Effect of Applying Virtual Reality Glasses as A supportive Intervention to Reduce Pain, Anxiety and Fear of Children during Burn Dressing

Yasmine Abd EL Ghany- Abd EL-Fatah[1], Eman Ahmed Samir[2] and Reda Abd-El Mohsen Mahmoud[3]

(1,2,3) Lecturers of Pediatric Nursing/ Faculty of Nursing/ Benha University/Egypt

Abstract:

Background: Burn injuries hurt physically and mentally, this is particularly true for young children who might not accept that procedural pain as dressing changes is a necessary component of recovery. **The study's aim was** to evaluate the effect of applying virtual reality glasses as a supportive intervention to reduce pain, anxiety, and fear of children during burn dressing. **Research design:** A quasi-experimental design was utilized to conduct the study. **Setting:** The study was conducted in Burn Department at Benha Teaching Hospital in Benha City, which affiliated to Egyptian Ministry of Health and Population. **Sample:** A purposive sample consisting of 60 children, they were divided randomly into control and study groups. **Tools of data collection** included four tools, **Tool (I):** A structured Interviewing Questionnaire Sheet that consisted of; **Part (1):** Personal characteristics of children**. Part (2):** Physiological measurements of children such as;, pulse, respiration, saturation level and dressing duration time**. Tool II: Pain assessment tool:** it included: **Part (1)** Children behavioral distress observational check list. **Part (2):** Wong- Baker faces (FACES) pain rating scale. **Tool (III):** Children's fear scale. **Tool (IV):** Beck Anxiety Inventory (BAI) scale**. The results:** revealed that there was a highly statistical significance difference between children' total level of pain, fear and anxiety before dressing compared to during dressing change with virtual reality glasses. **Conclusion:** It was concluded that, virtual reality glasses were an effective method in reducing pain, fear, anxiety, and physiological parameters caused by burn dressing in children aged 6–12 years. **Recommendation:** Conducting periodic in-service educational programs for all nurses working in the burn unit to learn about the use of virtual reality glasses to lessen the pain, fear and anxiety associated with burn dressing.

Keywords: Virtual Reality Glasses, Supportive intervention, Pain, Anxiety, Fear and Burn Dressing.

Introduction:

Burns are injuries to the skin and tissue brought on by a variety of substances, including fire, scalds, electricity, chemicals and radiation. Burn injuries are a major public health concern worldwide, causing approximately 310,000 fatalities annually due to their great risk of mortality and morbidity. Scald burns account for over 75% of burns in young children, and infant mortality rates are the highest. Numerous factors, including a large burn's surface area, inhalation injuries, poverty, and sepsis, greatly increase the risk of burn death and morbidity **(Żwierełło et al., 2023).**

Burn injuries are a serious health issue that can have long-term psychological and physiological effects. They are particularly common in children and require lengthy recovery. Compared to adults, children are more vulnerable to deeper burns due to their

thinner dermis. Environmental factors, local customs, sex, age, and economic status all influence the epidemiological patterns of burns. Total Body Surface Area (TBSA) and depth are used to evaluate the severity of burns. Based on TBSA, depth, and location, burns are categorized as superficial, partial, or full texture and range in severity from minor to major **(Ciornei et al., 2023).**

Even at facilities with all the necessary equipment, treating burns in children is difficult, expensive, and complex. Children who need burn treatment experience excruciating agony, physical strain, and psychological harm from wound debridement, frequent dressing changes, during hospitalization. Early traumatic characteristics of the burn include pain and anxiety during operations and burns. While a number of pharmacologic and non-pharmacologic therapies have reduced pain during burn dressing application, their effectiveness is still somewhat restricted **(Kaya & Özlü 2023).**

Pain is not only a sensory experience, but it is also an emotional and cognitive one, thus treating it alone with medication is insufficient. It is advised to use non-pharmacological techniques in addition to pharmaceutical ones to manage burn dressing discomfort and lower the amount of analgesic medication used. One of the utmost widely used non-pharmacologic strategies to lessen burn dressing pain perception and manage anxiety and fear is the distraction strategies **(Farzan et al., 2023).**

A more recent kind of diversion that may have been utilized in the pediatric context to help children feel less afraid and lessen pain is virtual reality (VR). Children undergoing burn treatment now have more options for managing their pain, fear, and anxiety due to recent developments in virtual reality technology. In recent years, using virtual reality as a distraction technique has grown in popularity as a supportive intervention **(Bahrololoomi et al., 2024).**

Children find virtual reality distraction especially captivating as it offers a fully immersive experience, both in terms of sound and visuals. VR has a lot of potential in the field of pediatrics since it directly appeals to children's imaginative and curious nature. With the three-dimensional world displayed directly before them on the headset screen, children may move about and engage with it. VR has been successfully used as a distraction technique in several healthcare procedures and settings for adults and children. VR can also used during venipuncture, dental work, burn injury repair, cancer therapy, and imaging tests like MRIs **(Oh et al., 2023).**

One way to categorize virtual reality (VR) is by the degree of immersion that the children feel. There are three types of VR systems available: completely immersive, semi-immersive, and non-immersive desktop. Using fully immersive virtual reality as a pain management tool has just become more popular in the last ten years, making it a relatively modern kind of diversion. This is mostly because of the more recent developments in the subject, which provide greater mobility, usability, and accessibility **(Niaz et al., 2023).**

