Research Protocol

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Health and Medical Research Fund

Research Fund Secretariat
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Food and Health Bureau
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Hong Kong

RESEARCH PROTOCOL

Title:
The Effect of Virtual Reality Phacoemulsification Cataract Extraction Simulation Surgery Training on Patient Safety and Outcomes: A Randomised Controlled Trial

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Introduction:

The rising burden of cataract and demand for cataract surgery in Hong Kong's aging population

Cataract is one of the leading causes of blindness and visual impairment from pooled data of population-based studies in East Asia including Hong Kong. [1] The latest studies have found that the global number of blindness due to cataract increased from 12.3 million in 1990 to 20 million in 2010 due to rapidly aging population. [2] Insufficient funding and lack of qualified ophthalmic practitioners to deliver cataract extraction surgeries efficiently are the major challenges to reduce the burden of cataract. [3] In Hong Kong, the Hospital Authority (HA) is undertaking various initiatives in response to fight the cataract epidemic, including implementation of key performance indicator based on the waiting time for cataract surgery and the public-private partnership programme. As a result, the number of cataract surgeries performed increased from 17,000 in 2008-2009 to 28,000 in 2012-13 and the average notional waiting time for cataract surgery had been reduced from over 44 months to below 16 months (http://www.info.gov.hk/gia/general/201310/16/P201310160421.htm).

However, there is no room for complacency in the recent remarkable achievements by HA. According to the government's Census and Statistics Department, the proportion of elderly persons aged 65 and over is projected to rise markedly, from 15 per cent in 2014 to 36 per cent in 2064 (http://www.censtatd.gov.hk/hkstat/sub/sp190.jsp?productCode=B1120015). **Hence, the rising demand for cataract surgery in Hong Kong will continue to be relentless and there is an imminent need to prepare for a strategic plan to uphold the quality of health service in cataract surgery.** Indeed, the most current Hong Kong Special Administrative Region's 2017 Policy Address in medical services, public health and elderly care still emphasized the need to enhance cataract operation output.

Traditional apprenticeship training in phacoemulsification cataract extraction surgery in patients

There is a constant influx of new ophthalmic surgical trainees every year to ensure the adequacy of manpower to provide quality eye care to the public in Hong Kong. Phacoemulsification cataract extraction surgery is one of the most commonly indicated surgeries and is part of the essential specialist training. Before obtaining the specialist qualification, The College of Ophthalmologists of Hong Kong requires a minimum experience of 200 cataract operations, of which 100 operations are performed by the trainee as the main surgeon (http://www.cohk.org.hk/training/training-curriculum/). This requirement is consistent with the guidelines of The Royal College of Ophthalmologists in the United Kingdom and The Royal College of Surgeons of Edinburgh (https://www.rcophth.ac.uk/training/ost-information/).

Traditionally, trainee eye surgeons learn cataract extraction surgery based on the apprenticeship model, in which they performed the surgical techniques step-by-step under the close supervision of a qualified trainer in patients' eyes. Unfortunately, the patient can be an unforgiving teacher. The trainees are exposed to real-time pressures during the procedure, especially when the majority of cataract extraction surgeries are performed under local anesthesia. The initial learning curve for phacoemulsification cataract surgery is quite steep, which is reflected by the higher complication rates in surgeries performed by trainees. The rate of posterior capsule (PC) tear among trainee surgeons varied from 4.8% to 15% and for PC tear with vitreous loss between 2.8% and 10%. [4, 5] Experienced surgeons tend to have much lower complication rates, with a vitreous loss rate of 0.53% to 1.63%. [6]

Furthermore, the cost of training surgeons in operation theatre is high because of prolonged operation time. [7, 8] **With rising public expectations and demands in the quality of cataract surgery outcomes, it is vital that ophthalmic trainees learn to operate in a manner that is safe and time efficient.**

Evaluation of the validity and impact of virtual reality simulated phacoemulsification training

Simulation medical education has been long recognized for its advantage in allowing the trainees to experience the consequences of their decisions and actions as they learn new skills without putting patients at risk. For decades, eye surgeons in Hong Kong had first practiced simulation surgery in pigs' eyes but it only produced limited benefit due to their tissue consistency and anatomy only had modest resemblance to human eyes. As a result, trainees usually begin cataract surgery in patients before skills are well developed. With the advent of 3-dimensional computer-generated virtual reality operating environments, the simulated phacoemulsification surgical experience has become more authentic. There are currently 3 virtual reality simulation platforms specifically designed for phacoemulsification training: Eyesi (VRmagic, Holding AG, Mannheim, Germany), MicroVisTouch (immersivetouch, Chicago, USA) and PhacoVision (Melerit Medical, Linkoping, Sweden). Eyesi has the highest number of reports in peer-reviewed clinical publications regarding to its validity and benefits to surgical outcomes. The device provides stereoscopic view through an operating microscope and consists of high-fidelity handheld instruments for insertion into an artificial eye (**Figure 1**). The foot-pedal controls are excellent proxies for the real phacoemulsification cataract extraction surgery. The training modules software has periodic updates to cater for more authentic simulation experience as well as to keep up with the most current trends in instrumentation and surgical techniques.

Top Left: The Eyesi virtual reality simulator provides stereoscopic view through an operating microscope and consists of high-fidelity handheld instruments for insertion into an artificial eye. **Bottom Left:** The foot-pedal controls are excellent proxies for the real microsurgical environment of phacoemulsification cataract extraction surgery. **Right:** For decades, eye surgeons in Hong Kong have first practiced simulation extracapsular cataract extraction surgery in pigs' eyes. It is a mediocre model for phacoemulsification training because it has only modest resemblance to human eyes. As a result, trainees usually being phacoemulsification surgery in patients before skills are well developed.

At least 7 training modules in Eyesi had been evaluated for their construct validities, which include anti-tremor training, forceps training, capsulorhexis, hydromaneuvers, phacoemulsification, navigation and cracking and chopping of nucleus. [9-14] The construct validities of these training modules have been defined by demonstrating its ability to differentiate between the performances of the expert surgeon compared to novice surgeons. Another crucial evaluation for simulation surgical training is on its efficacy to improve surgical knowledge and skills. Previous studies found that simulated training in Eyesi had led to improvements in certain skills including capsulorrhexis, use of microforceps, navigation and phaco-chopping techniques.13,15-19. **There are preliminary evidences on the validity and impact of Eyesi virtual reality simulation training modules.** ***The lack of robust clinical trials to assess the efficacy of simulation-based training for the transfer of skills to the operating theatre and patients.***

A recent systematic review by Thomsen et al published in 2015 identified 118 studies of which the majority (45%) were simulations of cataract surgery but characterized by a wide variety of evidence levels, with most (74%) only achieving level

2 (cohort study). 20 A number of validity studies had included medical students as participants which rarely had any value because the training models were intended for resident trainees who are different from medical students in clinical experience and intuition9, 10, 13, 16, 18In a number of studies, the improvement of surgical skills had been evaluated by comparison between virtual- training followed by assessment using the same platform or pigs' eyes Five studies had directly evaluated the impact of simulator-based training on real-life operating theatre performances and patient-related outcomes. Belyea et al reported a significant decrease in phacoemulsification time and power use (2.4 vs. 1.9 minutes; $p < 0.002$ and 28.2% vs. 25.3%; $p < 0.0001$, respectively) following training on Eyesi. Baxter et al found that the complication rates of cataract surgeries performed by resident trainees were lower than those previously reported in the literature.19,21. McCannel et al found a significant decrease in the number of errant continuous curvilinear capsulorhexes during cataract surgery after a capsulorhexis-intensive training curriculum on the Eyesi simulator (15.7% vs. 5.0% in the ostintervention cohort; $p < 0.0001$). However, these 3 studies were retrospective which could have been influenced by various confounding factors. Two prospective studies have been performed. Pokroy et al found significant decrease in operation time but nonsignificant difference in complication rates before and after training with Eyesi[21]. Thomsen et al reported that following Eyesi training, there were significant improvements in the performances in real-life operations by non-independent surgeons and less experienced surgeons (performed fewer than 75 independent phacoemulsification surgeries) assessed by masked observers using a well-validated, objective cataract surgery skills assessment tool.

To a certain extent, these previous studies established the validity and efficacies of the Eyesi simulator. However, the current evidence and assessment of simulator-based training is characterized by a scattered focus and lack of rigorous methodologies to ensure effective skills transfer to the operation theatre. The ultimate goal of simulator use is to improve patient safety and outcomes by trainees.

Given the wide adoption of simulator-based training by universities and tertiary ophthalmic centers in many parts of the world, there is an imminent need for a robust clinical trial to justify the efficacy of implementing virtual reality simulator training modules in structured phacoemulsification surgery training programmes.

Objective:

To determine the effect of Eyesi virtual reality training on phacoemulsification preformed on actual patients by eye doctor trainees.

