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Effect of Buzzy® Application on Pain During Subcutaneous Application in Children*

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Abstract

Background: Reducing children's pain during medical procedures is important for their response to painful procedures later in life and for their acceptance of medical care.

Aim: This study was conducted to determine the efficacy of the Buzzy® device used in subcutaneous administration to hospitalized or outpatient children in pediatric oncology immunology. The combination of vibration and ice physiologically suppresses the body's pain nerves and provides natural pain relief within seconds.

Methods: The study, conducted as a quasi-experimental single-group pretest–posttest design, was completed with 26 children aged 6-18 years. In this study, Introductory Information Form, Application Registration Form, Wong-Baker Faces Pain Scale, and Visual Analog Scale were used. For experimental application, Buzzy® was placed 3-5 cm above the injection site 30 seconds prior to subcutaneous application and then the subcutaneous application was performed. Paired samples *t*-test and Wilcoxon test were used to analyze the data.

Results: It was found that children experienced less pain when administered subcutaneously with the Buzzy® device ($P=.0001$). In addition, although there was no significant difference in mean saturation and blood pressure between the control and experimental applications in the children ($P > .05$), there was a significant difference in mean pulse rate ($P=.012$) and respiratory rate ($P=.003$).

Conclusion: The application of Buzzy® in reducing pain in children during subcutaneous application was found to be an effective method.

Keywords: Child, interventional pain, nonpharmacological method, Buzzy®

Introduction

Pain is an unpleasant warning and emotional experience associated with actual or potential harm. Pain, which is an unpleasant sensation, can be caused by the disease itself or by numerous attempts at diagnosis and treatment. Needle treatments are the primary source of pain in hospitalized children. Untreated pain can have short- and long-term physiological, psychological, and emotional consequences.[1,2]

Reducing pain during medical procedures in children is important for their response to painful procedures later in life and for their acceptance of health care.[3] Pain and anxiety experienced in childhood may also be a reason for fear and avoidance during hospital admission in adulthood.[4] The American Academy of Pediatrics and the American Pain Society advise reducing anxiety and pain even for minor procedures such as vascular access. Timely pain control for painful procedures in children increases tolerance for future procedures.[3]

Pain control in children is a team effort. Within this team, nurses have the opportunity to observe and assess the child more closely. In nursing, it is important to accurately and appropriately define, assess, and treat the child's pain. Successful pain management improves the child's quality of life and allows for early mobilization. It also reduces costs by shortening the hospital stay.[5,6] Recent studies often recommend the use of nonpharmacologic methods to reduce pain in children after surgery. These methods can be used alone or in combination with pharmacologic methods to control pain. When used properly, nonpharmacologic methods are also supported by studies demonstrating effective reduction and prevention of intervention pain.[7-15]

*This research was produced from a Master's thesis.

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It appears that studies of pain relief in children are generally conducted in children[8-12] hospitalized with an acute illness or during immunization.[11] However, the number of children with chronic diseases is increasing day by day worldwide. In particular, children with chronic diseases face many painful procedures during diagnosis, treatment, and follow-up.[16] Cancer and allergic problems are among the most common chronic diseases in children. The diagnosis and treatment process of childhood cancers can cause many problems due to the duration, intensity, and aggressiveness of the disease. Sometimes the acute side effects of chemotherapy and radiotherapy are more severe than the symptoms of the underlying disease.[17] In children, the suppression of bone marrow and the reduction in the number of neutrophils caused by radiotherapy and chemotherapy lead to disturbances in the delivery of treatment and increase the risk of infection by bacteria. Hematopoietic growth factors administered after radiation/chemotherapy aim to reduce neutrophil counts and associated risks.[18]

