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Examining the effect of "Shotblocker" in relieving pain associated with intramuscular injection

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ABSTRACT

This study was conducted in order to examine the effect of "Shotblocker" in relieving pain associated with intramuscular injection. The population of the study consisted of all the patients who were hospitalized in the hospital and received intramuscular diclomec treatment. In order to eliminate the individual pain differences, each patient constituted their own control group. Patient Information Form, Visual Analogue Scale (VAS), and Shotblocker were used to collect the data. Pain level of the patients was measured by using VAS within the first minute after the injection. The pain mean score of the patients was 1.22 ± 0.62 in the experimental group and 2.48 ± 1.12 cm in the control group and the difference between them was statistically significant ($p < 0.001$). Shotblocker was determined to be effective on relieving pain associated with intramuscular injection.

1. Introduction

Administering medication by intramuscular injection is a common responsibility in clinical nursing practice. [1,2] Even though this method is apparently simple, negligent intramuscular injection may lead to severe complications including pain, abscess, necrosis, infection, and nerve injury. [2,3,4] Most of these preventable aggravating conditions arise from the use of inappropriate techniques and lack of knowledge regarding the administration of medication. [3,5] Intramuscular injection is, actually, a complex process that necessitates technical competence and effective decision-making in terms of the administration tools and methods. [1] Despite healing and therapeutic effects of intramuscular injection, this injection may cause patients to experience pain and discomfort. [6] In particular, pain may develop depending on the mechanical trauma caused by the insertion of the injector as well as the sudden pressure felt when medication is infused into a muscle.[7]

In recent years, the concept of pain has become a significant area of interest in nursing studies, thus these studies have intensively focused on pain treatment.[8]Nurses play an indispensable role in pain control and management. They are distinguished from other healthcare professionals due to their extended interaction with patients—a degree of involvement that enables them to provide counsel regarding strategies for coping with pain, guide patients throughout recovery, implement planned treatments, and monitor treatment outcomes.[9]The quality of pain management depends on the knowledge, skills and behaviours of nurses concerning painful procedures.[7,9]They are responsible for preventing injection-related pain by carefully administering medication and relieving pain of patients.[7]

Researchers have examined the efficiency of non-pharmacological methods for relieving the pain associated with intramuscular injection in their studies.[10–16]Most of these studies have focused on alleviating injection-related pain in paediatric patients because children are vulnerable to the long-term consequences of pain and non-pharmacological methods exhibit promising potential for positively affecting pain behaviour.[6,7,17–19]One of the methods used to minimise pain felt during intramuscular injection is ShotBlocker application. ShotBlocker (similar to the Pain-away tool) is a 2-mm-thick, flat, horseshoe-shaped tool that has blunt points contacting with the skin and a hole in the middle pointing out the injection site.[10]A considerable number of international studies have been carried out on the use of ShotBlocker on paediatric patients.[10–15]Some studies have revealed that ShotBlocker effectively relieves pain associated with intramuscular injection,[10,11,15] whereas some others have indicated that ShotBlocker is an ineffective pain management tool.[12–14]A limited number of studies on ShotBlocker have been conducted with adult patients.[16]

When considering the lack of studies on adults and the variances in previous results, the present study was conducted to evaluate the efficiency of ShotBlocker as an aid in intramuscular injection performed on adult patients. In this regard, we tested the following hypotheses:

