The surgical simulator–assisted postgraduate ophthalmology residency training during the COVID-19 pandemic

Dear Editor,

The coronavirus disease 2019 (COVID-19) pandemic has adversely affected postgraduate teaching in all disciplines, more so in surgical specialties. Because of the high spike in COVID-19 cases, the offline faculty classes, clinical and academic grand rounds, and subspecialty clinical posting have been hampered drastically. All the residents were working in a modified duty roster to reduce unwanted exposure to the coronavirus. The COVID-19 protocols, interstate travel restrictions, limited outpatient consultations, and the fear of contracting the disease have resulted in fewer patients coming for elective surgical procedures. Moreover, one third to half of the department residents were being posted in COVID-19 wards to provide direct patient care at any given time.[1] This situation has undoubtedly caused a considerable amount of stress and anxiety among the residents and senior residents, fantasizing and fearing the worst and lamenting what might happen.

To overcome the situation, the department started an innovative online teaching curriculum through different platforms. A well-structured, wet-lab training with goat's eye and unused human cadaver eyes was initiated to practice different surgical techniques by both junior and senior residents.[2] To enhance the postgraduate surgical learning, the department had been trying to acquire the virtual reality simulator (Eyesi, VRmagic, Mannheim, Germany), and fortunately, it was commissioned during the pandemic time. This came as a boon to the residents at a time when elective operation theaters were completely shut down. The department decided to make the best use of the simulator during this downtime.

The currently available cataract surgery simulators are Eyesi (VRmagic Holding AG, Mannheim, Germany), PhacoVision (Melerit Medical, Linkoping, Sweden), MicroVisTouch® (Immersive Touch, Chicago, IL, USA), and the Help Me See (HMS) Eye Surgery Simulator (HelpMeSee Inc., NY, USA).[3] The HMS Eye Surgery Simulator is the only simulator that can produce a genuine computerized graphical environment to simulate the manual small-incision cataract surgery procedure.[4] The simulators can produce three-dimensional stereoscopic images and simulate the majority of cataract surgical steps, and the residents are able to get familiarized with a wide range of clinical situations without any real risk to the patients.[5]
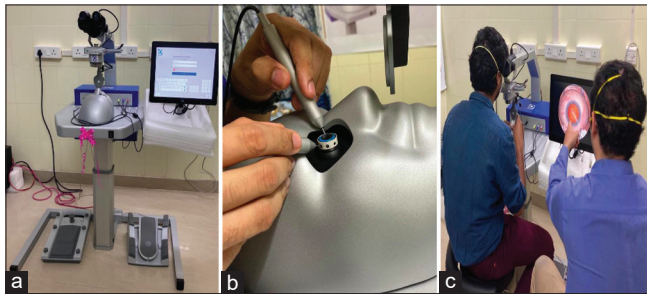
Eyesi is a reality simulator that supports the resident surgeon to practice various intraocular surgeries. It has a mannequin with a model eye attached to it and is connected to a computer display and operating microscope [Fig. 1a and b]. The sensors attached to it track every movement of instruments and the operating surgeon's hands. The software contains different teaching modules for cataract and vitreoretinal surgeries. A well-structured curriculum was prepared for all levels of the residents to practice on the simulator equally. Initially, the senior residents were oriented and trained on the simulator by the faculty surgeon and technical heads of the company. Then, under the senior residents' supervision, the junior residents completed four training modules of cataract surgery starting from Introduction, Beginner, Intermediate, and Advanced courses [Fig. 1c]. Each training module has different sets of tasks assigned by the software. The details of each of these modules are outlined in Table 1.

- *CAT-A-Introduction:* In this module, the residents try to learn the basic microsurgical skills, such as instrument navigation in the anterior chamber, tremor control, fine motor dexterity, and proper microscope use.
- *CAT-B-Beginner:* Isolated steps of cataract surgery are performed following abstract instrument handling tasks. Residents practice first steps in capsulorhexis, lens segmentation, lens removal, and intraocular lens (IOL) insertion in a simulated surgical environment.
- *CAT-C-Intermediate:* This module improves the acquired cataract skills through more challenging scenarios. Residents practice more advanced surgery techniques, such as vertical chopping or insertion of a toric IOL, and perform multistep cataract procedures, for example, the complete phacoemulsification (phaco) divide and conquer technique.
- *CAT-D-Advanced:* The advanced module offers more difficult cataract surgery situations under demanding conditions, such as high capsular tensions or weak zonules. Residents are challenged by randomized tasks and complications, such as posterior capsule rupture, requiring them to adapt to the surgical scenario quickly.

At the end of each module, the software provides a cataract challenge, and the software allows only 15 minutes for

completing the challenge [Fig. 2]. The trainee is not allowed to proceed to the next module until an adequate score is achieved in the previous module. After completing the simulator training, the residents were encouraged to perform phaco surgery under the direct supervision of a consultant surgeon. The use of a cataract surgical training module and the built-in probes helps the resident surgeon learn intraocular manipulation better and avoid inadvertent touch to the cornea and lens. The scoring system of Eyesi simulator gives feedback to the user for their efficient manipulations and helps them complete the task with utmost precision. The trainee sometimes finds the simulation steps harder than the real environment, and thus it prepares the trainee well to handle the real situation.

