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# ShotBlocker versus cryotherapy for reducing pain and anxiety associated with subcutaneous injection

**Original Article**

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**Abstract:** **Objective:** To determine and compare the abilities of ShotBlocker and cryotherapy for reducing pain and anxiety associated with subcutaneous injections. Subcutaneous injection has been used excessively for continuous, low-dose administration of drugs. Considering that these drugs may require prolonged administration, new devices and methods of injection are needed to decrease pain and anxiety associated with repeated drug injections.

**Methods:** A quasi-experimental study design on a purposive sample of 54 patients comprised of both sexes has been utilized. The subjects were divided into 2 equal groups (group 1, ShotBlocker; group 2, cryotherapy), and 3 tools were used, namely the socio-demographic and medical data sheet, Verbal Descriptor Scale for measuring pain, and Beck Anxiety Inventory.

**Results:** A significant reduction in pain and anxiety mean scores was observed after using cryotherapy and ShotBlocker techniques during subcutaneous injection. In addition, the ShotBlocker group exhibited significantly lower pain and anxiety mean scores compared with the cryotherapy group.

**Conclusions**: Our findings revealed that ShotBlocker and cryotherapy were effective non-pharmacological methods for reducing pain and anxiety levels associated with repeated subcutaneous injections.

**Keywords:** *anxiety • cryotherapy • pain • ShotBlocker • subcutaneous injection*

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## 1. Introduction

Injections have been a preferable method for administering drugs to achieve the desired effect directly and rapidly. Subcutaneous injections, in which the medication is released into the fatty layer of subcutaneous tissue completely below the skin, are among the various methods for injecting drugs.[1]

The subcutaneous route permits drugs like heparin and insulin to be absorbed gradually over a period of time. Choosing the correct place and proper method for injection helps to diminish the risk of complications.[2]

Different types of drugs can be administered through the subcutaneous route, which has rapid onset of action and high bioavailability. However, pain sensation at injection site might reduce patient adherence with medication. Over the previous years, several studies have explored the effect of diverse methods for reducing pain

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related to injection, such as patient posture, injection speed, manual pressure, acupressure, 2-needle technique, needle temperature, z-track, cryotherapy, and ShotBlocker.[3]

Cryotherapy, the nomenclature of which originates from the Greek word Cryo, refers to restoration using extremely low temperatures. This type of therapy aims to reduce pain, inflammation, spasm, and hematoma formation at place of injection.[4] Also, low temperature has an effect on sensory nociceptors through decreasing in the conduction time and synaptic activity in peripheral nerves; this may minimize the intensity of pain. Lowering the temperature of the nerves has been found to reduce sensory and motor conduction velocities, thereby reducing pain intensity.[5]

A ShotBlocker is a flexible plastic disk consisting of a large opening that is used during drug administration, with multiple skin contact points that are short and non-squeaky. This instrument is a novel application for pain intervention based on the gate control theory. During drug administration, ShotBlocker is put on the injection site, while non-sharp skin contact points are fixed promptly over the skin at the injection site and the medication is administered through a large opening.[6] ShotBlocker is pressed on the surface of skin during injections. It is designed to reduce pain by stimulating nerve endings faster as a result of application of pressure from rounded nubs that are present on the device. This stimulation decreases pain by blocking pain signals temporarily during injections and by inhibiting the central nervous system.[7]

Nurses have an important role in minimizing the degree of discomfort sensation and pain during any invasive procedure, together with ensuring appropriate preparation and administration of drugs. Usage of proper methods during subcutaneous injection can reduce pain, anxiety, and other complications.[8]

# 2. Review of literature

## 2.1 Aim

To evaluate the abilities of ShotBlocker and cryotherapy in the reduction of pain and anxiety associated with subcutaneous injection.

## 2.2. Research hypotheses

Patients who receive subcutaneous injections with the use of ShotBlocker will experience less pain and anxiety compared with those in whom a conventional hospital technique (H1) is used.

