Effect of Virtual Reality on Distraction of Children Attention during Dressing of Second Degree Burns

Sabah Mohamed Sharshor [1], Tarek Gamal Shoukr [2], Hend Elzoghpy Abdelrahman Mohamed [3], Mai Hassan Hassan Elsharkawy[4]

[1] Assist. Professor of Pediatric Nursing, Faculty of Nursing, Tanta University, Egypt.
[2] Prof. of Plastic & Reconstructive surgery Plastic & Reconstructive Surgery department, Faculty of medicine, Tanta University, Egypt.

[3]Teacher at Biala Secondary Nursing School for Boys at KafrElshiekh Governorate .
[4]Lecturer of Pediatric Nursing, Faculty of Nursing, Tanta University, Egypt.

Abstract

Background: Children and adolescent with serious burns require nursing and medical care to alleviate pain. As a non-pharmacological adjuvant analgesic used to divert children's attention, virtual reality (VR) has gained popularity. The study **aimed** to evaluate effect of virtual reality on distraction of children attention during dressing of second-degree burns. **Subjects and method**: Purposive Sampling of 50 children with second degree of burn participated in the study. The study was conducted at Pediatric Burn Unit of Plastic and Reconstructive Surgery department of Tanta University. **Four tools were** used to gather data: burn wound assessment, children behavioral distress observational check list, pain assessment tool, and physiological measurement sheet. **Results**: The study cleared that there were statistically significant differences in pain attention, behavioral distress and improving physiological parameters for children with second degree burn during dressing change using virtual reality distraction in study group than control group. **Conclusion:** Virtual reality as distraction technique appeared to be effective in reducing pain attention, behavioral distress and enhancing physiological parameters during dressing change in children with second degree burn. **Recommendation:** Creating periodic in-service educational program for all nurses working in the burn unit to learn about the use of virtual reality to lessen the pain associated with burn dressing.

Keywords: Attention distraction, Behavioral distress, Pain, Second degree burn, Virtual reality, Wound dressing.

Introduction

Burns are serious health problem and high mortality rate affecting 3% of children. The incidence rate of burn injuries in children under 16 years old is 25%. According to the American Burn Association (ABA), there are 250000 burn injuries among children in the US each year, with 6% to 8% of those requiring hospitalization. [1,2] Burns may result from heat, cold, chemical, or electrical sources. However, a small percentage of burns are significant and need to be transferred to specialized burn centers, necessitating hospital admission in most cases. Burn is considered one of the most traumatic childhood injuries. [3] Domestic burns constitute the largest proportion of the causes of burns 90% of burn incidents in Egypt due to unsafe domestic practices and injuries resulting from hot liquids. Scalds accounted for 56.7% of the causes of burns, while 38.6% were due to flames. Electrical and chemical burns were the cause in 1.6%. [4]Burns are classified based on how much of the skin's thickness is involved. Superficial burns involve the epidermal layer. The skin becomes erythematous, blanching, dry, and painful, but will not have bullae (cavities filled with fluid). Partial thickness burns are involved the epidermis and a portion of the dermis, and result in the formation of bullae. They are further subdivided into superficial and deep.[5]

Superficial partial thickness burns are moist and elastic and will blanch with pressure and may have edema. Deep partial thickness burns are drier and do not fade with pressure. Full-thickness burns affect both the epidermis and dermis, and they are visible as white, waxy, or even burned skin. They are not destroyed, but any surrounding areas that are not full thickness will be painful the muscle below the skin. [6]

Treating childhood burn pain begins with an initial burn treatment approach that is similar regardless of the cause of the burn. The initial assessment should initially include the airway, breathing and circulation, followed by determining depth of burn, total body surface area of burn and parts of the body affected. Circumferential burns should be identified and monitored closely as they may require escharotomy. The management includes both pharmacological and non-pharmacological interventions. Using pharmacological analgesics can cause major adverse effects. [7, 8]

Children with severe burns require painful treatments that are repeated often in order to improve wound healing and prevent infection. Children often find burn dressing to be the most upsetting and difficult part of being hospitalized. Insufficient management of this pain has negative physical and psychological implications. Children with burns can use distraction as a non-pharmacological pain management method. [9]

Distraction is a type of strategy used to divert children's attention from painful Medical procedures, pain or thoughts of pain or suffering are presented in a more neutral way. There are many different forms of distractions, ranging from passive activities; watching TV or listening to music to active activities such as interactive toys, video

games or immersive technology approaches like virtual reality. [10- 12]

The term "virtual reality" refers to a 3D, multi-sensory, highly interactive artificial world that completely immerses the user to create a sensation of spatial presence. The ability to interact with and control virtual things naturally gives the user the impression that they are moving around in the virtual environment, which may lead to the user feeling cut off from the actual world while still being a part of the simulation. [13]

Significance of the study

The World Health Organization (WHO), considers burns to be the fifth common nonfatal injury in children. In addition to cellular damage, burns can lead to physical and psychological problems, changes in lifestyle, and a greater rate of morbidity and death. Additionally, unpleasant procedures that might result in pain, stress, and worry are part of managing the injuries. [14] By immersing children in an enjoyable visual or audio distraction environment during unpleasant procedures, virtual reality distraction is a psychology-based strategy that can help them focus on something other than their suffering. [15,16]

Children enduring a variety of short invasive procedures such as dental procedures, urological endoscopies or dressing changes for burns, are thought to benefit from virtual reality distraction. [17] So, the study aimed to evaluate the effect of virtual reality on distraction of children's attention during dressings for children with second degree burn.

