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## How I Do It

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# The Galliform (Turkey Thigh) Model for Resident Training in Facial Plastic Surgery

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**Key Words:** Facial plastic surgery, local flap reconstruction, resident training, surgical education, surgical model, surgical simulation, suturing.

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## INTRODUCTION

Learning the subtleties of dissection and tissue rearrangement requires study and practice. Students with prior exposure to soft tissue techniques are most likely to benefit from teaching in the operating room. Soft tissue simulation allows necessary repetition and facilitates understanding of complex flap procedures. It also permits objective assessment of skill level.<sup>1,2</sup>

Educators have employed numerous materials and models to facilitate acquisition of cutaneous surgical skills. These include pigs' feet, synthetic multilayered skin pads, stretched animal skins, human cadavers, live mice, and virtual reality simulators. Each has its limitations. Pigs' feet are widely used in surgical training as a model for human skin.<sup>3</sup> Although structurally similar to the skin of human extremities, pig skin is thick and inflexible, making it a poor stand-in for human facial tissues. Multilayer commercial synthetic models simulate epidermal, dermal, and fat layers.<sup>4</sup> They allow for undermining and subcuticular closure techniques and carry no risk of infection or contamination. However, these models are expensive, and plastic layers imitate the feel of tissue poorly. Stretched animal skins require

considerable setup time and lack deep tissue layers. Live animals play an important role in the development of microvascular technique, but are expensive and ethically questionable when nonviable alternatives are available.<sup>5</sup> Formalin-fixed cadavers have rigid soft tissues that do not handle well. Fresh human parts are technically ideal but are rare, expensive, and pose a significant infection risk.<sup>6</sup> Computer-based virtual reality simulators featuring tissue deformation and haptic feedback are not yet fully developed.<sup>7</sup>

We present a facial soft tissue surgery model using defeathered fresh turkey thighs. It is inexpensive, readily available, and carries a low risk of zoonotic infection. We describe the histologic structure of galliform skin and compare its operative handling characteristics to human tissue and the more commonly used porcine limb model.

## MATERIALS AND METHODS

### *Galliform Skin Versus Human Facial Skin*

To better understand galliform skin, we reviewed existing veterinary literature on poultry integument and compared it to human and porcine skin. Furthermore, we examined the histology of commercially available turkey skin. We prepared histologic sections from medium-sized, fresh-chilled turkey thighs. The tissue was formalin-fixed, paraffin-embedded, and sectioned with a standard microtome. Sections were stained with hematoxylin and eosin. Tissue thicknesses were determined by light microscopy using a calibrated ocular reticule by an anatomic pathologist (P.R.E.).

### *Galliform Skin Versus Porcine Skin in the Soft Tissue Laboratory*

During a resident facial plastic training laboratory, we compared pigs' feet (our usual model) to fresh turkey thighs. Procedures simulated on turkey thigh included interrupted simple, mattress, and subcuticular suturing; Z-plasties, rhomboid, bilobed rotation, and island transposition flaps. Residents and attending physicians including fellowship-trained facial plastic

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Abington Memorial Hospital processed the hematoxylin and eosin slides gratis.

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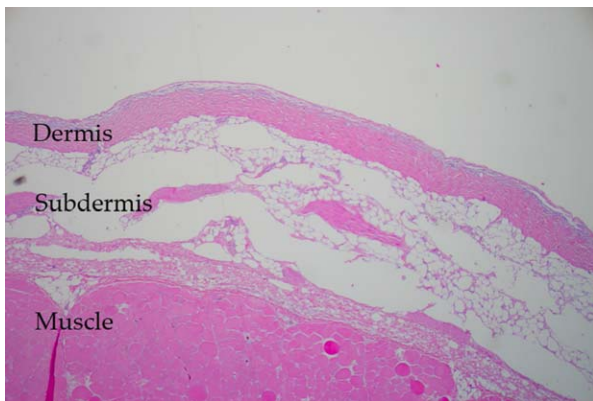


Fig. 1. Histologic section of turkey thigh (hematoxylin and eosin; original magnification,  $\times 40$ ), showing dermis, loose fatty subdermis, and underlying muscle. Epidermis is absent. [Color figure can be viewed in the online issue, which is available at [wileyonlinelibrary.com](http://wileyonlinelibrary.com).]

and oculoplastic surgeons were surveyed. Tissue texture, flexibility, and suturing characteristics were assessed during several soft tissue rearrangement tasks. The participants' subjective assessments were collected by the authors. The cohort's consensus opinions are presented in the Results section.

