Original Article

doi:10.31674/mjn.2024.v16i02.008

MJN

Impact of Shot Blocker on Alleviating Peripheral Intravenous Cannulation Associated Pain among School-Aged Children: A Randomized Controlled Trial

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ABSTRACT

Background: The aim of this research is to examine the effectiveness of ShotBlocker in reducing pain to enhance school-age patients' experience with intravenous cannulation. Nurses need to explore non-pharmacological approaches during intravenous cannulation to pain management while adhering to ethical and legal principles. **Objective:** To investigate effectiveness of ShotBlocker and ShotBlocker placebo in reducing pain during intravenous cannulation in school age children's patients. **Methods:** A Randomized Controlled Trial (RCT) that is comparative and prospective, was used. The study was conducted on 228 school age children's patients (6-12 years) who undergo intravenous cannulation in Emergency Departments (EDs). Three groups of patients were randomly assigned: ShotBlocker group (n=79), ShotBlocker placebo group (n=75), and control group (n=74). The patients were requested to evaluate the level of pain immediately following Peripheral Intravenous Line (PIV) procedure using the Wong–Baker Faces Pain Scale. **Results:** This study showed *P*-value=0.000 indicated that there are statistically significant differences in pain intensity among the ShotBlocker, ShotBlocker placebo, and control groups. In comparison to both the ShotBlocker placebo and control group, the ShotBlocker group's pain intensity was significantly reduced (mean difference 1.74684). Furthermore, there were higher pain levels noted in the ShotBlocker placebo (mean difference 8.50667) and control group (mean difference 8.757). **Conclusions:** When compared the ShotBlocker group with ShotBlocker placebo and control groups, the study discovered that the ShotBlocker use was effective in minimizing the levels of pain associated with the intravenous cannulation.

Keywords: Intravenous Cannulation; Nurses; Pain Management; Shotblocker

INTRODUCTION

Peripheral Intravenous Cannulation (PIVC) is a nursing procedure that is frequently carried out and varies according to the patient's health status, examination, and treatment plan, and is often linked with discomfort and pain (Xu *et al*., 2023; Al-Saadi *et al*., 2022). PIVC is a crucial part of patient care enhancement in healthcare settings, like emergency departments (EDs) and is regarded as a standard medical intervention in these settings (Evison *et al.*, 2022). Intravenous cannulation procedures are the main responsibility of the nurses (Liu *et al*., 2022). When nurses, decide about which IV cannulation to use, they should carefully consider various factors including the patient's individual characteristics, the length of treatment period, the specific kind and size of the cannula, the insertion site, and the potential complications that may arise (Alvarez-Morales *et al*., 2024; Kadhum & Bakey, 2023).

When undergoing an intravenous cannulation, children may act out in ways including crying, screaming, contorting their bodies, and tightening their muscles (Oommen & Shetty, 2024). To ensure the successful administration of intravenous cannulation to children, nurses usually need to dedicate extra time to reassuring or persuading the child (Sharp *et al.*, 2023). In some cases, restraining the child may be necessary, and the injections might need to be given forcefully (Ullman *et al*., 2023). If children are forcibly restrained and

Received: May 15, 2024 Received in revised form: August 30, 2024 Accepted: September 12, 2024

cannulation procedure was done against their consent, it can cause them discomfort and provoke their aggressive efforts to escape (Svendsen & Bjørk, 2021). As a result, the procedure could take longer than expected, and giving intravenous injections might be challenging, causing pain and potentially requiring numerous tries to be successful (Ghasemi *et al*., 2022).

