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The effects of playing digital games on children's pain, fear, and anxiety levels during suturing: A randomized controlled study

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Abstract:

OBJECTIVE: The aim was to determine the effects of digital game play on children's pain, fear, and anxiety levels during suturing.

METHODS: Data were obtained from 84 children between the ages of 8 and 17 years at the pediatric emergency department between January 16 and March 19, 2020, using the Socio-Demographic and Clinical Characteristics Form, the Wong–Baker Faces Pain Rating Scale (WBFPS), the Visual Analogue Scale (VAS), the Fear of Medical Procedures Scale (FMPS), and the State-Trait Anxiety Inventory for Children (STAI-CH). A four-block randomization system was used. The study group ($n = 42$) played digital games during the suturing procedure, unlike the control group ($n = 42$). Ethical permissions were obtained from the ethical committee, hospital, and families.

RESULTS: Before the suturing procedure, there was no statistically significant difference between the groups' mean scores. The intervention group was found to have statistically significantly lower WBFPS and VAS pain scores than the control group during the suturing procedure, and after the procedure, statistically significantly lower WBFPS, VAS, FMPS, and STAI-CH mean scores than the control group.

CONCLUSIONS: The digital game-playing approach applied before and during the suture procedure was found to be effective in reducing children's pain, fear, and anxiety levels.

Keywords:

Anxiety, digital game, fear, pain, pediatrics, suturing

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Introduction

In hospital environments, individuals, especially children, can experience intense physical pain and emotional stress.[1] An increasing number of medical interventions in diagnosis and treatment can cause children pain, which has to be endured.[2,3] Experiencing these painful medical procedures can lead to the emergence of psychological issues, in particular fear and anxiety.[4,5] These emotions trigger each other and are closely related.[5] In these circumstances, analgesics alone may not be effective in the control of pain; this is a worldwide health problem.[4] The World Health Organization and many pediatric associations have increasingly focused on developing coping methods for children facing pain, fear, and anxiety in medical settings.[6,7]

Studies show inadequate pain management procedures during invasive procedures in emergency services.[8,9] The two main

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Box-ED Section

What is already known on the study topic?

- Invasive medical procedures unleash pain, fear, and anxiety in most children. These three emotions trigger each other and are closely related.

What is the conflict on the issue? Has it importance for readers?

- There is growing interested in coping methods that will reduce to pain, fear, and anxiety of children during suturing.

How is this study structured?

- This study examining the effect of playing digital games on fear, pain, and anxiety levels experienced by children during suturing was conducted as a single-center and randomized controlled study using data from 84 child patients in the emergency department.

What does this study tell us?

- We found that the use of a low-cost digital game was an effective distraction for reducing fear, pain, and anxiety. This study suggests that allowing children to play such digital games using devices and internet connections during painful invasive procedures has the potential for supporting pediatric emergency departments.

approaches to pain management are pharmacological and nonpharmacological methods. Nonpharmacological pain management is a broad term that covers all interventions avoiding the use of pharmacological methods. These methods aim to reduce fear, anxiety, pain, and give children a sense of control.[10,11] The distraction method, the most used nonpharmacological method, has been shown effective in reducing pain and anxiety for both acute and chronic pain.[12] In this technique, the patient is encouraged to divert attention away from the ongoing medical procedure. Distraction methods can be classified as either active and passive, and some studies have shown that the former is the more effective.[13,14] In the active form, various sensory functions are exercised by enabling the child to participate in an activity during the procedure; in the passive form, distraction is instead achieved through the child's observation of a stimulus.[14] In addition to reducing pain and anxiety during painful, invasive procedures such as suturing, distraction methods reduce the need for anesthetic drugs and shorten procedure duration.[13,15]

Pain may cause children to fear invasive procedures, to be unwilling to undergo these, and to neglect the treatment. Therefore, research, knowledge, and practices are needed to control pain in emergencies.[15] Using games during procedures can increase social communication and reduce children's pain and anxiety.[16] The use of digital games, a type of nonpharmacological active distraction method, is considered to be potentially effective in improving health and quality of life.[13] In the literature, few studies focus simultaneously on children's pain, fear, and anxiety levels when undergoing active distraction.[17,18] This study, therefore, has the potential to contribute to the literature on the effects of digital games on the children's pain, fear, and anxiety levels during suturing.

