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The Effect of Eye Movement Desensitization and Reprocessing on Anxiety and Pain after Appendectomy in Hospitalized Children

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Abstract

Background: Surgical anxiety and pain are common complaints of hospitalized children, which can have devastating effects on the child's recovery process.

Aim: The present study was performed aimed to investigate the effect of one session of eye movement desensitization and reprocessing (EMDR) on anxiety and pain of hospitalized children after appendectomy.

Method: This clinical trial study was performed on 46 children hospitalized in the hospital affiliated to Isfahan University of Medical Sciences from December 2019 to February 2020. The subjects aged 12 to 16 years who underwent appendectomy and were randomly placed in two groups. The trait anxiety and demographic characteristics were assessed before the surgery. Six hours after the surgery, the intervention group received one session of EMDR along with the routine treatment, and the control group only received the routine treatment. State anxiety and pain were assessed in the two groups before, immediately and one hour after the intervention. $P<0.05$ was considered statistically significant.

Results: The state anxiety level after appendectomy was high in both control (50.87±12.45) and intervention (53.15±6.36) groups; however, the difference was not significant ($p=0.654$). Also, the mean of pain in the intervention and control groups before the intervention was not significantly different ($p=0.948$). But the level of state anxiety and pain immediately and one hour after the intervention showed a significant difference in the intervention and control groups ($p<0.05$).

Implications for Practice: The results of this study showed that EMDR can be effective in alleviating anxiety and pain after surgical procedures in hospitalized children.

Keywords: Anxiety, Appendectomy, Children, Eye movement desensitization and reprocessing, Pain

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Introduction

Hospitalization is one of the factors which changes a child's living conditions, and endangers his/her health, causing an unbalanced and abnormal state (1). For children, hospitalization is a crisis in adapting to the new environment, not only are they should cope with disease, but they should also adapt to other unknown risk factors (2).

Children may be hospitalized for different reasons; acute appendicitis is one of the most common pediatric surgical emergencies and appendectomy is one of the most common pediatric emergency procedures, which leads to the child's hospitalization (3). A surgical operation, especially for children and adolescents, is a very stressful experience, and many of them consider that losing consciousness is equivalent to death (4).

Surgery and anesthesia cause a lot of stress and pain for children, and its consequences remain for a long time after the hospital experience and sometimes manifest as phobias, anxiety reactions, hysteria, or persistent nightmares, as well as pessimism (5). Untreated anxiety and pain can not only have negative effects on emotional, cognitive, and psychological states of people, but also can cause adverse changes in physiological states of the body, including weakened immune responses, decreased wound healing, insomnia, depression, severe anger and hypersensitivity, developmental relapse, post-traumatic stress disorder, poor academic performance, low self-esteem, depression, and drug abuse during adolescence (6-8).

Anxiety and pain, whatever the cause, should be managed by health care providers with special attention to non-traumatic care (9). Nurses, as one of the most important members of the health team, play an important role in identifying the factors of anxiety and pain caused by hospitalization and surgery of a child and its management, as well as improving the child's health condition (10). Various non-pharmacological programs have been implemented by nurses to alleviate pain and reduce anxiety caused by painful and anxious procedures in different age groups; these programs include massage and relaxation therapy, reflexology, spirituality counseling, and cognitive therapy (11-14).

Although there is limited research on the effect of such interventions, they are generally safe, non-invasive, and cost-effective and can be implemented independently (15, 16). Today, regarding to the physical psychological effects of pharmacological treatment, there is increased tendency to use non-pharmacological methods to control anxiety and pain; these methods are effective, simple, and cost-effective, which do not require special time and equipment. Moreover, no side effects are reported in using non-pharmacological methods (17).

EMDR technique is one of the non-pharmacological methods which has recently been considered for controlling anxiety and pain in children (18). The technique has been first introduced by Shapiro in 1987, which included immersion, cognitive reconstruction, rapid and balanced use of eye movements, and bilateral stimulation. This method is especially used to help people suffering from mental health problems caused by traumatic experiences, anxiety, fear, unpleasant memories, post-traumatic stress disorder, grief, and a variety of emotional problems (19). The advantages of the EMDR include fast impact and lasting results, the limited number of sessions, and no need to do homework (20). Another advantage of this method is that no example of negative cognition which become more negative has not been reported in the cases of EMDR therapy (21). Also, this method does not rely on using medication to create rapid psychological changes; therefore, short-term and long-term side effects and recurrence are not expected (20). Some studies indicated that after therapy with EMDR, a significant recovery was achieved in the variables of the hospital anxiety and depression (22, 23). Although there were previous studies which evaluated anxiety disorders treated by EMDR therapy, no study was found which has specifically investigated the effect of this treatment method on the pain and anxiety of hospitalized children who underwent appendectomy in Iran; therefore, the present study was performed aimed to investigate the effectiveness of EMDR therapy on children's anxiety and pain after appendectomy.