Significance of the study:

In Egypt, burns are a major public health concern and a frequent cause of unintentional deaths. Every year burns to children cause over 100,000 emergency room visits and 2,500 fatalities. Children's burns are the number one cause of unintentional home

deaths under the age of fifteen and the fourth greatest cause of death for those under the age of fifteen. The majority of victims are under five years old **(Jordan et al., 2022).**

Burn injuries are a substantial cause of disability in children and are linked to the highest use of national health care resources. The World Health Organization (WHO) estimates that burns cause 180,000 child deaths annually and are a major source of illness and mortality worldwide **(Youssef et al., 2019).**

Providing a non-pharmacological method to lessen the discomfort and anxiety frequently is associated with invasive medical procedures, virtual reality (VR) has the prospective to have a considerable impact on nursing practice **(Abdel-Salam et al., 2023).** Therefore, this study was conducted to evaluate the effect of applying virtual reality glasses as a supportive intervention to reduce pain, anxiety, and fear of children during burn dressing.

Aim of the study

This study aimed to evaluate the effect of applying virtual reality glasses as a supportive intervention to reduce pain, anxiety, and fear of children during burn dressing through:

- Assessing the pain intensity of children undergoing burn dressing.
- Assessing the level of anxiety of children undergoing burn dressing.
- Assessing the level of fear of children undergoing burn dressing
- Evaluating the effect of applying virtual reality glasses on reducing pain, anxiety, and fear of children during burn dressing

Research Hypothesis:

The virtual reality glasses application is expected to be an effective supportive intervention on reducing children's level of pain, fear, and anxiety during burn dressing.

Subjects and method

Research design:

A quasi-experimental design was utilized to conduct the study.

Research setting:

The study was conducted in Burn Department at Benha Teaching Hospital in Benha City, which affiliated to Egyptian Ministry of Health and Population.

Sample:

The sample of the study was a purposive sample consisting of (60)child, they will be divided into control and study group. The process of assigning children into groups was established using a simple randomization method.

They were divided into two groups:

1- Study group: Thirty children who exposed to highly realistic virtual reality environment by three-dimensional simulating games watched by the child wearing three-dimensional vision glasses during burn dressing.

2- Control group: Thirty children who were not exposed to virtual reality environment during burn dressing and they are receiving traditional care.

Inclusion criteria of children:

- Children aged from 6-12 years who were undergoing burn dressing.
-Both genders.
- Children agreed to participate in the study.

Exclusion criteria of the children:

-Children who were medically unstable and unable to participate.
-Children with cognitive disabilities may struggle to comprehend and engage in the study methods.
-Children who have visual, or hearing problems may have a different experience with virtual reality glasses.

-Children with craniofacial anomalies may limit the correct use and fit of virtual reality glasses.

Tools of data collection:

Four tools were utilized to collect the data. These tools include the following:

Tool (I): A structured interviewing questionnaire sheet. It was developed by the researchers based on scientific literatures; it included two parts:

Part (1): Personal characteristics of Children.

Concerned with personal characteristics of the studied children such as; age, gender, educational level, site of burn and degree of burn.

Part (2): Physiological measurements of children such as; pulse, respiration, saturation level and dressing duration time.

Tool II: Pain assessment tool: it included two parts:

Part (1): Children behavioral distress observational check list: It was adopted from **Elliott et al., (1987),** to observe children according to the degree of distress they displayed during procedures that indicated discomfort as (crying, screaming, physical restraint, verbal resistance, emotional support, information seeking, verbal pain, and flailing at 15seconds 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).

Total score of children behavioral distress was classified as follows:

≥70 was considered severe distress.

70 < 60 was considered moderate distress. 60 <-50 was considered mild distress.

< 50% was considered no distress.

Part (2): Wong- Baker faces (FACES) pain rating scale:

It was adopted from **Wong &Baker, (1983)** to assess the intensity of pain in children. It consisted of 6 line-drawn faces ranging from "no hurt" to "hurts worst".

Scoring system of Wong- Baker faces (FACES) pain rating scale.

A scoring system was used to categorize pain into four levels and take scores; no pain (0), mild pain (1-2), moderate pain (4-6), and severe pain (8-10.)

Tool III: Children's fear scale (CFS):

It was adopted from **(McKinley, Coote, & Stein- Parbury, 2003)** to assess fear level in children experiencing painful medical procedures. This scale contained a row of five neutral faces ranging from a no fear face on the far left to a face showing extreme fear on the far right.

Scoring system of children's fear scale:

Scores on the CFS were translated to numerical scores and the total score ranges from 0 – 4. The scoring system was used to divide up fear into four levels namely: no fear (zero), mild fear (1), moderate fear (2), severe fear (3) and extremely fear (4).

Tool IV: Beck Anxiety Inventory (BAI) scale:

It was Adapted from **Beck et al, (1988).** It was used to assess children's anxiety levels during burn dressing consist of 20 items with a total score of 60. The mean scores for various levels of anxiety take scores as follows: not at all (0), mild (1), moderate (2), and severe (3).

Scoring system: The total anxiety score was then classified into the following categories: low anxiety: (0 to 21), moderate anxiety: (22 to 40), and high anxiety: (41 to 60).