Methods

Design, setting, and sample size

The data were collected in the Pediatric Emergency Department (PED) of the Training and Research Hospital between January 16 and March 19, 2020. The population of the study was children between the ages of 8 and 17 years who were sutured in the PED. Participants were randomly selected from among children who applied to the emergency department while the researcher was in the PED, and met the inclusion criteria. The sample size was determined by the power analysis of the GPower 3.1.9.4 (American) program as 84 children with 0.05 error, 0.95 confidence interval, and 0.5 effect size.

Participants and randomization

The inclusion criteria were being between the ages of 8 and 17 years, having no psychological diagnoses, having no problems in vision, hearing, speech, or speaking, and understanding Turkish, having at least 3 sutures (generally, local anesthesia is not applied to 1–2 sutures), having the procedure performed under local anesthesia, and giving assent to participate. The exclusion criteria were refusing to play digital games, having a physical problem or injury/incision that prevents playing digital games, having multi-trauma, and being too agitated to communicate with the researcher. Randomization was performed using the four-block randomization system. For the calculated sample number, quartered blocks of 1/4 were created. Groups were coded as A (intervention) and B (control). It was calculated that these two groups could be placed in blocks of four with six different combinations. The first six blocks of four were formed as ABBA, BABA, BBAA, AABB, ABAB, and BAAB. The same combination was repeated until the sampling was complete. Children who met the inclusion criteria were incorporated into the corresponding group in the table in order of their admission to the emergency department. In this way, the children were divided into two equal groups, intervention, and control. None of the children knew which group they were in, and none encountered the others.

Ethical approach

Permission was obtained from Ethics Committee of University (Issue No: B.302.IEÜSB.0.05.05- 20-046,

Date: November 26, 2019) and the institution involved. Original signed consent was obtained from all parents who assented to participate in the study through the Information and Informed Consent Form. Verbal consent was obtained from the children who assented. Apart from this, no other protocol was applied. A health-care professional from PED acting as a witness signed a form to this effect.

Data collection tools

Research data were collected using "Socio-Demographic and Clinical Characteristics Form," "WBFPS," "Visual Analog Scale (VAS)," "Fear for Medical Procedures Scale," and "State-Trait Anxiety Inventory for Children (STAI-CH)." The first researcher informed the children and their parents about the tools and collected the data. The average data collection time was 30 min. Data were obtained from children using face-to-face interviews and observation. A health-care professional was also present during data collection.

Socio-demographic and clinical characteristics form

This form consists of a total of 23 questions eliciting information, including age, gender, previous digital game-playing status, number of sutures, and duration of suturing. It was created by the researchers in accordance with the literature.[5,19]

Wong–Baker faces pain rating scale

WBFPS developed by Wong and Baker is a hand-drawn scale that includes six facial expressions ranging from smiling to crying and is recommended for use for children aged 3 years and older. Scoring is defined as 0 = no hurt, 2 = hurts little bit, 4 = hurts little more, 6 = hurts even more, 8 = hurts whole lot, and 10 = hurts worst.[20]

Visual Analog Scale

This is a 100 mm long horizontal line with the words "no pain" and "severe pain" at either end. It is suitable for school-age children. The child is asked to mark the point showing the intensity of pain felt at that moment.[2]

Fear of medical procedures scale

The fear of Medical Procedures Scale (FMPS) was developed by Bloom *et al*. in 1985 to assess children's fears associated with medical procedures and practices. The scale consists of 29 questions and 4 sub-dimensions, including operational, personal, environmental, and interpersonal items. In the 3-Point Likert Scale, for each question, children are asked to choose one of the expressions "no fear" (1 point), "moderate fear" (2 points), "high fear" (3 points). Scores range between 29 and 87. The validity and reliability study in Türkiye was conducted among children aged 7–14 by Alak in 1993, and the reliability coefficient was found to be 0.93.[21] In our study, Cronbach's Alpha was found to be 0.93.

