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Effect of Using Virtual Reality as Non-pharmacological Therapy to Reduce Pain in Chronic Septic Wounds for Patient with Cancer

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Abstract

Context: In the late stages of cancer, approximately 5% of individuals experience cancerous wounds and the life expectancy ranges from 6 to 12 months. Without a tailored and collaborative treatment approach, the frequency of persistent septic wounds is increased. These wounds frequently result in substantial pain, significantly affecting the patients' quality of life. **Aim:** to evaluate the effect of using virtual reality as non-pharmacological therapy to reduce pain in chronic septic wounds for patient with cancer. **Methods:** The research utilizes a quasi-experimental design, with study and control groups to fulfill its objectives. It was carried out within the Oncology department at Aswan University Hospital; the study involved a purposive sample of 80 patients. Various assessment tools were employed, including a structured interviews questionnaire for patient and Patient assessment which comprised three sections: Visual Analogue Pain Scale, Measuring the Vital Signs and Anxiety using Hamilton Anxiety Rating Scale. Additionally, a Patient Satisfaction Scale was utilized as part of the study's methodology. **Results:** The results indicated that the difference between study and control groups was statistically significant across all parameters including vital signs and pain intensity post using virtual reality also there was marked decrease in the percentage distribution for all variables of behavioral, physiological and discomfort for study group after using the virtual reality with statistically significant difference. **Conclusion:** Virtual reality application showed successful action as a non-pharmacological intervention in diminishing pain, anxiety and vital signs scores. Significant differences were revealed between the study and control groups, particularly the heart rate and blood pressure readings, resulting in enhanced physiological and behavioral aspects. Consequently, patients expressed higher satisfaction levels during dressing the chronic septic wounds among patients with cancer. **Recommendations:** Additional investigations involving larger sample sizes under similar conditions could offer conclusive proof of the efficiency of virtual reality. This would facilitate the integration of such an intervention into the standard care protocol for chronic septic wounds among patients with cancer.

Keywords: Cancer, Chronic Septic Wound, Non-pharmacological Therapy, Pain & Virtual Reality.

Introduction

With an estimated 18.1 million individuals getting yearly a new diagnosis with cancer. Cancer ranks as the second global cause of mortality. Cancerous wounds are described as complex, chronic, painful wounds that don't heal and produce a lot of foul-smelling discharge due to increased necrosis and infection. Cancerous wounds often result from genital, breast, lung, head and neck, or primary skin tumors that metastasized from their original locations. (**Furka, et al., 2022).**

Persistent septic wounds typically exhibit an irregular proliferative phase or enduring inflammation, resulting in an extended healing period lasting for months or even years. Although challenging to address, a thorough comprehension of the underlying pathophysiology, coupled with attentive care, often contributes to a successful recovery (**Lier, et al., 2020).** People who had chronic wounds deal with persistent, resistant and incapacitating pain that could even occur while they are at rest and that does not go away despite the use of regularly prescribed painkillers. **(Esumi, et al., 2020)**.

When changing the dressing, people with chronic wounds experience greater agony. Trauma caused by the wound cleaning procedures, replacement of dressings, and repetitive manipulation of the wound are all contributing to moderate and severe pain at the time of change. When changing a dressing, mechanical manipulation activates nociceptors, which are sensitized by sensory receptors in the wound bed that react to pressure and other mechanical stimuli which increase the pain perception. **(Ahmad, et al., 2019)**.

Therefore, the sensation of discomfort or pain during dressing changes is a personal experience shaped by a range of psychological variables. Several studies observed a moderate pulsating pain in chronic wounds during the dressing change, particularly when removing the previous dressing and cleansing the wound bed **(Spiegel, et al., 2019).**

Virtual reality (VR) initially conceptualized in the 1960s, underwent continuous development until the conclusion of the 20th century. This technology is rooted among the interdisciplinary collaboration **(Dailey-Hebert, et al., 2021).** In general, VR systems comprise hardware components like computers, mobile device, glasses, headphones, and gloves, along with software that creates virtual environments spanning various contexts like beaches, forests, and amusement parks. This makes VR an affordable and promising tool for pain management. The reviewed researches indicated that VR demonstrated efficacy in mitigating pain for patients undergoing invasive procedures, such as dressing changes for burns and postoperative discomfort. This emphasizes how it is important it is to implement cutting-edge VR technology that could successfully "distract" nociceptors during dressing changes, hence it is lowering pain thresholds **(Grassini, 2022).**

The VR technology is mostly been utilized in nursing education, particularly distance learning and simulation-based skill training. However, an increasing body of evidence suggests that VR could be employed in more inventive ways, particularly in ameliorating the physical challenging and psychological symptoms, especially in the context of chronic septic wounds among patients with cancer **(Plotzky, et al., 2021)**.

