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### Abstract

**Background:** Venepuncture is a minimally invasive procedure, which is commonly performed in hospitals; if the pain is inadequately managed, it can cause negative feelings in children. Distraction can reduce pain through affecting the central nervous system and releasing neurotransmitters that inhibit pain.

**Aim:** In this study, we aimed to compare the effects of play-dough and bubble making as distraction techniques on the intensity of venepuncture pain in children.

**Method:** In this randomized, controlled, clinical trial, 90 children aged three to six years old, were randomly allocated to the three groups of play dough, bubble making, and control (n=30 for each group). This study was performed in Qaem, Imam Reza, and Dr. Sheikh hospitals of Mashhad, Iran, in 2015. The interventions consisted of using play dough and bubble making, which were started five minutes before venepuncture. Following the intervention, pain assessment was performed using Wong-Baker Faces Pain Rating Scale. Chi-square, Fisher's exact, and One-way ANOVA tests were performed to analyze the data, using SPSS version 16.

**Results:** The mean of pain intensity in the play dough, bubble making, and control groups was  $5.1 \pm 1.8$ ,  $6.2 \pm 1.4$ , and  $8.2 \pm 1.5$ , respectively (out of ten). One-way ANOVA reflected a significant difference between the three groups ( $P < 0.001$ ). Tukey's post-hoc test showed that there was a significant difference between the play dough and control groups ( $P < 0.001$ ), bubble making and control groups ( $P < 0.001$ ), and bubble making and play dough groups ( $P = 0.009$ ).

**Implications for Practice:** Use of play dough could reduce the children's pain during venepuncture more effectively. Thus, use of such simple, inexpensive, and easy to access techniques might relieve pain in children.

**Keywords:** Child, Pain, Pain management, Phlebotomy Venepuncture

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## Introduction

Pain is a big stressor in hospitalized children (1); Wong considers illness and hospitalization as the first crises children encounter during early years of life, since they are less adaptive compared to adults (2). Pain and fear of injury due to venepuncture are highly prevalent, especially in children (3). Insertion of venous catheter is one the most frequent and painful invasive procedures in pediatric hospitals (4). Younger children feel more pain during procedures such as venepuncture than older ones (5). Nowadays, more than 90% of hospitalized children experience painful procedures (e.g., intravenous injection) (6).

In a former study, from 242 admitted children, 49% expressed that the most level of discomfort was caused by injection (7). Vosoghnia quoted from Turke and Melzack (2011) that more than 64% of children aged three to six years old reported venepuncture and blood sampling as the most painful and discomforting medical procedures, which might be due to the fact that young children are highly sensitive toward their body, and they react against venepuncture more intensively than other procedures because the plastic catheter remains inside the vein (8).

Those children with traumatic experiences of injection might develop needle phobia in future and consider other medical procedures as painful, and would refuse hospital admission later in life (9).

In addition, nurses working in pediatric departments spend considerable amounts of time to make young patients comply with injection (10). Therefore, unsuccessful pain relief, especially when pain is caused by inserting a needle, evokes painful memories and causes severe voluntary reactions (such as crying, thrashing, and preventing injection), and physiological (such as increased heart rate and vascular spasm) reactions during future experiences (11). Nurses would consequently have to limit movements of the child in order to administer injection, which would intensify fear and pain in him/her. On the other hand, unnecessary pain in children causes fear of injection and hospital, communication disorders, and distrust in pediatric nurses.

In addition, use of dolls and play dough in addition to distracting children allows them to develop an emotional bond with nurses and express their feelings and unknown fears through these techniques (14, 15). Children's interest in creating new and simple shapes and colorfulness of play dough can stimulate thought and innovation in them. Distraction with play dough can be a simple cognitive-behavioral intervention, which guides attention toward a pleasant and exciting process and away from stress-inducing stimuli (16).

When using clay or play dough, children directly touch materials, which transfers some of various their feelings (such as anger) to the materials. On the other hand, children express their desires and dreams while using play dough (17). Fostering ingenuity, creativity, imagination, and thought, promoting self-confidence and self-efficacy, enhancing problem-solving skills, controlling aggressive and stress-inducing behaviors, and creating a calm and safe atmosphere are some of the advantages of playing with clay or play dough (17). However, considering susceptibility of children to infection, special attention should be paid to the possibility of transmission of infectious agents when using play dough or clay (18).