State-trait anxiety inventory for children

STAI-CH was developed by Spielberger in 1973 to measure the anxiety caused to children in situations perceived as a threat. In the trait anxiety scale, the children are asked to evaluate how they "generally" feel, and in the state anxiety scale, how they feel in the situation they are in "at that moment," by indicating one of three options. Possible scores range between 20 and 60. A higher score indicates greater anxiety. The validity and reliability study in Türkiye was conducted by Özusta in 1995 for children aged 9–12; the Cronbach's Alpha of the state anxiety scale was found 0.82, and the Cronbach's Alpha of the trait anxiety scale was 0.81.[22] In our study, the Cronbach's Alpha of the state anxiety scale was found 0.91, and the Cronbach's Alpha of the trait anxiety scale was 0.78.

Procedure

Suturing was performed by the physician working in the trauma unit of the PED. One physician was assigned to the trauma unit, in monthly shifts. Suturing and local anesthesia application were performed by the same physician.

A digital game was played via iPad Air 2 32GB 9.7-inch Wi-Fi model tablet. The researcher created a folder with a range of selected games to appeal to different preferences. Children could choose from the following games: Word Travel, Talking Tom Candy Run, 384 Puzzles for Kids, Masha and The Bear, Subway Surfers, Head Ball 2, and Dream League Soccer.

During the suture procedure, the children in the intervention group played digital games, unlike the children in the control group. The routine practices of the clinic were carried out for both groups.

In the preprocedure, the researcher completed the sociodemographic and clinical characteristics form, with an explanation about WBFPS, VAS, FMPS, and STAI-CH. Parents were allowed to and were encouraged to stay with their children during the procedure. Children in the intervention group began playing about 1 min before the local anesthesia procedure [Figure 1].

The children in the intervention group continued to play throughout the suturing procedure. Children in all groups were asked to mark the pain they experienced during the procedure on the WBFPS and VAS. In postprocedure, all groups were asked to mark the pain experienced after suturing on the WBFPS and VAS. All were asked to respond to the FMPS and STAI-CH (state inventory only) to measure the fear and anxiety experienced.

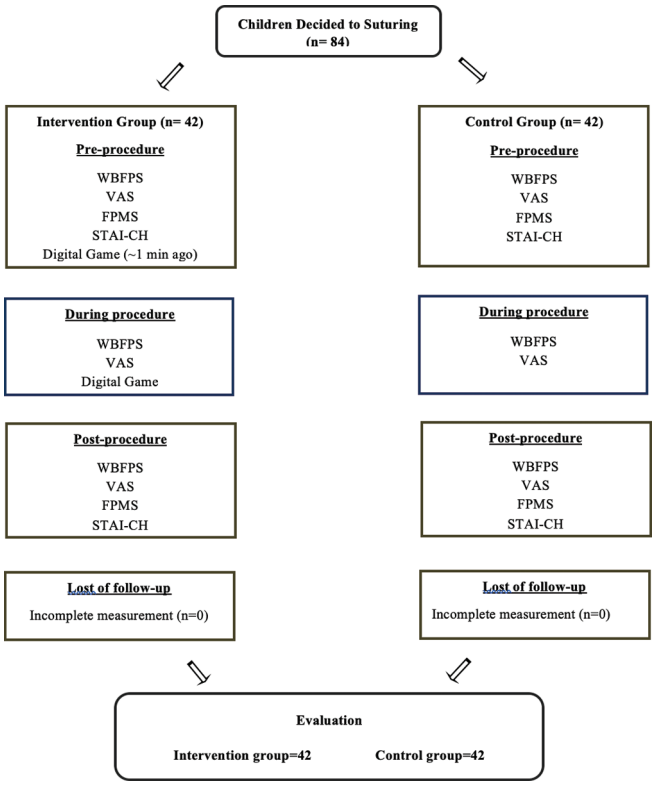

Figure 1: Study flow chart

It was observed that none of the children who started playing digital games left the process unfinished.

