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A randomized controlled study: The effect of preprocedurals ınformative animation watch about echocardiography and ıntraprocedural kaleidoscope watch on anxiety in children

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Abstract

Aim: This study was conducted as a randomized controlled study to investigate the effect of procedural cartoons displayed before echocardiography and kaleidoscope display during the procedure on anxiety in children aged 5–12 years.

Methods: The study was completed with 164 children aged 5–12 years who were admitted for echocardiography. The study was conducted with four groups: cartoons group, kaleidoscope group, cartoons + kaleidoscope group, and control group. Data were collected using a follow-up form and the Children's Fear Scale.

Results: The results showed that the cartoons, kaleidoscope, and cartoons + kaleidoscope groups had lower anxiety scores during the procedure than during the preprocedural period ($p < .001$). In the control group, there was no significant difference between anxiety scores before the procedure and during the procedure ($p > .05$).

Conclusion: The present study concluded that cartoon display for preparing children aged 5–12 years or distracting them during the procedure using a kaleidoscope was effective in reducing their anxiety.

KEYWORDS

anxiety, cartoon, child, echocardiography, kaleidoscope

1 | INTRODUCTION

Children are exposed to some medical procedures from the moment they are born. Among these processes can be counted bloodletting, vaccination applications, X-rays, and so forth. These procedures are a source of anxiety for children (Koller & Goldman, 2012). Anxiety is an unwanted behavioral and emotional response to an unknown situation or any potential danger. The main signs and symptoms of anxiety are tachycardia, changes in blood pressure, tachypnea, feeling of fluttering of butterflies in the stomach, nausea, dizziness, needing the toilet, excessive sweating with physiological symptoms such as nervousness, anxious behavior, and feeling that something bad is going to happen (Uzbay, 2002). Factors such as the child's age, cognitive development level, the duration of the disease, the type of disease, the attitude of the family, and cultural characteristics are effective on the level of anxiety about medical procedures in children. The individual's previous hospital experiences also affect

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medical procedure anxiety (Gonener, 2009). The reason for this is that the pain experienced due to the medical procedure is coded in the brain in a traumatic and damaging way and causes anxiety in subsequent experiences (Fanurik et al., 1997). It is important to know these characteristics of the child's anxiety in an accurate assessment (Ahmed et al., 2011).

Children give different psychological responses to anxiety according to age groups (Kennedy et al., 2008). Children in the playful period may think that they will be sick all the time because they do not know the concept of time, and they may be afraid of the devices used in examination and treatment (Hsu, 2004). School-age children may think that they are the cause of the disease when they get sick. School-age children may be depressed and sometimes experience regression during this period (Bahali et al., 2009). Children in this period should be allowed to ask questions, and their insights and expectations should be met. During the process, their participation should be ensured (Eldridge & Kennedy, 2010). The purpose of choosing children in the 5–12 age group in this study is that preschool and school-age children experience characteristics suitable for their age, and they experience excessive anxiety in the face of unknown events. However, the anxiety caused by the previous negative hospital experiences of these children may persist into advanced ages. These experiences may be effective in the development of anxiety disorders (Eldridge & Kennedy, 2010). Anxiety experienced before the procedure can cause physical (distress, resistance to treatment) and long-term psychological effects (separation anxiety) in pediatric patients (Cumino et al., 2017). In addition, due to the anxiety experienced by the child, it may be difficult to perform the procedure, and the duration of the procedure may be prolonged (Aytekin et al., 2016).

Painless procedures for examination and treatment (ultrasound, X-ray, etc.) can cause anxiety to children (Blount & Loiselle, 2009). Ultrasound, which is one of the medical procedures, may therefore cause preprocedural anxiety in children. One of the ultrasound interventions is echocardiography (ECO). ECO is an ultrasound method that gives information about the heart. Although ECO is a painless procedure, it can cause anxiety in children (Klassen et al., 2008). High anxiety in children during the procedure has negative effects on the procedure, and correct diagnosis is hindered (Kesselman et al., 2016). Therefore, it is important to reduce ECO-related anxiety in children.ECO procedure is applied by physicians. However, the ECO nurse has an important role in preparing the patient for the procedure, during and after the procedure (Kane et al., 2008). Preparation before the procedure: before the ECO procedure, the patient and their parents should be prepared for the procedure. In this way, the child's anxiety can be reduced and more comfortable cooperation can be established with the child during the procedure. The child and family are informed about the procedure. Then the child is taken to the ECO room to rest. Before the procedure, the chest should be bare and they should lie on the left shoulder (Lai et al., 2006). It should also be checked whether the sonographic gel is at body temperature before the procedure (Lai et al., 2006).