Methods

This clinical trial study with control and intervention groups was performed on 46 children hospitalized in the hospital affiliated to Isfahan University of Medical Sciences from December 2019 to February 2020. in the study was approved by the Research Center of the School of Nursing and Midwifery at the University of Medical Sciences and ethics committee of Isfahan University of Medical Sciences. The written consent was obtained from all parents and oral consent was obtained

from children.

The research setting of the present study was pediatric surgery wards affiliated to Isfahan University of Medical Sciences. The research samples consisted of all children aged 12-16 years admitted with acute appendicitis. According to the previous studies, with the accepted minimum mean difference of pain score (d=0.8) and considering Z1=0.05 and β-1=0.8, and using G*power 3.1.9.2, the sample size was determined as 42 people (24) that given the probability of 10% fall, the sample size was considered to be 46 people. The subjects were assigned into two groups of intervention (n=23) and control (n=23) using the Random block permutation method and randomized Allocation Software (RAS) with the same blocks. Three samples in the intervention group were excluded due to the unwillingness of parents and children to continue.

The inclusion criteria were: age of 12-16 years, history of first admission to the ward and first surgery, mental health based on patient's medical files and records, not performing any other non-pharmacological intervention to alleviate anxiety during the research stages, no history of eye, maxillofacial, neurological disorders, facial and neurological disorders which prevent eye movements, no history of chronic diseases such as disability, speech, and language disorders which prevent the child to provide information and communication, severe academic stress, parental death, divorce, and taking anti-anxiety and anti-depressant medication. The exclusion criteria were full unconsciousness for 6 hours after the surgery, the unwillingness of the child and his/her family to continue cooperation with the researcher at any stage of the study, and the child's critically illness (Figure 1).