Significance of the study:

A person with advanced cancer had a 5% chance of developing malignant wounds and their life expectancy will be only between 6 to 12 months. The symptoms become worse in the absence of an interdisciplinary and personalized treatment plan. **(Furka, et al., 2022).** Approximately 10 million individuals were succumbed to cancer-related causes worldwide in 2020. This included 2.26 million cases of lung cancer, 1.93 million cases of colon and rectal cancer, 2.21 million cases of breast cancer, and 9.6 million fatalities linked to other cancers. Remarkably, low- and middle-income nations were accounted for 51% of cancer cases worldwide. **(Ferlay, et al., 2021).**

Chronic septic wounds are prevalently increasingly, leading to intense pain that significantly diminished patients' quality of life **(Park, et al, 2021)**. The proportion of patients with chronic wounds ranges from 0.16 to 1.2. Eighty percent of individuals with wounds encounter varying degrees of pain **(Araújo, et al., 2021)**. Virtual reality diminishes the processing amplitudes in the cerebral cortex following painful stimuli. These reductions are associated with the early regulation of sensory inputs and are connected to the perception of nociceptive stimuli **(Esumi, et al., 2020)**.

Despite the frequent that necessitate for patients with cancer who suffer from persistent infected wounds to undergo dressing changes, also there is a lack of research on the efficacy of VR in alleviating pain and discomfort during such procedures. So, it is necessary to develop publications that consider the wellbeing of patients as well as a new autonomous method for the professionals' medical staff to lessen patient's discomfort. Therefore, the purpose of this study was to determine whether using virtual reality as a non-pharmacological intervention could effectively reduce pain among patients with cancer who have chronically infected wounds.

Aim of the study:

To evaluate the effect of using virtual reality as non-pharmacological Therapy to reduce pain in chronic septic wounds for patient with cancer.

Research hypotheses:

H1: After using virtual reality, study participants' pain scores will be lower than before compared to control group.

H2: After using virtual reality, study participants' vital signs scores will dramatically be improved compared to control group.

H3: After using virtual reality, study participants' behavioral and physiological scores will be enhanced.

Study Design:

To achieve the objective of the study, a quasi-experimental research design, was employed involving two groups study and control. The aim of a quasi-experimental design is to establish a cause and effect relation between the independent and dependent variable. But unlike an actual experiment, a quasi-experiment does not depend on random assignment **(Reichardt, 2019).** Virtual reality is the study's independent variable, and level of pain, vital signs and anxiety of patients with cancer who suffer from persistent septic wounds' discomfort is the dependent variable.

Setting:

The research was conducted in the Oncology department of Aswan University Hospital. The department contains five patients' rooms (for females and males). Each room including 3 beds and other room for examination and dressing which served patients with cancer from areas around the governorate of Aswan.

Subjects:
A purposive sample of patients (study – control) with diagnoses of cancer was enrolled in this study. who admitted to the oncology department at Aswan University Hospital from both sexes), aged between 35 and 60 years old.

Exclusion criteria:
Patients with dementia or history of major psychological disorder which could affect the patient communication with the researcher and take analgesic, all were excluded from the current study.

The sample size was determined using the G POWER 3.1 software program **(Rosner, 2016)**. The research required a minimum sample of 80 patients, with a 5% alpha error, 80% power, and an effect size of 0.39. The study comprised 80 participants, evenly divided into two groups: one for the study and the other for the control. Each group consisted of 40 patients who willing to participate in the research. The study group underwent wound dressing with the use of VR, while the control group received the routine standard wound care without VR.

Tools for data collection
Three research tools were employed to gather data for the study:

Structured patient interviewing questionnaire:
The researcher developed this questionnaire in an Arabic language based on **Zhang et al. (2022)** it encompasses two parts as following:

Part I. Patient's personal characteristics*:* This part concerned with assessment of patient's personal characteristics as age, gender and level of education.

Part II: Patient's Medical data: concerned with assessment of cancer types such as acute lymphoblastic leukemia, breast cancer, gastrointestinal system, lung cancer and bladder cancer. Beside assessing the cancer stage (I, II, III and metastasis). The types of treatment, surgery, chemotherapy, radiotherapy, combination, others were also assessed. Finally, the period since surgical intervention (two weeks, one month, two month and more).

