Scientific Article

Site-Specific Education Using Digital Media to Improve Patient Understanding of the Radiotherapy Trajectory: An Interventional Study

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Abstract

Purpose: The study assessed the effectiveness of a site-specific video educational material in improving patient understanding and confidence regarding radiation therapy trajectory.

Methods and Materials: A quasi experimental longitudinal pretest posttest study was conducted at a referral radiation therapy center from May 2020 to September 2020. It included 52 adult patients admitted for a first course radical radiation therapy. One generic and 6 site-specific (breast, pelvis, head and neck, brain, chest and abdomen, and bladder) animated cartoon videos were developed in house to provide concise overview of the overall patient’s trajectory in radiation therapy, with full visual description of the procedures and specific preparation measures. A 14-item questionnaire was designed to assess pre- and postintervention levels of understanding and confidence of patients, with calculation of and an understanding and confidence score (UCS), range 0-14.

Results: The mean (standard deviation) UCS in pre- and postintervention was 9.36 (2.48) and 11.92 (1.34) out of 14, indicating a mean increase of 2.57 subsequent to the intervention (P < .001). The effect size was large with a Cohen’s d = 1.01. Of the 14 dimensions explored, 8 were observed to have remarkable improvement, notably understanding the purpose of the tattoo mark, reason of daily or weekly imaging, and what to expect with radiation therapy. Participants with poor reading ability had greater increase in UCS (ΔUCS = 4.25 vs ≤ 2.33) and in 5 out of 8 dimensions with remarkable improvement.

Conclusions: The use of digital educational material in radiation oncology meets the urgent need for providing patients with concise and site-specific information, while sparing extra hospital visits to meet education coordinators during the COVID-19 crisis. Additional studies are warranted to assess both the clinical and long-term effectiveness of the educational material, using a longitudinal controlled design.

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Introduction

Radiation therapy, with its remarkable technological advances, has become one of the most important tools in anticancer treatment arsenal.\(^1\) The use of intensity modulated radiation therapy requires active involvement of the patients in the preparation for the simulation and treatment sessions, to optimize the treatment efficacy and control the side effects.\(^2\) Adequate knowledge and understanding of relevant aspects of radiation therapy by the patients are critical for their effective cooperation and participation in decision making.\(^3,4\)

However, in addition to the complexity of the radiation therapy pathway and the intervention of multidisciplinary teams, a percentage of patients present at first radiation therapy consultation with little knowledge and understanding of the role of radiation treatment and the multidisciplinary modalities.\(^5\) In addition, several misconceptions prevail such as the belief that radiation therapy causes cancer, rather than treats it. These kind of beliefs may induce anxiety and impair a patient’s cooperation.\(^6,8\) This stresses the need for proper patient education before and throughout the radiation therapy process.

The use of education videos in the clinical setting as a complement to the verbal and or written educational material has been associated with higher patient satisfaction.\(^9,10\) However, the quantity of information may be encumbering and may result in adverse effects. Therefore, it is preferable to develop customized and specific educational tools for patients who represent a marker of quality care.\(^6\) Specific tools enable to provide concise and accurate information to the patients based on their requirement. On the other hand, such tools should be adapted to the levels of patient literacy, which directly affect the level of understanding of the content and adherence to the instructions, and consequently the related health outcomes.\(^11\)

In the current practice, patient education comprises verbal conversations during meetings with site-specific coordinators under the supervision of the radiation coordinator. After to the meeting, patients are provided with pamphlets outlining the technical stages of radiation therapy from computed tomography simulation to treatment and the most common side effects. This practice is commonly adopted by different centers\(^12\) and has shown efficacy in improving patient satisfaction with treatment and compliance with the preparation guidelines, in addition to decreasing anxiety associated with treatment.\(^13,14\)

However, considering the significance of providing education specific to the patient’s case to enable better understanding and usage of the information, and in a view of restructuring our education system, the researchers engaged a reflection using different approach. The researchers volunteered team members to develop digital videos aiming to provide site-specific education of patients for radiation therapy. This approach is taken considering the advantages of the recent advances in communication technology and its omnipresence in peoples’ lives, and after analyzing different patients’ feedback and gaps of the current education system. The subsequent advent of the COVID-19 crisis helped expedite the decision and action.