Tools validity and reliability:

Validity

To evaluate the face and content validity of the study tools, the researchers submitted it to a jury of three experts (professors) in the field of Pediatric Nursing from Faculty of nursing, Benha university. Modifications of the study tools were done in accordance with the panel's evaluation of the sentences' clarity, appropriateness of content and sequence of items.

Reliability

Considering reliability, internal consistency of each tool's component was applied by the researchers by using Cronbach′s coefficient alpha. The reliability for the pain rating scale illustrated a coefficient alpha of r=0.84, fear scale yielded a coefficient alpha of r=0.88 and the anxiety scale yielded a coefficient alpha of r=0.92.

Ethical considerations:

Approval of the Scientific Ethical Research Committee in the Faculty of Nursing, Benha University was obtained (1/1/2024) prior data collection. The researchers clarified the purpose of the study and the expected outcomes to all contributing children during the initial interview. Oral approval was obtained from children's parents to participate in the study. The children were self-assured that all information would be kept confidential. Additionally, they were notified that they can withdraw from the study at any time without requiring to provide a reason.

Pilot study:

To assess the applicability and validity of the study tools and the time required to complete the questionnaire, a pilot study was conducted on 10% of the total sample (6 children). The study sample included the pilot subjects because no significant changes were made to the study tools.

Field work:

The actual field work was carried out over a period of three months and half (from middle of January 2024 to the end of April 2024) to accomplish the study's objective. The study was conducted through four phases, these phases include the following.

1-Assessment Phase:

Researchers collected baseline data from all studied children and assessed the selected children as well as the child's burn characteristics. The researcher then began to ask children about their favored mobile games, carton movies, and outlined the overall aims of the study. **(Tool 1)**

2-Planning Phase:

-Setting equipment required for virtual reality.
(Virtual reality (VR) 3D glasses).

-Virtual reality technology is a tool that creates 3D real-time animation using a head-mounted device and a smartphone. This study discusses the use of mobile devices to access this synthetic 3D environment. A multimodal experience utilizing a head-mounted device (HMD) with 3D-capable glasses, sensory input devices, and headphones can divert a child's attention.

- The researchers select games and videos based on the studied children's needs utilizing the following steps: Preparation and organizing of material videos and games based on children's ages and abilities. Selecting games and videos. Using virtual reality glasses approaches. **Preparing and organizing the material of games and videos;** the content of games and videos was prepared and organized under various headings based on the aim, objectives.

- **Select the games and videos:** The researchers' selection of videos based on the subsequent criteria: Children's needs and interest should be catered for in games and videos. Section breaks should be included in videos and games. Games and videos ought to have a respectable level of technical quality. Every video game's duration and speed are suitable for the age and gender of the children.

Manipulating and rearranging videos and games creates flow. Add effects, graphics, and music, change the style, pace, or tone of the videos and games to adjust the angle, then watch and take notes. Music, sound, colour adjustment, and additional effects were added. The prepared games and videos were edited by a video professional.

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

3 -Implementation phase:

-Researchers conducted interviews with each child who fulfilled the sampling inclusion criteria at the 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 (Saturday, Monday, and Wednesday) in the morning shift where burn dressing procedure took place in the morning at 9am.

-The researchers began collecting the data of each child. **(Tool I)** within 10 minutes

After that, the researcher classified the children into control and study groups equally and started to assess control group first to avoid bias.

For the control group:

The researchers measured the child's physiological parameters before and during burn dressing (temperature, pulse, respiration, saturation level) The body's axillary temperature was measured with a thermometer. The respiration rate was measured by observing movement of the chest, and the heartbeat was measured by palpating the radial artery. (Tool, I part 2) within 15-20 minutes.

- After the initial assessments, the researchers assessed the children's pain sensations, fear, and anxiety level using **tools II, tool III** and **tool IV** respectively before time of the burn dressing change procedure and during procedure to determine objective pain scores.

For the study group:

Each child should receive psychological preparation, including the importance of virtual reality glasses on their body muscles. Physical preparation comprises, helping the child assume relaxing position, such as; sitting with their entire back resting beside the back of a chair, placing their feet flat on the floor with legs separated, or lying supine with a pillow under their head.

The researchers measured the child's physiological parameters before and during burn dressing (temperature, pulse, respiration, saturation level) The body's axillary temperature was measured with a thermometer. The respiration rate was measured by observing movement of the chest, and the heartbeat was measured by palpating the radial artery. (Tool, I part 2) within 15-20 minutes.

- After the initial assessments, the researchers assessed the children's pain sensations, fear, and anxiety level using tools II, tool III and tool IV respectively before time of the burn dressing procedure and during procedure to determine the intensity of pain. The child was asked to wear three-dimensional vision eye goggles to watch three dimensional games before time of the burn dressing procedure and during procedure the researcher's measured intensity of pain, fear, and anxiety level using tools II, tool III and tool IV respectively.

4-Evaluation phase:

The evaluation was done to the children regarding level of pain, fear, and anxiety level using tools II, tool III and tool IV respectively before procedure without use of virtual reality, and then during dressing change with use of virtual reality and level of behavioral distress accompanied dressing change procedure was compared to the control group.

