

Effect of virtual reality method and multimedia system on burn patients' pain during dressing

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Abstract

Aim: Pain is the most important factor which forces burn patients to look for the health system's help. One of the non-pharmacological methods of pain relief for burn patients is virtual reality, which is a challenging technique because virtual reality headset itself may cause claustrophobia and anxiety followed by the cycle of anxiety and pain via creating a closed space. The present study is aimed to determine the effect of both methods of virtual reality and multimedia system on the burn patients' pain during dressing. Material and Method: The present clinical trial was conducted on 60 burn patients hospitalized in Sina Hospital, Tabriz, in accordance with the inclusion criteria using the technique of random allocation to three groups of virtual reality, multimedia system, and control. The sounds and virtual images were played through headsets in the virtual reality group and an LCD in the multimedia system group during dressing and dressing changes in five consecutive days. Data analysis was performed using a demographic questionnaire as well as the linear-visual scale of pain intensity. Furthermore, the repeated measurement test was used to investigate the changes in pain over time and compare the control group with the multimedia system and virtual reality groups. Results: Comparing the three groups indicated a significant difference (p=0.006). The results showed no significant difference between the virtual reality and control groups (p>0.05), but the pain score in the multimedia group was significantly different from the control group on the first (p= 0/02), second (p =0.008), third (p= 0/02) fourth (p =00) and fifth (p=0.03) days of the intervention. Comparison of multimedia and virtual reality showed the pain score in the virtual reality was higher than multimedia on the fourth day (p =0/002) of intervention. Discussion: Multimedia system can have positive effects on reduction of the burn patients' pain compared to virtual reality; therefore, it is recommended to use this method for controlling the burn patients' pain.

Keywords

Virtual Reality; Multimedia System; Pain; Burn

DOI: 10.4328/JCAM.5512 Received: 13.11.2017 Accepted: 13.11.2017 Printed: 01.10.2017 J Clin Anal Med 2017;8(suppl 5): 485-9
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Introduction

Burn is considered as one of the worst traumatic injuries resulting in a life threat all around the world (1). Annually, 500000 cases of burning occur in the United States, nearly 40000 of which are severe and require hospitalization, and about 3400 deaths occur due to burns (2). In Iran, a large number of burns occur annually so that, each year, more than 100000 cases of burns are reported in specialized burn centers, nearly 8000 to 9000 cases of which lead to hospitalization (3).

Burn injury is a physically and mentally very painful experience since patients experience severe pains during their treatment, especially during dressing changes (4), which significantly affects their mental health (5). Thus, the health care providers are faced with the challenge that how to help the burn patients adapt to the distressing and painful care procedures and interventions during the acute phase (6). The poor control of pain is associated with physiological and psychological results, including intractable pain, depression, and post-traumatic stress, and also extensively with suicidal thoughts (7).

Further, appropriate control of pain, resulted from therapeutic actions, would lead to a reliable relationship between the burn patients and the treatment staff, a reduction in mental disorders such as depression and post-traumatic stress, as well as progress in the patient's admission and cooperation in the recovery process (8). One of the basic methods for pain control among the burn patients is the use of opioids (narcotic drugs), which is associated with many side effects (9); on the other hand, the non-pharmacological pain control methods, besides having fewer side effects, are both non-addictive and non-invasive (10). One of the non-pharmacological and highly effective methods for reducing pain perception is distraction (11). When the pain drug treatments are insufficient and drugs are associated with side effects, the non-pharmacological treatments, such as distraction, would be effective in pain control (12). Furthermore, the non-pharmacological methods of pain control are easy and inexpensive with minimum side effects (13). One of the distraction methods for reducing the pain perception, which is based on the behavioral interventions, is the virtual reality, which is noticeable among the burn patients in cases that the analgesia are not created sufficiently. According to the reports, images and sounds of the virtual reality have lowered the patients' feeling of pain (14). The interventions in virtual reality are based on the patient's distraction from acute pain (15). Several studies have shown that virtual reality leads to the reduced pain during the painful procedures (16). A clinical trial was conducted by Faber et al. (2013) in order to determine the effect of frequent use of virtual reality on pain during the dressing change among adults and infant burn patients in the United States. The obtained results showed that the frequent use of this technique would significantly reduce the burn patients' pain (6). Another clinical trial was conducted by Schmitt et al. (2011) in order to determine the effect of virtual reality during physical therapy on the infant burn patients' pain, the results of which showed that the virtual reality would significantly reduce the pain (17). Hoffman et al. (2012), in a study on the effect of virtual reality on the infant burn patients' pain during occupational therapy, demonstrated that the virtual reality would lead to a significant reduction in the infants' burn pains during the occupational therapy (18). There is a two-way relationship between the burn patients' pain and mental problems, such as anxiety, which means that severe pain leads to the increased anxiety and, subsequently, increased intensity of pain among burn patients during therapeutic and care activities (19, 20). Studies have represented that a closed space would result in the claustrophobia and anxiety (21); therefore, by creating a closed space, the virtual reality headset might cause claustrophobia and anxiety in the patient and affect results of the study. Moreover, some studies have demonstrated applications of the multimedia system in various areas of burns for reducing the pain (25, 26, 27). However, none of these studies have directly compared the effects of these two methods on pain relief. In order to investigate the effect of claustrophobia and anxiety using virtual reality headset and creating the cycle of anxiety and pain, the present study was conducted to determine the effects of the two virtual reality and multimedia system methods on the burn patients' pain during dressing. In the virtual reality group, the images and sounds of a waterfall were played using the virtual reality headset, while in the multimedia system group, the same images and sounds were played in an open and quiet environment using an LCD; then, results of both interventions were compared. Thus, the evidence provided for health care providers, including nurses, can be more effective in choosing the virtual reality and multimedia system distraction as an appropriate method of pain control.