Hypothesis: *Trainees who received simulation training on Eyesi will have 1) better overall technical performance on phacoemulsification cataract surgery on actual patients based on the validated, objective and task-specific assessment tool (ICO-OSCAR) and 2) reduced operation time required than trainees who had no prior*

Eyesi training.

Plan of Investigation:

Subjects

Trainees recruitment and inclusion criteria:

Basic ophthalmic surgical trainees from all five HA clusters (Seven hospitals) in Hong Kong will be eligible to participate in the study. Invitation letters will be sent out to the Chief of Services and distributed to all eligible trainees. All trainees would have no ophthalmic microsurgical simulation training or phacoemulsification experience in the operating theater prior to enrolment. An informed consent will be signed before participation in the study. To ensure that the trainees' baseline characteristics were similar within and between each group, their surgical logbooks will be inspected just before the trainees attain their qualification to become higher surgical trainees by the College of Ophthalmologists of Hong Kong.

(ii) Study design

This is a randomized trial of phacoemulsification simulation training in virtual reality simulator in addition to wet laboratory versus in wet laboratory only.

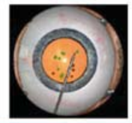
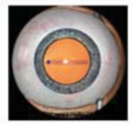
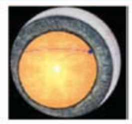
(iii) Methods

Trainees will go through three modules of training. Trainees must attend and complete a module before proceeding to the next. The first module consists of basic microsurgical training workshop and extracapsular cataract extraction course in the wet laboratory under supervision by a fellowship-trained instructor (at least 2-year post-fellowship). The second module will be phacoemulsification wet laboratory training with phacoemulsification system using model eyes (Kitaro WetLab, Frontier Vision Co., Ltd., Hyogo, Japan) under supervision.

After the second module, the statistician will use a computer program to perform block randomization to allocate the trainees to intervention or control groups in 1:1 ratio. Trainees will receive their training assignment through Whatsapp text message. Group A (Eyesi + Wet lab) will proceed to the third module, followed by operating room video recorded assessment of phacoemulsification surgeries in patients. Group B (Wet lab) will proceed to operating room video assessment.

Simulator training

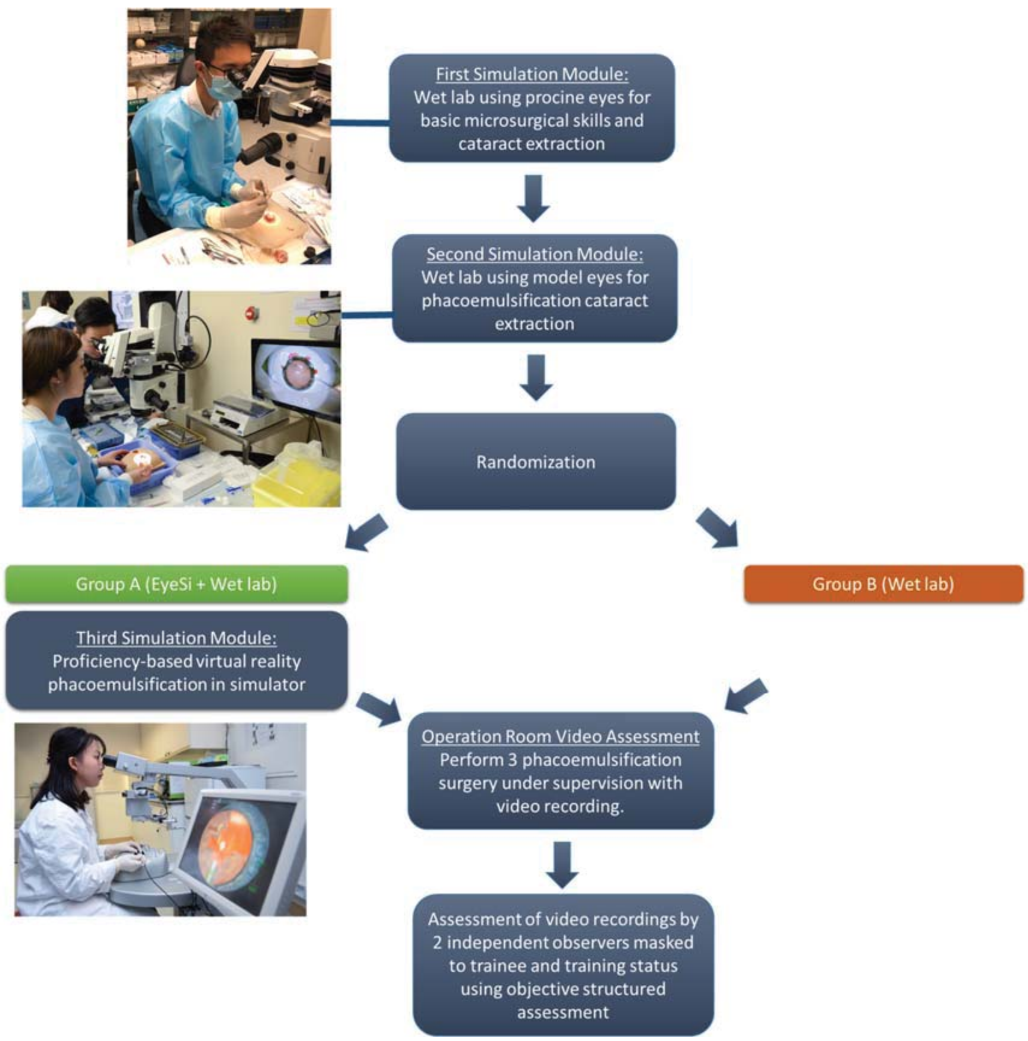
Trainees in Group A will be given a introduction tutorial to the simulator. The cataract interface on the Eyesi simulator, version 3.0, will be used for the study. A previously validated, structured training module will be used. [23] In brief, the participants in the intervention group will complete all 7 specified training modules on Eyesi (**Figure 2**), until they achieved a predefined pass/fail score of 600 points (of a maximum of 700 points) in 2 consecutive sessions.

Modules no.	Task Names	Task Descriptions	Test Level	Points	Illustrations
1	Intracapsular navigation	Aiming at objects within the capsule with the tip of instrument	2	0-100	
2	Antitremor training	Following a circular path on the capsule with the tip of instrument	4	0-100	
3	Intracapsular antitremor training	Following a circular path within the capsule with the tip of instrument	2	0-100	
4	Forceps training	Collecting objects in the anterior chamber with the forceps	4	0-100	
5	Bimanual training	Aiming at objects simultaneously with 2 instruments	5	0-100	
6	Capsulorrhexis	Performing a continuous curvilinear capsulorrhexis	1	0-100	
7	Divide and conquer or phacochop	Performing phacoemulsification on a medium-hard lens	5	0-100	
		Total score in two consecutive sessions		>600	

Surgical assessment procedure

Patients with cataract will be identified and recruited by investigators in eye clinic at Pamela Youde Nethersole Eastern Hospital, Tung Wah Eastern Hospital, Hong Kong Eye Hospital, Tseung Kwan O Hospital, United Christian Hospital and Alice Ho Miu Ling Nethersole Hospital. The first 3 consecutive phacoemulsification surgeries performed by trainees in actual patients supervised by qualified trainers will be video recorded and assessed. Trainees are only allowed to operate on uncomplicated cataract cases, defined as follows: (1) being performed under local anesthesia, (2) preoperative best-corrected visual acuity >1/60 (measured using a standard Snellen chart at 6 meters' distance) and (3) Lens Opacities Classification System III (LOC III) gradings of nuclear color (NC) < 4, nuclear opalescence (NO) < 4, Cortical (C) < 4 and Posterior Subcapsular (P) < 4. A research assistant masked to the participant's intervention group will visit the hospital where the participant performs the operation to ensure that the cataract cases comply with the predefined criteria. Age and visual acuity of the patients, the surgical steps that had been performed by trainees or supervisors, phacoemulsification time and energy, and total operation time will be recorded (**Appendix 1 data collection form template**). The study design flow chart is illustrated in **Figure 3**.

Group B will also receive the same simulator training after the study surgical assessments have been completed to ensure fairness to all participants during their training curriculum.



(iv) <u>Data processing and analysis</u>

Allocation concealment, data anonymization and masking

The statistician with the role of randomization coordinator does not take part in the preoperative training nor the clinical trial and will not access any data until all videos were collected and assessed. By having an independent randomization coordinator, the trainees group allocations will be concealed from all the other investigators. Furthermore, all of the investigators will not participate in supervising the third module (Eyesi simulator). Eyesi simulator training will be coordinated by the simulator technician via secured online booking system (**Appendix 2, Eyesi instruction manual**). The surgeries are video-recorded and thereafter anonymized regarding the identity of both the patient and the surgeon. The recordings before and after performance of the actual procedure in addition to logos, person identifiable data, and sound will be cropped. The videos will be reviewed by 2 masked cataract surgeons (1 consultant cataract surgery trainer from the HA and 1 experienced cataract surgery trainers from overseas) in a random order through a secured web-based platform. The outcome assessors are also masked to the identity of the surgeons until all data collected and saved in a database.

