Virtual Reality as a Distraction Intervention for Women Receiving Chemotherapy

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Purpose/Objectives: To explore the use of virtual reality as a distraction intervention to relieve symptom distress in women receiving chemotherapy for breast cancer.

Design: Crossover study.

Setting: The outpatient clinic of a midwestern comprehensive cancer center.

Sample: 20 women 18–55 years of age.

Methods: Using a crossover design, 20 subjects served as their own controls. For two matched chemotherapy treatments, one pretest and two post-test measures were employed. Participants were assigned randomly to receive the virtual reality distraction intervention during one chemotherapy treatment and received no distraction intervention (control condition) during an alternate chemotherapy treatment. An open-ended questionnaire elicited each subject's evaluation of the intervention.

Main Research Variables: Symptom distress, fatigue, anxiety.

Findings: Significant decreases in symptom distress and fatigue occurred immediately following chemotherapy treatments when women used the virtual reality intervention.

Conclusions: The distraction intervention decreased symptom distress, was well received, and was easy to implement in the clinical setting.

Implications for Nursing: Nursing interventions to manage chemotherapy-related symptom distress can improve patient quality of life and increase chances for survival by reducing treatment-related symptom distress and enhancing patients' ability to adhere to treatment regimens and cope with their disease.

Key Points . . .

- One way to cope with chemotherapy-related symptom distress is through the use of distraction interventions (concentrating on pleasant or interesting stimuli instead of focusing on unpleasant symptoms).
- A virtual reality distraction intervention decreased chemotherapy-related symptom distress in a sample of women with breast cancer.
- By decreasing chemotherapy-related symptoms, virtual reality has the potential to increase compliance with treatments, affect survival, and enhance quality of life.

Breast cancer is the leading cause of cancer mortality among women aged 30–50. One out of every eight women will develop breast cancer in her lifetime (Jemal et al., 2003). Standard treatment for breast cancer often involves neoadjuvant or adjuvant chemotherapy treatment. These treatments can cause severe side effects such as nausea, vomiting, and fatigue. To achieve a cure, women often must tolerate high levels of symptom distress as a result of treatment- and disease-related side effects. The purpose of this pilot study was to explore the use of virtual reality as a distraction intervention to relieve symptom distress, fatigue, and anxiety in women receiving chemotherapy for breast cancer.

Symptom distress is a global concept that encompasses the discomfort experienced from a wide variety of symptoms. Symptom distress interferes with a person's ability to perform activities of daily living and adversely affects quality of life (Ehlke, 1988; Pickett, 1991). Frequently reported symptoms associated with cancer chemotherapy are nausea and vomiting (Pickett; Watson & Marvell, 1992). As many as 60% of patients experience these side effects. Acute chemotherapy symptoms such as nausea and vomiting may begin with the chemotherapy infusion and last for 48 hours (Bender et al., 2002; Rhodes, Watson, Johnson, Madsen, & Beck, 1987). Research has shown that patients who are anxious during the first chemotherapy treatment are more likely to experience anticipatory nausea with subsequent treatments (Coons, Leventhal, Nerenz, Love, & Larson, 1987). These investigators also found that adults who are younger and those who develop anticipatory nausea are more likely to experience distress with chemotherapy treatments. For some patients, antiemetics are effective for the treatment of nausea and vomiting. However, nonpharmacologic interventions also have the potential to relieve these symptoms.

Other common physical symptoms associated with chemotherapy include anorexia, fatigue, and anxiety (Sarna, Lindsey,

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Dean, Brecht, & McCorkle, 1993; Watson & Marvell, 1992). Fatigue is a major problem for individuals receiving chemotherapy. Estimates suggest that 60%–100% of patients report experiencing chemotherapy-related fatigue (Winningham et al., 1994). In a study of 46 women who were treated for breast cancer with surgery and adjuvant chemotherapy, the most frequently reported chemotherapy-related symptoms were fatigue and pain (Wyatt & Friedman, 1998). Patients with breast cancer frequently experience changes in mental state that are manifested as anxiety, depression, difficulty concentrating, and changes in outlook (Munkres, Oberst, & Hughes, 1992; Watson & Marvell). Dodd, Miaskowski, and Paul (2001) looked at the effects of the symptom cluster of pain, fatigue, and insufficient sleep on functional status in 23 outpatients receiving three courses of chemotherapy. They found that age, pain, and fatigue all were significant predictors of changes in functional status. This study underscored the need for global measures of symptom distress and instruments that evaluate specific symptoms.

