

# Interactive Digital Education Aid in Breast Reconstruction

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**Background:** An interactive digital education aid for breast reconstruction patients was developed because of a perceived need to provide patients with more education regarding the treatment so that they can make better informed treatment decisions. A prospective randomized study was conducted to assess its effectiveness.

**Methods:** Breast cancer patients who were candidates for breast reconstruction were recruited and randomized into a control group and a study group. Both groups received routine assessment and education in the plastic surgery clinic, but the study group also watched the interactive digital education aid. Questionnaires assessing knowledge, anxiety, and satisfaction were administered (1) before the initial plastic surgery consultation, (2) immediately before surgery, and (3) 1 month after surgery.

**Results:** A total of 133 women participated, 66 in the control group and 67 in the study group. Women in both groups showed decreased anxiety, increased knowledge, and enhanced satisfaction with their decision-making ability associated with preoperative instructions about reconstructive surgery. However, the study group was significantly more satisfied than the control group with the method of receiving information and showed a less steep learning curve regarding the different techniques of breast reconstruction. They also tended to have a reduced mean level of anxiety and increased satisfaction with the treatment choice compared with the control group.

**Conclusions:** An interactive digital education aid is a beneficial educational adjunct for patients contemplating breast reconstruction. Patients who use an interactive digital education aid demonstrate greater factual knowledge, reduced anxiety, and increased postoperative satisfaction compared with patients given preoperative instructions using standard methods alone. The benefit of an interactive digital education aid is expected to be higher in a broad-based practice setting outside of a comprehensive cancer center. (*Plast. Reconstr. Surg.* 122: 717, 2008.)

The active participation of breast cancer patients in the planning of their treatment has been documented to be beneficial in terms of patient compliance,<sup>1</sup> satisfaction,<sup>2</sup> outcomes,<sup>3,4</sup> and ultimate quality of life.<sup>5-7</sup> For such participation to be meaningful in patients considering breast reconstruction, they must have a sufficient understanding of the indications for, the timing of, and the different techniques of breast reconstructive surgery. However, few women are inter-

ested in the topic of breast reconstruction before they are diagnosed with the cancer. They must therefore rapidly acquire the necessary knowledge after the emotionally charged diagnosis is made. The typical person to initiate this process and refer the patient to a plastic surgeon is the primary treating physician, usually a family practitioner, medical oncologist, or breast surgeon. However, there is a well-documented knowledge deficit among referring physicians regarding breast reconstruction, especially regarding contemporary techniques.<sup>8,9</sup> Added to this is the fact that many

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referring physicians are skeptical of the clinical benefits of reconstruction.<sup>8,9</sup> This skepticism is certainly one factor contributing to the overall low rate of breast reconstruction nationwide and the extreme geographic variations in its use.<sup>10,11</sup> The primary responsibility for overcoming these knowledge barriers rests with the plastic surgery community, the members of which must make a conscious effort to better educate patients and non-plastic surgery colleagues regarding the techniques and benefits of breast reconstruction. A further problem with the current approach is that busy surgeons and their staffs may provide insufficient or perhaps too technical information, and the patient, who may be struggling to assimilate this information at a time when she is overwhelmed by her cancer diagnosis and by other information regarding her diagnosis and care, may come away with not only an incomplete but possibly even an erroneous understanding of the surgery.

A further consideration is that people in our contemporary culture are increasingly sophisticated consumers of information. They are accustomed to fast-paced, visually appealing communication media from sources such as the Internet, which offers unprecedented access to information on almost any subject. This format may therefore be ideal for educating patients and colleagues about breast reconstruction. One problem with much of the information available is that it is inaccurate. It is especially important that patients considering a complicated surgical procedure such as breast reconstruction have access to information that is accurate and appropriate for their situation. It is also important to provide methods of education that will be easy to use and easily accessible. This realization formed the basis for designing a digital interactive computer-based educational aid on the subject of breast reconstruction that could provide critical information on breast reconstruction in a rapid, customized, and visually appealing way to women who need to quickly understand the fundamentals of breast reconstruction.

The resultant interactive digital education aid was designed to simulate a personal consultation with a plastic surgeon and covers the key issues for a patient to consider in deciding whether to undergo breast reconstruction and which method of reconstruction to choose. We then conducted a randomized, controlled clinical trial to test the effectiveness of this aid as a learning tool.