Patients who receive subcutaneous injections with the use of cryotherapy before and after injection will experience less pain and anxiety compared with those in whom a conventional hospital technique (H2) is used.

# 3. Methods

## 3.1. Research design

This study used a quasi-experimental design with a control group.

## 3.2. Setting

The present study was conducted at Medical & Surgical Department of Main Mansoura University Hospital.

## 3.3. Subjects

A purposive sample comprised of 54 patients of both sexes was included. Patients were divided into 2 equal groups (group 1, ShotBlocker; group 2, cryotherapy). Patients were selected according to the following sampling criteria.

### *3.3.1. Inclusion criteria*

- Age-range from 18 years to 60 years
- All males and females receiving subcutaneous injection
- Ability to give a response
- Able to participate in this study

### *3.3.2. Exclusion criteria*

- Unconscious or critically ill
- Visual and hearing impairment
- Received sedatives <2 h before the procedure.

## 3.4 Tools

- The following 3 tools were used in this study.

### *3.4.1. Tool I: Socio-emographic data*

This tool, which was developed by researchers after reviewing the literature, consisted of 2 parts, namely Part I: Demographic data and Part II: Health-related data.

**Part 1: Demographic data sheet**

This tool was used for collecting personal data, such as age, sex, occupation, marital status, and level of education.

**Part 2: Health-related data sheet**

This part was related to patient health information, such as patient diagnosis, timing of subcutaneous injection,

whether or not a fear of subcutaneous injection prevailed in the patient, name of the medication taken, and injection site.

#### *3.4.2. Tool II: Verbal descriptor scale*

This tool, which was adapted from the Australian Pain Society's study,9 consisted of a 6-point verbal rating scale. Participants were asked to select suitable descriptions that would report the intensity of the pain, which was accordingly graded into levels. The categories included "No pain," "Mild pain," "Moderate pain," "Severe pain," "Very severe pain," and "Worst possible pain."

#### *3.4.3. Beck anxiety inventory*

This tool, which was adapted from Beck et al.'s study,10 was a self-reported measure of anxiety that consisted of 21 items. Answers to each item ranged from 0 to 3, and ratings were accompanied by a statement describing the severity of a given anxiety symptom, with 0 indicating "no self-reported symptoms" and 3 indicating "more severe symptoms." The total score was calculated by finding the sum of the 21 items, which is expected to range from 0 to 63. Scores of 0–21, 22–35, and ≥36 indicated low, moderate, and potentially concerning levels of anxiety, respectively.

### 3.5. Validity of the tools

The tools utilized were tested for content validity by a panel of 5 experts from the Nursing Faculty Staff, after which any required modifications were made accordingly.

### 3.6. Reliability

The internal consistency for the BAI was given in terms of the following: Cronbach's α = 0.92, and test–retest reliability (1 week) for the BAI = 0.75.[10]

### 3.7. Pilot study

A pilot study was carried out on 10% of the subjects before commencement of data collection to test the tools for relevance, feasibility, applicability, and clarity, as well as to determine the length of time needed to collect the requisite data from each participant. According to the results of the pilot study, the tools did not require modification.

### 3.8. Ethical considerations

Ethical approval was obtained from the Research Ethics Committee of the Faculty of Nursing at Mansoura University (Reference No. P.0218). Consent to direct this study was obtained from the hospital administrator after explaining the aim of the study. Assent was obtained from each participant after giving clarification regarding the aim and nature of the study. Participants were notified that they can withdraw at any stage of the study and were assured of confidentiality of information.

### 3.9. Field work

Field work included pre-intervention, intervention, and post-intervention.

#### *3.9.1. Pre-intervention*

The researchers introduced themselves to the participants and clarified the aim of the study as well as the means for answering the questionnaire. Thereafter, assent was obtained from the participants who were asked for their cooperation.