Adherence to prescribed chemotherapy treatments is extremely important. The chances for survival are enhanced if patients receive all of the recommended chemotherapy treatments for their specific disease (Bonadonna, Valagussa, Moliterni, Zambetti, & Brambilla, 1995). However, because of chemotherapy-related symptom distress, patients often have difficulty adhering to the prescribed regimen (Dodd et al., 2001). As a result, management of chemotherapy side effects is a priority for oncology nursing and a major focus for oncology nursing research. Nursing interventions to manage chemotherapy-related symptom distress can improve patient quality of life and increase chances for survival by reducing treatment-related symptom distress and enhancing patients' ability to adhere to treatment regimens and cope with the disease (Grant, 1997; Lyman et al., 1996).

Distraction as an Intervention to Enhance Coping

One way to cope with chemotherapy-related symptom distress is through the use of distraction interventions. These interventions are effective because individuals can concentrate on pleasant or interesting stimuli instead of focusing on unpleasant symptoms (Hinds & Martin, 1988; Schneider, 1999). Techniques such as humor, relaxation, music, imagery, and virtual reality are classified as distraction interventions and can relieve physical symptoms such as pain, anxiety, nausea, fatigue, and stress (Ezzone, Baker, Rosselet, & Terepka, 1998; Good et al., 1999). Distraction also can alleviate psychological symptoms (Kolcaba & Fox, 1999).

The use of distraction as a coping mechanism for the physical and psychological symptoms of patients with cancer is well documented in the literature. Ali and Khalil (1991) found that self-distraction techniques (e.g., keeping busy, doing household work, sewing, watching television) were among the top four coping strategies used by a sample of 64 patients who had undergone mastectomies. Vasterling, Jenkins, Tope, and Burish (1993) found that patients receiving chemotherapy who used either a cognitive distraction or relaxation technique reported less nausea than the control group. Guided imagery significantly enhanced comfort levels in women with early-stage breast cancer (Kolcaba & Fox, 1999). Ezzone et al. (1998) demonstrated that music was effective in reducing nausea and vomiting in patients receiving chemotherapy as a part of a bone marrow transplantation.

Humor and relaxation are effective as distraction strategies, but these interventions require that patients consciously and continuously concentrate on the distraction strategy. With these interventions, individuals cannot allow competing stimuli from the environment to dominate their awareness. Many distraction interventions, such as imagery and progressive relaxation, require that patients practice the techniques prior to contact with unpleasant stimuli, and, even with practice, some individuals are unable to divert their attention away from unpleasant symptoms long enough to allow a distraction intervention to work. Gross (1995) compared the incidence and severity of symptoms in a relaxation guided-imagery intervention and a cancer care instruction control group in a sample of 30 women receiving chemotherapy for breast cancer. Subjects were followed for eight weeks, and no significant differences in symptoms were found between groups. One explanation for these findings is that, although research findings support the use of relaxation or imagery for a limited time, such as during a labor contraction, maintaining a self-induced image or state of relaxation for more than 20 minutes may be too difficult. Because chemotherapy treatments can last several hours, a distraction intervention that provides interactive images may be more effective.

Virtual Reality

Virtual reality is a computer-simulated technique that allows individuals to hear and feel stimuli that correspond with a visual image by wearing a headset that projects an image with accompanying sounds (see Figure 1). Virtual reality has unique features that may make it a more effective distractor than other interventions. Virtual reality is interactive, and it engages several senses simultaneously (Arthur, 1992; Pratt, Zyda, & Kelleher, 1995). Virtual reality is more immersive; therefore, it has the potential to be more capable of blocking sensations from competing environmental stimuli (Witmer & Singer, 1998).

