th century term for a baleful demon, or from the adjective **blue** meaning "sad" a usage first recorded in Chaucer's *Complaint of Mars* (c. 1385). Regardless of culture, language, era, or individual artist, the arts consistently depict depression using darkness.

Chiazzari[2], in her book, "The Complete Book of Color", reports that a person's current mood can affect their choice of color. She also reports that individuals who are unhappy will choose darker colors where individuals feeling fatigued will tend to choose lighter colors. However she cautions that people are taught to associate certain colors with certain moods, so they may be drawing on that learned behavior instead of truly associating a certain color with their mood.

Luscher (1971)[3] proposed that individuals with similar color preferences should also possess similar personality characteristics. According to Luscher, the physiological reactions that individuals experience while viewing primary colors of blue, red, yellow, and green reflect basic psychological needs of the individual.

Exner (1974[4], 1978[5]) and Exner and Wiener (1982[6]) reported on color preferences and psychopathology. Exner (1974[4]) noted that Hermann Rorschach suggested a relationship between chromatic color responses and affective states. Subsequent, extensive research has explored the relationship between color responses on the Rorschach Inkblot Technique and the role that form plays in reflecting the control of emotional expression, as well as the degree of cognitive effort and complexity involved in various types of color responses. Color variables play an important role in the Affect cluster in the interpretive strategy for the Rorschach Comprehensive System and personal changes seen in response to therapeutic interventions are reflected in changes in the Affect cluster in the Rorschach scoring.

Mary Bolles (1996[7]) Sara Cox (2010[8]) measured visual field sizes for the colors red, green and blue before color light sessions and then following the series of light sessions. Mary reported that she normally finds the blue field the largest, the red field the next largest, and the green to be the smallest in the pre-treatment measures. On post measures she typically finds an expansion of the visual fields. Sara also reported increases in the sizes of the visual fields as a function of treatment.

Lange and Rentfrow (2007[9]) reported on three studies that addressed the relationship between color preference and personality for 1245 subjects. Using the Strong Interest Inventory and the 16PF to assess personality variables, they concluded that the color preferences as assessed by the Dewy Color System Test were valid indicators of personality.

Nolan, Dai, and Stanley (1995[10]), in a study involving 72 undergraduates found that those scoring above a 10 on the Beck Depression Inventory tended to have a preference for black or brown. Edwards (1995[11]) studied 60 students from a general psychology class and found that there was a slight but not significant tendency of people with higher levels of depression to choose the color blue. Carruthers, et al (2010[12]) in developing the Manchester Color Wheel used 309 healthy volunteers, 108 anxious individuals and 110 depressed participants to classify the colors into positive, neutral and negative shades. They found that yellow was the most "drawn to" color and blue the commonest 'favorite' color for all the subjects.

Different shades of the same color had completely different positive or negative connotations and reproducibility was exceptionally high when color choice was recorded as positive, neutral or negative. They found that people with mental health disorders were more likely than healthy people to associate their moods with colors. They found that depressed subjects tended to select gray to describe their mood while anxious people chose red and happy subjects chose yellow. In their system dark blue was classified by their subjects as being negative while pale blue was classified as positive. They concluded that color can be used in psychology to assess a patient's mood and mental health. To test their theory, they used this classification system to assess the predictive role of color in hypnotherapy. They found that for patients with a positive mood color choice the odds of responding to hypnotherapy were nine times higher than that of those choosing either a neutral or negative color or no color at all (odds ratio 8.889; p=0.042)

As part of a study examining the effectiveness of color light therapy with treatment resistant depressed individuals the color preferences of the individual was tested prior to the beginning of the color light therapy sessions and following the end of the series of sessions. We have not been able to locate any prior studies that access color preferences both prior to and following treatment intervention.

METHODS

PARTICIPANTS

The principal investigator is employed part-time at Grayline Research Center where clinical trials for the various pharmaceutical companies are conducted. Subjects were recruited from individuals contacting the center to enroll in ongoing research studies in depression. If they did not qualify for one of the center's studies, they were recruited for the color light study. Subjects were also recruited by flyers posted around the local university and by referral of current and previous center subjects. Informed consent was obtained from all participants following a discussion of the nature of the study, as well as the possible consequences of the study.

