

Effectiveness of Mandala Coloring Intervention on Children's Preoperative Anxiety: A Randomized Clinical Trial Study in Iran

Abstract

Background: Mandala coloring is a distraction strategy to reduce the anxiety in children. However, it has received little attention for the management of anxiety in hospitalized children. This study aimed to examine the effectiveness of mandala coloring on preoperative anxiety in children. **Materials and Methods:** This randomized controlled trial study was conducted using a pre-test-post-test design in two intervention and control groups. The 64 school-age children, who were admitted to the pediatric surgery ward in Mofid Hospital in Tehran, were allocated to the test and control groups, using a single-blind block randomized design. Children in the control group underwent routine preoperative visits. Meanwhile, the children in the intervention group, mandala coloring intervention was done at least one hour before entering the operating room for 15–20 minutes. The level of anxiety was measured through the Spielberger State-Trait Anxiety Inventory, before and after the intervention of both groups. Results were analyzed using *t*-test and Pearson correlation. **Results:** In the intervention group, there was a statistically significant in post-intervention than the pre-intervention and the children reported a lower level of anxiety ($t = 4.51$, $df = 31$, $P = 0.01$). But, after the intervention, there was not a statistically significant between the intervention and control groups in terms of average trait ($t = 1.31$, $df = 61.86$, $P = 0.194$) and state anxiety levels ($t = -0.152$, $df = 58.94$, $P = 0.879$). **Conclusions:** The results indicated that likely, mandala coloring intervention was not effective in reducing preoperative anxiety in children. Further studies are needed to more assess the effects of mandala coloring on anxiety of children undergoing surgery.

Keywords: Anxiety, art therapy, child, management, mandala coloring, preoperative

Introduction

Surgery, as a stressful experience, often leads to psychological reactions in children before surgery. The most obvious preoperative reaction is anxiety manifested in the form of nervousness, worry, or even fear.^[1,2] According to previous studies, 50 to 80% of children experience severe anxiety before the induction of anesthesia.^[3-5] During the preoperative period, several factors including wearing unfamiliar clothes, waiting to be transferred to the operating room, fear of surgery and anesthesia, separation from family members, and encountering the unfamiliar environment of the operating room and surgical staff can induce or intensify fear and anxiety in children undergoing surgery.^[2,6,7] Anxiety is described as an unpleasant feeling of unexplained worry or discomfort associated with psychological and behavioral symptoms.^[8,9] Anxiety is an emotional state of transition or organic condition of the individual. Trait anxiety is

defined as the tendency or genetic, latent, and stable predisposition with behavioral and neural responses to negative emotional situations as a danger. The state anxiety is defined as the anxious reaction of the autonomic nervous system when faced with a stressful stimulus, generating apprehension, fear, and agitation.^[10-12] Preoperative anxiety can lead to increased heart rate, decreased pain threshold and greater demand for painkillers after surgery, increased restlessness during recovery, sleep disorders, night crying, bedwetting, mood swings, increased postoperative infections, and delay in wound healing, all adversely affecting postoperative recovery in children.^[4,13,14] There are various pharmacological and non-pharmacological methods for managing anxiety, among which pharmacological factors such as the use of benzodiazepines for the treatment of anxiety can increase the risk of respiratory suppression, side effects, and worsening of clinical symptoms. For this reason, non-pharmacological interventions,

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such as art therapy, may be safer alternatives.^[14,15] Art therapy is a subset of anthropomorphic medicine. According to the American Art Therapy Association (AATA), art therapy is a creative process to improve the physical and mental state and is a useful tool for coping with stress and anxiety.^[16] Mandala coloring is one of the branches of art therapy that can be effective in controlling anxiety.^[15] Mandala designs start from a central point and expand towards infinity with nested circles.^[17,18] Coloring mandala patterns diverts the child's attention from the disease and the surrounding environment and increases the child's focus on coloring the circles and has positive effects on improving hope, flexibility, and adaptation to the disease as well as the feeling of well-being and peace in hospitalized patients.^[19]