Aim of the study

The aim of the present study was to evaluate effect of virtual reality on distraction of Children's attention during dressing of second degree burns.

Subjects and Method

Experimental research design was applied.

Setting

The study was conducted at Pediatric Burn Unit of Plastic and Reconstructive Surgery Department of Tanta University affiliated to the Ministry of High Education.

Subjects and sample: Purposive Sampling of 50 child from the previously mentioned setting and they divided randomly. The study and control group calculation is based on type I error 0.05 and confidence level 95%

They were divided into two groups:

1- **Study group: Twenty five** children who exposed to highly realistic virtual reality environment by three-dimensional simulating games watched by the child wearing three-dimensional vision goggles during wound dressings.

2- **Control group**: **Twenty five** children who not exposed to virtual reality environment during wound dressings.

Inclusion criteria:

-Children aged 6-15years.

- Children with second degree burn and total body surface area of burn up to 25%

Tools of data collection:

Four tools were used in this study as the following:

Tool I: Burn Wound Assessment: [18]

It was constructed by the researcher after reviewing the related literature and includes three parts:

Part1:Bio-Sociodemographic characteristics and Burn Wound Assessment: (Age, sex, medical history, residence**,** site of injury; total body surface area (TBSA) of burn; depth of burn; skin color and medication administered.)

Part 2: The history of burns in children includes: location of burn, time of burn and causes of burn.

Part 3: First aid and hospitalization of the studied children included: first aid before hospitalization, timing of hospitalization, surgical decision, and length of hospitalization.

Tool II: **Children behavioral distress observational check list :**[19]

It was utilized to observe children according to the degree of distress they displayed during procedures that indicated Discomfort (crying, screaming, physical restraint, verbal resistance, emotional support, information seeking, verbal pain, and flailing) at 15second intervals throughout the procedure. The results were summed for each 15second interval within the phases of the procedure and then divided by the number of intervals to obtain an average value. Each point was divided into (4) points according to the severity of the distress whereas:

- Severe distress (4).
- Moderate stress (3)
- Mild stress (2).
- No distress (1).
- The total score of children behavioral distress was classified as follows:
- 70 and more was considered severe distress.
- 70 < 60 was considered moderate distress.
- 60 <-50 was considered mild distress.
- Less than 50% was considered no distress.

Tool (III): **Pain assessment tool**

FLACC scale was adopted From Merkel S, et al. (1997) [20] **.** It was used to assess behavioral pain in children who cannot self-report their level of pain. Pain is assessed by observing 5 categories including (face, legs, activity, cry, and consolability).

Scoring system:-

-(0) Relaxed and comfortable.
-(1-3) Mild discomfort.
-(4-6) Moderate discomfort/pain.
-(7-10)Severe discomfort/pain.

The scale was applied at three times:

1- Just before dressing change.

2- During dressing change:

a) Without use of Virtual reality distraction in control group.
b) With Virtual reality distraction in study group.

3- After closing the dressing without Virtual reality distraction**.**

4- **Tool(IV):Physiological measurement Sheet:**

It was measured by the researchers to assess physiologic response to pain and to assess child's general condition by measuring body temperature, heart rate and respiratory rate.

- Body temperature was measured axillary.
- Heart rate was measured by palpation of the radial artery.
- Respiratory rate was measured by observing chest movement.

Method

1-**Administrative process:** The Dean of the Nursing Faculty provided official approval for data gathering, and the directors of Pediatric Burn Unit of Plastic and Reconstructive Surgery Department of Tanta University to obtain their approval and cooperation for carrying out the study.

2-Ethical and legal considerations- : Ethical committee approval was obtained from Faculty of nursing, Tanta University [code 13-11-21] and faculty of medicine code No. of approval 35100/12/21.

- The complete sample was not experiencing any pain or discomfort due to the nature of the study.

-Privacy and confidentiality were taken into account when collecting the data.

- Children and their mothers provided consent to take part in the study after outlining the study's objectives, approving its publishing in a scientific journal, and mentioning the option to withdraw at any time.

3-The study tools were developed based on review of related literature: four tools were utilized.

Tool I: was constructed by the researcher after reviewing the related literature. It comprised of three parts.

Tool II: Children behavioral distress observational check list, Tool (III) Pain assessment tool (FLACC scale) and Tool (IV): Physiological Measurement Sheet.

4- Five pediatric nursing experts judged the study tools' content validity, as well as their clarity, relevance, comprehensiveness, understanding, applicability, and ease of implementation. The content validity index was 98.5%.

5-Reliability: Internal consistency was used to evaluate the reliability of the developed tools and Cronbach's alpha was 0.881.

6- To assess the tool's clarity, application, and feasibility, a pilot study was conducted on 10% of the selected sample. The necessary changes were made and the data from the pilot study were not included in the study.