## RESULTS

### Histology

Galliform birds are chickenlike species. They range in weight from the sparrow-sized painted quail to the heaviest member—the domestic turkey. Birds of this order have pliable skin with multilayered epidermises and a relatively thin, uniform dermis. Dermal papillae are absent except in the feet and under the feather follicles. Beneath the dermis, there is a thin elastic lamina forming a clear boundary between the dermis and the subdermis. The subdermis contains fat, both as a layer and as discrete fat bodies.<sup>8</sup> Attachments to underlying fascia and muscles are few and more flexible than in mammalian skin.

In our commercial-derived preparations (defeathered, chilled turkey thighs; Whole Foods, Austin, TX) the tissues were well preserved, with little evidence of autolysis or freezing artifact. The epidermis was absent throughout—most likely the result of defeathering (which involves rapid immersion in hot water and mechanical avulsion of feathers; Fig. 1). The dermis, subcutaneous fat, and subdermal connective tissues measure 0.2 mm, 1 mm, and 0.2 mm, respectively. This is similar to facial dermal thickness as described by Ha et al.<sup>9</sup> in biopsies from fresh human cadavers (facial dermis and epidermis ranged from  $0.38 \pm 0.09$  mm for the upper eyelid to  $1.22 \pm 0.15$  mm at the nasal tip).

### Galliform Skin Versus Porcine Skin in the Soft Tissue Laboratory

Ten otolaryngology residents, four attending physicians, and two students participated in the laboratory. Overall, the galliform model was preferred for suturing, rotation, and advancement flaps. It was thinner and more

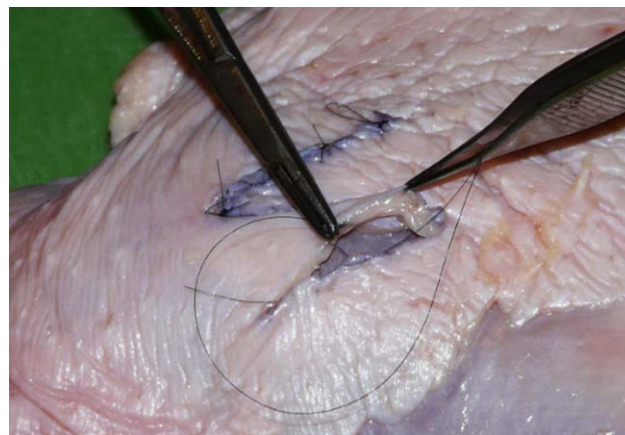


Fig. 2. Interrupted and subcuticular closure of Z-plasty in galliform model. [Color figure can be viewed in the online issue, which is available at [wileyonlinelibrary.com](http://wileyonlinelibrary.com).]

flexible than pig's skin and presented a larger flat surface for suturing. Experienced surgeons felt it resembled eyelid and geriatric facial skin. The porcine skin seemed more realistic as a model for Z-plasty correction of scar contracture using the pig's interdigital web. The thick, resistant pig's skin resembled nasal and nasolabial tissues. The absence of epidermis in the galliform preparation did not impair its use for subcuticular closure (Fig. 2).

## DISCUSSION

### Advantages and Limitations of the Galliform Model for Facial Plastic Simulation

**Pros.** Turkey thighs are available year-round at most American supermarkets. They are inexpensive and provide enough surface area to permit multiple practice procedures on a single thigh. Turkeys have thicker skin than other galliforms (e.g., chicken), more closely approximating human facial integument. The loose fascial attachments of avian dermis permit free undermining, rotation, and tunneling.<sup>10</sup> The relative elastic galliform skin stretches and "lies down" like mature human skin.<sup>11</sup> The dermis can be incised with sharp scissors and secured with fine monofilament suture. It serves as a good model for blepharoplasty, rhytidectomy, and local skin flaps.

**Cons.** The defeathering process removes the turkey epidermis, altering its surface feel. The thin, mobile dermis is "too easy" to advance and lacks a thick layer of dermal fat, so is a poor model of nasal or forehead reconstruction or facial scar revision. Thin collapsed vessels are inappropriate for vascular and free-flap simulation. As with any fresh animal model, zoonotic infections, especially from *Salmonella*, *Listeria*, and *Campylobacter* species, are possible<sup>12</sup> and necessitate good hand hygiene and decontamination of instruments and surfaces. The use of chorine washes in the commercial poultry processing reduces bacterial count and the risk of human infection.<sup>13</sup>

## CONCLUSION

No available simulation ideally replicates the structure and feel of all areas of human facial skin. We

studied a novel galliform model employing fresh turkey thighs. The dermal and subdermal components of galliform integument are histologically similar to mature human facial skin. In the teaching laboratory, turkey thighs can be used for suturing and local flap procedures. Galliform skin is an effective model for use in facial plastic education.

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