EYESI SLIT LAMP
Courseware Guide for Educators

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HAAG-STREIT SIMULATION

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Eyesi Slit Lamp Simulator – Courseware Guide for Educators

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1 The Eyesi Slit Lamp courseware

1.1 Introduction

Training with Eyesi Slit Lamp allows for a standardized learning experience and ensures that all students reach the same level of diagnostic proficiency. Featuring an embedded curriculum called Eyesi Slit Lamp courseware, the simulator can easily be integrated into ophthalmology or optometry programs.

Standardized curriculum

Eyesi Slit Lamp comes with a didactically structured curriculum, which has been designed to lead trainees step-by-step to expert performance. Students advance through the curriculum independently and self-guided. Educators can lock or unlock courses as required.

Database of virtual patients

The Eyesi Slit Lamp curriculum uses a case-based approach to teach diagnostic skills. The courseware starts with abstract scenarios to teach slit lamp handling and illumination techniques. After the trainees have learned to visualize anatomical features of healthy eyes, they get to know ocular pathologies and commonly used grading systems, for example, for cataracts. Finally, clinical cases with detailed patient histories support trainees in developing diagnostic skills. The Eyesi Slit Lamp case database contains a wide range of clinically relevant pathologies, ranging from infections of the eyelids to diseases of the chorioretinal complex.

Purpose of this guide

This guide provides a detailed overview of the Eyesi Slit Lamp curriculum and describes all tiers, courses, and cases so that you can get an idea of the training content installed on the Eyesi Slit Lamp. However, the solutions to the training tasks (for example, the exact number and type of findings and diagnoses) are not part of this guide.

1.2 Courseware structure

The courseware of the Eyesi Slit Lamp is organized into tiers of different levels of difficulty. Each tier comprises several training courses, and each training course contains several tasks. A task (or case) is the smallest training unit.

All tiers are described in detail in the following chapters.

INFO	**The courseware is being extended**
The Eyesi Slit Lamp courseware is continuously being extended. New courses and cases will be added in future software releases.	

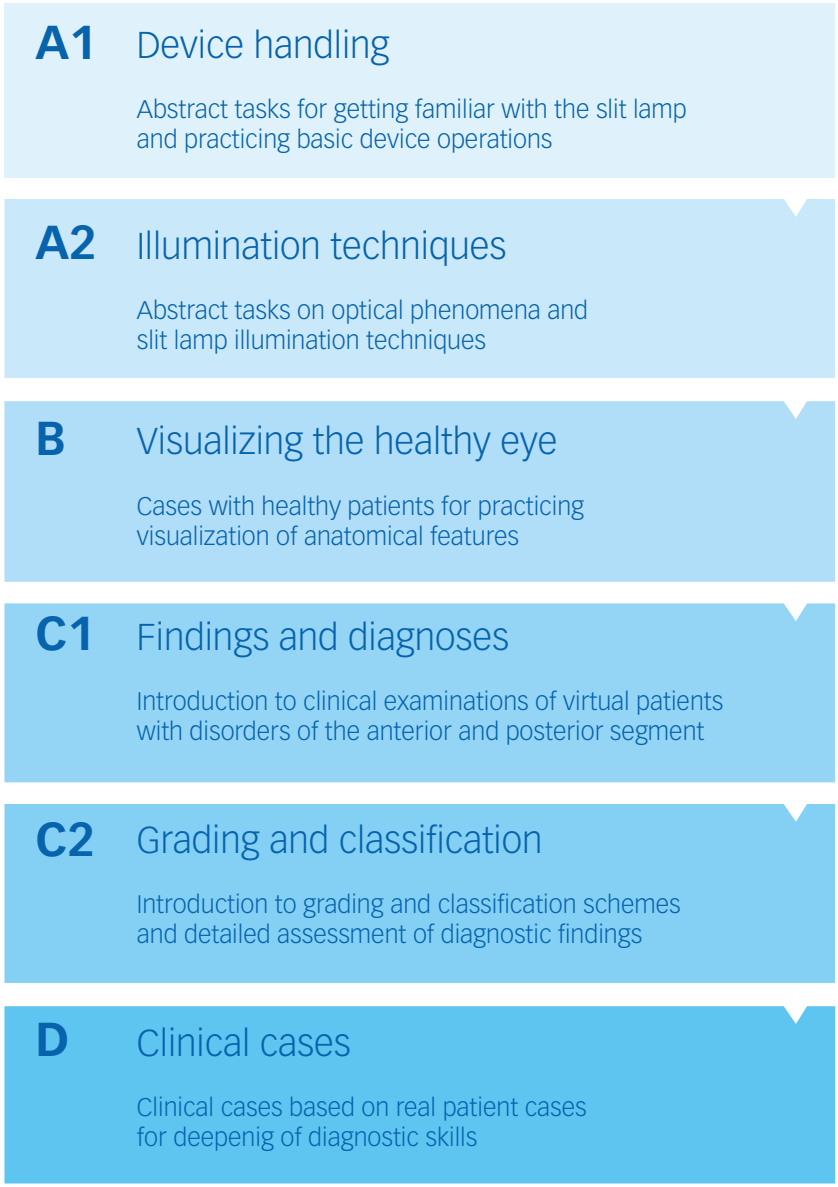


Fig. 1: Tiers of the Eyesi Slit Lamp courseware

1.3 Types of training courses

There are three types of training courses which serve different training purposes.