7-The study conducted within six months started from April 2022 to September 2022

Phases of the study

1)-Assessment Phase:

It was conducted by researchers for all study participants to collect baseline data and assess the child meeting the inclusion criteria of this study and child characteristic of burn. Then, the researcher began to ask children about their preferred mobile games, carton movies and explained the general objectives of the study. (**Tool 1**)

2)-Planning Phase:

-Setting equipment needed for virtual reality.

- Preparing virtual reality technology is an instrument consisting of a head-mounted device and a mobile phone that produces 3D real-time animation. In this study, it refers to employing mobile technologies to access this synthetic 3D environment. A child's attention can be diverted by a multisensory experience using the head-mounted device (HMD) with 3D-capable goggles, sensory input devices, and headphones

- Preparation of children and explain how to wear the goggles.

3)- Implementation Phase: -

- Each mother and her child who met the sampling inclusion criteria were interviewed

by the researchers at burn department. The researchers met every child in the previously mentioned setting after being admitted and hospitalized.

-The researchers attended to burn department 3 days per week in the morning shift whereas wound dressing procedure took place in the morning at 9am.

-The researchers began collecting the data of children (**Tool I)** within 10 minutes. Pain is assessed through observation of 5 categories including face, legs, activity, cry, and consolability (FLACC) scale **(Tool III)** The child were asked to wear three-dimensional vision eye goggles to watch three-dimensional games before time of the wound dressing procedure and during procedure the researchers measured intensity of pain, and was measured after dressing **(Tool III)** and Children behavioral distress observational check list used to observe children's behavioral reactions during procedures which indicate discomfort (**Tool II**)

The researchers assessed vital signs before, during, and following wound dressing. Using a thermometer, the body's axillary temperature was determined. The radial artery was palpated to determine heart rate, and chest movement was used to determine respiratory rate. (**Tool IV).**

4-Evaluation Phase:-

The evaluation was done to the children regarding level of pain which measured by (FLACC) scale **(Tool III)** before procedure without use of virtual reality, then during wound dressing with use of virtual reality and after wound dressing without use of virtual reality and level of behavioral distress accompanied wound dressing procedure was compared to the control group.

Statistical analysis

Statistical Package for the Social Sciences, version 20, SPSS Inc. Chicago, IL, USA, was used to organize, tabulate, and statistically analyze the acquired data. A range, mean, and standard deviation were computed for quantitative data. The Chi-square test was specifically used to compare two groups of qualitative data. The means of the two linked groups of parametric data (before and after data) were compared using the paired t-test. The Pearson correlation coefficient (r) is used to examine the relationship between the variables. In order to evaluate the findings of tests for significance, significance was adopted at p0.05, and highly significance was adopted at p0.01. [(21)]

Results

Table (1): Shows Percentage distribution of Socio demographic Characteristics and Burn Wound Assessment of studied children. The table reveals that average half (44%) of children their age were from 6-9 & 10-12 years respectively &nearly the same for control group. In relation to their sex nearly half (53%) of children (control &study) were males, majority of studied group (96%) had no medical history compared to 100% in control group. The table also show that 72%&80%of children used perflgan to relieve pain in both groups. 52% of studied and control group had red color skin with blisters .As regard mean total body surface area from 4-40% was25.960 ± 14.172 in study group compared to 19.440 ± 13.403 in control group.

Table (2): Shows behavioral distress among studied children during dressing change using virtual reality the findings shows that more than half of children (68%) had no distress during dressing in study group compared to 100% severe distress in control group. The table also shows a highly statistical significant difference between children behavioral distress in study and control group ($p<0.001$).

Table (3): Illustrates pain assessment in children in studied groups pre dressing without using virtual reality in both group, which was 92% severe pain in study group compared with 40 % in control group with statistical significant difference of pain between studied group p =0.001, during dressing with using virtual reality(92%) had moderate pain in study group while (100%) of control group had severe pain with highly statistical significant difference of pain between both groups ($p<0.001$), and after dressing without using virtual reality reveals that 56%of children had mild pain compared with 52 % had moderate pain in control group .

Table (4): Shows total mean score of studied groups regarding temperature. It reveals that mean score of temperature

decrease from 37.872 ± 0.368 before using virtual reality to 37.508 ± 0.330 during using virtual reality and also show highly statistically difference p<0.001, Also the mean score of temperature decrease from 37.828 ± 0.388 before dressing change to 37.432 ± 0.380 during dressing change in control group.

Table (5): The table presents decrease in mean score of pulse which decreases from 92.400 ± 10.992 to 90.560 ± 9.060 during using virtual reality in contrast to control group which increase from 88.560 ±9.328 before dressing change to 99.520±7.030 during dressing change. Table (6): Shows total mean score of respiration which decreases from 21.880 ± 2.619 before dressing change to 21.520 ± 2.417 during using virtual reality in contrast to control group while respiration increased from 19.920 ±3.546 before dressing change to 23.720 ± 2.031 during dressing change.

Table (7): Shows O2 saturation decrease from 93.760 ± 2.488 before dressing to 92.880 ±2.505 during using virtual reality in study group and from 94.960 ±2.406 before dressing change to 94.120 ±2.920 during dressing in control group.