Statistical analysis

Licensed SPSS (Statistical Package for the Social Science, IBM, US) for Windows 25.0.0 package program was used for data analysis. The suitability of the data to the normal distribution was examined with the Kolmogorov–Smirnov test. Continuous variables are expressed as mean ± standard deviation, median, and range. According to the results of the normality test, either the *t*-test or Mann–Whitney *U*-test was used in independent groups for comparisons between groups. Intergroup comparisons of categorical variables were performed using the Pearson Chi-square test or Fisher's exact test. In group comparisons, *t*-test, Wilcoxon test, and Repeated Measures ANOVA were used in repeated measurements in dependent groups. Tukey's test was used for *post hoc* analysis with the Bonferroni correction to determine which group caused the difference. The results were evaluated at a 95% confidence interval and $P < 0.05$ significance level.

Results

There was no statistically significant difference between the groups in terms of age, gender, educational background, previous suturing, and digital game-playing status ($P > 0.05$) [Table 1].

There was no statistically significant difference between the groups in terms of a previous admission to the emergency department, the number of sutures, and the duration of suturing ($P > 0.05$). There was a statistically significant difference in the area of the sutured ($P = 0.03$) [Table 2].

Before suturing, there was no statistically significant difference between the groups' mean WBFPS, VAS, FMPS, and STAI-CH scores ($P > 0.05$) [Table 3].

During the procedure, the WBFPS and the VAS pain score means in the intervention group were determined to be statistically significantly lower than those in the control group ($P < 0.01$) [Table 3].

After suturing, the state anxiety, and the fear scores mean in the intervention group playing digital games were found statistically significantly lower than those in the control group ($P < 0.01$). In the intervention group, both WBFPS and VAS pain scores were found to be statistically significantly lower than in the control group ($P < 0.01$) [Table 3].

Discussion

This study aimed to determine the effect of playing digital games on the pain, fear, and anxiety levels experienced by children aged 8–17 during suturing, and the main results are discussed in the light of the literature.

In our study, we observed lower mean pain scores in the intervention group during and after the procedure compared to the control group [Table 3]. Similar to our results, a study showed lower mean pain scores for a video game group and a group was given lollipop candy compared to the control group.[23] Another study with 200 children aged 4–13 years compared two groups during a phlebotomy process; one group played the Angry Birds game, and the other groups were given activities such as singing, reading, and bursting bubbles. The study suggested that all distraction methods are generally effective in pain management.[24]

In accordance with the literature, our results are similar to some studies with Virtual Reality (VR) glasses.[10,25,26] A recent study compared VR and standard-of-care distraction (a tablet or smartphone, music, jokes, and discussion) during plastic surgery procedure in children aged 6–16 years. They found that the use of VR reduced procedure time, but not pain or anxiety compared to standard-of-care distraction.[27] This solution was as therefore not more effective in reducing pain and anxiety than other methods, despite its relatively greater cost and lower accessibility. Furthermore, VR glasses have greater cost and lower accessibility than other distraction methods.