Patient assessment record: it consisted of three sections

The Pain Visual Analogue Scale: The assessment tool used in this study was adapted from **Chiarotto et al. (2019)** to evaluate different pain levels (unbearable, intense, discomforting, moderate, mild, none). The Visual Analog Scale (VAS) was scored from ten (worst pain imaginable) to zero (no pain). This scale was utilized to quantify the extent of discomfort experienced by patients before and immediately after debridement and dressing application. Another inquiry focused on the patient's experience with pain during the previous 24 hours, including its greatest and lowest intensities. This scale was categorized as follows:

- 0 was regarded as "no pain".
- It was deemed "mild pain" between 1-3.
- The range of "moderate pain" was 4-6.
- "Severe pain" was defined as between 7-9.
- 10 were deemed to be the "worst pain possible.

Vital Signs Measuring Scale: It was adopted from **Araújo, et al, (2021)**:- Systolic and diastolic blood pressure, pulse, oxygen saturation, and body temperature were assessed one minute before commencing the dressing change and directly after finishing. Besides, the behavioral pain sign was performed through a qualitative assessment of painful facial expression, vocal signs, altered body movement, pain location, and protective posture) and physiological changes (paleness and sweating) during dressing.

Hamilton Anxiety Rating Scale (HAM-A): It is the anxiety assessment tool which utilized in this study. It was adopted from **Borkovec and Costello (1993)** and gauges anxiety levels categorized as none, mild, moderate, severe, and very severe. The scale comprises 14 signs elements, each delineated by a set of signs and symptoms. It assesses both psychic and somatic anxiety. The psychic anxiety includes psychological distress and mental agitation, while somatic anxiety includes physical signs accompanying anxiety. Each element is assessed against four-points scale ranging from no symptoms (scored zero) to very severe symptom (scored four).

Scoring System: The Hamilton Anxiety Rating Scale's total scores varied from 0 to 56; higher values indicate more severe anxiety. It was put into the following categories:

- "No present" was defined as 0
- 18-24 were regarded as "mild to moderate".
- "Moderate to severe" was defined as 25–30.
- >30 was regarded as "severe anxiety
- 56 were regarded as very severe anxiety.

Patient Satisfaction Scale:
The study employs FAMCARE-Patient scale (FAMCARE-P).It is developed by **Lo, et al. (2009).** There were sixteen items total. Patients answered questions on their encounters with healthcare providers, their performance status, and their symptom load on a 16-item patient satisfaction survey (FAMCARE-P16), which was based on the FAMCARE measure of family satisfaction with cancer care. The original FAMCARE instrument was filled out by caregivers.

Scoring system:
Each item was scored against three points ranged from dissatisfied (scored zero, undecided (scored one), and satisfied (scored two), with a total satisfaction score of 32 scores classified as two main categories as satisfied

(score ≥70%), and dissatisfied (score <70%).

Procedures

Administrative design and ethical consideration

The Benha University Faculty of Nursing's Scientific Research and Ethics Committee granted the first clearance to conduct this study. The dean of the nursing faculty and the head of the oncology departments at Aswan University Hospital then provided official endorsement.

Throughout the study, meticulous attention was given to ethical considerations. The study's aims objectives and their entitlement to discontinue participation at any point was explained by the researchers. Verbal consent was additionally obtained from the participating patients. Researchers ensured the confidentiality and anonymity of all subjects.

Preparation of the study instruments: The researchers engaged in a comprehensive analysis of relevant literature reviews and pertinent studies. To formulate and select the data collection tool for this study. This encompassed a range of sources such as textbooks, evidence-based articles, online publications, and scholarly journals, aiming to enhance the theoretical comprehension of the research problem across its diverse dimensions.

Content validity and reliability: Five specialists from the medical-surgical nursing field two assistant professors from Nursing Faculty, Aswan University and three professors from Nursing Faculty, Benha University served on a jury that evaluated the tools' validity. Based on the panel's assessment of the content's appropriateness, completeness, and grammatical clarity, the change was put into effect. The Cronbach alpha test yielded results of 0.095 for the structured interview questionnaire and 0.857 for the visual analogue scale, indicating the reliability of the proposed research instruments. In terms of Hamilton Anxiety Rating Scale's, a study by **Borkovec & Costello, in (1993)** reported a Cronbach's alpha of 0.90, while for the Patient Satisfaction Scale, a study by **Lo et al., (2009**) Reported a Cronbach's alpha of 0.92.