- Online courses
- Learning courses
- Exam courses

1.3.1 Online courses

Online courses are available on VRmNet, the web-based training platform for simulators by Haag-Streit Simulation. Online courses are an optional part of the Eyesi Slit Lamp courseware and prepare trainees for the following practical courses on the simulator. In addition, the online courses provide background information on slit lamp handling, examination techniques, and pathologies.

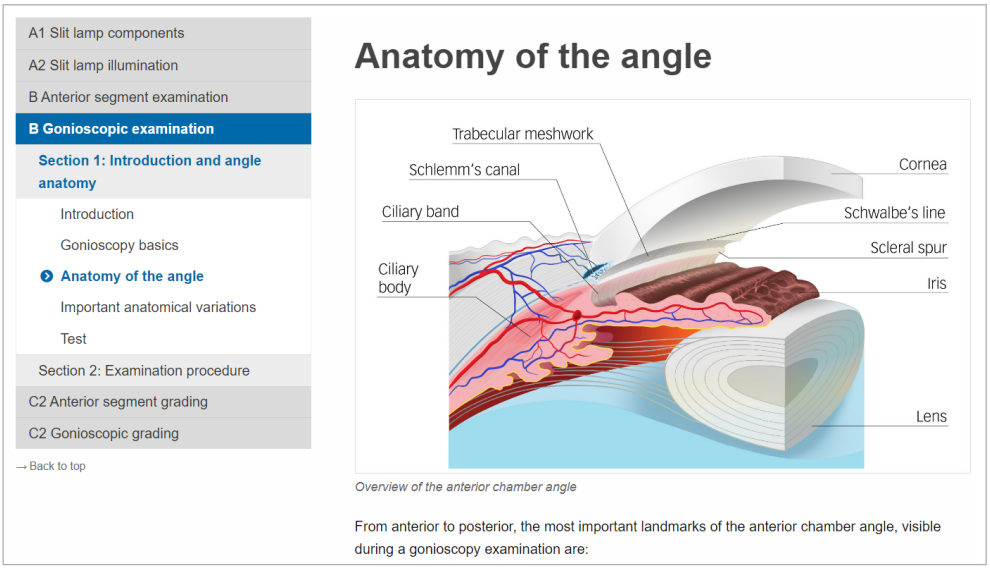


Fig. 2: Screenshot of an online course explaining the anatomy of the anterior chamber angle

1.3.2 Learning courses

In the "learning" courses, the simulator guides trainees through the current tasks step by step. The simulator shows and explains the required slit lamp settings and highlights the examination targets or pathological signs in the stereo microscope. Additional medical background information is provided on anatomical features or pathological signs. The training goal of the learning courses is to learn slit lamp handling, get familiar with eye anatomy, and be able to recognize signs of ocular pathologies.