#### *3.9.2. Intervention*

During the first injection, patients in both the groups were considered as the control group where subcutaneous injections were delivered using the conventional technique of the hospital without intervention. After the first injection, patients' pain and anxiety levels were assessed. During the second injection, the same patients in both the groups were considered the study group where intervention has been applied. Patients in group I received the second subcutaneous injection by having the ShotBlocker device applied through a large opening, and the application was carried out by fixing small points at the injection site, which were removed after the injection was completed. The ShotBlocker is a U-shaped device that has several points and is used mainly for intramuscular and subcutaneous injection and does not need any preliminary preparation or waiting time.

In anticipation of cryotherapy, the patients comprised in group II were treated with application of a cold compress for 5 min, which was carried out both before and after administration of the second subcutaneous injection. All injections were applied for both the groups by the same researchers.

#### *3.9.3. Post-intervention*

After the injections, the pain and anxiety levels of the patients were assessed and comparison between the groups was done.



**Figure 1.** ShotBlocker Device (Adopted from Doc Check Shop. https://www.doccheckshop.eu/injection-infusion/injection-infusion-accessories/other-injection-infusion/11547/bionix-shotblocker-injection-aid. Accessed May 5, 2022.)

### 3.10. Statistical analysis

After data collection, the obtained data were revised, coded, processed, and then analyzed using the statistical software IBM SPSS version 21 (IBM Corporation, Armonk, New York, United States). Quantitative data were presented as means and standard deviations (SDs), whereas qualitative data were presented as numbers (N) and percentages (%). The chi-squared test was used to determine differences between the study groups in relation to socio-demographic and medical data, whereas the paired *t* test and independent t test were used to determine the effectiveness of the different techniques used for reducing the pain and anxiety associated with subcutaneous injections. During all analyses, *P* values <0.05 indicated statistical significance.

## 4. Results

### 4.1. Socio-demographic characteristics of the study participants

As seen in Table 1, no significant difference was observed between the cryotherapy and ShotBlocker groups in terms of socio-demographic characteristics. Moreover, 51.9% and 55.6% of the cryotherapy and ShotBlocker groups were females, respectively, whereas 74.1% of participants in both the groups were aged over 40 years. A majority of participants (85.2%) in both the groups were married. Moreover, 44.4% of patients in the cryotherapy group had completed secondary school, whereas 44.4% of patients in the ShotBlocker group were illiterate. Manual work was predominant among the included patients (51.9% and 55.6% in groups I and II, respectively).

### 4.2. Medical data of the study participants

Table 2 shows the health-related data of both the groups. The majority of the participants in both groups had no diabetes mellitus ([DM]; 66.7% and 85.2% in group II and I, respectively). Furthermore, over three-quarters (77.8%) of patients in the cryotherapy group and all participants (100%) in the ShotBlocker group had used subcutaneous injections for less than 1 year. Majorities within the 2 studied groups of participants (96.3% and 74.1% in groups 1 and II, respectively) were afraid of subcutaneous injections. Anti-coagulant medication was predominant (70.4% and 81.5%) in groups II and I, respectively. We found that 59.3% of those in group 2 received injections in the arm, whereas 51.9% of those in group 1 received injections in the abdomen.

### 4.3. Comparison of subcutaneous injection-associated pain and anxiety mean scores before and after using cryotherapy

Table 3 clarifies that there was a significant reduction in the mean score of pain and anxiety levels while using cryotherapy method before and after the second injection rather than the first. This proved that cryotherapy has an effective role in decreasing pain and anxiety levels, which confirms our research hypothesis H2.