The present work describes the digital video educational material that was developed by the researcher’s team and assessed its effectiveness in meeting patients’ informational needs and relieving their anxiety. The baseline levels of understanding and confidence in various dimensions of radiation therapy trajectory were estimated and factors associated with the intervention effectiveness were analyzed.

Methods

Design and setting

A quasi-experimental longitudinal pretest posttest study was conducted at the radiation therapy center of a teaching referral hospital in Saudi Arabia from May to September 2020. The study protocol, material and assessment form were reviewed by the hospital’s institutional review board, which issued an ethical approval under the number IRB-2020-02.

Population and sampling

The study included adult patients (>18 years) who were candidates for a first course radical radiation therapy treatment during the study period, without having previous irradiation regardless of the body site. Patients who were treated with palliative intent, those with mental disorder, and those who were visually or hearing impaired were excluded. A convenience sampling method was used to include all eligible and consenting patients from the department.

Procedure and materials

Preintervention assessment

A semi-structured questionnaire was designed to assess the level of understanding, perception, or confidence regarding different site specific and nonspecific information received about radiation therapy trajectory. It comprised 14 items: 8 were Likert-type questions including 5 levels each, and the 6 others were dichotomous including “yes” or “no” answering option (Appendix E1). The 14 questions were derived from commonly asked questions by the patients undergoing radiation therapy at our institute and from questions derived
from comparable questionnaires from the literature.\textsuperscript{7,15} The reliability of the questionnaire was tested in a pilot study of 27 participants and demonstrated a good internal consistency with a raw Cronbach’s alpha value of 0.77.

The questionnaire was completed with demographic and clinical data including age, sex, city, and treatment site (head and neck, brain, breast, etc.). In addition, ability to read, attitude regarding the anxiogenic effect of having too much information about the treatment, and preference regarding the education material (video, phone call, pamphlet, other) were taken. Contact information (phone number, e-mail, and address) also were collected.

Patients were enrolled after the first consultation visit, during which time they received the standard education using the existing education system of the institution. The preintervention assessment questionnaire was administered in face-to-face or phone interviews by a trained investigator, who explained the importance, objectives, and procedure of the study.

\textbf{Intervention: Concept and content of the digital educational material}

After completing the preintervention assessment, patients were invited to an educational video session including a 4-minute, internally produced generic video on the steps of radiation therapy, followed by a site-specific video depending on the patient’s treatment site. Videos were animated cartoons lasting 3 to 4 minutes each and were designed to provide a concise overview of the patient’s trajectory in radiation therapy starting from referral to the end of treatment and follow-up.

\textbf{Conception and validation}

All videos were produced using a methodic framework that used an understandability and actionability checklist to direct the development process toward the following requirements: concise and comprehensive content; appropriate word choice and style; clear and simple use of numbers; organized information; ergonomic layout and design; relevant use of virtual aids; and vibrant identification and explanation of the actions, steps and instructions.\textsuperscript{16} Scripts were written by allocated teams and revised carefully by the project team. After script approval, the voice recording was produced by a professional expert to ensure the voice tone was proper and the key words highlighted. The recording was tested and listened to by the researchers. In addition to the voice recording, a collection of picture drawings and digital media information were generated based on the site-specific scripts, and then the animation was produced, revised, and corrected, if needed, by our team. Each educational material had a Patient Education Materials Assessment Tool evaluation to ensure understandability and actionability was achieved.\textsuperscript{16} Subsequently, all the videos were viewed by different people of different ages and educational level, who were asked to repeat what they have learnt to determine their level of understanding.

\textbf{Content}

The generic video included an introduction about radiation treatment of cancers, an explanation of the common steps of radiation therapy: starting from the first appointment with the radiation oncologist to an introduction of the radiation therapy team, followed by an explicit explanation of the simulation, planning and treatment procedures for radiation therapy and the subsequent follow-up.

At the time of the study, 6 site-specific videos were developed (approximately 3-4 minutes long each), targeting the following sites: breast, pelvis, head and neck, brain, chest and abdomen, and bladder. These contained full visual description and explanations of the computed tomography simulation and the radiation therapy treatment procedures, along with the specific preparation measures and precautions for the given site. Relevant details and requirements of the process were mentioned, such as diet, duration of treatment, the need to keep still during treatment, and instructions to report side effects during monitoring or follow-up.