## PATIENTS AND METHODS

### Interactive Digital Education Aid Development

The interactive digital education aid is a menu-driven, interactive software program that includes high-quality, three-dimensional animated graphics, patient testimonials, before-and-after photographs, and video explanations from plastic surgeons and clinical specialists in surgical, medical, and radiation oncology. It required 3 years to produce. The content was selected on the basis of information gleaned from patient focus groups and faculty discussions at the University of Texas M. D. Anderson Cancer Center. It is designed to answer general questions about breast reconstruction and to provide detailed explanations of the various techniques. The advantages and disadvantages of each method are presented in a balanced way. There is also discussion of why a woman may choose to have no reconstruction. There are stories from women who explain why they chose a particular method and how it has affected their lives. The user interface is intuitive and simple. It is designed to run on any computer. All information is printable. It may be run from a single compact disk (CD-ROM) and includes English and Spanish language versions. It also has a modular design to facilitate updating as principles and methods of breast reconstruction continue to advance.

### Evaluation of the Interactive Digital Education Aid

A prospective, randomized clinical study to evaluate the interactive digital education aid was approved by the Institutional Review Board at the University of Texas M. D. Anderson Cancer Center. From November of 2003 to April of 2004, candidates for breast reconstruction because of breast cancer were recruited to participate. Women were excluded if (1) they were unable to read, write, and speak English; (2) they had previously viewed the interactive digital education aid; or (3) the initial consultation was for the purpose of obtaining a second opinion. On study entry, the participants were randomized (computer generated) to one of two groups. The control group (non-interactive digital education aid group) received standard patient education consisting of printed material in books and pamphlets and personal instruction from attending surgeons, physicians in training, physician assistants, and nurses. The study group (interactive digital education aid group) received standard patient education plus the interactive digital education aid for viewing in the clinic and at home. Data were collected on all patients re-

garding relevant demographics (i.e., age, marital status, and highest level of education). The patients completed questionnaires during their visit to the plastic surgery clinic that were designed to assess their factual and subjective knowledge, anxiety level, and degree of satisfaction. These were administered at three times: (1) the clinic visit before receiving information at the initial plastic surgery consultation, (2) immediately before surgery, and (3) 1 month after surgery according to the schedule detailed in Table 1. Knowledge scores were calculated based on the percentage of the correct answers to 12 multiple-choice questions about specific reconstructive procedures. Satisfaction was measured according to a five-point Likert scale, ranging from “strongly agree” to “strongly disagree.” Anxiety was assessed using the Spielberger State and Trait Anxiety Inventory for Adults–State form.<sup>12</sup> This is a validated self-reporting assessment tool that measures situational anxiety symptoms. Scores range from 20 to 80, with higher scores indicating greater anxiety. This instrument was used because of documented reliability, validity, and wide use in clinical studies.<sup>13–15</sup> Finally, patient satisfaction was assessed with questions about the adequacy of information received, the mode of delivery, and satisfaction with the final outcome of the reconstructive surgery. Every patient was required to complete the full battery of questionnaires to be included in the final analysis.

### Statistical Analysis

Patient characteristics were compared between control and study groups using the *t* test and Pearson’s chi-square test, as appropriate. Generalized estimating equations were used to assess differences between groups regarding major outcomes.<sup>16</sup> Generalized estimating equations were chosen because they compensate for potential errors related to multiple measurements in the same population at different time points. Percent-

age of correct answers and anxiety level were used as dependent variables in two separate models. Patient characteristics, time, and group type were fitted as independent variables. Including the interaction term in the generalized estimating equations model between group and time will present the difference in the change in outcome between the two groups over time. Statistical significance was designated as a value of  $p < 0.05$ .

