Low-Tech Intraocular Ophthalmic Microsurgery Simulation (LTIOMS): A Low-cost Model for Home Use

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We describe a low-cost, low-tech, intraocular ophthalmic microsurgery simulation model for use at home. This model adds to the very limited literature on home-based ophthalmic simulation and is particularly pertinent during the Covid-19 pandemic due to fewer training opportunities and reduced service delivery.

Introduction

In order to maintain manual dexterity and surgical skills, trainees are encouraged to partake in regular simulation. Current options for intraocular surgical simulation require specialist microscopic equipment which is expensive and requires access to simulation facilities. Microsurgical simulation is normally reliant on using specialist equipment with an operating or portable microscope or alternatively by utilising virtual-reality simulators such as EyeSi[1]. These simulation options are thus not only location specific, but also time and resource intensive associated with high costs. Such factors form barriers to accessing regular, effective simulation practice.

Moreover, ophthalmic surgical training has been gravely affected by the Coronavirus (COVID-19) disease pandemic. Ongoing social distancing measures and reduction in clinical activity has had a knock-on effect on face-to-face surgical training sessions, and significantly reduced elective surgery has minimised training opportunities in routine surgery[2].

In a world governed by increasing social distancing, limited financial resources and significant cultural shifts towards education and training, we propose regular use of this home-based simulation model as an adjunct to surgical training, especially for junior trainees.

References

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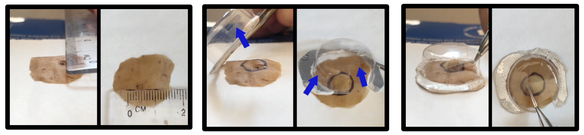
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Setup & Surgical Techniques

Capsulorhexis

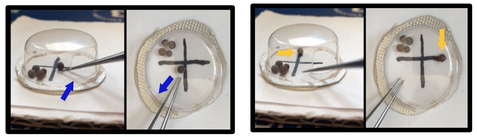
1) secure the thin slice of boiled potato to a flat work surface and mark a 7-10mm diameter circle 2) using a blade, prepare a lozenge packet with incision ports; a main incision port 5mm wide and full depth of the packet, and a paracentesis port 5mm x 2mm in size. Secure the lozenge packet over the potato using Blu Tack 3) Using a cystotome create a simulated 'capsular flap'. Using rhexis forceps, complete the simulated rhexis as guided by the circular markings



Equipment needed: thin slice of boiled potato ~2cm wide, small piece of cardboard work surface, ruler, marker pen, lozenge packets, small blade, Blu Tack® (putty like pressure sensitive adhesive, Bostik Ltd, Leicester, UK), cystotome on a 1ml syringe, capsulorhexis forceps.

Dexterity: Dot the Cross

1) Using a small blade prepare your lozenge packet with a 5mm wide x 10mm height incision port on your non-dominant side (blue arrows). Draw a 2cm x 2cm cross on a work surface. Secure the lozenge packet over the drawn cross. This is your simulated anterior chamber 2) Place 5 poppy seeds inside the chamber. Using your non-dominant hand and forceps, place the seeds on the edges of the cross (yellow arrows). Repeat as required.



Equipment needed: poppy seeds, marker pen, small piece of cardboard work surface, lozenge packets, small blade, Blu Tack®, forceps.

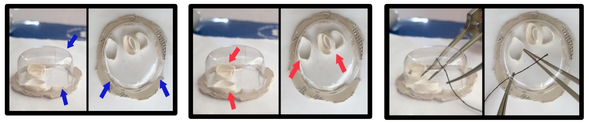
Set Up

- Smartphone, video mode x2 zoom
- Phone torch illumination
- Stand of books (10.5cm)
- Microsurgical tools and simulation props for different exercises



Dexterity: Loop the Hoops

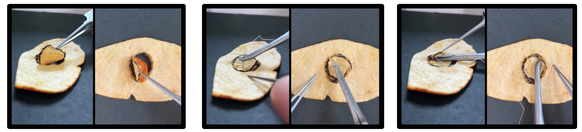
Equipment needed: paper drinking straw, suture, scissors, small piece of cardboard work surface, lozenge packets, small blade, Blu Tack®, forceps.



1) Using a small blade prepare your lozenge packet incision ports; two ports 90-120° apart measuring 5mm wide x full height of lozenge packet (blue arrows). Secure this lozenge packet to a flat work surface, such that the ports are aligned to your regular operating hand positioning. This is your simulated anterior chamber. 2) Using scissors cut three cross-sections 'hoops' of a drinking straw and place inside chamber (red arrows). 3) Using forceps and a suture, thread the hoops onto the thread. Repeat as required with both dominant and non-dominant hand.

Suturing

Equipment needed: orange peel, marker pen, small blade, Blu Tack®, suture of choice, needle holders, forceps.



1) Cut a 1cm disc out of thin orange peel. This is the simulation corneal 'graft'. Retain the remaining peel as the 'host' tissue. Flatten the remaining peel and secure to a flat worksurface using Blu Tack® 2) Using your suture of choice, needle holders and forceps, suture the 'graft' to the 'host' in various clock hour directions. 3) Repeat with non-dominant hand for practice.

Discussion

Smartphones are increasingly being incorporated into clinical practice and notably in the field of Ophthalmology[3]. Techniques for viewing and learning from surgical videos in three-dimension (3D) have also been described however there is a lack of intraocular microsurgical skills simulation solutions for Ophthalmology training especially for take-home practice[4, 5].

The disadvantages of smartphone use for home microsurgical training includes the two-dimensional (2D) visualisation and lack of magnification compared to a standard operating microscope. Nonetheless, a randomised controlled trial found that home microsurgical training using an iPad or jeweller's microscope produced similar outcomes in time for suture placement, anastomosis formation and anastomosis leak rate compared with the use of a laboratory microscope[6]. Another study in minimal-access surgical simulation sought to determine the differences between unstructured (unsupervised and in a home environment) and structured learning amongst surgical residents. The data revealed that there was no significant difference between the two groups in skill acquisition and technical proficiency[7].

Therefore, we believe by simplifying simulation training methods and enabling trainees to undertake it in the comforts of their own home or at the workplace office space, our intraocular microsurgery simulation model provides an easy, feasible, realistic and practical option. Assuming most trainees have access to a smartphone that they already own, and basic disposable surgical instruments as described in our technique, our model does not require any additional expense thereby minimising cost and resource barriers. Additionally, the smartphone use will enable the practice to be recorded and discussed with a trainer for feedback.

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