\textbf{Accessibility}

The digital content was uploaded into a digital education platform (*www.ssedurt.com*) and was completed with online consultable and printable brochures on acute radiation therapy side effects in each treatment site and the respective preventive and therapeutic recommendations. The patients were provided with a link to access the website via mobile phone, enabling full accessibility.

\textbf{Postintervention assessment}

Participants were instructed to answer the postintervention assessment questionnaire online at home. The questionnaire was similar to that used in preintervention assessment.

\textbf{Outcome of interest}

The level of understanding of radiation therapy among patients was indicated by the calculation of an overall understanding and confidence score (UCS). Answers for each Likert-type item (in the pre- or postintervention assessment scale) were attributed the scores 0, 0.25, 0.50, 0.75, and 1, which corresponded to the ascending level of understanding or confidence in the given item. Dichotomous questions (“yes” or “no” answer) were attributed the scores 0 and 1, which corresponded, respectively, to negative and positive understanding or confidence, whichever is relevant depending on the item.
(Appendix E1). The internal consistency of the scale was tested by calculation of Cronbach’s alpha, and UCS (range, 0-14) was calculated as the sum of the 14 items’ scores. The effectiveness of the intervention was indicated by the improvement in understanding and confidence, which was calculated as the difference $\Delta$ in scores between pre- and postintervention assessment. Thus, the difference in overall UCS ($\Delta$UCS) was given by the following formula:

$$\Delta$$UCS = Post UCS − Pre UCS

Improvement in understanding and confidence was further calculated at the item level as $\Delta$ Item score = Postintervention Item score − Preintervention Item score.

Both $\Delta$UCS and $\Delta$ Item score were analyzed as the study outcomes.

Statistical analysis

The database was generated automatically from online responses and was transferred to Microsoft Excel, where it was cleaned and coded. Statistical analysis was done using the Statistical Package for Social Sciences version 21.0 for Windows (SPSS Inc, Chicago, IL). Descriptive statistics were carried out, categorical variables were presented as frequency and percentage, while continuous variables were presented as mean ± standard deviation (standard deviation).

Paired $t$ test was used to analyze the significance of the pre- to postintervention change in UCS and item scores, and the effect size of the intervention efficacy was estimated by calculating Cohen’s $d$ for paired UCS scores. The mean $\Delta$ Item score of the study population were further depicted in a bar chart indicating pre- to postintervention improvement within each item.

We hypothesized that the extent of improvement in both UCS and item scores was correlated inversely with the preintervention scores. This would indicate that the intervention was more effective in participants with the poorest baseline levels of understanding and confidence. To test this hypothesis, we analyzed the correlations of preintervention UCS and Likert-type items’ scores with their respective $\Delta$ scores using Pearson’s correlation coefficient (R); a strongly negative correlation would support the above-mentioned hypothesis. However, for dichotomous items (“yes” or “no” questions), cross-tabulations of pre- and postintervention assessments were analyzed using McNemar test, with calculation of Kappa agreement coefficient; a statistically significant McNemar test along with a weak agreement (small Kappa), indicative of a dissociation between pre- and postintervention assessment, would support the above mentioned hypothesis. Factors associated with the extent of improvement in understanding and confidence were analyzed by comparing $\Delta$UCS across the different factors’ categories using independent $t$ test or one-way analysis of variance test as applicable. A $P$ value of < .05 was considered to reject the null hypothesis.

Results

Participants’ characteristics

Of a total 60 patients who accepted to participate in the study, 53 responded to the preintervention questionnaire among whom one patient did not return the postintervention questionnaire (response rate = 86.7%). The demographic and clinical characteristics of the 53 patients are depicted in Table 1.

Internal consistency of the scale and calculation of UCS

Analysis of the internal consistency of the pre- and postintervention understanding and confidence scales (14 items) showed Cronbach’s alpha = 0.829 and 0.784, respectively, indicating the reliability of the scale. The mean (standard deviation) UCS in pre- and postintervention was 9.36 (2.48) and 11.92 (1.34) out of 14, respectively, indicating a mean increase of 2.57 subsequent to the intervention ($P < .001$). The effect size was large with a Cohen’s $d = 1.01$, indicating high overall effectiveness of the intervention.