Allergen-specific immunotherapy applied to allergic diseases is one of the effective methods that provide recovery. The allergen, whose sensitivity is detected, is given for certain periods and in increasing doses over time. The main purpose is to ensure the development of immunotolerance. Allergen-specific immunotherapy applications can be performed by subcutaneous (SC), sublingual, nasal cavity, and lymphatic routes. This application has 2 basic steps: loading and maintenance therapy. The adequate therapeutic dose is given for a long time (usually 3-5 years) during the transition to maintenance therapy.[19]

Buzzy® is a pain blocker that combines vibration and ice, physiologically suppressing the body's own pain nerves and providing natural pain relief in seconds. The combination of cold application and vibration of Buzzy® is effective in controlling severe pain and soreness. Several scientific studies have demonstrated the effectiveness of Buzzy® on pain associated with administration of intramuscular vaccines[11] and intravenous cannulas.[12-15] However, a detailed literature search found only a limited number of studies that investigated the effect of Buzzy® on reducing pain during SC administration.[20] Research in this area is needed to support evidence-based practices. To this end, this study was conducted to determine the effect of the Buzzy® device used in the SC administration of immunotherapy or neutropenia treatment on pain and vital signs in children treated as inpatients or outpatients in the pediatric oncology-immunology unit.

Materials and Methods

Design

The quasi-experimental study was conducted on children between 6 and 18 years old who came to the pediatric oncology and immunology service of Zonguldak Bulent Ecevit College (BEU) Health Applications and Research Center from May to September 2019.

Research Hypotheses

Hypothesis 1: During SC use with Buzzy®, children's average Visual Analog Scale (VAS) score will be lower than the average VAS score during SC use with routine care.

Hypothesis 2: Children's average Wong–Baker Faces Pain Scale (WBFPRS) score during SC use with Buzzy® will be lower than the average WBFPRS score during SC use with routine care.

Hypothesis 3: The mean pulse rate of children during SC application with Buzzy® is lower than the mean pulse rate during SC application with routine care.

Hypothesis 4: The mean respiratory rate of children during SC application with Buzzy® is lower than the mean respiratory rate during SC application with routine care.

Hypothesis 5: The mean blood pressure of children during SC administration with Buzzy® is lower than the mean blood pressure during SC administration with routine care.

Hypothesis 6: Children's mean oxygen saturation level during SC administration with Buzzy® is lower than the mean oxygen saturation level during SC administration with routine care.

Research Population and Sample Selection

Children aged 6-18 years who came to the pediatric oncology and immunology service of BEU Health Applications and Research Center in Zonguldak for inpatient or outpatient treatment (35 children) formed the population of the study. Because 5 children did not meet the age criteria and 4 children were transferred to another hospital during treatment, they were not included in the sample. All phases of the study were completed with 26 children meeting the criteria for inclusion in the sample group.

Selection Criteria for the Sample

- Age between 6 and 18 years.
- Requirement of vaccination against Hematopoietic Growth Factors (HBF) or immunotherapy for the treatment of neutropenia in SC.
- Informed consent of the child and parents.
- Willingness of the child to participate in the study.
- No intake of medications with analgesic effect in the 24 hours prior to the application.
- The child has no mental or neurological disability.
- The child's consciousness is open and there are no communication problems
- The child and the parents can speak Turkish.

Instruments

Introductory Information Form: The form consists of 2 parts. In the first part, 21 questions are used to determine the sociodemographic characteristics of the children and their parents, the child's experiences, feelings, thoughts, and reactions to the previous SC injection. In the second part, there are 5 questions that allow to evaluate the views of children and parents after the SC injection by using Buzzy®.

Wong–Baker Facial Expression Rating Scale: The scale developed by Donna Wong and Connie Morain Baker is used to diagnose pain in children between 3 and 18 years old. On the scale, the lowest is "0" and the highest is "10." When using the scale, the child is told that each face belongs to a person, "0" is a happy face with no pain, and "10" is a sad face that is very painful. As the score increases, the child's severity of pain also increases.[21] The number of facial expressions given by the child is recorded.