Few prior tests of virtual reality as a distraction intervention have been conducted. Kozarek et al. (1997) explored the feasibility of using a virtual vision headset and travelogue tape as a distraction intervention for 50 adults undergoing routine gastric laboratory procedures. Eighty-six percent of the patients believed that the system was effective. This project, however, did not employ a control condition for comparison.

Figure 1. Virtual Reality Apparatus

In Japan, Oshuga et al. (1998) developed the "bedside wellness system," a prototype system that allows patients to take a virtual walk through the forest while in bed. Images are portrayed on bedside screens with corresponding sensory sensations (e.g., bird sounds, cool breezes) produced by the system. Foot devices enhance movement of the lower extremities and control movement of the image. A preliminary study with 20 healthy subjects suggested that the intervention helped people to relax, and further research is being conducted in adult patients with cancer.

Using a randomized control design with 30 subjects, Wint, Eshelman, Steele, and Guzzetta (2002) reported no significant differences in pain scores between adolescents with cancer who used virtual reality as a distraction intervention during lumbar punctures and those who did not. However, the intervention group did show improvement in scores, and 77% of subjects who used the head-mounted display reported that virtual reality was an effective distractor. A larger sample or a within-subjects design could have provided the statistical power necessary to demonstrate statistical significance.

Virtual reality was a more effective distractor than video games in controlling burn pain during dressing changes in a sample of 12 adults and children (Hoffman, Patterson, & Carrougher, 2000). Subjects reported that the environment created by the head-mounted device was more engaging than the flat-screen video game images. In a follow-up study using a sample of seven adults and children, pain ratings were compared during range-of-motion exercises. Pain ratings were significantly lower when patients used virtual reality than when they had no distraction. Further, pain ratings were reduced with repeated use of virtual reality, suggesting that the intervention was a true distractor, not just a novel experience (Hoffman, Patterson, Carrougher, & Sharar, 2001). In a case study report, pain ratings were lower in two adults who wore a virtual reality helmet that simulated a flight through a three-dimensional snow world during periodontal scaling treatments than when they had no distraction or watched a movie (Hoffman, Garcia-Palacios, et al., 2001). Virtual reality also is being used to treat phobias, including fear of flying (Wiederhold, Gevirtz, & Wiederhold, 1998) and heights (Rothbaum et al., 1995), and for rehabilitation of individuals with cognitive and functional impairments (Rizzo, Buckwalter, Neumann, Kesselman, & Thiebaux, 1998).

Schneider and Workman (1999) reported significant improvements in symptom distress in 12 children who used a virtual reality distraction intervention during outpatient chemotherapy treatments. Results demonstrated significantly lower scores on a symptom distress scale immediately following the chemotherapy treatment with the virtual reality distraction, as compared with scores obtained during chemotherapy treatments in a control group. The effect size of the intervention was 0.42 (Schneider & Workman, 1999). Eighty-two percent of subjects said that the chemotherapy treatment with the virtual reality equipment was better than other treatments, and no subjects indicated that the virtual reality made them feel worse. All subjects said that they would like to use the virtual reality equipment again (Schneider & Workman, 2000). This was the first study to suggest that virtual reality as a distraction intervention had positive clinical outcomes for patients with cancer receiving chemotherapy.

Conceptual Framework

Lazarus and Folkman (1984) defined coping as "constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person" (p. 141). Stress is delineated as a relationship between the person and the environment that the person evaluates as taxing or exceeding their available resources and threatening his or her well-being.