Pilot study

It was carried out to assess the instruments' simplest, applicable and comprehensive as well as to estimate time required to fill in the study tools. A pilot study involving 10% of the patients (8 patients) representing the study sample was conducted. No modifications were needed. So, the pilot study's sample was included in the overall study's sample.

Field work: The process of data collection needed more than six months to be completed; it was starting from April 2023 and concluding in October 2023. The researchers employed the existing tools to gather data by attending the Oncology department on three days -weekly basis (both morning and afternoon shifts), from 10:00 AM to 4:00 PM. The study comprised four distinct phases as following:

Assessment Phase: the researchers engaged in patient interviews, wherein they elucidated the study's objectives and requested their participation. Subsequently, each patient was individually interviewed to gather personal data and medical history. Moreover, the researchers evaluated the patients' understanding of VR and caring of septic wound. Additionally, assessments were conducted to gauge the severity of pain, level of anxiety and patient satisfaction. These interviews lasted approximately 45 minutes each.

Planning phase (virtual reality use): Based on the outcomes of the assessment phase, priorities and objectives were set.

Virtual reality technique. A virtual reality (used during dressing change). It was created by researchers based on the analysis of the patients' assessment and identified needs of the patients, review of the literature, patients' own level of knowledge and the advice of specialists. The information used by the researchers is on tablets and I-pads. It was written in Arabic and included information about cancer, types and causes of the chronic septic wounds and dressing changes as well as illustrations in the form of colored images and films for explanation in simple way.

The study group took part in a planned of the methodical VR technique for patients with cancer and persistently infected wounds. Reducing a patient's discomfort, pain, dysfunction and its psychological impact on the patients was the primary objective of VR technique.

Prior to the implementation of the VR technique, the following core conditions were met. A computer interactive means was prepared in the virtual setting, such as I- pad and tablet. On the other hand, patients submerge themselves in the virtual world created by technological devices. Patients are able to see, feel, and communicate just like they would in a real environment. Patients could also provide a similar stimulus by mixing stimuli via many sensory channels, including perception, sound, vision, and touch.

Virtual reality was also supported by information in the Arabic language reinforced by illustrations in form of showing colored pictures and films that involve many practical and theoretical information.

The theoretical information included information about the cancer & chronic septic wound for example: (causes, symptoms, diagnosis, several types of treatments and complications)

The practical information included technology of showing films about dressing change and types. Patient actively participate in the study through adherence to instruction and nutrition given to them.

Plans for the usage of VR technology were discussed and agreed upon with the nurse specialist and physician responsible for the treatment plan.

Implementation phase :

The researcher started to apply VR technique during dressing change. The patients did not restive any analgesics before the procedure and for 24 hours after deciding with their treating physician and nursing specialist, with the exception of situations when it was medically necessary due to chronic discomfort. Using an aseptic method, as the dressing was applied using surgical gloves according to the hospital's protocol. It involved replacing the dressings using 0.9% saline at room temperature, polyhexanide, conservative treatment and dressing removal. With a carbon scalpel blade number 15, a skilled nurse may suggest cautious instrumental debridement, which covers the lesion primary and obstructs it secondary. Every dressing was done by the same nurse. The changes of dressing took an average of twenty-five minutes.

Control group:

The patients received the routine wound dressing change according to the hospital policy during data collection process. Without implementing the VR program.

Evaluation phase:

Evaluating the effect of using VR for patients with cancer and chronic septic wound. Every patient in the study and control group underwent two evaluations: The same tool was used for both. Regarding the study group the first evaluation was done prior to implementation of the VR program and the second evaluation was done post-VR program. The pre-VR program evaluation was conducted using patients assessment record (pain visual analogue scale, vital signs, and HAM-A). Patient satisfaction scale was only utilized by the study group after VR program implementation.

Statistical analysis of the data:

The Statistical Package for the Social Sciences (SPSS), version 21 (SPSS Inc., Chicago, IL), was used for the collection, categorization, digitization, organization, and analysis of the data. Descriptive statistical methods, which make use of metrics like mean, standard deviation, frequency, and percentages, were used in the study. The mean scores within the same sample were compared between study phases using a variety of statistical tests, including the Paired (t) test. Furthermore, correlations between the research variables were determined using the Spearman correlation test (r) throughout several study phases, and numerical and percentage distributions were subjected to the Chi-square test. For the purpose of analyzing the results, a significance level was considered very significant when $p \leq 0.001$, significant when $p \leq 0.05$, and inconsequential when $p > 0.05$.