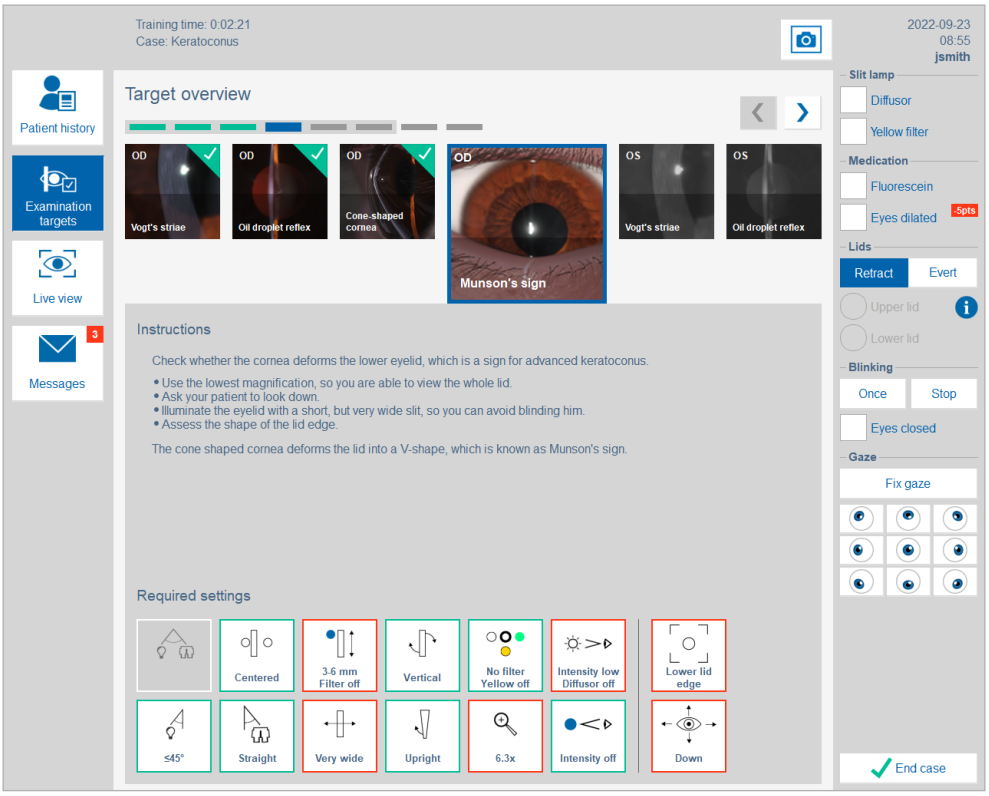


Fig. 3: In learning courses, the simulator guides trainees through the task. In the "Required settings" area, correct and wrong slit lamp settings are indicated. Here, Munson's sign has to be found in a keratoconus case.

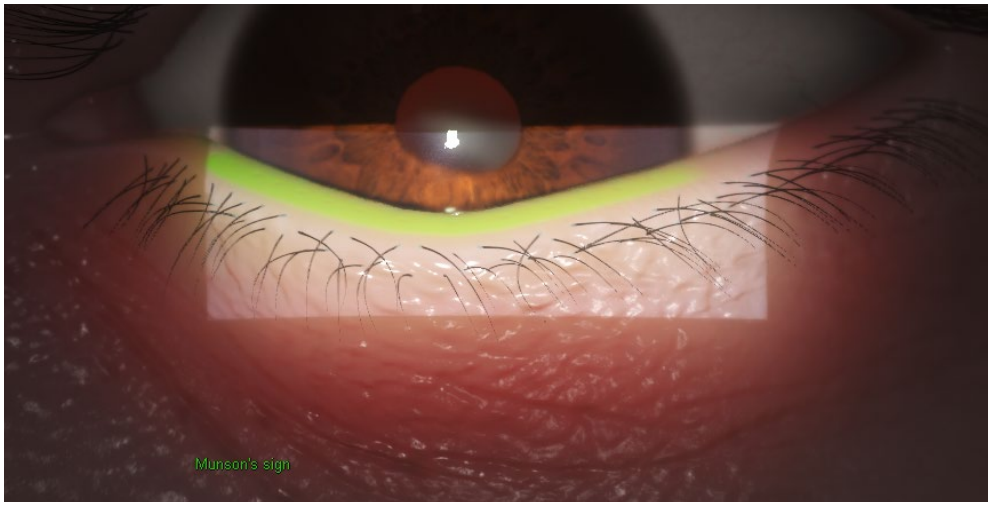


Fig. 4: Once all settings are correct, Munson's sign highlighted in the microscope

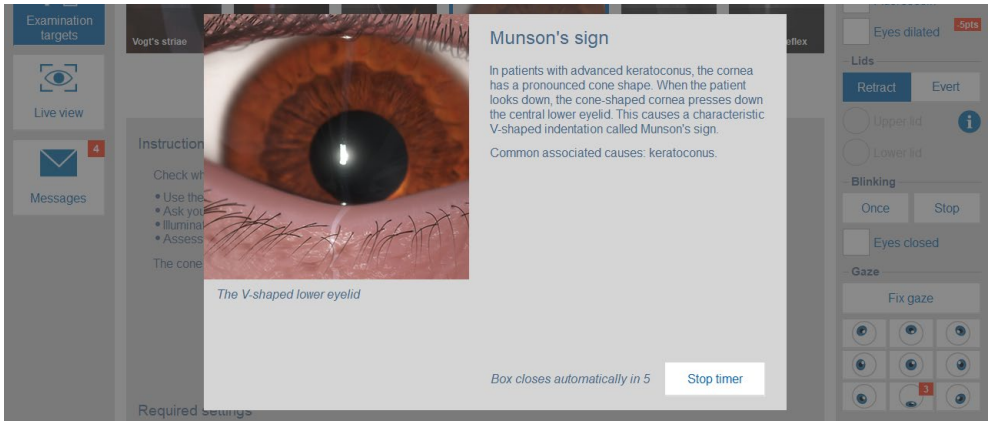


Fig. 5: A text box with background information is displayed.

1.3.3 Exam courses

Exam courses are designed to test the knowledge acquired in the "learning" courses. The virtual patients examined in the preceding "learning" courses are presented in random order without guidance from the simulator. Trainees are asked to detect suspicious signs and specify their findings and diagnoses in a multiple-choice form. In the grading courses of tier C2, the grade of a given pathology has to be specified. This way, trainees learn to examine the eye thoroughly and recognize suspicious signs. The evaluation following each task presents the correct, wrong, or missing answers.