Visual Analog Scale: This scale is used to convert some values into numbers that cannot be measured numerically. The child is asked to indicate the pain he or she feels on a 10-cm ruler in the area labeled "no pain" and "most severe pain." The length of the distance between the point of no pain and the point marked by the patient indicates the

patient's pain. Patients older than 5 years described this method as simple to use and easy to understand.[22]

Application Registration Form: This form is used for recording blood pressure, pulse rate, respiratory rate, and saturation level of children.

Pulse Oximeter Device: This is a device used for the non-invasive measurement of oxygen saturation in the blood. It allows the measurement of saturation and pulse rate values without invasive procedures on the patient.

Buzzy®: This is an 8 × 5 × 2.5-cm non-invasive pain control device with a plastic battery and vibration motor developed by pediatrician Ammy Baxter. An ice pack is placed under the Buzzy®. Buzzy shows its effect by applying local cold and vibration, 15-30 seconds before the procedure and 3-5 cm close to the area to be injected during the procedure.[23] Care should be taken to ensure that Buzzy® is in full contact with the skin. The ice pack is stored in the freezer and placed in the device prior to application. After application, the ice pack is wiped with 70% alcohol and stored in the freezer for refreezing.

Implementation of the Study

The research data were collected by the same researcher. The survey took place on weekdays between 8:00 AM and 5:00 PM among the children who met the selection criteria for the sample.

- The children in the study group and their parents completed an "Introductory Information Form" prior to the procedure. Completion of each form took an average of 5 minutes.

Control Application

- Pre-procedure blood pressure, respiratory rate during the procedure, pulse rate, and oxygen saturation were measured using a pulse oximeter and recorded on the "Application Registration Form."
- Control application, administration was as a vaccine in routine care and immune repipe or as HBF SC in neutropenia. In routine care, the procedure for SC use in children is explained to the child and their parents. In addition, the child is allowed to stay with the parent during the procedure if the parents desire so.
- The pain score perceived during the application of SC was recorded on the VAS and the WBFPRS, which were explained by interviewing the child immediately after the procedure (within the first minute).
- The second application, which was a test application, was performed with the Buzzy® device.

Experimental Application

- The second application was performed 1 month later in the children in the maintenance phase who received immunotherapeutic treatment and 1 week later in the children in the dose escalation phase. Because no standard time interval for the administration of HBF in neutropenia to oncologic patients was established, a second application in neutropenia was performed.
- Prior to the procedure, the Buzzy® device was introduced to the child and the children who requested it were screened, and permission was obtained for SC use with this device. Parents were allowed to remain with the child during the procedure if the child and parents desired so.
- The child's blood pressure before the procedure, respiratory rate during the procedure, pulse rate, and oxygen saturation were recorded using a pulse oximeter and noted on the "Application Registration Form."
- The Buzzy® application was started 30 seconds before the SC application, and the SC application was performed by drawing it 3-5 cm above the application area and continuing to act during the injection.
- The pain score felt during the SC application was recorded on the VAS and the WBFPRS, which were explained by interviewing the child immediately after the procedure (within the first minute).

After the procedure, the children and their parents for whom SC with Buzzy® was used were asked on the "Introductory Information Form" for their opinion about the injection of SC with Buzzy® (Figure 1). The first and second SC applications were administered to all children in the study group by the same researcher.

Ethics of Research

An informed consent form from the parents, permission from the institution, and ethics committee approval (12.09.2018-2018/17) were obtained.

Data Analysis

Statistical Package for the Social Sciences 19.0 (IBM SPSS Corp.; Armonk, NY, USA) program was used for the statistical analysis. Mean–standard deviation [minimum–maximum], number, percentage values, Shapiro–Wilk test, chi-square test, Wilcoxon test, and paired-samples *t*-test were used to assess the data. The results were evaluated in the CI of 95%, and $P < .05$ was considered statistically significant.

