Effects of guided imagery relaxation in hematopoietic stem-cell transplantation patients: a quasi-experimental study

Efeito do relaxamento com imagem guiada em transplantados de células-tronco hematopoéticas: estudo quase experimental

Efecto de la relajación con imagen guiada en trasplantados de células madre hematopoyéticas: estudio cuasi experimental

Luana Aparecida Alves da Silva[I]
ORCID: 0000-0003-0210-2791

Paulo Ricardo Bittencourt Guimarães[I]
ORCID: 0000-0002-9852-6777

Angela da Costa Barcellos Marques[I]
ORCID: 0000-0003-1442-0308

Larissa Marcondes[II]
ORCID: 0000-0002-8745-6486

Camila Schirmer Barbosa[III]
ORCID: 0000-0002-6208-6343

Pâmela Cristine Piltz Costa[IV]
ORCID: 0000-0002-7449-7078

Luciana Puchalski Kalinke[I]
ORCID: 0000-0003-4868-8193

[I] *Universidade Federal do Paraná. Curitiba, Paraná, Brazil.*
[II] *Hospital Erasto Gaertner. Curitiba, Paraná, Brazil.*
[III] *Prefeitura Municipal de Ji-Paraná, Atenção Primária à Saúde. Ji-Paraná, Rondônia, Brazil.*
[IV] *Hospital de Base Dr. Ary Pinheiro. Porto Velho, Rondônia, Brazil.*

Corresponding author:
Luana Aparecida Alves da Silva
E-mail: luanamcr@yahoo.com.br

ABSTRACT
Objective: To analyze the effects of the technique of virtual reality guided imagery in the vital signs of hematopoietic stem-cell transplantation patients. **Method:** Quasi-experimental study with 35 participants who received an intervention using virtual reality guided imagery with progressive muscle relaxation, applied three times a week for four weeks in a referral hospital for transplants in the south of Brazil. Data collected included: temperature, arterial pressure, respiratory rate, heart rate, pain, and oxygen saturation, before and after each intervention. The comparisons were analyzed using Wilcoxon's test. **Results:** There was a clinical significance between the mean measurements before and after for respiratory rate (p=0.00) in all stages, and for the variables Heart rate, Temperature, and Oxygen saturation from the 1st to the 12th measurements (p=0.05). **Conclusion:** The intervention was low cost, easy to apply, and showed positive effects, presenting itself as an option for patient-focused care.
Descriptors: Imagery, Psychotherapy; Relaxation Therapy; Hematopoietic Stem Cell Transplantation; Bone Marrow Transplantation; Vital Signs.

RESUMO
Objetivo: Analisar os efeitos da técnica de imagem guiada por realidade virtual nos sinais vitais de transplantados de células-tronco hematopoéticas. **Método**: Estudo quase experimental com 35 participantes que receberam intervenção de imagem guiada por realidade virtual com relaxamento muscular progressivo, aplicada três vezes por semana durante quatro semanas, em um hospital de referência em transplante no Sul do Brasil. Os dados coletados foram: temperatura, pressão arterial, respiração, frequência cardíaca, dor e saturação de oxigênio, antes e depois de cada intervenção. As comparações foram analisadas pelo teste de Wilcoxon. **Resultados**: Houve significância clínica entre as médias das aferições de antes e depois para Frequência respiratória (p=0,00) em todas as etapas; e nas variáveis Frequência cardíaca, Temperatura e Saturação de oxigênio, entre a 1ª até 12ª avaliação (p=0,05). **Conclusão**: Os efeitos da intervenção se mostraram favoráveis, de baixo custo e fácil realização, sendo uma opção de ação de cuidado centrado no paciente.
Descritores: Imagens, Psicoterapia; Terapia de Relaxamento; Transplante de Células-Tronco Hematopoéticas; Transplante de Medula Óssea; Sinais Vitais.