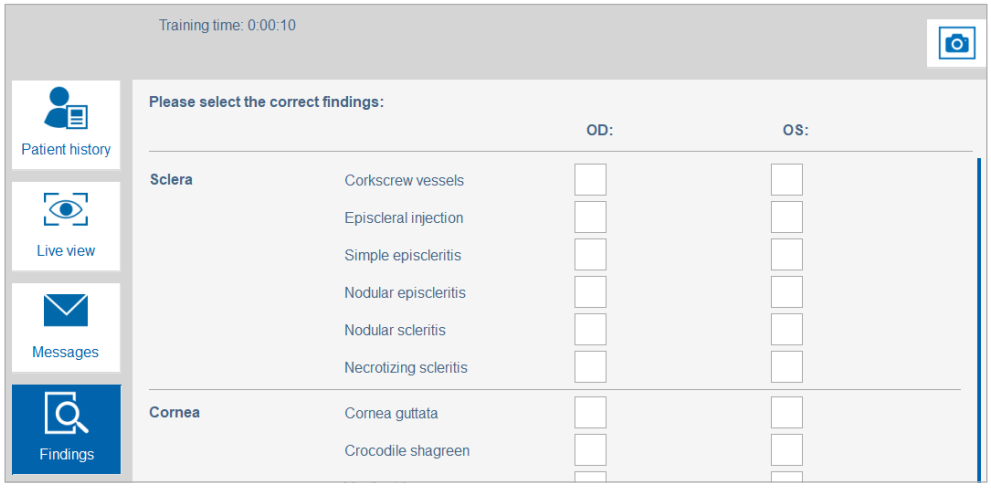


Fig. 6: Example of a findings input form in an exam course

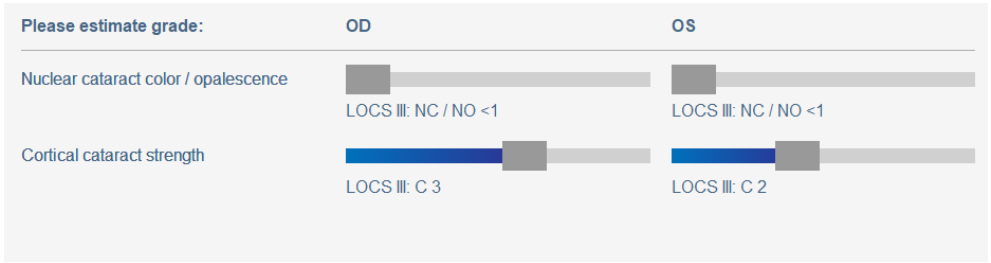


Fig. 7: Sliders for cataract grading

2 Tier A1: Device handling

This tier contains courses for training of basic slit lamp handling, such as focusing the microscope, changing the illumination angle, or using filters. The courses use a gamified teaching approach where trainees practice on objects placed in a virtual doctors' office.

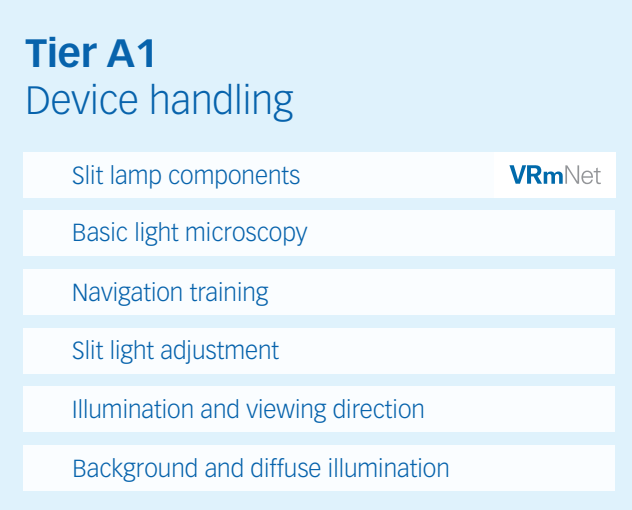


Fig. 8: Courses of tier A1; courses marked with "VRmNet" are online courses.

Simulator courses
In each case of the A1 courses, one new slit lamp setting is introduced and explained. In the first case, only one setting (the slit light intensity) is available. All other settings have no effect.

Each setting that has been introduced in one case will stay available in the following cases. With this step-by-step approach, trainees will become familiar with more and more settings as they progress through the courses of the tier. After completing the simulator courses of tier A1, trainees know all slit lamp functions and how to use them.

2.1 Slit lamp components | online course

Online courses are available on VRmNet, the web-based training platform for simulators by Haag-Streit Simulation.

2.1.1 Introduction

This online task gives an overview of the main components of a real slit lamp and Eyesi Slit Lamp.

Fig. 9: Screenshot from the online task

2.1.2 Slit lamp base

This online task explains how to position the slit lamp in front of the patient eye and to set the focus by moving the slit lamp base.

