

Training Laparoscopic Skills at Home: Residents' Opinion of a New Portable Tablet Box Trainer

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Abstract

Objective. To determine residents' opinion about a new portable box trainer, to see if they would be interested in using this for training at home, and to give an overview of the box trainers that could be used at home. **Methods.** An expert opinion study was performed among 27 gynecology residents to determine the value of the portable box trainer in training their laparoscopic skills and the value of using it at home. Their opinions were scored on a 5-point Likert scale. **Results.** Gynecology residents very much appreciated the portable box trainer in its design, size, visualization, light source, ability to record, and instruments (all median 4). They felt that the portable box trainer would be effective in training laparoscopic skills in general; in training hand-eye coordination, 3D perception, and tying knots (all median 4); and especially in training basic skills (median 5). Almost all residents would use the portable box trainer if they had one at home (median 5). The literature supports the hypothesis that training laparoscopic skills at home using a box trainer may be effective in acquiring and maintaining laparoscopic skills. **Conclusions.** Training laparoscopic skills at home using a portable box trainer may be of added value in the laparoscopic training of surgical residents. Residents feel positive about using the new portable box trainer that is presented and appreciate the possibility of training at home.

Keywords

portable box trainer, simulation, laparoscopy, training, validity, home

Introduction

Laparoscopic procedures are performed on a regular basis in the areas of general surgery, urology, and gynecology.¹ The performance requires development of specific psychomotor skills. Therefore, laparoscopic training methods have been the subject for innovation for the past 20 years.¹⁻³

Training for basic laparoscopic skills can be done in the operating room (OR), but this is time-consuming and can be in conflict with patient safety and OR efficacy.¹ As an alternative, box (video) trainers and/or virtual reality (VR) simulators can be used.¹

Effective box (video) simulation training improves hand-eye coordination, manipulation of long instruments in a limited space, ambidexterity, adjustment for tremor, and efficiency and accuracy of movements as well as getting used to reduced haptic feedback and depth perception through a camera.^{3,4} These elements can be implemented into simple and essential exercises, which can be validated and performed on any box (video) trainer.² The retention rate for simulator-learned practical skills is high; therefore, it is very effective in training reproducible and standardized skills.³⁻⁵

VR training programs have proven to be of great value in acquiring laparoscopic skills outside of the OR because they demonstrate good predictive validity.⁶ Limiting factors of VR simulators are that they are expensive, and the majority can only be used in the skills lab of the hospital.⁷ Hagen et al⁸ evaluated resident's attitudes in laparoscopic training. Residents expressed that having the possibility to train in a skills lab was of importance in their training curriculum but that the main disadvantages are the accessibility of the skills lab and that training time is not protected.⁸ Having the possibility of training at home creates more flexibility in these limiting factors, and therefore, it is of additional value to only training at the institution.^{8,9}

Box (video) trainers are less expensive and can be positioned outside a skills lab (for instance, in a registrar room or OR complex), which improves accessibility of

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the training simulator. In box trainers, standard laparoscopic instruments are used, which provide realistic haptic feedback. Box training has proven to be effective in laparoscopic skill improvement and retention, especially in training basic laparoscopic skills.^{3,4,9-15} It has been shown that VR training and box training are equally effective in acquiring basic laparoscopic skills and that laparoscopic skills taught in box trainers are reproducible in a VR environment and vice versa.^{3,9,10,13} To ensure validated laparoscopic training, validated exercises with a proper training goal should be performed.² Box training is of additional value to VR training programs because residents feel that they have too little time to train in a skills lab.¹ Having the possibility to train at home could be a way to ensure more time and space for laparoscopic training. Using portable box trainers or playing specific video games potentially can meet this preference. However, affordable validated box trainers for home use are relatively scarce.^{4,7,16-22}

Recently, a new portable box trainer was introduced, using a regular tablet computer as a camera and monitor. Assuming that nowadays almost every resident will have a tablet in their possession, no other devices are needed besides this portable box trainer, 2 laparoscopic instruments, and a tablet computer to practice laparoscopic skills at home.

The aim of this study was to determine residents' opinion about a new portable box trainer as a simulator and to see if they would be interested in using this new training tool at home. We also provide a literature overview of box trainers that can be used at home.