Table (8): Shows correlation between Children behavioral distress, pain during dressing using virtual reality and age of the child in study group. The table show that nearly 73% of children their age ranged from 6-9 & 10-12 years, 33% of children aged from 13-15 years had no distress during dressing using virtual reality while total children (100%) had severe behavioral distress during dressing in control group and with significant negative correlations between studied children behavioral distress and age of the child (P<0.05) . In study group, the table also show that 90.9% of children their age ranged from 6-9 & 10-12 years ,100% of children aged from 13-15 years had moderate pain during dressing using virtual reality while 100% of all children had severe pain during dressing in control group with negative correlation between pain and age of children (p = 0.862).

Table (9): Shows, correlation between children behavioral distress, pain and sex of studied groups. In study group ,the table illustrate that 61.5%of male,75%of female had no distress during dressing when using virtual reality while both males and females had severe pain during dressing in control group and there was negative correlation between total children behavioral distress and their sex (p=0.568) .In addition the table show that 100% of males , 83 % of females had moderate pain during dressing when using virtual reality while both sex of males , females had severe pain in control group and there was negative correlation between pain and sex (p= 0.125).

Table (1): Percentage distribution of socio demographic characteristics and burn wound assessment of studied groups.

Sociodemographic Characteristics		Studied groups				Chi-Square	
		Study		Control			
		N	%	N	%	X^2	P-value
Age of the child	6-9 Years	11	44.00	11	44.00	1.167	0.558
	10-12 Years	11	44.00	13	52.00		
	13-15 Years	3	12.00	1	4.00		
Sex	Male	13	52.00	13	52.00	0.000	1.000
	Female	12	48.00	12	48.00		
Medical history	Yes	1	4.00	0	0.00	1.020	0.312
	No	24	96.00	25	100.00		
Residence	Urban	8	32.00	10	40.00	0.347	0.556
	Rural	17	68.00	15	60.00		
Site of injury	Head &neck	0	0.00	3	12.00	3.191	0.074
	Trunk	8	32.00	6	24.00	0.397	0.529
	Upper limb excluding hands	10	40.00	4	16.00	3.571	0.059
	Hands	7	28.00	11	44.00	1.389	0.239
	Lower limb	9	36.00	7	28.00	0.368	0.544
Skin color	Red color skin	3	12.00	4	16.00	3.029	0.387
	Red color skin with blisters	13	52.00	13	52.00		
	Red color and Swollen	7	28.00	3	12.00		
	White with blisters	2	8.00	5	20.00		
Depth of burn (second degree)	Epidermis and dermis layers	25	100.00	25	100.00	-	-
Medication administered	Nalofen	3	12.00	3	12.00	0.772	0.680
	Perflgan	18	72.00	20	80.00		
	IbuProfen	4	16.00	2	8.00		
T-Test						T	P-value
Total body surface area (TBSA) of burn	Range	4 - 40		4 - 45		1.671	0.101
	Mean ±SD	25.960 ± 14.172		19.440 ± 13.403			

Table (2): Percentage distribution of children behavioral distress of studied groups:-

Total Children behavioral distress observational check list	Studied groups				Chi-Square	
	Study		Control			
	N	%	N	%	X^2	P-value
No	17	68.00	0	0.00	46.154	<0.001*
Mild	6	24.00	0	0.00		
Moderate	1	4.00	0	0.00		
Severe	1	4.00	25	100.00		
Total	25	100.00	25	100.00		

Table (3): Percentage distribution of studied groups regarding pain before , during and after dressing change .

FLACC scale		Studied groups				Chi-Square	
		Study		Control			
		N	%	N	%	X^2	P-value
Pre	Relaxed and comfortable	0	0.00	8	32.00	16.407	0.001*
	Mild	0	0.00	2	8.00		
	Moderate	2	8.00	5	20.00		
	Severe	23	92.00	10	40.00		
During	Relaxed and comfortable	0	0.00	0	0.00	50.000	<0.001*
	Mild	2	8.00	0	0.00		
	Moderate	23	92.00	0	0.00		
	Severe	0	0.00	25	100.00		
Post	Relaxed and comfortable	4	16.00	5	20.00	6.111	0.106
	Mild	14	56.00	6	24.00		
	Moderate	7	28.00	13	52.00		
	Severe	0	0.00	1	4.00		
P-value	Pre-During	<0.001*		<0.001*			
	Pre-Post	<0.001*		0.004*			
	During-Post	<0.001*		<0.001*			

Table (4) :Total mean score of studied groups regarding temperature:-

Temperature		Group		T-Test	
		Study	Control	t	P-value
Before	Range	37.2 - 39	37 - 38.5	0.411	0.683
	Mean ±SD	37.872 ± 0.368	37.828 ± 0.388		
During	Range	37 - 38.5	36.5 - 38	0.754	0.454
	Mean ±SD	37.508 ± 0.330	37.432 ± 0.380		
After	Range	37 - 38.5	36.5 - 37.8	1.404	0.167
	Mean ±SD	37.340 ± 0.319	37.204 ± 0.365		
B-D	Differences	0.364 ± 0.189	0.396 ± 0.134		
	Paired Test	<0.001*	<0.001*		
B-A	Differences	0.532 ± 0.180	0.624 ± 0.207		
	Paired Test	<0.001*	<0.001*		
D-A	Differences	0.168 ± 0.204	0.228 ± 0.162		
	Paired Test	<0.001*	<0.001*		