RESUMEN
Objetivo: Analizar efectos de técnica de imagen guiada por realidad virtual en los signos vitales de trasplantados de células madre hematopoyéticas. **Método:** Estudio cuasi experimental con 35 participantes que recibieron intervención de imagen guiada por realidad virtual con relajación muscular progresivo, aplicada tres veces por semana durante cuatro semanas, en hospital de referencia en trasplante del Sur de Brasil. Los datos recolectados fueron: temperatura, presión arterial, respiración, frecuencia cardíaca, dolor y saturación de oxígeno, antes y después de cada intervención. Las comparaciones analizadas por test de Wilcoxon. **Resultados:** Hubo significación clínica entre las medianas de los contrastes de antes y después para Frecuencia respiratoria (p=0,00) en todas etapas; y en las variables Frecuencia cardíaca, Temperatura y Saturación de oxígeno, entre la 1ª hasta 12ª evaluación (p=0,05). **Conclusión:** Los efectos de la intervención mostrados favorables, bajo costo y fácil realización, siendo una opción de acción de cuidado centrado en el paciente.
Descriptores: Imágenes en Psicoterapia; Terapia por Relajación; Trasplante de Células Madre Hematopoyéticas; Trasplante de Médula Ósea; Signos Vitales.

INTRODUCTION

The hematopoietic stem cell transplantation (HSCT) has the highest chance of curing hematologic diseases and increasing survival rates among all therapies available. However, its treatment is complex and challenging[1]. During the process of preparing and receiving stem cells for transplant, the risk of complications is high, including infections, bleeding, pain, fatigue, lack of appetite, in addition to other physical symptoms and psychological, social, and behavioral ones[2-3].

Patients who undergo HSCT demand specific care, which require not only technical and scientific knowledge and skills, but also availability and interest from the nurses to get to know their expectations, fears, and feelings about the experience, thus contributing for their adaptation and safety through integral care[4]. The treatment requires social isolation. The patient is separated from their residence, family, and work. Their routine is altered, and there are risks for complications, in addition to the fear of relapse and death. Moreover, the cure or the control of the disease does not always lead to the recovery of health and/or wellbeing.

Studies show that integrative and complementary practices (ICP) may help reducing the symptoms of the disease, regulating behavior, and improving health-related quality of life (HRQoL) and wellbeing, thus helping the patient deal with the disease[5-6]. A research with cancer patients showed that these practices can help improve the efficacy of conventional methods[7], since they reduce stress and provide psychological and functional health benefits.

Relaxation is a ICP that has beneficial effects, as it diverts the attention of the patients from the collateral effects of their treatment, relieving muscle tension and guiding towards relaxing thoughts, thus promoting physical and mental comfort[8]. While the stress can activate specific inflammatory pathways, the relaxation therapy and mind-body treatments, on the opposite direction, can improve physical and mental health[9]. In summation, these techniques cause a natural body relaxation response.

Among relaxation therapies, the guided imagery is a low-cost, safe, and easy-to-use intervention. The participant is invited to elaborate a sequence of mental images in natural settings where they are encouraged to move, focusing on the sensory content evoked by their senses, based on positive imagination[10]. The relaxation response compensates the stress response in the limbic system, signals the parasympathetic nervous system, and modulates stress neuropeptides. Immune, cardiopulmonary, and metabolic responses are modulated in this way, leading to lower cardiac and respiratory rates and a higher oxygen supply[11].

The mechanisms through which mind-body approaches function are yet understood. However, a systematic review has shown that the use of guided imagery in cancer patients was effective and beneficial as a complementary therapy, showing no adverse effects related with the therapy, meaning that it is a safe option[12]. Similarly, another systematic review which evaluated the effects of mind-body practices in people with HIV showed that the relaxation techniques had positive results in regard to quality of life and immune system, while promoting the relief of physical and psychological symptoms[13].

