

Effect of software-based therapeutic coloring on stress and anxiety in patients with multiple sclerosis: A quasi-experimental study

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ABSTRACT

Aim. The present study was conducted to examine the effect of software- based therapeutic coloring on stress and anxiety among multiple sclerosis (MS) patients.

Material and methods. This quasi-experimental was carried out among 30 MS patients of Neyshabur. Participants were assigned into intervention or control groups by simple random method.

Results. Anxiety score was significantly lower in the intervention group as compared to the controls ($p < 0.001$). A significant reduction in score of stress was observed in the intervention group as compared to pre-intervention. Stress score significantly reduced more in the intervention group as compared to the controls ($p < 0.001$).

Conclusion. This study indicated that therapeutic coloring based on software has significant effects on stress and anxiety among patients with MS.

Keywords: multiple sclerosis, therapeutic coloring, anxiety, stress

INTRODUCTION

Multiple sclerosis (MS) is a chronic disorder of central nervous system associated with neuronal demyelination which is known as the most common cause of neurological disability in young adults and middle-age population (1). Demyelinated regions spread throughout the white matter, and affect sensory and motor function (2). Sensorimotor symptoms including visual impairments, weakness, gut and bladder functional disorder, sensory inadequacy, and neurological symptoms are common (3,4).

The National Multiple Sclerosis Society announced that over 2 million individuals suffer

from MS, and 200 new cases are diagnosed on a weekly basis (5). On the other hand, costs associated with this disease are considerably high (3). Mortality rate due to MS in America has increased approximately 25% during past two decades (6). Based on a report by Iran MS society, 70,000 individuals with MS have been diagnosed, and number of new cases is increasing (7). Due to high mortality rate, addressing huge expense and various issues faced by patients, and attempts to reduce these issues and symptoms associated with this disease are necessary (4).

Overall, studies indicate that patients with MS suffer from higher levels of stress and anxiety as compared to healthy populations. A study by

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Article History:

Received: 2 December 2020
Accepted: 17 December 2020

Beiske et al. in Norway among 140 MS patients showed that 19% complained about anxiety; anxiety prevalence was significantly higher than normal population in these patients (8). Other studies also indicate that 25-40% of MS patients suffer from anxiety which affects their quality of life (9).

In recent years, non-pharmacological methods, also known as complementary remedies, have gained much attention. These methods include touch therapy, hypnotism, homeopathy, reflexology, sports medicine, physical therapy, aromatherapy, acupuncture, acupressure, rhythmic breathing, art therapy, comedy, following news and events, music therapy, and pet therapy (10). Non-pharmacological approaches such as rehabilitation are helpful for stress and anxiety treatment (11).

Complementary therapies are associated with various benefits for MS patients and patients use these methods widely (12). A study showed that about one third of patients with MS benefit from complementary therapies despite other common treatments. Also, acceptability of these therapies has increased in health care systems. These could decelerate the course of the disease; reduce the number of attacks; and delay the onset of permanent disability (13).

One of techniques of art therapy is “therapeutic coloring”. In this method, Mandala designs are used for coloring. Essence or the main purpose of Mandala is to connect with God; speaking to God; and recognizing the fact that spiritual and healing power resides inside mediator himself/herself (14). Considering the ease of therapeutic coloring and possibility for the patient to do this method on their own in a short period of time without the need to visit the clinic, and also less interference of therapist through treatment process, this method is distinct as compared to other methods with long face-to-face sessions.

Until now, no study has examined the effect of this technique on stress and anxiety among MS patients. Due to the effect of this method on resource allocation, also no need for special equipment and easy implementation by patients, and considering that therapeutic coloring has effectively reduced stress and anxiety among various populations with different diseases, this study was conducted to investigate the effect of software-based therapeutic coloring on stress and anxiety among patients with MS.

MATERIAL AND METHODS

This study is a quasi-experimental with pre-test and post-test design conducted in Neyshabur city. 30 patients with MS were selected based on inclusion criteria by census method.

Inclusion criteria were: willingness to participate, MS diagnosis, 19-40 years old, ability to understand and speak in Persian, no visual impairment or hearing loss, no current or previous history of psychiatric problems, no stressful events in the last 6 months such as marriage or divorce (patients or their parents), onset of severe disease in patients or their family, loss of family or friends, no drug abuse or use of sedatives, access to android mobile phones, history of psychological issues or known anxiety disorders, familiarity with software used in this study.

Unwillingness to participate in the study, use of sedatives during study period, stressful events in the last 6 months such as marriage or divorce (patients or their parents), onset of severe disease in patients or their family, loss of family or friends were considered as exclusion criteria.

