

'Open Window': a randomized trial of the effect of new media art using a virtual window on quality of life in patients' experiencing stem cell transplantation

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Abstract

Objectives: To measure the psychological effect of an art intervention on hospitalized patients and explore benefits to their quality of life.

Methods: We conducted a large prospective randomized trial between July 2006 and August 2009 of an art intervention, Open Window (OW), in patients undergoing stem cell transplantation for a hematological malignancy compared with a control group. The primary endpoint measured the effect of an art intervention on levels of anxiety, depression, and stress using the Hospital Anxiety and Depression Scale and the Distress Thermometer. The secondary endpoint measured the influence of OW on patients' experiences of stem cell transplantation using the OW survey and expectations questionnaires.

Results: Of the 199 patients in the study, 96 were randomized to the intervention group and 103 to the control group. Participants in the intervention group had significantly reduced levels of anxiety on the day before transplant ($p = 0.001$), at day 7 ($p = 0.041$), and day 60 ($p = 0.035$). There was a significant reduction in depression before transplant ($p = 0.022$). Participants in the intervention group reported better experiences ($p < 0.005$). Qualitative data showed that those in the intervention group commented freely on their likes and dislikes about OW and how it made them feel.

Conclusion: An art intervention, OW, had a positive influence on health-related quality of life and patients' experiences of having a stem cell transplant.

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Introduction

The incidence and burden due to morbidity and mortality of cancer grow worldwide each year. Diagnosis and treatment of cancer are associated with high levels of distress that is regarded as a reliable risk for adversely affecting a person's sense of well-being [1–3]. Distress includes feelings such as powerlessness, sadness, fear/panic, depression, and anxiety and can therefore adversely affect quality of life (QoL). It is also associated with emotional subscales such as anxiety and depression [4,5] that studies have found to be key risk factors of diminished QoL [6–9]. QoL is now recognized as an important outcome in the assessment and treatment of patients undergoing treatment for different types of cancer [10].

Open Window (OW)¹ is an innovative art intervention available in the National Stem Cell Transplant Unit at St. James's Hospital, Dublin, Ireland, where patients undergo treatment for hematological malignancies.

Because of the risk of infection, patients are treated in single, high-efficiency particulate air-filtered, positive pressure, en suite rooms. There are restrictions on room décor and visiting with the result that the environment is clinical and lacks stimulation. A quest to improve patients' QoL by enhancing the patient environment and providing stimulation was the main motivating factor in the conceptualization and development of the OW project. In recent years, music, visual, and the performing arts have been regarded as key factors in the creation of healing environments and providing patient-centered care in hospitals [11–13]. Art, whose value in health lies in its ability to comfort, console, and sustain [14], is thought to reduce stress and anxiety levels and promote well-being and a positive mood [15–18].

The OW system consists of a computer server, network hardware, and a PC for each room. This technology is used to create a unique virtual window controlled by patients. The window is created using a video projector and audio speakers. A remote control allows the patient

to switch art channels or open onto a number of 'virtual places' that provide a range of art, media, or experiences [19]. The aims of OW are to reduce the sense of isolation and provide an opportunity for reflection and a sense of connection with the outside world. Patients are actively involved in the commissioning process and regularly consulted by the curator.

Nine art 'channels' provide access to a collection of artworks by well-known artists, ranging from the visually complex to images of nature. Established national and international professional artists, chosen for the OW project according to the relevance of their ongoing practice, were provided with mobile phone cameras and camcorders to record images of the outside world that were of particular visual interest or personal significance to participants. These images were transmitted to the patients' room over the Internet and mobile phone networks.

All artworks were assessed by a committee, consisting of clinicians, arts professionals, nurse, hospital arts director, art critic/historian, psychologist, and patient advocate [20]. This was done to neutralize any issues of censorship while upholding the duty of care to patients. Costing for OW is package dependent and is associated with a patient subscription.

Methods

A randomized prospective clinical trial was conducted to measure the psychological effect of OW on the QoL of patients and assess how the introduction of an art intervention influenced patients' experience of stem cell transplantation.

