

A Mobile-Based Surgical Simulation Application: A Comparative Analysis of Efficacy Using a Carpal Tunnel Release Module

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Purpose The utilization of surgical simulation continues to grow in medical training. The TouchSurgery application (app) is a new interactive virtual reality smartphone- or tablet-based app that offers a step-by-step tutorial and simulation for the execution of various operations. The purpose of this study was to compare the efficacy of the app versus traditional teaching modalities utilizing the “Carpal Tunnel Surgery” module. We hypothesized that users of the app would score higher than those using the traditional education medium indicating higher understanding of the steps of surgery.

Methods A total of 100 medical students were recruited to participate. The control group (n = 50) consisted of students learning about carpal tunnel release surgery using a video lecture utilizing slides. The study group (n = 50) consisted of students learning the procedure through the app. The content covered was identical in both groups but delivered through the different mediums. Outcome measures included comparison of test scores and overall app satisfaction.

Results Test scores in the study group (89.3%) using the app were significantly higher than those in the control group (75.6%). Students in the study group rated the overall content validity, quality of graphics, ease of use, and usefulness to surgery preparation as very high (4.8 of 5).

Conclusions Students utilizing the app performed better on a standardized test examining the steps of a carpal tunnel release than those using a traditional teaching modality. The study findings lend support for the use of the app for medical students to prepare for and learn the steps for various surgical procedures.

Clinical relevance This study provides useful information on surgical simulation, which can be utilized to educate trainees for new procedures. (*J Hand Surg Am.* 2017;■(■):1.e1-e9. Copyright © 2017 by the American Society for Surgery of the Hand. All rights reserved.)

Key words TouchSurgery, surgical simulation, virtual reality carpal tunnel, cognitive task analysis.



EDUCATION AND TRAINING IN THE MEDICAL field is constantly evolving, continuously searching for new and improved alternatives to prepare competent and efficient physicians. New technologies and resources such as virtual simulation offer great

advantages to facilitate this movement. Current simulation modalities include standardized patients, patient simulators, procedure-specific simulation devices, computer-based simulation software, and more recently smart device—based (smartphone or tablet)

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virtual reality simulation applications (apps). The TouchSurgery app, developed in London in 2010, is an interactive and immersive virtual reality multimedia app available for free download on mobile smart phones and tablets. The app offers a step-by-step tutorial for the execution and completion of various operations spanning a number of surgical specialties. Each module is created and verified by board-certified medical specialists in the field. It guides the user through operations by breaking them down into component steps. The user can prepare for participation in an operative procedure by taking a “tutorial” module and then taking a “test” module to assess their understanding of the component steps and techniques. The app consists of a summation of making correct decisions (Fig. 1A), appropriate swipe interactions (Fig. 1B), and the time taken to complete each step. The app calculates total scores as a percentage with no negative marking (Fig. 1C). The app does not teach the pathophysiology of a disease or technical surgical skills. The function of the app focuses on familiarizing and preparing the user with a certain procedure in terms of anatomy, patient positioning and preparation, relevant medications, necessary instruments, incision placement, and the surgical steps to be taken by the surgeon during the surgical procedure. The potential benefits of such apps is to provide readily available, mobile, comprehensive, and easy-to-use tools to prepare for and learn the steps of a surgery for the student prior to participating in the surgery.

Among the various available modules included in the app is Carpal Tunnel Surgery. Carpal tunnel release surgery (CTR) is one of the most common procedures performed on the hand.¹ It is also considered one of the core surgical procedures that orthopedic and plastic surgery residents must complete as an Accreditation Council for Graduate Medical Education milestone.²

In addition to the didactic portion of the traditional model for surgical training, novice surgeons are dependent upon the ability of a senior surgeon to transfer the necessary knowledge and skills to them through observation, graded clinical responsibility, and graduated proctored surgical responsibility on the senior surgeon’s patients.^{3–6} In recent years, multiple factors including trainee work-hour restrictions, patient safety concerns, greater surgical subspecialization, and increasing complexity of procedures have made traditional surgical training methods increasingly difficult.^{3–5,7} The potential benefits of virtual reality surgical simulation apps are to provide readily available, mobile, versatile, cost-effective, and easy-to-use tools to prepare for and learn the

steps of a surgical procedure prior to participating in the surgery. The audience for such apps includes medical students, residents, as well as fellows looking to learn or prepare for new procedures or techniques.

A previous study using the TouchSurgery app observed construct, content, and face validity of 4 Intramedullary Femoral Nailing modules and demonstrated a significant difference in the performance between expert and novice level subjects.⁸ However, a study comparing the efficacy of the app to traditional teaching modalities has not been reported. The primary purpose of this study was to compare the efficacy of the app with a traditional teaching medium utilizing the Carpal Tunnel Surgery module and standardized test metrics. Secondary objectives were to assess content validity and desire to use the app in a routine educational curriculum via a subjective questionnaire. The hypothesis for this study was that users of the app would score higher than those using the traditional teaching medium.

METHODS

A total of 100 (second- and third-year) medical students were recruited to participate. The study group ($n = 50$) consisted of medical students learning the procedure through the app. The control group ($n = 50$) consisted of medical students learning the same procedure using the traditional medium consisting of a video lecture with slides. A recent study by Sugand et al⁸ determined that the TouchSurgery app demonstrated face, content, and construct validity for the Intramedullary Femoral Nailing procedure. The validation of this module was used as a template to justify the validation of the carpal tunnel procedure module. The carpal tunnel assessment that was administered to each student was created based on the content in the app. In addition, the assessment questions were evaluated by an orthopedic surgeon (A.M.I.) for accuracy and rationality. The content of the video was created using information from the TouchSurgery app Learn mode on the carpal tunnel procedure. This was the same mode that the students in the study group used to prepare for the procedure. The pictures and information in the video slide presentation were screen shots taken of each step of the procedure. The allocation of students into the 2 groups was randomized. A recruitment interest survey was sent out to all second-year and third-year medical students about participation in a research study.

Once 100 students were registered and met the inclusion criteria, simple randomization of the students by birth year into the 2 groups was conducted, while

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