Coping responses reflect the various thoughts and activities that people use to manage stressful situations (Lazarus & Folkman, 1984). Lazarus and Folkman theorized that two types of strategies with distinct coping functions exist—those directed at (a) managing or altering the problem (problem-focused coping) or (b) regulating the emotional response to the problem (emotion-focused coping). Defining the problem and formulating alternative solutions are problem-focused strategies. Examples of emotion-focused strategies include distancing, changing thoughts, making positive comparisons, and finding positive value in negative events. Lazarus and Folkman stated that individuals turn to emotion-focused coping when they perceive that nothing can be done to change the threatening condition. In this study, chemotherapy treatments were considered a stressor. Distraction meets the criteria for an emotion-focused coping strategy for dealing with this stressor. This study tested the premise that virtual reality as a distraction intervention decreases some of the possible symptom distress associated with chemotherapy treatments for women who have breast cancer.

Methods

Research Questions and Design

A crossover design was used to test two hypotheses. The first was that women diagnosed with breast cancer will have significantly lower symptom distress, fatigue, and anxiety levels immediately following an IV chemotherapy treatment during which they receive a virtual reality distraction intervention than they would with no virtual reality intervention. The second was that women diagnosed with breast cancer will have significantly lower symptom distress, fatigue, and anxiety levels 48 hours following an IV chemotherapy treatment during which they receive a virtual reality distraction intervention than they would with no virtual reality intervention.

With the crossover design, 20 subjects served as their own control, eliminating the need for randomization to produce group equivalence because post-treatment differences cannot be attributed to personal characteristics (Girden, 1992). Subjects were assigned randomly to the order in which they received the virtual reality and control conditions. Participants received the virtual reality treatment during either their first chemotherapy treatment (group A) or their second chemotherapy treatment (group B) (see Table 1). During the alternate chemotherapy treatment (control condition) subjects received standard care. The within-subjects design allows for control of chemotherapeutic agents, antiemetics, age, gender, and cancer diagnosis. An additional advantage of this statistically powerful design is that it allows for testing of the hypotheses in a single site. An adequate sample size can be obtained at one site, and ensuring that the intervention is administered consistently to all participants is easier. The

Table 1. Data Collection Schedule

Time	Instruments	Time to Complete (minutes)
Prior to initial chemotherapy	Demographic data, Symptom Distress Scale (SDS), State-Trait Anxiety Inventory (SAI), Revised Piper Fatigue Scale (PFS)	30–40
Chemotherapy with virtual reality	None	45–90
Immediately postchemotherapy	SDS, SAI, PFS, evaluation of virtual reality	25
48 hours postchemotherapy	SDS, SAI, PFS	10–15
Prior to second chemotherapy treatment	SDS, SAI, PFS	10–15
Chemotherapy without virtual reality	None	45–90
Immediately postchemotherapy	SDS, SAI, PFS	10–15
48 hours postchemotherapy	SDS, SAI, PFS	10–15

N = 10

Note. Schedule is for group A, where the virtual reality intervention was administered with the first chemotherapy treatment and control condition with the second.

manipulated independent variable is the virtual reality distraction intervention.

Sample

The population for this study was a group of women who were scheduled to receive IV chemotherapy as part of their treatment plan. A convenience sample of 20 women with breast cancer was selected. To be included in the study, participants had to (a) have a diagnosis of breast cancer, (b) be aged 18–55, (c) have a first diagnosis of cancer, (d) require at least two matched cycles of IV chemotherapy, (e) have received no previous IV chemotherapy, (f) be able to read and write in English, (g) have no clinical evidence of primary or metastatic disease to the brain or history of seizures, and (h) have no history of motion sickness.

Patients with breast cancer aged 18–55 who were receiving chemotherapy were selected for several reasons. In previous studies, younger adults have reported higher levels of symptom distress. The researchers believed that this age group would be less threatened by technology and more open to this type of an intervention. A methodologic advantage of using patients with breast cancer is that these patients receive several matched chemotherapy treatments over a period of months. Thus, controlling for the adverse effects of specific chemotherapeutic agents is possible. The homogeneity of the sample enhanced the probability of detecting intervention-induced differences in symptom distress.

During a 14-month period ending in January 2001, 24 eligible subjects were identified; 21 women (88%) agreed to participate, but one dropped out of the study because she decided not to receive chemotherapy. The final sample size of 20 participants completed the six time measures in the study. To calculate the power for this pilot study, the following parameters were used: (a) population SD = 1.0, (b) effect size = 0.4, (c) alpha = 0.10, and (d) one-tailed hypothesis test. Given these assumptions, a power of 0.70 corresponded to the sample size of 20 subjects.