Outcome measures

Primary outcome

Technical performance will be measured by the ICO-OSCAR rating scale (**Appendix 3**). The rating scale consists of task-specific items and global indices, which are rated from 0 point ("inadequately performed") to 5 points ("well performed"). Draping (item 1) and global indices will not be included in the final assessment score because all of the trainees have not been independent surgeons. The 2 masked expert graders will evaluate all videos independently. Before the initiation of the study, raters will be trained to ensure a standardized assessment and to avoid rater errors. Specifically, for the surgical steps remarked as performed by the supervisor, they will be adjusted to the lowest score ("inadequately performed") post hoc by the statistician.

Secondary outcomes

1. Total operation time
2. Phacoemulsification time
3. Phacoemulsification power
4. Number of run-away capsulorrhexis
5. Number of posterior capsule rupture
6. Number of vitreous loss requiring anterior vitrectomy

Reliability

A generalizability (reliability) coefficient will be calculated as a measure of the accuracy of the graders, and a value greater than 0.8 will be considered an acceptable level. The dependency of graders and procedure quantity will be analyzed on the generalizability coefficient.

Sample size calculation

The power calculation is based on a previous validated study on the procedure specific scale of the objective structured assessment of Eyesi phacoemulsification simulation training. [24] This study showed a mean difference in ICO-OSCAR scores of 32% in novice surgeons and 38% in intermediate surgeons before and after Eyesi simulator training intervention. On the basis of these findings, we determined that with an α of 0.05 (two sided) and a power of 80% (β=0.2 giving $Z\alpha$=1.96 and $Z\beta$=0.84, largest SD=4.40), the study would require 15 or more trainees. To compensate for possible drop outs, we plan to recruit 20 trainees. Each trainee would perform the surgery to 3 patients. Therefore, 60 patients will be recruited.

Statistical analysis

Pearson's Chi square test will be used to compare differences between categorical variables. Fisher's exact test is used when any of the expected cell count was less than 5. For non-parametric data, differences between means will be assessed by the Mann-Whitney U test. A discriminative ability on a 5% level ($P < 0.05$) is considered statistically significant. Analysis will be performed using SPSS 13.0 for Windows.

Purpose and Potential

The troubling paradox of traditional apprenticeship-based surgical training is that today's patients can be harmed in the training of tomorrow's surgeons. Commercial airline pilots have long been trained by virtual reality simulation to maintain top standards in aviation safety. The United States National Institute of Health's Agency for Healthcare Research and Quality has been providing funding opportunities since 2006 (https://grants.nih.gov/grants/guide/pa-files/PA-16-420.html) to projects which could propel the effective use of simulation approaches to improve patients' safety and outcomes in various healthcare disciplines. With the advent of computer generated 3-dimensional simulation platforms, there is accumulating evidence on the validity and efficacy of the Eyesi phacoemulsification training modules in improving eye surgeon trainee's surgical skills. However, the impact of the validated Eyesi training curriculum has not been well-proven in clinical trials. Our proposed RCT will provide level 1 evidence on the efficacy of Eyesi simulator training in the operating theatre and explore any neglected aspect of surgical training that needs to be developed in the future. The results of this study will become a reference for ophthalmic surgical training centers and professional institutes with statutory power to regulate specialists training credentials in all parts of the world when considering the implementation of novel virtual reality-based simulation phacoemulsification training.

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Appendix 1. Data collection form template

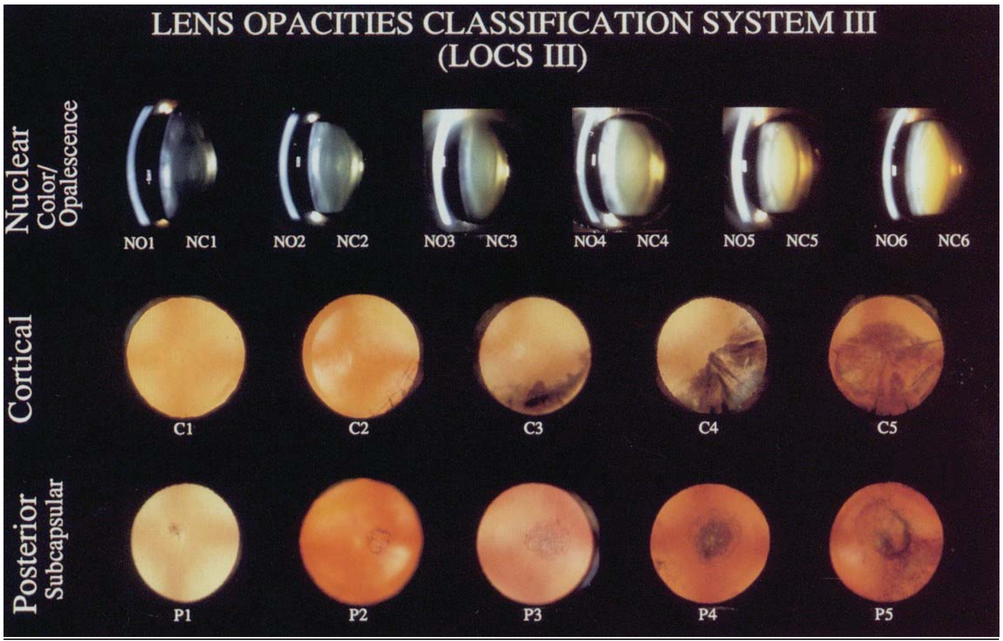
The Effect of Virtual Reality Phacoemulsification Cataract Extraction Simulation Surgery Training on Patient Safety and Outcomes: A Randomised Controlled Trial (VRPhaco Sim Study)

Trainee's information
ID: ________________ Age: ____ Gender: M / F Entry date to Oph Residency: _______ Medical school graduation date: ______ Hospital: _____________________ Dominant hand: Right / Left

On-site cataract surgery data Surgery Date: _________________

Patient Information			
Patient ID			
Gender	M / F	M / F	M / F
Age			
Eye	OD / OS	OD / OS	OD / OS
Cataract grading with LOCS III	NO ____ NC ____ C ____ P ____	NO ____ NC ____ C ____ P ____	NO ____ NC ____ C ____ P ____
Pre-op BCVA			
ICO – Ophthalmology Surgical Competency Assessment Rubric-Phacoemulsification (ICO-OSCAR:phaco): **Task-specific items performed by the trainee?**			
1) Incision & Paracentesis	Yes / No	Yes / No	Yes / No
2) Viscoelastic	Yes / No	Yes / No	Yes / No
3) Capsulorrhexis: Commencement of Flap & follow-through	Yes / No	Yes / No	Yes / No
4) Capsulorrhexis: Formation and Circular Completion	Yes / No	Yes / No	Yes / No
5) Hydrodissection	Yes / No	Yes / No	Yes / No
6) Phacoemulsification Probe and Second Instrument: Insertion Into Eye	Yes / No	Yes / No	Yes / No
7) Phacoemulsification Probe and Second Instrument: Effective Use and Stability	Yes / No	Yes / No	Yes / No
8) Nucleus: Sculpting or Primary Chop	Yes / No	Yes / No	Yes / No
9) Nucleus: Rotation and Manipulation	Yes / No	Yes / No	Yes / No
10) Nucleus: Cracking or Chopping with Safe Phacoemulsification of Segments	Yes / No	Yes / No	Yes / No
11) Irrigation and Aspiration Technique	Yes / No	Yes / No	Yes / No
12) Lens Insertion, Rotation, and Final Position of IOL	Yes / No	Yes / No	Yes / No
13) Wound Closure	Yes / No	Yes / No	Yes / No
Other surgery information			
Phacoemulsification Power			
Phacoemulsification Time			

Total Operation Time	___’ ___” (min) (sec)	___’ ___” (min) (sec)	___’ ___” (min) (sec)
Complications			
Run-away Capsulorrhexis	Yes / No	Yes / No	Yes / No
Posterior Capsule Rupture	Yes / No	Yes / No	Yes / No
Vitreous Loss requiring Anterior Vitrectomy	Yes / No	Yes / No	Yes / No



Source: Chylack LT et al, Arch Ophthalmol. 1993 Jun;111(6):831-6.

Appendix 2: Eyesi Instruction Manual

Table of Content

CUHK Eyesi® Manual Updated on: 20180608

1. Introduction to the Eyesi® simulator

The Eyesi® Simulator

Eyesi® Surgical (VRmagic Holding AG, Mannheim, Germany) is a virtual reality simulator for intraocular surgery training (Figure 1.1). It consists of two basic elements: the graphic user interface (touch screen) and the virtual surgical environment (visual field through the microscope). The graphic user interface serves as the control unit and enables users to log in, start training tasks, and configure instruments. The virtual surgical environment contains a computer-graphic presentation of the eye, which appears once the user has started a task. Currently, there are two versions of Eyesi® simulator available at our center: V2.8.13 and V3.2.16.