Results

The mean age of children in the study group was 11.76 ± 3.71 (6.0-18.0); 65.4% (n=17) were male, 46.2% (n=12) attended secondary school, and 80.8% (n=21) were primary school children. It was found that 57.7% (n=15) of the children were accompanied by their mothers, 26.9% (n=7) were accompanied by their fathers, and 15.4% (n=4) were alone (Table 1).

It was found that the average age of mothers was 36.19 ± 4.63 (30.0-45.0); 46.2% (n=12) had a primary school degree, and 73.1% (n=19) were not employed. It was found that the average age of fathers was 38.53 ± 4.74 (30.0-48.0); 34.6% (n=9) had primary or secondary education, and 96.2% (n=25) were employed (Table 2). It was found that the average number of children in the families was 2.12 ± 0.65 (1.0-4.0).

When the characteristics of the children related to the SC applications were examined, it was found that 61.5% of them applied for immunotherapy and 38.5% applied for HBF. It was found that 57.7% of children were treated with SC 1 week ago, 26.9% 1 month ago, and 15.4% 3 days ago, 57.7% had fear of injection SC, and 76.9% reacted at the last application of SC.

It can be seen that there is a significant difference between control and experimental application in terms of mean pulse rate ($P=.012$) and respiratory rate ($P=.003$). While the mean pulse rate in the SC application with routine care was 89.76 ± 13.91 (62.0-116.0) and the respiratory rate was 20.04 ± 3.56 (14-26), in the SC application with Buzzy®, the mean pulse rate was 87.15 ± 13.58 (60.0-112.0) and the respiratory rate was determined to be 18.88 ± 2.94 (14.0-24.0) (Table 3). There was no significant difference between mean oxygen saturation ($P=.366$) between control and experimental applications. Similarly, there was no significant difference between the mean values of blood pressure (systolic blood pressure $P=.317$, diastolic blood pressure $P=1.000$) between control and experimental applications (Table 3).