To participate in this pilot study, all subjects had to have a diagnosis of major depressive disorder, recurrent type according to DSM-IV. They had to have normal corrected vision and no color blindness. They had to commit to attending weekly sessions and be able to complete the questionnaires. Individuals were excluded for the following reasons:

• If they had been advised by their primary care provider to avoid being in sunlight or in an environment with full spectrum lights.
• If flashing lights made them uncomfortable, triggered headaches or other negative physical responses.
• If they had a diagnosis of epilepsy or if flashing lights had previously triggered a seizure.
• If the subject was pregnant or planned to become pregnant during the course of the study.
• If the subject had a diagnosis of borderline personality disorder, bipolar disorder, schizophrenia or other psychotic disorder including major depression with psychotic features, mental retardation or an organic mental disorder or mental disorder due to a general medical condition as defined in DSM-IV.
• If the subject had a substance abuse disorder (except nicotine and caffeine) within the previous 6 months as defined in DSM-IV.
• If the subject had a neurodegenerative disorder such as Alzheimer's disease, Parkinson's disease, multiple sclerosis, Huntington disease, etc.
• If the subject had a history of cancer that had been in remission for less than 5 years prior to the start of the study. This did not include basal cell or stage I squamous cell carcinoma of the skin.
• If the depression was secondary to traumatic head injury.
• If the subject had made a suicide attempt in the previous six months or was felt to be in imminent danger of self harm.
• If the subject had received electroconvulsive therapy within 6 months prior to screening.

• If the subject was currently receiving any other treatment for depression other than antidepressant medication.

Subjects were not required to discontinue any medications. If they were presently taking antidepressant medications they had to have been on the current dose for three months. Women who had not had a tubal ligation or hysterectomy or were not two years post menopause were given a urine pregnancy test prior to each light session and the results had to be negative.

MATERIALS AND PROCEDURE

Depression measure: The Physical Health Questionnaire-9 (PHQ-9) was used to assess the level of depression. This is a nine item questionnaire that covers the standard symptoms of depression. It yields two scores: a total score that reflects the severity level of the depression and a score that reflects how significantly the depression interferes with the individual's level of functioning. The possible scores range from 0 to 23, with 10 indicating moderate depression and higher scores indicating a higher severity level of depression. The PHQ-9 was used as a pre/post measure.

Color preference measure: The Audio-Bio Color system was used to determine color preferences. It is a computer administered color preference test. The test consists of a table of 12 rows of 8 squares. Twelve colors are distributed randomly through out the squares. The subject is instructed to select four colors in each row to discard. They discard the color by clicking on the square with that color. They are instructed to discard the four colors that they like the least. Each color was presented 8 times and received a score with a range from 0 to 8. The higher the score, the more individual preferred that color (Figure 1).

Equipment for color light session: The Audio-Bio Color automatic system was used to provide the color lights for the sessions. This is an RGB system with red
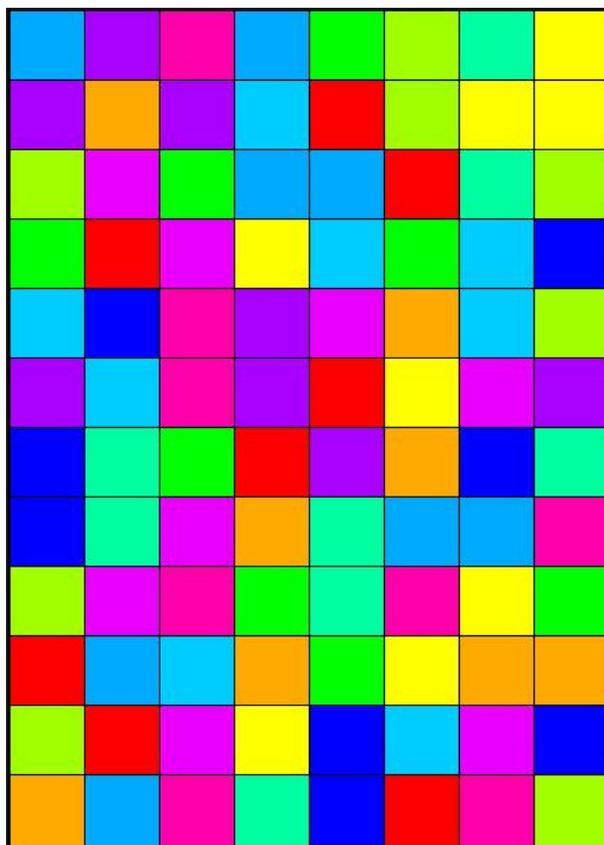

Figure 1. Color preference measure

having a nanometer value of 630, green 525, and blue 470. It is a computer controlled system that generates a treatment protocol based on the subjects' color preferences. The order that the colors are presented, the length of time that they are presented, whether or not they flash and at what rate are determined by the computer program. The lux range of the lights is 30 to 2380 measured 18 inches from the source of the light. The therapist only has to determine the length of the session.