What to do during the procedure: parents should also be taken to the ECO procedure room. During the ECO application, it is important to divert the attention of the child to reduce their anxiety. For this purpose, suitable toys, games, television, or movies can be used. In the ECO room, the child's vital signs are monitored by the nurse. Emergency cars and equipment should be available for use in emergencies (Lai et al., 2006). In some institutions, image device arrangements can also be made by nurses who have the necessary training (Kane et al., 2008).

What to do after the procedure: after the procedure, the nurse explains to the child and family that the procedure is over. The child’s and family’s questions are answered by the nurse and the physician, and the ECO results are reported by the physician.

Pharmacological and nonpharmacological methods can be used to reduce anxiety during ECO. One of the pharmacological methods is the sedation of children (Macias & Chumpitazi, 2011). However, sedation has many drawbacks such as additional cost, prolonged examination time, necessity of an anesthesiologist for complete sedation, and risk of developing complications (Kesselman et al., 2016). Therefore, before ECO, it is preferable to use nonpharmacological techniques to prepare children for the procedure and to relax them during the procedure.

Preparing children for the procedure involves properly informing children about the procedure before the procedure (Hallowell et al., 2008; Johnson et al., 2009; Wennström et al., 2011). Studies showing that preprocedure preparation has positive effects on anxiety (Kolk et al., 2000; Tunç-Tuna & Açikgöz, 2015) are reported in the literature. After appropriately preparing children for the procedure, they should also be supported during the procedure and nonpharmacological methods should be used to distract them.

The technique of distraction is a reliable and inexpensive method (Alhani et al., 2010; Wang et al., 2008). Among the methods that can be used to distract children are using distracting cards (Inal & Kelleci, 2012), using virtual reality glasses (Wismeijer & Vingerhoets, 2005) and soap bubbles (Longobardi et al., 2019).

The other two methods known to be effective are cartoon display (Düzkaya et al., 2021; La Vonne & Zun, 2012) and kaleidoscope display (Tüfekci et al., 2009).

Cartoon display is one of the most commonly used methods aimed at distracting children. Visual and auditory characters in cartoons help distract them from the stressful situation and focus on positive thoughts (Kaur et al., 2014**).** This method, which enables the focus of attention to be diverted before or during the procedure, takes the child's attention away from the procedure and reduces anxiety, and thus ensures that the procedure is carried out more comfortably. Some studies (Slifer et al., 2002; Yoo et al., 2011) show that visual, auditory, and sensory techniques that appeal to children's senses are effective in distracting attention. Cartoons can be used to divert attention and reduce anxiety (Durak & Uysal, 2021; Düzkaya et al., 2021; Inangil et al., 2020; La Vonne & Zun, 2012; Yoo et al., 2011). There are studies on the effects of cartoon display before the procedure (La Vonne & Zun, 2012; Lee et al., 2012; Szeszak et al., 2016) and during the procedure (Aytekin et al., 2016; Burns-Nader et al., 2017) on anxiety.

In addition, a kaleidoscope is a tool that can be used for distraction. Studies (Karakaya & Gözen, 2016; Tüfekci et al., 2009) have shown that use of a kaleidoscope is effective during painful procedures. In some studies (Canbulat et al., 2014; Koç Özkan & Polat, 2020), kaleidoscope display reduces anxiety along with pain.

However, in the literature, no study involved an intervention to distract children during the procedure along with the preliminary preparation before the ECO procedure. Our literature review did not yield any videos that were suitable for the children's age groups describing the ECO procedure.

The present study aimed to determine the effect of procedural cartoon display before echocardiography (ECO) and kaleidoscope display during the procedure on anxiety in children aged 5–12 years.

The hypotheses of the study were as follows:

Hypothesis 1. Children who watch a cartoon or a kaleidoscope about ECO procedures have lower anxiety scores during the procedure than children in a control group.

Hypothesis 2. Children who watch a cartoon about ECO procedures have lower anxiety scores during the procedure than children in a control group.

Hypothesis 3. Children who watch a kaleidoscope about ECO procedures have lower scores during the procedure than children who watch a cartoon.