Material and Method

The present study was a randomized clinical trial conducted to compare the effects of virtual reality and multimedia system methods on burn patients' pain during dressing in the Burns Ward of Sina Hospital, Tabriz University of Medical Sciences, Iran. In this study, the samples were selected based on the inclusion criteria using convenient sampling method; then, after obtaining the informed consent, all the 60 burn patients were randomly allocated to the three groups (virtual reality, multimedia system, and control), each of which included 20 subjects. The inclusion criteria included hospitalization since the entry into the Burns Ward, no history of burns, age of above 18 for male and female patients, tendency to participate in the study, being conscious and oriented, no drug addiction, general health over the past month, no eyesight and hearing problem, below 25% and second-degree burns, being in acute phase (42 to 72 hours), no numbness in target organs, and no diabetes. On the other hand, the exclusion criteria included the lack of tendency to continue cooperation, transmission to any section other than the Burns Ward, absence in more than one session, receiving sedatives without prescription, and receiving skin graft.

Data collection was performed using a demographic characteristics questionnaire (including age, gender, education level, sedatives intake, and burn percentage).The dressing pain intensity was examined by VAS (Visual Analog Scale), which was a 10-cm and 11-number line with a certain range so that the numbers 0 and 10 indicated no pain and intolerable pain, respectively. The subjects were asked to mark a point on the line corresponding to the intensity of their pain or express its numeric value to the researchers. These tools are widely used and their validity and reliability in acute pains have been proved (22). Moreover,

reliability of this tool has been confirmed by Mazloum using retest method so that this scale was completed by the researcher for 10 individuals in two steps and, then, its reliability was announced to be equal to 92% (23).

After covering the administrative procedures, obtaining the required administrative licenses, and registering the clinical trial in the Iranian Registry of Clinical Trials (IRCT), the researcher initiated sampling by referring to the Burns Ward in Sina Hospital, Tabriz. Once the subjects were allocated to the three groups (control, virtual reality, and multimedia system), similar virtual images (images and waterfall sounds) were played by the researcher. In the virtual reality group, the images and sounds were played through a virtual reality-specific headset, while in the multimedia system, the images and sounds were played through an LCD. The procedures were such that this technique was performed one session a day during the process of dressing on 5 consecutive days from the third day to the seventh day of burns (according to Faber and Schmitt) on the morning shift in order to prevent interference with other tasks of the relevant ward. After collecting and coding the data and importing them into SPSS V.18 software, data analysis was performed using the data analysis tests. To evaluate the changes in pain over the time and also compare the control group with the multimedia system and virtual reality groups, the repeated measurement analysis was used, and also the pre-intervention measurements were included in the model as the covariate.

Results

The demographic characteristics included age, gender, education, burn percentage, and sedative intake. Table (1) represents comparison of the three groups in terms of statistical differences. According to Chi-square test results, none of the three groups had difference in terms of demographic characteristics including gender, education, sedatives intake. Furthermore, ANOVA indicated no significant difference between the three groups in terms of age distribution and burn percentage.

The repeated measurement test results showed a significant difference between the three groups (p=0.006) (Table-2).

The pre-intervention measurements were included in the repeated measurement analysis model as covariate. The results of repeated measurement analysis showed no significant difference between the virtual reality and control groups (p>0.05), but the pain score of the multimedia group was significantly different from the control group on the first (p =0.02), second (p =0.008), third (p= 0/02), fourth (p =0.00), and fifth (p =0.03) days of the intervention. Comparison of multimedia and virtual reality showed the pain score of the virtual reality group was higher than multimedia group on the fourth day (p=0.002) of intervention. Table (3) shows the repeated measurements in accordance with the intervention days and Figure (1) shows the pain observation procedure on consecutive days.

