

Surgical Simulator Educators' Guide to Courseware 2.1





2 Educational Concepts

2.1 Step-by-Step to Expert Performance

«Optimal learning takes place when a trainee performs a well-defined task **Deliberate Practice** at an appropriate level of difficulty. Informative feedback is essential to improvement, as are opportunities for repetition to correct mistakes and polish a skill before moving to the next task.«¹ The training curriculum of Eyesi courseware offers training at an appropri-The Appropriate ate level of difficulty, leading trainees step-by-step to expert performance. Level of Difficulty Starting with introductory courses on microsurgical skills, the curriculum for both cataract and vitreoretinal surgery is divided into courses for beginning to advanced trainees, allowing you to assign simulator-based training units according to the current proficiency level of your residents. In simulation, it is possible to create an exercise designed to test a single, **Opportunities for** Repetition basic skill, while eliminating other distractions. Surgical tasks can be repeated in exactly the same setting until they are mastered. In addition, complications can be added under controlled conditions. The opportunity to try different options and see the consequences leads to a judgement of surgical settings based on experience – without actually injuring a patient. Eyesi courseware introduces skills essential to intraocular surgery step-bystep, starting with training of basic instrument handling and consecutively leading trainees to increasingly complex surgical multi-step procedures. While accomplishing training tasks, trainees will be supported by vocal Immediate Feedback and visual guidance from the training system. At the end of each task a detailed performance summary is provided. Further evaluation tools of the Eyesi Surgical simulator allow both you and Objective your trainees to keep track of learning progression over time. Based on Assessment the detailed assessment offered by Eyesi, you can tailor training contents to the individual needs of your residents relative to their current skill level.

1 K.A. Ericsson et al, The Role of Deliberate Practice in the Acquisition of Expert Performance, Psychological Review, Vol. 100 No. 3, 363-406, 1993

2.2 Basic Skills Training

- Instrument Handling First attempts at manipulating operating instruments under an operating microscope should not be on a patient, but should be practiced safely and without additional stress. In a simulated surgical environment, Eyesi Surgical gives trainees the opportunity to become familiar with the use of microsurgical instruments and proper parameter selection for OR machine settings. They will also practice effective use of the operating microscope and illumination before they actually enter the OR.
 - Abstract Tasks Eyesi Surgical's basic skills tasks are designed to advance the psychomotoric coordination of hand, eye and foot and spatial orientation inside the eye. The exercises aim to minimize reaction time, excess movements of the hands, and tremor. In order to train navigation in the interior of the eye and overcome the dissociation of intention and manual execution in eyehand coordination known as the fulcrum effect, abstract exercises have proven to be equal to or even more efficient than training in a real setting.
 - Tier A IntroductoryThe introductory courses of the CAT-A and VRT-A tiers use abstract train-
ing scenarios to help novices gain confidence and a profound understand-
ing of microsurgical skills essential to performing intraocular surgery safely
and effectively.





Example: The introductory cataract courses (CAT-A) comprise preparatory basic skill training tasks, such as circular anti-tremor training paths, allowing novices to concentrate on their hand movement without having to interact with tissue.

Example: The Bimanual Navigation courses are designed to train using the non-dominant hand and bimanual maneuvers, as needed for lens segmentation during phaco surgery. Operation machines are the most sophisticated parts of technical eye surgery equipment. Both functionality and operating modes have to be fully understood. Eyesi offers physics-based simulation of OR machine functions for both phaco and vitreoretinal procedures. **OR Machines**



Fig. 1: OR machine with parameters for phaco procedures



Example: In the Phaco Training tasks of the cataract courses, trainees explore the settings of the phaco machine and the physical effects of changing its parameters before performing phaco divide and conquer tasks.



Fig. 2: In the microscope view several guiding elements are displayed to help trainees understand the principals of phaco fluidics.

2.3 Training of Surgical Procedures

The beginners' to advanced courses of Eyesi courseware provide a simulated surgical environment to practice and refine core steps of cataract and vitreoretinal surgery procedures at increasing levels of difficulty. In the beginners' courses, abstract basic skills training is combined with isolated steps of surgical procedures, leading to more complex tasks and multistep-procedures in the intermediate and advanced courses. The advanced courses offer dedicated training for experienced trainees already proficient in the basic steps of surgery and needing broader exposure to scenarios which have the risk of complications.







