

## ÇOCUKLARDA İNTRAVENÖZ KANÜL SIRASINDA AĞRI VE KORKUYU AZALTMADA ÜÇ FARKLI YÖNTEMİN ETKİNLİĞİNİN KARŞILAŞTIRILMASI: RANDOMİZE KONTROLLÜ BİR ÇALIŞMA

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### Öz

Bu çalışma 4-6 yaş arasındaki çocuklara intravenöz kanül uygulaması sırasında yumuşak top sıkma, kaleydoskop veya sabun köpüğü üfleme uygulamalarının çocuğun ağrı ve korkusu üzerindeki etkisini araştırmaktır. Randomize kontrollü bir çalışmadır. Çalışma Türkiye'nin doğusunda bulunan bir üniversitesi hastanesinin çocuk acil servisinde yapılmıştır. Çalışmada yumuşak top sıkma grubunda 30 çocuk, kaleydoskop grubunda 30 çocuk, sabun köpüğü üfleme grubunda 30 çocuk ve kontrol grubu 30 çocuk bulunmaktadır. Verilerin toplanmasında Tanıtıcı Bilgi Formu, Faces Pain Scale-Revised ve Çocuk Korku Ölçeği kullanılmıştır. Çalışmaya alınan dört grupta benzer olduğu belirlendi. Yumuşak top sıkma, kaleydoskop ve sabun köpüğü üfleme grubundaki çocukların intravenöz kanül uygulaması sırasında yaşadığı ağrı ve korku, kontrol grubundaki çocuklara göre daha az ve aralarındaki puan farkı istatistiksel olarak önemli olduğu bulundu ( $p<0.05$ ). Çalışmada çocuk acil servisinde intravenöz kanül uygulama sırasında yumuşak top sıkma, kaleydoskop ve sabun köpüğü üfleme çocukların ağrı ve korkusunu azaltmada etkili olduğu görüldü.

**Anahtar Kelimeler:** Ağrı, Çocuk, Kaleydoskop, Korku, Sabun Köpüğü Üfleme, Yumuşak Top Sıkma

## COMPARISON of THE EFFICIENCY of THREE DIFFERENT METHODS in REDUCING PAIN AND FEAR in CHILDREN DURING INTRAVENOUS CANNULATION: A RANDOMISED CONTROLLED STUDY

### Abstract

This study investigates the effects of squeezing a soft ball, using a kaleidoscope, or blowing bubbles during intravenous cannulation on the pain and fear of children between the ages of 4 and 6. This study is a randomised controlled study. It was conducted in the pediatric emergency service of a university hospital in the east of Turkey. In the study, there were 30 children in the soft ball group, 30 children in the kaleidoscope group, 30 children in the bubbles group, and 30 children in the control group. The Descriptive Information Form, the Faces Pain Scale-Revised, and the Children's Fear Scale were used in data collection. Four groups included in the study were found to be similar. It was found that the children in the soft ball, kaleidoscope, and bubbles groups experienced less pain and fear than the children in the control group during an intravenous cannulation procedure, and the difference in score between the groups was found to be statistically significant. In the study, it was found that squeezing a soft ball, using a kaleidoscope, and blowing bubbles during an intravenous cannulation procedure in a pediatric emergency service were effective in reducing the pain and fear of children.

**Keywords:** Pain, Child, Kaleidoscope, Fear, Squeezing Soft Ball, Blowing Bubbles

## 1. INTRODUCTION

Pain is as old as human history, and it is an important health problem in children (1). According to the International Association for the Study of Pain, pain is an unpleasant emotional state resulting from actual or possible tissue damage (2,3). It is also a complicated and personal experience (4,5). Pain is an inevitable experience in the lives of many children, and often it cannot be adequately controlled. The reasons for this include false beliefs that children do not feel pain as much as adults do, insufficient doses of medication, and healthcare professionals not believing in a child's pain (4,6,7). Children's pain perception is influenced by age, gender, family, and social environment. Pain is an unpleasant situation both for the child and the family, and it should be treated (5,7,8). It may cause children to have a decreased quality of life and to experience fear, anxiety, and stress. A child's reluctance to participate in treatment and care may also cause problems, such as sleep and dietary problems. Minor invasive procedures, such as vascular access, blood collection, and vaccination, are the procedures that cause the most pain in children (7–10).