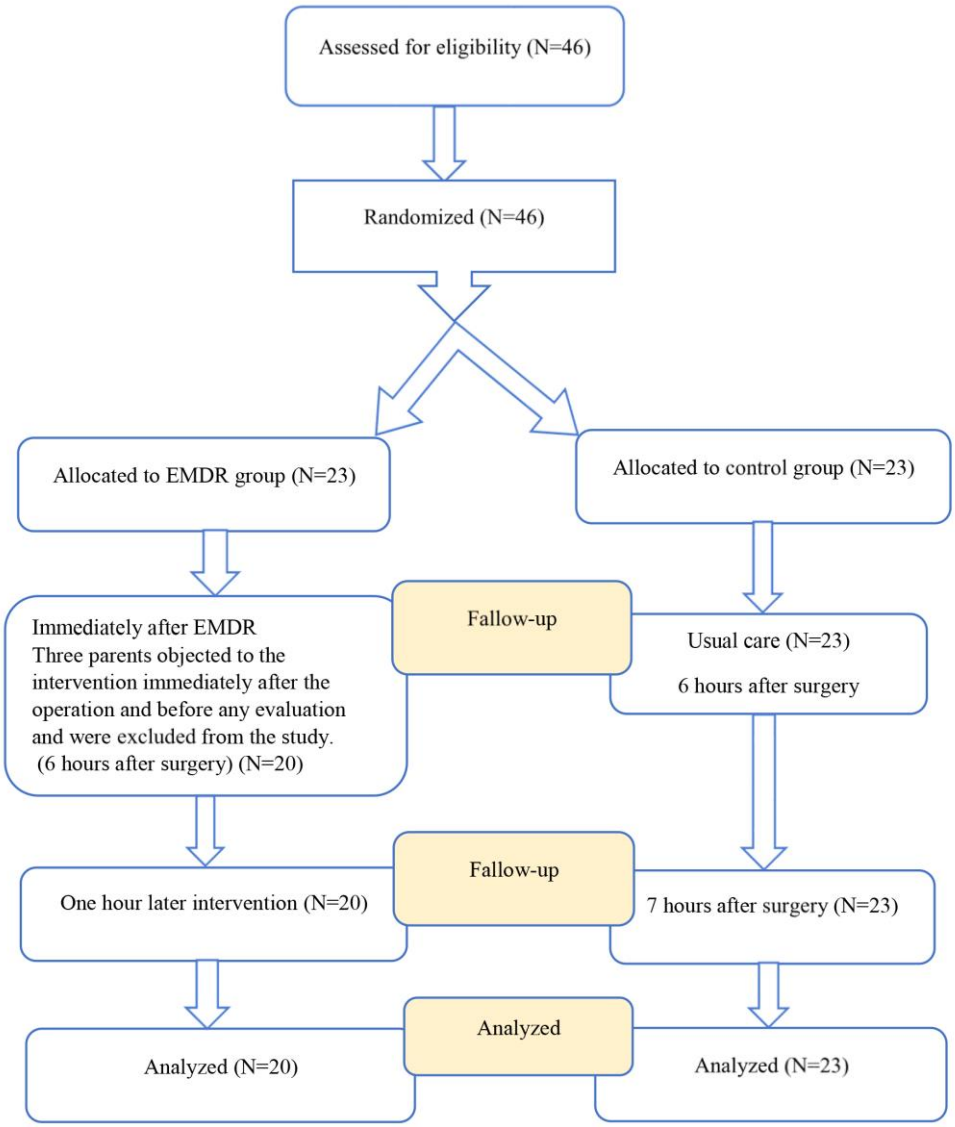

Figure 1. Flow diagram of the study

Data collection tools in this study included the demographic information questionnaire which consisted of child's age, gender, education, and parents' education, current employment status, the numerical pain scale (NPS), and the Spielberger state anxiety inventory which measures a person's general and normal emotions. The samples selected the option which better describes their general and major emotions (1- almost never, 2- sometimes, 3-often, 4-almost always). The STAI scale was developed in 1970. Spielberger anxiety inventory has 40 options, the first 20 of which measure state anxiety or situational anxiety, and the second 20 measure trait anxiety. This inventory has high scientific validity and is considered a standard test. In addition, Tidman (1990) calculated a reliability coefficient of 0.87 for measuring anxiety in hospitalized school-age children. In Iran, the reliability of the inventory has been reported as 0.87 (23).

The numerical pain scale (NPS) is a 10-centimeter line by which patients can rate their pain from 0 (no pain) to 10 (maximum pain). In the present study, the patients were asked to rate their pain on this scale. This tool has desirable validity and reliability to measure children's pain in this age range in the form of a self-report (25, 26).

Intervention

The researcher obtained the written permission from the Research Center of Isfahan School of Nursing and Midwifery and the Ethics Committee and delivered it to the hospital management. Then, the researcher referred to the pediatric surgery ward and explained the research topic, and started sampling. First, the list of hospitalized children waiting for surgery was checked and samples were randomly selected from children who met the inclusion criteria. Then, according to the random allocation by RAS, the samples were assigned into two groups of control and intervention. Before sending the children of the intervention group to the operating room, the researcher explained about the EMDR therapy and the duration of the intervention and informed them about the research process and purposes.

Then, the demographic information questionnaire was completed through the interview by the researcher. In addition, the Spielberger trait or hidden anxiety inventory was completed by the research units before the surgical operation; the items of the inventory were read by the researcher for the convenience of the child and the answers were checked in the inventory.

In the next stage, the Spielberger state anxiety and numerical pain scale were completed after the surgery by considering the same time for both groups and after the children regain consciousness before taking the second dose of analgesic after the surgery (at least 6 hours), as well as examining the samples' level of consciousness and measuring their ability to cooperate. Then, the research units received EMDR therapy for minimum of 30 minutes and maximum of 45 minutes.