Virtual Reality Technology

Virtual reality is considered a distraction technique because it diverts the focus of attention away from the stressful stimuli (Hinds & Martin, 1988). An individual wears a headset that projects an image with corresponding sounds. A computer mouse is used to manipulate the image. Distraction occurs because the person feels present in the simulated environment (Steuer, 1992). For this study, a commercially available headset (Sony PC Glasstron PLM-S700) was used. Participants wore the eight-ounce headset during an IV chemotherapy treatment. Subjects chose from three scenarios on CD-ROM. Each scenario lasts several hours, and choices included deep-sea diving, walking through an art museum, or solving a mystery.

Instruments

The **Symptom Distress Scale (SDS)** was developed by McCorkle and Young (1978) to identify concerns of patients receiving chemotherapy treatments. SDS is a general indicator of symptoms experienced by patients with cancer. It measures the occurrence of specific symptoms and provides an overall score of symptom distress. The instrument can measure changes in symptom distress within a single individual over time (Hinds, Quargnenti, & Wentz, 1992; McCorkle, 1987). SDS is a 13-item, Likert-type self-report scale that measures nausea, vomiting, pain, anorexia, sleep, fatigue, bowel elimination, breathing, coughing, and concentration. Patients rate specific symptoms on a scale of 1–5, with higher ratings indicative of more symptom distress. Total scores range from 13–65, and the scale takes 5–10 minutes to complete.

A correlation of 0.90 between SDS score and scores on the Ware's health perception questionnaire demonstrated convergent validity of the tool (McCorkle, 1987). The scale discriminates between survivors of myocardial infarction and patients with cancer (McCorkle & Quint-Benoliel, 1983), as well as between patients in home care and healthy controls (McCorkle). The reliability (coefficient alpha) ranged from 0.79–0.89 in numerous samples of adult patients with cancer (McCorkle). Coefficient alpha for the instrument in this study was 0.80.

A literature review suggested that anxiety and fatigue (Munkres et al., 1992; Piper et al., 1998; Wyatt & Friedman, 1998) also are prevalent in this population. Measures for these specific symptoms also were included. The **State-Trait Anxiety Inventory (SAI) for Adults** (Spielberger, 1983) measures transitory anxiety states in adults. Respondents rate each item on a scale of 0–3 with half of the items being reverse scored. A total score ranging from 0–60 is obtained by adding the weighted score for each item, and higher scores are representative of greater levels of anxiety. The reliability and validity of this instrument are well established. Alpha reliability in a sample of women with breast cancer who used guided imagery during radiation therapy was 0.90 (Kolcaba & Fox, 1999). This instrument has convergent and discriminate validity (Spielberger). The Likert-type questionnaire requires 8–12

minutes to complete. Alpha reliability for SAI with this sample was 0.89.

The **Revised Piper Fatigue Scale (PFS)** (Piper et al., 1998) is composed of 22 items numerically scaled 0–10 with higher scores indicative of greater levels of fatigue. Four dimensions of subjective fatigue are measured: behavioral/severity, affective meaning, sensory, and cognitive/mood. Five additional questions are included to provide qualitative data. The standardized alpha for the entire PFS with a population of patients with breast cancer was 0.97 and for each of the subscales was greater than 0.92. Concurrent validity is supported by significant correlations with the Profile of Mood States (McNair, Lorr, & Droppleman, 1971) and the Fatigue Symptom Checklist (Yoshitake, 1978). Coefficient alpha for the instrument in this study was 0.97.

The **Evaluation of Virtual Reality Intervention** is an open-ended questionnaire that was used to elicit subjects' opinions about the intervention. The evaluation elicits responses about the ease of equipment use, length of time the equipment was used, scenario choices, effectiveness of virtual reality as a distractor, and desire to use virtual reality during future treatments. The evaluation has been reviewed by a panel of experts for content validity and takes three to five minutes to complete. The responses from the evaluation were used to determine how well the intervention was received and to improve administration of the intervention in future studies. See Figure 2 for sample questions.