Fig. 10: Screenshot from the online task

2.1.3 Illumination system

This online task explains the principle of the slit lamp illumination system and how to adjust the various illumination settings such as slit width, slit length, or filters.

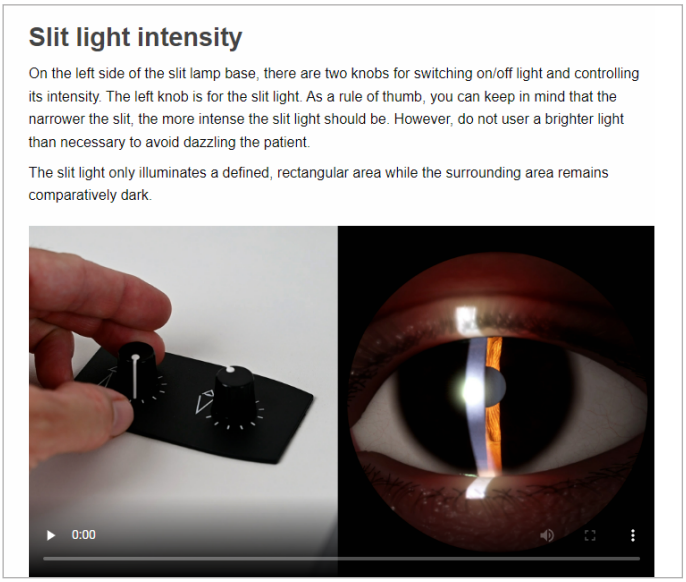


Fig. 11: Screenshot from the online task

2.1.4 Observation system

This online task explains how to set the microscope arm and its related features to get images at the required angle and magnification.

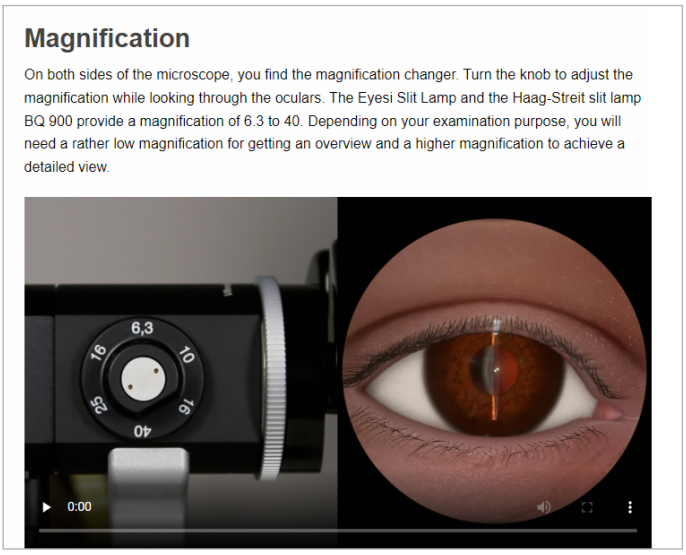


Fig. 12: Screenshot from the online task

2.2 Basic light microscopy (learning) | simulator course

2.2.1 Eyepiece adjustment

This case helps you to adjust the microscope to your eyes. You will only see a black focusing rod through the microscope. In a real slit lamp, the focusing rod can be attached to the slit lamp base. The rod has a constant distance to the microscope. It is used as an aid to adjust the eyepiece distance and diopter settings.

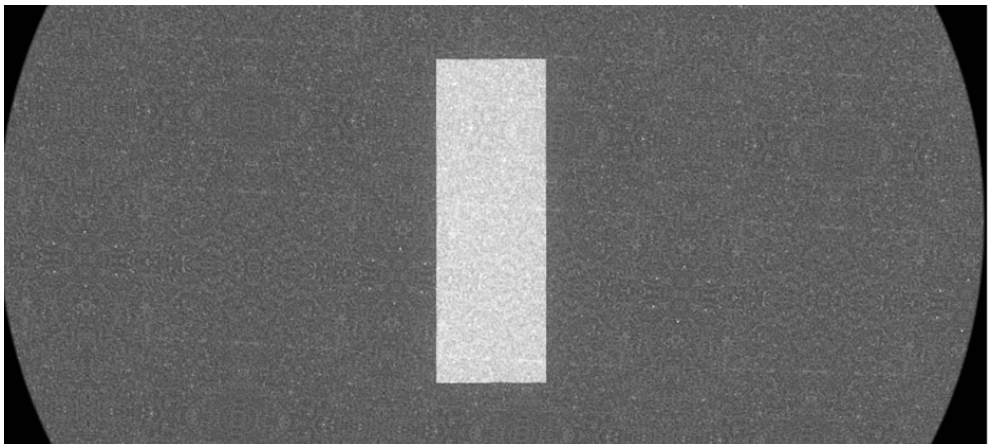


Fig. 13: Focusing rod with slit light

2.2.2 Slit light intensity

In this task, students learn how to adjust the slit light intensity.