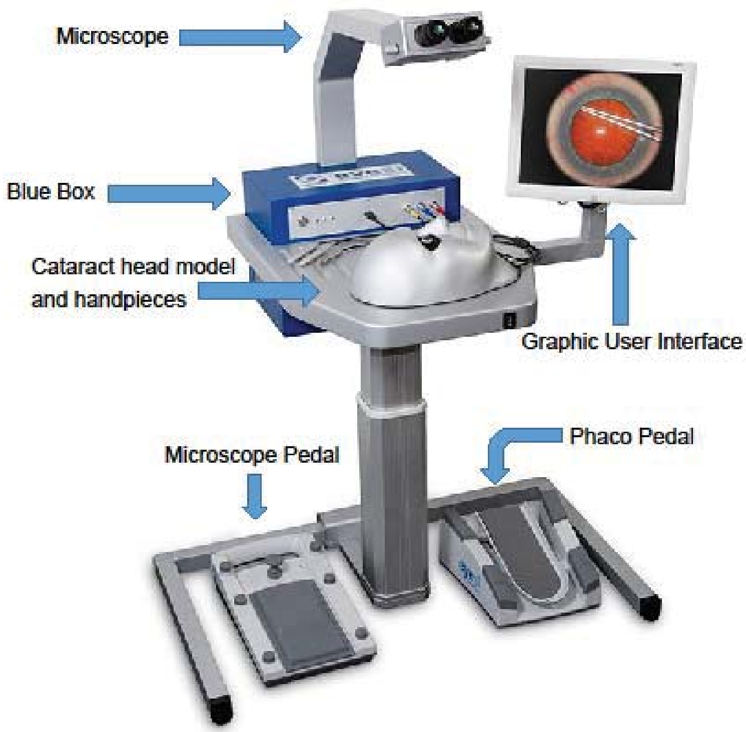


Figure 1.1 Eyesi® simulator (V3.2.16)

1

Safety Information

- Do not use sharp objects, such as a pen, to touch the screen. Use only your fingers. Do not press hard on the screen.
- Do not apply excessive force when operating.
- Head model
    - Do not reach inside the head model, and avoid penetration of any objects or fluids.
    - Only insert Eyesi® instruments through the pre-made holes in the silicone pads surrounding the eye.
    - Never leave the instruments hanging in the holes without support. Pull instruments out completely when not in use.
    - Do not drop the head model.
- Handpieces
    - Do not bend handpiece tips.
    - Do not drop handpieces.
    - Do not bend cables.

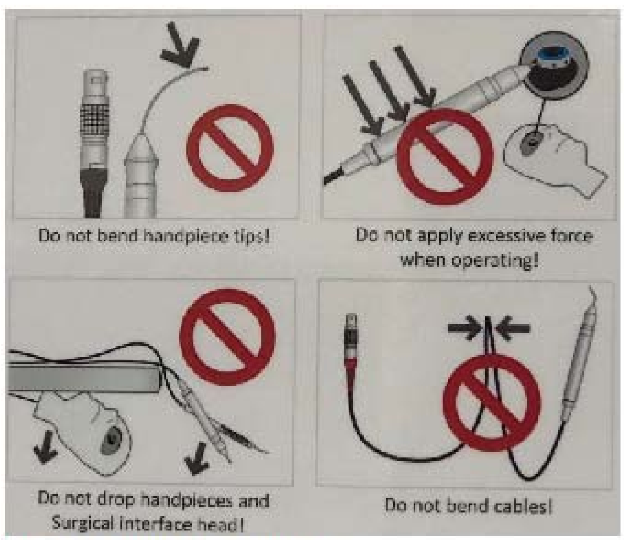


Figure 1.2 Important information on handling

2

Power On and Log In

-

- Take out the handpieces and head model from the storage case (Figure 1.3a-c (V2.8.13), Figure 1.3d-f (V3.2.16)).

Figure 1.3a Storage case (V2.8.13)

Figure 1.3b Cataract head model (V2.8.13)

Figure 1.3c Handpieces (V2.8.13)

Figure 1.3d Storage case (V3.2.16)

Figure 1.3e Cataract head model (V3.2.16)

Figure 1.3f Handpieces (V3.2.16)

- Plug the cataract head model into the USB port on the blue box (Figure 1.4) (there is also a vitreoretinal head (Figure 1.5)).


Figure 1.4 Plugging in the cataract head model


Figure 1.5 Vitreoretinal head

- Plug the handpieces into the ports according to their colours and **red spot to red spot** (Figure 1.6).

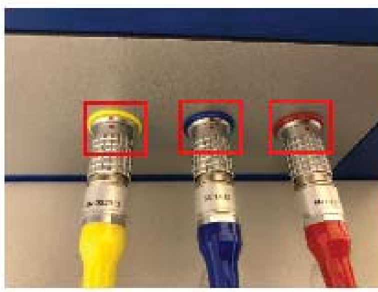


Figure 1.6 Connecting the handpieces


Figure 1.7 Power button and lights

- To turn on the Eyesi®, hit the power button on the blue box (Figure 1.7). The red light will turn on first, then the yellow light, and finally the steady green light.
- Now turn on the touch screen monitor. There are five round buttons on the side of the monitor. Hit the lowest button to turn on the screen (Figure 1.8). For Eyesi® V3.2.16, there are five buttons at the bottom of the monitor. Hit the rightmost button to turn on the screen.
- The log-in screen will now appear (Figure 1.9).

Figure 1.8 Monitor buttons

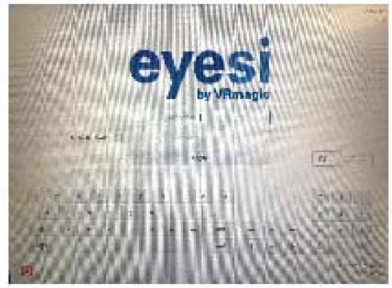


Figure 1.9 Log-in screen

2. Operating the Microscope

- Upon starting each task, you will have to zoom and focus the microscope on the virtual eye. Make sure the microscope is properly adjusted before you begin any task.
- To adjust the pupillary distance, turn the knobs adjacent to the eyepieces of the microscope (Figure 2.1).
- To adjust the height of the microscope, use the "up/down" button on the platform (Figure 2.2).

Figure 2.1 Knobs for adjusting the pupillary distance

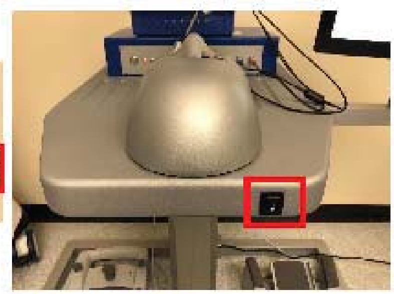


Figure 2.2 "up/down" button

- At the start of each task, select the "microscope" tab.

Figure 2.3a Foot pedal (Eyesi V2.8.13)

Figure 2.3b Foot pedal (Eyesi V3.2.16)

- To zoom in or out, use your left foot to touch the "Zoom ↑" or "Zoom ↓" buttons on the floor. Always zoom first, then focus.
- To focus up or down, use your left foot to touch the "Focus ↑" or "Focus ↓" buttons on the floor.
- You can also center the virtual eye in the microscope by using the joystick by manipulating it with your left foot.

3. Training Courses

- You are now ready to start the simulations.
- For each task listed, you will have the following information:

  - Goal: the objective/desired endpoint of the task
  - Screenshots: images of the task at hand
  - Instruments: instruments you will need to perform each task. There are three different colored ports on the Eyesi®: yellow, blue and red. Each port becomes a specific instrument depending on the task and module. When viewed through the microscope, the ports will function

as instruments, such as forceps, pointers, etc.

- Instructions: descriptions of how to perform the task
- Tips: advice that may help you in performing the task

4. Getting Started

Booking

- Please visit the website below for booking the Eyesi® Surgical Simulator system before using it: https://www.skedda.com/account/login?returnUrl=https%3A%2F%2FWetlabDOVS.skedda.com%2Fbooking

- If you have not been assigned a user account yet, please contact Ms. Kerensa Liu (Email: kerensaliu@cuhk.edu.hk; Tel: 3943 5815) or Ms. Asa Chong (Email: asachong@cuhk.edu.hk; Tel: 3943 5850)

- A training course will be arranged for every beginner before getting your account.

Logging In

- Turn on Eyesi® and at the log-in screen (Figure 4.1), enter:

  - User Name: usually your first name + your last name.
  - For example, the User Name of Dr. Chan Tai Man is "taimanchan".
  - Password: same as your User Name; you will receive a prompt to change the password once you have successfully logged in.