### RESULTS

Five hundred forty-eight patients presented for breast reconstruction consultation. Fifty percent (274 of 548) were not invited to participate in the study because they failed to meet eligibility criteria ( $n = 151$ ) or for various practical reasons (e.g., inadequate time, research nurse not available, patient not interested) ( $n = 123$ ). Of the patients who were initially enrolled, 51 percent (141 of 274) were dropped either because of refusing to participate when they were randomized to the noninteractive digital education aid group ( $n = 73$ ) or because they did not complete all of the questionnaires ( $n = 68$ ). Typical explanations for not completing the questionnaires included a change in treatment plan (e.g., electing breast conservation), choosing to continue care at another institution, or being unable to complete questionnaires at the proper times. Complete data were obtained from the 133 remaining patients after randomization to the interactive digital education aid group ( $n = 66$ ) or noninteractive digital education aid group ( $n = 67$ ). Age, level of education, marital status, and number of children were similar for both groups (Table 2 and Fig. 1).

All patients in the study group viewed the interactive digital education aid. The majority used it at home (60 of 66), and many watched it more than once (31 of 66) or with other family members (30 of 66). The number of patients indicating that they were satisfied with the means of acquiring information about breast reconstruction was

**Table 1. Questionnaire Administration Schedule**

Questionnaire No.	Nature of Assessment	First Preoperative Visit		Second Preoperative Visit		Postoperatively	
		IDEA	Control	IDEA	Control	IDEA	Control
1	Knowledge assessment	X	X	X	X	X	X
2	Demographics/subjective knowledge and plans	X	X	X	X		
3	IDEA-related questions			X			
4	Outcome satisfaction					X	X
5	Spielberger STAI (anxiety state)	X	X	X	X	X	X

IDEA, interactive digital education aid; STAI, State and Trait Anxiety Inventory.

**Table 2. Patient Characteristics**

	Control Group (n = 67)	IDEA Group (n = 66)	p Value*
Age (yr)	46.8 ± 8.7	47.2 ± 10.2	0.82†
Education			0.10
Some college or less	38 ± 57.6	28 ± 43.1	
College or more	29 ± 42.4	38 ± 56.9	
Marital status			0.89
Not married	21 ± 30.3	19 ± 29.2	
Married	46 ± 69.7	46 ± 70.8	
Have children			0.44
No	8 ± 12	11 ± 16.9	
Yes	59 ± 87.9	54 ± 83.1	

IDEA, interactive digital education aid.

\* $\chi^2$  test unless otherwise indicated.

†t test.



**Fig. 1.** Sample screen from user interface.

higher in the interactive digital education aid group than in the control group ( $p = 0.03$ ) (Table 3). There were also nonsignificant trends toward increased numbers of patients in the interactive digital education aid group indicating that they received all necessary information and had an improved ability to choose reconstructive options (Table 3).

**Table 3. Affirmative Responses Related to Use and Content of the IDEA**

Question	IDEA Group (%)	Control Group (%)	p Value*
Were you pleased with the information medium?	63 (96.9)	57 (86.4)	0.03
Did you receive all necessary information?	62 (95.4)	58 (87.9)	0.12
Were you easily able to make a decision?	63 (96.9)	60 (90.9)	0.15

IDEA, interactive digital education aid.

\*t test.

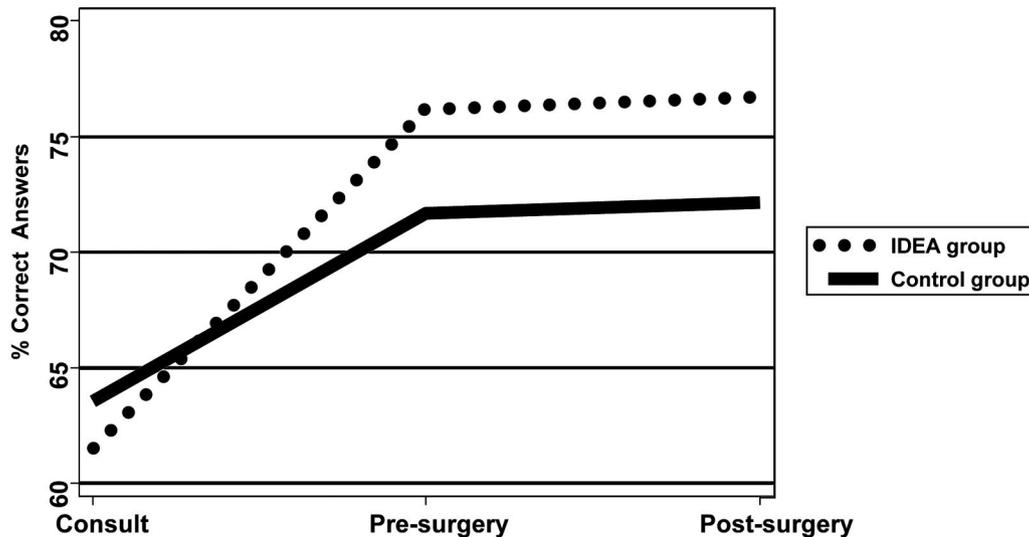
At the initial consultation, both groups of patients showed similar levels of knowledge about breast reconstruction ( $p = 0.59$ ) (Fig. 2). Knowledge levels in both groups also improved over time between the first and second preoperative clinic visits; however, the interactive digital education aid group showed a significantly greater improvement in their knowledge level, with a mean increase in correctly answered questions of 14 percent compared with 8 percent in the control group ( $p = 0.02$ ), as shown in Table 4.