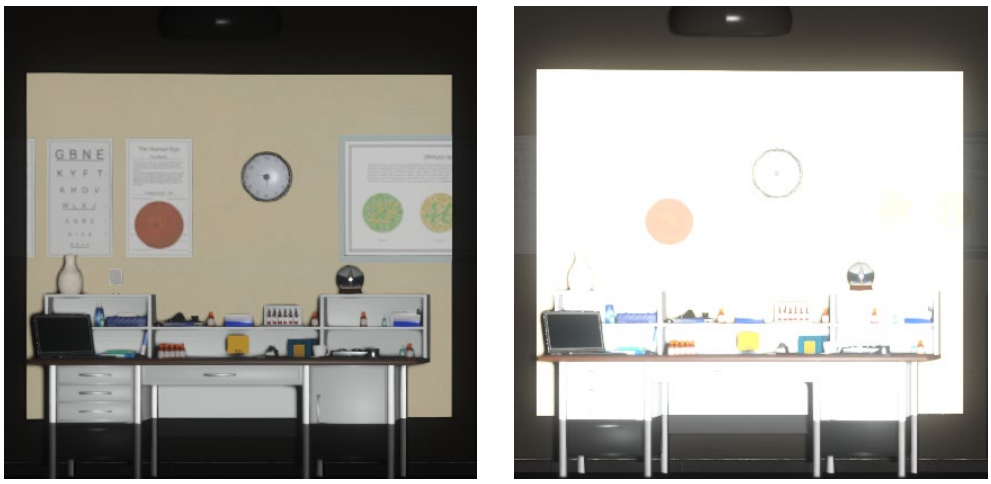


Fig. 14: The slit light illuminates the virtual doctor's office

2.2.3 Diffusor

The diffusor is a frosted acrylic glass plate that can be inserted into the light beam. On this simulator, the diffusor is activated on the touch screen. Trainees learn how to activate the diffusor and how it affects the light distribution.

Fig. 15: The diffusor distributes the slit light evenly over the whole scene.

2.2.4 Magnification

Trainees learn to use the magnification changer and increase the magnification step by step. In addition, they learn about the depth of field, which gets smaller at higher magnifications.

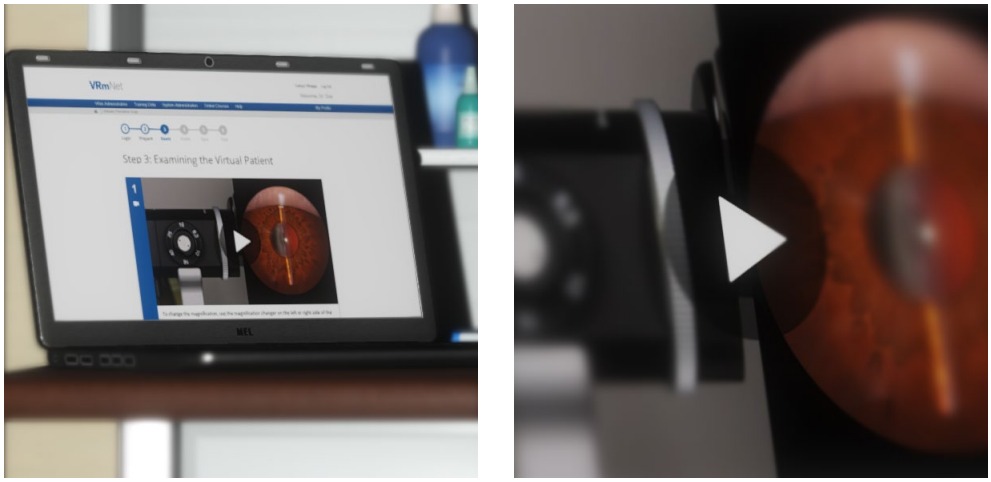


Fig. 16: Trainees look at an object with different magnifications

2.3 Navigation training (learning) | simulator course

2.3.1 Lateral translation

This task trains horizontal movements with the slit lamp. Trainees need to find objects in the office and place a marker on them. Further, they learn to move the whole slit lamp base to scan a wide area and to move only the control lever for fine movements.

Fig. 17: Marking objects with the black line

2.3.2 Vertical translation

To practice vertical movements, trainees need to rotate the control lever to move the microscope up or down and find objects on a bookshelf.

Fig. 18: Marking objects with the black line

2.3.3 Focus adjustment

The forward and backward movement of the slit lamp changes the focus. In this task, the focal plane is shown as a blue rectangle. Trainees need to bring different bottles into focus to practice focus adjustment.

Fig. 19: Bringing objects into focus

2.3.4 Navigation exercise

This task combines the X, Y, and Z movements of the previous tasks. By finding different objects in the doctor's office, students get used to moving the slit lamp laterally and vertically and focusing on objects.

Fig. 20: Focusing on different objects with a cross-hair

2.4 Slit light adjustment (learning) | simulator course

2.4.1 Slit width

In this task, trainees learn how to adjust the slit width, when to use wide and narrow slit widths, and how to set the light intensity accordingly.