Table 1: Sociodemographic characteristics of children

	Intervention Group (*n*=42), *n* (%)	Control Group (*n*=42), *n* (%)	Test value	*P*
Age (mean: 12.29±3.00)				
8–12	21 (50.0)	22 (52.4)	0.048	0.827
13–17	21 (50.0)	20 (47.6)		
Gender				
Female	14 (33.3)	11 (26.2)	0.513	0.474
Male	28 (66.7)	31 (73.8)		
Educational background				
Preschool	0	1* (2.4)	2.204	0.531
Primary school	14 (33.3)	18 (42.9)		
Secondary school	14 (33.3)	13 (31.0)		
High school	14 (33.3)	10 (23.8)		
Previous suturing status				
Sutured	13 (31.0)	8 (19.0)	1.578	0.208
Unsutured	29 (69.0)	34 (81.0)		
Previous digital gaming status				
Those who play a digital game	40 (95.2)	40 (95.2)	†	1.000
Those who do not play a digital game	2 (4.8)	2 (4.8)		

*Even though one child was 8-year-old, this child was categorized as a preschooler due to never previously being enrolled in school, †Fisher's exact test. χ^2=Pearson Chi-square

Table 2: Clinical characteristics of children

	Intervention Group (*n*=42), *n* (%)	Control Group (*n*=42), *n* (%)	Test value	*P*
Previous admission to the PED				
Available	42 (100.0)	39 (92.9)	*	0.241
Not	0	3 (7.1)		
Number of sutures discarded				
3	11 (26.2)	16 (38.1)	3.200	0.202
4	21 (50.0)	13 (31.0)		
5 or more	10 (23.8)	13 (31.0)		
Sutured area				
Head	8 (19.0)	14 (33.3)	8.826	0.032
Upper extremity	11 (26.2)	18 (42.9)		
Lower extremity	22 (52.4)	10 (23.8)		
Body	1 (2.4)	0		
Suture time (min)				
4–9	27 (64.3)	27 (64.3)	2.022*	0.344
10–15	14 (33.3)	11 (26.2)		
16–20	1 (2.4)	4 (9.5)		

*Fisher's exact test. χ^2: Pearson Chi-square, PED: Pediatric emergency department

In our study, we determined that the mean pain scores of the intervention group during and after the procedure showed a steady decrease compared to the preprocedure and that the reduction was statistically significant. Similar to our study, in a study with 99 children aged 3–18 years at a PED, reduced pain levels both during and after the procedure were found for children who viewed cartoons during medical procedures.[28]

In our study, no difference between groups was found in the preprocedure fear score means, while postprocedure, the fear score means decreased in the intervention group, but increased in the control group. In the study conducted with 46 children between the ages of 2 and 15 years, intervention group children were allowed to play with a humanoid robot before invasive procedures, and it was concluded that they experienced less fear than the control group.[29] In a study conducted with 136 children aged 7–12 years, lower fear scores were found for those using VR glasses during an intravenous injection procedure compared to the control group.[5] These results again suggest that distraction methods have positive effects on reducing fear of medical procedures.

In our study, no statistically significant difference was observed between the groups' preprocedural trait anxiety mean scores, but lower postprocedural scores were found in the intervention group. Compared to the preprocedure, a 14-point fall was observed in the state anxiety score averages of those playing digital games postprocedure, while in the control group, the decrease was only 2.98 points. It is thought that this minor

Table 3: Comparison of the scale scores of the groups

	Intervention Group (*n*=42)		Control group (*n*=42)	Test value	*P*
WBFPS, median (IQR)					
WBFPS preprocedure	6 (4–6)		4 (4–6)	−0.571*	0.568
WBFPS during procedure	4 (2–6)		8 (4–10)	−4.477*	<0.01
WBFPS postprocedure	2 (0–2)		4 (4–6)	−6.098*	<0.01
Group (*F*, *P*)		23.332†, <0.01			
Time (*F*, *P*)		77.742†, <0.01			
Group-time (*F*, *P*)		46.014‡, <0.01			
VAS, median (IQR)					
VAS preprocedure	6 (4–7)		4.5 (4–6)	−1.196*	0.232
VAS during procedure	4 (3–6)		8 (5–9)	−4.867*	<0.01
VAS postprocedure	1 (0–2)		4.5 (3–6)	−6.006*	<0.01
Group (*F*, *P*)		23.391†, <0.01			
Time (*F*, *P*)		75.636‡, <0.01			
Group-time (*F*, *P*)		51.868†, <0.01			
FMPS, mean±SD					
FMPS preprocedure	50.43±9.34		49.07±9.05	0.676‡	0.501
FMPS postprocedure	42.62±5.93		51.38±9.74	−4.975‡	<0.01
T	10.624		−2.290		
P	<0.001		0.027		
STAI-CH Trait, median (IQR)					
Trait anxiety preprocedure	29 (26–32.25)		29 (25–32)	−0.692*	0.489
STAI-CH State, median (IQR)					
State anxiety preprocedure	48 (41.75–50.25)		46 (39–51)	−0.300*	0.764
State anxiety postprocedure	31.5 (28–34.25)		41 (37.75–49)	−5.732*	<0.01
Z§	−5.651		−2.772		
P	<0.001		<0.01		