Table (5): Total mean score of studied groups regarding pulse :-

Pulse		Group		T-Test	
		Study	Control	t	P-value
Before	Range	60 - 110	75 - 105	1.332	0.189
	Mean ±SD	92.400 ± 10.992	88.560 ± 9.328		
During	Range	65 - 105	87 - 110	-3.906	<0.001*
	Mean ±SD	90.560 ± 9.060	99.520 ± 7.030		
After	Range	60 - 95	76 - 90	-1.176	0.245
	Mean ±SD	82.880 ± 8.048	85.000 ± 4.062		
B-D	Differences	1.840 ± 5.625	-10.960 ± 7.220		
	Paired Test	0.115	<0.001*		
B-A	Differences	9.520 ± 7.246	3.560 ± 7.489		
	Paired Test	<0.001*	0.026*		
D-A	Differences	7.680 ± 5.121	14.520 ± 4.736		
	Paired Test	<0.001*	<0.001*		

Table (6): Total mean score of studied groups regarding respiration :-

Respiration		Group		T-Test	
		Study	Control	t	P-value
Before	Range	16 - 25	16 - 26	2.223	0.031*
	Mean ±SD	21.880 ± 2.619	19.920 ± 3.546		
During	Range	17 - 27	20 - 28	-3.484	0.001*
	Mean ±SD	21.520 ± 2.417	23.720 ± 2.031		
After	Range	16 - 23	16 - 22	-0.833	0.409
	Mean ±SD	18.240 ± 1.615	18.640 ± 1.777		
B-D	Differences	0.360 ± 2.498	-3.800 ± 2.160		
	Paired Test	0.478	<0.001*		
B-A	Differences	3.640 ± 2.413	1.280 ± 2.208		
	Paired Test	<0.001*	0.008*		
D-A	Differences	3.280 ± 1.860	5.080 ± 1.288		
	Paired Test	<0.001*	<0.001*		

Table (7) : Total mean score of studied groups regarding O2 saturation :-

O2		Group		T-Test	
		Study	Control	t	P-value
Before	Range	90 - 96	90 - 98	-1.733	0.089
	Mean ±SD	93.760 ± 2.488	94.960 ± 2.406		
During	Range	88 - 98	89 - 98	-1.611	0.114
	Mean ±SD	92.880 ± 2.505	94.120 ± 2.920		
After	Range	90 - 98	90 - 98	-2.559	0.014*
	Mean ±SD	94.000 ± 2.432	95.720 ± 2.319		
B-D	Differences	0.880 ± 2.242	0.840 ± 1.993		
	Paired Test	0.061	0.046*		
B-A	Differences	-0.240 ± 2.962	-0.760 ± 1.877		
	Paired Test	0.689	0.054*		
D-A	Differences	-1.120 ± 2.297	-1.600 ± 2.769		
	Paired Test	0.023*	0.008*		

Table (8): Correlation between Children behavioral distress, pain during dressing using virtual reality and age of the child:-

Group			Age of the child						Chi-Square	
			6-9 Years		10-12 Years		13-15 Years			
			N	%	N	%	N	%	X^2	P-value
Study	Total Children behavioral distress observational check list	No	8	72.73	8	72.73	1	33.33	16.087	0.013*
		Mild	3	27.27	3	27.27	0	0.00		
		Moderate	0	0.00	0	0.00	1	33.33		
		Severe	0	0.00	0	0.00	1	33.33		
	Pain Pre	Moderate	0	0.00	2	18.18	0	0.00	2.767	0.251
		Severe	11	100.00	9	81.82	3	100.00		
	Pain During	Mild	1	9.09	1	9.09	0	0.00	0.296	0.862
		Moderate	10	90.91	10	90.91	3	100.00		
	Pain Post	Relaxed and comfortable	2	18.18	2	18.18	0	0.00	1.623	0.805
		Mild	5	45.45	7	63.64	2	66.67		
		Moderate	4	36.36	2	18.18	1	33.33		
Control	Total Children behavioral distress observational check list	Severe	11	100.00	13	100.00	1	100.00	-	-
	Pain Pre	Relaxed and comfortable	5	45.45	3	23.08	0	0.00	7.517	0.276
		Mild	0	0.00	2	15.38	0	0.00		
		Moderate	1	9.09	3	23.08	1	100.00		
		Severe	5	45.45	5	38.46	0	0.00		
	Pain During	Severe	11	100.00	13	100.00	1	100.00	-	-
	Pain Post	Relaxed and comfortable	2	18.18	3	23.08	0	0.00	4.083	0.665
		Mild	4	36.36	2	15.38	0	0.00		
		Moderate	4	36.36	8	61.54	1	100.00		
		Severe	1	9.09	0	0.00	0	0.00		

Table (9): Correlation between Children behavioral distress, pain and sex of studied groups: -