Included patients were assigned into two groups using simple random allocation method. Informed written consent was obtained and study objectives were explained to participants before initiation. Data collection was carried out using a demographic questionnaire, depression questionnaire, and DASS-1 stress anxiety questionnaire. Stress and anxiety were examined before and after the intervention using DASS-21. It is a combination of three self-report scales to assess negative affect in depression, anxiety and stress including 21 questions. Each subscale is made of 7 questions which gives a final score. Each question is scored from 0 (not at all) to 3 (completely). Since DASS-21 is a short form of the original scale (42 questions), the final score of each subscale should be doubled. Validity and reliability of the questionnaire have been confirmed in previous studies (15). Individuals with low to moderate stress and anxiety level were included in this study.

In the intervention group, mandala designs coloring software was installed on mobile phones. 3 sessions per week for a month were conducted. In first 3-sessions, designs were introduced. 3 mandala designs were provided and participants were asked to choose 2 of their most favorite ones with

authors' supervision, and then they started coloring the designs without any training. Designs gradually became more sophisticated during study period and evolved from simple designs to complete and composite models. In this step, familiarity with the work and recreational aspect of coloring were considered. Next 4-sessions were about attention to inner voice and participants were asked to do this as they were coloring the designs and to write down what they were thinking about at the end. At the end of this phase, subjects recognized their negative inner thoughts and negative attributions they were making towards themselves. Final 4-sessions were associated with change in inner voice content and participants were asked to turn their negative inner voices into positive thoughts. In this phase, 2 designs were offered to each participant to choose only one design based on details and complexities of each design. At the end, stress and anxiety tests were again administered. In the control group, only the questionnaire without any intervention was completed at time points similar to the intervention group.

Data were analyzed using SPSS, 25. For qualitative variables, frequency and percent, and for quantitative variable, mean, standard deviation, median, and variation range were used. Normality of quantitative parameters was examined by Shapiro-Wilk Test. Independent and paired t-test, Mann-Whitney, Wilcoxon, Chi square, and Fishers test, were used for data analysis. Also, analysis of covariance was used to control for confounding effect. $p \leq 0.05$ was considered as statistically significant.

This study was approved by ethics committee of Neyshabur University of Medical Sciences (IR.NUMS.REC.1396.26). Ethical issues such as informed consent from study units, confidentiality of personal information, having the right to discontinue the study at any time point, and preservation of intellectual property rights in electronic and printed resources were considered throughout the study. Informed consent was requested from the patients who provided the data during data collection.

RESULTS

30 patients with MS entered this study and were assigned into intervention ($n = 15$) and control ($n = 15$) groups.

All participants were included in the final analysis. Mean age of participants in the control and intervention group were 32.73 ± 8.04 and 34.87 ± 11.10 , respectively, without any significant difference between the two groups ($p = 0.398$). In the intervention group, half of participants were females, while in the control group, 60% were females. Controls had significantly higher levels of education ($p = 0.041$), and were mostly residents of Neyshabur city. Overall, 9 out of 30 participants lived in the suburbs of Neyshabur city (3 in the control and 6 in the intervention group). Majority of subjects were married (56.7% in the intervention group and 70% in the control group). Results indicated no significant differences between study groups in terms of demographic variables including marital status, gender, residence, job status, insurance, and income ($p > 0.05$) (Table 1).

TABLE 1. Comparison of the frequency distribution of demographic characteristics between the two groups of test and control

		Groups of therapy		P value
Variables		Control N (%)	Interven N (%)	
Gender	Male	12(40)	15(50)	0.43
	Female	18(60)	15(50)	
Resident	City	27(90)	24(80)	0.47
	Suburbs	3(10)	6(20)	
Marital status	Single	7(23.4)	9(30)	0.30
	Married	21(70)	17(56.7)	
	Widow	2(6.6)	4(13.3)	
Educa	Illiterate	0	2(6.7)	0.1
	Primary	2(6.7)	5(6.7)	
	High school	6(20)	8(26.7)	
	University	22(73.3)	15(50)	
Insurance	Yes	29(97.7)	25(83.3)	0.12
	No	1(3.3)	5(16.7)	
Occupation	Employee	5(16.7)	2(6.7)	0.32
	Re ed	1(3.3)	2(6.7)	
	Self-employment	12(40)	10(33.3)	
	Housekeeper	11(36.7)	14(46.7)	
	Other	1(3.3)	2(6.7)	
Income	No income	9(30)	13(43.4)	0.55
	100-200 USD	15(50)	10(33.3)	
	>200 USD	6(20)	7(23.3)	