Therefore, pain assessment and management should be taken into account considering the complicated nature of this experience (Bachi & AL-Fayyadh, 2022). When it comes to pain management, there are two main approaches: pharmacological interventions, which comprise medications, and non-pharmacological interventions, which include alternative techniques, like ShotBlocker (Yu *et al*., 2023). These non-pharmacological techniques are regarded as safe, cost-effective, reusable, and require minimal procedural effort (EL-mahdy *et al*., 2023). The ShotBlocker is specifically created to alleviate pain by redirecting the child's focus away from the discomfort of injections. The primary objective is to successfully divert attention, resulting in the child being oblivious to the sensation of pain (Hafez & Ali, 2023). The importance of this study lies in its ability to evaluate the effectiveness of the non-pharmacological device in alleviating pain and improving comfort for school-age children undergoing peripheral intravenous cannulation. The majority of research has primarily concentrated on the application of ShotBlocker in relation to intramuscular injections and vaccines, rather than focusing extensively on its use in intravenous cannulation (Gautam *et al*., 2024; Gürdap & Cengiz, 2022; Yildirim & Dinçer, 2021; Sedat *et al.*, 2019; Aydin & Avşar, 2019). This justifies conducting the current study aiming basically to fill the highlighted research gap, and at the same time generating evidence-based recommendations for paediatric nurses practicing intravenous cannulation. Therefore, the aim of this study to test the hypothesis. The ShotBlocker is an easy-to-use plastic device that is designed with a simple C-shaped structure and small protrusions on its back. Developed by Bionix® in the United States, the ShotBlocker is an original tool intended to minimize injection pain. However, all ages can use this unique tool.

Alternative Hypothesis: (H1)

Using a ShotBlocker will lead to a significant reduction in pain levels among school-age children receiving an IV cannula, compared to children who do not receive it.

METHODOLOGY

Research Design

This research employed a prospective, comparative, randomized controlled trial (RCT) design, which is considered the gold standard that researchers utilized to assess the effectiveness of novel interventions (Hariton & Locascio, 2018). Two essential components for an appropriate randomized trial are the allocation sequence's randomization and adequate concealment for this sequence when identified before subject participation, as shown in Figure (1), which offers the Study Protocol Algorithm.

Participants and Sample

This study was conducted on school age children's patients (6-12 years) who were admitted to the Emergency Departments (EDs). According to UNICEF (2023), the official 12-year educational pathway in Iraq begins of 6 years elementary education, 3 years of median level education and then 3 years of secondary-level education. That is, the age of 12 years is part of middle school. A simple random sampling technique was used in this scientific study. Simple randomization has the greatest advantage of removing bias (Lim & In, 2019). Therefore, it was used in this study. After being thoroughly examined by the ED physician(s), patients who had given a written order for an intravenous cannulation, were systematically targeted. Throwing a die method was chosen. Subjects who had gotten the numbers 1 and 2, were assigned to the ShotBlocker group, while those who had gotten the numbers 3 and 4 were assigned to the ShotBlocker placebo group. Subjects who had gotten 5 and 6 were assigned to the control group. The sample consisted of (228) school age children's patients. Assigned these patients to the intervention and control groups. A-priori sample sizes for t-tests were used to obtain the minimum sample size, as presented in table (1). The response rate is approximately 92%.

Data Collection Tool(s)

Blinding

The blinding description is an important standard of strong methodological quality, especially in relation

to RCT internal validity. In this experimental trial, used the single-blind technique refers to the process of concealing certain information from participants in a study (Saltaji *et al*., 2018).

This is typically done to minimize bias and confounding factors to ensure the integrity of the results. In the context of a randomized control trial, blinding refers to keeping participants unaware of certain details, such as the treatment assignment or the group to which participants belong (e.g., experimental group or control group). This helps to ensure that the study's outcomes are not influenced by expectations or preferences, and that the results are more reliable and objective (Moustgaard *et al*., 2020). There have been 228 school age children's patients in the sample. Due to using the dice throwing method, an unequal number of subjects were assigned into each group of these subjects as shown in Figure (1).