Effectiveness of the intervention by item/dimension

Analysis of the effect of the intervention on each dimension separately showed greatest improvement in understanding of the purpose of the tattoo mark (mean $\Delta$ item score = 0.50 out of 1), followed by the understanding of the reason of daily or weekly imaging (0.42), what to expect with radiation therapy (0.33), steps for radiation therapy process from consultation to the end of treatment (0.32), and misbelief that radiation therapy is painful (0.25). On the other hand, the lowest improvements were observed in dimensions with initially high levels of knowledge at baseline, such as easiness to find the radiation therapy department in the referral center (mean $\Delta$ item score = 0, $P = 1.000$), knowledge that radiation therapy uses high radiation energy to destroy cancer cells (0.04, $P = .322$), and remembrance of most important educational information after consultation visit (0.12, $P = .003$; Fig 1).
Correlation of improvements with the baseline levels

The extent of improvement in overall knowledge and confidence, indicated by $\Delta KCS$, showed strong negative relationship with preintervention scores, with Pearson’s correlation coefficient $R = -0.846$ ($P < .001$). Likewise, improvement within each Likert-type item was inversely correlated with the preintervention score in the respective item, and the correlation coefficients $R$ ranged from $-0.655$ ($P < .001$) for “anxiety about today’s radiation therapy appointment” to $-0.916$ ($P < .001$) for “amount of information given about the start of radiation therapy.” For dichotomous items (yes/ no answer), there was a significant dissociation between pre- and postintervention scores in 4 out of the 6 concerned variables, showing weak agreement (Kappa <0.246) and significant McNemar test ($P < .05$; Table 2).

Factors associated with the extent of effectiveness of the intervention

Improvement in understanding and confidence was remarkably greater among elderly participants ($\Delta KSC = 3.54$ vs $2.24$) as well as those who were illiterate or with poor reading ability ($\Delta KSC = 4.25$ vs $\leq 2.33$), and both results approached statistical significance ($P < .1$). There was no significant difference in improvement of knowledge and confidence across sex ($P = .758$), treatment ($P = .537$), or belief that too much information may lead to anxiety ($P = .230$; Table 3). By analyzing separately each of the 8 dimensions with the greatest improvement, we observed significant associations of reading ability with 5 of the 8 dimensions; that is patients with poor reading ability had greater improvements notably in understanding what to expect from radiation therapy, the steps of treatment, and information given to manage side effects, besides the misbelief that radiation therapy is painful (Table 4).

Discussion

The present intervention study meets a real need in targeted patient education in radiation oncology via the integration of a digital educational material illustrating the generic and site-specific steps of the radiation therapy trajectory and explaining the “what, why, and how” of the key stages and requirements. The
findings demonstrated the effectiveness, with large effect size, of the intervention in improving the overall understanding of patients of the radiation therapy trajectory with no difference between the different treatment sites. It also demonstrated particular effect in a set of specific dimensions and greater benefit among participants with low baseline levels of understanding, notably those with poor literacy. The utility

**Fig. 1** Pre- to postintervention improvement of knowledge and confidence about radiation therapy by dimension. Bars represent the mean levels of knowledge and confidence at baseline (blue portions) and positive improvement (green portions) in the given dimension. Dimensions are presented from bottom to top in ascending order of the extent of improvement. Significance level: *$P < .05$; **$P < .001$.**
of this intervention was even more perceptible during the COVID-19 crisis, as it spared unnecessary exposure of patients to the hospital risk of infection for additional education visits. Also, several patients from remote location found advantage through the home access to the online educational material and its comprehensive content.

### Table 2 Correlations of baseline

| Item/dimension                                                                 | R   | P value |
|--------------------------------------------------------------------------------|-----|---------|
| Overall KCS                                                                    | −0.846 | <.001* |
| 1. Understanding of the steps taken for RT process from consultation to the end of treatment | −0.885 | <.001* |
| 2. Amount of information given about the start of RT                           | −0.916 | <.001* |
| 3. Information given to help manage RT side effects                           | −0.911 | <.001* |
| 4. Similarity of information given by patient educator at consultation visit with that given at 1st appointment visit at the RT unit | −0.698 | <.001* |
| 5. Understanding the importance of the preparation for RT                      | −0.876 | <.001* |
| 6. Understanding what to expect with RT                                         | −0.820 | <.001* |
| 7. Remembering most of the instruction and educational information after consultation visit | −0.872 | <.001* |
| 8. Anxiety about today’s RT appointment                                        | −0.655 | <.001* |
| 9. Easiness to find RT department                                               | 0.670 | 1.000   |
| 10. Understanding the purpose of the tattoo mark for RT                         | 0.093 | <.001* |
| 11. Understanding the reason of daily or weekly imaging for RT                 | 0.089 | <.001* |
| 12. Understanding that there is no need for isolation during RT                | 0.288 | .008*   |
| 13. Misbelief that RT is a painful procedure                                    | 0.246 | .002*   |
| 14. Awareness that RT uses high radiation energy to destroy cancer             | 0.297 | .625    |