Pharmacological methods are used in invasive procedures to alleviate children's pain. Analgesic drugs are used in pharmacological methods (7,11,12). Before considering one of the analgesics used for pediatric patients, it would be more appropriate to consider the purpose of pain control (13–18). Since nurses are the healthcare professionals who spend the most time with parents and children, they should inform parents and children about the principles of pain control, taking on the role of advocate and educator. The primary care goal of nurses is to reduce the child's pain and to increase quality of life (7,14,19). Nurses should be able to manage painful interventions to ensure the comfort of children within the scope of traumatic care (13–18). Pain management contributes to reducing fear, anxiety, and distress associated with painful procedures and to preparing children emotionally for future medical interventions (13–18). Due to many side effects of pharmacological methods, non-pharmacological methods are also preferred for pain relief (1,5,6).

Some of the advantages of non-pharmacological methods are the fact that they are low cost, they enable children's participation in their own care, they have few side effects, and they can be used when analgesic drugs cannot be used (6,7,11). These methods are supportive methods, cognitive/behavioural methods, and physical methods. Cognitive or behavioural methods focus on making children relax or on distracting them to reduce or control their pain level. Methods of distracting children such as using a kaleidoscope, blowing bubbles, telling stories, using controlled breathing techniques, playing electronic games, using virtual reality glasses, inflating balloons, and squeezing a soft ball provide active distraction for the child (4,5,7,20). Studies have found that distraction methods reduce the pain and anxiety experienced by children during painful procedures, reporting that using a kaleidoscope, inflating balloons, or squeezing a soft ball are effective in reducing the pain level of children during phlebotomy (3,4,6,7,9,12,18,20).

There are no randomised controlled studies on which method is more effective – squeezing a soft ball, using a kaleidoscope, or blowing bubbles – in children during painful procedures such as intravenous cannulation. This study aims to compare the effects of these three methods in reducing the pain and fear children can experience during intravenous cannulation.

Hypotheses of the study:

- Hypothesis 1: Squeezing a ball with the other hand during intravenous cannulation reduces the child's pain and fear.
- Hypothesis 2: Blowing bubbles during intravenous cannulation reduces the child's pain and fear.
- Hypothesis 3: Using a kaleidoscope during intravenous cannulation reduces the child's pain and fear.

#### Aim of the study

The aim of this study is to investigate the effects of these three methods during intravenous cannulation on the pain and fear of children between the ages of 4 and 6.

