

The Effect of a Multi-Dimensional Play Program on Children's Pain Intensity During Burn Dressing Change in Burn Intensive Care Units: A Clinical Trial

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Abstract

Background: Playing is one of the recommended tools in recent years for decreasing pain in children having painful and stressful experiences. It can also help these children cope with such situations.

Objectives: This study was performed with the aim of assessing the effect of a multidimensional play program on pain intensity during wound dressing change in children hospitalized in burn intensive care units.

Methods: In this clinical trial, forty 7 to 12-year-old children, hospitalized in burn intensive care units of Imam Mousa Kazem (SA) medical educational center in Isfahan, were selected through simple random sampling and were divided into 2 groups. The multi-dimensional play program was applied for children in the experimental group. Finally, pain intensity was assessed in the groups, using Wong-Baker's pain rating scale. In addition, the results were documented in the pre and posttest stages, and data analysis was performed using statistical tests.

Results: The children's average pain scores of burn dressing change before and after the intervention were 8.6 ± 0.9 and 5.5 ± 1.3 in the experimental group and 8.7 ± 0.8 and 8.4 ± 0.8 in the control group, respectively. According to the t test results, there was a significant difference between the groups in terms of pain intensity after burn dressing change in the posttest ($P < 0.05$).

Conclusions: This study indicated that application of a multidimensional play program can be useful in decreasing children's pain intensity during burn dressing changes.

Keywords: Play, Therapy, Pain, Child, Burn

1. Background

Annually, more than half a million children are hospitalized because of burns around the world. More than 90% of hospitalized children undergo painful and aggressive procedures, while children with burn injuries experience greater pain (1). Overall, patients with burn injuries endure a series of painful procedures during their medical treatment (2); therefore, burn treatment is often more painful than the burn incident itself (3, 4). In fact, such painful medical treatments can promote negative responses towards these procedures (2). In other words, these patients not only suffer from the outcomes of burn injuries, but also undergo some painful care procedures, such as wound dressing change (1). Therefore, researchers are trying to decrease children's pain due to painful procedures as much as possible through different methods (5).

In burn patients, the most common methods of pain management during wound dressing are medicinal methods. These methods are associated with some complica-

tions, such as inadequate pain management, respiratory depression, and excessive sedation (3). On the other hand, children's responsiveness to medicinal therapies is lower than adults, while use of nonmedicinal or complementary therapies may decrease the amount of required drugs for pain management (5). Therefore, nurses are required to apply nonmedicinal methods of pain management to provide effective care for children (6).

One of the nonmedicinal interventions for pain alleviation in burn children is distraction of thought. In this method, one's attention is directed towards something other than pain (7). Play therapy, as an active thought-distraction method (6, 8), is a widely used tool in clinical units and is recommended for decreasing pain in children having stressful experiences; also, this method improves their compatibility with such situations. Three games (including usual and therapeutic games) are applied in medical programs (9), which can be performed by nurses in any location (6).

Selection of the type of game is directly related to the child's age. Some methods are used to involve all senses of school children, considering their sensory evolution and information processing. A virtual multidimensional space provides better conditions for distracting attention from pain in many children. This in fact prepares a virtual environment and allows children to interact with a simulated world, causing visual, auditory, and motor stimulation.

Use of a virtual multidimensional space exposes the child to a gaming environment, involves his/her senses, and separates him/her from the real environment. The child is actively involved in this method, continuously uses concentration resources, and responds to attention distractors, which increase his/her pain threshold. Accordingly, nurses can perform the procedure easier and faster, and the likelihood of failure and repeated efforts can be decreased. In fact, nurses' satisfaction and children's comfort can be achieved altogether (7). Nurses are in an ideal position for effective pain management of burn patients. Overall, assessing pain intensity, planning nonmedicinal methods for pain relief, and evaluating these methods for achieving positive results are among the nursing responsibilities (10).

2. Objectives

Considering the importance of pain management in wound dressing change and its accelerating effect on the recovery of children with burn injuries, this study aimed to assess the effect of a multidimensional play program on pain intensity during dressing changes of children, hospitalized in burn intensive care units.

3. Methods

The present two-group, two-stage clinical trial was performed in Imam Mousa Kazem (SA) health educational center of Isfahan, as the only burn center in Isfahan. The study population included all children, hospitalized in the burn units of this health educational center. A total of 40 children, who met the inclusion criteria, were randomly selected through convenience sampling (shuffling numbered cards) during 8 months. The participants were then divided into experimental and control groups.