**Abbreviations:** R = Pearson’s correlation coefficient; RT = radiation therapy; SD = standard deviation.

* Statistically significant (P < 0.05).

### Table 3 Factors associated with overall improvement in knowledge and confidence (N = 52)

| Parameter                  | Category       | ΔKCS | P value |
|----------------------------|----------------|------|---------|
| Age (y)                    | <60            | 2.24 |         |
|                            | ≥60            | 3.54 | .083    |
| Sex                        | Male           | 2.43 |         |
|                            | Female         | 2.64 | .758    |
| Treatment site             | Abdomen, pelvis| 3.23 |         |
|                            | Head and neck  | 2.48 |         |
|                            | Breast         | 2.03 |         |
|                            | Brain          | 2.50 | .537    |
| Reading ability            | Poor           | 4.25 |         |
|                            | Medium         | 2.05 |         |
|                            | Good           | 2.33 | .078    |
| Believing that too much information may lead to anxiety in expectations of your treatment? | No | 2.21 |         |
|                            | Yes            | 2.99 | .230    |

**Abbreviation:** ΔKCS = the extent of improvement in overall knowledge and confidence.

### Relevance and effectiveness of the intervention

The relevance and importance of proper preparation of patients regarding radiation oncology is based on several dimensions of treatment efficacy and safety and overall patient’s psychological and physical well-being during and after the treatment. Therefore, various societies have established guidelines standardizing the procedures, to address the relevant variables related to patient preparation, including both general and tumor- and site-specific parameters. The conceptual framework of the present study was based on the necessity for conciseness in delivering the quality information to patients. Therefore, common radiation therapy education aspects were provided via a generic video intended for all patients, and site-specific aspects were included in the site-specific videos, which were visualized only by the concerned patients. This concept prevented from encumbering patients with irrelevant information that may induce confusion in their particular case, while enabling full accessibility of the relevant information to be visualized and revisualized at their convenience.

Early use of audiovisual programs in complement to verbal and written instructions led to the significant improvement in patients’ levels of preparation, besides coping and reduced anxiety and stress levels associated with the treatment. By probing into the dimensions of
knowledge that could be included in multimedia educational materials, some researchers demonstrated the effectiveness of such intervention in improving patient’s knowledge about the disease, investigative tests, treatment, and physical and psychological functioning. These researches opened the perspective for reviewing the content of the educational methods used in routine practice and optimizing it to the institution’s and patients’ specific needs. Furthermore, the real effectiveness of multimedia educational interventions and their superiority over verbal and written materials was questioned. In 2004, Dunn et al conducted a controlled study and evidenced that there was no significant clinical effect of exposure to a video educational material compared with routine standard educational material.

Several multimedia educational materials have been developed to add value and meet specific educational needs and were tested using different study designs. For example, in 2013, Matsuyama et al developed a 23-minute DVD guide delivering a specific educational content along with real-life patient narratives. The effectiveness of the intervention was tested on a group of radiation therapy-naïve patients before radiation therapy treatment, in a pretest posttest experimental design. Using a 15-item self-assessed knowledge questionnaire, authors observed significant increase in the overall level of knowledge after the intervention and concluded that the use of the short educational video improves patients’ knowledge.

These results are comparable to the findings in the present study, which used the same pretest posttest design and showed great efficacy of the digital video in improving the understanding and confidence among patients regarding radiation therapy trajectory. However, whether the video material has a specific effect with reference to other media could neither be demonstrated in the present study nor in the study by Matsuyama et al.