## 2. MATERIALS AND METHODS

### 2.1. Study Design

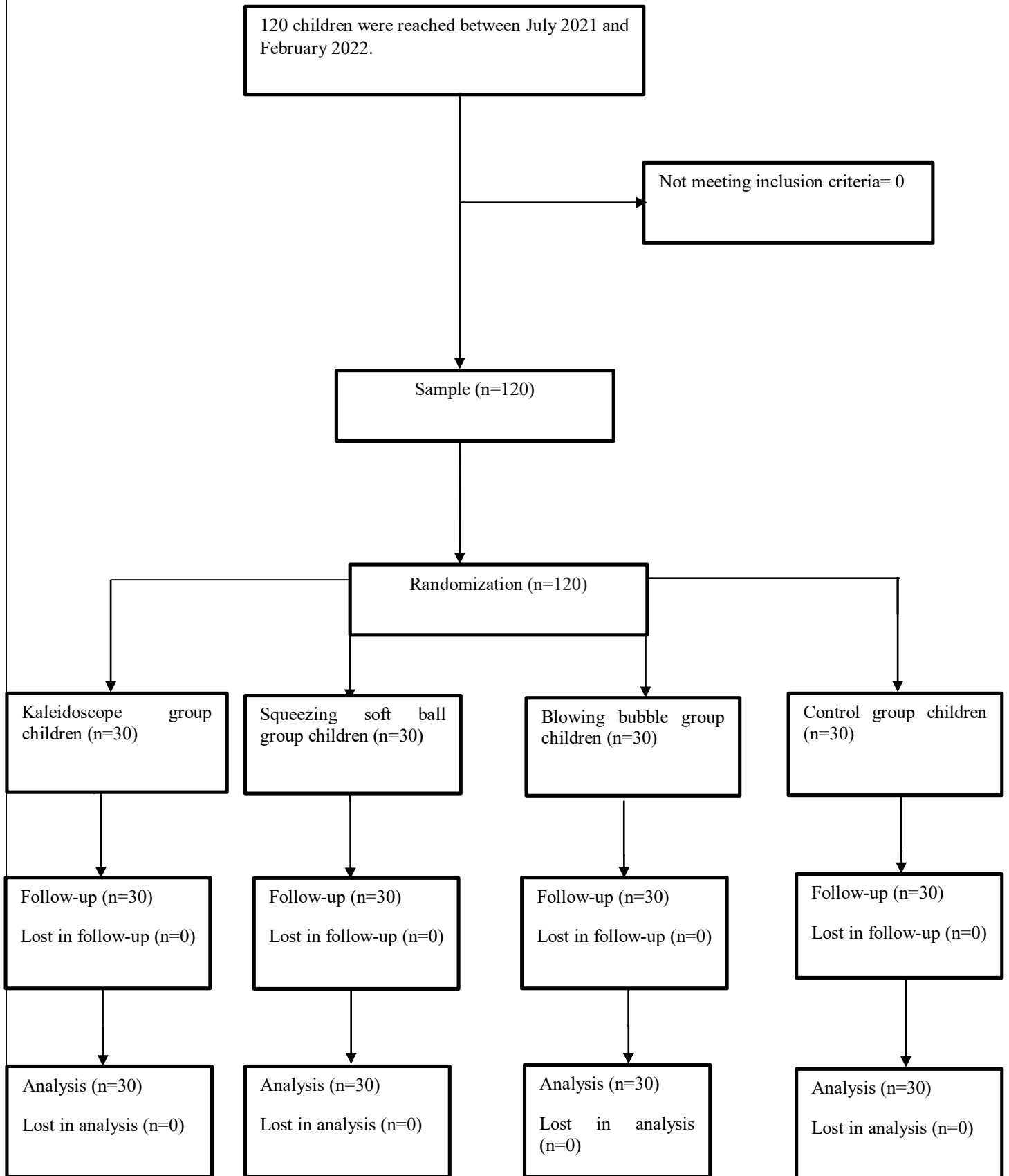
This study is a randomized controlled study. The study was conducted in the pediatric emergency service of a university in the eastern region of Turkey between July 2021 and February 2022.

### 2.2. Study Sample

Sample of the study was determined as 120 with 95% confidence interval, 5% level of significance, 0.7 effect size and 95% power of representing the population according to power analysis performed.

Children were selected in the sample group with a simple random sampling method, one of the probability sampling methods. Squeezing a soft ball, using a kaleidoscope, blowing bubbles, and control group were written on cards and put in a bag. Children were asked to draw a card from the bag. Thus, groups were formed by a drawing lot method, one of the simple random sampling methods, with 30 children in each group (Figure 1).