Procedure

This study was conducted in the outpatient center of a midwestern comprehensive cancer center. Protocol approval was obtained from the hospital institutional review board and cancer center protocol review committee. The principal investigator and two research assistants conducted all data collection. A standard protocol was followed for application of the virtual reality intervention and collection of data. Before the first scheduled chemotherapy treatment, the project director contacted eligible individuals. When participants arrived at the clinic, the investigator explained the study, demonstrated the virtual reality equipment, answered questions, and obtained written informed consent. Participants completed the initial set of questionnaires (demographic form, SDS, SAI, and PFS). The women then were assigned randomly to receive the virtual reality treatment during either the first or second chemotherapy treatment.

For the control condition, normal and customary care, such as pretreatment teaching, obtaining venous access, administering chemotherapy, providing homecare instructions, and administering antiemetic medications, was provided by the outpatient clinic RNs. Immediately following the completion of chemotherapy, subjects completed the SDS, SAI, and PFS for a second time. Arrangements were made for the researcher to contact the subject, via telephone, two days following the completion of the first chemotherapy treatment to complete a third SDS, SAI, and PFS.

During the alternate chemotherapy treatment, when participants were randomized to receive the virtual reality distraction intervention, the same procedures outlined previously were followed. In addition, during this treatment, the participants received the virtual reality distraction intervention. For this treatment, the researcher showed participants the virtual reality equipment and provided a brief explanation of how to use it. The researcher helped the subjects put on the headset and recorded the time that each intervention was initiated. Participants were able to choose from one of three possible virtual reality scenarios. The subjects used the virtual reality equipment for 5–10 minutes to get accustomed to the equipment, and then a clinic nurse administered the chemotherapy.

The study participants continued using the virtual reality equipment throughout the duration of the chemotherapy infusion. Women were free to change scenarios or remove the headset if they wished to discontinue the intervention. As in the control condition, the clinic nurse followed all normal and customary nursing procedures. Chemotherapy infusions for the control and intervention groups lasted 45–90 minutes. Following chemotherapy, the virtual reality equipment was removed and a subjective evaluation of the intervention was completed in addition to the standard measures. The researcher recorded the amount of time in minutes that the virtual reality was used and asked participants to estimate the amount of time that they had used the distraction intervention. To ensure treatment equivalency for both conditions, data were collected regarding medication use, specifically antiemetics and analgesics. All subjects received the same medications during the virtual reality intervention and control condition chemotherapy treatments.

Data Analysis

Following data collection, data were entered on an SPSS® (SPSS Inc., Chicago, IL) data file for analysis. A frequencies procedure was used to determine distributions and variances. To ensure that no differences in baseline symptoms existed between the groups receiving the virtual reality during the first or second chemotherapy treatments, paired t tests were used to test for group differences related to sequencing effects of the chemotherapy treatments. Because no differences were found, data were combined into a control and virtual reality intervention group for further analysis. Paired t tests were used to determine the mean difference in SDS, SAI, and PFS values immediately following the chemotherapy treatment and 48 hours following treatment. The level of significance for this pilot study was set at $p < 0.10$.

- Did you experience any unusual sensations or feelings while using the headset? If yes, please list.
- Do you have any suggestions for other types of images that you would like to see with the headset?
- Did the headset change the way you were able to concentrate on other activities that were occurring in the treatment room? If so, how?
- Would you like to use the virtual reality equipment again during a chemotherapy treatment?
- Compared with your previous treatment when you did not use the virtual reality equipment, how did you feel about this treatment?