The regular practice of relaxation may diminish the levels of adrenaline and cortisol, reducing arterial pressure (AP), heart rate (HR), and respiratory rate (RR), improving immune-system functioning and balancing the activity in the left and right brain hemispheres[14]. Studies that used relaxation techniques have shown that the intervention influences body functions observed by the reduction of AP and HR, increasing body temperature (T)[15-16].

This leads us to highlight the essential role of nurses, who are the main responsible in the multidisciplinary team for planning and providing patient-focused care, establishing personalized health-care actions to provide them with a better quality of life[17].

Within the context of verifying the effect of relaxation with virtual reality guided imagery, the alternative hypothesis of this study is: relaxation guided by virtual reality has a positive impact on the vital signs of hospitalized patients who underwent HSCT.

OBJECTIVE

To analyze the effects of the technique of virtual reality guided imagery in the vital signs of hematopoietic stem cell transplantation patients.

METHODS

Ethical aspects

This article was extracted from the thematic project "Relaxation with guided imagery for health-related quality of life during hematopoietic stem-cell transplantation". The research was approved by the Research Ethics Committee from the General Hospital of the Universidade Federal do Paraná. It is registered in the Brazilian Registry of Clinical Essays (ReBEC) under record number RBR-37ymzb.

Due to the beneficial effects of the intervention, some patients chose to continue the intervention until discharge; however, the data relating to this period was not used in this study.
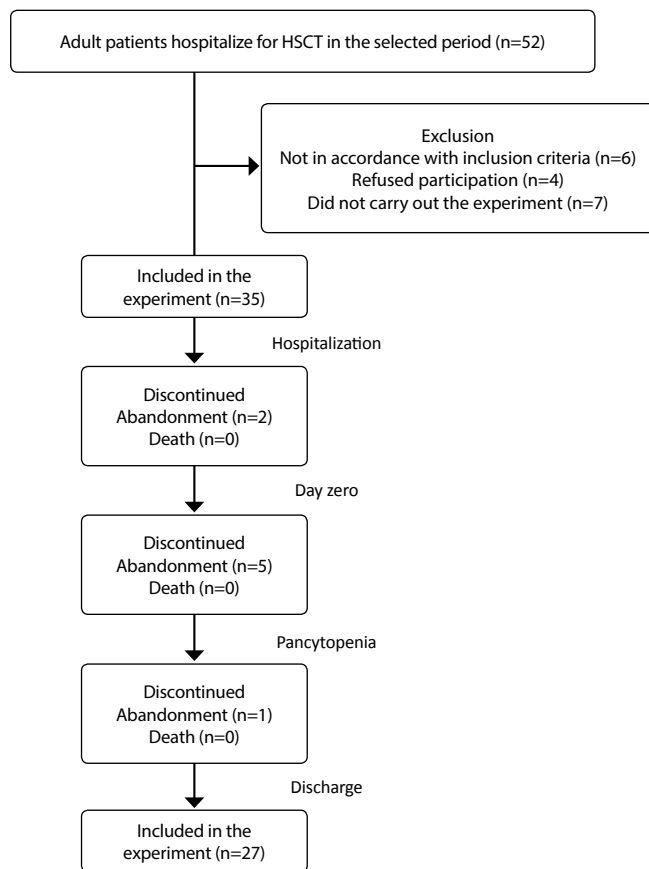
Design, period, and place of study

Quasi-experimental study, guided by the CONSORT instrument. Data collection took place from October 2019 to October 2020, in a Bone-Marrow Transplant Unit (BMTU) in a public teaching hospital in the south of Brazil, a referral hospital for HSCT in Latin America.

Population; criteria of inclusion and exclusion

Although the selection of the sample was non-probabilistic, sample size calculation was carried out considering the yearly mean of 2016, 2017, and 2018, of 52 HSCT in adults. Therefore, 35 patients were selected, among those who agreed to participate and attended inclusion criteria.

