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BRIEF COMMUNICATION

A novel simulation model for corneal gluing

Lanxing Fu[1]✉ and Emma J. Hollick[1]

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Corneal perforation is an ophthalmic emergency, and corneal gluing can improve outcomes and reduce the need for tectonic keratoplasty [1, 2]. It is challenging to practice because corneal perforation presents acutely. There is no non-mammalian simulation model for corneal gluing. Simulation practice can be used as an adjunct to the traditional surgical apprenticeship model [3]. We describe a novel simulation model for corneal gluing practice.

A full-thickness defect simulating a corneal perforation was created in an egg after the eggshell was dissolved with 5% acetic acid (white distilled vinegar, Royal Sun, distributed by Amazon

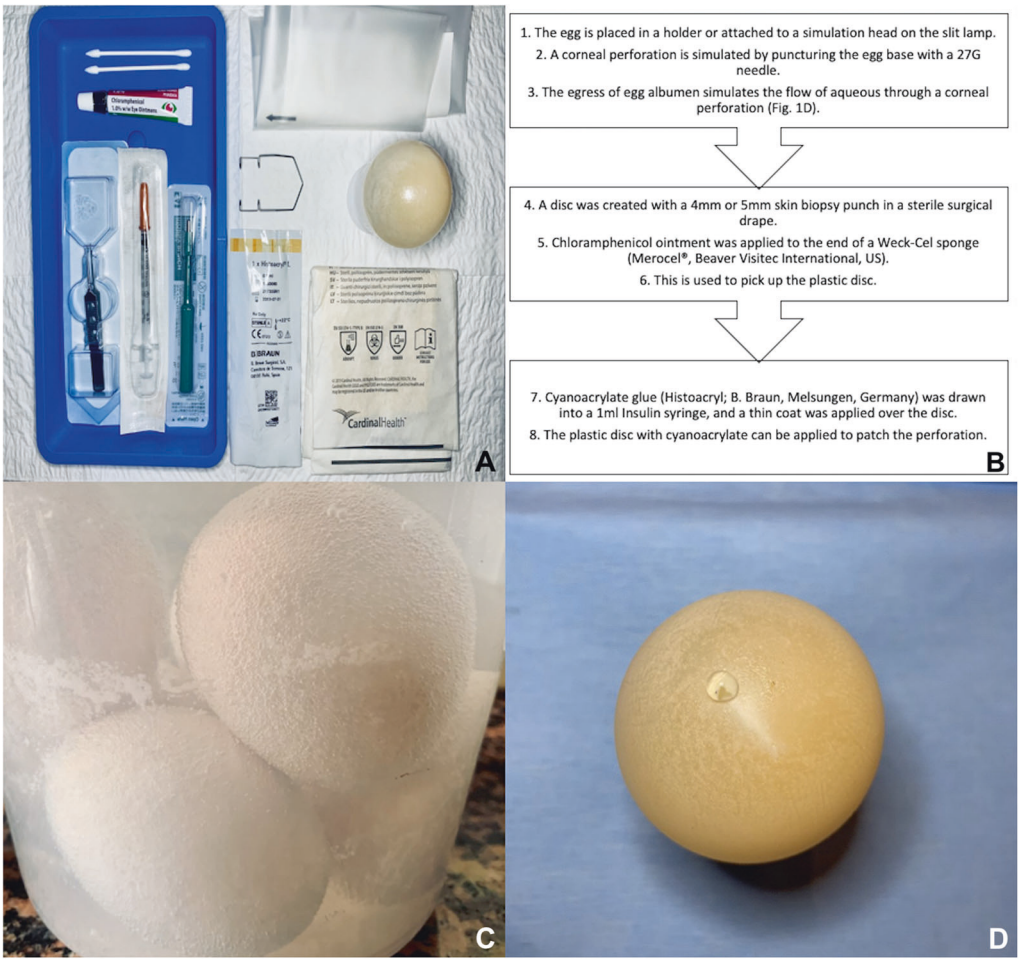

Fig. 1 Simulation model for practising corneal gluing procedure. The equipment (**A**) and method (**B**) to practice corneal gluing with the simulation model. To prepare the corneal gluing simulation model, emersion in 5% acetic solution dissolves the eggshell (**C**). A small perforation is made, and the egress of egg albumen simulates aqueous in a corneal perforation (**D**).

[1]King's College Hospital NHS Foundation Trust, London, UK. ✉email: L.Fu@nhs.net

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Table 1. Participant feedback survey.

Question	Mean Score (1–5) before simulation session (range)	Mean Score (1–5) after simulation session (range)	*p* value
How confident would you rate your knowledge on corneal gluing?	2.8 (1–4)	4.3 (3–5)	0.002
How confident would you be in assessing the size of a corneal perforation?	3.1 (1–4)	4.0 (3–5)	0.03
How confident are you in performing corneal gluing independently?	2.6 (1–4)	4.2 (3–5)	0.003

Mean scores from the 5-point Likert scale (1 = no confidence, 5 = high confidence) participant survey completed after the simulation session ($n = 14$).

Stores, Seattle, United States; Fig. 1). The egress of albumen through the outer soft membrane was used to teach cyanoacrylate glue (Histoacryl Blue; B. Braun, Melsungen, Germany) application to ophthalmology trainees ($n = 14$). Assessments of procedure numbers, perforation seal, and model damage were undertaken. A pre- and post-training questionnaire using a 5-point Likert scale (1 = no confidence, 5 = high confidence) was completed by participants for knowledge, confidence in corneal perforation assessment, and corneal gluing procedure SurveyMonkey®. Wilcoxon signed-rank test was performed to assess for significant changes pre- and post-simulation practice. Fourteen participants undertook 42 cyanoacrylate patch applications. Six applications had an incomplete seal on the first attempt and had to be repeated. One simulation model was discarded due to defect size being too large, and 4 had irregularity of the surface due to the over-application of glue. There was good feedback from the post-session survey (Table 1).

This simulation model can teach how to apply the glue on a disc to seal a leaking perforation without using excess glue. It is more useful than simulation models for corneal gluing using human or animal eyes, which may have had excessive manipulation or mechanical trauma and prolonged storage after retrieval. Issues with fidelity to human tissue will apply with the use of animal eyes and both require a dedicated space with sterilization and disposal facilities. This model recreates what occurs in an actual corneal perforation: the aqueous flowing out of the defect site without additional manipulation, that other models cannot do (Supplementary Video) [4].

This novel and cost-effective model simulates a leaking corneal perforation and is effective for practicing corneal gluing. Ophthalmology trainees can gain greater confidence before undertaking corneal gluing on patients.

DATA AVAILABILITY

The datasets generated during and/or analyzed during this study are available from the corresponding author on reasonable request.

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AUTHOR CONTRIBUTIONS

LF was responsible for designing the simulation model, evaluation study, analyzing data, interpreting results, and drafting the manuscript. EJH was responsible for designing the simulation model, reviewing and providing feedback on the manuscript.

COMPETING INTERESTS

The authors declare no competing interests.

ADDITIONAL INFORMATION

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Correspondence and requests for materials should be addressed to Lanxing Fu.

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