

Teaching Suturing in a Workshop Setting: A Comparison of Several Models

Keith G. Tokuhara, David W. Boldt, and Loren G. Yamamoto MD, MPH, MBA

Abstract

Objectives: *Suturing is taught in workshops using a variety of models. The purpose of this study is to compare the resemblance to human skin of four models commonly used to teach suturing: pig skin, beef tongue, hot dog and latex glove.*

Methods: *5 centimeter biconvex incisions were made in each of the models and closed by 50 physician study volunteers comprised of 33 board-certified physicians and 17 resident physicians. They rated each model on a scale of 1 to 4, where 4 closely resembles human skin and 1 does not resemble human skin.*

Results: *The following mean ratings were given by study volunteers: beef tongue 3.5 ± 0.5 , pig skin 3.2 ± 0.8 , latex glove 1.6 ± 0.7 , hot dog 1.4 ± 0.6 .*

Conclusion: *Beef tongue and pig skin were rated highest by study volunteers. However, pig skin is much cheaper than beef tongue. Pig skin is the best inexpensive model for teaching skin suturing of the four models studied.*

Introduction

Suturing is taught in workshops using a variety of models that simulate human skin. Teaching medical students and residents in a surgical skills lab rather than in the clinical setting introduces fundamental techniques in a less stressful, more controlled environment and improves suturing skills prior to actual patient contact. It has been shown that formal instruction and practicing of skin suturing in a workshop setting results in measurable improvements in suture placement.¹

Ideally, the model should closely resemble human skin. High-tech virtual reality suturing simulators have been developed at some training programs that provide a high degree of realism,² but most programs do not have the resources to afford such elaborate tools. Many teaching programs use one of several commercially produced synthetic skin models available. These have similarity to human skin, but are purchased at a substantial cost.

It has been suggested that biological models, namely freshly-prepared animal tissue, provide a more realistic medium for practicing skin suturing when compared to synthetic models.³ A survey in 1989 showed that most dermatology residency programs in the US used

pigs' feet for teaching and practicing skin suturing techniques.⁴ The first mention of pigs' feet as a model for teaching and practicing the skills of skin suturing is by Straith and colleagues in 1961⁵. Since then, several other studies have affirmed its credibility.^{6,7,8}

The purpose of this study is to compare the resemblance to human skin of four models commonly used to teach suturing: pig skin, beef tongue, hot dog and latex glove, all of which were suggested anecdotally by several clinical professors of surgery. Cost and availability were the two main factors used to select the models for this study.

Methods

Pig skin was purchased from a local beef and pork processor, cut into 5 cm by 12 cm sections, and stored frozen. Beef tongue was also purchased from the processor and stored frozen. Prior to use, these models were defrosted in the refrigerator and allowed to equilibrate to near room temperature. Hot dogs were purchased from a local grocery store, stored frozen, and defrosted in a similar manner. Latex gloves were purchased from a local drug store.

For each suturing session in our study, one 5 by 12 cm piece of pig skin, one beef tongue, one hot dog, and one latex glove were used. The models were replaced for each session. Organic models were used raw, and the latex glove was filled with rolled newspaper and volunteers were instructed to suture only through the latex. Prior to suturing, each model was secured on a tray and a 5 centimeter, biconvex incision was made in each of the models. The order was randomized, and physician study volunteers were instructed to close the incisions in an interrupted fashion with commercially-purchased suture material consisting of a cutting needle and swaged-on suture. Following closure, the volunteers completed a survey rating the four models on a whole-number scale from 1 to 4 (4=closely resembles human skin, 1=does not resemble human skin).

Results

Fifty physicians in total participated in our study. The demographics of our participants are as follows: 22 physicians board certified in emergency medicine, 3 emergency medicine residents, 10 physicians board

Authors:

- Department of Pediatrics,
University of Hawaii,
John A. Burns School of Medicine
Honolulu, HI 96822 (K.G.T.,
D.W.B., L.G.Y.)
- Emergency Department,
Kapiolani Medical For Women
And Children,
Honolulu, HI 96826 (L.G.Y.)

Correspondence to:

Loren Yamamoto, MD, MPH
Department of Pediatrics
1319 Punahou Street, 7th Floor
Honolulu, HI 96826
Phone: (808) 983-8387
Fax: (808) 945-1570
email: loreny@hawaii.edu

certified in obstetrics/gynecology, 8 obstetrics/gynecology residents, 6 pediatric residents, and 1 physician board certified in family practice. 21 were male, and the average number of years in practice for the non-residents was 9.6. The human skin similarity ratings are summarized in table 1. Beef tongue and pig skin are significantly better than latex glove and hot dog (see 95% confidence intervals of the mean in table 1).

Discussion

These results suggest that beef tongue and pig skin more closely resemble real human skin. However, for the purposes of teaching suturing in workshops, beef tongue is more expensive compared to the other three models. Pig skin can be purchased inexpensively as pork (pig) backs from most grocery stores or as a large slab of pork (pig) belly skin and divided into several individual pieces that permit 1 or more lacerations each. The skin on pigs' feet can also be purchased, but this is more expensive. For this reason, pig skin is more economical than beef tongue.

Despite their similarity to human skin, however, there are several limitations to using these biological models as teaching tools. Postmortem changes in the tissue physical properties, make them less realistic compared to viable skin tissue. Beef tongue and pig skin are perishable, requiring refrigeration or freezing and thawing prior to use. There is a risk of exposure to porcine blood-borne pathogens and tissue-colonizing bacteria. These materials are available in beef/pork retailing and wholesaling, but they are not easily obtainable in the hospital setting. Some teaching programs might choose to use synthetic models for these drawbacks, despite their inferior resemblance to human skin.

Hot dog was rated poorly by study volunteers. They cited poor tissue strength and suture pull-through as weaknesses. Cooked hot dogs or sausages with stronger "skins" (casings) may possess more tensile strength than the uncooked ones used in this study, but probably not comparative to that of the biological models. Latex glove material rated higher than hot dog. Perhaps the reason for this preference lies in the observation by several of our study participants that latex gloves possess a good deal of tensile strength. This quality, combined with the ease of accessibility in almost any hospital or clinical setting and a low cost, make latex gloves a reasonable alternative.

Several commercially produced synthetic skin models are available, but we chose not to include them in our study because they are expensive to purchase. These materials are not easily obtained by students and residents, or by smaller teaching program.

Our study design was limited by the inability to blind the physicians to the type of models being tested. Therefore, preexisting bias could not be eliminated. Furthermore, the rating scale of 1 to 4 is subjective, but

	Mean rating + SD	95% CI
Beef tongue	3.5 ± 0.5	3.35 to 3.65
Pig skin	3.2 ± 0.8	2.95 to 3.37
Latex glove	1.6 ± 0.7	1.40 to 1.77
Hot dog	1.4 ± 0.6	1.21 to 1.55

provided the best estimate of qualitative resemblance to human skin. Biologic models may have varied ratings depending on their freshness, prior storage, and whether they were cooked or not.

In summary, beef tongue and pig skin were rated highest by our study participants. Pig skin is the best model, of the four models tested, to teach suturing in workshops based upon cost and resemblance to real human skin.

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