H0. ShotBlocker inefficiently relieves the pain associated with

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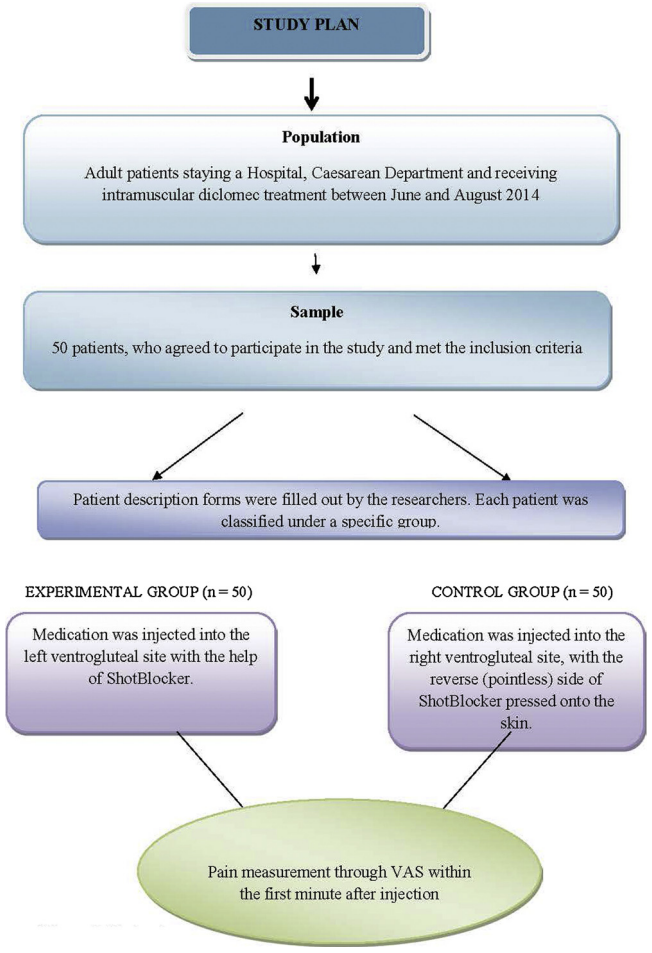

Fig. 1. Study plan.

intramuscular injection.

H1. ShotBlocker efficiently relieves the pain associated with intramuscular injection.

2. Materials and Methods

This controlled and quasi-experimental study was conducted in order to examine the effect of "Shotblocker" in relieving the pain associated with intramuscular injection. The population of the study consisted of adult patients who had a caesarean section and received intramuscular diclomec treatment between June and August 2014. Among the population, 50 patients who met the inclusion criteria and agreed to participate in the study were included in the sample (Fig. 1). In order to remove the individual differences regarding the control of pain, each patient constituted their own control group.

The inclusion criteria for patients were as follows:

1 Being in recovery in the postoperative 12 h
2 Being aged 18–45 years
3 Having no visual or hearing problems
4 Having no illness that may cause loss of the senses
5 Being willing to communicate and cooperate
6 Having no medication administered on the injection sites for their hospitalization duration.

2.1. Data Collection Tools

The following instruments were used to collect data:

1 *Patient Information Form:* This form was prepared by the researchers to obtain patients' demographic information, such as age, weight, height and educational status.
2 *Visual Analogue Scale (VAS):* This scale is a 10-cm ruler used to measure pain.

While one end of the ruler ('0') indicates no pain, the other end ('10') denotes the worst possible pain experienced by patients. This scale is one of the most commonly used pain measurement tools because it rapidly provides results and guides patients with both values and images. VAS is more sensitive and reliable for measuring pain level than other unidimensional scales. It also enables users to successfully evaluate the efficiency of methods designed to reduce pain. The studies have aimed to standardise the VAS as a vertical version of the scale in order for patients to better understand it. [20] Its vertical edition was therefore used in the present study.

3 *ShotBlocker:* Produced by Bionix (Toledo, OH, United States), ShotBlocker is a patented tool developed to minimise the pain and anxiety associated with injection. It intends to be used in intramuscular and subcutaneous injections[21] (ANNEX-4). Being suitable for all age groups, ShotBlocker is not a typical medication administration aid. It is pressed against the skin surface during injection and does not have any side effect. Its area contacting with the skin has 2-mm-thick blunt points and a hole in the middle pointing out the injection site. The pointed surface of the tool is placed on the administration area right before injection. The blunt points do not penetrate into the skin but they provide physical stimulation that may be helpful in managing pain. This feature of ShotBlocker was designed in accordance with the principles of the Gate Control Theory [13,14,16,21] (Fig. 2).