Methods

Participants

During 2 laparoscopy courses (January and June 2014) at the University Medical Center Utrecht, Dutch gynecology residents ($n = 27$) used a new portable simulator. Residents were chosen as the key user group in this study because most of them have experience with training on a box trainer and a VR trainer. They have spent more time training on box and VR trainers than the true experts in the skill of laparoscopic surgery.² They were selected by their attendance at a mandatory basic or advanced 2-day laparoscopy course. None of the participants had seen or used the simulator before. All participants received a standardized demonstration and instruction about the simulator use and the tasks to perform. Residents had 20 minutes each to practice their laparoscopic skills on the trainer by performing 2 relatively simple validated exercises for box training. The trainer was not used at home, and no technical problems occurred when training. After the trial, all residents filled out a questionnaire considering their opinion about the usefulness and value of the simulator on a 5-point Likert scale. The questionnaire was especially



Figure 1. Lap Tab trainer™ for laparoscopic skills training. (3-Dmed, Franklin, OH).

designed for this study. The first part of the questionnaire contained questions about the opinion and the appreciation of the design, size, visualization, light source, ability to record, and instruments of the simulator. The second part of the questionnaire contained statements about the residents' opinion concerning the value of the simulator in training laparoscopic skills in general, in hand-eye coordination, in 3D perception, in basic skills, in tying knots, and in retaining laparoscopic skills. The last part of the questionnaire contained statements about whether they would want to use the simulator in their training curriculum. This study was exempted for institutional board review from the University of Utrecht, the Netherlands.

Materials

A new simulator, the Lap Tab trainer™ (3-Dmed, Franklin, OH), was used. This is a polyester, collapsible box trainer. Dimensions are length 15" × width 12" × height 2" (L 38 cm × W 30.5 cm × H 5 cm) when folded flat. Height increases to 10.25" (26 cm) and length increases to 20" (51 cm) when it is set up for use (Figure 1). Weight is 4.0 lbs (1.8 kg). The simulator was provided by 3-Dmed for skills training and evaluation.

The simulator is easy to set up (fold out) and is used with a tablet computer. The tablet computer functions as camera and monitor of the simulator. In this study an iPad 2, model A1395, 16 Gb (Apple Inc, Cupertino, CA) was used. The simulator does not require the use of an additional light source because the "cavity" is open and room light is used. In this model, there are 2 ports for the laparoscopic instruments. To perform the exercises, 2 reusable laparoscopic Maryland graspers (Karl Storz GmbH & Co. KG, Tuttlingen, Germany) were used. The participants performed 2 validated exercises for box training: the "Post and

Sleeve” and “Pee on a Peg” exercise. In the Post and Sleeve exercise, 6 sleeves are positioned on the left side of a board. The sleeves have to be picked up with the left hand, passed over to the right hand, and then be transferred to their mirrored posts on the opposite side. After the 6 sleeves have been moved successfully to the other side, the exercise is to be repeated in the opposite direction, now starting with the right hand. In the Pee on a Peg exercise, 14 wooden beads must be taken out one by one from the cup and be placed on various pegs of different heights. The left side of the peg-board has to be completed with the left hand, the right side with the right hand. These exercises were developed to train and test hand-eye coordination, manual dexterity, depth perception, and interaction of the dominant and nondominant hand (3-Dmed, Franklin, OH).²

Statistical Analysis

The questionnaire contained questions that had to be answered on a 5-point Likert scale. Statistical analyses were carried out using IBM SPSS Statistics Data Editor 20.0. The median of the results was chosen to be evaluated because the sample size was small and the results were not normally distributed.

Results

A total of 27 gynecology residents participated; their characteristics are shown in Table 1. The residents were at different levels of their surgical training. Their experience in training laparoscopic skills on a box trainer or a VR trainer was variable.

The assessment of the simulator and the value of its laparoscopic training qualities are shown in Table 2. The residents appreciated the simulator overall very much. They felt that it would be very useful in training basic laparoscopic skills, especially, and that it would also be useful for training laparoscopic skills in general and for retention of their skills.

The opinion of the residents about the value of the portable box trainer in training laparoscopic skills at home is shown in Table 3. Of the 27 residents, 20 reported that they would use the simulator weekly for training, and 6 others would use it monthly.

Results of the literature search for box trainers for laparoscopic skills training to be used at home are provided in the discussion section. Most of the trainers have to be self-built by the trainee. Some are commercially available and ready for immediate use.

Discussion

The new portable box trainer was highly appreciated by the key user group (residents in training for a surgical

Table 1. Demographics.