The inclusion criteria were as follows: 1) age range, 7-12 years; 2) minimum of 1 dressing change using the center's standard method; 3) lack of severe (deep) burns, preventing participation in the study; 4) lack of effective underlying diseases, such as disabilities or mental disorders; 5) parents' written consent for participation in the study; and 6) parents' literacy and age above 18 years. On the

other hand, the children were removed from the study if they needed intravenous sedation during wound dressing, lost communication abilities due to any reason, or showed unwillingness to participate in the study.

In the first stage, the researcher obtained permission from the ethics committee and visited the study environment to collect written parental consent forms after explaining the aims and importance of the study and giving assurance about the confidentiality of information. The parents could also participate in or leave the study at any stage.

The researcher completed the first part of the questionnaire, using the patients' records and information provided by ward nurses and parents. This section included the baseline and demographic characteristics, such as age and gender of parents and children, duration of wound burn, wound site, percentage, and wound severity. In addition, in this stage, children's pain intensity after burn dressing change was assessed in both groups, using Wong Baker's self-report pain severity questionnaire, which has been widely used in different studies and is confirmed due to its standard validity and reliability (11).

Immediately after dressing change, the children were asked to specify their pain intensity by pointing at one of the cartoon faces. The procedure of dressing change included dressing opening, wound rinsing and cleaning if necessary, and finally using a new dressing; these stages were followed consecutively. Dressing change was performed in the morning and only once during the day.

Afterwards, a multidimensional virtual-reality (VR) headset was used in the experimental group (Samsung gear VR headset; Korea, Samsung Co. and Oculus Co.). It is made of a plastic body and is tightened around the child's head by soft and wide rubber bands. Inside the plastic body, 2 high-quality lenses are placed on the child's eyes to present Super-AMOLED display images. This tool weighs 318 grams (dimension, 201.9 × 116.4 × 92.6 mm) and can be easily placed on the head. Some touch buttons are next to the plastic body, and children can use them in the playing environment.

A multidimensional game, known as Smash Hit, was the selected game application in this study, which is designed by Mediocre company in the musical arcade style for children above 7 years. The headset was placed on the children's eyes at 30 to 40 minutes before the beginning of dressing change. The children were in a simulated game space. As soon as they noticed the target, they started shooting at it by pressing the button on the headset. They started the game with 25 balls and were supposed to break the cone-shaped glasses in the 3D environment by pressing the touch keys and shooting the balls.

The game camera was fixed, and children were in-

structured to break the obstacles by the balls. Overall, the game environment is well designed and a new simulated setting follows each space; therefore, the game is always attractive to children. The music is also pleasant, which makes the game more enjoyable to children. Immediately after dressing change, the game was paused and children's pain intensity was assessed by asking them questions and showing them the questionnaire. Since the children were treated separately at different times, blinding was only achieved in the patient group (single-blind design).

4. Results

A total of 40 children were recruited in this study. The experimental group included 12 males and 8 females, while the control group included 14 males and 6 females. The Chi square test results indicated no significant difference in children's gender distribution between the groups. The average age of children in the experimental and control groups was 8.7 ± 1.6 and 9.2 ± 1.9 years, respectively. In addition, the average age of parents in the experimental and control groups was 32.9 ± 4.6 and 33.2 ± 4.5 years, respectively.

The findings of the present study indicated that the average duration of pain due to burn wound was 3.7 ± 1.6 and 3.6 ± 2.5 days in the experimental and control groups, respectively. Accordingly, independent t-test results showed no significant difference between the groups in terms of children's average age, duration of burn wound, and parents' age. Distribution of the cause, site, and depth of burn wounds in the groups is presented in [Table 1](#).

The likelihood ratio Chi square test showed no significant difference between the groups in terms of distribution of burn site or cause. In addition, the results indicated that burn depth distribution was completely similar between the groups. In the experimental and control groups, 90% and 75% of children's burns had occurred at home, respectively. The findings revealed that in the experimental and control groups, only 10% and 15% of the parents had university education, respectively.

Mann-Whitney test showed no significant difference between the groups in terms of burn percentage ($P > 0.05$). Independent t-test indicated that the average pain intensity score was significantly lower in the experimental group immediately after the end of dressing change, compared to the control group. However, the results did not represent any significant differences between the groups in terms of children's average pain intensity. In addition, paired t-test showed no significant difference in terms of the average pain intensity due to dressing change in the control group before and after the intervention, while the

average pain intensity significantly decreased after the intervention in the experimental group.

5. Discussion

Pain perception at the burn wound site is due to the stimulation of local receptors, transmission of nerve impulses through A delta and C fibers, and consequently transmission of a nerve signal to the posterior horn of the spinal cord. Conscious perception of pain occurs when the resulting impulse is transmitted towards the brain and areas collectively known as pain matrices (3).