Results:

Table (1): Comparison between the study and control groups' personal data (n =80).

Patients' personal data	Items	Studied patients (n=40)		Control patients (n=40)		X^2	P value
		N	%	N	%		
Age	35-<45	16	40	14	35	3.028	0.220 ns
	45- <55	19	47.5	22	55		
	55-60	5	12.5	4	10		
X ± SD		**47. 67±4.87**		**48. 24 ± 8.93**		**t=0.265**	**P=0.792ns**
Gender	- Male	11	27.5	17	42.5	1.652	0.426 ns
	- Female	29	72.5	23	57.5		
Level of education	- High education	19	47.5	23	57.5	1.098	0.895ns
	- Read and write	8	20	10	25		
	- Can't read and write	13	32.5	7	17.5		

Table (2): Comparison between the study and control groups' medical data ((N =40).

Patient medical data	Items	Studied patients (n=40)		Control patients (n=40)		X^2	P value
		N	%	N	%		
Types of cancer	- Acute lymphoblastic leukemia	5	12.5	7	17.5	1.799	0.409 ns
	- Breast cancer	20	50	18	45		
	- Lung cancer	10	25	6	15		
	- Bladder cancer	5	12.5	9	22.5		
Stage of cancer	- Stage I.	25	62.5	22	55	3.591	0.309ns
	- Stage II.	11	27.5	13	32.5		
	- Stage III.	3	7.5	2	5		
	- Metastasis	1	2.5	3	7.5		
Types of treatment	- Surgery.	10	25	9	22.5	1.148	0.563 ns
	- Surgery and chemotherapy	20	50	18	45		
	- Surgery and radiotherapy	4	10	6	15		
	- Combination.	6	15	7	17.5		
Duration of surgery	- Two weeks	10	25	8	20	0.627	0.428 ns
	- One month	24	60	22	55		
	- Two months	4	10	7	17.5		
	- More than two months	2	5	3	7.5		

Table (3): Comparison between the study and control groups regarding the vital signs and pain before and after dressing change, using virtual reality n = 80.

Items	Non using virtual reality Control groupn = 40		Using virtual reality Study groupn = 40		t_1 (P_1)	t_2 (P_2)
	pre dressing change	Post dressing change two hours	pre dressing change	Post dressing change two hours		
	Mean ±SD	Mean ±SD	Mean ±SD	Mean ±SD		
Pain intensity	34.78±7.176	32.76±6.841	32.54±4.644	31.88±4.843	T: 1.257 P :0.210	T: 16.432 P <0.001*
Worst pain in the last 24 hours	8.94±1.156	7.33±0.686	7.00±0.543	6.75±0.451	T:- 0.186 P :0.853	T: 0.615 P :<0.001*
Mildest pain in the last 24 hours	243.50±41.84	135.00±29.28	131.00±18.97	130.00±12.54	T: 1.590 P :0.113	T: 1.257 P <0.001
Fatigue	18.78± 10.61	55.28±7.29	54.00±6.55	52.18±7.00	T: 0.00 P :1.00	T: 62.117 P <0.005*
Heart rate	3.204±34.35	1.401±2.647	1.400±1.433	1.388±1.321	T: - 0.904 P: 0.367	T: 51.543 P <0.005*
Blood pressure	3.245±25.81	2.561±1.549	2.385±1.632	2.234±0.871	T: 1.544 P: 0.124	T: 48.266 P <0.005*
Temperature	3.512±13.33	3.654±3.346	3.302±4.452	3.213±4.234	T: 1.257 P :0.210	T: 9.792 P <0.001
Oxygen saturation	4.443±28.25	3.459±4.543	3.440±3.854	2.567±3.456	T:- 0.186 P :0.853	T: 5.755 P <0.001
Respiratory rate	3.567±51.39	3.432±50.42	2.801±47.66	2.743±33.620	T: 1.590 P :0.113	T: 0.367 P <0.005*
Total	32.410±3.690	32.850±3.973	27.680±3.265	31.900±3.641	T :-0.811 P: 0.418	T: -8.638 P:0.000**

t_1 (P_1): *p value for comparing between the (study group and control group) pre.*

t_2 (P_2): *p value for comparing between the (study group and control group) post*

***:** statistically significant at $p \leq 0.05$. No significant at $p > 0.05$.*

Table (4): Comparison of behavioral, physiological, and anxiety during dressing change between the study group patients before and after using the VR. (n =40).