Bubble making technique was used in several studies; for instance, the results of a study by Caprilli et al. (2012) indicated that the level of pain in bubble making group was significantly lower than control group after intervention (18). A study performed by Alavi et al. (2008), which aimed to determine the effect of bubble making on pain intensity using numerical and photographic scales of Oucher, showed that there was a significant difference between control and intervention groups in terms of mean pain intensity (4). Nevertheless, to the best of our knowledge, no studies have been done on the effect of using play dough on the intensity of venepuncture pain in children.

Based on the comprehensive literature review and experiences of the research team in pediatric wards, the need for safe, simple, cost-effective and available techniques was highlighted. Considering the importance of child support and communication through interactive games during invasive and painful procedures, use of bubble making and play dough is suitable for children. Although some studies have evaluated the effects of bubble making in various fields such as venepuncture, no studies have focused on the effects of using play dough and comparison of the effects of bubble making and play dough distraction techniques on the pain experienced by children. Therefore, in this study, we aimed to compare the effects of bubble making and play dough on venepuncture pain intensity in children.

## Methods

This controlled, randomized, clinical trial with a post-intervention design was conducted on all the children referring to the pediatric emergency departments of Imam Reza, Dr. Sheikh, and Qaem hospitals of Mashhad, Iran (the only hospitals affiliated to Mashhad University of Medical Sciences with pediatric emergency departments) in 2015. A total of 90 children, aged between three and six years old, were randomly selected through convenience sampling and were assigned to the three groups of play dough, bubble making, and control.

The minimum sample size was calculated using comparison of means of two populations. A pilot study was performed on 30 children (10 from each group) in order to evaluate the mean and standard deviation of pain intensity ( $6.9 \pm 1.6$  in the control group and  $5.8 \pm 1.3$  in the play dough group). At 95% confidence interval and 80% power, the sample size was calculated to be 28 for each group, which was enlarged to 30 children to improve results. to avoid baseline imbalance.

The inclusion criteria were as follows: 1) parental consent to recruit the children into the study; 2) children aged three to six years old; 3) absence of acute pain; 4) no use of opioid analgesics (or other pain medicines) or non-steroidal anti-inflammatory drugs in the past 24 hours (based on the medical records of the children); and 5) no prior experience of venepuncture. The exclusion criteria of the study were unsuccessful venepuncture at first attempt and unwillingness of children or their parents to continue participation in the study.

The data collection tools included a demographic questionnaire and Wong-Baker Faces Pain Rating Scale. The demographic questionnaire included seven items on gender, age, birth order, father's educational level, father's occupational status, maternal level of education, and mother's occupation. The content validity of the demographic questionnaire was confirmed by ten faculty members of School of Nursing and Midwifery, Mashhad University of Medical Sciences, Mashhad, Iran. This questionnaire was filled out prior to venepuncture. Pain intensity was assessed after the intervention, using Wong-Baker Faces Pain Rating Scale. This standard tool includes six faces that describe different levels of pain ranging from 'no pain' (0) to 'hurts worst' (10); pain intensity was graded as zero, two, four, six, eight, and ten.

After venepuncture, the researcher showed the scale to the samples and asked them to point to the face that accurately showed their level of pain. The researchers marked the picture and recorded the related score. This scale was designed and standardized by Wong and Baker in 1998 [2]. Its validity and reliability were confirmed in previous studies; for instance, in a study by Nikfarid (2010), its correlation coefficient was calculated to be 0.82 (19). In the present study, inter-rater reliability of the scale was established during the pilot study. For this purpose, venepuncture pain intensity in ten children, aged between three and six years old, was estimated by two observers (the researcher and his assistant). Then, the correlation between the two assessments was calculated through Pearson's correlation coefficient ( $r=0.89$ ).

