

# The Use of a Novel Local Flap Trainer in Plastic Surgery Education

Amy C. Kite, MD\*  
Morgan Yacoe, BFA†  
Jennifer L. Rhodes, MD‡

**Summary:** With the limitations of work hour restrictions and legal liability surgical resident's operative experience is declining. We sought to find other methods of training using tactile surgical simulations for plastic surgery. With the collaborative efforts of a local artist, a local flap trainer was designed to simulate the natural properties, layers, and interaction between layers of tissue. A session was held with Plastic Surgery faculty, residents, and students to review and practice local flaps using the trainer. Afterward, the participants filled out a survey evaluating the simulated skin and tissue model and the effectiveness of the class as a teaching model. The survey given had multiple questions asking the participant to provide a ranking from 1 to 10. The results show that the class utilizing the new suture pad was an effective teaching tool with an average score of 9.56. The suture pad was given a score of 6.77 for simulating realistic skin. Overall, the group rated increased understanding and confidence of local flaps after the class. Surgical skill simulations are becoming increasingly more important with the decline of resident operative experience. There are limited options for surgical simulations that provide a realistic experience. We designed a suture pad that is effective at simulating human tissue. The surveys show that using this suture pad in flap workshops provides a valuable teaching tool. (*Plast Reconstr Surg Glob Open* 2018;6:e1786; doi: 10.1097/GOX.0000000000001786; Published online 11 June 2018.)

## INTRODUCTION

The design and execution of local flaps represents a basic pillar of the specialty of plastic surgery. The traditional “see one, do one, teach one” training model is the foundation of modern day residency training; however, restrictions in duty hours has had a significant effect on the surgical residents' clinical experience.<sup>1</sup> It is widely accepted that resident education outside of the clinical setting must be enhanced. With this comes a shift from the apprenticeship model toward the use of simulation for skill development.<sup>2</sup>

The field of general surgery developed simulations to help standardize skills. The American Board of Surgery

now requires all board-certified surgeons to demonstrate their skills in standardized simulations. They use a 3 phase curriculum consisting of a cognitive phase where an experienced instructor teaches the task, an associative phase where the student performs the task, and an autonomous phase.<sup>3</sup>

We believe that Plastic Surgery training can benefit from development of a rigorous surgical simulation curriculum. To achieve this goal, appropriate tactile, interactive simulation trainers must be available. Our goal was to develop an appropriate surgical trainer to allow accurate simulation of the basic plastic surgery principles, specifically the design and executions of local flaps.

## METHODS

We sought to design a model replicating the feel of human skin and subcutaneous tissue to allow accurate simulation of local flap design and execution. Specific criteria included tensile and elastic properties similar to human skin, simulating undermining techniques, reasonable cost, and creating anatomic replicas. Our goal was to provide residents with a simulation experience in the planning and execution of local tissue transfer.

After testing a variety of chemical products and fabrication techniques, the final design of the local flap trainer

From the \*Virginia Commonwealth University Medical Center, Plastic and Reconstructive Surgery, Richmond, Va.; †VCU School of the Arts, Richmond, Va.; and ‡VCU Center for Craniofacial Care Children's Hospital of Richmond at VCU, Virginia Commonwealth University Medical Center, Plastic and Reconstructive Surgery, Richmond, Va.

Received for publication June 29, 2017; accepted March 26, 2018.

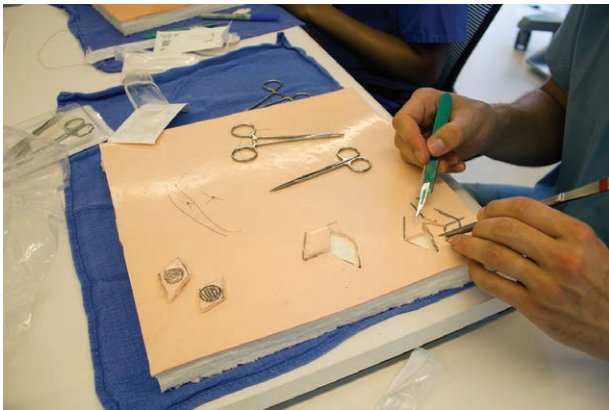
Copyright © 2018 The Authors. Published by Wolters Kluwer Health, Inc. on behalf of The American Society of Plastic Surgeons. This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

DOI: 10.1097/GOX.0000000000001786

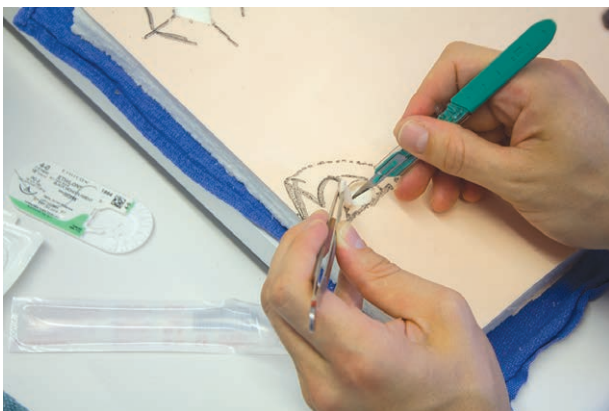
**Disclosure:** The authors have no financial interest to declare in relation to the content of this article. The Article Processing Charge was paid for by the authors.