A study by Kipping et al. on teenagers (age range, 11 - 17 years) in Queensland, Australia (2012), as well as a study by Maani et al. on a population aged 20 - 27 years in Washington (2011) and few other reports, indicates that virtual multidimensional games are possible tools for pain management during painful dressing changes (12, 13). This finding is based on the fact that if lattice formation in the brain stem receives sufficient and diverse sensory stimulations, it can selectively prevent sensory transmission, such as pain (14).

According to Mack Coel and Malot model (1984), the sensory capacity is limited. When more than 2 actions are required by sensory resources, they receive less attention or the function of one or both activities is completely disrupted (15). The present study aimed to determine the effect of virtual multidimensional games on pain severity of burn dressing in children. The results showed that the average pain intensity immediately decreased from 8.6 to 5.5 after dressing change in children who were playing games during the procedure.

In this regard, Kaheni et al. performed a study in 2015 on hospitalized children in 3 burn units of Shahid Zare hospital in Sari, Iran. Based on the findings, pain intensity of burn dressing change decreased more significantly (8.02 ± 1.18 vs. 2.57 ± 1.70) (16). Considering the use of similar tools in the mentioned study and present research for pain intensity, it seems that the cause of this difference is the game content.

A study by Das et al. in 2005 at women's and children's hospital of Adelaide, Australia, with the cooperation of South Australia university, aimed at assessing the effect of virtual multidimensional games on pain moderation in children with acute burn injuries. The study was performed on 9 children with the average age of 10 years. According to the findings, when children were receiving routine care (medicinal anesthesia) during burn dressing change (4.1 ± 2.9), they had higher levels of pain in comparison with the time they played virtual multidimensional games, in addition to receiving medicinal anesthesia (1.3 ± 1.8) (17).

Table 1. The Frequency Distribution of Burn Characteristics (Cause, Site, and Type of Burn) in the Experimental and Control Groups

	Play Program Group		Control Group		Significance Level	
	n	%	n	%	P Value	X ²
Cause of burn					0.19	4.75
Thermal (hot liquid)	15	75	11	55		
Thermal (fire)	4	20	8	40		
Electrical	1	5	0	0		
Chemical	0	0	1	5		
Site of burn					0.75	1.21
Trunk	2	10	1	5		
Upper limb	2	10	3	15		
Lower limb	3	15	5	25		
Two sites or more	13	65	11	55		
Type of burn (degree)					1	0
First and superficial second degree	2	10	2	10		
Deep second and third degree	18	90	18	90		

Table 2. The Mean Pain Intensity Scores of Children After Wound Dressing Change in the Groups

	Before Intervention		After Intervention		Significance Level	
	Mean	SD	Mean	SD	P Value	t
Play program group	8.6	0.9	5.5	1.3	< 0.001	16.27
Control group	8.7	0.8	8.4	0.8	0.21	1.28
Significance level						
P	0.72		8.73			
t	0.35		< 0.001			

The difference in the mean pain intensity scores can be due to the use of local anesthesia, along with games, in the alleviation of pain (due to burn dressing change), while in the other mentioned studies, no other drug interventions were used simultaneously with the game during dressing change. Considering the limited research in this area, it seems that further studies can confirm the effectiveness of virtual multidimensional games in reducing pain intensity of burn dressing change and their preference over other methods.

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Footnotes

Authors' Contribution: Ali Noruzi Koushali: study design, search, data collection, data analysis, and writing of the manuscript; Mostafa Najafi: study design; Reza Daryabeigi and Nasrollah Alimohammadi: study design, data analysis, and writing of the manuscript.

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References

1. Rasuli S, Lotfi M, Seyedamini B, Zamanzadeh V, Naghili B. The effects of biological, synthetic and traditional dressing on pain intensity of burn wound in children. *Iran J Nurs*. 2013;26(85):15-25.
2. Moore ER, Bennett KL, Dietrich MS, Wells N. The effect of directed medical play on young children's pain and distress dur-