2.2. Preliminary Application

In order to determine the efficiency of the data collection tools, these were preliminarily used to obtain information from 10 patients to

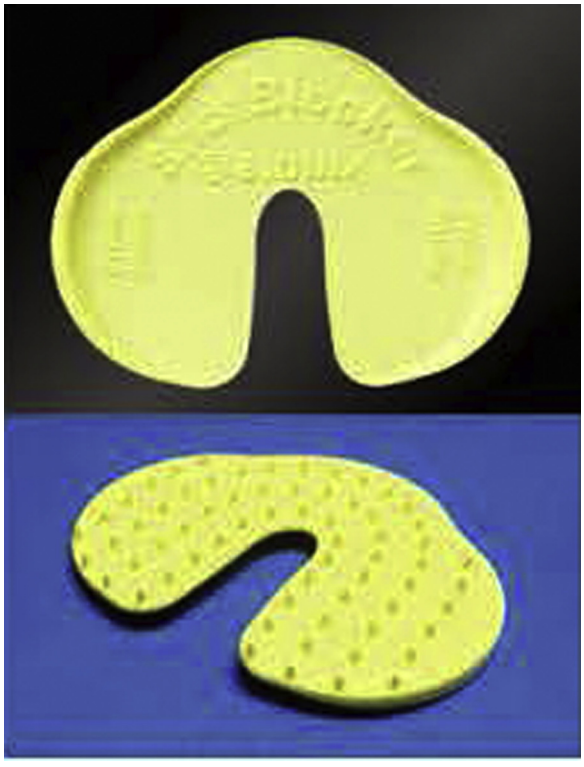

Fig. 2. Shotblocker.

whom diclomec was administered intramuscularly. Afterwards, necessary revisions were made on the data collection tools. The patients who participated in the preliminary application were excluded from the application.

2.3. Nursing Intervention

The patients who met the inclusion criteria were informed about the purpose of the study and their written and verbal consents for participation were obtained. To eliminate differences in the medication administration manner, the same researcher (E.A.) performed the injections on all patients. In order to remove the individual differences regarding the control of pain, each patient constituted their own control group.

Since the analgesic effects of spinal anaesthesia at the level of L5-S2 with bupivacaine last for 3–3.5 hours[52], the data started to be collected 12 h after surgery. In other words, after the postoperative 12th hour, the data were collected at the second and third injections (diclomec) performed at 12 -h intervals. For these second and third injections, the patient's left VG and right VG regions were used. While the experimental group consisted of patients who were administered with the intramuscular analgesic injection on their left ventrogluteal region, the control group consisted of patients who were administered with an analgesic injection on their right ventrogluteal site. Upon calculations made based on postoperative hours, injections were administered twice a day at equal intervals.

While the Shotblocker was applied to patients in the experimental group by being placed on the injection site during the intramuscular injection, the reverse surface of the Shotblocker, which has no effect, was applied to the injection site of patients in the control group. For impact, the flat surface should be used (https://www.bionix.com/medicaltech/product-category/pain-relief/). The Shotblocker was used in both experimental and control groups because it was thought that simply using nothing for controls could affect the pain perception of the patients psychologically.

The level of pain experienced by the patients was measured by using VAS within the first minute following injection. The VAS score was recorded on the patient diagnosis form.

The following materials were prepared for medication administration:

a
- a Medication (diclomec amp.)
- b Sterile injector and injector tips (no. 21; length, 3.75 cm)
- c Alcohol
- d Cotton pad
- e Waste container
- f Gloves
- g ShotBlocker
- h Medication tray

The steps in injection administration:

1 One of the researchers washed her hands and prepared the medication tray.
2 Diclomec injection was prepared, by paying particular attention to sterilising the injector and changing the injector tip.
3 About 0.2–0.3 ml of air was drawn into the injector to create an air lock.
4 The patient was determined for medication administration and informed about the procedure. This patient was asked to lie in a supine position to ensure comfort and the injection site was examined in terms of abscess, necrosis or hematoma.
5 The ventrogluteal site was cleaned using an alcohol-wetted cotton pad and with circular motions, starting inward and moving outward. The site had a 5-cm diameter.