In the sampling process, all the children, referring to the aforementioned pediatric departments on the first, second, and third days of the intervention, were assigned to the play dough, bubble making, and control groups, respectively. On each day, sampling was continued until the sample size was achieved ( $n=30$  for each group). In this study, no dropout was reported.

The venepuncture rooms were quiet and with adequate air conditioning, located in the pediatric emergency departments. The venepuncture environment was similar for all the children. All the children were asked to lie in supine position and a similar antiseptic was applied in all the cases. Venepuncture was performed on the cephalic, basilic, brachial, or dorsal hand veins with similar angiocaths in terms of brand and color (number 22). To control the effect of nurses' skill on pain in the children, two skillful nurses with adequate experience performed venepuncture. The nurses were working in the pediatric emergency departments and were willing to cooperate with the study.

In the play dough group, the samples were encouraged to form some shapes with play dough five minutes prior to the procedure. The children were helped in forming the shapes based on their needs and in so doing, the nurses tried to communicate with the children. At this stage, shape formation was voluntary and based on the desire of the samples; the purpose was to gain cooperation and trust of the children. Thereafter, the samples and their parents were guided into the venepuncture room and were laid down on the bed. The researchers were seated in a way that they could observe the face of the children and their reactions. While communicating with the children, one of the researchers started to

use play dough from the beginning of the venepuncture, i.e., the moment the angiocath was inserted into the skin.

Every one minute, a specific shape was made by the children. The first shape was a simple pink flower, the second shape was a yellow chick, the third one was a green frog, the fourth one was a red lollipop, and the fifth one was a simple dummy. The use of play dough started from the beginning of the venepuncture and continued until the end of the procedure. The time, shapes, and the order of presentation were similar for all the children. In addition, by completion of each shape, the researchers asked short questions with simple answers from the children, such as “what is this shape?”, “have you seen this shape before?”, or “look closely, can you make this again later?”. Nurses and parents encouraged the children to participate using physical gestures or phrases such as “can you do this again?” and “what is this (meaning the shape) doing?”.

In the bubble making group, the children were taught how to make bubbles prior to venepuncture. Five minutes before the procedure, the children were encouraged to make bubbles until the end of the procedure. In the control group, venepuncture was performed in the routine manner and no extra intervention was performed to alleviate pain. In addition, the procedure in the bubble making and control groups was done in the supine position.

Pain intensity in all the three groups was estimated ten minutes after venepuncture by the research assistant using Wong-Baker Faces Pain Rating Scale. Upon showing the scale to the samples and giving simple instructions for each picture, the samples were asked to point to the picture that best described the level of pain they experienced, and the score was recorded afterwards.

The most important moral considerations in this study included obtaining approval of the Ethics Committee of Mashhad University of Medical Sciences and informed consent from the parents. After collecting and coding the data, they were entered into computer. Descriptive statistics (for summarizing the data), Kolmogorov-Smirnov, Chi-square, One-way ANOVA, Kruskal-Wallis, and Fisher's exact tests were performed using SPSS version 16. *P*-value less than 0.05 was considered significant.

## Results

The mean age of the samples in the play dough, bubble making, and control groups was  $4.5 \pm 1.1$ ,  $4.2 \pm 1.1$ , and  $4.3 \pm 0.9$  years, respectively. The results of Kruskal-Wallis test showed that there were no significant differences between the three groups in terms of age ( $P=0.60$ ). Other demographic features of the samples and the homogeneity of the three groups were determined using Chi-square and Fisher's exact tests (Table 1).

The mean pain intensity in the play dough, bubble making, and control groups was  $5.1 \pm 1.8$ ,  $6.2 \pm 1.4$ , and  $8.2 \pm 1.5$  (out of ten), respectively. One-way ANOVA reflected a significant difference in the mean pain intensity between the three groups ( $P<0.001$ ). The results of Tukey's post-hoc test indicated that there was a significant difference between play dough and control groups ( $P<0.001$ ), bubble making and control groups ( $P<0.001$ ), and bubble making and play dough groups ( $P=0.009$ ) in terms of mean pain scores (Table 2).