Items	Pre Using virtual reality		Post Using virtual reality		X^2	P. Value
	N	%	N	%		
Patient experience:						
Typical facial expression of pain	35	87.5%	10	25. %	11.11	<0.005*
Altered body movement	25	62.5%	13	32.5%	7.71	<0.001
Protective posture	28	70. 0%	8	20. 0%	11.033	<0.001
Sweating	8	20.0%	2	5.0%	9.69	<0.005*
Pallor	6	15.0%	1	2.5%	.215	0.043 *
Anxiety	37	92.5%	5	12.5 %	5.733	0.020*
Total	1.2±22.4		1.1±30.3		T: 1.257	<0.001

NB: Significant <0.05, * highly statistically significant at ≤0.001

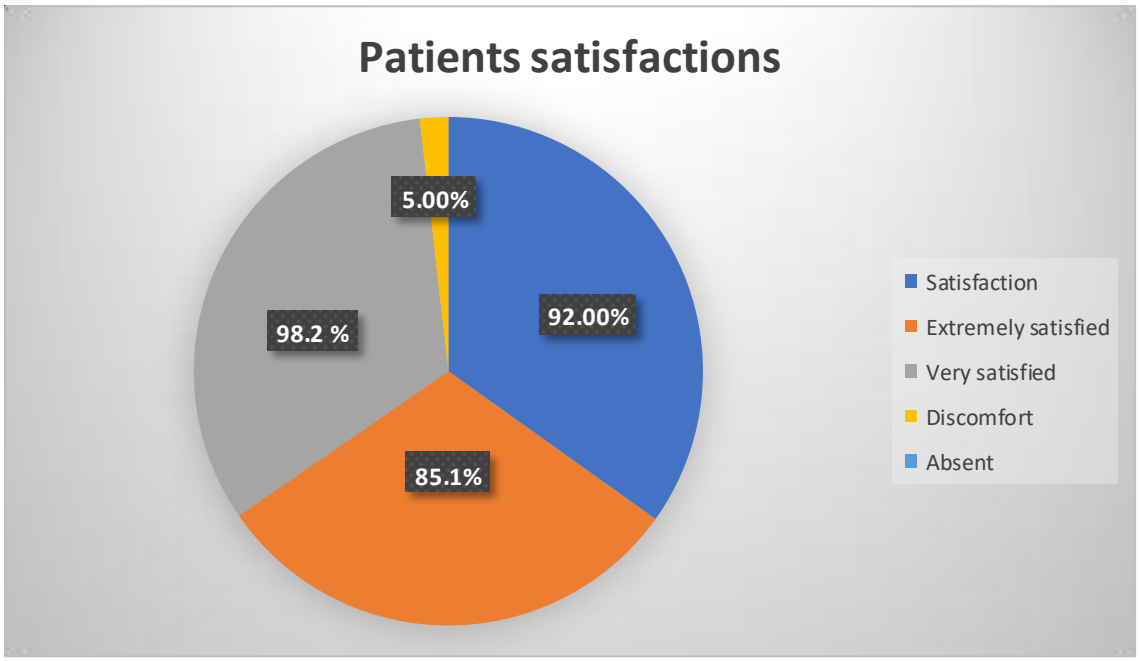

Figure (1): Percentage distribution of the study group satisfaction level after dressing change post using virtual reality (N=40).

Table (5): Correlation between pain, vital sings and anxiety score post using virtual reality for the study group (n= 40)

Variables	Total anxiety score	
	r	P
Total vital sings score	**0.242**	**0.015***
Total visual analogue pain	**0.849**	**< 0 .029**

Table (1): Revealed the comparison between the study and control groups' personal data. It demonstrated that 47.5%, 55% of the study and control groups' aged between 46- 55 years old with the mean age 47. 67±11.87& 48. 24 ± 8.93 respectively, while 72% and 57.5% of the study and control groups were females. The participants' educational level reveals that the highest percentages were 47.5% and 57.5 % respectively were educated.

Table (2): Illustrated the comparison between study and control groups regarding the medical data. The table demonstrated that 55%, 54.5% respectively of the study and control groups who suffer from breast cancer. And 52.5% and 55% of both groups had stage I of cancer. In relation to types of treatment 50%, 45% respectively among the study and control groups had undergoing surgery and chemotherapy. While 60% and 55% had surgery from one month duration.

Table (3): Revealed the Comparison between the study and control groups regarding the vital signs and pain pre and post dressing change using virtual reality. A statistically significant differences were reveled between the study and control groups concerning all variables of vital signs and pain intensity at (P= 0.005) post implementing the virtual reality with no statistically significant differences between the two groups regarding all variables pre using the VR at(P>0.05).