2 | METHODS

2.1 | Design and setting

This study was conducted at the ECO Unit of a University of Health Sciences Health Application and Research Hospital. This study aimed to determine the effect of procedural cartoon display before ECO and kaleidoscope display during the procedure on anxiety in children aged 5–12 years. The study included children aged 5–12 years who were admitted to the ECO unit for ECO ultrasound between November 6, 2018 and February 1, 2019 and who met the sample selection criteria. Sample selection criteria were age between 5–12 years, undergoing the ECO procedure for the first time, having no communication problems (children without speech problems were included, patients with developmental disabilities were not included), being accompanied by mother and/or father during the procedure, and obtaining informed consent of parents and verbal consent of children.

2.2 | Sampling and randomization

Sample size was determined using power analysis by the study of Canbulat et al. (2014). In power analysis, it was determined that 39 participants were required for each study group, and therefore, 156 participants with 5% alpha error margin ($\alpha = .05$), 20% beta error margin ($\beta = .20$), and 80% power were required. However, in the present study, 41 children were included in each group and 164 children were included in total. Power analysis at the end of the study was found to be 82% with 5% alpha error margin ($\alpha = .05$) and 82% power. The Cohen f^2 effect size of the study is ($f = 0.266$).

2.3 | Patient selection

Children were divided into four groups: cartoon group, in which a procedural cartoon was displayed before the procedure; kaleidoscope group, in which a kaleidoscope was displayed during the procedure; cartoon + kaleidoscope group, in which a procedural cartoon was displayed before the procedure and a kaleidoscope during the procedure; and control group, in which routine practices of the clinic were performed (Figure 1). Children were assigned to groups using the method of stratified permuted block randomization; a stratified-by-age permuted

block randomization table created using the randomization program (randomization.com) was used. A total of 100 and 64 assignments were made in blocks of eight, with an equal number of children from each method. One of the researchers who conducted the study enrolled the participants and assigned participants to the interventions. The other researcher, participants, and evaluators participated in the study without knowing their assignment to the intervention. The reason why we used the stratified permutation block randomization method is that we do not have a ready patient list and it is not known how many people fall into the strata. For this reason, when patients / healthy individuals are included in the study, blocks should be separated according to these characteristics, and when the block is finished according to each layer, it is necessary to switch to a new block. However, using this method instead of using these blocks, according to the order of the children coming to the outpatient clinic, ensured that the study groups were homogeneously distributed and that the results were affected by independent variables (such as age).

The number of children who came to the ECO polyclinic during the study was 647. The number of children aged 5–12 who met the inclusion criteria in the study was 168. Four people who did not accept to participate in the study were excluded from the study. For each group, the number of randomly assigned participants who received the intended treatment and were analyzed for the primary outcome was 41. For each group, there were no excluded participants who wished to exit the study after randomization.

2.4 | Data collection

A cartoon that described the ECO procedure and a kaleidoscope were used in the study.

2.5 | Cartoon about the ECO procedure

A cartoon describing the ECO procedure was prepared by the researchers from the literature (Kesselman et al., 2016; Lai et al., 2006; Szeszak et al., 2016). The screenplay of the film was written as two separate scenarios considering characteristics of the 5–7 and 8–12 years age group. The scenarios were evaluated by 10 experts, and the film was finalized by expert recommendations. Then, it was transformed into a two-dimensional cartoon and voiceover was added. The cartoon was examined by five experts and was finalized in line with the feedback obtained.

The cartoon (Figure 2) introduces ECO materials, its purpose, and the procedure itself. The cartoons prepared were named "İpek's Adventure of Echocardiography" for the 5–7-years age group and "Can's Adventure of Echocardiography" for the 8–12-years age group. Cartoon characters describing the ECO process were selected as characters that would have a positive effect on the children. The characters of İpek and Can represent a typical child with whom a target audience of children aged 5–12 years can easily relate. During the animation, İpek and Can explained the basic information about the ECO process. Dialogs between the characters were kept as

Randomization of children (N=164)			
Cartoon group (n=41)	Kaleidoscope group (n=41)	Cartoon+Kaleidoscope group (n=41)	Control group (n=41)
Before ECO procedure Informing the family and child Questionnaire form Children's Fear scale			
Cartoongroup (n=41) -Watching Cartoon	Kaleidoscope group (n=41) -No interference	Cartoon+Kaleidoscope group (n=41) -Watching cartoon	Control group (n=41) -No interference
During ECO procedure			
Cartoongroup (n=41) - No interference -Children's Fear scale	Kaleidoscopegroup (n=41) - Watching kaleidoscope -Children's Fear scale	Cartoon+Kaleidoscope group (n=41) -Watching kaleidoscope -Children's Fear scale	Control group (n=41) -No interference -Children's Fear scale