We conducted the trial from August 2005 to October 2009 in the National Stem Cell Transplant Centre at St. James's Hospital, Dublin, Ireland. The study protocol was approved by the institutional review board. Eligible patients were those referred for stem cell transplantation for hematological malignancies or aplastic anemia and in whom it was anticipated that all care would be undertaken at St. James's Hospital. Participants were treated by the 'Transplant Team' adhering to all the appropriate unit protocols. All patients provided written and verbal informed consent.

Sample size calculation

In order to test the null hypothesis that the group means are equal, alpha was set at 0.05. The test is 2-tailed, and with a minimum power of 80%, a sample size of 100 in each of the groups was necessary to yield a statistically significant result. This computation assumes that the mean difference is 1.66500 (corresponding to means of 5.55000 vs. 3.88500) and the common within-group standard deviation is 4.14000 [21].

Participants were allocated a study number and randomly assigned to the intervention (a room with OW) or control group (a room without OW) on a 1:1 ratio. A computer random number generator (Stats Direct, StatsDirect Ltd, Cheshire, UK) used random

block sizes to produce the allocation sequence. On receipt of consent, participants were allocated to either the intervention or control group on the instructions of an independent telephone randomization service. Because of the visual nature of the intervention, it was not possible to mask the allocation.

All patients that met the criteria were invited to participate in the study. Eligible patients who provided consent were randomized to the intervention or control group. The unit is the only center for adult transplantation in Ireland; therefore, there was no self-selection of patients. Data were collected at seven time points: T1 (day of admission); T2 (Day -1, the day before transplant); T3 (Day +7, seven days after transplant); T4 (prior to discharge); T5 (Day +60 post transplant); T6 (Day +100 post transplant); and T7 (6 months post transplant). All questionnaires and interviews were administered and conducted, respectively, by a research assistant who was not a member of staff in the unit and was not an artist. The sponsors did not have any role in the design and conduct of the study, and the study was conducted in accordance with the trial protocol. Ethical approval was granted by the institutional ethics committee. An independent adjudicator agreed to review any adverse responses and interim data analysis.

The study protocol describes a four-arm trial (autologous and allogeneic stem cell transplant groups) using stratified sampling. However, more than 50% of those assessed for eligibility did not meet the criteria, because they received their follow-up care in a hospital other than St. James's; therefore, recruitment would have taken an unacceptably long time. Furthermore, interim analysis failed to detect a difference between patients undergoing autologous or allogeneic stem cell transplantation in terms of study outcomes. Therefore, recruitment of participants stopped when a sample size of 100 for each group (intervention and control) was reached.

Open Window

Participants in the control and intervention groups received standard treatment, but those in the intervention group also had access to OW. Participants could select from a master menu of nine art channels with themes of nature, locations of personal significance, visual abstraction, and classic artworks. Patients had the option to deselect any artwork and exclude it from their future viewing experience. In a collaborative act with the curating artist, patients were asked to identify a location that they would like to view. A remote camera was subsequently placed in the location, and images were transmitted to the patients' room. It was the intention of the curating artist to provide artworks that empathized with the individual emotional and psychological responses associated with being diagnosed and treated for a life-threatening illness

Outcome measures and follow-up

The primary outcome was the measurement of levels of anxiety, depression, and distress in participants over 6

months. The Hospital Anxiety and Depression Scale (HADS) [22] and the Distress Thermometer [23] were chosen as the most appropriate psychometric tools for collecting data. These tools are commonly used in cancer research for assessing health-related quality of life and are regarded as valid and reliable with this patient group [24–26]. They correlate well, contain few questions, thus minimizing patient burden [22–24], and have the ability to detect changes over time [23,27,28]. The HADS is a 14-item scale with subscales for anxiety and depression and can be completed in 3–5 min with a score of 7 or less taken as normal [7]. Scores of over 11 indicate a mood disorder, and scores from 8 to 10 are suggestive but not diagnostic. The Distress Thermometer is a single-item visual analogue scale that is regarded as having optimal sensitivity and specificity for identifying distress at a cut-off score of ≥ 5 in assessing psychological well-being in cancer patients [23,24]. It also includes a 34-issue problem list divided into six categories (Practical, Physical, Family, Emotional, Spiritual, and Other) that patients used to identify issues that have caused them distress in the preceding week. Patients were asked to tick YES or NO to the items listed as being a problem in the past week.