(LFT) consisted of a foam core base overlaid with multiple silicone layers. Through a unique method of fabrication, the layers were adhered to each other to simulate the natural adherence of dermis to subcutaneous fat. Two variations were produced: a basic LFT and a 3D head and neck bust LFT (cost: Flat LFT \$150, 3D face model \$200). Next, a local flap curriculum was developed utilizing the LFT.

Participants included 9 plastic surgery residents with 1–2 residents per each postgraduate year 1–5, 2 faculty attending surgeons, a general surgery-trained burn fellow, and a plastic surgery nurse practitioner. Attendants were provided with an LFT, marking pen, scalpel, needle driver, forceps, scissors, and 3-0 nylon suture, which was donated for the simulation. The session began with an introduction to local flaps including a videos on local flaps obtained through the Plastic and Reconstructive Surgery Journal website<sup>4</sup> (<http://journals.lww.com/plasreconsurg/pages/videogallery.aspx?videoId=358&autoplay=true>). Starting with the rhomboid flap, the video was first shown demonstrating the design of the flap. Then an instructor used a dry erase board to elaborate and point out important pitfalls. Participants then designed and executed the rhomboid flap on the LFTs (Fig. 1). Bilobe, rotational, and z-plasty flaps were taught and practiced in a similar fashion (Fig. 2). Senior resi-



**Fig. 1.** This figure features a participant utilizing the flat local flap trainer to practice a rhomboid flap design.



**Fig. 2.** This figure features a participant utilizing the flat local flap trainer to practice a bilobe flap design.



**Fig. 3.** This figure demonstrates 1 of the participants using the specialty designed face model to execute a forehead flap.

dents were paired with junior residents while attending surgeons supervised.

Once individuals showed confidence designing and executing local flaps on the basic LFT, the head and neck LFT was used to practice anatomic location-specific skills (Fig. 3). A forehead flap, bilobed flap, and nasolabial flap were designed, incised, elevated, and inset into the nasal defects (Fig. 3).

Participants were given a survey of questions to evaluate the session using a 1–10 scale (Fig. 4).