FIGURE 1 Flowchart. ECO, echocardiography

simple as possible while the film was being prepared. Each scene in the cartoon was designed according to real-life ECO equipment. The prepared film was sent to 15 experts for expert opinion, and the scenario of the film was finalized according to the evaluations of 10 experts (child development specialists, child psychiatry specialists, educational sciences specialists, academic nurses) who gave feedback. In the final evaluation of the voiced cartoon, a high level of agreement was found among the experts in the statistical analysis of the scores given by the five experts who gave their opinions on the evaluation form consisting of nine items (W = 0.80). Animations were prepared in high-definition image quality, in digital video content format with video compression standards and appropriate voiceovers were used in animation. Cartoons were made by an expert who prepared animation at the cartoon company (animation © Nuri Avcı, 2018). The maximum ideal length of educational videos is recommended to be less than 6 min (Guo et al., 2014). The duration of each cartoon in the study was 4 min.

The cartoons were displayed to the cartoon group and the cartoon + kaleidoscope group.

2.6 | Kaleidoscope

In this study, a kaleidoscope was used for distraction during the procedure. A kaleidoscope is a toy with colorful patterns in binoculars (Figure 3). Beads in the kaleidoscope form different patterns with the help of a mirror system each time the binoculars are rotated (Figure 4). In the study, a kaleidoscope was displayed to the kaleidoscope group and the cartoon + kaleidoscope group.



FIGURE 3 Kaleidoscope



FIGURE 4 Kaleidoscope shape



FIGURE 2 Preprocedural informative animations about echocardiography

2.7 | Measurement / instruments

In this study, the Introductory Information Form and Children's Fear Scale (CFS) were used to collect data.

2.8 | Introductory information form

The Introductory Information Form comprises 41 questions regarding children's introductory information (sociodemographic characteristics, previous hospital experiences, presence of chronic diseases, and ECO knowledge levels), follow-up of children's vital signs and children's anxiety scores before and during the procedure, and whether children enjoyed the methods used.

2.9 | CFS

In our study, CFS was used to measure anxiety levels of the patients. CFS is a scale that determines how much anxiety a child experiences regarding the procedure. CFS comprises line drawings of five faces and is scored from 0–4. "No anxiety" is indicated as "0" and "extreme anxiety" as "4" (McMurtry et al., 2011). In the study, CFS was independently filled before and after the procedure by the child, parent, and the physician and researcher who performed the ECO. During the post-procedure period, children were asked to mark the score which best expressed their fear during the procedure.

2.10 | Intervention

There are four groups in the study (cartoon group, kaleidoscope group, cartoon + kaleidoscope group and control group). The data from parents and children who agreed to participate in the research were recorded on the Introductory Information Form by the researcher who held face-to-face interviews with all study groups. It was ensured that at least one parent was present next to the child during the procedure. In all groups, children, parents, and physician were informed about how to use the CFS before the procedure. The ECO process takes on average 10–15 min and the procedure is compatible with the process time. The ECO procedure was performed by the same physician in the ECO room. The cartoon application before the ECO procedure and the kaleidoscope application during the ECO were applied by the same researcher nurse in the same ECO room. Before the procedure, the children and their parents were informed about the study and verbal and written consent was obtained. The forms were administered to all children in the sample group by the same researcher nurse by the procedure steps.

2.11 | Cartoon group

Before the procedure, the child, parent, physician, and researcher independently assessed anxiety levels of the child and the scores given were recorded by the researcher nurse. The cartoons "Can's Adventure of Echocardiography" and "İpek's Adventure of Echocardiography" prepared for children according to their age groups were displayed on a tablet computer. After the procedure, the child, parent, physician, and researcher independently used the CFS to assess anxiety levels experienced by the child during the procedure.

2.12 | Kaleidoscope group

Before the procedure, the child, parent, physician, and researcher nurse independently assessed anxiety levels of the child and the scores given were recorded by the researcher. During the procedure, the child was displayed a kaleidoscope. After the procedure, the child, parent, physician, and researcher used the CFS to independently assess anxiety levels experienced by the child during the procedure.

2.13 | Cartoon and kaleidoscope group

Before the procedure, the child, parent, physician, and researcher nurse independently assessed anxiety levels of the child and the scores given were recorded by the researcher. The cartoons "Can's Adventure of Echocardiography" and "İpek's Adventure of Echocardiography" prepared for children according to their age groups were displayed on a tablet computer. During the procedure, the child was shown a kaleidoscope.