Figure 2. Sample Questions: Subjective Evaluation of Virtual Reality Intervention

Results

Descriptive Data

Sample characteristics are displayed in Table 2. SDS scores ranged from 13–34, with the highest mean scores occurring 48 hours following chemotherapy treatments. The lowest score on the SDS ($\overline{X}$ score = 16.6) occurred immediately following the

Table 2. Sample Demographics

Variable	n	%
Age (years)		
Range = 27–55	–	–
$\bar{X}$ = 42.6	–	–
SD = 7.9	–	–
Diagnosis		
Adenocarcinoma		
• Infiltrating ductal	12	60
• Lobular	3	15
Ductal carcinoma in situ	3	15
Metastatic	2	10
Ethnic identification		
Caucasian	16	80
African American	3	15
Other	1	5

N = 20

chemotherapy treatment when women used the virtual reality distraction intervention (see Figure 3). Scores on the PFS followed a similar pattern (see Figure 4). Scores ranged from 0–7.9, with the highest level of fatigue occurring two days after chemotherapy treatments and the lowest level of fatigue ($\bar{X}$ score = 1.85) immediately following chemotherapy treatment when the participants used the virtual reality. Scores on the SAI ranged from 20–67.

Results of analysis using paired t test demonstrated that a significant difference existed in the SDS (p = 0.095) and PFS (p = 0.040) scores immediately following the chemotherapy treatment when subjects used the virtual reality intervention (see Table 3). Mean state anxiety scores were lower following the use of the virtual reality, but no significant differences were found (p = 0.230). Cohen's effect size for the intervention was calculated to be 0.30 for the SDS and 0.41 for the PFS. The hypothesis that virtual reality could mitigate chemotherapy-related symptom distress as a distraction intervention partially was supported.

Paired t tests indicated no significant changes in any of the measures of symptom distress, fatigue, or anxiety two days later, but a trend toward lower scores existed with the virtual reality condition (see Table 4).

To assess the distraction quality of the intervention, participants were asked to estimate the amount of time they used the virtual reality equipment. Although the mean length of time for an IV chemotherapy treatment with virtual reality was 67 minutes, the mean time estimated by the participants was 42 minutes. This difference in time perception was significant at the p < 0.001 level (see Figure 5).

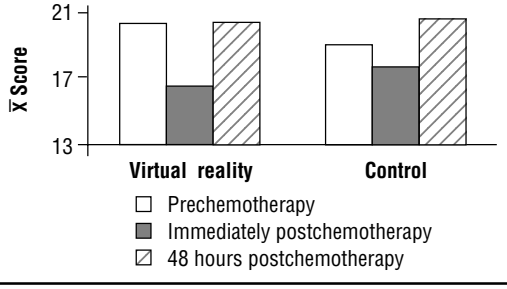

Figure 3. Descriptive Statistics: Symptom Distress Scale

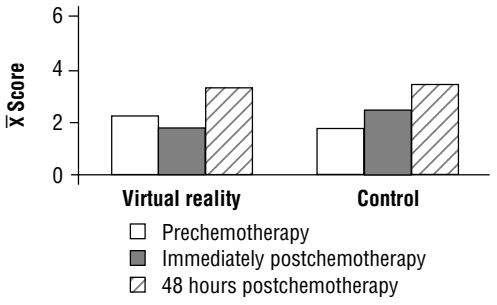

Figure 4. Descriptive Statistics: Revised Piper Fatigue Scale

Responses to the open-ended questionnaire provided descriptive data regarding the subjects' evaluation of the intervention. Some key findings included that the women thought that the headset was easy to use, they reported experiencing no unusual sensations, all subjects preferred the chemotherapy treatment with the virtual reality treatment, and 95% indicated that they would be willing to use the intervention again.

Discussion

This study contributes to the discussion that distraction is an effective coping mechanism. The findings are congruent with the theoretical framework, supporting the premise that virtual reality, as an emotion-focused distraction intervention, decreases the symptom distress associated with chemotherapy treatments. The major findings of this study demonstrated that symptom distress and fatigue were significantly lower immediately following chemotherapy treatment during which the virtual reality intervention was implemented. The findings support the work of other researchers that distraction interventions are useful for the mitigation of symptom distress (Ezzone et al., 1998; Vasterling et al., 1993).