Tier B Beginners' Courses

Example: In the capsulorhexis training of the beginners' tier (CAT-B), a well defined flap and a guiding circle is offered, so novices can focus on completing a full circular capsulorhexis. In the beginning tasks, viscoelastic is already injected.

Tier C Intermediate Courses

Example: The capsulorhexis training of CAT-C courses offers random training scenarios for injecting viscoelastic, creating an initial flap into the capsule and performing a rhexis at increasing levels of capsular tension.

Tier D Advanced Courses

Example: The advanced cataract cases of the CAT-D tier include radial tears located in different positions, variations of capsular membrane tension, and weakened zonular fibers. In the Capsulorhexis Variations course, the surgical scenario is randomized by the simulator and trainees have to adapt to unexpected and challenging situations. Courses with capsular plaques and white cataracts complete the training experience.

2.4 Guidance and Evaluation

The Eyesi Surgical Simulator offers immediate vocal and visual guidance and feedback on the trainee's performance. In normal training mode, guiding messages are displayed in the microscope view, for example to provide warnings if something is going wrong. In more advanced courses, all guidance options have been intentionally deactivated.

Performance Summary

Eyesi Surgical provides objective assessment of surgical performance and detailed skill evaluation. Various parameters relating to instrument and microscope handling, surgical efficiency and tissue treatment are recorded by the system. At the end of each task, the trainee is presented with a performance summary based on these parameters. The task score is made up of attained objectives and penalty points, e.g. for injuries caused or inefficient use of instruments.

Task: Cataract Navigation Training, Leve	er Navigation		Start Replay	Export Video
Entry		Value	Score	Range
▼ Target achievement			excellent	
- Completed objects		20/20	100	[0 100]
▼ Efficiency			good	
Time		00:59.7	-1	[-20 0]
Instrument handling			good	
Microscope handling			excellent	
Tissue treatment			excellent	
Grades: excellent good	Task Score: 95	/100		
Return To Course Overview		6	Proceed (Attemp	t: 2 of 3)

Fig. 3: Evaluation Screen

Immediate Feedback

Evaluation Screen

Training Reports

Proficiency over Time The evaluation data of each training session is stored in a database and can be viewed in PDF training reports for each user. Both educators and users can create user training reports showing the evaluation data of multiple training sessions.



 For more information on training reports please refer to section 4.5 on page 23.

2.5 Keeping Control of the Learning Process

A scoring gate is a required minimum score. Trainees can proceed to the next task only after they have achieved the required score for the current task. The scoring gates increase as trainees progress to courses of the next tier. As a result, you are able to objectively assess the skills development of each trainee and control the surgical learning pathway.

To ensure that trainees consistently perform at a given skill level, VRmagic has also introduced reliability gates, which require trainees to reach a defined score several times in succession before moving to the next task. Courses with reliability gates guarantee high training intensity and reproducible results. Throughout Eyesi courseware reliability gates are set to three, requiring trainees to reach the scoring gate three times in a row.

Tesk:	Options	Attempts		Score		Status
Cataract Navigation Training - Level 1	R3	5	90	90	85	0
Cataract Anti-Tremor Training - Level 1	R3	1	30	0	0	0
Cataract Anti-Tremor Training - Level 2	R3	0	0	0 .	0	_ ≙
Cataract Navigation Training - Level 2	R3	0	0	0	0	_ ≙
Cataract Anti-Tremor Training - Level 5	R3	0	0	0	0	_ ≙
Cataract Anti-Tremor Training - Level 6	R3	0	0	0.	0	_ ≙
Please perform the tasks in the given order. Repetition of accomplished tasks is allowed.			Cou	rse Sco	ore: 295/	1800
Reset Course				0	Select Task	

Fig. 5: Course Overview screen; the score column is divided into several bars, one for each required attempt. Green bars indicate that the required score was reached.

Another tool designed to help you keep control of the learning process is the Cataract Challenge course. The Cataract Challenge course is a course that appears repeatedly in regular time intervals. The course requires trainees to consecutively perform all steps of a surgical procedure in a limited time window. Since the same course has to be attempted repeatedly, this feature will help you benchmark the surgical skills development of your residents over time and verify consistency in their performance level.

 For more information on the Cataract Challenge course, please refer to section 3.1 on page 12. Challenge Courses

3 Courseware Overview

3.1 Cataract Tiers and Courses

CAT-A Introductory The CAT-A tier uses abstract scenarios to train basic microsurgical skills, such as instrument navigation in the anterior chamber of the eye and proper use of microscope and OR machine settings.