A secondary outcome of the study was whether patients' experience of undergoing stem cell transplantation matched their expectations. The expectations questionnaire, which was developed for this study, contained a single item asking participants to rate their experience of having a stem cell transplant on a five-point scale ranging from much worse, a little worse, as expected, a little better, and much better than expected. The expectations questionnaire was administered at T6.

Semi-structured interviews were conducted with all participants to provide explanatory data and a benchmark against which data from the expectations questionnaire could be explained and interpreted. The four main topics explored were patients' views of their environment, control, stress, and expectations of having a transplant. Those in the intervention group only were also asked for accounts of their experience of OW.

The OW survey questionnaire was designed to assess the views of participants in the intervention group. It consisted of five sections with a total of 31 items and was administered at T4 (time of discharge). Section 1 contained 11 statements about how OW made them feel, and Section 2 contained eight questions on the types of images the participants preferred on the OW system. Responses for sections 1 and 2 were given on a five-point Likert scale ranging from 'Strongly Agree' to 'Strongly Disagree' in questions. Section 3 contained five statements that explored the duration, frequency, preferred time of day that participants used OW, and their views on the technology. Section 4 contained six items on which type of image was most popular and included the option of stating a preference for the accompanying music and the television. This was the only means used to assess participants' use of other communication media in the study. Section 5 was an open invitation to the

participants to document any comments they had about OW that they felt were relevant to their experience and had not been addressed in the questions.

Statistical analysis

Analyses were carried out using SPSS version 17.0 (IBM Corporation, Armonk, New York, US). Quantitative variables were compared using ANOVA. This test provides details regarding the main effect for time, groups, and interaction effect [29]. Binary calculations were compared using the Chi-square test. All reported *p*-values were 2-sided with $p < 0.05$.

Computer-assisted qualitative data analysis software, NVivo 7 (QSR International, Doncaster, Victoria, Australia), was used to manage and support the qualitative data [30]. Template analysis was the framework used for data analysis. This includes techniques for organizing and analyzing textual data thematically and is used within many epistemological positions [31,32].

Results

Between July 2006 and October 2009, 425 patients were assessed for eligibility, and 214 patients who met the eligibility criteria were invited to participate in the study. Fifteen declined and 199 were randomized. Ninety six were randomly allocated to the intervention group with 12 lost to follow-up, 8 died, and 4 withdrew because of severity of symptoms. One hundred and three were allocated to the control group with 7 lost to follow-up, 4 died, and 3 withdrew because of severity of symptoms (Figure 1). One hundred and eighty participants completed the study. All participants received standard treatment based on unit protocols and delivered by the 'Transplant Team'. The demographics of all participants are shown in Table 1. There was no significant difference between the groups when numbers, type of transplant, donor, conditioning therapy, gender, age, and educational level were compared.

Using the cut-off score of 7 on the HADS, binary calculations revealed that the intervention group had significantly lower levels of anxiety than the control group at T2 ($p=0.001$) (Figure 2), T3 ($p=0.041$) (Figure 3), and T5 ($p=0.035$) (Figure 4). Levels of anxiety were marginally lower but not statistically significant at all other data collection points. The results for depression are similar in that the trend was more in favor of the intervention group. Binary calculations for depression against the cut-off point of 7 showed $p=0.022$ at T2 only (Figure 5).

The repeated measures ANOVA statistical test showed no significant differences in levels of distress at any time point in any of the groups ($p=0.370$).