### 4.4. Comparison between subcutaneous injection-associated pain and anxiety mean scores before and after using ShotBlocker

It is observed from Table 4 that a statistically significant difference in the mean score of pain and anxiety levels is prevalent when using ShotBlocker during the second

| Items | Intervention type | | | | $\chi 2$ | *P* value |
|---|---|---|---|---|---|---|
| | Group II cryotherapy (N = 27) | | Group I ShotBlocker (N = 27) | | | |
| | N | % | N | % | | |
| *Sex* | | | | | 0.074 | 0.785 |
| Male | 13 | 48.1 | 12 | 44.4 | | |
| Female | 14 | 51.9 | 15 | 55.6 | | |
| *Age (years)* | | | | | 4.286 | 0.232 |
| 19–29 | 0 | 0 | 3 | 11.1 | | |
| 30–39 | 2 | 7.4 | 2 | 7.4 | | |
| 39–40 | 5 | 18.5 | 2 | 7.4 | | |
| <40 | 20 | 74.1 | 20 | 74.1 | | |
| *Marital status* | | | | | 1.143 | 0.565 |
| Single | 0 | 0 | 1 | 3.7 | | |
| Married | 23 | 85.2 | 23 | 85.2 | | |
| Widowed | 4 | 14.8 | 3 | 11.1 | | |
| *Education* | | | | | 3.698 | 0.296 |
| Illiterate | 10 | 37 | 12 | 44.4 | | |
| Read and write | 3 | 11.1 | 2 | 7.4 | | |
| Secondary school | 12 | 44.4 | 7 | 25.9 | | |
| University | 2 | 7.4 | 6 | 22.2 | | |
| *Occupation* | | | | | 3.771 | 0.287 |
| Manual work | 15 | 55.6 | 14 | 51.9 | | |
| Mental work | 12 | 44.4 | 13 | 48.1 | | |

**Table 1.** Socio-demographic characteristics of study participants (N = 54).

injection rather than the first. This proved that ShotBlocker has an effective role in decreasing pain and anxiety levels, which confirms our research hypothesis H1.

### 4.5. Comparison between cryotherapy and ShotBlocker in terms of reducing subcutaneous injection-associated pain and anxiety

Table 5 shows that the ShotBlocker group had more significant reduction in the mean score of pain and anxiety levels than the cryotherapy group. This means that both methods were effective in decreasing pain and anxiety levels where the *P* value was 0.000, but ShotBlocker was more effective than cryotherapy in reducing pain and anxiety levels.

## 5 Discussion

Poor management methods for repeated subcutaneous injections have led to more pain and anxiety. Given that pain is one of the most common causes of human suffering, its management has been highly prioritized in nursing care. One of the most important responsibilities of nurses is the accurate and safe administration of medication to reduce pain, hematoma formation, and bruising.[11] The essential source of anxiety for patients receiving injection is needle pain, with fear possibly intensifying the perceived pain. The present study had been conducted to evaluate the effects of ShotBlocker and cryotherapy in reducing pain and anxiety during subcutaneous injections.

Concerning socio-demographic data, over half of our studied participants were female, which contrasted with the results of El-Deen and Youssef,[12] who showed that about two-thirds of the study participants were male. However, Emel et al.'s study[13] found that the majority of study participants were female. Regarding age, slightly less than three-quarters of the studied sample were aged over 40 years, which was consistent with the results of El-Deen and Youssef,[12] who found that more participants were aged between 39 years and 59 years. On the other hand, in the study of Aydin and Avsar,[14] it was demonstrated that more than half of the participants were aged between 18 years and 28 years.

A large proportion of the participants included in the present study were married. This is in accordance with the conclusions drawn in the study of Celik and Khorshid,[15] who found that the majority of the studied participants were married. The findings of present study

| Items | Intervention type | | | | $\chi 2$ | *P* value |
|---|---|---|---|---|---|---|
| | Group II cryotherapy (N = 27) | | Group I ShotBlocker (N = 27) | | | |
| | N | % | N | % | | |
| *Diagnosis* | | | | | 2.533 | 0.111 |
| DM | 9 | 33.3 | 4 | 14.8 | | |
| No DM (other diseases) | 18 | 66.7 | 23 | 85.2 | | |
| *Time of commencement of usage of subcutaneous injection* | | | | | 6.750 | 0.034 |
| Less than 1 year | 21 | 77.8 | 27 | 100 | | |
| 1–10 years | 3 | 11.1 | 0 | 0 | | |
| 11–20 years | 3 | 11.1 | 0 | 0 | | |
| *Are you afraid of subcutaneous injections?* | | | | | 5.283 | 0.022 |
| Yes | 20 | 74.1 | 26 | 96.3 | | |
| No | 7 | 25.9 | 1 | 3.7 | | |
| *Type of medication* | | | | | 0.912 | 0.340 |
| Insulin | 8 | 29.6 | 5 | 18.5 | | |
| Anticoagulant | 19 | 70.4 | 22 | 81.5 | | |
| *Injection site* | | | | | 0.670 | 0.413 |
| Abdomen | 11 | 40.7 | 14 | 51.9 | | |
| Arm | 16 | 59.3 | 13 | 48.1 | | |