- ing burn wound care. *J Pediatr Health Care*. 2015;**29**(3):265-73. doi: [10.1016/j.pedhc.2014.12.006](https://doi.org/10.1016/j.pedhc.2014.12.006). [PubMed: [25631102](https://pubmed.ncbi.nlm.nih.gov/25631102/)].
3. Mazlom SR, Hosseini Amiri M, Tavooosi SH, Manzari ZS, Mirhosseini H. Effect of direct transcranial current stimulation on pain intensity of burn dressing. *Evid. Based Care*. 2015;**4**(4):35-46.
 4. Naderi F, Aghayi A, Mohammadzadeh M, Nazemi S, Salmani F, Rashvand M. Comparing the effect of music on pain threshold, anxiety, behavioral responses to pain and the hemodynamic parameters during dressing change in burn patients. *Quarterly Horizon Med Sci*. 2014;**20**(1):63-8.
 5. Hadadi Moghadam H, Kheirkhah M, Jamshidi Manesh M, Haghani H. The impact of distraction technique on reducing the infant's pain due to immunization. *Horizon Med Sci*. 2011;**16**(4):0.
 6. Baratee F, DABIRIAN A, Yoldashkhan M, Zaree F, Rasouli M. Effect of therapeutic play on postoperative pain of hospitalized school age children in pediatric surgical ward. *Faculty Nurs Midw Quarterly*. 2011;**21**:25-8.
 7. Babaie M, Shirinabadi Farahani A, Nourian M, Pourhoseingholi A, Masoumpoor A. Pain management using distraction in school-age children. *Iranian J Nurs Res*. 2015;**10**(3):71-80.
 8. Sadeghi T, Shamshiri M, Mohammadi N, Shoghi M. Effect of distraction on children's behavioral responses to pain during IV catheter insertion. *J Hayat*. 2013;**18**(4):1-9.
 9. Sahiner NC, Bal MD. The effects of three different distraction methods on pain and anxiety in children. *J Child Health Care*. 2016;**20**(3):277-85. doi: [10.1177/1367493515587062](https://doi.org/10.1177/1367493515587062). [PubMed: [26040282](https://pubmed.ncbi.nlm.nih.gov/26040282/)].
 10. Mohammadi Fakhar F, Rafii F, Jamshidi Orak R, Inanlo M. The effect of jaw relaxation on pain anxiety of burn dressing: Randomized clinical trial with control group. *Iran J Nurs Res*. 2011;**5**(19):58-67.
 11. Nikfarid L, Ghamar Yousefi R, Namazian M, Namdar F, Azam Nezami M. Comparison of EMLA cream versus local refrigeration for reducing venipuncture-related pain in pediatric patients of children's medical center, 2008. *Iranian J Nurs res*. 2010;**5**(16):32-7.
 12. Kipping B, Rodger S, Miller K, Kimble RM. Virtual reality for acute pain reduction in adolescents undergoing burn wound care: a prospective randomized controlled trial. *Burns*. 2012;**38**(5):650-7. doi: [10.1016/j.burns.2011.11.010](https://doi.org/10.1016/j.burns.2011.11.010). [PubMed: [22348801](https://pubmed.ncbi.nlm.nih.gov/22348801/)].
 13. Maani CV, Hoffman HG, Morrow M, Maiers A, Gaylord K, McGhee LL, et al. Virtual reality pain control during burn wound debridement of combat-related burn injuries using robot-like arm mounted VR goggles. *J Trauma*. 2011;**71**(1 Suppl):S125-30. doi: [10.1097/TA.0b013e31822192e2](https://doi.org/10.1097/TA.0b013e31822192e2). [PubMed: [21795888](https://pubmed.ncbi.nlm.nih.gov/21795888/)].
 14. Izadpanah AM, Farajzadehe Z, Khazaei T. Impact of distraction technique on reducing the infants' vaccination pain. *Mod Care J*. 2014;**11**(1):1-9.
 15. Law EF, Dahlquist LM, Sil S, Weiss KE, Herbert LJ, Wohlheiter K, et al. Videogame distraction using virtual reality technology for children experiencing cold pressor pain: the role of cognitive processing. *J Pediatr Psychol*. 2011;**36**(1):84-94. doi: [10.1093/jpepsy/jsq063](https://doi.org/10.1093/jpepsy/jsq063). [PubMed: [20656761](https://pubmed.ncbi.nlm.nih.gov/20656761/)].
 16. Kaheni S, Sadegh Rezaei M, Bagheri-Nesami M, Goudarzian AH. The effect of distraction technique on the pain of dressing change among 3-6 year-old children. *Int J Pediatr*. 2016;**4**(4):1603-10.
 17. Das DA, Grimmer KA, Sparnon AL, McRae SE, Thomas BH. The efficacy of playing a virtual reality game in modulating pain for children with acute burn injuries: a randomized controlled trial [ISRCTN87413556]. *BMC Pediatr*. 2005;**5**(1):1. doi: [10.1186/1471-2431-5-1](https://doi.org/10.1186/1471-2431-5-1). [PubMed: [15745448](https://pubmed.ncbi.nlm.nih.gov/15745448/)].