Fig. 3. Drug application with shotblocker.

6 While the experimental group consisted of patients who were administered with the intramuscular analgesic injection on their left ventrogluteal region, the control group consisted of patients who were administered with an analgesic injection on their right ventrogluteal site.
7 The patient was told to take deep breaths and speak in order to distract her.
8 The injector was held with the active hand and the injector sheath was carefully took off.
9 While the Shotblocker was applied to the injection site of patients in the experimental group during the intramuscular injection, its ineffective back surface was applied to patients in the control group due to the intention of eliminating the possibility of psychological responses.
10 The injector was held like grasping a pen and was inserted swiftly into the skin at an angle of 90°. Injection was performed with a single movement into the site surrounded by the hole of ShotBlocker (Fig. 3).
11 After the injector was embedded into the tissue, the researcher changed hands without dislodging the ShotBlocker from its position. Blood flow was controlled with the active hand.
12 When there was no blood flow from the site within a 5-second aspiration, medication was continuously administered at a dose of 1 ml per 10 s.
13 After 3 ml of the medication was administered, an air lock was created by drawing air into the injector. The injector was kept stable for 10 s to ensure the adequate distribution of the medication.
14 After the injection was completed, a dry cotton pad was placed over the insertion point by applying mild pressure. The injector was pulled out at the angle same as insertion angle. Finally, the ShotBlocker was removed.
15 Pressure was applied on the injection site with the dry cotton pad for an additional 15–20 s.
16 Within the first minute after intramuscular injection, the VAS was used to evaluate the patient's pain level. The VAS scores were

recorded on the patient information form.
17 The patient was helped to take a comfortable position.

2.4. Data Collection

The patient information form was handed out to the patients after injection administration. Before administration, the patients were informed about VAS. As previously stated, the patients were asked to evaluate their pain level by using VAS immediately (first minute) after intramuscular injection. The numerical values corresponding to the responses given by the patients on the scale were recorded on the data collection form.

Two separate blank forms (VAS) were used for each application (experimental and control applications) because evaluating pain and recording specific pain stages on the same scale as well as examining previous pain levels may influence the evaluation of subsequent pain levels.20

2.5. Data Analysis

The data were analysed using SPSS software (version 16). Percentage distribution and mean tests were used to assess the data.

2.6. Ethical Considerations

In the planning stage, approval from the University Ethics Committee and necessary permissions from the related hospital were obtained. Before data collection, the patients were informed about the purpose of the study and the processes. Their questions were answered and written and verbal consents of the patients were obtained.

3. Results

Table 1 shows the descriptive characteristics of the patients. 60% of them were aged between 18–28 years, 84% were primary high school graduates, and 56.0% had BMI values of 25.00 and above. The average age, mean weight, mean height, and mean BMI of the patients were 27.64 ± 5.14, 65.86 ± 9.54, 161.60 ± 6.35, and 25.06 ± 2.35, respectively.

Table 2 compares the pain scores of the experimental and control groups. The analysis showed that mean pain scores of experimental and control groups were 1.22 ± 0.62 and 2.48 ± 1.12, respectively. A statistically significant difference was found between the pain mean scores of the groups ($p < 0.0001$).