**Table 1: Distribution of the studied children in the play dough, bubble making, and control groups in terms of demographic characteristics**

Variable		Play dough	Bubble making	Control	Test result
Gender	Boy	20 (66.7)	17 (56.7)	15 (50.0)	* $P=0.42$
	Girl	10 (33.3)	13 (43.3)	15 (50.0)	
Birth order	First	13 (48.1)	10 (33.3)	13 (43.3)	** $P=0.77$
	Second	12 (44.4)	15 (50.0)	14 (46.7)	
	Third	2 (7.4)	4 (13.3)	3 (10.0)	
	Fourth	0 (0.0)	1 (3.3)	0 (0.0)	
Age of the child (year)	Mean $\pm$ SD	$4.5 \pm 1.1$	$4.2 \pm 1.1$	$4.3 \pm 0.9$	*** $P=0.60$

\*: Chi-square

\*\* : Fisher's exact test

\*\*\*: Kruskal-Wallis

**Table 2: Mean and standard deviation of pain intensity in the play dough, bubble making, and control control groups after the intervention**

Pain intensity after the intervention mean±SD			The results of One-wa ANOVA	
	Play dough	Bubble making	Control	
	5.1±1.8	6.2±1.4	8.2±1.5	P<0.001
Post-hoc tests (Tukey)	Comparison of the play dough and bubble making groups			P=0.009
	Comparison of the bubble making and control groups			P<0.001
	Comparison of the play dough and control groups			P<0.001

## Discussion

This study aimed to compare the effects of distraction with play dough and bubble making techniques on the pain intensity of children undergoing venepuncture. The results exhibited a statistically significant difference in mean pain intensity of the three groups, and showed that the play dough group had a significantly lower level of pain intensity, as compared to the other two groups. The pair-wise comparison of the three groups demonstrated a significant difference in mean pain intensity between the play dough and control groups, the bubble making and control groups, as well as the bubble making and play dough groups.

In this regard, Caprilli et al. (2012) conducted a study with the purpose of determining the effects of bubble making, as a distracting technique, on intensity of venepuncture pain in children. The results suggested that the level of pain intensity in intervention group was significantly lower than control group (18). The results of this study were consistent with ours, since in the present study, bubble making was used in one of the intervention groups as a distracting technique, which resulted in a lower level of pain in this group compared to the control group.

According to the gate control theory of pain, decrease in pain intensity of the intervention groups of the present study during venepuncture can be evaluated, because this theory introduces a special system of thick straps that activate cognitive processes in choice through adjusting the spinal gate. The focus of this theory is on psychological factors involved in pain. Based on this theory, some interventions such as distraction (e.g., play dough and bubble making) can decrease pain (20, 21). Moreover, in this technique (play dough), a strong bond is developed between children and nurses (22).

Alavi et al. (2008) conducted a study to determine the effects of bubble making on intensity of venepuncture pain in children. Based on numerical and photographic scales of Oucher, it was found that there were significant differences between control and intervention groups regarding mean pain score (4). The results of the study by Alavi et al. (2008) were consistent with the findings of the present study, since bubble making was used in both studies as a distraction technique, which leads to involvement of multiple senses.

In fact, based on the neurocognitive model of attention to pain, tension and pain reduce when a distracting factor is able to guide attention of a subject away from painful stimuli. This theory is in accordance with the attention competition model, because when some activities requiring serious attention are done at the same time, two or more of these activities compete with each other and one of them fails. Therefore, if the attention-distracting factor is strong enough, pain stimulus will be defeated and the person will feel less pain as a result (17, 18, 21). In the present study, it seems that play dough and bubble making techniques could significantly lower the intensity of pain in the children. Thus, a higher level of decrease in the pain intensity of the play dough group is possible.

Gupta et al. (2014) carried out a study to compare the pain-relieving effects of watching animations on the severity of venepuncture pain in children aged up to seven years old. The results demonstrated a statistically significant difference in the mean age of control and intervention groups. In addition, mean score of pain in the intervention group was lower than the control group (22). The results of this study were in agreement with our findings, since distraction techniques were used in both studies. However, in the study by Gupta et al., a passive distraction technique was used, while in the present study, active distraction techniques that could engage multiple senses, especially the sense of touch, were used. In addition, communication is deeper in the active distraction techniques.