After the procedure, the child, parent, physician, and researcher used the CFS to independently assess anxiety levels experienced by the child during the procedure.

2.14 | Control group

Children in the control group were not applied any additional intervention, except for the routine practices of the ECO outpatient clinic. Before the procedure, the child, parent, physician, and researcher nurse independently assessed anxiety levels of the child and the scores given were recorded by the researcher nurse. After the procedure,

the child, parent, physician, and researcher used the CFS to independently assess anxiety levels experienced by the child during the procedure. Child and parent outcomes were evaluated by another researcher who was involved in the study but was not involved in data collection.

2.15 | Data analysis

All statistical analyses were performed using Statistical Package for Social Sciences (SPSS Version 24.0.). Analysis of variance (F-table values) was used to compare measurement values of three or more independent groups with normal distribution, whereas Kruskal–Wallis H test (chi-square; χ^2-table values) was used to compare measurement values of three or more independent groups without normal distribution. Pearson's or Monte Carlo test was used to assess the correlations of two qualitative variables depending on expected values. Wilcoxon test (Z-table values) was used to compare measurement values of two dependent groups without normal distribution. Kruskal–Wallis H test (χ^2-table values) was used to compare measurement values of three or more independent groups without normal distribution, whereas Friedman test (χ^2-table values) was used to compare measurement values of three or more dependent groups. A p value of <.05 was considered statistically significant. If the p value was significant ($p < .05$), Bonferroni test was performed as a post hoc analysis. Friedman test (χ^2-table values) was used to compare the mean heart rate and O_2 saturation values before, during, and after the procedure. Intraclass correlation coefficient was used to assess the coherence between the child, parent, researcher, and physician.

2.16 | Permission and ethics

Ethics committee approval from Eskişehir Osmangazi University Clinical Research Ethics Committee (2018/13) and institutional approval from Afyonkarahisar Health Sciences Hospital, Department of Pediatric Health and Diseases (2018-E.2024) were obtained for the study. The purpose and method of the study were explained to the children and their parents. Verbal consents of the children who volunteered after the information was obtained along with written informed consent of their parents by the principle of willingness and volunteering. The study was registered in the Clinical Trial Registry (NCT04334733).

3 | RESULTS

The study was completed with a total of 164 children (78 [48%] girls and 86 [52%] boys), with 41 children in each group. Before and during the procedure, anxiety levels of children in the study were independently assessed by the children themselves, their parents, and the physician as well as researcher who performed the ECO procedure. The pre-procedure coherence between the assessors in the study was "high" in the cartoon group ($p = 0.947$) and kaleidoscope group ($p = 0.942$), whereas it was "perfect" in the cartoon + kaleidoscope group ($p = 0.953$) and control group ($p = 0.950$). The coherence in the scores given to children's anxiety levels during the procedure was "high" in the cartoon group ($p = 0.941$), whereas it was "perfect" in the kaleidoscope group ($p = 0.963$), cartoon + kaleidoscope group ($p = 0.989$), and control group ($p = 0.981$).

TABLE 1 Baseline characteristics of the study groups (N = 164)

Variable (N = 164)	Cartoon group (n = 41) or n (%) $\bar{X} \pm$ S.S.	Kaleidoscope group (n = 41) or n (%) $\bar{X} \pm$ S.S.	Cartoon + kaleidoscope group (n = 41) or n (%) $\bar{X} \pm$ S.S.	Control group (n = 41) or n (%) $\bar{X} \pm$ S.S.	*p* value
Gender					
Female	18 (43.9%)	21 (51.2%)	20 (48.8%)	19 (46.3%)	$\chi^2 = 0.489$ $p = .921$
Male	23 (56.1%)	20 (48.8%)	21 (51.2%)	22 (53.7%)	
Child age, years	8.54 ± 2.30	8.49 ± 2.29	8.59 ± 2.39	8.44 ± 2.32	F = 0.030 $p = .993$
Children's previous medical procedure experience					
Yes	20 (48.8%)	13 (31.7%)	22 (53.7%)	15 (36.6%)	$\chi^2 = 5.284$ $p = .152$
No	21 (51.2%)	28 (68.3%)	9 (46.3%)	26 (63.4%)	
Parents accompanyıng children in the echocardiography process					
Mother	27 (65.9%)	24 (58.5%)	31 (75.6%)	30 (73.1%)	$\chi^2 = 3.805$ $p = .703$
Father	10 (24.3%)	13 (31.7%)	8 (19.5%)	9 (22.0%)	
Mother and father both	4 (9.8%)	4 (9.8%)	2 (4.9%)	2 (4.9%)	

Note: Data are represented as number (percentage) or mean ± SD, where appropriate. ® "Analysis of variance" test (F-table value). Pearson χ^2.