In addition, a higher number of women in the interactive digital education aid group responded “yes” when asked whether the experience with and outcome from reconstruction met with their preoperative expectations (Table 5). There was a significantly higher number of patients in the interactive digital education aid group than in the control group responding “yes” when asked whether they were pleased with their choice of treatment and the appearance of the reconstructed breast ( $p = 0.03$ ) (Table 5).

The groups did not differ significantly in their anxiety levels at the time of the first preoperative visit ( $p = 0.69$ ) (Fig. 3). In addition, both groups experienced a similar decline in their anxiety level between the first and second preoperative clinic visits and the first postoperative visit. There was a trend toward an increased reduction in anxiety levels between the preoperative and postoperative visits in the interactive digital education aid group, but the difference between the groups was not significant as determined by the generalized estimating equations model.

## DISCUSSION

We conclude that the interactive digital education aid was successful in informing women about breast reconstruction and helped them choose the technique most appropriate for them. This was evidenced by the fact that a significantly greater number of women in the interactive digital education aid group than in the control group indicated that the experience and outcome of reconstruction met with their preoperative expectations. The interactive digital education aid was also well accepted by both the breast cancer patients and the surgical staff at our institution. In fact, many patients asked to watch the interactive digital education aid even before arriving at the plastic surgery consultation. These patients had heard about the interactive digital education aid from more “experienced” patients who had already watched the interactive digital education aid or from referral physicians who in most cases had heard



**Fig. 2.** Both groups had a similar factual knowledge regarding breast reconstruction procedures at baseline ( $p = 0.59$ ,  $t$  test). Preoperative assessment demonstrated superior improvement in knowledge in the interactive digital education aid group compared with the noninteractive digital education aid (control) group as determined by generalized estimating equations analysis ( $p = 0.02$ ).

**Table 4. Generalized Estimating Equations to Examine the Change in Correctly Answered Questions over Time\***

	$\beta$ Coefficient	SE	$p$ Value	95% CI
IDEA†	-2.60	3.00	0.39	-8.48-3.29
Time	8.08	1.96	0.00	4.23-11.93
IDEA $\times$ time‡	6.41	2.72	0.02	1.07-11.74
College or more†	4.33	2.33	0.06	-0.23-8.89
Constant	61.80	2.20	0.00	57.48-66.12

CI, confidence interval; IDEA, interactive digital education aid.

\*Adjusted for age and having children.

†Reference group: non-IDEA, some college or less.

‡Interaction between IDEA group and time.

about the interactive digital education aid from other patients. Furthermore, all the patients in the study group planned to watch the interactive digital education aid, including the very few who did not watch it because of time constraints. The popularity of the interactive digital education aid is further shown by the fact that 46 percent watched it more than once and 45 percent watched it with family

members or friends. These results indicate that patients may feel more comfortable receiving the information in a potentially less stressful environment outside the hospital. It also enables family members and friends who are part of the patient’s support group, but who are not always able to participate in the consultation, to receive specific information about the procedures and participate in the decision-making process.