Table (4): Revealed the comparison between behavioral, physiological and anxiety during dressing change among the study group patients before and after using the VR. It displayed that there was marked decrease in the percentage distribution regarding the all variables of behavioral, physiological and discomfort among the study group after using the VR with statistically significant difference at (P<0.05).

Figure (1): Illustrated that, 92% of the studied patients were satisfied while 98.2% - 92% were very satisfied and 85.1% were extremely satisfied post using the virtual reality.

Table (5): Illustrated the correlation between total study group's pain, vital signs and anxiety score post using the virtual reality. The table showed a positive statistically significant correlation between pain and anxiety at p <0.029, vital sings and anxiety p=0.015 post using the virtual reality for the study group

Discussion:

Healthcare professionals have recently are become interested in the virtual reality (VR), a growing technology that had been utilized to treat pain complaints. **Grassini (2022).** So, the study aimed to evaluate the effect of using virtual reality as non-pharmacological therapy to reduce pain of the chronic septic wounds for patient with cancer.

Concerning individual data, the present study indicated that around half of the study and control groups fell within the age range between 46 to 55years old, with mean ages of 47.67±4.87 and 48.24±8.93, respectively. Furthermore, above two-thirds of the study group and over half of the control group were females. Additionally, over half of the control group and nearly half of the study group had attained a high level of education.

These findings corroborated a study done by the **Welsh Cancer Intelligence & Surveillance Unit (2021)** who found that incidence rates of cancer were much higher among women than men and that people aged between 45 to 55 years old account for more than half (54%) of all new cancer cases. These results, however, are at odds of a study done by the **UNDESA, (2019)** who found that more than half 50% patients with cancer are within 65 years old of age or older. This is most likely due to ineffective cellular repair processes and the build-up of risk factors for specific malignancies, which increase with age.

More than half of patients among the study and one quarter of the control group were highly educated; this finding highlights the need of education for the success of adopting virtual reality (VR) technology as a non-pharmacological therapy for chronic septic wound pain reduction. These findings matched the finding of study done by **Larsen et al. (2020)** who display the findings of the study based on Norwegian registry data regarding the educational attainment, income, and the risk of cancer and found that the majority of cases with cancer (47.6%) were highly educated followed by primary school education (29.5%).

In terms of medical data, the findings of the present study showed that over half of both studied groups had breast cancer, and being in stage I. Given that half of the studied patients in both groups were female and in early stages of the disease, these results could be interpreted as evidence that the best course of action when the disease is still in its early stages is surgery.

These findings corroborated the finding of a study done by **Kutluk, et al., (2023),** who studied Syrian Refugees From Southern Turkey regarding their medical features and outcomes of cancer and found that around half of both studied groups had breast cancer, leukemia, and lymphoma and half of them had both undergone chemotherapy and surgery as a form of treatment.

The present study findings agreed with the finding of a study done by **Charmsaz et al., (2019)** who highlights from the 55th IACR annual conference and study novel strategies for treating cancer. They concluded that surgery, chemotherapy, and radiation were the most widely used traditional treatment methods for cancer. According to **Arruebo et al. (2021)** who conduct a study concerning evolution of cancer treatment, they found that, surgical tumor excision followed by chemotherapy is the most often advised conventional treatment approach for cancer.

According to the comparison of vital signs and pain intensity during dressing change for both groups, pre-post using the virtual reality, the present study found statistically significant differences between the study and control group regarding all variables of vital signs and pain intensity post using the virtual reality .

The reduced discomfort during dressing changes may be explained by the patient diverting their attention from unpleasant sensations as a result of the visual and auditory distractions offered by the virtual reality program. VR's primary uses are for distraction and establishing a feeling of presence in a virtual setting.

Users could be distracted from uncomfortable real-world situations, such painful treatments, and feel detached from the treatment setting due to the sense of presence in a simulated environment.

Additionally, since the virtual reality program distracts people from their pain and worry, it's possible that this helped lower systolic and diastolic blood pressure prior to dressing changes. This reduces the amount of time that patients may think about discomfort at the start of the operation, which helps them feel more at ease **Sahin & Basak (2020).** These findings are supporting the first andsecond hypotheses.