Administrative Design:

A letter was submitted from the Dean of the Faculty of Nursing, Benha University to the director of Benha teaching hospital and the head of the burns department containing purpose of the study and methods of data collection.

Statistical analysis:

Using an electronic computer and the SPSS version 20 statistical tool, the gathered data were arranged, tabulated, and analyzed. For the data, descriptive statistics were computed in the following formats: frequency and distribution for qualitative data, mean and standard deviation for quantitative data. Moreover, the chi square test was used in analytical statistics to compare categorical data between groups (X^2 value). Pearson's correlation coefficient test was also applied. In all results, a P value of less than 0.05 was recognized as statistically significant (*),a P value of more than 0.05 as statistically insignificant, and a P value of greater than 0.001 as highly significant (**).

Results:

Table (1): Illustrates that, less than half (46.7%) of children's age is about 6 < 8 years in study group while, more than one quarter (26.7%) of them is about 10 <12 years in the control group and the mean age is about 9.00±4.432 & 8.000±4.010 years for both groups respectively. While, more than half of children of children (63.3%) in study group are females. Regarding site of burn, less than half (40.0% & 43.3%) have burned in the head and trunk in the control and study group respectively. Regarding degree of burn, more than half of children (63.3%) in the study group have a second degree of burn. Moreover, there are no statistical significance differences between children in both study and control groups.

Table (2): Clarifies that, the mean heart rate of the study group during intervention was 89.56 ±9.06 b/m while, mean heart rate of the control group was 99.52 ±7.031 b/m. Regarding respiratory rate, the mean respiratory rate of the study group during intervention is 17.4±2.31 c/m while, is 23.720 ± 2.031 c/m in the control group. Regarding oxygen saturation, the mean of the study group during intervention is 94.000 ± 2.432 while, is 90.86 ± 2.11 in the control group. It also shows that, mean dressing duration time is10.5± 6.32 min in the study group while, is16.3± 6.32min in the control group. Therefore, there are highly statistical significance difference (P<0.000) between children in the study group during intervention compared to control group.

Table (3): Illustrates that, less than three quarters (73.3%) of children in the study group have no pain during dressing with VR intervention while, more than half (56.6%) of children in the control group have severe pain during dressing without VR intervention. Therefore, there are highly statistical significance difference(P<0.000) between children in the study group during/ intervention compared to control group.

Table (4): Shows that, one third (33.3%) of children in the study group hurts little more before dressing while, two thirds (66.7%) of them have no hurt during dressing with VR intervention. It also clarifies that, more than half of children in the control group (56.6%) have hurts worst during dressing without VR intervention. Therefore, there are highly statistical significance difference (P<0.000) between children in the study group during/ intervention compared to control group.

Figure (1): Illustrates that, half (50.0%) of the studied children had severe level of pain before

the virtual reality glasses intervention. However, during the virtual reality glasses intervention, two thirds (66.7%) had mild level during the intervention. there is highly statistical significance difference (P<0.000) between children in the study group before/ compared to during intervention.

Table (5): Clarifies that, more than one quarter (30.0%) of children in the study group have severe fear before dressing while, less than two thirds (60.0%) of them have no fear during dressing with VR intervention. It also clarifies that, more than one third and less than half of children in the control group (36.6% & 43.3%) have extremely fear before and during dressing without VR intervention respectively. Therefore, there are highly statistical significance difference (P<0.000) between children in the study group during/ intervention compared to control group.

Figure (2): Illustrates that, more than half (53.3%) of the studied children had severe level of fear before the virtual reality glasses intervention. However, during the virtual reality glasses intervention, less than two thirds (60.0%) had mild level during the intervention. there is highly statistical significance difference (P<0.000) between children in the study group before/ compared to during intervention.

Table (6): Clarifies that, the mean wobbliness in legs of children in the study group before intervention is 2.74± 898 while, is 1.99± 743 during intervention. Regarding heart pounding/racing, the mean of children in the study group before intervention is 2.56± 767 while, is 1.45± 547 during intervention. Regarding hands trembling, the mean of children in the study group before intervention is 2.53± 652 while, is 1.67± 534during intervention. It also shows that, mean hot/cold sweats is2.86± 864 of children in the study group before intervention while, is 1.52±537 during intervention. Therefore, there are highly statistical significance difference (P<0.000) between children in the study group before compared to during intervention.

Fig (3): Illustrates that, less than three quarters (70.0%) of the studied children had a high anxiety level before the virtual reality glasses intervention. However, during the virtual reality glasses intervention, more than half (54.0%) had a low anxiety level during the intervention.