**Figure 1. Randomization Scheme**



### 2.3. Ethical Statement

Before initiating the study, 28.09.2021-3977 numbered ethics committee approval was taken from Firat University Non-interventional Research Ethics Committee. After hospital permissions were taken, parents were informed about the aim and content of the study. Parents were informed that squeezing soft ball, kaleidoscope and blowing bubbles do not harm children in any way and studies conducted show that they are effective in reducing children's pain. They were told that their personal information would be kept confidential and they could leave the study whenever they wanted. Parents were told that the study was based on the principles of voluntariness and confidentiality. Written and oral permission were taken from parents. Pediatric nurse who helped in collecting the data agreed to participate in the study voluntarily. The pediatric nurse does not have any conflict of interest. The study was conducted in line with the principles of Declaration of Helsinki. The study was registered in the Clinical Trial Registry (NCT05483699).

Inclusion criteria: Children with no verbal, visual or mental disability between 4 and 6 years of age who referred to pediatric emergency service. For pediatric nurse; working in the pediatric emergency service and having at least 5 years of experience in inserting intravenous cannula.

### 2.4. Data Collection Tools

Descriptive Information Form, Faces Pain Scale-Revised and Children's Fear Scale were used.

**2.4.1. Descriptive Information Form:** It includes questions about the child's age, gender, grade, family's economic status, maternal level of education, paternal level of education, maternal working status and paternal working status.

**2.4.2. Faces Pain Scale-Revised (FPS-R):** The scale developed by Bieri et al. is used to evaluate the pain levels of children between the ages of 4 and 17 (21). There are pictures of 6 faces in the scale. Level of pain is evaluated as "0,2,4,6,8,10". The face on the leftmost side is given a score of 0 and interpreted as "no pain", while the face on the rightmost side is given a score of 10 and interpreted as "a lot of pain". Pain severity increases as score increases.

**2.4.3. Children's Fear Scale:** The scale was developed by McMurtry et al. to find out the anxiety levels of children between 4 and 10 years of age (22). There are five face pictures in the scale. Anxiety level is scored between "0 and 4". 0 indicates "no anxiety", while a scared face is scored 4 and indicates "too much anxiety".

#### Kaleidoscope group

Kaleidoscope includes shapes of flowers and mirrors in the shape of triangle placed with an angle of 60°. While rotating one of the cylinders, various shapes and colourful eyes are formed when viewed with one eye. When the kaleidoscope is rotated, the patterns look different all the time because the colourful parts are moving, attracting the child's attention.

#### Squeezing soft ball

The soft ball has a diameter of about 8-10 cm and can return to its old form when it is squeezed.

## Blowing bubbles

Children in this group were shown bubble blower before intravenous cannulation and they were shown how bubbles formed and how to blow. Children blew bubbles during intravenous cannulation.

## Procedure

15 minutes before the intravenous cannulation procedure, the second researcher interviewed the parents and the children in squeezing soft ball, kaleidoscope, blowing bubbles and control groups separately and filled in descriptive information form and Children's Fear Scale. After randomization, the second researcher, the child and the parent went to the blood collection room for the procedure. Children in the Kaleidoscope group were given the kaleidoscope before intravenous cannulation and they were shown how to use it. The children were told to look at the kaleidoscope during the procedure until the procedure ended. The children in the squeezing soft ball group were given the ball before the procedure. They were told to squeeze and loosen the ball with the hand that was not used for the procedure while intravenous cannula was being inserted. The children in the blowing bubble group were shown the bubble blower before intravenous cannulation and they were told how bubbles were formed and how they would blow. During intravenous cannulation, the child blew the blower. Routine procedures were applied on the children in the control group without any interventions. Inserting the intravenous cannula took 3-5 minutes. The procedure was carried out in the same room by the same nurse for four of the groups. After the intravenous cannulation procedure ended, a researcher and parents filled in Faces Pain Scale-Revised and Children's Fear Scale separately and independently to find out the level of pain and fear experienced by the child during the procedure.