4. Discussion

The changes and developments in disciplinary fields are equally reflected in the healthcare industry generally and in the nursing sector particularly.[22]The ability of nurses to provide quality care can be improved by updating their knowledge and skills about the functions that they perform in a healthcare system. This upgrading of competencies should focus on the development of expertise in implementing complex care processes and the application of science and technology innovations.[23]Basing nursing practice on science and evidence is an indispensable measure that enables nurses to adapt to the constant changes and developments in the nursing profession.[22] One such development is ShotBlocker, which is intended to enhance the quality of nursing care. In this study, the effectiveness of ShotBlocker in relieving the pain associated with intramuscular injection was examined and discussed in relation to relevant literature.

As previously discussed, most of the patients belonged to the age group of 18–28 years, with their average age of 27.64 ± 5.14 (Table 1). This age range was expected given that the sample was composed of maternity clinic patients. Individuals with a BMI range of 18.5–29.9 were identified as safe for ventrogluteal injection of medication.[24]As can be seen, most of the patients in the present study had a BMI of 25 or higher. This result was also expected because the subjects were postpartum women.

The VAS results showed that the experimental group had lower mean pain scores than the control group and this difference was statistically significant ($p < 0.0001$) (Table 2). As previously stated, the blunt points on the surface of ShotBlocker are intended for physical stimulation that may alleviate or influence the perception of pain; this design feature accords with the insights provided by the Gate Control Theory.[13,14,16,21] This theory, which was first proposed by Melzack and Wall (1965), is considered as a revolution in pain management. This theory proposes that the presence and severity of pain depends on the transition of neurological stimuli and gate mechanisms in the nervous system control such transition. While small fibres carry pain stimuli, large fibres close the gates to these stimuli. The reticular structure in the brain stem regulates sensorial inputs. If sufficient or extreme sensorial stimulus is received, the brain stem closes the gates by suppressing the transition of pain stimuli. If the gates are open, stimuli that induce pain reach the consciousness level, but if the gates are closed, stimuli cannot reach consciousness and pain is not felt.[25,26]The action mechanism of ShotBlocker works by rapidly stimulating small nerve endings through the pressure applied on the skin via its blunt points. This stimulation temporarily blocks slow pain signals during injection and reduces pain by closing the gates to the central nervous system..[13,14,16,21]. In the study conducted by Çelik & Khorshid[16] on adult patients, ShotBlocker relieved the pain associated with intramuscular injection and increased patient satisfaction with the way the procedure was handled. The author divided the patients into administration, placebo, and control groups. Intramuscular injection was performed with the help of ShotBlocker for the administration group; injection was performed by using the back side (pointless side) of the tool for the placebo group; and intramuscular injection was performed in the control group without using any tool. Although no difference was found between the pain severity scores of the placebo and control groups, the pain severity score of the administration group was lower than those of the other two groups. Additionally, the satisfaction level of the administration group was higher. The present study generated similar results; the pain mean score of the experimental group was lower than the control group. Susilawati et al.,[15] used a tool called as Pain-away, which is similar to ShotBlocker. In their study, newborns were divided into experimental

Table 1
Characteristics of Patients (n = 50).

Descriptive Characteristics	Number	Percentage
Age Group		
18–28	30	60.0
29 or older	20	40.0
Educational Status		
Primary school	42	84.0
High school	8	16.0
BMI		
18.50–24.99	22	44.0
25.00 or higher	28	56.0
Age [Mean (SD)]	27.64 ± 5.14	
Weight [Mean (SD)]	65.86 ± 9.54	
Height [Mean (SD)]	161.60 ± 6.35	
BMI [Mean (SD)]	25.06 ± 2.35	

Table 2
Mean Pain Scores of the Experimental and Control Groups.