The secondary outcome of the study was whether patients' experience of undergoing stem cell transplantation matched their expectations. Chi-square tests showed a highly significant difference between participants' actual experience versus their expectations with 63% of the intervention group and 27% of the control

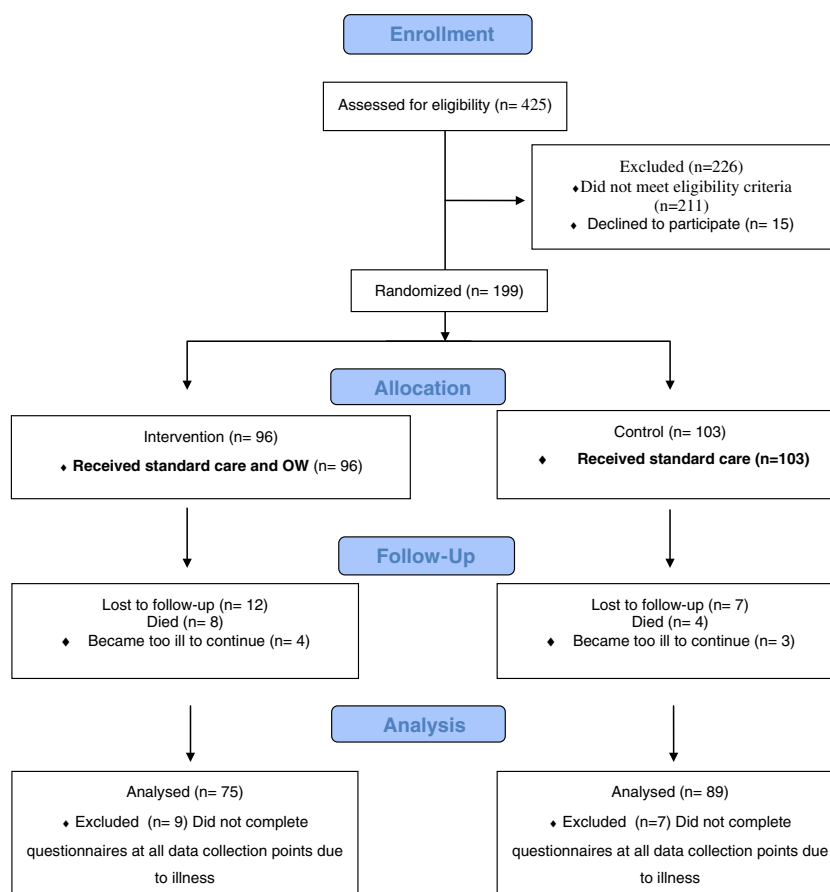


Figure 1. Study profile

group reporting that the experience was better or much better than expected ($p < 0005$) (Figure 6).

The qualitative data highlight similarities between the intervention and control groups in relation to

Table 1. Demographics of control and intervention groups

	Intervention	Control	Pearson Chi-square
Gender			
Male	58	60	
Female	38	43	$p = 0.096$
Age			
18–34	29	28	
35–69	67	75	$p = 0.0222$
Education level			
Secondary/senior	59	57	
Undergrad/post grad	37	46	$p = 0.76$
Type of transplant			
Allogeneic SCT ^a	66	66	
Autologous SCT	30	37	$p = 0.49$
Conditioning RIC ^b	24	28	$p = 0.58$
Conditioning TBI ^c /Cy ^d	28	28	$p = 1.0$
Conditioning Bu ^e /Cy ^f	14	9	$p = 0.30$
Autologous SCT BEAM ^g	30	37	$p = 0.30$

^aSCT, stem cell transplant.

^bRIC, reduced intensity regimen. Fludarabine, Busulphan, ATG or Fludarabine, Melphalan, Campath 1G.

^cTBI, total body irradiation, single fraction, 7.5 Gy.

^dCy, Cyclophosphamide i.v. 60 mg/kg \times 2 days.

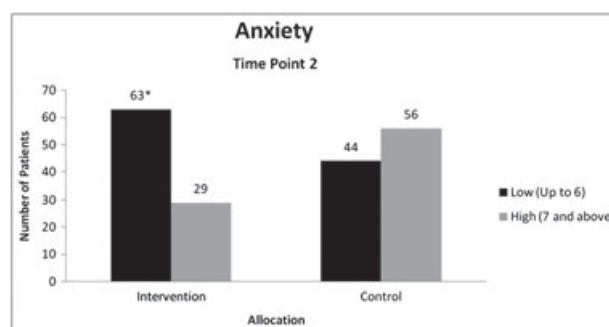
^eBu = Busulphan 4 mg/kg p.o. \times 4 days or 3.2 mg/kg i.v.