Table (1):- Distribution of the studied children according to their personnel characteristics and their medical history in the study/control group (n =60)

Items	Study group n=30		Control group n=30		X^2	P value
	No.	%	No.	%		
Age/ years						
6 < 8	14	**46.7**	9	30.0		
8 <10	7	23.3	7	23.3		
10<12	9	30.0	8	**26.7**	0.184	0.589
Mean ±SD	**9.00±4.432**		**8.000±4.010**			
Gender						
Male	19	**63.3**	12	40.0		
Female	11	36.7	18	60.0	0.659	0.217
Educational level						
Primary	11	36.7	9	30.0		
Preparatory	9	30.0	10	33.3		
Secondary	10	33.3	11	36.7	1.257	1.895
Site of burn						
Head &neck	13	**43.3**	12	**40.0**		
Trunk	3	10.0	5	16.7		
Upper limb excluding hands	4	13.2	3	10.0		
Hands	8	26.7	7	23.3	0.845	0.793
Lower limb	2	6.6	3	10.0		
Degree of burn						
First degree	3	10.0	7	23.3		
Second degree	19	**63.3**	14	46.6	2.891	0.247
Third degree	8	26.7	9	30.0		

Table (2): Mean scores of the studied children's physiological parameters undergoing dressing change in the study / control group (n =60)

Physiological Parameters	Group		Paired T- test	P value
	Study (With VR intervention)	Control (without VR intervention)		
	Mean ±SD	Mean ±SD		
Heart rate (b/m)				
Before dressing	**95.4 ±10.45**	94.6 ±10.44	1.332	0.189
During dressing	**89.56 ±9.06**	99.52 ±7.031	1.024	0.001*
Temperature				
Before dressing	37.87±0.36	37.82±0.388	0.411	0.683
During dressing	36.71±0.330	37.4±0.380	0.754	0.001*
Respiration				
Before dressing	19.5±2.78	19.880 ± 2.619	2.223	0.564
During dressing	17.4±2.31	23.720 ± 2.031	0.721	0.001*
Oxygen saturation				
Before dressing	**92.70 ± 2.54**	91.86 ± 2.43	2.733	0.189
During dressing	**94.000 ± 2.432**	90.86 ± 2.11	2.559	0.001*
Dressing duration time / min				
Before dressing	15.3± 7.24	15.4± 7.53	3.411	3.521
During dressing	10.5± 6.32	16.3± 6.32	2.754	0.001*

Statistical significant at P value <0.001*

Table (3): Percentage distribution of the studied children's behavioral distress undergoing dressing change in the study / control group (n =60)

Total children behavioral distress	Study group n=30		Control group n=30		X^2	P value
	During dressing with VR intervention		During dressing without VR intervention			
	No.	%	No.	%		
No	22	**73.3**	0	0.0	45.243	0.000**
Mild	8	26.7	0	0.0		
Moderate	0	16.7	13	43.4		
Severe	0	0.0	17	56.6		
Total	30	100.0	30	100.0		

Highly statistical significant at P value <0.000**

Table (4): Percentage distribution of studied children's pain according to Wong- Baker faces (FACES) pain rating scale undergoing dressing change before and during virtual reality intervention in the study / control groups (n =60)

Items		Study group (With VR intervention) n=30		Control group (without VR intervention) n=30		X^2	P value
		No.	%	No.	%		
Before dressing	No hurt	0	0.0	0	0.0	30.243	13.254
	Hurts little bit	1	3.3	2	6.6		
	Hurts little more	10	**33.3**	7	23.3		
	Hurts even more	4	13.4	6	20.0		
	Hurts whole lot	8	26.7	5	16.8		
	Hurts worst	7	23.3	10	**33.3**		
During dressing	No hurt	20	**66.7**	0	0.0	50.452	0.000**
	Hurts little bit	10	33.3	0	0.0		
	Hurts little more	0	0.0	0	0		
	Hurts even more	0	0.0	8	26.6		
	Hurts whole lot	0	0.0	5	16.8		
	Hurts worst	0	0.0	17	**56.6**		

Highly statistical significant at P value <0.000**

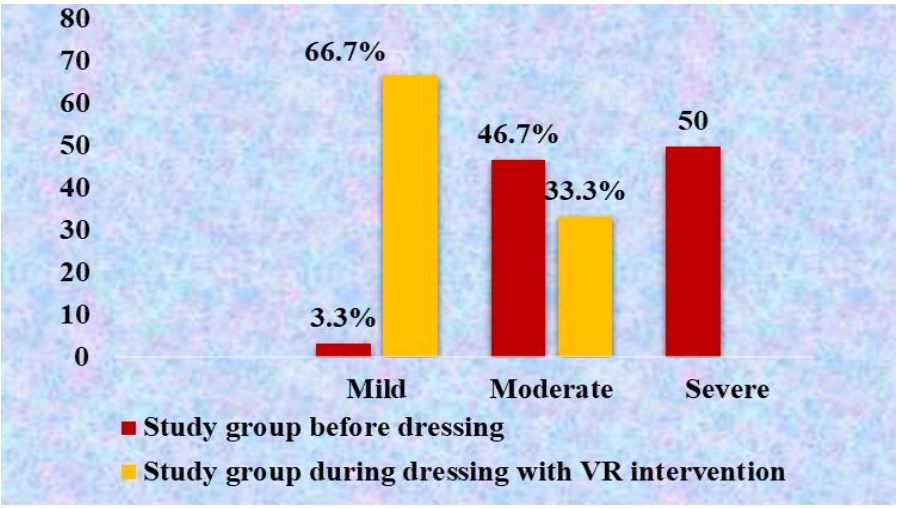

Figure (1): Percentage distribution of total pain score according to Wong- Baker faces (FACES) pain rating scale among children undergoing dressing change before and during virtual reality intervention in the study group (n =30)

Table (5): Percentage distribution of the studied children's fear according to children's fear scale undergoing dressing change before and during virtual reality intervention in the study / control groups (n =60)