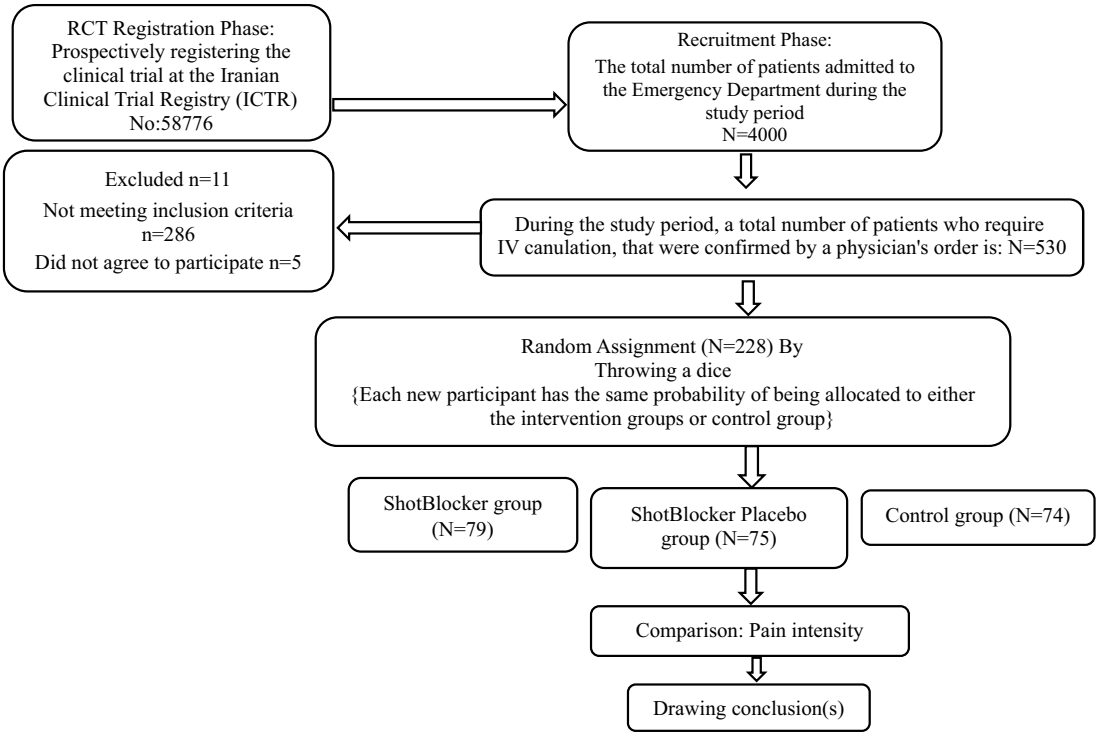

Figure 1: Study Protocol Algorithm

Table 1: Minimum Sample Size Determination

Parameter of calculating the Minimum Sample Size	Selected Values
Anticipated effect size (Cohen's d)	0.5
Desired statistical power level	0.8
Probability level	0.05

Minimum total sample size (one-tailed hypothesis): 102

Minimum sample size per group (one-tailed hypothesis): 51

Minimum total sample size (two-tailed hypothesis): 128

Minimum sample size per group (two-tailed hypothesis): 64

Demographic Data Form

To collect the essential descriptive data on the study participants, the demographic data section was created. These details included age, sex, residence, and educational level.

Wong–Baker FACES Pain Scale

This scale combines images and numbers for rating pain. The scale comprised of six different facial

expressions that show varying degrees of pain, ranging from "no hurt" to "hurts worst". Each face is assigned a numerical value from 0 to 10. Children can easily understand the faces and emotions depicted on the scale and point out to the one that most closely matches their pain level (Beneta, 2023).

The following is an excerpt that clarifies the pain scores associated with each face: the first face indicates a pain score of 0, representing "no hurt". The second face represents a pain score of 2, indicating "hurt little bit". The third face represents a pain score of 4, indicating "hurt little more". The fourth face represents a pain score of 6, indicating "hurts even more". The fifth face represents a pain score of 8, indicating "hurts whole lot". The sixth and final face represents a pain score of 10, indicating "hurts worst".

Inclusion Criteria and Exclusion Criteria

Inclusion Criteria

The inclusion criteria were targeted guardians of subjects who give permission for their children (6-12 years) to involvement in the study. The skin of their hands intact, only applied to the left and right hands during insertion intravenous cannulation. No communication difficulties including hearing, vision, and speech which may impair the quality of the information gathered (Van der Straaten *et al*., 2020). Not receiving oral or parenteral analgesic treatment before cannula insertion, and not undergoing chemotherapy treatment due to may be affecting sensory measurements of pain (Lindbeck *et al*., 2023).