At the beginning of the therapy, the stages of performing EMDR intervention were explained to the subjects according to the age of the child and using metaphors. The technique of deep breathing was taught to the children. Bilateral stimulation (BLS) method, which is the use of the researcher's fingers, and signs to stop and continue the researcher's hand movements were determined and coordinated with the child. Then, the children were asked to imagine and describe a safe place such as the beach, forest, bathroom, bedroom, grandmother's arms, balcony, etc. and feel most comfortable and relaxed. The features of described places were written on a piece of paper. Then, the therapy plan was designed. The child was asked to talk about his/her disease and surgery and negative feelings. Then, the children's negative cognition (NC) and positive cognition (PC) were obtained and scored based on the subjective unit of distress (SUD) grading from 0 to 10 and volatile organic compounds (VOC) grading from 1 to 7. The children were then asked to recall and retain their disturbing memories, which are related to the surgery, hospitalization, and subsequent anxiety, and all the unpleasant aspects and feelings which cause distress. They simultaneously focused their eyes on the researcher's finger movements and had rapid eye movements as tracking the researcher's finger. These bilateral stimuli were performed up to a maximum of 24 times per minute, depending on the child's ability, and the children were asked to talk about their negative feelings about that disturbing event after each set. The SUD and VOC scores were obtained after performing an average of 4 to 5 sets. Then, the therapy focused on the child's positive cognition and replaced it with negative cognition. The child was asked to visualize and retain the disturbing memory in the mind, and was asked to rely on his/her positive cognition, and track the researcher's hand movement with his/her eyes. The intervention continued until the

subjective units of distress reduced and the positive cognition unit increased. At the end of the intervention, the children were asked to reimagine themselves in the safe place they imagined at the beginning of the session. Then, the child was physically examined by the researcher and helped to relieve the feeling of tension and physical tightness which may have evoked by associating disturbing memories through deep breathing technique. Finally, a general evaluation of the intervention was performed.

Then, at the end of the session, the state inventory and numerical pain scale were completed by the intervention group immediately and one hour after the intervention. One hour and two hours later without performing an intervention, the questionnaires were completed by the research units in the control group. The control group received the routine care of the ward.

Data were prescribed as quantitative (discrete and continuous) and qualitative (nominal). Regarding to the nonparametric nature of data, non-parametric inferential descriptive statistical methods (Friedman test, Kruskal-Wallis analysis of variance, Mann-Whitney test) were used to analyze the data using SPSS (version 16). $P<0.05$ was considered statistically significant.

Results

The children's mean age in the intervention group was 13.85±1.72 years and in the control group was 13.79±1.44 years, which was not significantly different between the two groups (p=0.857). The frequency distributions of children's gender, mothers' and fathers' occupation, and mothers' and fathers' education showed no significant difference between the two groups (p>0.05) (Table 1).

Trait anxiety in the intervention group and control group was 33.57±8.67 and 35.87±7.77, respectively, which showed no significant difference between the two groups. According to the results, 75% of the intervention group and 83.4% of the control group had mild to moderate trait anxiety, respectively, which wasn't significantly different between the two groups (p=0.349).

The mean of state anxiety in the intervention group before the intervention was 53.15±6.36 and in the control group was 50.87±12.45, which was not significantly different between the two groups (p=0.654). The mean of state anxiety immediately after the intervention in the intervention group was 32.05±7.17 and in the control group was 50.58±11.02, which showed a significant difference between the two groups (p<0.05). State anxiety one hour after the intervention in the intervention and control groups was 31.10±5.96 and 49.91±9.99, respectively, which was significantly different between the two groups (p<0.05).

Table 1. Demographic characteristics in the intervention and control groups at baseline [Mean (SD), Freq. Number (%) of participates, n=43]

		intervention		control			
		N	%	N	%	χ^2	P*
Sex	Girl	11	55	9	39.13	1.35	0.253
	Boy	9	45	14	60.87		
Mothers' jobs	Employed	6	30	11	47.83	1.15	0.282
	housewife	14	70	12	52.17		
Fathers' job	Unemployed	1	5	2	8.69	0.42	0.855
	Employed	18	90	19	82.62		
	Retired	1	5	2	8.69		
mother's education	Under diploma	0	0	3	13.04	1.22	0.221
	diploma	8	40	10	43.47		
	academic	12	60	10	43.47		
Father's education	Under diploma	0	0	3	13.04	0.53	0.650s
	diploma	5	25	4	17.39		
	academic	15	75	16	69.57		