Age (years), median (range)	30 (27-38)
Gender	
Male, n (%)	5 (18.5%)
Female, n (%)	22 (81.5%)
Postgraduate year (PGY)	
PGY 1	1
PGY 2	11
PGY 3	2
PGY 4	5
PGY 5	8
PGY 6	0
Missing	
Hand dominance	
Right, n (%)	25 (92.6%)
Left, n (%)	2 (7.4%)
Experience with box trainers	
<10 Times, n (%)	11 (40.7%)
10-20 Times, n (%)	1 (3.7%)
≥20 times, n (%)	4 (14.8%)
Missing, n (%)	11 (40.7%)
Experience with virtual reality trainer	
<10 Times, n (%)	9 (33.3%)
10-20 Times, n (%)	6 (22.2%)
≥20 Times, n (%)	5 (18.5%)
Missing, n (%)	7 (25.9%)

Table 2. Residents' Opinion of the Simulator and Its Laparoscopic Training Qualities.^a

Assessment of Simulator	Median (Range)
Design	4 (3-5)
Size	4 (3-5)
Visualization	4 (2-5)
Light source	4 (3-5)
Ability to record	4 (2-5)
Instruments	4 (2-5)
Value for Laparoscopic Training	Median (Range)
General	4 (4-5)
Hand-eye coordination	4 (4-5)
3D perception	4 (3-5)
Basic skills	5 (4-5)
Tying knots	4 (0-5)
Retaining skills	4 (3-5)

^a5-Point Likert scale: 1 = *strongly unappreciated*; 2 = *unappreciated*; 3 = *undecided*; 4 = *appreciated*; 5 = *strongly appreciated*.

specialty). They rated the simulator “good” to “very good” on most items. The residents, therefore, would like to incorporate the home trainer in their training curriculum for basic laparoscopic skills. Also, training laparoscopic skills using a box trainer at home seems to be of

Table 3. Assessment for Home Training of the Simulator.^a

Opinion	Median (Range)
The simulator is easy to use	5 (4-5)
I would use the simulator at home, if it was available	4 (3-5)
I would use the simulator if I had a tablet	5 (3-5)
This simulator is valuable for residents to train at home	4.5 (4-5)
This simulator is valuable for medical specialists to train at home	4 (2-5)
This simulator should be introduced in the residency curriculum	4 (3-5)
This simulator should be provided by the hospital	5 (3-5)
If I had this simulator, I would use it for practice at home	5 (2-5)

^a5-Point Likert scale: 1 = *strongly unappreciated*; 2 = *unappreciated*; 3 = *undecided*; 4 = *appreciated*; 5 = *strongly appreciated*.

added value for the busy residents.¹ A variety of different exercises can be placed into the box.

Many of the portable box trainers reported in the literature are either Build-It-Yourself (BIY) boxes or were commercially available. BIY boxes often take a long time and a lot of effort to design and build.^{7,16-20} Accessories have to be purchased; therefore, costs might still be high. The BIY boxes may, however, bring practical solutions when financial resources are limited. Validated commercial box trainers are available but are often more expensive and, most of the time, not easy to transport, so training at home is not possible.^{4,21}

The literature demonstrates that home training may be an effective additional strategy to learn basic laparoscopic skills.^{3,4,9-13} It is known that training time is not directly correlated to the level of competence in training laparoscopic skills.^{7,14,23} When implementing a portable box trainer as a simulator for home use in a training curriculum, it is, thus, very important to provide validated exercises with a proper training goal to the registrars. The exercises should be competence based and not time based.²

Apart from validated exercises and validated training equipment, assessment of the results of training should be considered in designing a laparoscopic training curriculum. Level of competence should be assessed by a tutor who has the ability to see the performance. An advantage of the use of a tablet as a screen and monitor is also the possibility to record the exercises. When the registrar is convinced that he or she is proficient, the recorded exercise can be sent to the supervisor for final assessment.

Limitations of this study are the relatively small sample size with a homogeneous study group. Still it demonstrates clearly that residents would like to have training possibilities at home, and it gives a good impression of how residents feel about training laparoscopic skills at home. To determine the effectiveness of home-based training of laparoscopic skills, a larger trial should be set up among surgical residents.

Conclusion

Training laparoscopic skills at home using a portable box trainer seems to be of added value in the laparoscopic training of gynecology residents. Residents feel positive about the new simulator that is presented and the possibility of training at home. Validated exercises should be used, and practice should be structured. A minimum level of competence should be determined, and an assessment should be conducted. The simulator is a relatively cheap and effective device, which is appreciated by gynecology residents.

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Study concept and design: Henk W. R. Schreuder
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Declaration of Conflicting Interests

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