The study included 18-year-old or older patients whose proposed treatment was HSCT. Patients who were unable to filling in the questionnaires due to physical (visual and auditory) disabilities were excluded, as well as those who had a history of vertigo, labyrinthitis, and/or epilepsy in their records. From the 52 adult patients admitted for HSCT in the period of the study, 7 did not undergo the intervention. Their variables were not collected for comparison and they were excluded from the study. 6 others were

not in accordance with inclusion criteria, while 4 refused participation. The patients who refused to continue participating or to fill in the questionnaires, as well as those who refused two consecutive intervention sessions, had their participation discontinued.

Adult patients hospitalize for HSCT in the selected period (n=52)

Exclusion
Not in accordance with inclusion criteria (n=6)
Refused participation (n=4)
Did not carry out the experiment (n=7)

Included in the experiment (n=35)

Hospitalization

Discontinued
Abandonment (n=2)
Death (n=0)

Day zero

Discontinued
Abandonment (n=5)
Death (n=0)

Pancytopenia

Discontinued
Abandonment (n=1)
Death (n=0)

Discharge

Included in the experiment (n=27)

Note: Day zero is the day of the HSCT itself. It takes place after three to ten days of preparation, depending on the protocol used; the period of pancytopenia varied from five to eight days after day zero.

Figure 1 - Flowchart for participant selection, Curitiba, Paraná, Brazil, 2021

Study protocol

The relaxation technique using a guided virtual reality imagery was applied three times a week, with one day of interval, from the day of hospitalization until discharge, by a member of the research team or a trained nurse. The professionals involved were trained individually to: apply the data collection and intervention, measure participant vital signs; equipment hygiene, maintenance, and operation; monitorization and observation of the participant during the intervention. After receiving orientation, the professionals observed at least one intervention and carried out at least one intervention supervised by the researchers.

Vital signs were measured before and after each intervention. All equipment used to measure vital signs belonged to the BMTU and are of exclusive use of each patient.

To facilitate the comparison of data, a limit of 12 interventions was established, considering the expected length of four weeks for the hospitalizations. The virtual reality was used to increase the capacity to visualize and the feeling of being present in the setting, contributing for a relaxing environment.

The technique consisted in the reproduction of a narration that guided the patient towards relaxation, accompanied by 360º projected images and sounds of nature coupled with instrumental music, for approximately 10 minutes. BOBO VR Z4 virtual reality headset with embedded headphones were used in the process. The participant stayed in their hospital room in a safe and comfortable position, which allowed the intervention to be carried out. To prevent and control infections and protect participants, the intermediary disinfectant solution Surfic® was used, in the concentration of 0.5%, before and after each use. Furthermore, masks for the virtual reality headtset and protectors for the headphones were used, both disposable.

Analysis of results and statistics

The following variables were evaluated: heart rate (HR), respiratory rate (RR), temperature (T), peripheral capillary oxygen saturation (SpO_2), systolic arterial pressure (SAP), diastolic arterial pressure (DAP), and pain. Data collection used a sociodemographic and clinical questionnaire (SDCQ), which included the variables: sex, marital status, family income, type of transplant, stem-cell source, and diagnosis. The questionnaire was applied once, before the experiment. A specific instrument was created to collect data on the variables HR, RR, T, SpO_2, SAP, DAP, and pain - using a numerical verbal scale. Data were collected before and after each application of the guided imagery technique.

Data were recorded in Microsoft® Excel, Office 365®. Information was double input by independent researchers and later validated. For a before-and-after comparison of the variables HR, RR, T, SpO_2, SAP, DAP, and pain, Wilcoxon's test was applied with the help of the software Statistica, version 7. Only the data from participants who saw the experiment through to the end was considered. The significance level adopted was $p<0.05$.