Exclusion Criteria

The exclusion criteria were subjects with cellulitis at the planned cannula insertion site, open wounds, burns, rashes, abscess, or boils. These conditions may make it more likely that worsening of the state (Lurie *et al.*, 2022). Exclusion criteria also included peripheral vascular disease at the planned IV cannula insertion site (e.g., peripheral artery disease, raynaud's disease, peripheral neuropathy, diabetes). The small blood vessels that supply oxygen and blood to tissues close to the skin and nerves are impacted by these diseases. Therefore, it may be very difficult to inserted IV cannula appropriately and safely in these children (Shaikh *et al*., 2022). Exclusion criteria also included blood clotting disorders or increased risk of bleeding (e.g., thrombocytopenia and haemophilia). These conditions may increase the potential of significant bleeding during the procedure, and thus may be exposing them to additional health risks. Exclusion criteria also included anatomical abnormalities that impede IV cannula proper insertion. Also included subjects with history of repeated IV cannula insertion or IV injections within the previous three months. Exclusion criteria also included Children with a splint or cast on the right or left hands, as well as those with upper limb amputation.

Interventional Procedure

As displayed in table (2), the first step in performing this research included intravenous cannulation administration protocols to school age children's patients (6-12 years) After receiving approval from the patient's caregiver. The same nurse had inserted the cannula began by sterilizing the skin and identifying the appropriate vein, in terms of placing the Shot Blocker in right or left hands. For all insertions during the study, 22 Gauge/ blue cannula was used. Above the area of the intervention, the Shot Blocker was fixed with a plaster by 2 cm. Between the placement of Shot Blocker and the cannula insertion, no more than 20 seconds should elapse. Following that, Wong-Baker Face Pain Scale was used to determine the pain level.

Table 2: Intravenous Cannula Insertion Protocol

Hand sanitizing
Wearing gloves
The suitable vein is chosen to place IV cannulation
The tourniquet is placed 10-12 cm above the vein of chosen. The chosen hand is below heart level.
Once the vein was palpated, the area is cleaned with 70% alcohol and allowed to dry for 5 seconds.
The Below the intended vein entry point, hold the needle at an angle of 30-45 degrees to the skin approximately 1cm.Then, once the needle enters the hole, advanced into the vein by reducing the angle to about 15 degrees.
Once the needle enters the vein, the cannula is filled with blood. Then, inserting the needle into the vein slowly, was done.
The needle is retracted 1cm with the inactive hand once released, to the hand under the arm. The needle is in the lumen of the vein if blood is flowing. Then, the plastic part is inserted into the vein slowly.
The tourniquet is released with the inactive hand without moving the Angio catheter in the vessel.
It is examined to determine whether the area is painful, swollen, and red.
Finally, the cannula is fixed on the skin with tape

Shot Blocker Group

The Shot Blocker is an easy-to-use plastic device that is designed with a simple C-shaped structure and small protrusions on its back. Specifically, it was used in this study to evaluate its effectiveness in reducing pain. As the injection takes place, the Shot Blocker applies strong pressure on the skin, diverting attention away from the needle's pain. Upon completion of the insertion, the Shot Blocker is gently removed from the skin. Ensuring proper hygiene and safety protocols are followed, it undergoes sterilization before being ready for use on further patients.

Shot Blocker Placebo Group

The method involves fixed the smooth, flat side of the Shot Blocker directly on the skin in the area where the cannula is inserted. This technique is used in the study to assess the efficacy of the Shot Blocker in reducing pain in participants receiving a placebo, when compared with the other surface of the Shot Blocker and the control groups.

Data Collection

The written consent forms were completed by the patient's parents or legal guardians. Additionally, the patient's parents or legal guardians were advised that their patient's information will be kept confidential and that participation in the study is entirely voluntary and will not have any financial or legal consequences. the researcher has completed and successfully passed the Human Research Protection Fundamental Training provided by the Office for Human Research Protections (OHRP). In order to guarantee the complete protection of the rights, welfare, and well-being of human participants during their participation in a study. The second researcher conducted several studies with randomized controlled trials that were published in reliable research journals. Both the first and the second researcher has a Human Research Protection Training Certificate. Also, the first researcher underwent a full course to study applied research methods with excellent degree. A paediatric nurse with a bachelor's degree in nursing and more than 7 years of experience working in children's wards in hospital. She has gained extensive experience in ensuring safe and effective care for sick children. Moreover, she has completed extensive training on the intravenous cannulation device in the paediatric ward, making her able to master the intravenous cannulation procedures. This training prepares practically to carry out precise procedures and achieve the best results for children's patients.