Discussion

Results of the present study demonstrated that both virtual reality and multimedia system methods reduced the burn dressing pain, except that the virtual reality resulted in the relative control of the burn dressing pair, while the multimedia system led to a significant reduction in the burn dressing pain. No statistical difference was obtained in terms of the demographic and clinical variables such as age, gender education level, burn percentage, and sedatives intake; therefore, the obtained results indicating effectiveness of the type of the method on level of the burn dressing pain among burn patients were highly reliable and not influenced by the confounding factors. The present study showed that the multimedia system was more efficient than the virtual reality in reducing the burn patients' pain during dressing. Faber et al. (2011), by investigating the effect of virtual reality on the burn patients' pain during dressing, demonstrated that the burn patients' pain during dressing in the intervention group was significantly less than that in the con-

Table 1. Participants' demographic data

Variable	Levels of variable	Virtual reality	multimedia	control	Statistical test	
Age(year)	Male and female	32 ±8	34±10	39±12	f=0/62	p=0/54
Burn Percentage	Male and female	15±6	15±7	16±6	f=0/45	p=0/65
Gender	Male	(45)9	(70)14	(55)11	x^2=2/62	p=0/5
	Female	(55)11	(30)6	(45)9	df=2	
Education	Under diploma	(95)19	(85)17	(95)19	x^2=5/3	p=0/5
University	(5)1	(5)3	(5)1	df=6		
Palliative	Receive	(75)15	(75)15	(75)15	x^2=0/2	p=1
No receive	(25) 5	(25) 5	(25) 5	df=4		

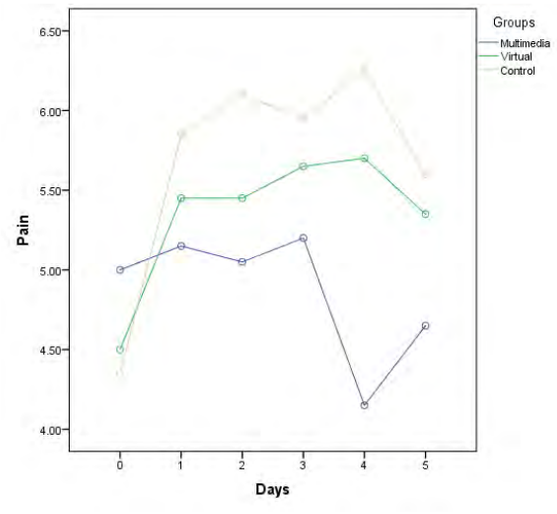

Figure 1. Changes of pain over time in three groups

Table 2. The result of repeated measurements analysis with first measure as a covariat

Variable	Source of variation		Wilks' Λ	F	d.f.	Error df	SS	d.f.	MS	F	P
Pain	Within subjects	Time	0.97	0.33	4	53					0.85
		Group * Time	0.81	1.50	2	90					0.16
	Between Subjects	Group					123.79	1	61.89	5.52	0.006
		Error (between)					627.38	91	11.20		

Table 3. The results of repeated measure analysis on pain score in three groups

Pain	Groups	Mean	Std. Deviation	comparison	p-value	Lower Bound	Upper Bound
Day1	Multimedia	5/15	1/98	M vs V	0/196	-1/594	0/333
	Virtual reality	5/45	1/98	M vs C	0/023	-2/097	-0/161
	Control	5/85	1/72	C vs V	0/301	-1/457	0/458
day2	Multimedia	5/05	2/11	M vs V	0/181	-1/818	0/351
	Virtual reality	5/45	2/35	M vs C	0/008	-2/573	-0/394
	Control	6/10	1/65	C vs V	0/169	-1/827	0/327
day3	Multimedia	5/20	2/54	M vs V	0/136	-1/886	0/263
	Virtual reality	5/65	2/03	M vs C	0/027	-2/299	-0/141
	Control	5/95	1/63	C vs V	0/447	-1/476	0/659
day4	Multimedia	4/15	2/58	M vs V	0/002	-3/097	-0/756
	Virtual reality	5/70	2/12	M vs C	0/00	-3/766	-1/413
	Control	6/25	2/02	C vs V	0/258	-1/826	0/500
day5	Multimedia	4/65	2./71	M vs V	0/10	-2/322	0/208
	Virtual reality	5/35	2/68	M vs C	0/030	-2/685	-0/144
	Control	5/60	1/35	C vs V	0/571	-1/614	0/90

M= Multimedia, V=Virtual reality, C=Control

trol group (6), which was consistent with results of the present study. Similarly, in the present study, virtual reality could reduce the burn patients' pain during dressing, although the reduction was not significant. Moreover, the results obtained by Schmitt et al. (2011) who investigated the effect of virtual reality on the burn patients' pain during dressing were consistent with results of the present study since, in their study, this treatment technique also led to a significant reduction in the patients' pain (17). In another study conducted on effect of the use of virtual reality on control of the infant burn patients' pain during occupational therapy, Hoffman et al. (2009) showed that the virtual reality resulted in the reduced pain of the infant burn patients during occupational therapy, which was consistent with results of the present results (18).