Dawdy et al developed a 5-minute video highlighting the importance and providing instructions for rectal and bladder preparation prior computed tomographic scan and radiation therapy sessions, among patients with prostate cancer. The aim of the intervention was to reduce the rate of rescan due to improper patient preparation. Its effectiveness was evaluated via a 2-arm randomized controlled study, which included a group of patients who received a pamphlet with the multimedia material (multimedia group) and another group who received only the pamphlet (pamphlet group); both were compared with a retrospective control group (control). For both multimedia and pamphlet groups, a significant decrease in rescan rate was observed, from 76% in the control group to 24% equally in the 2 intervention groups. This demonstrates the relevance of providing the patient with an additional education material subsequent to verbal instructions and also suggests that the effectiveness is independent of the choice of the material type. In other words, the crucial aspect of effectiveness may lie in providing an additional educational material in a convenient format, which can be consulted at any moment by the patient.

However, beyond the differences in design, the observed effectiveness in different studies may have various interpretations depending on several factors. One of the factors may be discrepancy in the levels of baseline literacy between the studied populations. In the present study, a relatively high percentage of the participants

| Table 4 | Factors associated with specific improvement in knowledge and confidence (N = 52) |
|---------|---------------------------------|
| Parameter | Category | Q10 | Q11 | Q6 | Q1 | Q13 | Q2 | Q8 | Q3 |
| Age (y) | <60 | 0.44 | 0.41 | 0.32 | 0.31 | 0.23 | 0.22 | 0.17 | 0.15 |
| Sex | >60 | 0.69 | 0.46 | 0.37 | 0.37 | 0.31 | 0.25 | 0.29 | 0.29 |
| Treatment site | Male | 0.53 | 0.47 | 0.20* | 0.29 | 0.21 | 0.16 | 0.21 | 0.13 |
| | Female | 0.48 | 0.39 | 0.41 | 0.34 | 0.27 | 0.27 | 0.20 | 0.22 |
| Reading ability | Abdomen, pelvis | 0.45 | 0.45 | 0.27 | 0.36 | 0.09* | 0.25 | 0.16 | 0.07 |
| | Head and neck | 0.63 | 0.38 | 0.31 | 0.38 | 0.50 | 0.22 | 0.28 | 0.19 |
| | Breast | 0.47 | 0.35 | 0.26 | 0.24 | 0.06 | 0.16 | 0.10 | 0.18 |
| | Brain | 0.50 | 0.50 | 0.45 | 0.36 | 0.44 | 0.28 | 0.30 | 0.28 |
| Believing that too much information may lead to anxiety | Poor | 0.75 | 0.38 | 0.69 | 0.59* | 0.75* | 0.47* | 0.34 | 0.47* |
| | Medium | 0.45 | 0.36 | 0.20 | 0.25 | 0.09 | 0.16 | 0.23 | 0.00 |
| | Good | 0.45 | 0.45 | 0.29 | 0.28 | 0.18 | 0.19 | 0.16 | 0.18 |
| | No | 0.39* | 0.39 | 0.35 | 0.22* | 0.14 | 0.20 | 0.17 | 0.12* |
| | Yes | 0.63 | 0.46 | 0.31 | 0.44 | 0.38 | 0.26 | 0.24 | 0.27 |

Abbreviations: RT = radiation therapy; Q1 = understanding steps for RT process from consultation to the end of treatment; Q2 = overall amount of information given about the start of RT; Q3 = information given to help manage RT side effects; Q6 = understanding what to expect with RT; Q8 = amount of anxiety about your RT appointment; Q10 = understanding the purpose of the tattoo mark for RT; Q11 = understanding the reason information may lead to anxiety.

* Approached statistical significance (P < .10).
† Statistically significant (P < .05).
Values are mean score difference from pre- to postintervention, in the given item.
were illiterate or poorly educated, which effected their preintervention levels of understanding subsequent to exposure to the standard educational material. In return, the extent of improvement was greater among this category of patients compared with those with adequate level of literacy, indicating added value of the video educational material for this category of patients. If delivering quality health information in radiation oncology is crucial to improve compliance and health outcomes, patients’ literacy is vital in understanding and adhering to the instructions appropriately. Therefore, radiation oncologists and therapists should undertake relevant actions to enhance health literacy among patients and improve communication for patients with poor literacy. In addition, educational materials should be designed with a flexible approach that is easy to understand for all kinds of people with different education levels. A recent work by Smith et al consisted of developing an audiobook about radiation oncology treatment intended for patients with poor literacy. The audiobook met the satisfaction of patients and improved their confidence and vocabulary to communicate effectively with the oncology team. Such action should inspire teams working in settings where patients are poorly educated, to improve access to quality health information. The judiciousness of assessing the levels of literacy among patients prior designing and implementing any educational material should be considered.