CAT-B Beginners' In the CAT-B tier different steps of cataract surgery will be trained separately; following abstract instrument handling tasks, trainees will practice first steps in capsulorhexis, lens segmentation, lens removal, and intraocular lens insertion in a simulated surgical environment.

- CAT-C Intermediate The CAT-C tier will refine trainees' surgical skills: they will practice advanced surgery techniques before performing multi-step cataract procedures in a simulated surgical environment.
 - CAT-D Advanced The CAT-D tier offers training of complex cataract surgery cases under de-Courses manding conditions, such as increasing capsule tensions, weak zonules, complications, white cataracts, or capsular plaques.
- Cataract Challenge Course As soon as the CAT-B tier has been unlocked, the Cataract Challenge course appears at time intervals of 60 minutes training time while trainees practice on the regular courses of the Eyesi Courseware 2.1. It is designed to challenge the emerging surgical skills by mimicking the conditions of real surgery; trainees have to perform a complete cataract procedure in sequential order; they only have one attempt at each cataract step and a limited time window of 15 minutes. Because the challenge course appears at regular time intervals, it is a great tool to benchmark the training progress of trainees over time.



Fig. 6: Training tasks of the Cataract Challenge course



Fig. 7: Overview of the tiers and courses of the cataract courseware



Date: 2012-08-19 No. Pages: 3

Software version: Eyesi V2.8 System serial number: 042

User: Dr Best 1 Group: 3rd year Handedness: right 2 Total Training Time: 2h 3min 87 Tasks from 2012-08-11 to 2012-08-18



Course Score 5 1800						1580
Cataract Navigation Training - Level 1 3x50			2011-08-11 13:59 78	2011-08-11 14:01 85	2011-08-11 14:03 79	2011-08-18 12:51 89
Cataract Anti-Tremor Training - Level 1 req. 3x50	2011-08-11 14:04 86	2011-08-11 14:04 92	2011-08-11 14:05 38	2011-08-11 14:06 100	2011-08-11 14:06 98	2011-08-11 14:07 100
Cataract Anti-Tremor Training - Level 2 req. 3x50				2011-08-11 14:07 100	2011-08-11 14:08 82	2011-08-11 14:08 96

Fig. 19: First page of a training report

- 1 User data (user name, user group, handedness)
- 2 Total amount of training time and attempted tasks
- 3 Course name
- 4 Proficiency graph: shows the course score over time. A black vertical line indicates that the course was reset. A green vertical line indicates the point in time when all tasks of the course have been completed for the first time.
- **5** The first row shows the achieved total score of the complete course.
- 6 The first column shows the task names, the required score, and the reliability gate. The following columns show the attempts made on a task, the far right column representing the most recent attempt. Green task scores: the required score was reached. Black task scores: the required score was not reached.

5 Course Descriptions

5.1 Introductory Cataract Courses (CAT-A)

The CAT-A tier uses abstract scenarios to train basic surgical skills, such as instrument navigation in the anterior chamber of the eye and proper OR machine settings.

Training Objectives

- Proper microscope set-up for optimal visualization
- Spatial understanding of the anterior chamber boundaries, permitting safe movements
- Pivot movement on wound fulcrum to minimize wound stress and eye tilting
- Economy of movements within the anterior chamber
- Bimanual instrument handling
- Safe movements within the posterior capsule

Courses of the CAT-A tier

- CAT-A Anterior Chamber Navigation
- CAT-A Intracapsular Navigation
- CAT-A Bimanual Navigation
- CAT-A Instruments

All tasks have to be completed in **sequential order**. After a task has been completed, it may be repeated for further practice. A **required score of 50 points** must be reached with a reliability of **three times in a row** to advance to the next task of the course.

CAT-A Anterior Chamber Navigation

Course Description

This course uses abstract tasks to train basic hand-eye coordination in the anterior chamber. Trainees will learn to perform efficient and controlled movements using a pointing instrument. In the Navigation Training tasks, the tip of the instrument has to be moved to defined targets. In the Anti-Tremor Training tasks trainees will practice to move the instrument tip along a given trajectory. Each task of this course has to be completed three times in a row. At task start, the microscope needs to be adjusted.