The nurse has received specialized and in-depth training in pain assessment in children to ensuring quality health care. To expand knowledge and skills, the nurse conducted a pilot study to evaluate pain in children before conducting the research. During 7 years of work experience, this provided for nurse a deeper understanding of children's pain experience and helped develop effective strategies to assess and relieve their pain. This training and practical experience qualifies to perform precise procedures, accurately assess pain in children, and provide exceptional care to the paediatric patients to ensuring the best health outcomes and well-being.

The study protocol was prospectively documented in the database of the Iranian Register of Clinical Trials with id no. 74139 and ref no. IRCT20230714058776N1 on 21st January, 2024. This study was conducted in the Emergency Departments (EDs) at Al-Aziziya General Hospital, Wasit, Iraq and Al-Numaniyah General Hospital during the period of January 22nd to February 21st of 2024.

Data Analysis

IBM-Statistical Package for Social Sciences (SPSS) version 24 was used to analyse the data, and both descriptive and inferential statistical measures were used. Descriptive statistics are used to analyse the demographic data and pain levels for Shot Blocker, Shot Blocker placebo and control groups. Independent sample *t*-test was used to measure the difference in the pain scores across three groups.

Ethical Consideration

The study received ethical confirmation from the Committee of Scientific Research (CSR) at the College of Nursing, University of Baghdad, Iraq on 22nd November 2023. Also, this study obtained approval from the Ministry of Planning (Central Statistical Organization) on 12th December 2023.

RESULTS

Table 3: Participants' Sociodemographic Characteristics

Variable	Frequency	Percent
Age Control Group (Years): Mean (SD): 8.76 ± 2.06		
6-8	35	47.3
9-10	20	27.0
11-12	19	22.7
Total	74	100.0
Age Shot Blocker Placebo (Years): Mean (SD): 8.90 ± 2.00		
6-8	34	45.3
9-10	21	28.0
11-12	20	26.7
Total	75	100.0
Age Shot Blocker (Years): Mean (SD): 8.98 ± 2.02		
6-8	34	43.1
9-10	22	27.8
11-12	23	29.1
Total	79	100.0
Residency Control Group		
Urban	56	75.7
Rural	18	24.3
Total |	74	100.0
Residency Shot Blocker Placebo		
Urban	48	63.5
Rural	27	36.5
Total	75	100.0
Residency Shot Blocker		
Urban	50	63.3
Rural	29	36.7
Total	79	100.0
Sex Control Group		
Male	44	59.5
Female	30	40.5
Sex Shot Blocker Placebo Group		
Male	47	62.7
Female	28	37.3
Sex Shot blocker Group		
Male	46	62.2
Female	33	37.8
Education Control Group		
Elementary School	65	87.8
Middle School	9	12.2
Total	74	100.0
Education Shot Blocker Placebo Group		
Elementary School	65	86.7
Middle School	10	13.3
Total	75	100.0
Education Shot Blocker Group		
Elementary School	68	86.1
Middle School	11	13.9
Total	79	100.0

The dominant age group is between 6 and 8 years old in the control group (n = 35; 47.3%), Shot Blocker placebo group (n = 34; 45.3%), and Shot Blocker (n = 34; 43.1%). followed by age 9-10 years in the control group (n = 20; 27.0%), Shot Blocker placebo group (n = 21; 28.0%), and age 11-12 years in the control group (n = 19; 22.7%), Shot Blocker placebo group (n = 20; 26.7%), and Shot Blocker (n = 23; 29.1%).

Regarding residency, urban areas are predominant in the control, Shot Blocker placebo, and Shot Blocker groups (n = 56; 75.7%, 48; 64.0%, 50; 63.3%), respectively. In terms of gender, there is a higher percentage of males compared to females in all three groups. In the control group, males (n = 44; 59.5%), females (n = 30; 40.5%). In the Shot Blocker placebo group males (n = 47; 62.7%), females (n = 28; 37.3%), and the Shot Blocker group males (n = 46; 58.2%), females (n = 33; 41.8%).