Items		Study group (With VR intervention) n=30		Control group (without VR intervention) n=30		X^2	P value
		No.	%	No.	%		
Before dressing	No fear	0	0.0	0	0.0	34.354	12.241
	Mild fear	6	20.0	5	16.7		
	Moderate fear	8	26.7	4	13.4		
	Severe fear	9	**30.0**	10	33.3		
	Extremely fear	7	23.3	11	**36.6**		
During dressing	No fear	18	**60.0**	0	0.0	50.452	0.000**
	Mild fear	12	40.0	6	20.0		
	Moderate fear	0	0.0	7	23.3		
	Severe fear	0	0.0	4	13.4		
	Extremely fear	0	0.0	13	43.3		

Highly statistical significant at P value <0.000**

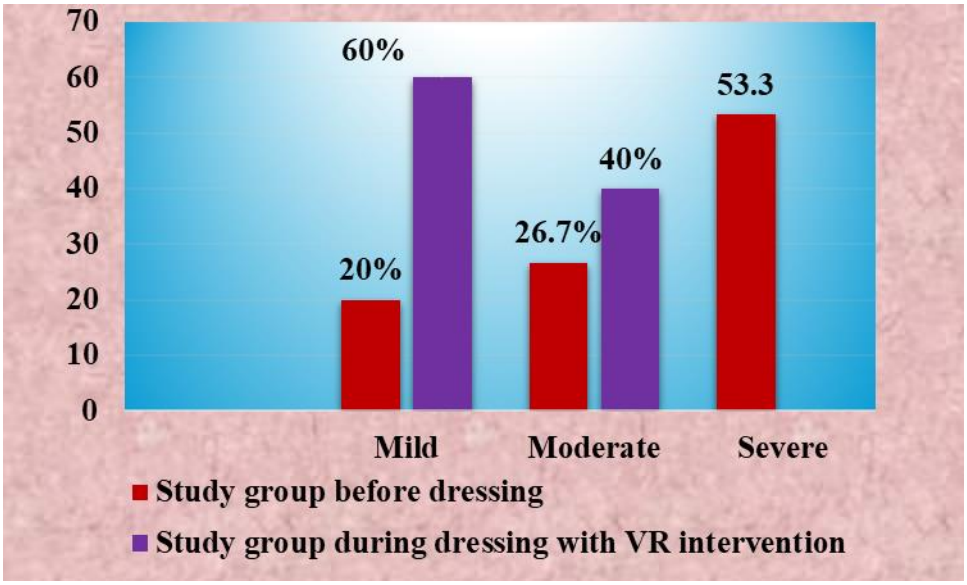

Figure (2): Percentage distribution of total fear score according to children's fear scale among children undergoing dressing change before and during virtual reality intervention in the study group (n =30)

Table (6): Mean and standard deviation of the studied children's anxiety signs according to Beck Anxiety Inventory (BAI) scale undergoing dressing change before and during virtual reality intervention in the study group (n =30)

Items	Study group n=30		Paired t-test	P Value
	Before intervention	During intervention		
	Mean ±SD	Mean ±SD		
Numbness or tingling	2.56± 704	1.98± 643	5.215	0.00**
Feeling hot	2.53± 645	1.67± 532	5.324	0.00**
Wobbliness in legs	**2.74± 898**	1.99± 743	5.824	0.00**
Unable to relax	2.47± 677	1.77± 549	5.478	0.00**
Fear of worst happening	2.71± 764	1.84± 668	6.325	0.00**
Dizzy or lightheaded	2.43± 845	1.52± 664	5.142	0.00**
Heart pounding/racing	**2.56± 767**	1.45± 547	5.236	0.00**
Unsteady	2.41± 764	1.75± 547	6.245	0.00**
Terrified or afraid	2.54± 707	1.78± 684	5.324	0.00**
Nervous	2.43± 675	1.64± 534	6.123	0.00**
Feeling of choking	2.54± 847	1.49± 754	5.214	0.00**
Hands trembling	**2.53± 652**	1.67± 534	6.102	0.00**
Shaky / unsteady	2.50± 788	1.76± 641	5.324	0.00**
Fear of losing control	2.53±852	1.58± 547	6.310	0.00**
Difficulty in breathing	2.12± 835	1.54± 576	5.147	0.00**
Fear of dying	2.54± 845	1.47± 684	5.210	0.00**
Scared	2.46±768	1.54± 531	6.248	0.00**
Indigestion	2.43± 846	1.72± 584	5.914	0.00**
Face flushed	2.50± 894	1.70± 654	6.357	0.00**
Hot/cold sweats	**2.86± 864**	1.52±537	5.467	0.00**