Required score:	50 points
Reliability gate:	3
Course mode:	sequential
Course options:	microscope reset

- Navigation Training Level 1
- Anti-Tremor Training Level 1
- Anti-Tremor Training Level 2
- Navigation Training Level 2
- Anti-Tremor Training Level 5
- Anti-Tremor Training Level 6

CAT-A Intracapsular Navigation

Course Description

This course uses abstract tasks to train controlled movements within an empty capsule where the lens has already been removed. In the Navigation Training tasks, the tip of the instrument has to be aimed at targets within the capsule. In the Anti-Tremor Training tasks, the instrument tip has to be moved along given trajectories.

Required score:	50 points
Reliability gate:	3
Course mode:	sequential

- Intracapsular Navigation Training Level 1
- Intracapsular Anti-Tremor Training Level 1
- Intracapsular Anti-Tremor Training Level 2
- Intracapsular Navigation Training Level 2
- Intracapsular Anti-Tremor Training Level 3
- Intracapsular Anti-Tremor Training Level 4

CAT-A Bimanual Navigation

Course Description

The CAT-A Bimanual Navigation course is designed to train bimanual dexterity as needed in surgical techniques such as chopping, cracking, or bimanual I/A. Trainees will have to use two pointing instruments simultaneously to either aim at given objects or to perform opposing movements in a controlled manner.

Required score:	50 points
Reliability gate:	3
Course mode:	sequential

- Bimanual Training Level 1
- Cracking & Chopping Training Level 1
- Bimanual Training Level 2
- Cracking & Chopping Training Level 2
- Bimanual Training Level 3
- Cracking & Chopping Training Level 3
- Bimanual Training Level 4
- Cracking & Chopping Training Level 4

CAT-A Instruments

Course Description

The CAT-A Instruments course introduces use of the forceps and the phaco probe. Trainees will practice handling of the forceps by grasping and maneuvering abstract objects. Basic phaco skills, such as irrigation, aspiration and emulsification are trained on abstract objects. The phaco training tasks require an appropriate setup of the OR machine.

Required score:	50 points
Reliability gate:	3
Course mode:	sequential

- Forceps Training Level 1
- Forceps Training Level 2
- Phaco Training Level 1
- Forceps Training Level 3
- Forceps Training Level 4
- Phaco Training Level 2

5.2 Cataract Courses Beginner (CAT-B)

In the CAT-B tier different steps of cataract surgery will be trained separately; following abstract instrument handling tasks, trainees will practice first steps in capsulorhexis, lens segmentation and lens removal in a simulated surgical environment.

Training Objectives

- Effective forceps techniques for optimal tissue manipulation during the rhexis
- Deeper understanding of appropriate vector forces for the rhexis
- Effective bimanual movements for phaco chopping
- Optimizing the fluidics of the phaco probe during each step of cataract surgery
- Safe aspiration of cortex during irrigation and aspiration
- Safe use of ultrasound and aspiration during quadrant removal
- Efficient sculpting for divide and conquer technique
- Dynamic bimanual movements needed for nucleus cracking

Courses

- CAT-B Navigation and Instruments
- CAT-B Capsulorhexis
- CAT-B Intracapsular Tissue
- CAT-B Stop and Chop
- CAT-B IOL Insertion

All tasks have to be completed in **sequential order**. The microscope needs to be set up at the start. It maintains its focus and zoom between tasks. A **required score of 60 points** must be reached with a reliability of **three times in a row** to advance to the next task of the course. After a task has been completed, it may be repeated for further practice.

In intervals of 60 minutes training time, trainees will be asked to attempt the **Cataract Challenge** course. The challenge course requires trainees to complete all steps of cataract surgery in a limited time window of 15 minutes. There are no required scores, no second attempts at any task, and a continuously running clock.

CAT-B Navigation and Instruments

Course Description

The CAT-B Navigation and Instruments course repeats training of basic instrument skills in abstract scenarios as already introduced in the CAT-A courses. Trainees will refine their instrument movements as well as the handling of forceps and phaco instrument.

Required score:	60 points
Reliability gate:	3
Course mode:	sequential

- Navigation Training Level 3
- Intracapsular Navigation Training Level 3
- Anti-Tremor Training Level 7
- Forceps Training Level 4
- Intracapsular Anti-Tremor Training Level 5
- Bimanual Training Level 5
- Cracking & Chopping Training Level 5
- Phaco Training Level 3

CAT-B Capsulorhexis

Course Description

The CAT-B Capsulorhexis course trains opening of the anterior capsule. Abstract tasks will be combined with training of the surgical procedure at increasing levels of capsule tension. Trainees will start practicing circular movements in both clockwise and counterclockwise direction and then create a corresponding rhexis. An initial tear will be offered at varying positions. No viscoelastic has to be injected in this course.