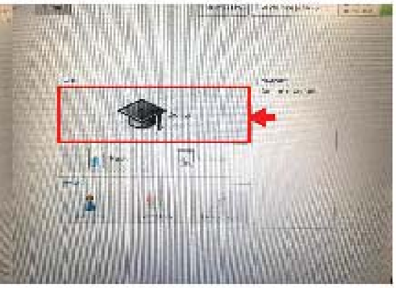
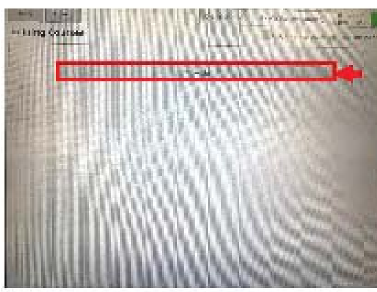


Figure 4.1 Log-in screen

Figure 4.2 Main screen

- If you are shown a "Login Failed!" message, try again more slowly with the tip of your finger.
- If you are logging in for the first time, enter your First Name, Last Name, Email address and handedness
- You will be brought to the main screen (Figure 4.2). Select "Courses".
- Select "5 modules" under "Training Courses" (Figure 4.3).



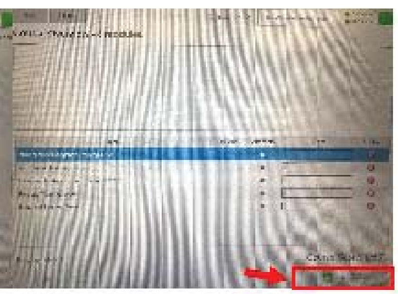


Figure 4.3 Course selection

Figure 4.4 Course Overview

- You will see the "Course Overview" page with the list of tasks you will perform during training. To open any task, touch the task to highlight it and press "Select Task" at the lower right-hand corner of the screen (Figure 4.4).
- You will then see the task description page, where you can select different tabs to view "Instructions" and "Presentations." (Some tasks have slide presentations and animations that you can view.) Once you have read through the various tabs, select "Start Simulation" to begin the task.

8

5. Eyesi® Modules

Our Eyesi® virtual reality simulation training consists of 5 modules. The modules are listed in the table below (Table 6.1). Thomsen et al. discovered that the performance of ophthalmic trainees (no cataract surgery experience) and experienced cataract surgeons (>4000 cataract procedures) in 7 modules differed significantly. In this course, 5 of these 7 modules, with lower level, are selected to train your intraocular micro-forceps handling and bimanual techniques. Each of the tasks scores 100 points.

Modules	Level
1. Intracapsular Navigation Training	1
2. Anti-Tremor Training	3
3. Intracapsular Anti-Tremor Training	1
4. Forceps Training	1
5. Bimanual Training	3

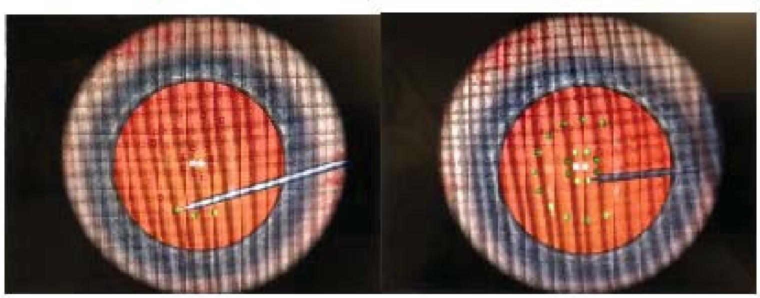
Table 5.1: Tasks adopted in our training course

1) Intracapsular Navigation Training – Level 1

Training goals:

- Train your manual dexterity.
- Improve your hand-eye coordination.
- Understand the dimensions of the capsule.

Screenshots:



9

Instructions:

Several spheres are arranged in an empty capsule.

Insert the tip of the pointer instrument into a sphere. Hold the tip of the instrument steady until the sphere turns green. You have completed the task when all the spheres are green. Be careful not to injure the zonular fibers and the capsule. If necessary, use the J-shaped pointer for better access; this must be inserted horizontally. Do not try to reach a sphere through the capsule tissue, as this injures the capsule and has no effect on the sphere.

Scoring criteria:

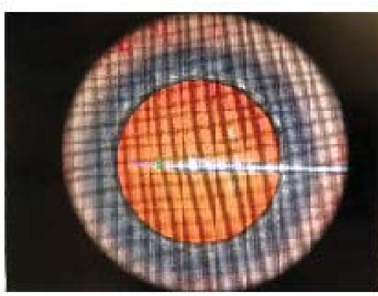
- The time taken to carry out the tasks.
- Target achievement.
- Injuries to the iris and capsule.
- Accuracy of instrument movements.
- Efficiency of instrument movements (odometer).

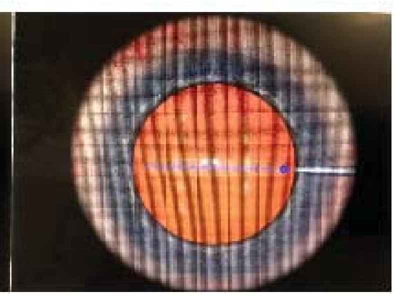
2) Anti-Tremor Training – Level 3

Training goals:

- Train your manual dexterity.
- Learn how to perform accurate instrument movements.
- Reduce tremor.

Screenshots:





10

Instructions:

A line is shown in the anterior chamber. The starting point of the line is marked by a sphere.

Insert the tip of the instrument into the sphere. The sphere will turn green. Keeping the instrument tip inside the sphere, guide the sphere along the line to the end point. Stay as close to the line as you can. When you have completed the task, the sphere will change color and the path taken by your instrument tip is shown. Red shows where the instrument tip was too far from the line, green shows where it was on target.

Scoring criteria:

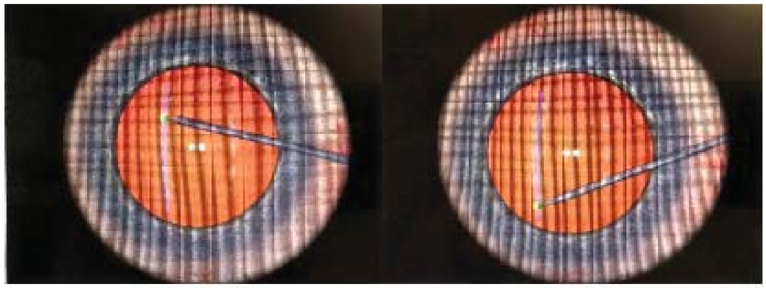
- The time taken to carry out the tasks.
- Tremor.
- The average distance of the instrument tip from the sphere.
- Injures to the cornea or capsule.
- The accuracy of your movements.

3) Intracapsular Anti-Tremor Training – Level 1

Training goals:

- Train your manual dexterity.
- Learn how to perform accurate instrument movements.
- Get a feeling for the dimensions of the capsule.

Screenshots:



Instructions:

A line is shown in the empty capsule. The starting point is marked by a sphere.

Insert the tip of the instrument into the sphere. The sphere will turn green. Keeping the instrument tip inside the sphere, guide the sphere along the line to the end point. Stay as close to the line as you can. When you have completed the task, the sphere will change color and the path taken by your instrument tip is shown. Red shows where the instrument tip was too far from the line, green shows where it was on target.

Scoring criteria:

- The time taken to carry out the tasks.
- Tremor.
- The average distance of the instrument tip from the sphere.
- Injuries to the cornea or capsule.
- The accuracy of your movements.

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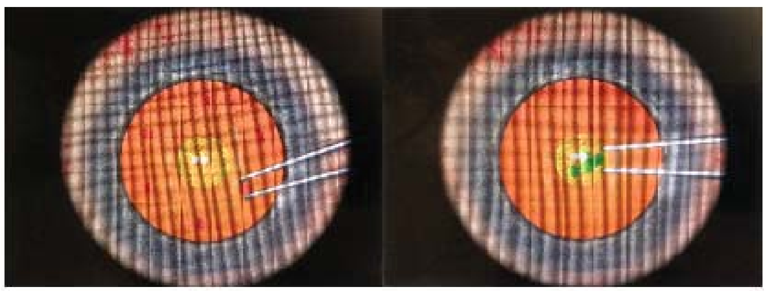
4) Forceps Training – Level 1

Training goals:

- Understand the dimensions of the anterior chamber.
- Get used to handling the forceps.
- Minimize tissue stress.

Screenshots:



Instructions:

Several spheres are arranged in the anterior chamber.

Insert the forceps closed and horizontally oriented. Grasp each shape using the forceps and move it into the green wire sphere in the center. You have completed the task when all the objects are in the sphere. Be aware of the position of the forceps shaft and tip relative to the sys structures.