TABLE 2 Comparison of anxiety scores of the groups before echocardiography procedure

Preprocedural anxiety scores	Cartoon group (n = 41)		Kaleidoscope group (n = 41)		Kaleidoscope + cartoon group (n = 41)		Control group (n = 41)			Multiple comparison[b]
	$\bar{X} \pm$ S.S.	Median [IQR]	$\bar{X} \pm$ S.S.	Median [IQR]	$\bar{X} \pm$ S.S.	Median [IQR]	$\bar{X} \pm$ S.S.	Median [IQR]	p^a	
Children-reported	1.76 ± 0.99	1.5 [1.5]	1.61 ± 1.20	1.5 [1.0]	2.22 ± 1.27	2.0 [2.0]	1.39 ± 1.20	1.0 [2.0]	$\chi^2 = 10.522$ **$p = .015$**	**[3–4]**
Parent-reported	1.98 ± 1.21	2.0 [2.0]	1.59 ± 1.12	1.5 [1.0]	2.24 ± 1.26	2.5 [1.5]	1.27 ± 1.29	1.0 [2.0]	$\chi^2 = 14.400$ **$p = .002$**	**[1–4]** **[2–3]** **[3–4]**
Observed-reported	1.88 ± 0.93	2.0 [2.0]	1.59 ± 1.02	1.0 [1.0]	2.27 ± 1.16	3.0 [2.0]	1.39 ± 1.12	1.0 [1.5]	$\chi^2 = 15.140$ **$p = .002$**	**[2–3]** **[3–4]**
Doctor-reported	1.83 ± 0.97	2.0 [2.0]	1.66 ± 1.13	1.5 [1.0]	2.20 ± 1.21	2.0 [2.0]	1.29 ± 1.03	1.0 [1.5]	$\chi^2 = 13.560$ **$p = .004$**	**[1–4]** **[3–4]**

Note: Interquartile range (IQR) = Q1-Q3 = 25. Percentiles – 75 percentiles.
The bold values are represented as mean±SD.
[a]"Kruskal–Wallis H" test (χ^2-table value).
[b]Bonferroni test values.

TABLE 3 Comparison of procedural anxiety scores of the study groups

Procedural anxiety scores	Cartoon group (n = 41)		Kaleidoscope group (n = 41)		Kaleidoscope + cartoon group (n = 41)		Control group (n = 41)		p^a
	$\bar{X} \pm$ S.S.	Median [IQR]	$\bar{X} \pm$ S.S.	Median [IQR]	$\bar{X} \pm$ S.S.	Median [IQR]	$\bar{X} \pm$ S.S.	Median [IQR]	
Children-reported	0.78 ± 0.79	1.0 [1.0]	1.14 ± 0.96	1.0 [2.0]	0.90 ± 0.86	1.0 [1.0]	1.39 ± 1.07	1.0 [1.0]	$\chi^2 = 4.352$ $p = .114$
Parent-reported	1.20 ± 0.95	1.0 [1.5]	1.15 ± 1.06	1.0 [2.0]	0.98 ± 0.94	1.0 [2.0]	1.24 ± 1.02	1.0 [2.0]	$\chi^2 = 1.401$ $p = .496$
Observed-reported	0.85 ± 0.82	1.0 [1.0]	1.17 ± 0.95	1.0 [2.0]	0.93 ± 0.88	1.0 [1.5]	1.32 ± 1.03	1.0 [1.5]	$\chi^2 = 3.077$ $p = .215$
Doctor-reported	0.85 ± 0.85	1.0 [1.0]	1.10 ± 0.97	1.0 [2.0]	0.88 ± 0.87	1.0 [1.0]	1.27 ± 1.03	1.0 [2.0]	$\chi^2 = 3.074$ $p = .215$

[a]"Kruskal–Wallis H" test (χ^2-table value).
Abbreviation: IQR, interquartile range.