In a clinical trial performed by Maclaren et al. (2005), entitled “The comparison of the effects distraction techniques on tension and pain during venepuncture in children”, 88 eighty eight children aged between one and seven years old underwent venepuncture in a pre-operative ward. The samples were divided into the three groups of interactive games, showing movies (passive distraction), and standard care. The results demonstrated that there was no statistically significant difference in mean pain intensity of the three groups (23). The results of this study were not in agreement with the findings of the present study. One possible reason for this discrepancy can be the passiveness of the distraction techniques used in that study, since children stay calm during passive activities and would get distracted through receiving planned environmental stimuli (23).

In the study by Maclaren, interactive games, which are considered as active distractions, were used in one group. Nonetheless, this intervention did not cause a significant decrease in pain intensity, while in the present study, bubble making and the use of play dough could significantly reduce pain intensity. Additionally, in the current study, Wong-Baker scale was used to measure pain intensity. This scale is considered to be the most accurate instrument for estimating pain in children aged 3-18 years old (24). In the study by Maclaren, a visual analogue scale was used to assess pain intensity, which is more applicable and understandable to children older than five years, while the sample were aged one to seven years old in that study; thus, the scale was not suitable for the study population. Moreover, in the present study, the samples were aged three to six years old, and the way children react to pain is affected by their age.

Razzaghi et al. (2012) performed a study to compare the effects of distraction and tactile stimulation on the severity of venepuncture pain in children aged five to ten years old, who were admitted to pediatric internal wards. The results showed a significant difference between the routine care, tactile, and bubble making groups in terms of pain intensity, but there was not a statistically significant difference in mean pain intensity of the bubble making and tactile groups (25).

Mahdipoor Rabari et al. (2010) performed a study entitled: “The comparison of the effects of distraction techniques on the severity of pain during venepuncture in children diagnosed with strabismus”. The results of that study did not demonstrate any significant differences between the bubble making and tactile groups in terms of mean pain intensity ( $P>0.05$ ), but there was a significant difference between the intervention and control groups concerning pain intensity (26).

Given the statistically significant difference between the intervention and control groups in the studies of Razzaghi (2012) and Mahdipoor(2010), the results of these studies were consistent with those of the present study. Since distraction techniques, which can fully engage children, were used in all the three studies and lower pain intensity in the intervention groups was observed as compared to the control groups. Tactile stimulation was used as an intervention in the studies by Razzaghi and Mahdipoor, which did not show a statistically significant difference in pain intensity between tactile and bubble making groups, but there was a statistically significant difference between the play dough and bubble making groups of the present study. In this respect, the results of the current study were not consistent with the results of Razzaghi and Mahdipoor studies, which could be due to different mechanisms of play dough distraction technique and tactile stimulation that is, the use of play dough, which is considered as a distraction technique, can involve multiple senses in children, but it does not affect the physiology and pathways of pain, but tactile stimulation is one of the complementary techniques that distributes and transmits energy from caregivers to patients and adjusts the fields of energy in humans and the environment (27). Therefore, this difference in results can be secondary to the different nature of the applied techniques in the present study and the studies performed by Razzaghi and Mahdipoor. In addition, the difference in the age range of the samples and pain assessment tools can be the other reasons for this discrepancy.

The limitations of this study included not video recording the venepuncture procedure in the children due to limited financial resources, to solve this problem a nurse helped us during the completion of the scale. In addition, pain assessment was only based on the samples' opinion, which was because of the type of applied tool and limited financial resources.

### **Implications for Practice**

The results of this study indicated that even though both distraction techniques used in this study, i.e., use of play dough and bubble making, could effectively lower the level of venepuncture pain in children aged between three and six years old, use of play dough could diminish the intensity of

venepuncture pain more effectively. Therefore, it is recommended to use this technique as an easy to access and effective technique to stimulate thought and innovation. However, conducting further studies on this issue, video recording the venepuncture procedure in children, and using the opinion of a research assistant, can promote the internal validity of the study and facilitate judgment on the effectiveness of these techniques.

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### Conflict of interest

The authors declare that there is no conflict of interest.

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