*Note*: DM, diabetes mellitus; SD, standard deviation.

**Table 2.** Medical data of study participants (N = 54).

| Items | Before cryotherapy (first injection), M ± SD | After cryotherapy (second injection), M ± SD | *t* test* | *P* value |
|---|---|---|---|---|
| Pain score | 3.48 ± 1.01 | 2.44 ± 0.93 | 17.838 | 0.000 |
| Anxiety score | 8.96 ± 5.30 | 7.29 ± 5.44 | 6.968 | 0.000 |

*Note*: **t* test = paired *t* test.
M, mean; SD, standard deviation.

**Table 3.** Comparison of subcutaneous injection-associated pain and anxiety mean scores before and after using cryotherapy (N = 27).

| Items | Before ShotBlocker (first injection), M ± SD | After ShotBlocker (second injection), M ± SD | *t* test* | *P* value |
|---|---|---|---|---|
| Pain score | 4.11 ± 0.75 | 1.07 ± 0.26 | 28.442 | 0.000 |
| Anxiety score | 7.40 ± 2.24 | 1.148 ± 2.28 | 17.179 | 0.000 |

*Note*: **t* test = paired *t* test.
M, mean; SD, standard deviation.

**Table 4.** Comparison between subcutaneous injection-associated pain and anxiety mean scores before and after using ShotBlocker (N = 27).

| Items | Cryotherapy, M ± SD | ShotBlocker, M ± SD | *t* test* | *P* value |
|---|---|---|---|---|
| Pain score | 2.44 ± 0.93 | 1.07 ± 0.26 | 7.333 | 0.000 |
| Anxiety score | 7.29 ± 5.44 | 1.148 ± 2.28 | 7.026 | 0.000 |

*Note*: **t* test = independent *t* test.
M, mean; SD, standard deviation.

**Table 5.** Comparison between cryotherapy and ShotBlocker in terms of reducing subcutaneous injection-associated pain and anxiety (N = 27 in each group).

emphasized that over and above half of the participants undertook manual work, which may be related to the high prevalence of unemployed females who came from rural areas. However, Elsaid and Abdelkhalek[16] reported that the majority were professionals and housewives. Regarding educational level, less than half of those in group I were illiterate, whereas the same percentage of those in group II had completed secondary school. This may be related to the fact that the majority of the study subjects came from rural areas with poor socio-economic status and had low education levels. Meanwhile, the study by El-Deen and Youssef12 stated that over half of the participants in both their studied groups were educated.

Alabdalhai et al.[17] reported that the mean duration for starting subcutaneous injection was M ± SD=6.6 ± 2.1. The present study detected that more than three-quarters of those in group II and all participants in group I had started subcutaneous injection since less than 1 year earlier. Moreover, our results showed that less than three-quarters of those in group II and a majority of those in group I feared subcutaneous injections. Furthermore, the most common medication used in both the groups was anti-coagulant.

Regarding injection site, over half of those in the cryotherapy and ShotBlocker groups (59.3 and 51.9%) received injections into the arm and abdomen, respectively. Meanwhile, a study by Alabdalhai et al.17 illustrated that over three-quarters of the patients received injections into the right thigh.