Included the majority of elementary school participants compared to in the middle school. In the control group, the elementary school (n = 65; 87.8%), the middle school (n = 9; 12.2%). In the Shot Blocker placebo group, the elementary school (n = 65; 86.7%), the middle school (n = 10; 13.3%). In the Shot Blocker group, the elementary school (n = 68; 86.1%), the middle school (n = 11; 13.9%).

Table 4: Differences in Pain Intensity Among Control, Shot blocker Placebo, Shot Blocker Groups

One-Sample Test						
Pain	**Test Value = 0**					
	T	***df***	**Sig. (2-tailed)**	**Mean Difference**	**95% Confidence Interval of the Difference**	
					Lower	**Upper**
Control	61.471	73	0.000	8.757	8.47	9.04
Shot Blocker Placebo	57.672	74	0.000	8.50667	8.2128	8.8006
Shot Blocker	15.840	78	0.000	1.74684	1.5273	1.9664

df: Degree of freedom; Sig.: Significance

The study results display that there are statistically significant differences in pain intensity among control, Shot Blocker placebo, and Shot Blocker groups (p-value = 0.000, 0.000, 0.000) respectively. The study results display the mean difference for Shot Blocker is 1.74684. This indicates that Shot Blocker is significantly lower compared to Shot Blocker placebo, which is 8.50667, and the control group is 8.757. This demonstrates Shot Blocker's actual value in reducing pain than both the control group and the Shot Blocker placebo group.

Table 5: The Mean Average of Pain Level among Control, Shot blocker Placebo, Shot Blocker Groups

One-Sample Statistics				
	N	**Mean**	**Std. Deviation**	**Std. Error Mean**
Pain control group	74	8.7568	1.22542	0.14245
ShotBlocker Placebo	75	8.5067	1.27738	0.14750
ShotBlocker	79	1.7468	0.98017	0.11028

This table shows the differences clearly and easily. Pain control group contains 74 participants. The average pain level was 8.7568, which reflects the intensity of pain felt by participants in the absence of any intervention. The standard deviation is 1.22542, indicating dispersion of pain scores around the mean. placebo Shot Blocker group contains 75 participants. The average pain level was 8.5067, showing that the effect of Shot Blocker placebo was almost similar to the control group. The standard deviation is 1.27738, indicating a similar dispersion to the control group results. Shot Blocker group contains 79 participants. The average pain level is 1.7468, which indicates a significant reduction in pain intensity due to the use of Shot Blocker. The standard deviation is 0.98017, indicating less dispersion in pain scores compared to the other two groups. The significant differences in means between the Shot Blocker group and the other two groups (8.7568 and 8.5067 vs. 1.7468) support the effectiveness of Shot Blocker in pain management.

DISCUSSION

The research objectives of statistically verifying the efficacy of Shot Blocker in reducing pain associated

with intravenous cannulation in school-age children (6–12 years) when compared to Shot Blocker placebo and control group subjects were achieved. The study design was a randomised controlled trial (RCT) to compare the effectiveness of Shot Blocker with Shot Blocker placebo and control group. The single-blinding was used to reduce bias and confounding factors, and this helps ensure that the results were not influenced by expectations or preferences. School-age children (6-12 years) were randomly assigned to the three groups who met specific inclusion criteria. Standardised protocols for intravenous cannulation and the Wong-Baker Face Pain Scale for pain assessment have been established to ensure consistency across three groups and minimise bias. The study's findings demonstrated Shot Blocker's actual value in reducing pain compared to both the control group and the Shot Blocker placebo group. the Shot Blocker placebo group that utilised the Shot Blocker's flat, smooth side. shows that there was no meaningful pain reduction benefit from the Shot Blocker placebo. Also, the control group's pain level can be regarded as a baseline for comparison because they did not employ any pain relief techniques. The Shot Blocker placebo group and the control group displayed approximate levels of pain intensity. By following these steps, the researcher has effectively achieved the research objectives of evaluating the effectiveness of Shot Blocker in reducing pain associated with intravenous cannulation in school-aged children compared to Shot Blocker placebo and control subjects in a rigorous and systematic manner.