Group			Sex				Chi-Square	
			Male		Female			
			N	%	N	%	X^2	P-value
Study	Total Children behavioral distress	No	8	61.54	9	75.00	2.022	0.568
		Mild	3	23.08	3	25.00		
		Moderate	1	7.69	0	0.00		
		Severe	1	7.69	0	0.00		
	Pain Pre	Moderate	1	7.69	1	8.33	0.003	0.953
		Severe	12	92.31	11	91.67		
	Pain During	Mild	0	0.00	2	16.67	2.355	0.125
		Moderate	13	100.00	10	83.33		
	Pain Post	Relaxed and comfortable	3	23.08	1	8.33	1.105	0.576
		Mild	7	53.85	7	58.33		
		Moderate	3	23.08	4	33.33		
Control	Total Children behavioral distress	Severe	13	100.00	12	100.00	-	-
	Pain Pre	Relaxed and comfortable	4	30.77	4	33.33	3.766	0.288
		Mild	0	0.00	2	16.67		
		Moderate	2	15.38	3	25.00		
		Severe	7	53.85	3	25.00		
	Pain During	Severe	13	100.00	12	100.00	-	-
	Pain Post	Relaxed and comfortable	3	23.08	2	16.67	1.907	0.592
		Mild	2	15.38	4	33.33		
		Moderate	7	53.85	6	50.00		
		Severe	1	7.69	0	0.00		

Statistically significant difference at ($P<0.05$)

Discussion

Virtual reality (VR) is a way to reduce the negative impact of painful intervention in children by in cooperating fun into distraction. The use of interactive virtual environments makes it possible to capture more attention, as virtual reality is considered a complementary strategy that has been proven to produce positive results in children's attention being diverted during painful procedures, especially during burn wound dressing. (22)

This study cleared that average half of studied children their age ranged from 6-9 & 10-12 years. This school age period which characterized by being more creative and being more active which lead to several accidents including burns. These resul similar to results of **Lauwens et el (2020) who** reported that most of their study children are from 6-12 years old. (23)

The results of the current study illustrated that more than half of studied children were males. It may be due to males may be active and having physical activities more than females. **Hoffman et el (2020)** supported the current study and reported the major sector were males (24) .While**, Gupta (2018)** disagreed with this result and mentioned that the majority of studied children were female (25)

The results of the present study illustrated that more than half of children were living in rural area. This can be due to different factors including lack of parental supervision and inappropriate cooking practices. Similarly, **Ridout (2021)** reported that most children with burns live in rural area. (26)

Regarding pain assessment in children in the virtual reality group and the control group before, during and after dressing changes, the result of the current study revealed that children in the virtual reality group had an observable reduction in pain scores during and after dressing children in the control group. This may be due to that the children considered the VR fun, engaging, realistic and were enjoyable to try discovering a new technology so the VR has great role to distract children attention during painful procedures. **Henry Xiang et al (2021)** was congruent with the study and reported that the most of children in the distraction group had either mild pain or no pain, with statistically significant differences between the mean pain scores of children using the virtual reality distraction technique and those who underwent dressing without it. (27).

While, on the contrary **Taylor et al. (2021)** stated that no difference between historical controls (no VR) and children undergoing minor surgery with VR and local anesthesia in their pain scores. (28) Also according to **Walther-Larsen (2019)** also reported that No significant difference in pain scores was noted between the two groups but higher satisfaction when using VR versus standard care. (29)

The current study showed that the children's overall behavioral distress scores were different between both groups, with the behavioral distress scores in the VR group being lower during the dressing than in the no-distraction technique group, and with a highly significant difference between the two groups. This means that virtual reality was effective in declining behavioral distress during dressing changes. Similarly, **(Sung-HeeHan et el 2019) (30)** reported that virtual reality was more effective methods in

minimizing children's anxiety and distress during medical procedures. On the other hand, **Canares 2021** stated that there were no differences in distress for children between the groups. [31]

Regarding physiological parameters the present study showed decrease in means of pulse and respiration in the VR group during dressing change. This finding was supported by **Wong (2021)** who mentioned that when comparing to a control group, pulse rates in the VR distraction group were considerably lower.[32] Also **Butt (2022)**mentioned that decline in respiration when using virtual reality during painful medical procedures .[33]on the other hand, **Ding (2019)** reported that no significant variations in pulse and any physiological parameters were found between the VR and control groups. [34]

Regarding oxygen saturation, no significant differences in O2 in both two groups during the dressing changes. Also, **Walco et al (2015)** stated that no significant differences in O2 levels across groups were seen during the dressing changes. This could be because a variety of things, besides pain, have an impact on O2. The oxygen saturation impacted by other factors such as the age of the children, their anxiety and stress levels, medicine usage, and how much they participate in distraction techniques. [35]

The study determined that there was significant negative correlations between Total studied children behavioral distress and age of the child. This is may be due to the older children can express their feeling , report their feeling and understanding painful procedure more than younger children .This matched with **Heijden et al (2017)** who said that younger children often had higher distress levels than older ones. [36]These findings are inconsistent with **Indovina (2018)** who reported that younger children had less score of distress during medical procedures. [37]

The study cleared that there is a negative correlation between children's ages and their pain sensation. This relationship may be due to children's need to verbally communicate their pain, which can be challenging for younger children. This matched with **Hadley et al. (2019)** who mentioned that children between the ages of 10 and 14 benefit more from fully immersive VR [38]In contrast **Piskorz (2018)** noted that age of children has no impact on their level of pain. when using virtual reality environment during any painful procedure. [39]

The study revealed that there were a statistically negative correlation between children's behavioral distress and sex in the control group. it may be due to both males and females have the same reaction to painful procedures in this period of age mainly in young age **Özalp (2020)** was in harmony with current study and stated that there was no difference in the studied groups' levels of pain with reference to the point of sex**.**[40]

The present study also finds that there was a negative correlation between pain levels and children's gender. This due to both children in this age have no tolerance to pain According to **Karakaya (2016),** whose findings were consistent with the current findings, There was no obvious variation in the groups' pain levels according to their gender**..** [41]

Conclusion and Recommendations

Based upon the findings of the present study, it can be concluded that distraction techniques using virtual reality had a significant positive effect in minimizing behavioral distress, physiological parameters and intensity of pain associated with second degree burn during dressing change among children.