The interest in the interactive digital education aid was further shown by the high number of patients who had to be excluded from the study because they had already watched the interactive digital education aid before they came to the plastic surgery clinic or because they wanted to watch the interactive digital education aid and refused to be in the control group. Although we did not directly assess the surgeons’ reactions to the interactive digital education aid, anecdotal reports suggest that many surgeons believed that patients who watched the interactive digital education aid before the initial consultation were better pre-

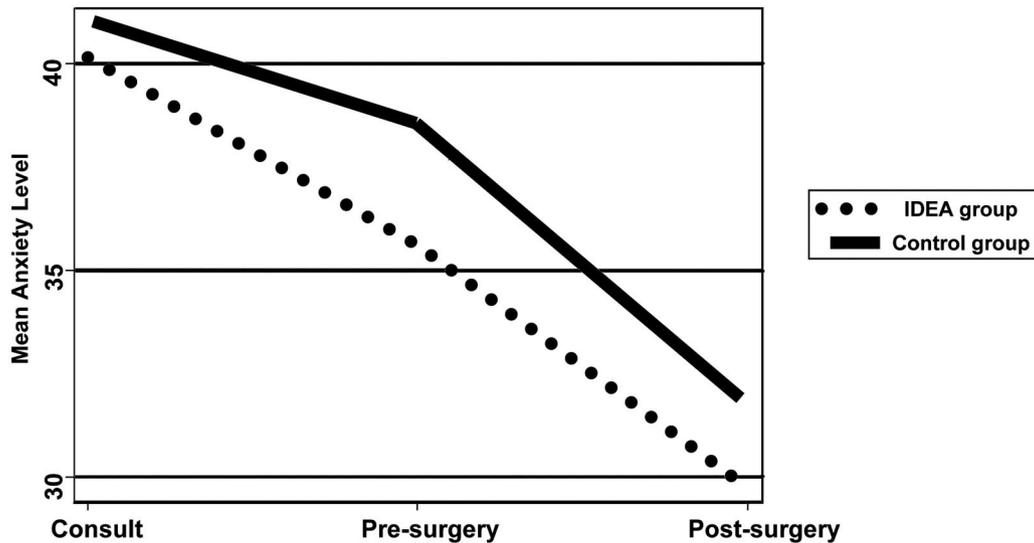
**Table 5. Affirmative Responses Related to Reconstructive Outcomes**

Question	IDEA Group (%)	Controls (%)	$p$ Value*
Were your expectations met?	62 (95.4)	58 (87.9)	0.12
Were you pleased with the treatment choice?	62 (95.4)	55 (83.3)	0.03
Were you satisfied with breast reconstruction? (mean $\pm$ SD)	15.9 $\pm$ 4.10	15.9 $\pm$ 4.00	0.10†

IDEA, interactive digital education aid.

\* $\chi^2$  test unless otherwise indicated.

† $t$  test.



**Fig. 3.** Both groups had a similar initial level of anxiety at baseline ( $p = 0.69$ ,  $t$  test). A trend of increased reduction in the anxiety level between the preoperative and postoperative visits was seen in the study group; however, the difference was not statistically significant as determined by generalized estimating equation analysis ( $p = 0.66$ ).

pared in terms of their knowledge about breast reconstruction; it also decreased the amount of time and effort the surgeons had to invest in the consultation. This concept is supported by previous studies showing that computer-based education before a medical visit reduces the amount of time that is needed to provide information at health care visits.<sup>17,18</sup> Future studies would benefit from including an assessment of the surgeon's perspective on how the interactive digital education aid affects the consultation process. Regardless, as awareness of the interactive digital education aid increased and more women asked to view the interactive digital education aid, several of the plastic surgeons at our institution requested that all of their patients watch the interactive digital education aid as a routine part of the plastic surgery consultation.

One of the main advantages of the interactive digital education aid is its simplicity of use. It does not require that the patient have previous computer experience to run the program. Indeed, all patients in the study group, of varying ages, were able to operate the program independently. A further advantage of the interactive digital education aid is that it enables patients to assimilate the information when they are not overwhelmed by other information or distracted by other concerns. Typically, patients have numerous consultations on the same day or over only a few days, with the plastic surgery consultation often the final appointment. Many patients report being over-

whelmed by the amount and complexity of the information that they have received by the time they arrive at the plastic surgery clinic.