Required score:	60 points
Reliability gate:	3
Course mode:	sequential

- Anti-Tremor Training Level 3
- Capsulorhexis: Initial Flap CCW 0°, Low Tension, Perm. Visco
- Capsulorhexis: Initial Flap CCW 90°, Low Tension, Perm. Visco
- Anti-Tremor Training Level 4
- Capsulorhexis: Initial Flap CW 0°, Low Tension, Perm. Visco
- Capsulorhexis: Initial Flap CW 90°, Low Tension, Perm. Visco
- Anti-Tremor Training Level 3
- Capsulorhexis: Initial Flap CCW 180°, Med. Tension, Perm. Visco
- Capsulorhexis: Initial Flap CCW 270°, Med. Tension, Perm. Visco
- Anti-Tremor Training Level 4
- Capsulorhexis: Initial Flap CW 0°, Med. Tension, Perm. Visco
- Capsulorhexis: Initial Flap CW 270°, Med. Tension, Perm. Visco

CAT-B Intracapsular Tissue

Course Description

This course is designed to introduce essential skills needed in phaco surgery; hydrodissection and hydrodelineation as well as removal of the lens and residual cortex. The Hydro Maneuvers tasks train separation of the lens nucleus from the cortex and the capsule as well as separation of the epinucleus from the harder inner nucleus. In the Divide and Conquer tasks, lens parts have to be removed using the phaco instrument. The Irrigation-and-Aspiration tasks train the removal of residual cortex after lens removal. Different OR machine settings can be explored.

Required score:	60 points
Reliability gate:	3
Course mode:	sequential

- Hydro Maneuvers Level 1
- Phaco Divide and Conquer Level 7 (Soft Lens)
- Hydro Maneuvers Level 2
- Phaco Divide and Conquer Level 1
- Irrigation and Aspiration Level 1
- Phaco Divide and Conquer Level 2
- Irrigation and Aspiration Level 2

CAT-B Stop And Chop

Course Description

This course teaches skills needed for applying the Stop and Chop technique for nuclear segmentation and removal. Trainees will begin by carving a central groove into the lens using the phaco instrument and then splitting the nucleus into two halves. Subsequently, the lens halves have to be aspirated with the phaco tip and then chopped into quadrants using the horizontal chopper. Each step of the Stop and Chop procedure is trained in separate tasks.

Required score:	60 points
Reliability gate:	3
Course mode:	sequential

- Phaco Divide and Conquer Level 3 (sculpting performed, crack into two halves)
- Phaco Chopping Training Level 1 (half nucleus, horizontal chopper)
- Phaco Divide and Conquer Level 8 (sculpt and crack into two halves)
- Phaco Chopping Training Level 2 (two half nuclei, horizontal chopper)

CAT-B IOL Insertion

Course Description

The IOL Insertion course trains the complete procedure of inserting an intraocular lens (IOL) into an empty capsule bag. After injecting viscoelastic into the capsule, trainees have to inject spheric or toric lenses. Finally, the viscoelastic has to be removed again and the position and orientation of the IOL has to be checked. In the last two tasks, the position of a misplaced IOL has to be corrected.

Required score:	60 points
Reliability gate:	3
Course mode:	sequential

- IOL Insertion Level 1 (insert spheric IOL)
- IOL Insertion Level 2 (insert toric IOL)
- IOL Insertion Level 3 (misplaced spheric IOL)
- IOL Insertion Level 4 (misplaced toric IOL)

5.3 Cataract Courses Intermediate (CAT-C)

The CAT-C tier refines already acquired cataract skills through more challenging surgical scenarios: trainees will practice advanced surgery techniques before performing multi-step cataract procedures in a simulated surgical environment.

Training Objectives

- Effective use of cystotome and forceps for flap construction
- Proper use of viscoelastic fluid to preserve chamber depth and flap stability during the rhexis
- Rhexis techniques on high tension capsules
- Hydrodissection technique for dense nucleus
- Complete I&A step using straight or bent tip for either coaxial or bimanual irrigation and aspiration
- Complete phaco divide and conquer procedure with sculpting, cracking, quadrant removal
- Stop-and-chop technique
- Horizontal chopping principals

Courses

- CAT-C Capsulorhexis
- CAT-C Divide and Conquer
- CAT-C Chopping
- CAT-C Irrigation/Aspiration

All tasks have to be completed in **sequential order**. The microscope needs to be set up at the start. It maintains its focus and zoom between tasks. A **required score of 70 points** must be reached with a reliability of **three times in a row** to advance to the next task of the course. After a task has been completed, it may be repeated for further practice.