Khademi *et al.*^[15] (2021) showed that mandala coloring improved anxiety symptoms caused by COVID-19 and hospitalization in adult patients. Moharamkhani *et al.*^[19] (2023) also found that mandala painting can reduce anxiety in 9–14-year-old children with cancer. It seems that most of the studies in the literature have highlighted the need to investigate the effectiveness of mandala coloring in reducing anxiety in different samples. However, given that different diseases tend to cause varying degrees of anxiety in affected patients, it is necessary to examine different diseases and their impacts on different populations, especially children undergoing surgery. Given the importance and necessity of reducing preoperative anxiety in children and the need to conduct more studies to find the most effective non-pharmacological methods for reducing anxiety in children, aimed to examine the effectiveness of mandala coloring on preoperative anxiety in children.

Materials and Methods

The 64 children candidates for surgery admitted to the pediatric surgical wards of Mofid Hospital, affiliated with Shahid Beheshti University of Medical Sciences in Tehran, Iran, who met the criteria for entering the study, were selected and randomly assigned to two groups including the mandala coloring group (32 people) and the control group (32 people). The children were allocated to the control and intervention groups using a simple lottery. The children in the mandala coloring (intervention) groups were selected in the first three days of the week (Saturday, Sunday, and Monday) and the children in the control group were in the second three days of the week (Tuesday, Wednesday, and Thursday). The sampling process continued until all children were assigned to the two groups. The current study was an interventional Randomized clinical trial with IRCT code IRCT20220203053920N1. The inclusion criteria for children were 6 to 18 years of age, full awareness of place, time, and persons, moderate to severe anxiety level based on Spielberger State-Trait Anxiety Inventory (STAI) before participation, the ability to communicate verbally, and having the physical strength to color Mandala designs. The exclusion criteria were moderate to severe pain during

the intervention (measured with a visual numerical scale), the need for emergency surgery, child's restlessness, and unwillingness to continue the study. The sample size was estimated using the following equation^[20,21]:

Where the probability of the first type error was $Z_{\alpha/2} = 1.96$ for $\alpha = 0.5$, the probability of the second type error was $Z_{\beta/2} = 1.96$ for $\beta = 0.5$, the test power was equal to $1 - \beta = 0.08$, and the effect size was $\frac{(\mu_1 - \mu_2)}{\sigma} = 0.70$.

Accordingly, taking the first and second type errors as 0.05 and 0.80 at the confidence level of 0.95, the sample size was estimated equal to 32 persons per group.

Since the children in the two groups were selected on different days of the week, the children in each group did not have any contact with those in the other group. The researcher attended the pediatric ward and provided some instructions to the parents and their children about the intervention procedure and obtained informed consent from the parents. To homogenize the two groups before measuring preoperative anxiety, a brief explanation about surgery was given to children. Thus, all children had some basic information about their surgery according to their age. All children and their mothers routinely attended a room located within the operating room for 15-20 minutes, and then the children were transferred to the operating room by a nurse. During this period, the children in both groups did not receive any medical intervention. In addition to the presence of the child with his mother and receiving routine care in the preoperative phase, mandala coloring facilities were provided for the children in the intervention group. The children colored the mandala patterns before entering the operating room for 15-20 minutes. The children's anxiety was measured using a checklist on two occasions before and after the mandala coloring intervention. No intervention was performed on the days when the children in the control group were examined, and only children's anxiety was measured when the children stayed in the waiting room for 15–20 minutes before induction of anesthesia. Five different mandala designs were printed separately on A4 (0.21 × 7.29 cm) paper for the children in the mandala group. The child's anxiety was measured before the intervention and then a pack of 12 colored pencils was provided to the child and he/she was asked to choose one of the mandala coloring designs as he/she wished and paint it for 15–20 minutes.