*Mann–Whitney *U*-test, †Repeated measures ANOVA (according to group-time interaction), ‡Student's *t*-test, §Wilcoxon test. SD: Standard deviation, IQR: Interquartile range, WBFPS Wong-Baker Faces Pain Rating Scale, VAS: Visual Analog Scale, FMPS: Fear of Medical Procedure Scale, STAI-CH: State-trait anxiety inventory for children

decrease was due to the relief experienced at the end of the process. A study with 180, 6–10 years old, children undergoing the vascular access procedure compared the effects on anxiety levels of watching cartoons, playing digital games, and communicating with parents. It was determined that the lowest anxiety level was experienced by the group playing digital games, and therefore, this activity can be considered the most effective distraction method in reducing child anxiety.[13]

The vast majority of children exposed to invasive medical procedures experience pain, leading to fear and anxiety. These emotions trigger each other and are closely related. Restraining children and forcing them to undergo invasive medical treatment can increase their uneasiness, prompting attempts to escape, and can cause negative psychological effects. However, the use of distraction methods during invasive medical procedures, including providing digital games, playing music, and demonstrating breathing exercises has been shown to have a positive effect on pain, fear, and anxiety levels.[5]

Limitations

Study results are limited to children receiving suturing at the PED at one hospital. Among the limitations of the study was the use of different physicians performing the suturing procedure. Participants were informed about the study, but were not told to which group they were assigned; however, this has been clear to those who were given games to play.

Conclusions

In this study, during and after the suturing procedure, significantly lower WBFPS and VAS pain scores were found for children playing digital games compared to those who did not. After the suturing procedure, the game players' fear and anxiety scores were found to be significantly lower than those of the nonplayers. In accordance with the results obtained, digital game playing can reduce children's pain, fear, and anxiety during painful procedures such as suturing. Recommendations can be made to hospital management and staff regarding the provision of devices and internet connections for children to play digital games in painful invasive procedures. Furthermore, studies can be conducted to determine the effect of different distraction methods in all invasive procedures applied to children.

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Author contributions CReDiT statement – Mandatory for all article types

MK: Conceptualization (equal), methodology (equal), acquisition, analysis and interpretation of data (lead), writing - original draft (equal), review and edit (equal), final approval (equal), FO: Conceptualization (equal), methodology (equal), analysis and interpretation of data (equal), writing - original draft (equal), review and edit (equal), final approval (equal), TY: Conceptualization (equal), methodology (equal), analysis and interpretation of data (equal), writing - original draft (equal), review and edit (equal), final approval (equal).

Conflicts of interest

None Declared.

Ethical approval – Mandatory for original articles

The protocol for the research project has been approved by the research ethics committee of İzmir University of Economics prior to the study (Issue No: B.302.IEÜSB.0.05.05- 20-046, Date: 26/11/2019).

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The research conforms to the provisions of the Declaration of Helsinki in 1995 (as revised 2013).

Consent to participate – Mandatory for original articles and case reports

All participants gave an informed consent for the research before volunteering and the anonymity was preserved.

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