## 2.5. Statistical Analysis

The data were evaluated by using SPSS 22. Program. Shapiro-Wilk analysis was used to find out whether the data were normally distributed. Percentage, Chi-square, mean, one-way Anova and Bonferroni advanced analysis test were used in data analysis. *P value of* < .05 was considered as statistically significant.

## 3. RESULTS

This part includes the results obtained from the study which was conducted to find out the effects of squeezing soft ball, looking at kaleidoscope or blowing bubble during intravenous cannulation on children's pain and fear.

Comparison of the descriptive characteristics of children in kaleidoscope, squeezing soft ball, blowing bubbles and control group and their parents is shown in Table 1. It was found that there were no statistically significant differences between children in the kaleidoscope, squeezing soft ball, blowing bubbles and control group in terms of age, gender, grade and family economic status, maternal level of education, paternal level of education, maternal working status and paternal working status and four groups were found to be similar ( $p>0.05$ , Table 1).

**Table 1. Descriptive characteristics of children and parents (n=120)**

Descriptive characteristics	Squeezing soft ball group (n=30)		Kaleidoscope group (n=30)		Blowing bubble group (n=30)		Control group (n=30)		X <sup>2</sup>	P
	n	%	N	%	n	%	n	%		
Age										
4	11	36.68	11	36.68	13	43.32	12	40.00	1.044	.984
5	8	26.64	8	26.64	9	30.00	9	30.00		
6	11	36.68	11	36.68	8	26.64	9	30.00		
Gender										
Female	12	40.00	11	36.68	11	36.68	7	23.35		
Male	18	60.00	19	63.32	19	63.32	23	76.65		
Grade										
Not attending school	13	43.32	13	43.32	16	53.30	13	43.32	3.536	.739
Kindergarten	7	23.35	7	23.35	7	23.35	11	36.68		
Primary education	10	33.33	10	33.33	7	23.35	6	20.00		
Family economic status										
Income>expense	24	80.00	23	76.66	27	90.00	27	90.00	4.005	.676
Income=expense	5	16.66	6	20.00	3	10.00	2	6.66		
Income<expense	1	3.34	1	3.34	0	0.00	1	3.34		
Maternal level of education										
Illiterate	2	6.66	5	16.66	3	10.00	3	10.00	5.553	.786
Primary education	13	43.34	16	53.33	10	33.33	13	43.34		
High school	11	36.67	7	23.35	13	43.34	10	33.33		
University	4	13.33	2	6.66	4	13.33	4	13.33		
Paternal level of education										
Illiterate	0	0.00	1	3.34	0	0.00	1	3.34	5.163	.820
Primary education	10	33.33	12	40.00	10	33.33	10	33.33		
High school	15	50.00	15	50.00	13	43.32	14	46.66		
University	5	16.67	2	6.66	7	23.35	5	16.67		
Maternal employment status										
Housewife	15	50.00	18	60.00	10	33.33	15	50.00	4.405	.221
Employed	15	50.00	12	40.00	20	66.67	15	50.00		
Paternal employment status										
Unemployed	1	3.34	1	3.34	0	0.00	0	0.00	2.034	.565
Employed	29	96.66	29	96.66	30	100.00	30	100.00		

Table 2 shows the comparison of pre-procedure Children's Fear Scale total mean scores of children in kaleidoscope, squeezing soft ball, blowing bubbles and control group as reported by the child, parent, nurse and researcher. No statistically significant difference was found between pre-procedure Children's Fear Scale total mean scores of the groups ( $p>0.05$ , Table 2).