Fig. 21: Setting the slit light to different widths

2.4.2 Slit length

Trainees have to set the slit length to adapt to the height of objects displayed on a diagram. The slit lamp scale above the setting screw is used to measure objects displayed on a laptop screen.

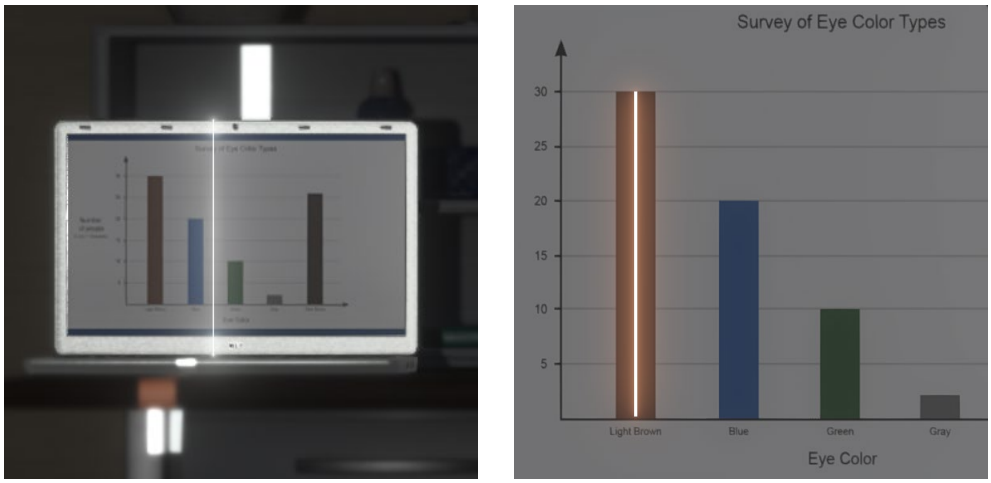


Fig. 22: Setting the slit length to defined values

2.4.3 Slit rotation

Trainees learn to rotate the slit to defined angles. The rotated slit may be used to measure angles and widths or, in gonioscopy, to keep the slit image vertical while rotating the mirror lens.

Fig. 23: Rotating the slit on a clock scale

2.4.4 ND filter

With the ND gray filter, the light can be fine-tuned in the lowest intensity range to find a setting that is not too bright for the patient but bright enough to make out the details. Students learn to use this filter by means of a Pelli-Robson contrast sensitivity chart.

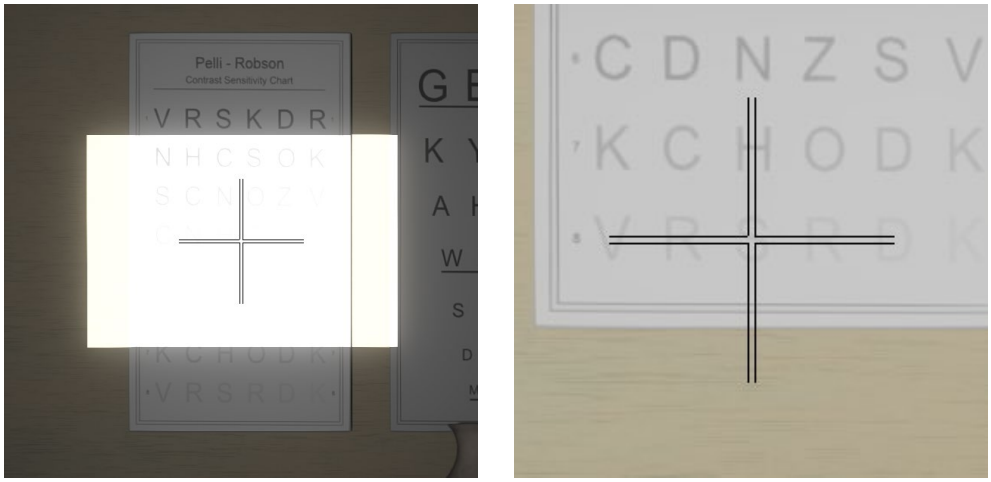


Fig. 24: Using the ND filter

2.4.5 Red free filter

The red-free (= cyan) filter blocks the red wavelengths from the slit light, transmitting only the green and blue portions. Trainees learn how to use the filter, which effects it has, and when it is useful, for example, when examining blood vessels on the retina.

Fig. 25: Exploring the effects of the red-free filter

2.4.6 Blue and yellow filter

Trainees get to know the blue and yellow filters of the slit lamp. They can try out how the blue filter increases the visibility of fluorescein ink on a yellow card. Further, they can see how the yellow filter further increases contrast.

Fig. 26: A yellow note with fluorescein ink viewed without and with cobalt blue filter

2.5 Illumination and viewing direction (learning) | simulator course

2.5.1 Microscope arm rotation

By looking at a coffee mug from different perspectives, students practice how to rotate the microscope arm. They learn how the microscope rotates around its common focus with the slit light. Further, the base locking screw is introduced, which prevents the slit lamp from moving.

