

## **A cost-effective cadaveric model for plastic surgery simulation**

Sir,

The hours plastic surgery trainees spend in the operating theatre are increasingly limited compared to their predecessors due to current working time regulations, especially in Europe.<sup>[1]</sup> Trainees have to look for alternative training methods to hone their skills, and cadaveric models can be the answer in complementing regular surgical training. A recent systematic review concluded that training using a cadaveric model is a good way to increase trainees' confidence.<sup>[2]</sup> Fresh frozen cadavers are the gold standard in providing a realistic simulation of live surgery. Unfortunately, without costly freezer storage, they decompose quickly after defrosting.

Traditionally, formalin was used to embalm bodies for the study of anatomy. However, tissue changes induced by formalin make it a poor substitute for the use of plastic surgery simulation. Fortunately, advances in embalming methods introduced soft-fixation techniques, such as Thiel and Genelyn, which gave cadavers live-like tissue quality such as softness and flexibility. An earlier study by Jaung had confirmed the superiority of Thiel over other embalming techniques, including Genelyn, in producing live-like cadavers for surgical training.<sup>[3]</sup> However, centres should take a few other factors, such as cost

and production time, into consideration when deciding which technique is most suitable for them. First, with regards to production time, Thiel cadavers have to be immersed for a minimum of 3 months.<sup>[1]</sup> Second, the Thiel method requires investment in expensive new facilities.<sup>[4]</sup>

The Genelyn cadaveric model is overall a cheap, good and convenient alternative in the practice of raising microvascular flaps. Genelyn's exact composition is unknown as it is a propriety mix, but it contains methanol, formaldehyde and dyes. The embalming procedure involves getting arterial access via the femoral or carotid arteries and draining the fluid from the femoral or jugular veins. The advantages of Genelyn are that it does not require expensive investment in any new infrastructure, and its production is significantly faster because cadavers do not need to be immersed for long periods.

As a soft fix embalming technique, Genelyn cadavers exhibit relatively good tissue pliability and joint mobility. This is confirmed when we compared the range of movements of various joints between Genelyn and formalin cadavers. In all joints evaluated, Genelyn cadavers exhibit a greater range of movement compared to formalin cadavers. This is especially useful for simulating real surgical conditions as patients may have to be placed in different positions for surgical procedures [Figure 1].

We also attempted a pilot study in comparing between Genelyn and formalin cadavers in raising microvascular flaps. One formalin and one Genelyn cadaver were used. A trainee was recruited to raise a dorsalis pedis flap on both models and had to fill in a questionnaire to rate the surgical experience upon completion (1–10, 1 being unsuitable for simulation and 10 being as

good as live surgery). The Genelyn model scored highly on all aspects including the ease of identification of structures, suppleness, colour of the tissues and overall satisfaction. The time taken to complete the procedure was also significantly shorter in the Genelyn model [Figure 1].

In conclusion, although Thiel cadavers currently provide the best surgical simulation among the soft fix embalming methods, the above authors believe that the Genelyn cadaveric model is sufficiently good for plastic surgery simulation and is much more cost-effective after taking into consideration the logistical requirements.<sup>[4]</sup> Plastic surgery trainees can benefit from more practice on the Genelyn cadaveric model, and in the future, more studies into other plastic surgery techniques that could be simulated on this model should be investigated.

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#### Conflicts of interest

There are no conflicts of interest.

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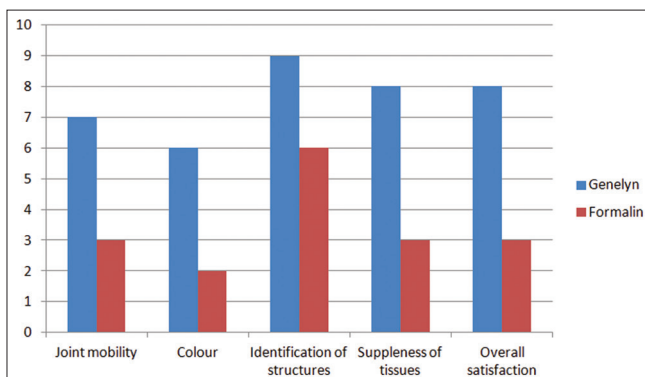
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**Figure 1:** Comparison of the surgical experience of Genelyn and Formalin cadavers

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