Although the measures of symptom distress 48 hours after the chemotherapy treatment were not significantly different, a consistent trend toward lower scores occurred with the virtual reality intervention. A major gap exists in behavioral intervention research in that researchers have not measured the lasting or long-term effects of interventions. Assuming that the effect size of the intervention will be diluted with time is reasonable. The results of this study would suggest that further research using a larger sample to measure lasting effects is warranted.

The virtual reality intervention did not affect anxiety scores. This finding is consistent with previous research with a sample of adolescents (Schneider & Workman, 1999). State anxiety levels were high prior to and decreased immediately following the chemotherapy treatment. These scores likely were related to patients' relief about the treatment being over. In addition, the nature of the intervention was that it

Table 3. Paired T Test Immediately Following Chemotherapy

Instrument	t	p	Effect Size
Symptom Distress Scale	–1.36	0.095	0.30
Revised Piper Fatigue Scale	–1.82	0.040	0.41
State-Trait Anxiety Inventory	–0.77	0.230	0.17

Table 4. Paired T Test 48 Hours Following Chemotherapy

Instrument	t	p
Symptom Distress Scale	–0.900	0.19
Revised Piper Fatigue Scale	–0.466	0.32
State-Trait Anxiety Inventory	–0.710	0.24

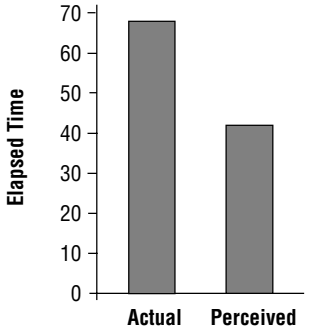

Figure 5. Perception of Time While Using Virtual Reality
t = 3.69; p < 0.001

was challenging and engaging, and the intervention possibly did not induce a relaxation response. Patients often reported that solving a mystery was exciting or the deep sea diving was interesting.

Wearing the head-mounted display reality resulted in an altered perception of time, which substantiates the distracting qualities of the virtual reality. This finding has clinical implications. Women receiving chemotherapy often spend long, tedious days in treatment centers waiting for blood count results, medication orders to be processed, preparation of chemotherapy, and finally, the administration of premedications, hydration, and chemotherapy. Women reported that they appreciated anything that interrupted this monotonous cycle of waiting.

The virtual reality intervention did not increase symptoms. Researchers have expressed concern in the literature regarding cyber sickness, in which the use of virtual reality equipment could lead to symptoms similar to those experienced with motion sickness (Rizzo et al., 1998). None of the subjects in this study reported any unusual symptoms such as dizziness, increased nausea, or visual disturbances. As with other treatments, the intervention should be used with caution. Clinicians should instruct patients to discontinue virtual reality if any untoward reactions are experienced.

The implementation of distraction interventions often requires a quiet environment and experienced personnel. In contrast, virtual reality can be used in a busy clinic setting and requires minimal nursing time. The cost of the headset, computer, and software was approximately $1,800. The equipment can be set up in five minutes, and several patients can use a single set of equipment throughout a clinic day. A wider variety of scenarios on CD-ROM could be available. One subject who had participated in the study brought in a CD-ROM for use with the headset during a subsequent chemotherapy treatment.

The findings of this study are congruent with those of previous research that suggest that virtual reality can be used to manage symptoms (Hoffman et al., 2000; Oshuga et al., 1998; Wint et al., 2002). The limitations of this pilot study are the small sample size and single study site. To date, all of the studies exploring the effectiveness of virtual reality have employed small sample sizes. Few controlled studies have been conducted using virtual reality as a distraction technique. The findings of this study offer direction for future research: (a) The study should be repeated using an experimental design and multiple study sites, (b) future studies should compare virtual reality to other distractors, (c) the virtual reality intervention should be tested with different samples and different outcome variables, and (d) research should explore how coping styles affect the use of distraction interventions. This intervention has the potential to be effective for other cancer populations, patients with a variety of diagnoses, and older adults. Ongoing study of this distraction technique will determine whether virtual reality is an effective intervention.

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