Highly statistically significant at P value <0.000**

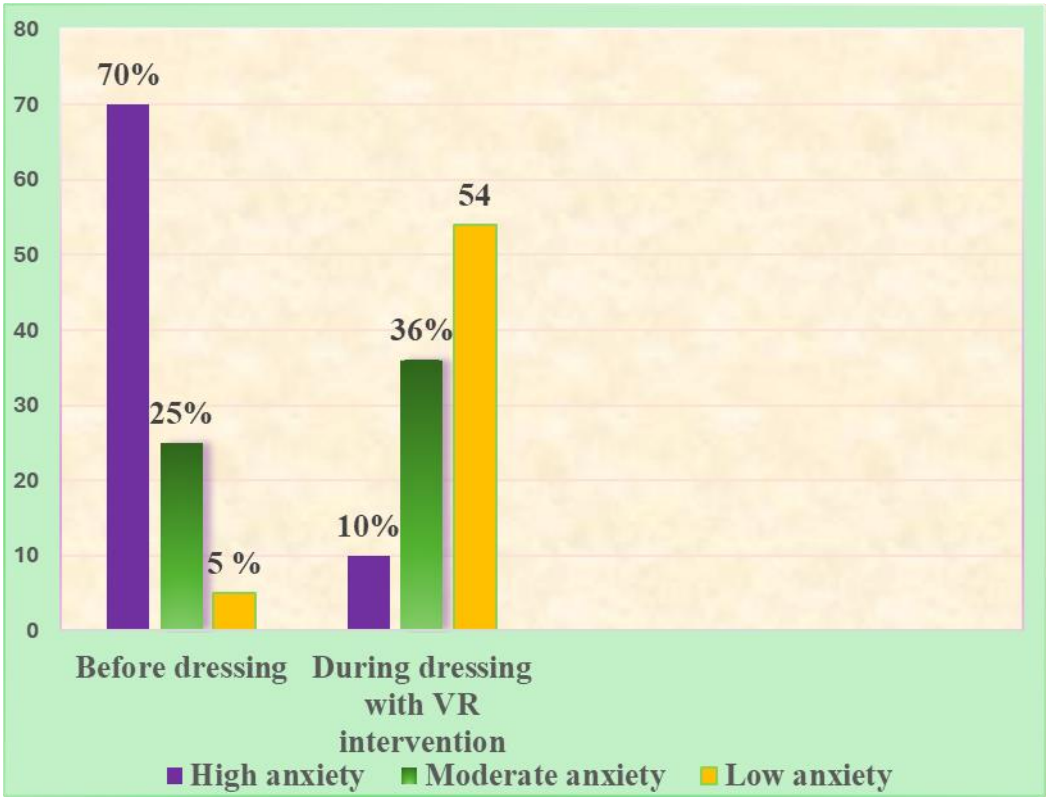

Figure (3): Percentage distribution of total anxiety score among children undergoing dressing change before and during virtual reality intervention in the study group (n =30)

Discussion

Burn injuries have a high death rate and are a serious public health issue. Children with severe burns need unpleasant interventions often, such dressing changes, to promote wound healing and prevent infection. Children who receive burn dressings, which are an essential part of burn care, experience severe pain, misery, and frequently even fear **(Markiewicz-Gospodarek et al., 2022)**

New opportunities for the treatment of pain and anxiety in children receiving burn treatment have been made possible by recent developments in virtual reality technology. Children spend less time thinking about pain because VR distraction diverts their focus from processing pain **(Savaş et al., 2023).**

This study aimed to evaluate the effect of applying virtual reality glasses as a supportive intervention to reduce pain, anxiety, and fear of children during burn.

According to characteristics of studied children, the current study illustrated that, less than half of children's age is about 6 < 8 years in study group while, more than one quarter of them is about 10 <12 years in the control group and the mean age is about 9.00±4.432 & 8.000±4.010 years for both groups respectively. This result was correspondent to results of **Lauwens et al., (2020)** who reported that most of their study children are from 6-12 years. Also, the existing study displayed that the nearly two thirds of children in study group were females. This result was supported with

Gupta (2018) who illustrated that, most studied children were female.

Regarding site of burn, less than half of children have burns in the head and trunk in both the control and study group. This is explained by the fact that scald burns often occur when children reach for a container of hot liquid while playing or pull a hot substance from either a cooking stove or a countertop, resulting in immersion or spilling of the hot substance on the children's upper extremities (head and trunk). This result was aligning with **Gessesse & Yitayew (2020),** who displayed that, 47.1 % of cases burn occur in upper extremities.

Regarding physiological parameters, the present study showed decrease in pulse and respiration in the study group with VR during wound dressing and there is highly statistical significance difference (P<0.000) between children in the study group during intervention compared to control group. From the researcher's perceptiveness, that changes in the physiological parameter may be attributed to the fear and anxiety experienced by children during burn dressing. This finding was supported by **Kaya & Özlü (2023)** who mentioned that, the pulse and respiration rates in the VR distraction group were considerably lower.

This finding is in accordance with **Helmy et al. (2022)** who found that there were declines in mean pulse and respiration rates of children in the virtual reality group compared to the control group, with statistically significant differences observed before and during intervention.

Concerning children's behavioral distress level, the current study results illustrated that less than three quarters of children in the study group have no pain during dressing change with VR intervention while, more than half of them have severe pain in the control group during dressing without VR intervention. This could be attributed to the positive effect of virtual reality application in reducing children's behavioral distress level during the burn dressing.

These findings are confirmed by **Gerçeker et al. (2021)** who discovered that the use of virtual reality in the intervention group significantly reduced pain competed to the control group receiving pharmacological intervention alone.

Regarding children's pain according to Wong- Baker faces (FACES) pain rating scale. The study findings showed that, one third of children in the study group hurts little more before dressing while, two thirds of them have no hurt during dressing with VR intervention. Therefore, there are highly statistical significance difference (P<0.000) between children in the study group during intervention compared to control group. This can be attributed to that virtual reality glasses is one of distraction techniques helping in reducing children's pain level during the dressing change.