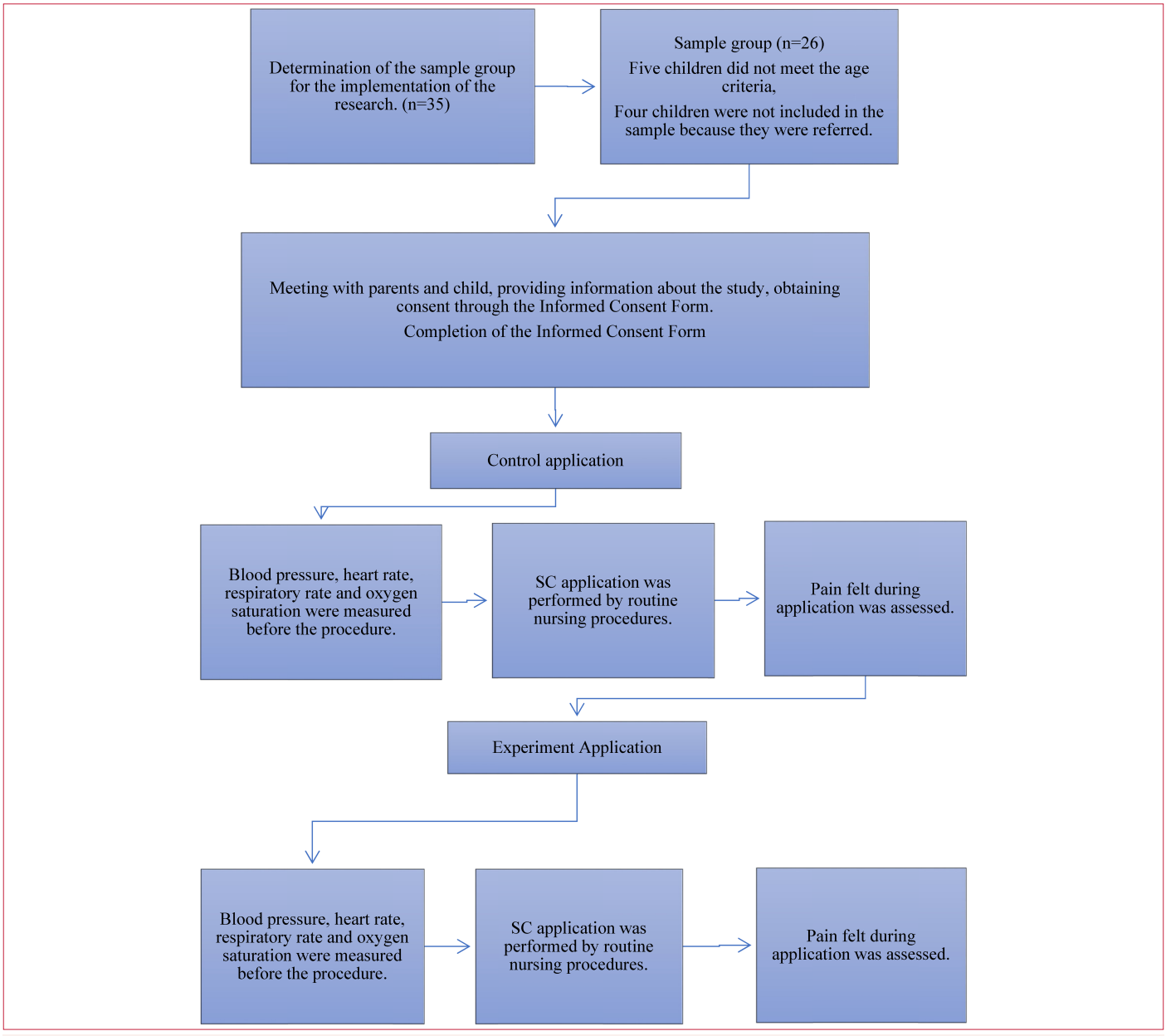

Figure 1. Application flowchart.

It is found that there is a significant difference between the control and experimental applications of the children in terms of the mean values of VAS and WBFPRS (P=.0001). The WBFPRS mean was 4.12 ± 1.28 (2.0-6.0) in the SC application, while the VAS mean was 4.12 ± 1.26 (2.0-6.0), whereas the mean WBFPRS score was 0.54 ± 1.06 (0.0-4.0) (Table 4).

It was found that 92.3% (n=24) of children were curious about the Buzzy® application, and all children (100%, n=26) reported that the method worked and they were satisfied with the application (Table 5).

Discussion

Medical interventions are among the greatest sources of pain and fear in hospitalized children. Providing timely and effective pain control during painful procedures applied to the child will increase the tolerance to pain in later applications. If health professionals intervene in pain early in children's lives, they can help prevent the development of needle phobia. When the child first encounters needles, needle pain management and distraction can protect the child from traumatic experiences related to medical intervention, clinical environment, and experiences. It can prevent the child from developing anxiety and even phobia later in life.[9,10]

Especially children with chronic diseases are faced with many painful procedures during the diagnosis, treatment, and follow-up process.[2] It is very important to provide pain control during painful medical procedures in these children. In this direction, Buzzy® was used during SC HBF and immunotherapy applications, which is one of the most

Table 1. Distribution of Some Characteristics of the Children

Characteristics	Mean ± SD	Median (Min-Max)
Child		
Age	11.76 ± 3.71	12.0 (6.0-18.0)
Gender	N	%
Girl	9	34.6
Boy	17	65.4
Education status		
Not going to school	1	3.8
Homeschooling	2	7.7
Primary education	11	42.3
High school	12	46.2
Which child		
1.	21	80.8
2.	5	19.2
Bedside caregiver		
Mother	15	57.7
Father	7	26.9
Alone	4	15.4
Total	26	100.0

frequent applications for oncology and immunology patients with chronic diseases.