RESULTS

35 participants were included. 17 (77.14%) was followed up until discharge; eight (22.86%), were not due to complications that prevented continuing the practice. The participants were followed up from 19 to 45 days of hospitalization. Therefore, some participants did not reach four weeks hospitalization or 12 interventions, and remained in the study due to the fact they complied the intra-hospital treatment according with the protocol adopted.

The mean age of the participants was 38 years old, varying from 18 to 65 years old. Most were male (22; 62.68%), with an income from one to three minimum wages (21; 60%). Regarding the transplant modality, most were related allogeneic transplants (28; 80%) after a diagnosis of some type of leukemia (13; 37,14%). The second most common diagnosis was severe aplastic anemia (9; 25.71%).

A mean of 10.8 interventions was carried out, with a standard deviation (SD) of 4.41 interventions. Significant results were found in the comparison of the mean vital signs before and after for HR, RR, T, SpO_2, SAP, and DAP. There was no significant difference between the measurements in regard to pain, since most participants were not feeling any before, during, or after the intervention (Table 1).

Table 1 - Means of the variables heart rate, respiratory rate, temperature, and oxygen saturation before and after each intervention, Curitiba, Paraná, Brazil, 2021

Intervention	HR*			RR†			T‡			SpO₂§		
	Before	After	p‖	Before	After	p‖	Before	After	p‖	Before	After	p‖
1	79.74	76.86	**0.018**	21.20	17.31	**0.000**	36.15	36.24		95.63	96.46	**0.005**
2	83.21	80.53	**0.023**	20.85	17.94	**0.000**	36.30	36.30	**0.002**	95.76	96.61	
3	84.81	82.74		20.42	17.16	**0.000**	36.25	36.34		96.34	97.19	**0.002**
4	87.93	87.68		20.54	17.82	**0.000**	35.65	36.25	**0.000**	96.57	97.14	
5	89.32	85.48	**0.011**	20.39	17.71		36.33	36.38		96.13	96.35	
6	89.17	86.45	**0.028**	20.86	18.59	**0.000**	38.47	38.62		96.28	97.59	**0.001**
7	88.65	85.27	**0.020**	20.81	18.08	**0.000**	36.39	36.55		96.42	97.38	**0.001**
8	91.08	90.64		21.12	18.36	**0.000**	36.77	36.94	**0.007**	96.76	97.52	**0.005**
9	91.57	88.22	**0.036**	20.57	18.00	**0.000**	36.71	36.90		95.78	97.04	**0.005**
10	93.25	89.58	**0.010**	20.29	17.79	**0.001**	36.80	39.48		95.50	96.46	**0.005**
11	94.59	89.27	**0.001**	21.50	18.91	**0.001**	36.49	36.67	**0.015**	96.55	97.23	**0.012**
12	94.18	90.23	**0.021**	21.55	17.91	**0.000**	36.64	36.69		96.59	97.05	