Recommendations:

Based on the findings of the present study, the following recommendations are suggested:

1. Distraction strategies should be incorporated into everyday nursing care using a variety of pharmacological techniques.
2. Creating periodic in-service educational program for all nurses working in the burn unit to learn about the use of virtual reality to lessen the pain associated with burn dressing.
3. Both members of the health team and the families should have access to written booklet regarding burn pain and its alleviating non-pharmacological pain treatment approaches.
4. Equipment for virtual reality distraction should be available at pediatric burn unit to divert the children's attention.
5. Other techniques can be used as passive distraction for attention such as watching TV which is already found in burn unit in dressing room and was recommended to having something fun for children such as cartoon.

Reference

1. Moehrlen T, Landolt M, Meuli M, Moehrlen U. Non-intentional burns in children: Analyzing prevention and acute treatment in a highly developed country. Journal of the International Society for Burn Injuries. 2019; 45(8):1908-917.
2. Barrett L, Fear S, Waithman C, Wood M, Fear W. Understanding acute burn injury as a chronic disease. Journal of Burns & trauma.2015;7(1):12-23.
3. Jeschke G, van E, Choudhry M, Chung K, Gibran S, Logsetty S. Burn injury. Journal of Nature Reviews Disease Primers. 2020; 6(1):1-25.
4. Halawa E, Barakat A, Rizk H, Moawad E. Epidemiology of non-fatal injuries among Egyptian children. Journal of BMC public health. 2015; 15(1) :1-9.
5. Rice L, Orgill D. Assessment and classification of burn injury.journal of British of Journal Anaethesia. 2022; 22(3): 94-103
6. Rangaraju P, Kunapuli G, Every D, Ayala D, Ganapathy P, Mahadevan A. Classification of burn injury using Raman spectroscopy and optical coherence tomography. Journal of Burns.2015; 45(3): 659-70.
7. Baakdah A, Turkistani M, Al-Qarni M, Al-Abdali N, Alharbi A, Bafaqih A, Alshehri S. Pediatric dental treatments with pharmacological and non-pharmacological interventions. Journal of bmc oral health, (2021). 21(1):1-9.
8. Khademi D, Kamangar D, Brennan D, Malekzadeh R. Opioid therapy and its side effects journal of. Archives of Iranian medicine. 2016;19(12): 870.
9. Scapin Q, Echevarría E, Fuculo B, Martins C, Barbosa V, Pereima M. Use of virtual reality for treating burned children. The Brazilian **Journal** of Nursing. 2017; 70(2): 1291–295.

10. Brown J, Rodger S, Ware S, Kimble M, Cuttle L. Efficacy of a children's procedural preparation and distraction device on healing in acute burn wound care procedures. journal of Trials. 2019; 13(1):238.

11. Green E, Cadogan J, Harcourt D. A qualitative study of health professionals' views on using iPads to facilitate distraction during paediatric burn dressing changes. Journal of Scars, burns & healing. 2018; 4(1): 23-122.

12. Scapin S, Guanilo E, Junior F, Goncalves N, Rocha K, Coimbra R. Virtual Reality in the treatment of burn patients. Journal of Burns. 2018;44(6): 1403- 416.

13. Khadra C, Ballard A, Déry J, Paquin D, Fortin S, Perreault I, LeMay S. Projector-based virtual reality dome environment for procedural pain and anxiety in young children with burn injuries Journal of pain research. 2018;48(97) :343-353.

14. Suman A, Owen J. Update on the management of burns in paediatrics. Journal of BJA education. 2020; 20(3): 103.

15. Tennant M, McGillivray J, Youssef J, McCarthy C, Clark J. Feasibility, acceptability, and clinical implementation of an immersive virtual reality intervention to address psychological well-being in children and adolescents with cancer. Journal of Pediatric Oncology Nursing. 2017;37(4): 265-77.

16. Ding J, He Y, Chen L, Zhu B, Cai Q, Chen K, Liu G. Virtual reality distraction decreases pain during daily dressing changes following haemorrhoid surgery. Journal of International Medical Research. 2019; 47(9): 4380-88.

17. Tork D , Basam A. The Effect of Virtual Reality-Based intervention on pediatric pain and anxiety levels during Venipuncture procedure. Journal of International Medical Research . 2015;7(1): 626-35.

18. Wang Q, Xu S, Guo B, Xu Y,Lu W. Virtual reality as an adjunctive non-pharmacological therapy to reduce pain in school-aged children with burn wounds. Journal of Burn Care & Research. 2023 ; 44(4) :832-36.