By analyzing each dimension of patient’s knowledge separately, several misconceptions may be highlighted, thereby enabling focus on the major gaps of knowledge within a specific population of patients. In the present study, we have enumerated 8 major gaps and misconceptions among the 14 dimensions explored, and for which the effectiveness of the intervention was remarkably higher. Four of these 8 dimensions were related to radiation therapy technical details such as the purpose of the tattoo marks and daily and weekly imaging for radiation therapy simulation. Misunderstanding of such issues may lead to misbeliefs and anxiety. Through our center experience, number of patients had misinterpreted the tattoo marks as metastasis of their cancer, as these are often drawn in the contralateral side of the tumor, while the daily and weekly images were misinterpreted as the diagnosis of a fast-progressing tumor requiring close monitoring. Such misconceptions probably induce high levels of anxiety and might considerably impair the psychological well-being of the patient. Indeed, anxiety was among the 8 dimensions with the lowest baseline levels and greatest postintervention improvement in the present study. In accordance with our observations, longitudinal study of the anxiety course during radiation therapy showed that radiation therapy simulation sessions were associated with highest levels of anxiety, after the first radiation therapy session. This further emphasizes the importance of providing appropriate information about the treatment at the simulation, ensuring accurate understanding of patients, in addition to screening for clinical anxiety cases and subgroup of patients with high tendency for anxiety that may require specialist intervention.

Various design possibilities and approaches may be used in creating patient educational materials in radiation oncology. Recently, progress in digital technology enabled the use of advanced tools in patient education. Among these tools is augmented reality. Although such tool was primarily engineered to enhance the accuracy of radiation therapy, by further optimizing patient positioning and visualizing clinical information for professional use, it was proposed for educative purpose to the patients. It is suggested that the use of such a tool would enable patients better visualize their tumor and understand the importance of some specific issues related to radiation therapy, such as adherence with instructions around bladder filling and rectal suppositories, etc. The enhancement of such materials and their personalization to the institution and team will probably improve patients’ familiarity with radiation therapy by offering a 3-dimensional virtual immersion mimicking the real-life experience. One can expect that in near future, patients will be able to benefit from fully customizable virtual education program as part of the progress in telemedicine. This is the intent of our institute in view of the challenges faced during COVID-19 crisis.

Limitations and perspectives

The major limitation of this study is the use of self-assessment in measuring patients’ understanding, without the use of an objective rating of the level of understanding or the assessment of a clinical outcome such as the rescan rate or the level of patient preparation. Therefore, the actual efficacy of the intervention in improving patient knowledge and confidence should be further assessed using a more appropriate design. Nevertheless, the main objective was to develop and pilot the 6 site-specific videos, which was followed by 4 other videos, including central nervous system, pediatrics, advanced treatment techniques, and palliative radiation therapy. All videos were uploaded to a website that includes further information about the radiation therapy department and team in the referring hospital. Lately, we added a WhatsApp chat platform to the website, dedicated to answer specific patients’ concerns and questions by real radiation therapy team members.

Conclusions

The use of digital educational material in radiation oncology meets the urgent need for providing patients with concise and site-specific information. The pilot implementation of this approach for the first time in our institution enabled significant improvement of patients’
understanding and confidence in various dimensions related to radiation therapy trajectory, while reducing their anxiety. The maximal effectiveness of the intervention was observed in patients with low literacy and poor reading ability, who found a reliable alternative for the written educational material. Furthermore, the levels of pre- to postintervention improvement enabled identifying several misconceptions and gaps in patients’ knowledge and perception about radiation therapy, which will help to adapt the content of both the standard and digital educational material. Additional studies are warranted to assess both the clinical and long-term effectiveness of the educational material, using a longitudinal controlled design. Digital technology—based patient education has become imperative in these times of a health crisis (COVID-19) to reduce the risk of infection dissemination and unburden the health care facilities while simultaneously improving the quality of patient care.

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Supplementary materials

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