In intervals of 60 minutes training time, trainees will be asked to attempt the **Cataract Challenge** course. The challenge course requires trainees to complete all steps of cataract surgery in a limited time window of 15 minutes. There are no required scores, no second attempts at any task, and a continuously running clock.

CAT-C Capsulorhexis

Course Description

The CAT-C Capsulorhexis course is designed to enhance the acquired basic capsulorhexis skills. Following a preparatory abstract forceps training, trainees will practice to tear an Initial Flap into the capsule. The rhexis then has to be performed on capsules with increasing tension, which makes the capsule more sensitive. The same capsulorhexis task first has to be performed with a guiding circle and then without one.

Required score:	70 points
Reliability gate:	3
Course mode:	sequential

- Forceps Training Level 2
- Capsulorhexis: Low Capsular Tension, Guidance
- Capsulorhexis: Low Capsular Tension, No Guidance
- Forceps Training Level 3
- Capsulorhexis: Medium Capsular Tension, Guidance
- Capsulorhexis: Medium Capsular Tension, No Guidance
- Forceps Training Level 4
- Capsulorhexis: High Capsular Tension, Guidance
- Capsulorhexis: High Capsular Tension, No Guidance

CAT-C Divide and Conquer

Course Description

This course fosters an advanced understanding of nuclear segmentation using the divide and conquer technique. First, trainees will mobilize the lens by performing hydrodissection and hydrodelineation. After cracking a pre-sculpted lens, trainees will then have to perform the complete divide and conquer procedure including sculpting, cracking and lens removal on a soft and a medium hard lens.

Required score:	70 points
Reliability gate:	3
Course mode:	sequential

- Hydro Maneuvers Level 3
- Phaco Divide and Conquer Level 4
- Hydro Maneuvers Level 6
- Phaco Divide and Conquer Level 5
- Phaco Divide and Conquer Level 6

CAT-C Chopping

Course Description

The CAT-C Chopping course aims at practicing bimanual instrument movements and chopping techniques as needed for lens removal. In the abstract Cracking & Chopping Training tasks trainees will practice the bimanual instrument movements required for lens cracking and handling lens segments. The horizontal and vertical chopping techniques are trained in the Phaco Chopping Training tasks; trainees have to stabilize the lens with the phaco instrument and at the same time chop it into smaller pieces using a horizontal or vertical chopper.

Required score:	70 points
Reliability gate:	3
Course mode:	sequential

- Cracking & Chopping Training Level 5
- Phaco Chopping Training Level 3 (full nucleus, horizontal chopper)
- Cracking & Chopping Training Level 6
- Phaco Chopping Training Level 4 (half nucleus, vertical chopper)
- Cracking & Chopping Training Level 8
- Phaco Chopping Training Level 5 (two half nuclei, vertical chopper)
- Phaco Chopping Training Level 6 (full nucleus, vertical chopper)

CAT-C Irrigation/Aspiration

Course Description

This course trains the removal of residual cortex while avoiding a capsular rupture caused by exerting stress to capsule and zonular fibers. The Intracapsular Anti-Tremor task is intended to prepare trainees for capsule polishing. The Intracapsular Navigation Training task trains instrument handling in the sub-anterior capsular region, especially with J-shaped instruments. In the Irrigation and Aspiration tasks trainees can explore the use of adequate vacuum and flow values for removing residual cortex.

Required score:70 pointsReliability gate:3Course mode:sequential

- Intracapsular Anti-Tremor Training Level 3
- Irrigation and Aspiration Level 3
- Intracapsular Navigation Training Level 3
- Irrigation and Aspiration Level 4

5.4 Cataract Courses Advanced (CAT-D)

The CAT-D tier offers training of complex cataract surgery cases under demanding conditions, such as increasing capsule tensions and weak zonules and complications. In the courses trainees will be challenged by randomized tasks and complications, requiring them to quickly adapt to the surgical scenario.