The study result comes in accordance with **Alrimy et al., (2023)** who noticed that there is significant reduction in pain using FLACC pain scale during VR treatment compared to traditional treatment with a statistically significance difference between two groups.

Concerning children's fear, the present study results demonstrated that more than one quarter of children in the study group have severe fear before dressing while, less than two thirds of them have no fear during dressing with VR intervention. Therefore, more than one third and less than half of

children in the control group have extremely fear before and during dressing without VR intervention respectively. From the researcher's point of view this is due to the effectiveness of virtual reality application in reducing children's level of fear during dressing change.

The study results were consistent with **Bannink Mbazzi et al., (2022)** who found that, the use of virtual reality in the intervention group significantly reduced fear scores compared to the control group. Also, this result comes in accordance with (**Kılıç & Tural Büyük (2024)** who reported that VR intervention reduced children fear during dressing (P<0.000) which is consistent with our results.

Concerning children's anxiety according to Beck Anxiety Inventory (BAI) scale. The findings of the current study displayed that, there were highly statistical significance difference (P<0.000) between children in the study group before compared to during intervention. These results are in line with **Smith et al. (2022)** who reported that reduced levels of pain and anxiety in the active virtual reality group compared to the standard care group, with significant differences detected in pain intensity and distress behaviors. The findings of **Sharshor et al., (2023)** also support these results, as they found significantly lower pain and anxiety scores during procedures in the virtual reality group compared to the control group. These findings suggest that virtual reality glasses have a strong and positive effect on reducing anxiety levels in children.

In conclusion, the use of virtual reality glasses has a strong positive effect in reducing pain, fear, and anxiety levels in children during burn dressing. These findings are coherent with previous studies and highlight the importance of virtual reality as a non-pharmacological distraction intervention for managing pain, fear, and anxiety in pediatric patients.

Conclusion:

Based on the present study's results, it can be noticed that VR was found to be an effective supportive intervention in reducing the pain, anxiety, fear levels and physiological parameters of children undergoing dressing change.

Recommendations:

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

- Conducting periodic in-service educational programs for all nurses working in the burn unit to learn about the use of virtual reality to decrease the pain, fear and anxiety associated with burn dressing.
- Both members of the health team and the families should have access to booklets regarding burn pain and its alleviating non-pharmacological pain treatment approaches.
- Equipment for virtual reality distraction should be available at pediatric burn unit to divert the children's attention.
- Future studies should investigate the long-term effects of VR interventions on pain and anxiety levels, as well as explore potential psychological and physiological benefits.

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تأثير تطبيق نظارات الواقع الافتراضي كتدخل داعم لتقليل الألم والقلق والخوف لدى الأطفال أثناء تضميد الحروق

ياسمين عبدالغني عبدالفتاح- ايمان احمد سمير- رضا عبدالمحسن محمود

تؤدي إصابات الحروق إلى آلام جسديًه وعقليًه وينطبق هذا بشكل خاص على الأطفال الذين قد لا يتفهمون أن الألم الإجرائي أثناء تغيير الحروق هو جزء أساسي من أجل التعافي. لذا هدفت هذه الدراسة الي تقييم تأثير تطبيق نظارات الواقع الافتراضي كتدخل داعم لتقليل الألم والقلق والخوف لدى الأطفال أثناء تضميد الحروق. و تم استخدام تصميم شبه تجريبي لإجراء هذه الدراسة. حيث أجريت هذه الدراسة في قسم الحروق بمستشفى بنها التعليمي بمحافظة القليوبية التابعة لوزارة الصحة والسكان المصرية على عينة غرضية مكونة من (60) من الأطفال أثناء تضميد الحروق. وتم استخدام ثلاث ادوات: الأداة الأولى: استمارة استبيان بالمقابلة، مكونة من جزئين الجزء الأول: الخصائص الشخصية للأطفال. الجزء الثاني: العلامات الفسيولوجية للأطفال. الأداة الثانية: أداة تقييم الألم ، مكونة من جزئين الجزء الأول: قائمة ملاحظة الاضطرابات السلوكية للأطفال. الجزء الثاني: مقياس تصنيف الألم في وجوه وونغ بيكر. الأداة الثالثة: مقياس الخوف لدي الأطفال. الأداة الرابعة: مقياس بيك للقلق. و أوضحت الدراسة بأن هناك فرق ذو دلالة إحصائية عالية بين المستوى الكلي للألم والخوف والقلق لدى الأطفال قبل مقارنة أثناء تضميد الحروق باستخدام نظارات الواقع الافتراضي. كما تطبيق نظارات الواقع الافتراضي يعتبر تدخل داعم و فعال في تقليل الألم ,القلق, الخوف والعلامات الفسيولوجية أثناء تضميد الحروق لدى الأطفال ما بين 6-12 عام. وقد أوصت الدراسة بضرورة تطوير برامج دورية توعوية لجميع الممرضين العاملين في وحدة الحروق للتعرف على كيفية استخدام نظارات الواقع الافتراضي لتخفيف الألم والخوف والقلق أثناء بتضميد الحروق.