The present study's findings are consistent with a study done by **Li et al. (2021)** who examined the effect of VR training on postural adjustments in patients with chronic low back pain. They said that there were nine publications in the most recent systematic review and meta-analysis. The VAS, or visual analog pain scale, was employed in six of these investigations to measure pain levels both prior to and following the virtual reality therapy. The VAS scale was used to assess the level of pain. Six investigations used the VAS scale to rate the degree of pain. The pooled investigation of the VR effect on VAS found that VR-based therapy considerably reduced pain symptoms. The outcomes of VR therapy showed a considerable reduction in pain perception when compared to the control group.

In a study done by **Liw & Ningning's (2021)** who examined the use of virtual reality technology to manage pain following hepatobiliary and pancreatic surgery, the researchers found that the VR group's pain perception score was significantly lower than the control group. In while a study done by **Jingjing & Qiaomei (2019)** who carried out a comparable study to investigate the impact of virtual reality technology on the pain associated with dressing changes among adults with burns.

The results aligned with the outcomes of the current investigation. This investigation showed a statistically significant difference regarding blood pressure level between the VR group and the control group. **Hua, et al., (2015)** conducted a study with similar findings, evaluating the effect of virtual reality distraction on pain management during chronic wound dressing changes. Researchers discovered that VR users' heart rates were noticeably lower than those of the control group.

These findings, however, go in counter to the finding of a study done by of **Wu et al. (2019)** who in their clinical trial on postoperative pain among Chinese males during dressing changes observed that there were no significant difference regarding the heart rates between the VR group and control group.

Regarding the behavioral, physiological and anxiety during dressing change, the current study findings revealed a marked reduction in the percentage distribution for all variables of behavioral, physiological and discomfort of the study group after using the VR technology. with statistically significant difference. This finding indicates that the positive impact on patient physiological status and behavior is a result of distraction and altered thought processes facilitated by virtual reality. By redirecting their focus and behaviors away from pain and anxious tendencies, patients experience a shift in their emotions and actions, ultimately promoting a sense of ease and comfort during the procedure. This finding is supporting the third hypothesis.

Similarly, the finding of a study done by **Araújo, et al., (2021)** who examined how virtual reality affected pain during dressing changes for chronic wounds and found that, when comparing the groups, behavioral evaluation during dressing changes showed a significant difference in the typical expressions of pain at ($p = 0.016$) and protective posture at ($p = 0.031$). This finding suggests that virtual reality effectively distracts the perception of pain during dressing replacement, resulting in improved behavioral and physiological aspects and a reduction in anxiety levels during the dressing change.

Regarding satisfaction of patients post using virtual reality, the present study reveals that the majority of the patients were very satisfied post using the virtual reality. This result agrees with a study done by **Araújo, et al., (2021)** who reported that following the application of virtual reality during dressing change, the majority of participants expressed satisfaction. Moreover, ninety-one percent reported no discomfort when utilizing virtual reality**.**

Considering the correlation between the total pain, vital signs and anxiety score post using virtual reality among study group. Study findings revealed a statistically significant positive correlation between pain, vital signs and discomfort post using virtual reality for study group. These results indicate that using VR has proved to be an effective non pharmacological means on reducing pain, discomfort and vital signs score among patient with cancer during dressing for chronic septic wounds. These results agree with the finding of a study done by **Indovina, et al., (2018**), who study the effect of virtual reality as a distractor for pain during medical intervention and concluded that VR would likely to relieve pain and anxiety in patients with cancer experiencing medical procedures or treatments.

In a similar study done by **Zhang et al. (2022)** who observed improvement in the anxiety level, vital signs, and pain in patients with cancer after conducting a systematic review and meta-analysis to examine the effectiveness of virtual reality in controlling breast cancer symptoms. Within the same

framework, **Khadra et al. (2020)** perform a study who showed that, when dressing a persistent septic wound, VR alone dramatically reduced pain ratings as compared to analgesia.

Conclusion:

The results of the present study indicate that the utilization of virtual reality as a non-pharmacological therapy proved effective in diminishing pain, anxiety, and vital signs scores. There were significant differences observed between the study and control groups, particularly in heart rate and blood pressure readings. This led to enhanced physiological and behavioral aspects, ultimately resulting in increased patient satisfaction during dressing changes for chronic septic wounds among patients with cancer.

Recommendation:

The following recommendation could be suggested in the light of the study's findings:

1. The integration of virtual reality into standard care is recommended for conducting dressing changes among patients with cancer and chronic septic wounds.
2. Additional investigations are recommended to explore the effectiveness of VR as a non-pharmacological approach for pain reduction during dressing changes for chronic septic wounds and other types of pain.
3. Conducting further research with larger probability sample sizes under identical conditions could offer conclusive evidence on the efficacy of virtual reality.

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