According to research hypothesis and results, a statistically significant reduction in the mean score of pain and anxiety levels was prevalent while using cryotherapy during the second injection rather than the first. Moreover, Taghlili et al.[18] reported that the use of cold compress during subcutaneous injection of enoxaparin sodium could significantly decrease pain at the injection site. Similarly, El-Deen and Youssef[12] proved that the application of cryotherapy before and after subcutaneous injection had a great effect on reducing occurrence of hematoma and pain.

The blunt points of ShotBlocker are designed for physical stimulation, which may have an impact on pain perception. ShotBlocker causes pressure over skin through these blunt points, thus leading to rapid stimulation of small nerve endings. This stimulation stops pain signals during injection and decreases pain sensation by closing the gates of pain perception to the central nervous system.[19] Such an explanation would be in conformity with the results of the present study, which showed a significant difference in pain levels between the conventional injection technique during first injection and ShotBlocker during second injection.

This finding supports those drawn in Sahiner et al.'s study,[20] in which it was reported that the pain levels decreased when using ShotBlocker during insulin injection in children with type 1 diabetes.

Finally, the present study found a statistical difference in the level of anxiety in the 2 groups during the second injection, which was consistent with the findings of Girgin et al.,[21] who illustrated that the post-procedure fear scores for the ShotBlocker group were lower than that for the control group. Similarly, Sahiner et al.20 found a significant difference between the groups in terms of procedural anxiety levels reported by the family and observer, favoring the intervention groups using ShotBlocker.

## 5.1. Strengths and limitations

- ***The strengths of this study*** involve the facts that a smaller number of studies were applied to detect the effect of using ShotBlocker during subcutaneous injection; and this study carried out a comparison between the effects of using cryotherapy vis-à-vis those of using ShotBlocker during subcutaneous injections. Both methods had very effective roles in reducing pain and anxiety and can be easily applied.
- ***The limitations of this study*** involve the facts that pain expression by various individuals may differ based on physiological, cultural, and psychological characteristics; accuracy for pain assessment may not be achieved; and there is a need to conduct this study on larger samples from different settings for supporting the efficiency of these methods.

## 5.2. Implications for practice

Nurses have an important role during subcutaneous injection administration. The findings of the present study have proved several implications in nursing practice and education:

- Awareness about benefits of ShotBlocker as an evidence-based non-pharmacological technique for clinical nursing practice ought to be dispersed to advance its utilization.
- Cryotherapy should be utilized in patients receiving subcutaneous injections.
- ShotBlocker and cryotherapy techniques should be taught for nursing students and can be integrated into clinical practice.
- Guidelines for the procedure of subcutaneous injections can be prepared based on ShotBlocker and cryotherapy techniques.

# 6. Conclusions

Based on our results, the present study concludes that both ShotBlocker and cryotherapy were effective in reducing pain and anxiety levels during subcutaneous injections.

## 6.1. Recommendations

The following recommendations are suggested based on the results of the present study:

- Larger samples are needed to validate the findings and make generalizations.
- Information about the advantages of ShotBlocker should be spread to encourage usage within the clinical setting.
- Cryotherapy should be utilized in patients receiving subcutaneous injections.
- ShotBlocker and cryotherapy should be merged into clinical practice for nursing students.
- Guidelines for the procedure of subcutaneous injections can be prepared based on ShotBlocker and cryotherapy techniques.


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# Ethical approval

Ethical approval was obtained from the Research Ethics Committee of the Faculty of Nursing at Mansoura University (Reference No. P.0218).

# Conflicts of interest

No author has any potential conflict of interest to disclose.