^fCy = Cyclophosphamide 50 mg/kg i.v. \times 4 days.

^gBEAM = BCNU 300 mg/m², Etoposide 400 mg/m² \times 4 days, Ara-C 800 mg/m² 4 days, and Melphalan 140 mg/m².

participants' views on the environment, expectations of what the experience of having a stem cell transplant would be like, stress, and control. An unexpected theme called 'self and others' emerged, which related to surprise at how well they coped.

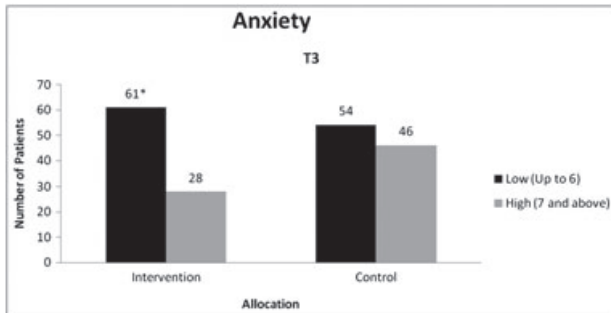
The theme, called 'self and others', emerged unexpectedly from the data because participants frequently referred to things they had learned about themselves as a result of going through the experience of being diagnosed with and receiving treatment for a life-threatening illness. They also talked about how relationships with family and friends had changed during this time.



* $p = 0.001$

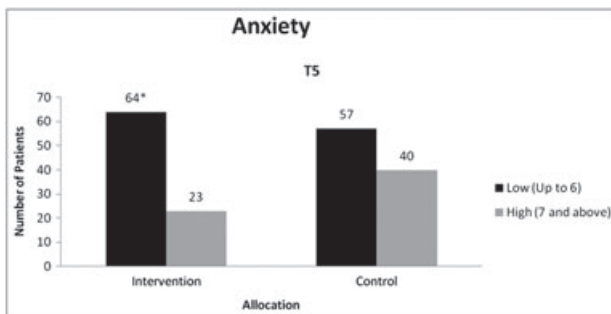
Figure 2. Level of anxiety at T2. * $p = 0.001$

A randomized trial of the effect of an art intervention



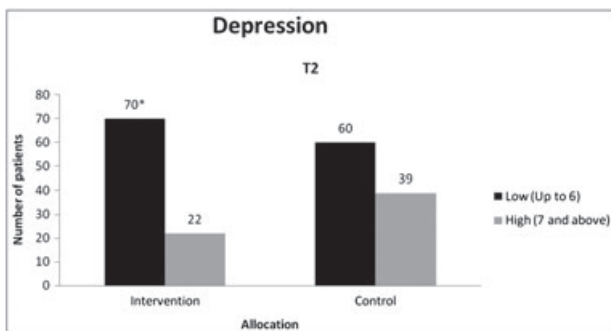
* $p=0.041$

Figure 3. Level of anxiety at T3. * $p = 0.041$



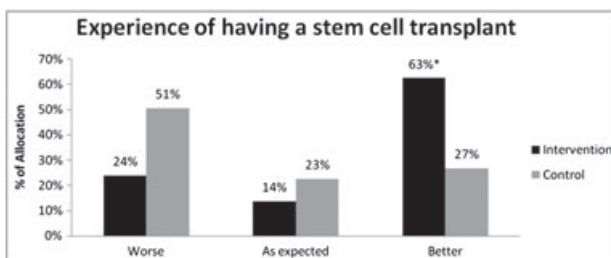
* $p=0.035$

Figure 4. Level of anxiety at T5. * $p = 0.035$



* $p=0.022$

Figure 5. Level of depression at T2. * $p = 0.022$



* $p<0.001$

Figure 6. Experience of having a stem cell transplant. * $p = <0.001$

‘Generally speaking now I do kind of see life a little bit differently. I suppose before all this I would have found things a major problem, but they’re not problems now. I can deal with things much better, I’m just a bit more philosophical about what is a major problem’.

Comments in relation to control centered on whether participants perceived that they had control over their lives or situation, and although some expressed feelings of frustration at not having control and having lost their ‘role’ in the family, most expressed positive views and an expectation of having control in the future.