**Table 2. Comparison of pre-procedure children's fear scale total mean scores of children in groups (n=120)**

Children's Fear Scale	Squeezing soft ball group (n=30)	Kaleidoscope group (n=30)	Blowing bubble group (n=30)	Control group (n=30)	f	p
	X ± SD	X ± SD	X ± SD	X ± SD		
Reported by child	4.50±.68	4.60±.67	4.36±.88	4.43±.50	.605	.613
Reported by parent	4.56±.72	4.70±.53	4.83±.37	4.80±.40	1.530	.210
Reported by nurse	4.20±.84	4.33±.88	4.30±.83	4.40±.62	.322	.809
Reported by researcher	4.30±.83	4.56±.72	4.66±.54	4.73±.44	2.516	.062

Table 3 shows the distribution of mean pain scores of the children in four groups during the procedure as reported by the child, parent, nurse and researcher. Statistically significant difference was found between mean pain scores of the groups during procedure. The highest mean pain score was found in the control group ( $5.00 \pm .64$ ,  $4.86 \pm .50$ ,  $4.73 \pm .63$ ,  $4.90 \pm .66$ ,  $p < 0.05$ , Table 3).

**Table 3. Comparison of pain scores of children in four groups during the procedure (n=120)**

Faces Pain Scale-Revised	Squeezing soft ball group (n=30)	Kaleidoscope group (n=30)	Blowing bubble group (n=30)	Control group (n=30)		
	X ± SD	X ± SD	X ± SD	X ± SD	F	p
	1.000	.000	.298	.000	.000	1.000
Reported by child	3.40±.77	3.86±1.13	3.46±.77	5.00±.64	21.068	.000
Reported by parent	3.50±.68	3.66±1.18	3.23±.85	4.86±.50	21.880	.000
Reported by nurse	3.06±.73	2.53±.77	2.63±.92	4.73±.63	51.704	.000
Reported by researcher	3.06±.69	2.60±.77	2.56±.07	4.90±.66	54.704	.000
	Squeezing soft ball group - Kaleidoscope group	Squeezing soft ball group - Blowing bubble group	Squeezing soft ball group - Control group	Kaleidoscope group - Blowing bubble group	Kaleidoscope group - Control group	Blowing bubble group - Control group
	p <sup>q</sup>	p <sup>q</sup>	p <sup>q</sup>	p <sup>q</sup>	p <sup>q</sup>	p <sup>q</sup>
Reported by child	.216	1.000	.000	.298	.000	.000
Reported by parent	1.000	1.000	.000	.1000	.000	.000
Reported by nurse	.054	.198	.000	.1000	.000	.000
Reported by research	.172	.115	.000	.1000	.000	.000

SD: standart sapma q: Bonferroni test

Table 4 shows the comparison of mean Children's Fear Scale scores of the children in four groups during the procedure. According to the answers of the participants, the difference between the mean Children's Fear Scale scores of the children in squeezing soft ball group and the mean Children's Fear Scale scores of the children in kaleidoscope group was found to be statistically significant ( $p = .000$ ,  $p = .030$ ,  $p = .002$ ,  $p = .017$ ). According to the answers of children, parents, nurse and researcher, the highest mean Children's Fear Scale scores during the procedure were in the control group and the difference between the mean scores of the control group and the other groups was found to be statistically significant ( $p < 0.05$ , Table 4).



**Table 4. Comparison of fear scores of children in four groups during the procedure (n=120)**

Children's Fear Scale	Squeezing soft ball group (n=30)	Kaleidoscope group (n=30)	Blowing bubble group (n=30)	Control group (n=30)	f	P
	X ± SD	X ± SD	X ± SD	X ± SD		
Reported by child	3.43±.93	2.46±.89	2.96±.66	4.70±.53	45.502	.000
Reported by parent	3.20±.76	2.66±.75	2.86±.77	4.56±.56	42.338	.000
Reported by nurse	2.86±.68	2.20±.76	2.26±1.01	4.60±.56	73.861	.000
Reported by researcher	2.80±.61	2.23±.72	2.70±.83	4.46±.68	55.333	.000
	Squeezing soft ball group - Kaleidoscope group	Squeezing soft ball group - Blowing bubble group	Squeezing soft ball group - Control group	Kaleidoscope group- Blowing bubble group	Kaleidoscope group- Control group	Blowing bubble group- Control group
	p <sup>q</sup>	p <sup>q</sup>	p <sup>q</sup>	p <sup>q</sup>	p <sup>q</sup>	p <sup>q</sup>
Reported by child	.000	.131	.000	.085	.000	.000
Reported by parent	.030	.456	.000	1.000	.000	.000
Reported by nurse	.002	.158	.000	.817	.000	.000
Reported by researcher	.017	1.000	.000	.080	.000	.000