The demographic and clinical information questionnaire included five items which are: the children's age and sex, history of surgery, type of surgery, and a history of hospitalization. The children's anxiety was measured using the Spielberger State-Trait Anxiety Inventory (STAI). This tool was developed by Spielberger in 1983 and measures patients' state and trait anxiety as a self-report scale.^[22] It consists of 20 items that measure the quality of stress, worry, anxiety, and anger based on a four-point Likert scale from 1 (very little) to 4 (very much). The total STAI score

varies from 20 to 80. The scores on the state anxiety scale are organized as 20–31 (mild), 32–42 (mild/moderate), 43–53 (moderate/severe), 54–64 (relatively severe), 65–75 (severe), and ≥ 76 (very severe).^[20] This instrument was validated in 1994 for Iranian society with the internal consistency of $\alpha = 0.91$ for the whole instrument, $\alpha = 0.91$ for state anxiety, and $\alpha = 0.90$ for trait anxiety.^[23] In the present study, Cronbach's alpha coefficient was obtained as $\alpha = 0.87$.

The collected data were analyzed with IBM SPSS Statistics v25.0 software using descriptive and inferential statistics. Frequency, percentage, mean, and standard deviation were used to describe the data. Given the number of research variables, the analysis of variance (ANOVA) was run to test the research hypothesis. Moreover, to determine the effect of the independent variable on the dependent variables, independent samples *t*-test, and Pearson correlation were used. The level of significance in data analysis was considered to be less than 0.05 ($P < 0.05$).

Ethical considerations

The protocol for this study was approved with the code of ethics IR.SBMU.RETECH.REC.1400.975 by the Vice-Chancellor for Research and Technology of Shahid Beheshti University of Medical Sciences. Verbal and written informed consent was also obtained from all participants and their parents.

Results

Table 1 shows the demographic and clinical characteristics of the participants in the intervention and control groups. As can be seen, the average age of the children in the intervention and control groups was 9.46 (1.45) and 9.21 (1.89), respectively, and out of 64 children in this study, 37 (57.81%) were boys. The results of the independent *t*-test and Chi-square test showed no statistically significant difference between the two groups in terms of age, gender, type of surgery, history of hospitalization, history of surgery and the two groups were identical in terms of demographic and clinical characteristics ($P > 0.05$) Figure 1).

The results from the *t*-test showed no statistically significant difference between the two groups in preoperative anxiety before the intervention ($P = 0.145$). But, in the mandala coloring group there was a statistically significant in post-intervention than the pre-intervention and the children reported a lower level of anxiety ($P = 0.01$). However, after the end of the mandala coloring in the intervention group and routine care in the control group, there was not a statistically significant difference in preoperative anxiety between intervention and control groups ($P > 0.05$) [Table 2].

Discussion

The present study examined the effect of mandala coloring intervention on children's preoperative anxiety. The results indicated that the anxiety reported by the children in the intervention group decreased significantly after mandala