*Fisher Exact Test

Table 2. Frequency distribution of situational anxiety levels in the two groups at different times after surgery

	anxiety levels	before		Immediately after		one hour later		χ^2	P**
		N	%	N	%	N	%		
Control	slight	2	8.69	2	8.69	1	4.35	1.52	0.468
	Medium to low	2	8.69	4	17.39	3	13.04		
	over average	6	26.09	4	17.39	10	43.48		
	Fairly intense	11	47.84	12	52.18	9	39.13		
	Intense	2	8.69	1	4.35	0	0		
Intervention	slight	0	0	12	60	12	60	38.38	0.001
	Medium to low	1	5	5	25	6	30		
	over average	5	25	3	15	2	10		
	Fairly intense	14	70	0	0	0	0		
	Intense	0	0	0	0	0	0		
		P*=0.000		P*=0.000		P*=0.363			

* Kruskal Wallis Test, **Friedman test

The assessment of the level of state anxiety showed that 85% of the intervention group and 88.2% of the control group had higher than moderate anxiety before the EMDR intervention. While, immediately after the intervention, only 15% of samples in the intervention group and 54.2% of samples in the control group had higher than moderate anxiety. Also, one hour after the intervention, 10% of the intervention group and 37.5% of the control group had higher than moderate anxiety. Friedman's test showed that the levels of state anxiety in the intervention group at different times (before the intervention, immediately, and one hour after the intervention) were significantly different ($p>0.05$) (Table 2).

The mean pain score before the intervention in the intervention group and control group were 6.30±1.75 and 6.17±2.58, respectively, which showed no significant difference between the two groups ($p>0.05$). Immediately after the intervention, the mean pain scores in the control and intervention groups were 4.22±1.85 and 6.04±2.35, respectively, indicating that the two groups had a significant difference in terms of pain ($p<0.05$). Also, one hour after the intervention, the mean scores of pain in the intervention group and control group were 4.40±1.98 and 5.87±2.21, respectively, which indicated a significant difference between the two groups ($p<0.05$). The severity of pain was compared between the two groups in terms of the level of pain, which showed a significant difference between the two groups after the intervention (Table 3).

There was a significant relationship between the level of anxiety and pain before the intervention ($r=4.58$, $p<0.05$). However, there was no relationship between anxiety and pain after the intervention in the intervention group, but in the control group, the relationship was significant in the three stages of the evaluation (Table 4).

Table 3. Frequency distribution of pain levels in the two groups at different times after the intervention

		before		Immediately after		One hour after			
	Pain level	N	%	N	%	N	%	χ^2	P**
Control	slight	3	13.04	3	13.04	3	13.04	3.96	0.138
	intermediate	9	39.13	9	39.13	8	34.78		
	severe	11	47.83	11	47.83	12	52.18		
Intervention	slight	1	5.0	8	40.0	8	40.0	36.86	0.000
	intermediate	11	55.0	10	50.0	9	45.0		
	severe	8	40.0	2	10.0	3	15.0		
		H=0.004		H=7.912		H=7.187			
		P*=0.948		P*=0.005		P*=0.007			

*Kruskal Wallis Test, **Friedman test

Table 4. Correlation of situational anxiety, characteristic anxiety, pain score, sex, age (Spearman correlation, phi)

	situational anxiety		pain			characteristic anxiety	sex	age
			before	Immediately after	One hour after			
Control	before	r	0.409*	0.451*	0.492*	-0.282	0.149	0.193
		P	0.047	0.027	0.015	0.182	0.486	0.366
	Immediately after	r	0.409*	0.445*	0.512*	-0.273	0.131	0.242
		p	0.047	0.029	0.011	0.197	0.542	0.254
	One hour after	r	0.441*	0.456*	0.530**	-0.241	0.156	0.197
		p	0.031	0.025	0.008	0.256	0.468	0.357
Intervention	before	r	0.528*	0.420	0.367	0.232	0.070	-0.040
		p	0.017	0.065	0.111	0.325	0.769	0.867
	Immediately after	r	-0.413	-0.195	-0.161	0.218	0.035	0.036
		p	0.071	0.410	0.498	0.355	0.883	0.880
	One hour after	r	-0.307	-0.066	-0.031	0.134	0.009	0.131
		p	0.187	0.783	0.898	0.573	0.971	0.581

* Correlation is significant at the 0.05 level (2-tailed).
** Correlation is significant at the 0.01 level (2-tailed).