Scoring criteria:

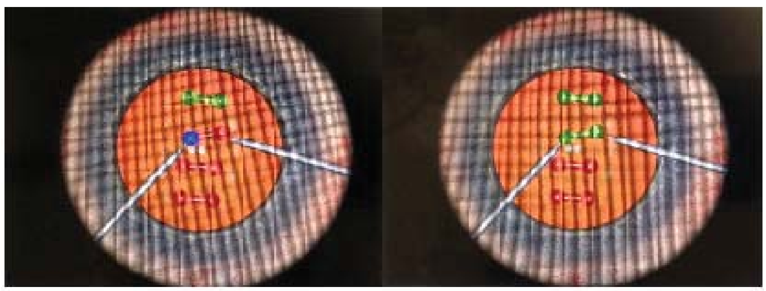
- The time taken to carry out the tasks.
- Injuries to the cornea and lens.
- Incision stress

5) Bimanual Training – Level 3

Training goals:

- Train your bimanual dexterity.
- Reduce unnecessary instrument motion.
- Improve your hand-eye coordination.

Screenshots:



Instructions:

Barbell-shaped objects are arranged in the anterior chamber.

Use the two pointer instruments. Pierce the spherical ends of a barbell-shaped object simultaneously with the instrument tips. Hold both instruments steady in this position until the object turns green. You have completed the task when all the objects are green.

Scoring criteria:

- The time taken to carry out the tasks.
- Injuries to the cornea and lens.
- Efficient use of instrument.

6. Shutting down the simulator

- After using the Eyesi® simulator, hit the power button on the blue box (Figure 6.1a). For Eyesi V3.2.16, you can also press the red power button on the log-in screen and select "Shut down" to switch it off (Figure 6.1b).

Figure 6.1a Power button

Figure 6.1b Power button on log-in screen

- Pull the cable heads out to disconnect the handpieces and head model from the blue box and place them back into the storage case. Do not turn the cable head while pulling.
- Lock the storage case (Figure 6.2a-b).

Figure 6.2a Lock the storage case (Eyesi V2.8.13)

Figure 6.2b Lock the storage case (Eyesi V3.2.16)

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- Fill in the logbook (Figure 6.3).

Figure 6.3 Logbook

7. References

1. Paul, Samantha K., Paul, Alfred A., and Greenberg, Paul B., "The virtual cataract surgery course manual for ophthalmology residents 2017 edition" (2017). Research at Brown, Broader Impacts and STEM Open Educational Resources. Brown Digital Repository. Brown University Library. https://doi.org/10.7301/Z07D2SB4

2. Thomsen ASS, Kiilgaard JF, Kjaerbo H, et al. Simulation-based certification for cataract surgery. *Acta Ophthalmol*. 2015;93(5):416-421.

Appendix 3: ICO OSCAR Phaco

INTERNATIONAL COUNCIL of OPHTHALMOLOGY

International Council of Ophthalmology's Ophthalmology Surgical Competency Assessment Rubric (ICO-OSCAR)

The International Council of Ophthalmology's "Ophthalmology Surgical Competency Assessment Rubrics" (ICO-OSCARs) are designed to facilitate assessment and teaching of surgical skill. Surgical procedures are broken down to individual steps and each step is graded on a scale of novice, beginner, advanced beginner and competent. A description of the performance necessary to achieve each grade in each step is given. The assessor simply circles the observed performance description at each step of the procedure. The ICO-OSCAR should be completed at the end of the case and immediately discussed with the student to provide timely, structured, specific performance feedback. These tools were developed by panels of international experts and are valid assessments of surgical skill.

ICO-OSCAR Instructor Directions

1. Observe resident phacoemulsification surgery.
2. Ideally, immediately after the case, circle each rubric description box that you observed. Some people like to let the resident circle the box on their own first. If the case is videotaped, it can be reviewed and scored later but this delays more effective prompt feedback.
3. Record any relevant comments not covered by the rubric.
4. Review the results with the resident.
5. Develop a plan for improvement (e.g. wet lab practice/tips for immediate next case).

<u>Suggestions</u>:

- If previous cases have been done, review ICO-OSCAR data to note areas needing improvement.
- If different instructors will be grading the same residents, it would be good that before starting using the tool they grade together several surgeries from recordings, so they make sure they are all grading in the same way.

ICO-Ophthalmology Surgical Competency Assessment Rubric: Phacoemulsification (ICO-OSCAR: Phaco)						
Date ______ Resident _______ Evaluator _______		Novice (score = 2)	Beginner (score = 3)	Advanced Beginner (score = 4)	Competent (score = 5)	Not applicable. Done by preceptor (score= 0)
1	Draping:	Unable to start draping without help.	Drapes with minimal verbal instruction. Incomplete lash coverage.	Lashes mostly covered, drape at most minimally obstructing view.	Lashes completely covered and clear of incision site, drape not obstructing view.	
2	Incision & Paracentesis: Formation & Technique	Inappropriate incision architecture, location, and size.	Leakage and/or iris prolapse with local pressure, provides poor surgical access to and visibility of capsule and bag.	Incision either well-placed or non-leaking but not both.	Incision parallel to iris, self sealing, adequate size, provides good access for surgical maneuvering.	
3	Viscoelastic: Appropriate Use and Safe Insertion	Unsure of when, what type and how much viscoelastic to use. Has difficulty accessing anterior chamber through paracentesis.	Requires minimal instruction. Knows when to use but administers incorrect amount or type.	Requires no instruction. Uses at appropriate time. Administers adequate amount and type. Cannula tip in good position. Unsure of correct viscoelastic if multiple types available.	Viscoelastics are administered in appropriate amount and at the appropriate time with cannula tip clear of lens capsule and endothelium. Appropriate viscoelastic is used if multiple types of viscoelastics are available.	
4	Capsulorrhexis: Commencement of Flap & follow-through.	Instruction required, tentative, chases rather than controls rhexis, cortex disruption may occur.	Minimal instruction, predominantly in control with occasional loss of control of rhexis, cortex disruption may occur.	In control, few awkward or repositioning movements, no cortex disruption.	Delicate approach and confident control of the rhexis, no cortex disruption.	
5	Capsulorrhexis: Formation and Circular Completion	Size and position are inadequate for nucleus density & type of implant, tear may occur.	Size and position are barely adequate for nucleus density and implant type, difficulty achieving circular rhexis, tear may occur.	Size and position are almost exact for nucleus density and implant type, shows control, requires only minimal instruction.	Adequate size and position for nucleus density & type of implant, no tears, rapid, unaided control of radialization, maintains control of the flap and AC depth throughout the capsulorrhexis.	
6	Hydrodissection: Visible Fluid Wave and Free Nuclear Rotation	Hydrodissection fluid not injected in quantity nor place to achieve nucleus rotation.	Multiple attempts required, able to rotate nucleus somewhat but not completely. Tries to manually force rotation before adequate hydrodissection.	Fluid injected in appropriate location, able to rotate nucleus but encounters more than minimal resistance.	Ideally see free fluid wave but adequate if free nuclear rotation with minimal resistance is achieved. Aware of contraindications to hydrodissection.	

7	Phacoemulsification Probe and Second Instrument: Insertion Into Eye	Has great difficulty inserting the probe or second instrument, AC collapses, may damage wound, capsule or Descemet's membrane	Inserts the probe or second instrument after some failed attempts, may damage wound, capsule or Descemet's membrane.	Inserts probe and second instrument on first attempt with mild difficulty, no damage to wound, capsule or Descemet's membrane.	Smoothly inserts instruments into the eye without damaging the wound or Descemet's membrane.	
8	Phacoemulsification Probe and Second Instrument: Effective Use and Stability	Tip frequently not visible, has much difficulty keeping the eye in primary position and uses excessive force to do so.	Tip often not visible, often requires manipulation to keep eye in primary position.	Maintains visibility of tip at most times, eye is generally kept in primary position with mild depression or pulling on the globe.	Maintains visibility of instrument tips at all times, keeps the eye in primary position without depressing or pulling up the globe.	
9	Nucleus: Sculpting or Primary Chop	Frequently incorrect power used during sculpting, applies power at inappropriate times, excessive phaco probe movement causes constant eye/nucleus movement, unable to engage nucleus (chop method) or the groove is of inadequate depth or width (divide and conquer), cannot control Phacodynamics. Unable to correctly work foot pedals.	Moderate error in power used while sculpting, tentative, frequent eye/nucleus movement produced by phaco tip, difficult to engage nucleus (chop technique) or groove adequately after many attempts (divide and conquer), poor control of phacodynamics with frequent anterior chamber depth fluctuations. Has difficulty working foot pedals.	Uses correct power with minimal error when sculpting, occasional eye/nucleus movement caused by phaco tip, some difficulty in engaging or holding nucleus (chop method) or groove adequate with minimal repeat attempts, fairly good control of phacodynamics with occasional anterior chamber depth change. Minimal mistakes using foot pedals.	Sculpting is performed using adequate ultrasound power regulated by the pedal, with forward movements that do not change the eye position or push the nucleus, the nucleus is safely engaged (with chop method) or the groove is appropriate in depth and width (divide and conquer technique), phacodynamics are controlled as evidenced by the internal anterior chamber environment. Adept at foot pedal control.	
10	Nucleus: Rotation and Manipulation	Unable to rotate nucleus.	Able to rotate nucleus partially and with zonular stress.	Able to rotate nucleus fully but with zonular stress.	Nucleus is safely and efficiently manipulated producing minimal stress on zonules and globe.	