‘I can accept that they [staff] are professionals and they know exactly what they’re doing and therefore without hesitation I comply to everything that they ask me to and that’s been my way since, since we started this. What they say I do, without question because they are the bosses’.

When asked for their views of the environment, participant responses generally related to practical or aesthetic issues. Many highlighted negative aspects of the room. Words such as clinical, clean, functional, bright, airy, and nice were used when providing positive descriptions. Words like dark, small, and prison-like were used in negative descriptions. However, many of these references were followed by comments indicating that participants also understood why they were there, the reasons for the restrictions and, if given the choice, would not want to be anywhere else because that is where they needed to be to get better.

‘My feeling in the room is that the room is protecting me so they said for instance on the ward, “you may walk up and down the corridor ward with a face mask on”, and one big reason I haven’t done that is I thought this room is set up a hundred percent care for me whereas once you go past that second door there you are less protected, you can bump in to someone and exchange germs’.

Participants generally felt that they knew what to expect in relation to the physical effects of treatment. Nausea, vomiting, fatigue, and diarrhea were most frequent. The high risk of infection and/or mucositis caused anxiety, but participants generally felt that if they complied with treatment and stayed in their room with limited visitors, the nursing and medical staff would be able to anticipate their needs.

Those in the intervention group commented freely about OW and how it made them feel. Some participants used the words ‘distraction’, ‘interesting’, or ‘something else to look at’. Others felt it provided connection with the outside world, and some experienced the value of both.

‘It kind of took me out of this place for a bit, to somewhere I can picture myself sitting down having a picnic’.

For some, it caused them to imagine being part of the scenes that they viewed, and they valued its ability to let them be ‘somewhere else’ other than their room and even think about something else other than their illness.

‘“Open Window” takes away this feeling of being trapped in a box or in a prison. The fact that you look at the wall and you can see horses racing out there with a forest behind them or lakes and boats, it takes away the feeling of being caged’.

‘They [the images] were relaxing when I watched them, you know you just lie there and you’re just in a trance. . . you’re not here, you’re in another world. That video with the cows grazing, I mean being born and reared in the country I felt I was in that field’.

Participants reported both positive views and negative views of what they saw on OW. The following quote provides a good insight into the role of art in particular contexts and personal meaning.

‘The image of a wilting flower was totally alien. . . it’s very hard to look at an image on a wall and say “That’s how it is”! That’s how it is if you feel well, but it’s not if you are lying on the edge of eternity’.

Analysis of the OW survey questionnaire showed that 64% of the intervention group reported that OW helped them deal with confinement/isolation and 74% felt it provided a sense of connection with the outside world. The majority of participants (70%) watched OW for three or more days per week, and 61% viewed OW for periods of up to 1 h per day. Only 30% said that they preferred watching TV. Seventy-seven percent indicated a preference for art videos over static photographic images. However, of those who expressed a preference for photographic images, 90% preferred images of familiar places or family members.

Discussion

This study shows that an art intervention such as OW affects the health-related quality of life of patients undergoing stem cell transplantation by reducing levels of anxiety, altering negative expectations of the transplant, and increasing the sense of connection to the outside world. Participants from the intervention and control groups expressed surprise and how they coped and the positive effect of experiencing a life-threatening illness on personal relationships. A possible explanation for this is ‘response shift’. This is described as a change in internal standards, values, and concepts of QoL [33]. It is unique to individuals in maintaining and improving QoL when experiencing chronic or life-threatening illness and is facilitated through strong social and family support [34].

However, the highly significant benefit of OW on the experiences of the intervention group as indicated by the expectations questionnaire suggests that OW has an additional benefit beyond response shift. Qualitative data indicated that participants felt its value was in its ability to distract them from their immediate physical

and psychological situation, to stimulate their imagination, and to connect them to a world outside the hospital. Participants experienced OW in a manner similar to that of an art museum/gallery in that they did not spend long periods viewing OW and created their own personal experience by controlling the system and choosing what they wanted to see [35–38]. This is supported by the findings from the qualitative data that showed that participants commented freely on their likes and dislikes about OW. They also commented that OW stimulated conversations with health-care staff and visitors on subjects other than the patients’ medical problems.