Many other psychological non-pharmacologic methods have been also used for pain relief; in this regard, the multimedia systems can be mentioned, which are PC-like systems composed of LCD and TV with capability of playing digital images and sounds as well as moving pictures that are to some extent similar to the real images (24).For instance, Kaur et al. (2011) conducted a study to determine effectiveness of the multimedia system in reducing pain and distress among children during venipuncture. Their findings indicated the significantly reduced pain during venipuncture in the intervention group watching cartoons (25), which was consistent with results of the present study. Similarly, in the present study, the multimedia system led to a significant reduction in pain intensity. Moreover, Choudhury et al. (2013) investigated the effect of audiovisual distraction on pain relief during ear micro-suction, the results of which indicated that pain in the intervention group was significantly less than the control group, which was consistent with results of the present study (26). As another example, Miguez-Navarro and Guerrero- Marquez (2014) investigated the effect of audiovisual distraction on pain reduction among children aged 3-11 years old. Their findings showed that the pain during venipuncture was significantly reduced in the intervention group watching cartoons, which was consistent with results of the present study (27). The headset, which is specifically used for playing images and sounds of the virtual reality, separated the patient's eyesight from the room, using a small computer screen placed in front of the patient's eyes, blocks the hospital noise using the headset, and replaces the noise with relaxing images and sounds. As a result, once the invasive procedures are performed by the health staff, the patient's attention is distracted from the real world to the virtual world (28). This is based on the assumption that pain perception has a psychological structure, and accordingly human attention is limited and should be focused on the painful stimuli to perceive the pain. Therefore, pain perception is limited when attention of the individuals is distracted from the painful stimuli (29). On the other hand, regarding the fact that a closed space causes claustrophobia and anxiety (21) and since there is a two-way relationship between anxiety and pain, the increased anxiety results in the cycle of pain and anxiety (19, 20). In the same way, by separating the individual from the environment, the virtual reality headset creates a closed space so that the increased anxiety may lead to the increased pain as well as the continued cycle of pain and anxiety. The present study clearly showed that the multimedia system was an appropriate method for reducing the burn patients' pain compared to the virtual reality so that it significantly reduced the pain level; however, due to creating the claustrophobia and anxiety, the virtual reality led to a relative reduction in the pain level.

One of the limitations of the present study was that dressing of the female patients was performed with the help of the female researcher due to the cultural issues as well as the different gender of the researcher, so such a difference in the dressing method might influence results of the study. Moreover, the lack of private room for patients during the intervention, fatigue and stress of the patients during dressing due to the invasive operation, and the sample size limitation due to consideration of the below 25% burns were other factors that could affect the results. To compensate for these limitations at the time of dressing, the patient privacy was kept using a shield; besides, dressing was carried out early on the morning shift when fatigue and stress of patients were less. Since the patients with higher burn percentage were transferred to ICU and also due to the fact that it was impossible to perform sampling of the higher burn percentages in the ward, it is suggested to perform the future studies on the samples with burns of above 25%.

Conclusion

Results of the present study showed that the burn patients' pain during dressing was significantly reduced by the multimedia system method compared to the virtual reality technique, which indicated efficiency of the multimedia system compared to the virtual reality in reducing the burn patients' pain during dressing. On this basis, it is suggested to use this method to control

pain of the burn patients. Furthermore, it is proposed to evaluate this method seriously and precisely in the future studies in order to determine its advantages and disadvantages as well as its costs for the patient and care systems.

Hereby, the authors would like to acknowledge the Vice Chancellor of Tabriz University of Medical Sciences for financial support, authorities and employees of Sina Hospital in Tabriz for their cooperation to prepare a perfect environment for the research, and also the burn patients for their active participation in the study.

Competing interests

The authors declare that they have no competing interests.

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How to cite this article:
Ebrahimi H, Namdar H, Ghahramanpour M, Ghafourifard M, Musavi S. Effect of virtual reality method and multimedia system on burn patients' pain during dressing. J Clin Anal Med 2017;8(suppl 5): 485-9.