Mean (SD) score of anxiety in the intervention group before and after the intervention was 11.17 ± 4.48 and 5.33 ± 3.84 , respectively, with statistically significant difference ($p < 0.0001$). Mean (SD) score of anxiety in the control group before and after the intervention was 12.17 ± 3.44 and

TABLE 2. Comparison of anxiety level distribution between test and control groups before and after the intervention

Anxiety	Before		After		changes	p-value*
	Mean ± SD	Median (min-max)	Mean ± SD	Median (min-max)		
Control	12.17± 3.44	12.50(5.00-18.00)	12.03±3.09	11.50(6.00-18.00)	-0.13±1.43	0.614
Interven	11.17±4.48	11.00(3.00-18.00)	5.33±3.84	5.00(0.00-16.00)	-5.83±2.75	<0.0001
Crude P-VALUE**	0.337		<0.0001		<0.0001	
Adjusted P-value***	-		<0.0001		-	

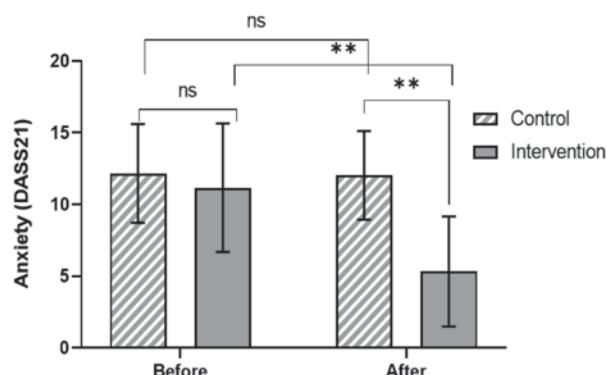
* Based on paired t test.

** Based on t test.

*** Based on analysis of covariance considering pre-test and studies as covariate.

12.03±3.09, respectively, with no statistically significant difference ($p = 0.61$). At baseline, no significant difference was observed between two groups in terms of anxiety score; however, they were significantly different after the intervention. Reduction in anxiety score was also more pronounced in the intervention group ($p < 0.0001$).

Using analysis of covariance, pre-intervention value and education level (which were heterogeneous in groups) were entered as confounding variables in order to control their effect. After adjusting for these two variables, two groups were still significantly different in terms of anxiety score ($p < 0.0001$) (Table 2, Figure 1).

**FIGURE 1.** Comparison of anxiety level distribution between test and control groups before and after the intervention (ns makes meaningless and ** makes meaning in level of 1%)

Moreover, anxiety level was examined as a ranked -qualitative variable. 13.3%, 46.7%, and

30% of controls showed mild, moderate, and severe anxiety before intervention, respectively. After the intervention, these values were 16.7%, 56.7%, and 23.3%, respectively, without any significant change as compared to the baseline ($p = 0.655$). In comparison, 13.3%, 36.7%, and 26.7% of the intervention group showed mild, moderate, and severe anxiety which reached to 13.3%, 6.7%, 3.3%, respectively, after the intervention. Individuals without anxiety comprised 23.3% of the intervention group which increased to 76.7% after the study ($p < 0.0001$). On the other hand, difference between the two group was not significant at baseline but after the intervention, anxiety level was significantly lower in the test group ($p < 0.0001$).

Stress score in the intervention group at baseline and after the intervention was 10.20 ± 3.59 and 4.10 ± 2.41 , respectively and the difference was statistically significant ($p < 0.0001$). Mean score of stress among controls before and after intervention was 12.43 ± 2.92 and 13.10 ± 2.66 , respectively and this increase was significant ($p = 0.03$). at baseline, two groups were statistically different which remained the same after the intervention in terms of stress level. Reduction in stress score in the intervention group was significantly higher than controls ($p < 0.0001$). After adjusting for stress level at baseline and also education level, a significant difference was observed between two groups regarding stress level ($p < 0.0001$) (Table 3, Figure 2).

TABLE 3. Comparison of stress level distribution between test and control groups before and after the intervention

Stress	Before		After		changes	p-value*
	Mean ± SD	Median (min-max)	Mean ± SD	Median (min-max)		
Control	12.43± 2.92	13.00(7.00-18.00)	13.10±2.66	13.00(7.00-17.00)	0.67±1.72	0.033
Interven	10.20±3.59	10.00(3.00-18.00)	4.10±2.41	4.00(0.00-10.00)	-6.1±2.44	<0.0001
Crude P-VALUE**	0.009		<0.0001		<0.0001	
Adjusted P-value***	-		<0.0001		-	

* Based on Wilcoxon Singed Ranked test.