Eyesi surgical simulator is proven to enhance the hand stability of the resident surgeon and helps immensely while performing phaco in the operation theater.[6-9] Eyesi simulator was introduced in the U.K. residents' curriculum, and it resulted in a significant reduction in complication rate, phaco

Figure 1: (a) Eyesi surgical simulator unit with mannequin and a model eye attached to it and connected to a computer display and operating microscope. (b) Model eye with the probes inside them. (c) Junior resident performing simulation lab training under the supervision of a senior resident
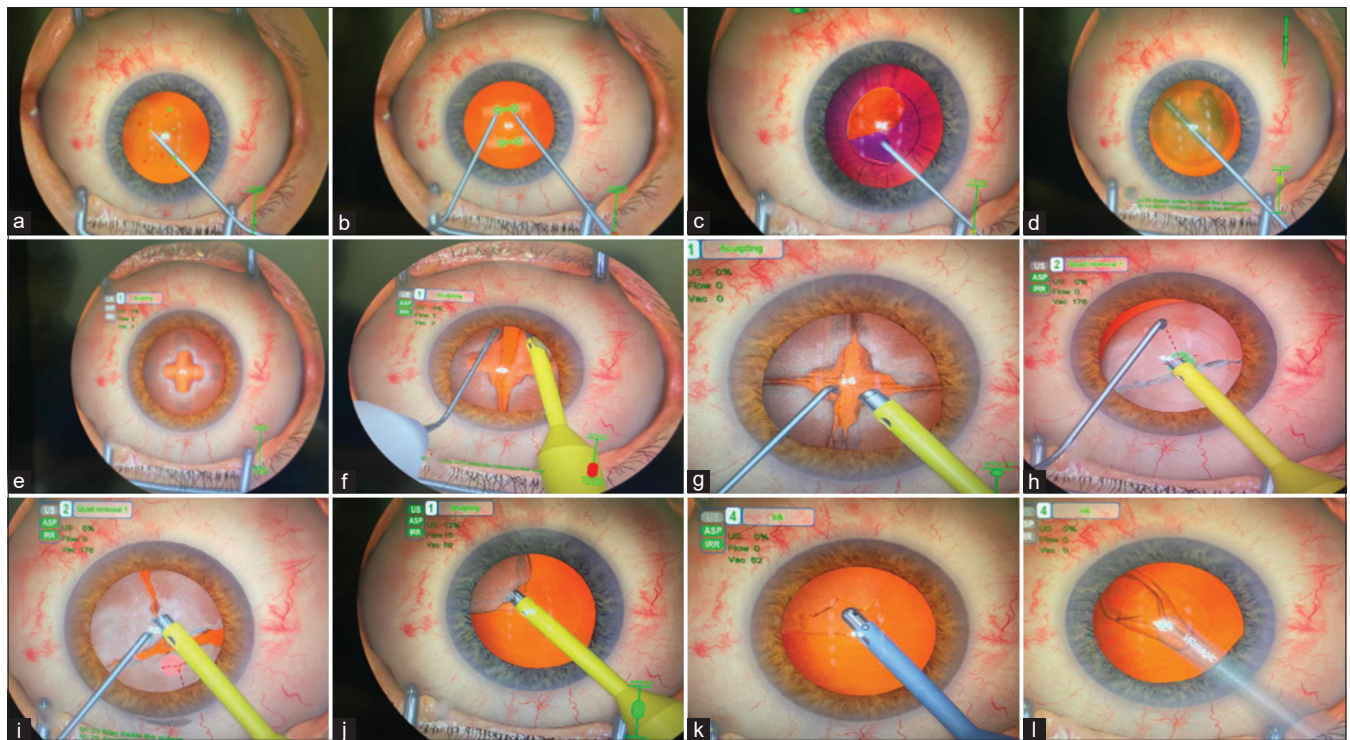
Figure 2: Steps of simulation lab training by the residents: (a) and (b) bimanual navigation, (c) capsulorhexis with cystitome, (d) hydrodissection, (e) nucleus sculpting, (f) division of the nuclear fragments, (g) nucleus divided into four quadrants, (h) resident learning vertical chopping, (i) nucleus chopped into various fragments, (j) nucleus emulsification, (k) irrigation and aspiration of the cortex with coaxial Irrigation & Aspiration (IA), (l) intraocular lens implantation

Table 1: Different levels of tasks performed by the residents in simulator

CAT-A-Introduction	CAT-B-Beginner	CAT-C-Intermediate	CAT-D-Advanced
Anterior chamber navigation	Navigation and instruments	Capsulorhexis	Capsulorhexis errant tear
Intracapsular navigation	Intracapsular tissue	Divide and conquer	Weak structures
Bimanual navigation	Stop and chop	Chopping	Capsular plaque
Instruments	IOL insertion	Irrigation/aspiration	White cataracts
		Toric IOLs	Varying cases Anterior vitrectomy

IOL=intraocular lens

time, and phaco energy used by the resident surgeon while operating in theater.[10]

With COVID-19 restrictions and limitations of nonemergency elective ophthalmic surgeries, resident surgical training is hampered all over the country. Well-structured wet-lab and simulator lab training are the way forward in the near future as the second wave of COVID-19 also has hit the country more devastatingly.[3] Although we could not do any prospective study about the effects of simulator training among the residents, with minimum opportunities that they got in the operation theater, they were more confident than before.

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Conflicts of interest
There are no conflicts of interest.

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