Session frequency and length: The weekly sessions were 27 minutes long.

TREATMENT PHASE
Initial Session: During the initial visit the prospective subjects were interviewed to determine their eligibility

to be included in the study and were given information regarding the study. If they were eligible they were asked to read and sign the informed consent and they were given a brochure detailing HIPPA information. Following this they were asked to complete the pre-treatment questionnaires. A schedule for the weekly sessions was established.

Weekly light sessions: At the beginning of the session the subject was seated in front of a computer and was asked to complete the color preference test. The room lights were dimmed so that the ambient light would not distract from the colors on the screen. Following this, the subject moved to a recliner chair. The chair was placed in a reclining position and the spotlights that were used to deliver the color lights were positioned. A smaller spotlight was focused on a spot midway between the top of the head (cz on the international 10-20 system of electrode placement) and the depression directly between the eyes, just superior to the bridge of the nose (nasion). The second, larger spotlight was focused on the abdomen and centered to an imaginary line that ran from the top of one iliac crest (top of the hip bone) to the top of the other iliac crest. If the subject was wearing glasses or ear rings, they were asked to remove them during the session. The subject was instructed to relax and to sit with their eyes closed during the presentation of the lights. They were reminded that they would be alone in the room during the light session and were given a call button that they could use to summon a staff member if, for any reason, they needed assistance or wished to terminate the session. They were also asked to reposition their clothing once the staff member left the room so that the maximum area of the abdomen would be exposed to the lights. The light sessions were conducted in a darkened room. Once the spotlights were positioned and the program initiated the person conducting the session left the room. At the end of the session, the subject was allowed sufficient time to reposition their clothing and cover their abdomen before the therapist re-entered the room.

RESULTS

A total of 17 participants began the survey, with 59% completing the entire series of treatments and the post-treatment measures. Of the participants who completed the study, the mean level of depression before treatment was 17.70 (SD = 3.20, N = 10), and of the participants who did not complete the study, the mean was 16.86 (SD = 4.45, N = 7). Using an independent measures t-test to compare the participants who completed the survey to those who did not, no significant difference in PHQ-9 scores was found (t (15) = .456, p > .05). The percent of the participant's life described as depressed for the participants who completed the entire study (M = 58%, SD = 16.83) did not differ significantly from the percent of life spent in depression for those that left the study (M = 49%, SD = 10.10, t (14) = 1.25, p > .05). The number of medications that the completers were taking at the time of the study (M = 1.90, SD = 4.01) did not differ significantly from the number of medications that the non-completers were taking at the time of the study (M = 4.43, SD = 5.77, t (15) = 1.07, p > .05). Further, the number of prior treatments for depression tried by the completers (M = 3.40, SD = 1.90) did not differ significantly from the number of prior treatments for depression tried by non-completers (M = 2.57, SD = 2.07, t (15) = .854, p > .05).

The completers' and non-completers' pre-treatment color preferences were also compared. The completers' pre-treatment red preference (M = 3.60, SD = 3.20) was not significantly different from the non-completers' (M = 5.00, SD = 3.22, t (15) = .885, p > .05). Participants who completed the study had an average green preference score of 2.20 (SD = 2.39) and those who left the study had an average green preference score of 3.43 (SD = 1.51). The two groups did not differ significantly from one another (t (15) = 1.20, p > .05). The completers' pre-treatment blue preference score (M = 5.20, SD = 2.82) did not differ significantly from the non-completers' pre-treatment blue preference score (M = 4.86, SD = 3.08, t (15) = .238, p > .05). The remaining of the results provided will only include the participants who completed the

Variable	Mean	SD	1	2	3	4	5	6	7
1. PHQ 9 Pre	17.70	3.20							
2. PHQ 9 Post	8.30	5.76	.265						
3. Red Pre	3.60	3.20	.258	.128					
4. Red Post	3.60	2.95	-.002	-.038	.028				
5. Green Pre	2.20	2.39	.139	.479	-.264	.107			
6. Green Post	4.00	2.49	.056	.023	.042	.694*	.577		
7. Blue Pre	5.20	2.82	-.658*	-.175	-.236	.011	.207	.142	
8. Blue Post	3.20	3.29	-.426	.208	-.055	-.071	.628	.338	.689*

*Indicates a significant correlation at the *p* < .05 level.