11	Nucleus: Cracking or Chopping With Safe Phacoemulsification of Segments	**CRACKING**: Grooves are not centered or deep enough and go into epinucleus, nucleus is constantly displaced from central position, unable to crack nucleus at all, eye constantly moving. **CHOPPING:** Always endangers or engages adjacent tissue, unable to accomplish chop of any piece. **SEGMENT PHACOEMULSIFICATION**: produces significant wound burn, great difficulty pursuing fragments around the anterior chamber and into the bag, poor awareness of second instrument tip and difficulty keeping the second hand instrument under the phaco tip,	**CRACKING**: Some grooves are centered and deep enough and some go into epinucleus, displaces nucleus in most grooves, attempts to split nucleus with instruments too shallow in groove, able to crack portion of nucleus, eye often moving. **CHOPPING:** endangers or engages adjacent tissue in most chops**,** able to accomplish chop of some pieces. **SEGMENT PHACOEMULSIFICATION**: produces light wound burn, pursues most fragments around the AC and into the bag, the second hand instrument is sometimes under the phaco tip	**CRACKING**: Most grooves are centered and deep enough, rarely goes into epinucleus, rarely displaces nucleus, sometimes attempts to split in mid-nucleus but succeeds, eye usually in primary position. **CHOPPING:** endangers or engages adjacent tissue in some chops**,** able to accomplish chop of most pieces. **SEGMENT PHACOEMULSIFICATION**: produces minimal wound burn, pursues some fragments around the AC and into the bag, the second hand instrument is usually under the phaco tip	**CRACKING**: Grooves are centered, deep enough to ensure cracking, length does not reach epinucleus, nucleus is not displaced from central position, places instruments deep enough to easily and successfully crack nucleus, eye stays in primary position. **CHOPPING:** Nucleus engaged and vertical or horizontal chop technique undertaken with no inadvertent engagement of adjacent tissue (especially capsule). Full thickness nuclear chop of all pieces in a controlled and fluid manner. **SEGMENT PHACOEMULSIFICATION**: No wound burns, Pieces are "floated" to the tip without "pursuing" the fragments around the anterior chamber and the bag, The second hand instrument is kept under the phaco tip to prevent posterior capsule contact if surge arises.	
12	Irrigation and Aspiration Technique With Adequate Removal of Cortex	Great difficulty introducing the aspiration tip under the capsulorrhexis border, aspiration hole position not controlled, cannot regulate aspiration flow as needed, cannot peel cortical material adequately, engages capsule or iris with aspiration port.	Moderate difficulty introducing aspiration tip under capsulorrhexis and maintaining hole up position, attempts to aspirate without occluding tip, shows poor comprehension of aspiration dynamics, cortical peeling is not well controlled, jerky and slow, capsule potentially compromised. prolonged attempts result in minimal residual cortical material.	Minimal difficulty introducing the aspiration tip under the capsulorrhexis, aspiration hole usually up, cortex will engaged for 360 degrees, cortical peeling slow, few technical errors, minimal residual cortical material.	Aspiration tip is introduced under the free border of the capsulorrhexis in irrigation mode with the aspiration hole up, Aspiration is activated in just enough flow as to occlude the tip, efficiently removes all cortex, The cortical material is peeled gently towards the center of the pupil, tangentially in cases of zonular weakness.	

13	Lens Insertion, Rotation, and Final Position of Intraocular Lens	Unable to insert IOL, unable to produce adequate incision for implant type **NON-FOLDABLE:** unable to place the lower haptic in the capsular bag, unable to rotate the upper haptic into place **FOLDABLE:** unable to load IOL into injector or forcep, no control of lens injection, doesn't control tip placement, lens is not in the capsular bag or is injected upside down.	Insertion and manipulation of IOL is difficult, eye handled roughly, anterior chamber not stable, repeated attempts result in borderline incision for implant type **NON-FOLDABLE:** repeated hesitant attempts result in lower haptic in the capsular bag, upper haptic is rotated into place but with excessive force on capsulorrhexis and zonules and repeated attempts are necessary **FOLDABLE:** difficulty loading IOL into injector or forcep,, hesitant, poor control of lens injection, difficulty controlling tip placement, excessive manipulation required to get both haptics into capsular bag.	Insertion and manipulation of IOL is accomplished with minimal anterior chamber instability, incision just adequate for implant type **NON-FOLDABLE:** the lower haptic is placed inside the capsular bag with some difficulty, upper haptic is rotated into place with some stress on the capsulorrhexis and zonule fibers **FOLDABLE:** , minimal difficulty loading IOL into injector of forcep, hesitant but good control of lens injection, minimal difficulty controlling tip placement, both haptics are in the capsular bag.	Insertion and manipulation of IOL is performed in a deep and stable anterior chamber and capsular bag, with incision appropriate for implant type. **NON-FOLDABLE**: The lower haptic is smoothly placed inside the capsular bag; the upper haptic is rotated into place without exerting excessive stress to the capsulorrhexis or the zonule fibers. **FOLDABLE**: Able to load IOL into injector or forcep, lens is injected in a controlled fashion, fixation of IOL is symmetric; the optic and both haptics are inside the capsular bag.	
14	Wound Closure (Including Suturing, Hydration, and Checking Security as Required)	If suturing is needed, instruction is required and stitches are placed in an awkward, slow fashion with much difficulty, astigmatism, bent needles, incomplete suture rotation and wound leakage may result, unable to remove viscoelastics thoroughly. unable to make incision water tight or does not check wound for seal. Improper final IOP.	If suturing is needed, stitches are placed with some difficulty, resuturing may be needed, questionable wound closure with probable astigmatism, instruction may be needed, questionable whether all viscoelastics are thoroughly removed, Extra maneuvers are required to make the incision water tight at the end of the surgery. May have improper IOP.	If suturing is needed, stitches are placed with minimal difficulty tight enough to maintain the wound closed, may have slight astigmatism, viscoelastics are adequately removed after this step with some difficulty, The incision is checked and is water tight or needs minimal adjustment at the end of the surgery. May have improper IOP.	If suturing is needed, stitches are placed tight enough to maintain the wound closed, but not too tight as to induce astigmatism, viscoelastics are thoroughly removed after this step, the incision is checked and is water tight at the end of the surgery. Proper final IOP.	

	Global Indices					
15	Wound Neutrality and Minimizing Eye Rolling and Corneal Distortion	Nearly constant eye movement and corneal distortion.	Eye often not in primary position, frequent distortion folds.	Eye usually in primary position, mild corneal distortion folds occur.	The eye is kept in primary position during the surgery. No distortion folds are produced. The length and location of incisions prevents distortion of the cornea.	
16	Eye Positioned Centrally Within Microscope View	Constantly requires repositioning.	Occasional repositioning required.	Mild fluctuation in pupil position.	The pupil is kept centered during the surgery.	
17	Conjunctival and Corneal Tissue Handling	Tissue handling is rough and damage occurs.	Tissue handling borderline, minimal damage occurs.	Tissue handling decent but potential for damage exists.	Tissue is not damaged nor at risk by handling.	
18	Intraocular Spatial Awareness	instruments often in contact with capsule, iris and corneal endothelium', blunt second hand instrument not kept in appropriate position.	Occasional accidental contact with capsule, iris and corneal endothelium, sometimes has blunt second hand instrument between the posterior capsule and the activated phaco tip.	Rare accidental contact with capsule, iris and corneal endothelium. Often has blunt second hand instrument between the posterior capsule and the activated phaco tip.	No accidental contact with capsule, iris and corneal endothelium, when appropriate, a blunt, second hand instrument, is always kept between the posterior capsule and the tip of the phaco when the phaco is activated.	
19	Iris Protection	Iris constantly at risk, handled roughly.	Iris occasionally at risk. Needs help in deciding when and how to use hooks, ring or other methods of iris protection.	Iris generally well protected. Slight difficulty with iris hooks, ring, or other methods of iris protection.	Iris is uninjured. Iris hooks, ring, or other methods are used as needed to protect the iris.	
20	Overall Speed and Fluidity of Procedure	Hesitant, frequent starts and stops, not at all fluid.	Occasional starts and stops, inefficient and unnecessary manipulations common, case duration about 60 minutes.	Occasional inefficient and/or unnecessary manipulations occur, case duration about 45 minutes.	Inefficient and/or unnecessary manipulations are avoided, case duration is appropriate for case difficulty. In general, 30 minutes should be adequate.	