It is noteworthy that, despite a similar initial level of knowledge about breast reconstruction, in the interval between the initial consultation and preoperative visit, the patients in the interactive digital education aid group reported acquiring a significantly higher level of knowledge. This increase in knowledge may be attributable to the additional education provided by the interactive digital education aid. Learning the material in a visual way may have been particularly beneficial. This possibility is supported by the fact that some of the patients mentioned that they were "visual persons" and that having a visual tool helped them better understand the reconstruction options.

Anxiety levels for women in both groups declined significantly following surgery. This is not surprising because the initial anxiety that women were experiencing was likely related to being newly diagnosed and anticipating the surgery, which was lessened once the surgery was over. The amount of anxiety experienced after surgery did not differ between the two groups. Because the interactive digital education aid intervention was focused on providing information about the reconstruction procedures, this may explain why differences in knowledge, but not anxiety, emerged between the women who saw the interactive digital education aid and those who did not.

It was also interesting to see that despite the fact that both groups indicated a similar level of satisfaction with the amount of information received, the study group reported higher satisfaction with respect to the method of delivery of the information. These findings complement those of previous studies showing that patients may benefit more from exposure to individualized education such as computer-based education that can be tailored to a patient's own pace of learning. This is particularly true regarding patients with low literacy skills.<sup>19</sup> For such patients, learning from a physician or nurse may be more stressful than using a computer; in some instances, the patient may be intimidated by the large medical team or concerned that she may be asking the wrong questions. In addition, there may be insufficient time for the patient to process and consider the information provided during a busy consultation.

Despite the fact that both groups reported that they had enough information to make a decision about the type of reconstruction, it may be that it took more effort for participants in the study group than in the control group to make the right decision. However, having realistic expectations regarding the final result was also mentioned by some of the patients as one of the main contributions of the interactive digital education aid to their preoperative education, and this was supported by a trend showing that a higher percentage of patients in the study group (92 percent) than in the control group (87 percent) achieved results at the level of their preoperative expectation. Thus, the extra effort required to make a decision appears to have paid off in the form of met expectations.

Ultimately, the object of the interactive digital education aid was to help patients make the best decision in their specific case. In this regard, a higher percentage of patients in the interactive digital education aid group (97 percent) than in the control group (91 percent) reported that they had enough information to make a decision regarding the best breast reconstruction technique for them. In our work, both the study and the control group showed a high level of satisfaction with the amount of information received and their ability to make a decision; the gap between the two groups was greater with respect to their satisfaction with the method of reconstruction they chose (95 percent in the interactive digital education aid group versus 83 percent in the control group). It may be that a wider gap between the two groups with respect to satisfaction with the information received in the study would be found at a non-

cancer institution than at a cancer center such as the one at which this study was conducted. This assumption is supported, for example, by the wide geographic variation in the type of breast cancer surgery performed in North America and Europe.<sup>20,21</sup> Furthermore, studies suggest that the variability observed in the type of breast cancer surgery performed is unlikely to be fully explained by disease factors<sup>22,23</sup> but instead by problems with the communication of information between physicians and cancer patients.<sup>24</sup> In particular, patients may not be fully informed regarding their treatment alternatives and/or may be overly influenced by their physician's preference.<sup>20,22</sup> A study assessing factors influencing the use of post-mastectomy breast reconstruction and based on the national cancer database suggested a similar situation with respect to breast reconstruction.<sup>11</sup> This situation can be corrected, at least partially, through standardization of the means of education, such as the interactive digital education aid tested in this study. Such a means of communication would still allow surgeons to present the various options of reconstruction and to recommend the method that in their judgment fits the patient the best; this approach would also enable patients to better explain their wishes.

## CONCLUSIONS

In summary, this study found that an interactive digital education aid that explains the various methods of breast reconstruction can contribute significantly to the patient's education. Having the opportunity to obtain information from both the interactive educational aid and the medical team appeared to be beneficial, particularly in terms of increasing the patient's knowledge about the procedures themselves and increasing the patient's satisfaction with how the information was delivered. Future studies may include a study conducted among reconstructive plastic surgeons that assesses the impact of the breast reconstruction interactive digital education aid on their practices in terms of the time they need to spend educating their patients and the number of meetings required with the patients before surgery.

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