Courses

- CAT-D Capsulorhexis Errant Tear
- CAT-D Weak Zonules and Capsules
- CAT-D Capsulorhexis Variations
- CAT-D White Cataracts
- CAT-D Capsular Plaques

All tasks have to be completed in **sequential order**. The microscope needs to be set up at the start. It maintains its focus and zoom between tasks. A **required score of 80 points** must be reached with a reliability of **three times in a row** to advance to the next task of the course. After a task has been completed, it may be repeated for further practice.

In intervals of 60 minutes training time, trainees will be asked to attempt the **Cataract Challenge** course. The challenge course requires trainees to complete all steps of cataract surgery in a limited time window of 15 minutes. There are no required scores, no second attempts at any task, and a continuously running clock.

CAT-D Capsulorhexis Errant Tear

Course Description

The CAT-D Capsulorhexis Errant Tear course refines the technique of creating a clockwise / counterclockwise rhexis under increasingly difficult conditions; the capsule tension is medium to high, and the tear tends to run outwards. In all tasks, viscoelastic has to be injected before opening the anterior capsule. An initial tear has been created and a guiding circle is displayed.

Required score:	80 points
Reliability gate:	3
Course mode:	sequential

- Capsulorhexis: Errant Tear CCW, Medium Capsular Tension
- Capsulorhexis: Errant Tear CW, Medium Capsular Tension
- Capsulorhexis: Errant Tear CCW, High Capsular Tension
- Capsulorhexis: Errant Tear CW, High Capsular Tension
- Capsulorhexis: Errant Tear CCW, High Capsular Tension, No Guidance
- Capsulorhexis: Errant Tear CW, High Capsular Tension, No Guidance

CAT-D Weak Zonules and Capsules

Course Description

In this course, a Capsulorhexis has to be performed on a patient with weak zonules. Between the tasks, capsular tension varies from low to high. In some tasks an initial tear has to be created, and in some tasks the tear tends to run outwards. Throughout the course, viscoelastic needs to be injected and no guiding circle is displayed. The course also includes a hydrodissection and delineation task with a weak capsule as well as an irrigation and aspiration task with weak zonules.

Required score:80 pointsReliability gate:3Course mode:sequential

- Capsulorhexis: Weak Zonules, Low Capsular Tension
- Capsulorhexis: Weak Zonules, Medium Capsular Tension
- Capsulorhexis: Weak Zonules, High Capsular Tension
- Hydro Maneuvers Level 8
- Irrigation and Aspiration Level 5
- Capsulorhexis: Weak Zonules, Low Capsular Tension, Errant Tear CW
- Capsulorhexis: Weak Zonules, Medium Capsular Tension, Errant Tear CCW
- Capsulorhexis: Weak Zonules, High Capsular Tension, Errant Tear
 CW

CAT-D Capsulorhexis Variations

Course Description

The difficulty of this course is that the conditions under which the rhexis has to be created vary randomly and unpredictably. For example, capsular tension may be low, medium, or high, or the zonules might be intact or weak. The aim of this course is to prepare trainees for surprises in real patient cases and to further improve their skills.

Required score:	80 points
Reliability gate:	3
Course mode:	sequential

- Capsulorhexis: varying situations, perm. visco, guidance
- Capsulorhexis: varying situations, no guidance

CAT-D White Cataracts

Course Description

This course practices the steps and precautions needed when dealing with white cataracts. Trainees have to stain the capsule with trypan blue dye to facilitate visibility of the rhexis in the absence of a red reflex. Then, generous injection of viscoelastic is necessary to increase anterior chamber pressure, which counteracts the high intracapsular pressure and prevents an uncontrollable capsule tear when opening the capsule bag (Argentinian flag sign). The course is supplemented by a hydro maneuvers task, where hydrodissection has to be performed on a white lens.

Required score:	80 points
Reliability gate:	3
Course mode:	sequential

- Capsulorhexis: white cataract, low capsular tension
- Capsulorhexis: white cataract, high capsular tension, weak zonules
- Hydro Maneuvers Level 7

CAT-D Capsulorhexis Capsular Plaques

Course Description

This course focuses on anterior capsule plaques of varying size and location. Depending on the plaque position trainees have to decide whether to tear around the plaque or tear through the plaque. Leading the capsulorhexis through a plaque requires great care because of the different tear behavior. In many tasks high capsular tension and weak zonules increase the danger of capsular damage.

Required score:	80 points
Reliability gate:	3
Course mode:	sequential

- Capsulorhexis: small plaques, different locations, medium capsular tension
- Capsulorhexis: varying plaques, high capsular tension, weak zonules