19. Elliott C, Jay S, Woody P. An observation scale for measuring children's distressduring medical procedures. Journal of Pediatric Psychology. 1987;12 (1):543–51.

20. Merkel S, Voepel-Lewis T, ShayevitzR, Malviya S.The FLACC: A behavioural scale for scoring postoperative pain in young children. Pediatric nursing.1997;23:293-797.

21. White S. Reading the medical literature: Basic & Clinical Biostatistics. Lange Medical Book. Medical Publication Division. New York. 5th ed: McGrawHill Co., 2019,161-218.

22. Zeroth A, Dahlquist M, Craft C. The effects of auditory background noise and virtual reality technology on video game distraction analgesia.Journal of Pain .2019 ;19(1) :207-17.

23. Lauwens Y, Rafaatpoor F, Corbeel K, Broekmans S, Toelen J, Allegaert K.Immersive virtual reality as analgesia during dressing changes of hospitalized children and adolescents with burns. 2020; 7(11):194.

24. Hoffman G, Patterson R, Rodriguez A, Peña R, Beck W, Meyer J. Virtual reality analgesia for children with large severe burn wounds during burn wound debridement. Journal of Frontiers in virtual reality. 2020; 1 (1) :602299.

25. Gupta A, Scott K, Dukewich M. Innovative technology using virtual reality in the treatment of pain. Journal of Pain Medicine. 2018; 19(1) : 151-59.

26. Ridout B, Kelson J, Campbell A, Steinbeck K. Effectiveness of virtual reality interventions for adolescent patients in hospital settings.Journal of medical Internet research .(2021). 23(6): 24967.

27. Xiang H., Shen J, Wheeler K, Patterson J, Lever K, Armstrong M ,Fabia B. Efficacy of smartphone active and passive virtual reality distraction vs standard care on burn pain among pediatric patients. Journal of JAMA Pediatrics .2021; 4(6) :2112082.

28. Taylor S, Chandler M, Menendez M, Diyaolu M, AustinR, Gibson L,Chao D. Small surgeries, big smiles: using virtual reality to reduce the need for sedation or general anesthesia during minor surgical procedures. International Journal of Pediatric Surgery . 2021 : 37 (1):1437-45.

29. Walther S, Petersen T, Friis S, Aagaard G, Drivenes B, Opstrup P. Immersive Virtual Reality for Pediatric Procedural Pain. Journal of Pain Research 2019 ;9(7):501-7.

30. Ryu H, Park J, Nahm S, Jeon T, Oh Y, Lee H, Han S. The effect of gamification through a virtual reality on preoperative anxiety in pediatric patients undergoing general anesthesia. Journal of clinical medicine .2018; 7(9): 284.

31. Canares T, Parrish C, Santos C, Badawi A, Stewart A, Kleinman K, McGuire J. Pediatric coping during venipuncture with virtual reality . Journal of JMIR Pediatrics and Parenting. 2021; 4(3) : 26040.

32. Wong L, Li C, Chan W, Choi K, Chen J, Yeung T, Chan N. Virtual reality intervention targeting pain and anxiety among pediatric cancer patients undergoing peripheral intravenous. Journal of Cancer Nursing . 2021: 44(6): 435-42 .

33. Butt M, Kabariti S, Likourezos A, Drapkin J, Hossain R, Brazg J, Motov S. Efficacy of mindfulness-based virtual reality as an intervention in the pediatric emergency department. Journal of Academic Emergency Medicine. 2022. 29(3) :270-77.

34. Ding J, He Y, Chen L, Zhu B, Cai Q, Chen K, Liu G. Virtual reality distraction decreases pain during daily dressing changes following haemorrhoid surgery. International Journal of Medical Research .2019; 47(9) :4380-88 .

35. Hua Y, Qiu R, Yao Y, Zhang Q, Chen L. The effect of virtual reality distraction on pain relief during dressing changes in children with chronic wounds on lower limbs. Journal of Pain Management Nursing . 2015 :16(5): 685-91.

36. Heijden E, de Jong A, Rode H, Martinez R, van Dijk M. Assessing and addressing the problem of pain and distress during wound care procedures in pediatric patients with burns. Journal of Burns. 2017 ;18 (4) :66-97.

37. Indovina P, Barone D, Gallo L, Chirico A, De Pietro G, Giordano A. Virtual reality as a distraction intervention to relieve pain and distress during medical procedures. The Clinical journal of pain .2018; 34(9): 858-77.

38. Hadley W, Houck C, Brown K, Spitalnick S, Ferrer M,Barker D.evaluating the use of virtual reality to teach emotion regulation for the prevention of adolescent risk behavior .Journal of pediatric psychology .2019;44(4) :425-35.

39. Piskorz J, Czub M. Effectiveness of a virtual realityintervention to minimize pediatric stress and pain intensityduring venipuncture. J ournal of Specialists Pediatric Nursing. 2018;23 (1):12201.

40. Özalp G, Ayar D, Özdemir Z, Bektaş MEffects of virtual reality on pain, fear and anxiety during blood draw in children aged 5–12 years old.Journal of clinical nursing . 2020; 29(7):1151-61.

41. Karakaya A, Gozen D. The effect of distraction on pain level felt by school-age children during venipuncture procedure. Journal of Pain Management Nursing. 2016;17(1):47-53.