It is thought that the children in the study group experienced SC practice very often and this is due to their chronic health problems. Mutlu and Balcı[10] stated in their study that children with acute health problems are exposed to less-invasive procedures than children with chronic diseases.

Table 2. Distribution of Some Characteristics of the Parents

	Mother	Father
Characteristics	Mean ± SD Median (Min-Max)	Mean ± SD Median (Min-Max)
Age	36.19 ± 4.63 38.0 (30.0-45.0)	38.53 ± 4.74 40.0 (30.0-48.0)
Education status	n (%)	n (%)
Primary school	12 (46.2)	9 (34.6)
Middle school	7 (26.9)	9 (34.6)
High school	5 (19.2)	6 (23.1)
University	2 (7.7)	2 (7.7)
Working status		
Working	7 (26.9)	25 (96.2)
Not working	19 (73.1)	1 (3.8)
Total	26	100.0

Pain is a subjective finding, and the most reliable source for pain assessment is the individual's own pain expression. Pain, which is a subjective finding, should be measurable by making it as objective as possible.[24,25] Changes in pulse rate, respiration, blood pressure, and oxygen saturation can be observed in children due to both anxiety and fear caused by the medical procedure, and pain. Pulse rate, respiration, blood pressure, and oxygen saturation were measured in this study.

In the findings obtained, it was determined that there was a significant difference between the control and experimental applications in terms of mean pulse rate ($P < .05$). It was observed that the average pulse rate was lower in the experimental application using Buzzy®. This finding is the third hypothesis of the study, "The mean pulse rate of children during SC application using Buzzy® is lower than the average pulse rate during SC application with routine nursing care." It confirms this hypothesis. Similarly, it was determined that there was a significant difference in the mean respiratory rate of the first and second measurements ($P < .05$). This finding is the fourth hypothesis of the study, "The mean respiratory rate of children during SC application using Buzzy® is lower than the average respiratory rate during SC application using routine nursing care." It confirms this hypothesis.

It is seen that studies on pain control in children during medical interventions have obtained different results in terms of mean pulse rate and respiratory rate.[10,26,27] Mutlu and Balcı reported that balloon inflation is effective in reducing pain when taking venous blood samples in children aged 9-12. In that study in which they evaluated also the effect of coughing and coughing methods, they determined that coughing reduced the pulse rate of children.[10] Göksu in his study, evaluating the effect of virtual reality glasses used during venous blood collection on the pain felt, found that the pulse rate decreased in the experimental group while it increased in the control group.[26]

It was found that there was a significant difference between the children's control and experimental applications in terms of the mean values of VAS and WBFPRS. It can be seen that the mean scores of VAS and WBFPRS were lower during the experiment ($P = .0001$). These results support the first hypothesis of the study, "During SC use with Buzzy®, the mean of VAS scores of children is lower than the mean of SC VAS scores during SC use with routine care." and confirm the second hypothesis, "The mean of WBFPRS scores of children during SC use with Buzzy® is lower than the mean of WBFPRS scores during SC use with routine care." It has been suggested that this is due to the fact that during SC application of Buzzy®, children direct their attention in different directions and experience less pain due to the effect of cold application and vibration.

The results of the study are consistent with those in the literature.[8-15] Distraction is a simple and effective technique to divert children's attention from medical procedures and needle sticks. In recent years, distraction techniques for children and adolescents have been shown to be effective in reducing the pain, distress, fear, and anxiety associated with needle procedures.[8-15] The Studies have shown that, in general, children with acute health problems are less exposed to needle procedures.[8-14] As a result of the extensive literature search, a limited number of studies were found on pain management in children with chronic health problems.[7]