OW also connected patients to the outside world through family images and familiar locations. OW did not compete with television, Skype, or Facebook as participants were free to engage with any of these technologies. The preference for art videos by the majority of participants may relate to their deliberately contemplative mood and pace compared with the action-based narratives of television. The return to view OW 3–4 times a week indicated that it held aesthetic appeal and personal meaning for the participants.

Benson’s [39] theory of aesthetic absorption that draws a great deal from Dewey’s pragmatist philosophy provides a psychological perspective on the possible effect of art as a process that is an active, personal, and creative choice. Benson’s view is that aesthetic absorption in art represents the beginning of a journey for the viewer in which they continue to engage, reflect, and formulate meaningful and unique personal social and cultural experiences similar to normal life. These types of ‘normal life’ experiences rarely exist for patients with a chronic or life-threatening illness who need to spend long periods in hospital.

This may explain the significantly lower levels of anxiety reported by the intervention group at T2, T3, and T5. Participants experiencing OW were less anxious; therefore, they perceived that their experience was better than they expected. It is feasible to suggest that these lower levels of anxiety had a positive influence on patients’ QoL even in the context of experiencing intense treatment and side effects for a life-threatening illness. These results support rejection of the null hypothesis that OW has no effect.

Our results are consistent with nonrandomized trials of art interventions in hospitals that report on the positive role of art in the health-care environment. However, they are often anecdotal, descriptive, and rarely critical. Ulrich et al. [40] explored the effects of putting photographs of nature or abstract images at the foot of the bed of patients recovering from cardiac surgery. This study was limited in that it was small, nonrandomized, and the abstract art images were computer derived, raising the issue of using art of high quality and appropriateness. Staricoff et al. [15], in a nonrandomized study, looked at the effect of visual and performing arts on patients, staff, and visitors. No detail was given of the visual art or how respondents were selected. A follow-up study [16] tried to measure

the effects of the art interventions on blood pressure, cortisol, and CD4 levels. This investigation was limited in that many different clinical situations were studied, most of the findings were not statistically significant, and randomization was not carried out. Diette and Rubin [41] carried out a randomized study using distraction techniques (nature sights and sounds), but numbers were small (control=39 and intervention=41). They found that pain control was more effective during bronchoscopy, but anxiety levels were unaffected. Behrman [42] claims that it is very difficult to provide rigorous proof of the value of art in health and that the absence of rigorous evaluation results in uncertainty in relation to its benefits.

Strengths and limitations

The OW project wished to enhance the patient experience using technology to produce high quality images without compromising patient care. OW was designed with a view to incorporate current art practice, patient participation, and patient control. Previous art and health interventions treated the artist as 'auteur' and the patient as a passive observer. In seeking to be truly patient centered, this intervention introduced a new paradigm of patient as commissioner/co-curator of the artworks.

OW provided a structure in which artists, patients, and families came together to provide psychosocial support in the form of a collective artwork. Artists used their skills as interpreters of the visual to create art experiences that could sustain repeated viewing over extended periods. Families had a means to give 'form' to their support by contributing significant personal imagery to the collection. Patients were able to exercise control over the clinical environment and have their aesthetic opinion made instantly visible in their hospital room. In this way, necessary moments of reflection were visually highly personalized.

As the proposed sample size of 200 was slightly less than intended, the 80% power calculation was somewhat undermined.

Although the study was conducted in a specific population, the authors feel that this technology can be applied to other patient groups.

Conclusion

This study shows that the use of art intervention in adult hospitals is possible and that rigorous evaluation of its effect can be carried out in the context of a randomized prospective trial. The introduction of OW had a positive effect on QoL as measured by levels of anxiety, depression, and the experiences of patients having a stem cell transplant. Patients' expectations and experiences of hospitals are very important, and any intervention, such as OW, which can alter these favorably, is welcome.

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Note

1. To view OW, go to following links: <http://vimeo.com/6301289> and <http://flickr.com/gp/32621943@N00/Y1n54r>.

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