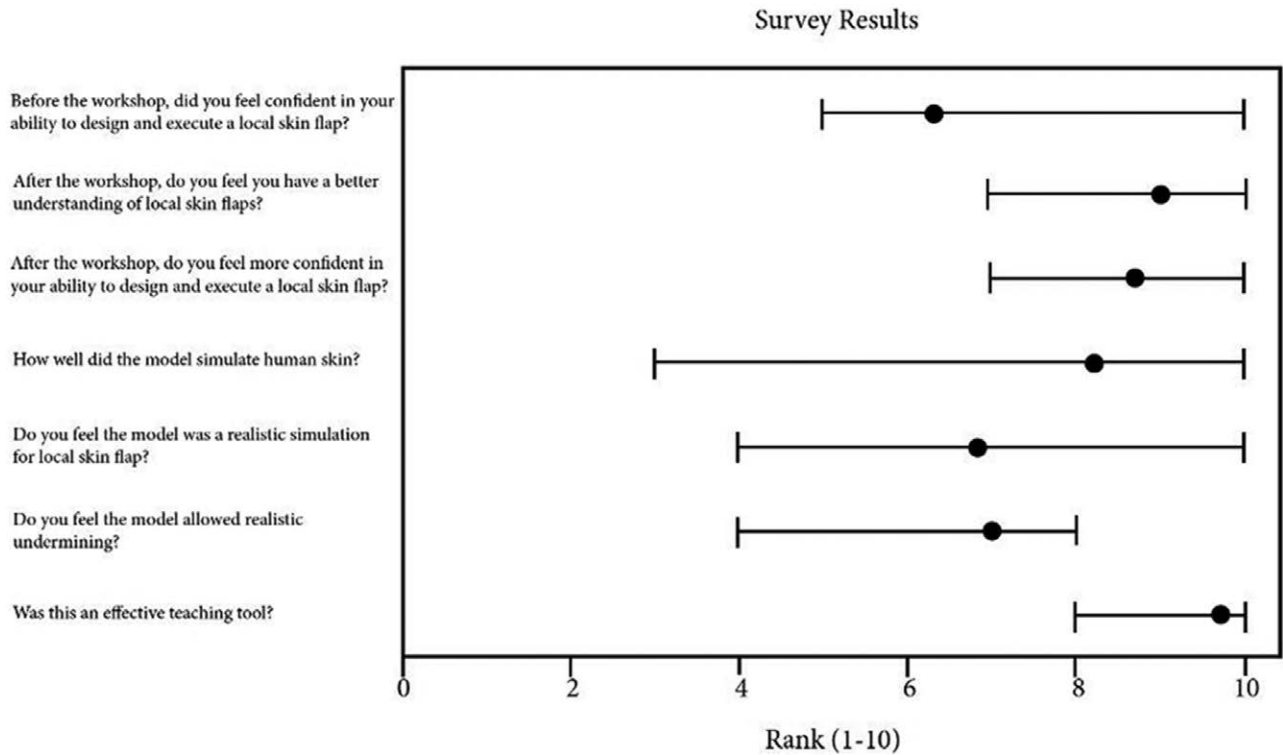
## RESULTS

Learners averaged 6/10 for confidence designing and executing local flaps before the session. After the session, learners reported a better understanding of the theory underlying local flaps 9/10 and felt more confident in their ability to plan and execute local flaps reporting 8/10. The realism of undermining was given 7/10. The LFT was scored 7/10 on simulating the design and execution of local flaps accurately. A score of 10/10 was given for the effectiveness of the trainer as a teaching tool (Fig. 4).

Comments included “excellent materials and way to demonstrate operative principles”, and “great exercise in designing/thinking about local flaps.”

## DISCUSSION

Simulation-based teaching will be essential in the future of plastic surgery training.<sup>5</sup> To provide an effective simulation one must be able to recreate a realistic experience and environment. Traditional products used for simulation include various types of foam pads, pig’s feet, surgical sponges, and tying boards.<sup>6,7</sup> None of these products accurately simulates human skin and soft tissue. Foam products often rip and thicker pig skin bends the needle while suturing. Many institutions also have restrictions to using animal-based products in simulation centers. Cadavers are costly, often not available, and the preserved tissue is not as elastic as live tissue. Most other skin simulators can cost hundreds of dollars and do not provide a reliable replication of tissue layers and elasticity.



**Fig. 4.** Participant assessment of local skin flap design workshop. Participants were asked 7 survey questions evaluating the workshop and suture pad models. Higher numbers indicate higher priority where 10 is the maximum score. Median rank and interquartile range is demonstrated.

With the use of our LFT, we created a teaching session based on the 3 phase simulated curriculum espoused by the general surgery simulation training literature.<sup>3</sup> Participants reported better understanding of local flaps and felt the LFT simulated human skin better than other available models. Future directions include development of trainers and curriculum in more advanced plastic surgery techniques and development of objective assessment and feedback for each resident.

### CONCLUSIONS

The development of a novel LFT replicates elasticity of natural skin and is an effective training tool.

*Amy C. Kite, MD*

Virginia Commonwealth University Medical Center  
 Plastic and Reconstructive Surgery  
 P.O. Box 980154 Richmond, VA 23298-0154  
 E-mail: amy.kite@vcuhealth.org

### REFERENCES

1. Rohrich RJ. "See one, do one, teach one": an old adage with a new twist. *Plast Reconstr Surg.* 2006;118:257-258. doi:10.1097/01.prs.0000233177.97881.85.
2. Rosen JM, Long SA, McGrath DM, et al. Simulation in plastic surgery training and education: the path forward. *Plast Reconstr Surg.* 2009;123:729-738; discussion 739.
3. Mason KF. Changes in the wind. *Compos Technol.* 2004;10:26-31. doi:10.1021/jf052913o.
4. Long SA, Stern CS, Napier Z, et al. Educational efficacy of a procedural surgical simulator in plastic surgery : a phase I multi-center study. 2009;132:2009.
5. Gosman A, Mann K, Reid CM, et al. Implementing assessment methods in plastic surgery. *Plast Reconstr Surg.* 2016;137:617e-623e.
6. Janus JR, Hamilton GS. The use of open-cell foam and elastic foam tape as an affordable skin simulator for teaching suture technique. *JAMA Facial Plast Surg.* 2014;15:385-387. doi:10.1001/jamafacial.2013.137.
7. Bastos EM, Silva RD. Proposal of a synthetic ethylene-vinyl acetate bench model for surgical foundations learning: suture training. *Acta Cir Bras.* 2011;26:149-152.