coloring. Mandala coloring as a branch of art therapy creates a positive mental state and helps children focus their attention and devote themselves to the present moment.^[24] However, there was not a statistically significant difference in the level of anxiety in the mandala coloring and control groups before and after the intervention, indicating that mandala coloring did not have a significant effect on reducing preoperative anxiety in children. Similarly, Babaei (2021) and Al-Yateem (2016) did not find a significant association between preoperative anxiety levels in children in the painting therapy group.^[25,26] This similar finding can be attributed to the similarities in the research samples and the temporary nature of preoperative anxiety. On the contrary, Khademi (2021) who examined the effect of 30 min/day for six consecutive days performing mandala painting on the anxiety of hospitalized COVID-19 patients,^[15] and Moharamkhani (2023) who examined the effect of 45 minutes of mandala coloring on reducing the anxiety of 9–14-year-old children with cancer,^[19] reported contradictory findings. This inconsistency may be due to the differences in the sample size, the duration of the intervention and the number of intervention sessions, the average length of stay, and the acute and chronic nature of anxiety. It is still not clear how much time is needed for mandala coloring to be effective and more studies are needed to determine the minimum time required to achieve the maximum effect of mandala coloring on anxiety.^[27] It is also possible that the permanence of the stress caused by the disease in the mentioned studies has caused anxiety to become permanent and chronic, while preoperative anxiety in the present study was acute and periodic.^[28] leading to the ineffectiveness of mandalas on anxiety control. In addition, several factors such as fear of death, isolation, distance from parents and family members, dietary changes, sleep disorders, and physical symptoms affect the development and persistence of anxiety.^[15] Since the prohibition of taking food by mouth and fasting before surgery, the absence of the family members with the child in the operating room, the fear of death due to surgery, and the possibility of sleep disturbance following hospitalization are among the common preoperative conditions that can impact the effectiveness of mandala painting. Other reasons for such inconsistent findings could be attributed to the difference in the participants' age group, cultural norms, and mandala geometric designs. Thus, future studies need to investigate the presence of specific elements or their combinations, such as the spatial arrangement of circles, squares, semicircles, and triangles, which may improve the effect of mandala coloring on anxiety.^[27] The data in the present study showed no significant association between the patients' demographic characteristics and anxiety. Likewise, Kim (2023) examined the effect of art therapy on anxiety, and no significant relationship between gender and age with the level of anxiety.^[29] Finally, it can be argued that there is still no strong evidence that art therapy is effective in reducing the severity of anxiety symptoms.^[30] Thus, there is a need for further research in this field to obtain more reliable findings. As one of the limitations of the present study, the sampling was done only in one educational hospital. Thus, the findings have

Table 1: The participant's demographic and clinical characteristics

Variables		Groups		p
		Mandala n (%)	Control n (%)	
Gender	Female	14 (43.75)	13 (40.62)	Chi=0.064, df=1, p=0.80
	Male	18 (56.25)	19 (59.38)	
Age		9.46±1.45	9.21±1.89	p=0.557
Type of surgery	Appendectomy	1 (3.12)	0 (0)	df=6, p=0.676
	Umbilical hernia	1 (3.12)	2 (6.25)	
	Tonsillectomy	0 (0)	1 (3.12)	
	Gastrointestinal surgery	13 (40.63)	10 (31.25)	
	Adenoidectomy	0 (0)	1 (3.13)	
	orthopedics	8 (25)	10 (31.25)	
	Genitourinary urination	9 (28.13)	8 (25)	
History of previous hospitalization	Yes	20 (62.5)	23 (71.88)	Chi=0.638, df=1, p=0.424
	No	12 (37.5)	9 (28.12)	
History of surgery	Yes	13 (40.63)	17 (53.12)	Chi=1.004, df=1, p=0.316
	No	19 (59.37)	15 (46.88)	

**Figure 1: Shows the chart for the sampling procedure**

limited generalizability to the whole community due to the difference in the treatment and care routines of each hospital. Another limitation of this study was the use of self-report tools, which could affect the measured level of anxiety in children because the level of anxiety reported by professionals may be higher, or the anxiety reported by parents may be lower than the level reported by the child.^[31] Thus, future studies need to use other tools to measure anxiety levels in children.

Conclusion

The results of the present study showed that mandala coloring intervention reduced preoperative anxiety in post-intervention than the pre-intervention in mandala group and the children reported a lower level of anxiety. However, after intervention there was no significant

difference in preoperative anxiety between the two groups of mandala and control. Therefore, in the future, more studies are needed to assess the effect of mandala coloring intervention on the anxiety of children undergoing surgery and also on the anxiety of their parents.

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Conflicts of interest

Nothing to declare.

Table 2: Comparing the anxiety levels between the two groups

Anxiety	Groups				p value
	Intervention		Control		
	Mean	SD	Mean	SD	
Pre-intervention	89.34	17.99	82.75	17.76	0.145
Post-intervention	84.43	16.58	81.34	17.40	0.469
p value	0.01		0.134		
State anxiety	44.34	9.36	44.75	11.80	0.879
Trait anxiety	40.09	10.90	36.59	10.41	0.194

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