Table 1. Descriptive statistics and correlations of variables of interest.

entire study. All of the participants were Caucasian, 80% were female, and the average age was 51.80 (SD = 13.98).

To investigate the data, the descriptive information and correlations among variables were examined. This information is presented in Table 1. Upon visual inspection of the descriptives, the pre- and post-treatment scores on the PHQ-9 differ widely, as well as the green and blue preference variables. There were only three significant correlations: 1) a negative correlation (r = -.658, p < .05) between the pre-treatment depression score and the pre-treatment blue preference, 2) a positive correlation between post-treatment green and red preferences (r = .694, p < .05), and 3) a positive correlation between the pre- and post-treatment blue preference (r = .689, p < .05). To examine the change in depression scores, a paired-sample t-test was used to compare the participants' scores on the depression measure before and after treatment. The pre-treatment scores (M = 17.70, SD = 3.20) were significantly higher than the post-treatment scores (M = 8.30, SD = 5.76, t (9) = 5.13, p < .01). This test indicates that despite the participants' chronic depression, the level of depression was lower after the treatments. To test the difference between pre- and post-treatment scores of green preference and blue preference, two more paired-sample t-tests were performed (red was not investigated because there was no change). Pre-treatment blue preference (M = 5.20,

SD = 2.82) is significantly higher than post-treatment blue preference (M = 3.20, SD = 3.29, t (9) = 2.58, p < .05). Pre-treatment green preference (M = 2.20, SD = 2.39) was significantly lower than post-treatment green preference (M = 4.00, SD = 2.49, t (9) = -2.53, p < .05). Given the significant changes in the depression and color preference scores, more analyses were conducted to investigate the relationship between the change in these variables. First, variables were computed by subtracting the pre-treatment scores from the post-treatment scores. Thus, a positive change would indicate an increase in depression or color preference. Descriptive information and correlations among the change variables can be found in Table 2. Unfortunately, the apparent relationships between the changes in color preference and the change in depression are not significant. This could be due to the small sample size (N = 10), but further research will need to be conducted to verify.

Table 2. Descriptive statistics and correlations of change variables.

Variable	Mean	SD	1	2	3
1. Δ PHQ 9	-9.40	5.80			
2. Δ Red	0.00	4.29	-.013		
3. Δ Green	1.80	2.25	.376	-.222	
4. Δ Blue	-2.00	2.45	-.433	.207	-.322

* Indicates a significant correlation at the *p* < .05 level.

DISCUSSION

This was a pilot study to determine if the subjects' responses to the color light treatment would be sufficient to warrant further study.

This study utilizes a repeated measures design, and there was no control group. We are cognizant that in the course of depression that there are individuals that experience spontaneous improvement and with all treatments the placebo effect may be a factor. However, considering the chronicity of the depression in the group and the number of different treatments they had previously tried, we feel that these are less of a concern than they might be in individuals experiencing their first or second episode of depression.

This research was funded by the primary investigator and funds were not available to have a control group that was matched for age, gender, education, medical condition, level of depression, etc. However, with the exception of the 19 year old, whose number of years of depression was limited by his age, all of the subjects had suffered from depression for a number of years and when not experiencing a major depressive episode were experiencing dysthymia. Such individuals are frequently described has having "double depression" although double depression is not recognized in the DSM-IV.

Seven subjects dropped out of the study. Five of the subjects dropped out for reasons not associated with the demands of the study or their response to the treatment. The two individuals who dropped out, where no outside factors were identified were each on more than ten different medications. Considering the number of possible side effects and interactions of the medications being taken, introducing yet another treatment modality may have predisposed the light treatment to failure. In future studies the number of medications the individual is currently taking will be a consideration for whether or not the subject is accepted in the study.

In the present study the subjects received a 27-minute light treatment once a week for 10 to 12 weeks. With white light for the treatment of seasonal affective disorder the individual commonly is exposed to the light daily with the length of the daily sessions and the number of days involved varying from therapist to therapist. Traditional syntonic therapy as practiced by syntonic optometrists requires at least three consecutive days of treatment per week for a total of 20 sessions. (Gottlieb, R., Wallace, L. 2001[13]). The current pilot study suggests that weekly light sessions might be just as effective as daily sessions but the study needs to be expanded and replicated. Due to the small number of subjects, the results cannot be generalized to larger populations. However, we hope that the significant level of improvement in the depressive symptoms and the interesting changes in color preference will encourage others to perform similar studies.

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