## References


1. Kim H, Park H, Lee SJ. Effective method for drug injection into subcutaneous tissues. *Sci Rep*. 2017;7:9613.
2. Shepherd E. Injection technique 2: administering drugs via the subcutaneous route. *Nurs Times*. 2018;114:55–57.
3. Kara D, Güneş ÜY. The effect on pain of three different methods of intramuscular injection: a randomized controlled trial. *Int J Nurs Pract*. 2014;22:152–159.
4. Craven RF, Hirnle CJ, Jensen S. *Fundamentals of Nursing*. 7th ed. Philadelphia: Wolters Kluwer-Health/Lippincott Williams & Wilkins; 2013.
5. Freire B, Geremia J, Baroni BM, Vaz MA. Effects of cryotherapy methods on circulatory, metabolic, inflammatory and neural properties: a systematic review. *Fisioter Mov*. 2016;29:389–398 (in Brazil).
6. Aydin ST, Güven SD. The effect of ShotBlocker application on intramuscular injection pain in adults: a randomized controlled trial. *Int J Nurs Didact*. 2020;10:1–4.
7. Cobb EJ, Cohen LL. A randomized controlled trial of the ShotBlocker for children's immunization distress. *Clin J Pain*. 2009;25:790–796.
8. Taylor C, Lillis C, Lynn P. *Fundamentals of Nursing*. 8th ed. Philadelphia, PA: Lippincott, Williams & Wilkins; 2014.
9. Australian Pain Society. *Pain in Residential Aged Care Facilities: Management Strategies*. 2nd ed. 2018:30. Chapter 2. https://www.apsoc.org.au/publications. Accessed November 4, 2021.
10. Beck AT, Epstein N, Brown G, Steer RA. An inventory for measuring clinical anxiety: psychometric properties. *J Consult Clin Psychol*. 1988;56:893–897.
11. Joseph M. *Assess the Effects of Cryotherapy on Pain and Bruise among Patients Receiving Subcutaneous Heparin Injection at KMCH*. Faculty of Nursing, The Tamil Nadu Dr. M. G. R. Medical University; 2012.
12. El-Deen DS, Youssef NFA. The effect of cryotherapy application before versus after subcutaneous anticoagulant injection on pain intensity and hematoma formation: a quasi-experimental design. *Int J Nurs Sci*. 2018;5:223–229.
13. Emel T, Nese C, Leyle K. Effect of ShotBlocker on relief of pain due to hepatitis B vaccine injection into deltoid muscle. *Int J Caring Sci*. 2017;10:1669–1675.
14. Aydin E, Avşar G. Examine the effect of ShotBlocker in relieving pain associated with intramuscular injection. *Complement Ther Med*. 2019;47:102192.
15. Celik N, Khorshid L. The use of ShotBlocker for reducing pain and anxiety associated with intramuscular injection: a randomized, placebo controlled study. *Hol Nurs Prac*. 2015;29:251–271.

16. Elsaid R, Abdelkhalek W. The effect of ShotBlocker and Z-Track techniques on reducing the needle pain and anxiety associated with intramuscular injection. *Int J Nurs Didact.* 2019;9:31–38.
17. Alabdalhai S, Mokabel F, Ghuneimy Y. Impact of cold therapy on the pain and hematoma on the site of injection of enoxaparin. *IJARIIE.* 2017;3:380–387.
18. Taghlili F, Kiapour A, Zavardeh M. Effect of localized cold compress on pain severity with the subcutaneous injection of enoxaparin: a randomized controlled trial. *J Kermanshah Univ Med Sci.* 2021;25. doi: 10.5812/jkums.110984.
19. Susilawati S, Soetjiningsih S, Arhana BNP, Subanada IB. Effectiveness of PainAwayÂ® on hepatitis B intramuscular injection in term neonates: a randomized controlled trial. *Indo J Paed Perinatal Med.* 2010;50:214–219.
20. Sahiner NC, Turkmen AS, Acikgoz A, Simsek E, Kirel B. Effectiveness of two different methods for pain reduction during insulin injection in children with Type 1 diabetes: Buzzy and ShotBlocker. *Worldviews Evid Based Nurs.* 2018;15: 464–470.
21. Girgin BA, Aktaş E, Kılınç D, Gözen D. Let's prefer the pain reducing intervention, buzzy or ShotBlocker: a randomized controlled trial. *J Behcet Uz Child Hosp. Dergisi.* 2020;10:290–298 (in Izmir).