Comments:

Golnik KC, Beaver H, Gauba V, Lee AG, Mayorga E, Palis G, Saleh GM. Cataract surgical skill assessment. Ophthalmology. 2011 Feb;118(2):427.e1-5.

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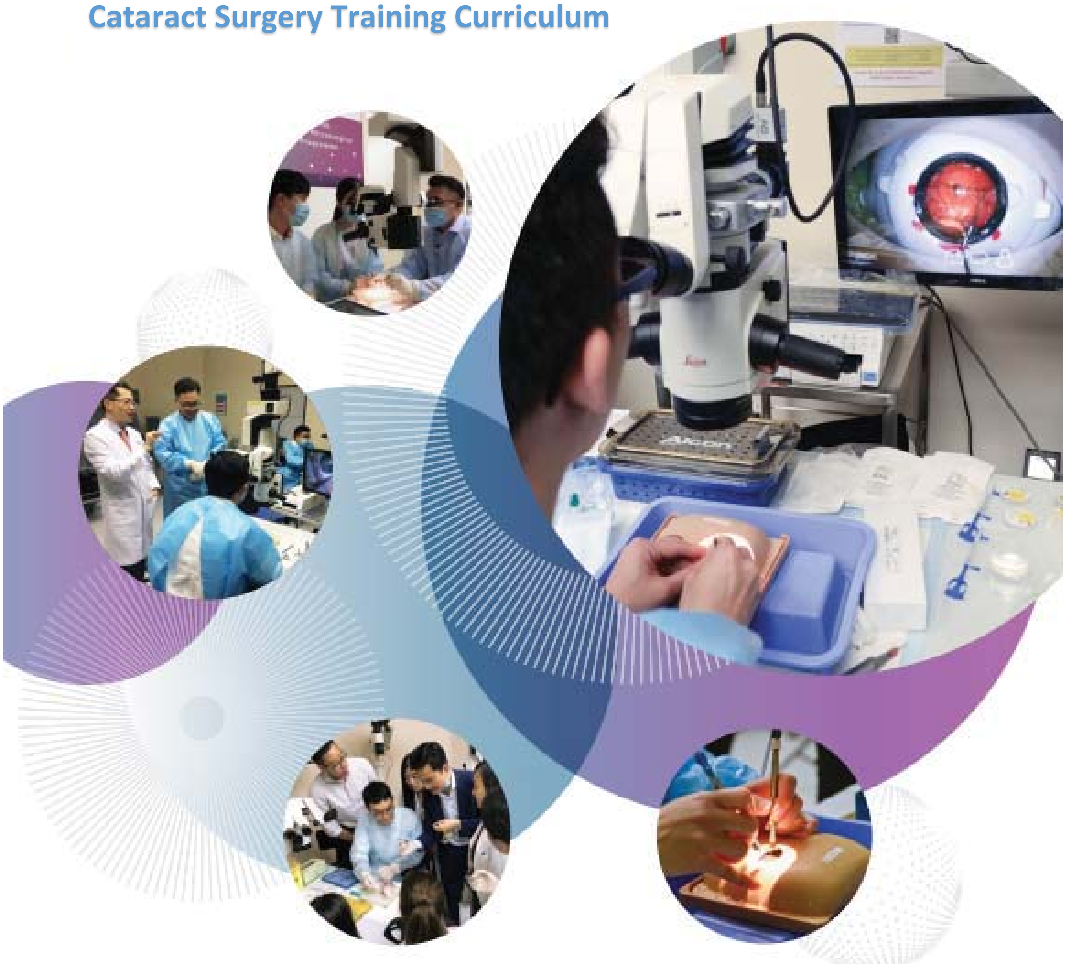
CUHK Jockey Club Ophthalmic Microsurgical Training Programme

香港中文大學賽馬會眼科顯微手術培訓計劃

Cataract Surgery Training Curriculum



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同心同步同進 RIDING HIGH TOGETHER

Organised by:

香港中文大學醫學院
Faculty of Medicine
The Chinese University of Hong Kong

First Module

Course Name:

Basic Ophthalmic Microsurgical Skills Workshop

Course Objectives:

1) Learn accepted names of essential ophthalmic microsurgical instruments
2) Demonstrate ability to drive operating microscope
3) Demonstrate ability to place suture under operating microscope
4) Intraocular micro-forceps handling and bimanual training in virtual reality simulation platform
5) Learn the principles of ruptured globe repair

Course Programme:

Location	**Topic**	**Instructor(s)**
3/F Wet lab, CUHK Eye Centre	Lecture (1) Surgical microscope and basic setup (30mins) Lecture (2) Suture materials (30 mins) Lecture (3) Basic suturing of conjunctiva, sclera and cornea (30 mins) Practical (1) Use of microscope and suturing skills board (1.5hrs)	**Dr. Kendrick Shih** **Dr. Joy Leung** **Dr. Raymond Wong** **Dr. Aziz Kam** **Dr. John Yeung**
3/F OMTC, Hong Kong Eye Hospital	Lecture (4) Surgical instruments, Ophthalmic Viscosurgical Devices Instruments and Intraocular lenses (45 mins) Lecture (5) Principles of ruptured globe repair (45 mins) Practical (2) Ruptured globe repair on pig eyes (1.5hrs)	**Dr. Leonard Yuen** **Dr. Marcus Marcet** **Dr. Alvin Au** **Dr. Aziz Kam**

For enquiries: please contact Ms. Ella Fung (Programme Manager) at (852) 3943 5850 or yukyanfung@cuhk.edu.hk

Course Name:
Extracapsular Cataract Extraction (ECCE) Workshop

Course Objectives:

1) To allow trainees to safely and confidently perform ECCE in a simulated environment.
2) To improve fine motor skills under an operating microscope.
3) To gain proficiency in all steps of ECCE.

Course Programme:

Location	**Topic**	**Instructor(s)**
3/F Wet lab, CUHK Eye Centre	Lecture (1) Extracapsular Cataract Extraction (ECCE) – Introduction to surgical techniques and pearls (30mins) Lecture (2) Extracapsular Cataract Extraction (ECCE) – Management of complications. (30 mins)	**Dr. Keith Chan** **Dr. Lam Nai Man**
3/F OMTC, Hong Kong Eye Hospital	Practical (1) ECCE in pig's eyes (3hrs)	**Dr. Alex Ng** **Dr. Mandy Wong** **Dr. Irene Yeung**

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Second Module

Course Name:
Basic Phacoemulsification Workshop

Course Objectives:

1) Basic knowledge of cataract surgery
2) Performing corneal incision and paracentesis
3) Performing a continuous circular capsulorrhexis
4) Techniques in phacoemulsification
5) Insertion of intraocular lens
6) Technique of wound closure

Course Programme:

Location	Topic	Instructor(s)
3/F OMTC, Hong Kong Eye Hospital	*Lectures* (1) Wound construction and Chop techniques (20 mins) (2) Complications and management (20 mins) (3) Various IOL types (20 mins) (4) Phacodynamics (20 mins)	 **Dr. Lawrence Iu** **Dr. Aziz Kam** **Dr. Tommy Chan** **Dr. Stephen Li**
3/F OMTC, Hong Kong Eye Hospital	*Practical* 1) Phaco practical in model eyes (3hrs)	 **Dr. Tommy Chan** **Dr. Michelle Fan** **Dr. Lawrence Iu** **Dr. Aziz Kam** **Dr. Stephen Li** **Dr. Raymond Wong**

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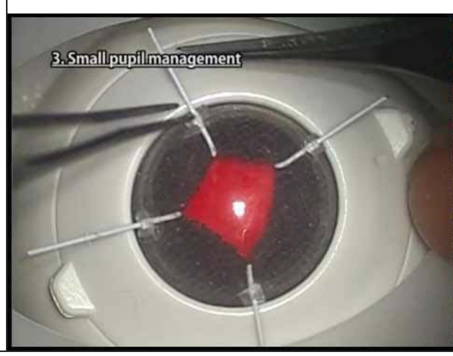
Course Name:
Phacoemulsification Techniques Workshops

Course Objectives:
1) Learn phaco techniques in small pupils and synechiae
2) Management of capsulorrhexis complications
3) Learn the perioperative management for uveitic cataracts
4) Practise the use of pupil dilation devices

Course Programme:

Location	Topic	Instructor(s)
3/F Lecture Theatre, Hong Kong Eye Hospital	*Lecture* (1) Phaco techniques for Residents: How to deal with small pupils, posterior synechiae and capsulorrhexis complications. (1hr)	**Dr. Carmen Chan**
3/F OMTC, Hong Kong Eye Hospital	*Practical* (1) Small pupil phaco practice in model eyes (3hrs) 	**Dr. Carmen Chan** **Dr. Tommy Chan** **Dr. Vanissa Chow** **Dr. Shaheeda Mohamed**

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