*HR – heart rate; †RR – respiratory rate; ‡T – Temperature; § SpO₂ – peripheral capillary oxygen saturation; ‖p – significance probability p < 0.05.
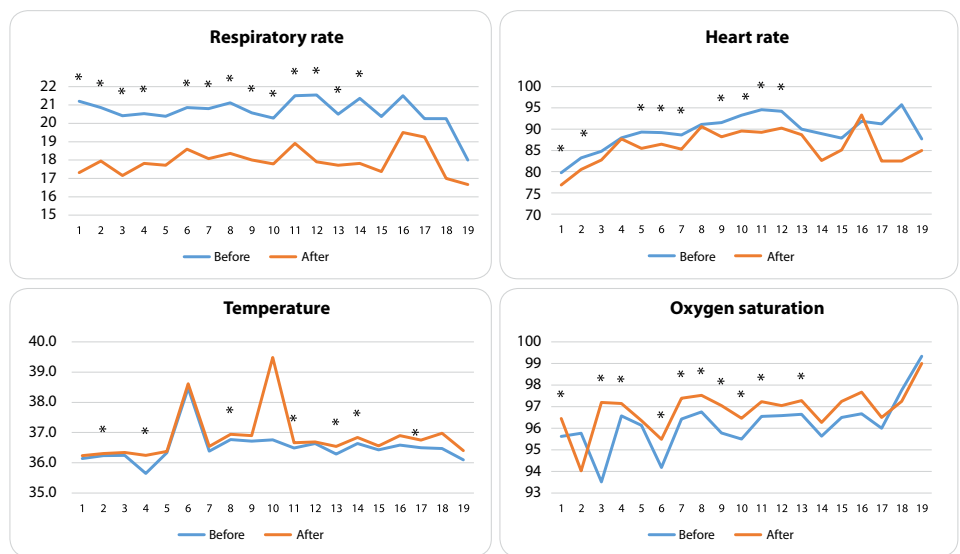
HR presented significant differences in nine moments, with a reduction in the values found after the intervention. RR presented the most significant changes, being lower at the end of the intervention. Significant values were found at 12 moments. Regarding temperature, its values were higher after intervention, with significant differences at 7 moments. Similarly, SpO₂ values were higher after intervention, with a significant difference at 10 moments. The results are presented in Figure 2.

Regarding AP, it presented the lowest before-after variation among all values analyzed. However, SAP showed a significant difference at two moments, in the sixth intervention, while DAP did so at one moment, in the first intervention. There were no significant variations in pain, since the symptom was not present in most evaluations.

* Probability of significance of p>0.05.

Figure 2 - Comparison of the means of the variables respiratory rate, heart rate, temperature, and oxygen saturation before and after intervention, Curitiba, Paraná, Brazil, 2021

DISCUSSION

The relaxation therapy with guided imagery is an option for interventions in the context of HSCT. Its use broadens health care actions, favoring patient-focused integral care, where the patient is the protagonist.

The mean age of participants in the study can be considered low, when compared with international means. South-Korean studies showed means above 48 years old[18-19]; a multi-centric Italian research found a mean of 50 years old[20]; and an investigation from the United States reported a mean of 56 years old[21]. On the other hand, in Brazil, the mean ages are similar to that found in this research, as another study carried out with a similar population in the South of the Country shows[2]. The same was true for a study in a private transplantation center in the northeast of the country, with means of 38 years old, approximately[22].

For all studies[2,18-22], however, the population of patients undergoing HSCT is relatively young and in a productive age. Isolation from one's family, work, and social life in general, associated with the limitation of one's own autonomy as related with the restrictions of treatment, generates negative impacts on the quality of life and even in the therapeutic course and in the response to the patients. Other related factors include financial toxicity resulting from the inability to provide for one's family and from health care treatment costs, even in universal public health systems, such as the Brazilian one. All these components are very important for the treatment and should be considered by professionals who attend this type of patient in the provision of options that can soften the psychological and physical burden.

The allogeneic HSCT was the most common in this study, and types of leukemia were the most common diagnosis. The prevalence of this modality of transplant, considered to be more complex, could be related with the characteristics of the BMTU where the study took place, which is a referral service in Latin America.

Regarding the effects of the intervention in data signs, there were significant differences in the means of HR, RR, T, SpO_2 before and after the intervention, with lesser changes in the AP, indicating that a state of relaxation was indeed achieved. For HR and RR, this study causes a diminution of the values analyzed, according with this research. Regarding oxygen saturation, there was an increase in values, which can be related with the respiratory exercises integrated in the intervention. Results could be related with the technical efficiency in the reduction of physiological symptoms of stress.

No studies found used virtual reality guided imagery in HSCT. However, in other investigations that used interventions with guided imagery in critical contexts of health treatment, the positive results of the intervention on the vital signs were similar. A North-American study that evaluated the effects of the guided image in the preparation to extubate 42 patients on mechanical ventilation found that HR and RR were significantly lower in the intervention group, in addition to better oxygen saturation values in the second session, despite the absence of differences in AP[23].