Discussion

According to the results of the present study, the level of anxiety before the intervention was high in both intervention and control groups, and no difference was found between the two groups in this regard, which was expected based on the random allocation. The child's anxiety level significantly reduced after the EMDR therapy intervention in the intervention group.

The results of the present study were in line with the results of the study by Shahnavazi et al. (2016), which aimed to determine the effect of EMDR on the anxiety of 12-20-year-old adolescents with thalassemia. They showed that the adolescents with major thalassemia in the intervention group had lower anxiety after receiving the EMDR therapy than the adolescents in the control group (27). However, their study was conducted on adolescents for two days per week in the ward for patients with thalassemia, but the present study was conducted for one session on hospitalized children who underwent surgery.

Also, Khan et al. conducted a review study on the articles published between 1999 and 2017, aimed to compare cognitive-behavioral Therapy (CBT) and EMDR in reducing the symptoms of post-traumatic depression and stress in children. They showed that the EMDR therapy had better results than the CBT in reducing children's anxiety (28).

However, there are studies with contradictory results on the effect of EMDR therapy compared to other cognitive-behavioral therapies in reducing anxiety. Chen et al. (2018) in a review study aimed to determine the effect of the EMDR therapy in children and adults who have experienced complex childhood trauma indicated the effectiveness of the EMDR therapy (20). In another study comparing the EMDR and CBT, there was no significant difference between different groups and the two therapies had the same effects (29). The results of Wigley and colleagues showed the effectiveness of EMDR as a technique to prevent anxiety in children's Sedo-analgesia (18). Although these results were consistent with the findings of the present study and showed the feasibility of implementing this method for children in painful procedures, they used different tools to assess pain and anxiety which were different from the present research.

The mean of pain score in the intervention group significantly reduced immediately after and one hour after the EMDR intervention. This finding was in line with the results of the study by Maroufi et al., which evaluated the effect of the EMDR therapy on the severity of pain after surgery in 12-18-year-old adolescents (24). They used Wong-Baker FACES Pain Rating Scale (WBFS) to measure the pain which was observed and reported by the researcher, while in the present study, the self-report tool was used to for pain measurement, which also indicated a reduction in pain from the patient's point of view.

In the present study, a positive and statistically significant correlation was observed between postoperative pain and anxiety. After performing EMDR, simultaneous reduction of pain and anxiety

was reported in children. But immediately after and one hour after the intervention, as pain reduced in the intervention group, low level of anxiety was reported. However, this reduction was not proportional and this correlation was not statistically significant. In the control group, high level of pain and anxiety were reported in all three stages of measurement, and a positive and significant correlation was found between pain and anxiety in all three measurements. This finding is contrary to the results of Matthyssens et al., that the pain level didn't change by reducing preoperative anxiety (30). But Rosa Esteve et al. showed a significant relationship between anxiety sensitivity and postoperative pain in children (31).

The finding of this study was in line with the results of Suárez et al., who showed that EMDR was more effective than the conventional methods of treatment in managing chronic pains (32). Although their study investigated the management of chronic pains, their results were in line with the results of the present study which showed that EMDR therapy was effective in reducing pain and anxiety.

One of the limitations of the present study was that after the surgery, parents and children have high anxiety and tension that challenges the use of non-pharmacological therapies for these children. Therefore, there is a need for more training about such care before surgery. The present study attempted to control this factor by providing more training before surgery. Moreover, postoperative severe pain is the other factor which can lead to restlessness and aggression in the child and parents, therefore, appropriate pain management is necessary before intervention. The presence of a therapist beside the patient can be effective to control anxiety, which was tried to be the same in both groups.

Implications for practice

The findings of this study indicated the effectiveness of EMDR therapy to reduce pain and anxiety in hospitalized children who underwent appendectomy. Therefore, this non-pharmacological method can relieve hospital anxiety in children. It is suggested to nursing administrators pay more attention to non-pharmacological care such as EMDR in modern education to control children's anxiety and pain.

Acknowledgments

This thesis was scientifically approved in the Research Center of the School of Nursing and Midwifery at the University of Medical Sciences with code 398305 and the ethical approval code IR.MUI.RESEARCH.REC.1398.372 in the ethics committee of Isfahan University of Medical Sciences. Also, the present study was registered on the https://www.irct.ir/ with code IRCT20190925044880N1.

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Conflicts of interest

The authors declared no conflict of interest.

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