3.1 | Comparison of the groups in terms of some variables

Some descriptive characteristics of the children are included in Table 1. There were no statistically significant differences between the groups in terms of age, gender, presence of previous hospital experiences, and the person accompanying them during the ECO ($p > .05$); thus, the groups were similar in terms of these characteristics. The groups were also found to be similar in terms of educational background, number of siblings, ranking among the siblings by age, presence of any previous hospitalization, presence and number of any painless medical interventions previously performed, number of any painful medical interventions previously performed, and presence and number of any surgical procedures previously performed ($p > .05$).The groups were homogeneous in terms of the sociodemographic and ECO-related characteristics of the child.

3.2 | Comparison of the groups in terms of anxiety levels

In the study, children's anxiety scores before and during the procedure were compared between groups. Among the anxiety scores given to children before any action was performed (before the procedure), the lowest anxiety score of all groups was observed in the control group and the highest anxiety score was observed in the cartoon + kaleidoscope group (Table 2). Anxiety levels of the children were determined without any application before the study. However, the assignment of children to groups was not made according to their anxiety levels, which is the limitation of this study. However, the fact that the control group had the lowest level of anxiety before the procedure coincidentally, and despite this, the anxiety score decreased in the experimental groups during the procedure, while remaining the same in the control group is important in terms of showing that the applied methods are effective.

The anxiety levels of children during the ECO procedure are included in Table 3. There was no statistically significant difference between the groups in terms of the anxiety scores given by the children, parents, researcher, and the ECO physician during the procedure ($p > .05$). According to the scores given by the children (Table 4), the anxiety scores during the procedure were lower than those before the procedure in the cartoon group, cartoon + kaleidoscope group, and kaleidoscope group ($p < .001$). In the control group, there was no difference between the anxiety scores before the procedure and during the procedure ($p > .05$). No comparison was made between groups after the procedure. The reason why we did not make a comparison between the post-procedure groups is that since we measured procedural anxiety in the study, the children were completely relieved and anxiety decreased due to the end of the post-procedure.

4 | DISCUSSION

There is no study on anxiety in children before or during ECO in the literature. However, in studies focusing on magnetic resonance imaging (MRI), which is a similar painless procedure, both adults and children are reported to experience anxiety (Perez et al., 2019; Viggiano et al., 2015). Different methods can be used to reduce anxiety (Ahmed et al., 2011). Preparing children for the procedure and distracting them during the procedure can be effective in reducing procedure-related anxiety (Düzkaya et al., 2021; Yoo et al., 2011).

Books (Hallowell et al., 2008; Johnson et al., 2009) or cartoons (Inan & Inal, 2019; James et al., 2012; Miguez-

TABLE 4 Intragroup comparison of children's anxiety scores before and during the procedure

	Preprocedural		Inter-procedural		
Children's procedural anxiety scores	**$\bar{X} \pm$ S.S.**	**Median [IQR]**	**$\bar{X} \pm$ S.S.**	**Median [IQR]**	***p*[a]**
Cartoon group	1.76 ± 0.99	1.5 [1.5]	0.78 ± 0.79	1.0 [1.0]	Z = -5.147 **$p < .001$**
Kaleidoscope group	1.61 ± 1.20	1.5 [1.0]	1.14 ± 0.96	1.0 [2.0]	Z = -3.508 **$p < .001$**
Cartoon+ kaleidoscope group	2.22 ± 1.27	2.0 [2.0]	0.90 ± 0.86	1.0 [1.0]	Z = -4.808 **$p < .001$**
Control group	1.39 ± 1.20	1.0 [2.0]	1.39 ± 1.07	1.0 [1.0]	Z = 0.000 $p = 1.000$

[a]"Wilcoxon" test (Z-table value).

The bold values are represented as mean±SD.

Abbreviation: IQR, interquartile range.

Navarro & Guerrero-Marquez, 2016; Szeszak et al., 2016) prepared for use during the pre-procedure preparation can be beneficial. Techniques to divert attention can be effective during the procedure. One of these techniques is to use kaleidoscope during the procedure (Canbulat et al., 2014; Tüfekci et al., 2009). The present study evaluates the effects of the cartoon prepared by researchers describing the ECO procedure and kaleidoscope use during the procedure on the ECO-related anxiety in children.