The school-age children that represent a sensitive age group are characterised as increasingly curious; they are considered from young children who face health challenges. In the regard of health challenges, situations may occur that require immediate medical attention, resulting in a visit to a hospital emergency department (Silva *et al*., 2023). When school-age children undergo intravenous cannulation, it can be traumatic for these children, which may impact their hospital experience and future interaction with health care (Suleman, Atrushi & Enskar, 2022). Hence the importance of researching and using non-pharmacological methods in reducing pain associated with intravenous cannulation.

Therefore, based on the main aim of the study, which is determining the effectiveness of Shot Blocker and Shot Blocker placebo compared to the control group in reducing pain intensity, the researchers endeavoured to empirically examine the corresponding hypothesis using the aforementioned design. One of the main findings of this clinical trial was that statistically significant differences in pain intensity among the Shot Blocker group, Shot Blocker placebo group, and control group were authenticated, as displayed in table 4. A P value <0.05 or <0.01 is used for deciding whether to accept or reject the alternative hypothesis. The p-values were 0.000, indicating that the observed differences in pain intensity among the groups are highly statistically significant, providing valuable insights into the effectiveness of Shot Blocker in pain management. Therefore, the alternative hypothesis (H1) is supported, which suggests that using a shot blocker will lead to a significant reduction in pain levels among school-age children receiving an IV cannula, compared to children who do not receive it. In table (5), results demonstrate that using the Shot Blocker can be an effective and reliable method of pain relief compared to using no intervention or using the Shot Blocker placebo.

This study is the first randomised controlled trial examining the effectiveness of Shot Blocker in school-age children during intravenous cannulation, according to a review of the literature (Mendes, Furlan & Sanches, 2022). The results of this study may be consistent with several previous studies that explored the effectiveness of Shot Blocker in reducing pain but other injection procedures in different age groups (Girgin *et al.*, 2023; Şahan & Yildiz, 2022; Karabey & Karagözoğlu, 2024; Bilge *et al.*, 2019; Caglar *et al*., 2017). The results of the study conducted by Şahan & Yildiz (2022) greatly support the results of the study on the effectiveness of using Shot Blocker in reducing pain during injection procedures. Their study showed that Shot Blocker is effective in reducing pain levels among adult patients receiving intramuscular injections. This is consistent with findings of the study, promoting confidence in the effectiveness of Shot Blocker in relieving pain during injections Caglar *et al.* (2017), conducted as a randomised controlled study on immunisation, showed that the use of Shot Blocker was effective in reducing acute pain during the hepatitis B vaccine in term neonates. The findings of this study are consistent with the findings of the study on the effectiveness of Shot Blocker in reducing pain during injection procedures. The authors can relate this study to the current work by confirming that the effectiveness of Shot Blocker in reducing pain is not limited to a specific type of injection or a specific age group but rather extends to neonates. This enhances using the Shot Blocker to effectively

reduce pain in clinical practice to improve health care quality.

Girgin *et al*. (2023) conducted a randomised controlled study on needle-related procedures in children aged 6–12 years receiving subcutaneous insulin injection using Shot Blocker and manual pressure. The results of this study were largely consistent with the results of the study on the effectiveness of using Shot Blocker in reducing pain. This study contributes to enhancing the credibility of the use of Shot Blocker as an effective tool not only to relieve pain but also to reduce fear associated with needle-related procedures in children.

Karabey & Karagözoğlu (2024) conducted a study on intravenous cannulation using a pre-post design on a single sample group to evaluate the effectiveness of Shot Blocker on pain and comfort levels. Participants in the study were individuals aged 18-65 years. The findings of this study are consistent with the results of the study on the effectiveness of using Shot Blocker in reducing pain during injection procedures. The findings of this study demonstrate that Shot Blocker is not only effective in reducing pain during intramuscular injection but also during intravenous cannulation, enhancing its use to improve patient comfort and reduce pain in injection procedures. This comparison with the aforementioned studies highlights Shot Blocker's ability to provide a more comfortable medical experience for patients, whether adults or children, and can therefore be considered an evidence-based tool in daily clinical practice to improve the quality of healthcare.