Table 3. Comparison of Mean Vital Findings of the Children

	Control Measurement Mean ± SD Median (Min-Max)	Experimental Measurement Mean ± SD Median (Min-Max)	Test Value	
			t	*P*
Pulse	89.76 ± 13.91 108.0 (62.0-116.0)	87.15 ± 13.58 96.0 (60.0-112.0)	**−2.524***	**.012***
Respiratory	20.04 ± 3.56 22.0 (14.0-26.0)	18.88 ± 2.94 21.0 (14.0-24.0)	**−2.929***	**.003***
Systolic BP	101.35 ± 7.50 104.0 (90.0-110.0)	100.5 ± 78.99 90.0 (80.0-100.0)	−1.000†	.317†
Diastolic BP	57.69 ± 7.10 60.0 (50-70)	57.69 ± 7.13 60.0 (50-70)	0.000†	1.000†
SpO_2	98.19 ± 0.85 96.0 (95.0-99.0)	98.12 ± 0.43 98.0 (97.0-99.0)	−0.905†	.366†

*Paired-samples *t*-test. †*Z* value was taken for Wilcoxon test. Values with statistically significant differences are shown in bold.
BP, blood pressure; SpO_2, oxygen saturation.

Table 4. Comparison of Children's Mean VAS and WBFPRS Scores

	Control Measurement Mean ± SD Median (Min-Max)	Experimental Measurement Mean ± SD Median (Min-Max)	Test Value	
			Z	*P*
VAS	4.12 ± 1.26 4.0 (2.0-6.0)	0.56 ± 1.08 2.0 (0.0-4.0)	**−4.340†**	**.0001†**
WBFPRS	4.12 ± 1.28 4.0 (2.0-6.0)	0.54 ± 1.06 2.0 (0.0-4.0)	**−4.650†**	**.0001†**

†Wilcoxon tests. Values with statistically significant differences are shown in bold.
VAS, Visual Analog Scale; WBFPRS, Wong–Baker Faces Pain Scale.

Buzzy® is a pain blocker that can control pain in multiple ways and provide natural pain relief in seconds. Buzzy® helps control pain through the application of cold, vibration, and distraction. Because of these features, the Buzzy® device has many benefits. Canbulat et al showed that Buzzy® effectively reduces pain and anxiety during IM immunization in children aged 7-12 years.[11,14]

It can be seen that 92.3% of children were curious about Buzzy® after the SC application, and all of them stated that the method works and they were satisfied with the application. In the studies conducted, it was found that the distraction methods used to reduce pain associated with needle procedures in children increased both child attention and parent satisfaction, supporting the research findings. In the study by Goksu (2017), it was found that the pain of the majority of children in the experimental group decreased after blood sampling with virtual reality goggles, that the children felt that this method worked and that the children were very satisfied with this application. When parents' views of the method used were assessed, it was found that parents were mostly satisfied.[27] In the study by Erbay[26], which examined the effect of watching cartoons on pain perception during peripheral vascular access, it was found that parents in the experimental group had higher mean scores on care satisfaction compared with the control group.[26]

Table 5. Evaluation of Children's Views About Buzzy® and SC Application

Views	N	%
Reaction	24	92.3
Curious	2	7.7
Effectiveness of the methods		
Yes	26	100
No	0	0.0
The child's satisfaction with the application		
Pleased	26	100.0
Not glad	0	0.0
Total	26	100.0

SC, subcutaneous.

Limitations of the Research

Due to the limited number of the study group, a separate control group could not be formed, and the study was conducted in a single group.

Conclusions and Suggestions

The use of Buzzy® has been shown to be an effective method of pain relief in children during the use of SC.

Consistent with these findings, it is recommended that the Buzzy® device can be used to reduce pain in children during short-term painful procedures such as SC and that the efficacy of Buzzy® use can be supported by evidence-based studies that should be conducted in different painful applications and in different age groups.

Ethics Committee Approval: Ethics committee approval was received for this study from the Clinical Research Ethics Committee of Zonguldak Bülent Ecevit University (12.09.2018-2018/17).

Informed Consent: Written informed consent was obtained from the participants who participated in this study.

Peer-review: Externally peer-reviewed.

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