Groups	VAS X ± SD	Test and p value
Experimental group	1.22 ± 0.62	t = 10.23, df = 49,
Control group	2.48 ± 1.12	**p < 0.0001**

and control groups, and the infants were intramuscularly injected with Hepatitis B vaccine. The injection-related pain stated by the experimental group was lower than the pain reported by the control group15. On the ShotBlocker website, two summarised studies[10,11] mentioned the efficiency of ShotBlocker in reducing the pain felt by children during intramuscular injection. Grundrum et al.,[11] examined the pain levels of children vaccinated by intramuscular injection and found that the pain levels felt by the experimental group (ShotBlocker group) were significantly lower than those of the controls. They however, provided no detailed information on the methodology and statistics of the study.[11]Guevarra[10] also conducted a study on children, divided into ShotBlocker and control groups. The ShotBlocker group felt a 'mild level of pain' (93.2%), whereas the control group reported a higher level of pain (57%). Similar to Gundrum,[11]Guevarra[10] did not comprehensively describe the methodology and statistics.

Drago et al.,[14]who likewise investigated ShotBlocker and pain levels amongst children, found that the pain scores of children decreased, as evaluated by nurses and caretakers and no difference was found between the children's evaluations.[14]The studies of Cobb and Cohen[13] and Mennuti-Wasburn,[12]whose sample consisted of children scheduled for vaccination, indicated that ShotBlocker ineffectively reduced intramuscular injection-related pain.

In the present study, the pain mean score was 1.22 ± 0.62 in the experimental group (ShotBlocker group) and 2.48 ± 1.12 cm in the control group. The difference between the scores was statistically significant ($p < 0.0001$). In the study by Çelik & Khorshid16, the mean score for the pain level (determined by VAS) felt by the patients was 7.85 ± 7.03 in the administration group, 20.3 ± 14.39 in the placebo group, and 26.7 ± 20.30 mm in the control group, and this difference was found to be statistically significant ($p = 0.000 < 0.05$) 16. In the study by Susilawati et al., [15], the Pain-away tool was evaluated and the pain levels of the groups were measured using the DAN scale. The pain mean scores of the experimental and control groups were 5 and 7, respectively, thus indicating that the Pain-away reduced injection-related pain.[15]Gundrum et al.,[11] evaluated the mean pain level of the patients using a scale of 0–10 points and found that the pain mean scores of the experimental and control groups were 1.12 and 2.29, respectively. Similar to Gundrum et al.,[11] low pain levels were found in the present study.

The literature has showed that intramuscular injection performed without adhering to proven techniques increases the pain experienced by patients; whereas, injection carried out in accordance with established methods affects pain. Some of the measures taken to reduce pain during injection include selecting a suitable injection site,[3]ascertaining the appropriateness of medication volume for the injection site,[4]gradually administering medication,[3]changing the injector tip,[3,6]determining the appropriate position3, distracting patients during the procedure,[4,18]applying the air-lock technique, and advising patients to take deep breaths during the procedure.[1] The present study adopted one of the pain relief methods recommended in the literature; that is, BMI suitability was taken into account in planning the procedure. Additionally, appropriate techniques and methods were employed; selecting the ventrogluteal area as the injection site, changing the injector tip, distracting the patients, asking the patients to take deep breaths, creating an air lock, administering 3 ml of the medication within 30 s, waiting for the alcohol to evaporate, waiting for 10 s after injection, injecting at an angle of 90° and pulling out the injector at the insertion angle. The sample in this study consisted of patients who were experiencing high levels of pain and were aware that analgesics were intramuscularly administered. These conditions may have psychologically affected patients in the experimental and control group, thereby contributing to the reduction of pain scores in the groups.

5. Conclusion and Recommendations

This study was conducted to examine the effectiveness of ShotBlocker in relieving pain associated with intramuscular injection. The results confirmed such effectiveness. In line with the results, the following measures are recommended:

1

1 The use of ShotBlocker as an aid in the administration of medication by intramuscular injection should be required and stipulated in in-service training programmes and intramuscular injection protocols.
2 Information on the advantages of ShotBlocker as an evidence-based non- pharmacological method for clinical nursing practice should be disseminated in order to promote its use and thereby reduce pain of patients.
3 A randomized study can be conducted by comparing the use of Shotblocker and injections performed without Shotblocker.

Declaration of Competing Interest

The authors have no financial/commercial conflicts of interest in this study.

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