#### 4. DISCUSSION

Pain is subjective and it is an unpleasant experience for children. Children have the right to lead a pain-free life. Children experience pain due to injury, trauma, acute and chronic diseases, changing dressing, invasive procedures such as collecting blood and vascular access. Pain causes children to experience fear, stress and anxiety (1,4,7,19). Non-pharmacological methods cognitive/behavioural methods are the most frequently used methods in reducing and controlling children's pain. Distracting technique, which is a cognitive/behavioural method, aims to increase pain tolerance and decrease pain sensitivity by focusing the child's attention to another stimulant other than pain (4,6). This study evaluated the efficiency of squeezing soft ball, kaleidoscope or bubble blowing during intravenous cannulation on children's pain and fear levels.

It was found that using kaleidoscope during intravenous cannulation was effective in decreasing pain and fear levels of the children who participated in the study. In studies conducted, kaleidoscope was used during vascular access procedure of children and it was reported that children's pain, anxiety and fear levels decreased (4,7,23-25). It can be seen that the technique of distracting the child by using kaleidoscope is effective in decreasing the pain, anxiety and fear experienced during invasive procedure. The technique of distracting the child depends on focusing the child's perception, senses and interest on a stimulant other than pain.

In the study, it was found that children's squeezing soft ball during intravenous cannulation was effective in decreasing pain and fear levels of the children. In their studies, Aydın et al., Sadeghi et al. and Girgin et al. found that squeezing soft ball during invasive procedures was effective in decreasing pain, fear and anxiety levels of children (26-28). Although there are few studies in literature on squeezing soft ball, this study is in parallel with the literature. The child's squeezing soft ball during invasive procedures may be a recommended method since it is fun and easy to use for the child (28).

In the study, it was found that children's blowing bubbles during intravenous cannulation procedure decreased their pain and fear levels when compared with the control group and the difference between was statistically significant. In their studies, Longobard et al. and Caprili et al. reported that blowing bubbles was effective in decreasing pain, fear and anxiety while waiting for medical intervention and during blood collection procedure (29,30). Although there are not enough studies in literature to support this application, this study is in parallel with the existing studies. Blowing bubbles can be recommended to children since it is a low-cost and practical method (30).

There are no studies in literature in which squeezing a soft ball, kaleidoscope and blowing bubbles were used during intravenous cannulation in pediatric emergency service. In this study, it was found that these three techniques were effective in reducing children's pain and fear. Children's focusing their attention on another stimulus during intravenous cannulation shows that they control pain and fear well because in distraction technique, the child is distracted from a negative stimulus (22). In the study, mean fear scores of children in the kaleidoscope group (reported by child=2.46±.89, reported by parent= 2.66±.75, reported by nurse=2.20±.76 and reported by researcher= 2.23±.72) were lower and significantly better than those of the children in the squeezing soft ball group (reported by child=3.43±.93, reported by parent= 3.20±.76, reported by nurse=2.86±.68 and reported by researcher= 2.80±.61) ( $p<0.05$ ). It can be seen that when compared with squeezing soft ball, kaleidoscope attracts the attention of 4-6 years old children more, increases pain tolerance and is effective in reducing fear.

## 5. CONCLUSION

This study measured the pain and fear experienced by 4-6 year-old children during intravenous cannulation. Squeezing soft ball, kaleidoscope and blowing bubble were used to relieve the pain and fear experienced by children and it was found that children's pain and fear levels decreased.

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