In the literature, there were no video tutorials prepared to tell children about the ECO procedure. However, a limited number of studies conducted using videos and animations describing different procedures are included in the literature (Szeszak et al., 2016). In a study by Hogan et al. (2018), 50 pediatric patients undergoing MRI were displayed a 7-min video informing about MRI before the procedure. This video was found to be effective in reducing the anxiety of children aged between 13 and 17 years, whereas it was found to be ineffective in children aged less than 13 years (Hogan et al., 2018). In another study conducted by McGlashan et al. (2018), 21 children (12 healthy children and nine children with neurological disorders) aged between 6.5 and 11.5 years who underwent MRI were included. The cartoon display informing about the procedure before it began was determined to be effective in reducing children's anxiety. Moreover, there was no difference between the groups of healthy children and children with neurological disorders in terms of anxiety levels and animation effectiveness (McGlashan et al., 2018). In a study by Szeszak et al. (2016) that included 24 children aged between 5 and 11 years, MRI was performed without sedation. In the study, an educational cartoon describing the procedure during the preprocedural period was found to be effective in reducing children's anxiety (Szeszak et al., 2016). In our study, it was found that displaying the cartoons describing the procedure before it began reduced anxiety levels experienced by children during the procedure (Table 4). All these results indicate the importance of preprocedural preparation in reducing children's anxiety.

In our study, a kaleidoscope was used to reduce the anxiety levels of children by distracting them during the procedure. In the literature, there are two studies (Canbulat et al., 2014; Koç Özkan & Polat, 2020) that used a kaleidoscope to investigate procedural anxiety in children. Canbulat et al. (2014), who studied the effect of kaleidoscope use on procedural anxiety in 188 children aged between 7–11 years, used a kaleidoscope and distraction cards to divert children's attention during a blood-collecting procedure. The anxiety levels of the kaleidoscope group and the distraction card group were lower than those of the control group (Canbulat et al., 2014) ($p < 0.01$). In a study by Koç Özkan and Polat (2020) that included 139 children aged between 4–10 years, two different ways of distracting (virtual reality glasses and kaleidoscope) were employed to assess pain and anxiety during vascular access procedure. In the study, the pain and anxiety levels of the virtual reality glasses group and the kaleidoscope group were significantly lower than those of the control group (Koç Özkan & Polat, 2020) ($p < 0.01$). Our study also found that kaleidoscope use is effective in reducing anxiety levels. This conclusion is important because it indicates that kaleidoscope use during painless medical interventions also reduces anxiety.

4.1 | Limitation of study

The anxiety levels of children were determined before the procedure in the present study. However, the children were not assigned to groups based on their anxiety levels, and this is a limitation of our study. However, incidentally, the lowest anxiety level before the procedure was observed in the control group, whereas the anxiety scores in the experimental groups decreased during the procedure; the anxiety scores remained the same in the control group, which is notable because it indicates that the methods are effective.

5 | CONCLUSION

In the present study, displaying educational cartoons describing the ECO procedure to children and/or the use of a kaleidoscope during the procedure to distract children were effective in reducing procedural anxiety. Further randomized studies are needed to determine if the findings are similar. The methods used in the study are inexpensive, easy, and reliable to eliminate anxiety during the ECO procedure. Nurses need to be aware of children's anxiety levels before the ECO procedure. We recommend that healthcare workers should develop an awareness of the necessity of reducing children's anxiety levels not only during painful interventions but also during painless medical interventions.

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CONFLICT OF INTEREST

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

ETHICAL STATEMENT

Ethics committee approval from Eskişehir Osmangazi University Clinical Research Ethics Committee (2018/13) and institutional approval from Afyon Kocatepe University Ahmet Necdet Sezer Research and Application Hospital Department, Department of Pediatric Health and Diseases (2018-E.2024) were obtained for the study. The purpose and method of the study were explained to the children and their parents. Verbal consents of the children who volunteered after the information was obtained along with written informed consent of their parents in accordance with the principle of willingness and volunteering. This study is Birsel Molu's doctoral thesis (dated: 25.12.2019). The study was presented as an oral presentation at the International Congress of Rumi Pediatrics (IRUPEC 2019).

AUTHORS' CONTRIBUTIONS

Concept - Birsel Molu, Ayfer Açıkgöz. Design - Birsel Molu, Ayfer Açıkgöz. Supervision - Birsel Molu, Ayfer Açıkgöz. Resources - Birsel Molu, Ayfer Açıkgöz. Materials - Birsel Molu. Data collection and/or processing - Birsel Molu. Analysis and/or interpretation - Birsel Molu, Ayfer Açıkgöz. Literature search - Birsel Molu. Writing - Birsel Molu, Ayfer Açıkgöz. Critical reviews - Birsel Molu, Ayfer Açıkgöz. Other - Birsel Molu, Ayfer Açıkgöz.

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