An Iranian study with hemodialysis patients found a significant reduction in SAP, RR, and HR after guided imagery relaxation, but temperature and oxygen saturation were not tested[24] Similarly, a randomized clinical trial carried out in Greece and Cyprus, with progressive muscle relaxation associated with guided imagery, showed a significant difference in SAP, HR, and T, despite not having evaluated RR[15].

Regarding temperature, there was an increase in values after intervention. This finding is related with relaxation responses. Results from a randomized clinical trial (RCT) suggest that this response influences body function and reduces pressure levels and HR, while increasing body temperature. The same RCT indicates that AP changes are related with situations of continuous adjustment, being connected with long-term stimuli[15], which could not be verified in this study.

A research that evaluated the quality of life of 55 patients with hematologic cancer during the hospitalization stages using the European Organization for Research and Treatment of Cancer Quality of Life Questionnaire - Core 30 (EORTC QLQ-C30) found pain was a significant symptom during the period of pancytopenia in cancer patients after HSCT, being considered the second symptom that most decreased the quality of life of these patients[2]. In this study, the measurements of pain showed no significance, but most participants did not report the symptom during interventions. This variable may present bias, as patients received analgesic medication as part of their treatment. Another factor that should be highlighted is that the participants chose the time for the intervention and whether they would accept it or not; this may have led them to avoid doing so during episodes of acute pain.

The use of guided imagery resulted in a significant reduction of pain in another quasi-experimental study with cancer patients, carried out in Turkey[25]. In addition, a systematic review that evaluated the effects of guided imagery in the physiological and psychological outcomes of adult patients in intensive care had positive effects on the pain of those who received interventions with guided imagery, when compared to those who received regular care[11].

A review, aiming to analyze studies that use guided imagery as a strategy to improve the HRQoL of cancer patients showed that using guided imagery in this group of patients promotes wellbeing, feelings of relaxation, and reduction of stress, with participants highly satisfied with the results of the intervention[26]. These factors are related with changes in the vital signs, when we consider the effects of relaxation as a response to the stress.

The intervention was, in general, well-receive by patients, and does not disrupt treatment routine. The cost of application is relatively low and no evidence of collateral effects to its use was found. The alterations changed in vital signs show its effectiveness to induce a state of relaxation, which could contribute to aspects of the life and treatment of the patient in the context of HSCT.

Study limitations

Considering mind-body therapies, physiological effects are believed to increase with practice. In this research, this connection between frequency and benefits could not be observed, due to the time the treatment was expected to last during hospitalization.

Participants had heterogeneous diagnoses and transplant modalities, which can be considered another limiting factor in this research. Treatment protocols thus the time participants remained in the unit, varied, which may have impaired the comparison of results during evaluation. The loss of eight participants in the follow up stage should also be taken into consideration. In addition, due to the characteristics of the intervention, the research could not be blinded.

Contributions to the Field of Nursing

The use of guided imagery relaxation can bring benefits for the patient in the context of HSCT, since the availability of complementary integrative therapeutic options can contribute to improve HRQoL as it relieves physical and emotional symptoms, perceiving the individual holistically and having them as the focus of care. This study shows evidence recommending the use of this technique.

CONCLUSIONS

The nurse has an essential role in the promotion of the patient's wellbeing, reducing stress and anxiety during treatment. Results indicate that the use of guided imagery relaxation through virtual reality led the participants of the research to a relaxed state. This effect was made clear by the changes in vital signs examined before and after, with a significant lowering of RR and HR and an increase of SpO_2 and T, showing the efficacy of the technique. Therefore, guided imagery relaxation can be used in patients who undergo HSCT with beneficial effects.

We suggest the development of further experimental studies using guided imagery as an intervention in this type of population, to evaluate its effects. Finally, it should be remarked that researches with more participants could be generalized, thus providing better evidence for technical application.

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