** Based on Mann-Whitney test.

*** Based on Analysis of Covariance considering pre-test and studies as covariate.

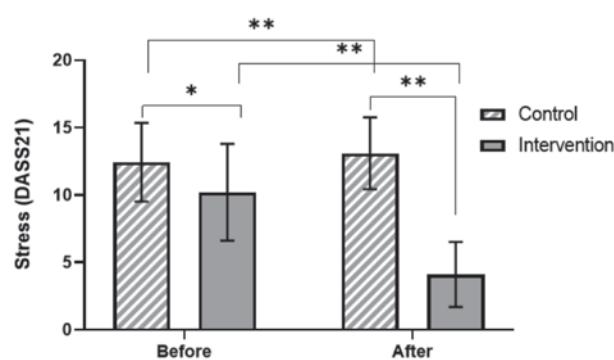


FIGURE 2. Comparison of stress distribution between test and control groups before and after the intervention (* makes meaning in the 5% level and ** makes meaning in the 1% level)

Stress based on classification level was also compared between groups. In the control group, 20% of participants showed mild stress level which raised to 33.3% after the intervention and this increase was significant ($p = 0.046$). In comparison, 10% of participants in the intervention group indicated mild stress at baseline which was alleviated to the normal level after the intervention but this difference was not significant ($p = 0.083$). On the other hand, the difference between groups at baseline was insignificant ($p = 0.282$); however, after the intervention, the ratio of participants with mild stress was significantly lower in the intervention group (9% as opposed to 33.3%) ($p < 0.0001$).

DISCUSSION

Present study showed significant reduction of stress and anxiety in the intervention group as compared to controls. Lobadi and colleagues (14) examined the effect of therapeutic coloring on reducing anxiety and enhancing self-image in normal and wrong-doer teenage girls and indicated that main and adjusted scores of total anxiety reduced significantly. They concluded that therapeutic coloring could be a complementary therapy for reducing anxiety and emphasized that further studies in other age groups with longer duration and more precision are warranted in this field.

Kim and colleagues (16) conducted a study titled as “a computer system using a structured mandala to differentiate and identify psychological disorders”. In this study, 495 participants with four types of psychiatric disorders were recruited. Computer system was able to identify 67 signifi-

cant elements and factors, and authors indicated that structured mandala could be an art therapy tool with high validity and reliability to differentiate between psychiatric problems. In fact, evidence of psychiatric problems in these designs is enough to use them as a tool for psychiatric diagnosis which indicates the effectiveness of mind in coloring geometric designs.

Kasser and colleagues (17) investigated if coloring mandalas could reduce anxiety. They suggest that structured coloring of a reasonably complex geometric pattern may induce a meditative state that benefits individuals suffering from anxiety. This is in line with results of the present study showing that targeted and structured coloring could be used for anxiety relief.

Van der Vennet and colleagues (18) also tested whether coloring on a mandala design as compared to a plaid design, or a blank paper would reduce anxiety. They concluded that coloring a mandala reduces anxiety to a significantly greater degree than coloring on a plaid design or coloring on a blank paper. This is also consistent with our results and shows that structured therapy could increase the effectiveness of intervention and treatment protocols should move towards using structured methods. Another study by Nadezhda et al. (19), titled as “Adolescents’ School Anxiety Correction by Means of Mandala Art Therapy”, determined that mandala art therapy is an effective means of school anxiety correction in adolescents.

However, study by Habibi and colleagues (20) showed inconsistent results as compared to ours. They showed that mindfulness-based art therapy among postmenopausal women reduced depression and stress and improved the quality of life without any significant effect on anxiety. In this method, the main focus of treatment is to turn negative thoughts into positive reflections. In fact, through art therapy, unconscious mind releases emotions that have been holding inside. Patients write down their negative feelings through coloring, share their own emotions, and as a result, try to improve their function. Coloring effectiveness in therapy is based on this claim that inner speech is intrinsically linked to self-awareness (21).

Various studies have shown that proximity of speech and self-awareness centers in human brain may explain the observed changes in self-awareness and reduced anxiety in patients undergoing

art therapy (14). Patients with MS have higher levels of psychiatric disorders such as stress and anxiety as compared to healthy population (8). Therefore, anxiety management with this method could be considered as a treatment protocol in MS.

Limitation of this study is that participants may have been familiar with software similar to the one used in this study which was out of authors' control.

CONCLUSION

This study indicated that therapeutic coloring based on software has significant effects on stress

and anxiety among patients with MS and leads to remarkable decrease in these variables.

Acknowledgements

This research study was approved by Vice Chancellor for Research of Neyshabur University of Medical Sciences. We would like to thank all participants in this study, and also Research Vice Chancellor of Neishabour University of Medical Sciences for their financial support.

All authors contributed equally to this paper.

Conflict of interest: none declared

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