Bilge *et al*. (2019) found that the use of Shot Blocker through mechanisms supported by the gate control theory can reduce the sensation of pain during injection procedures. This theory suggests that pain is regulated in the central nervous system, specifically in the spinal cord, where a mechanism called neural gating occurs (Uma & Clement, 2020). The neural gate controls the transmission of pain signals from the nerves to the brain. Based on this theory, pain can be alleviated by directing attention to non-painful nerve signals, which influence the closing of the neural gate and relieve pain. Consequently, when the needle penetrates the skin, it generates minimal pain due to these mechanisms (Hao *et al*., 2023). By this theory, it can be confirmed that Shot Blocker enhances healthcare quality via scientifically supported biological mechanisms (Heitler, 2023).

There are many non-pharmacological methods effective in relieving pain during intravenous cannulation. Including music therapy, virtual reality, buzzy devices, distraction methods, and chewing gum methods. This non-pharmacological approach is a multi-option proven effective in reducing pain to improve patient comfort during intravenous cannulation. This comprehensive approach enhances the quality of healthcare and provides the best possible patient experience (de Alencar *et al*., 2024; Gilbertson, Rasekaba & Blackberry, 2023; Kaplan, Gular & Avsarogullan, 2023; Karaca & Guner, 2022).

Many nurses and healthcare providers realise the importance of their crucial role in alleviating pain for patients (Fahd & Shawq, 2023; Dadoosh & Sadeq, 2022). This depends on providing emotional and cognitive support to patients and guiding them about appropriate non-pharmacological methods to relieve pain. Thanks to the ability to adapt the treatment plan for each patient according to his individual needs, nurses can play a major role in alleviating pain (Alnfeai & Alqahtani, 2023).

Limitations

There were a few difficulties conducting the study because it is new and the first of its sort. Examples of such predicaments are but are not limited to import the ShotBlocker electronically because this tool is unavailable in Iraq. This research was conducted at Al-Aziziya General Hospital, Wasit, Iraq and Al-Numaniyah General Hospital, which may limit the result's generalisability to a wider range of subjects. The emergency wards are designed for emergency cases, making it not feasible to conduct randomised control trials (RCT). Also, the presence of morning consultation clinics makes obtaining a sample during the morning shift problematic and difficult. Finally, there may be other factors that could influence the pain experienced during peripheral intravenous cannulation, such as anxiety levels and previous experiences.

CONCLUSION

The Shot Blocker application effectively reduced the intravenous-cannulation-related pain levels compared to both Shot Blocker placebo and control groups. Pain intensity levels significantly decreased for the Shot Blocker group, while they notably elevated for the Shot Blocker placebo group and were even higher

for the control group. Subject pain levels during intravenous cannulation using either the Shot Blocker or Shot Blocker placebo technique do not have a significant role in the patient's demographic characteristics. This study showed that use of the Shot Blocker device is a useful method for reducing pain scores during intravenous cannulation. This suggests that utilising techniques to reduce pain levels during intravenous cannulation is advantageous, particularly innovative non-pharmacological approaches like the Shot Blocker device. Essentially, it emphasises the importance of implementing effective pain reduction methods, especially those that are non-pharmacological and innovative, to enhance the patient experience during intravenous cannulation.

Future research may explore the long-term effects of Shot Blocker use across different patient populations, including those with chronic conditions, various age groups, and differing levels of anxiety about medical procedures. Additionally, further studies may investigate combining Shot Blocker with other non-pharmacological pain management techniques to determine if there is a synergistic effect, potentially leading to greater pain reduction. Finally, research could evaluate the cost-effectiveness and overall patient satisfaction with Shot Blocker in different clinical settings, encouraging broader adoption of this innovative pain management tool.

Conflict of Interest

The authors declare that they have no conflict of interests.

ACKNOWLEDGEMENT

The authors express their gratitude to the College of Nursing at the University of Baghdad, Iraq, for facilitating the research procedures.

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