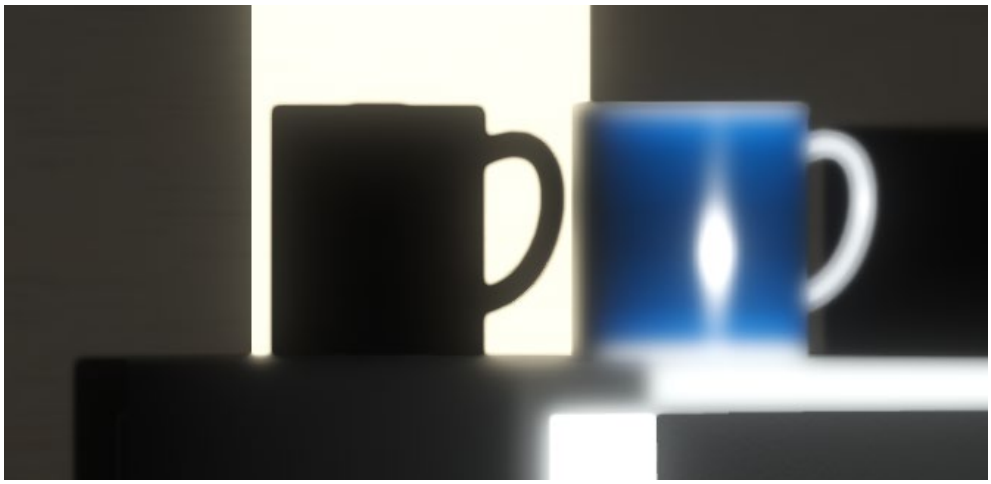


Fig. 27: Viewing the mug from the side reveals its shadow on the wall behind

2.5.2 Illumination arm rotation

The coffee mug is used again to introduce the effects of rotating the illuminating arm. Trainees learn how to set the slit light to defined angles and how a narrow slit viewed from the side emphasizes the three-dimensional contours of an object.

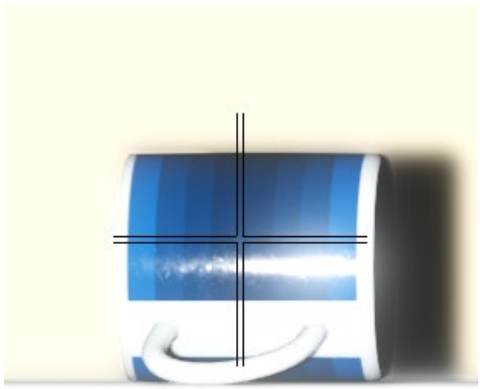


Fig. 28: Changing the angle of a narrow slit reveals the curvature of the mug

2.5.3 Illumination angle

The angle formed by microscope and illumination arm is called illumination angle (independent of the positions of the two arms). By examining a snow globe and changing the illumination angle, trainees learn how to form an optical section.

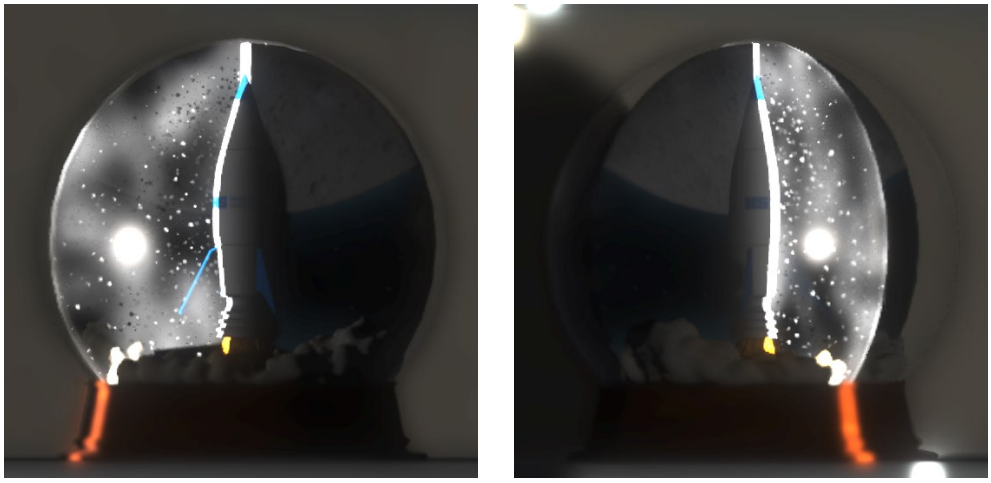


Fig. 29: Creating an optical section by choosing suitable illumination angles

2.5.4 Decentering

In this task, students use the light reflected from the wall to illuminate a slide from behind (retroillumination). Students learn how to decenter the light focus to retroilluminate objects while keeping them in the center of the microscope.

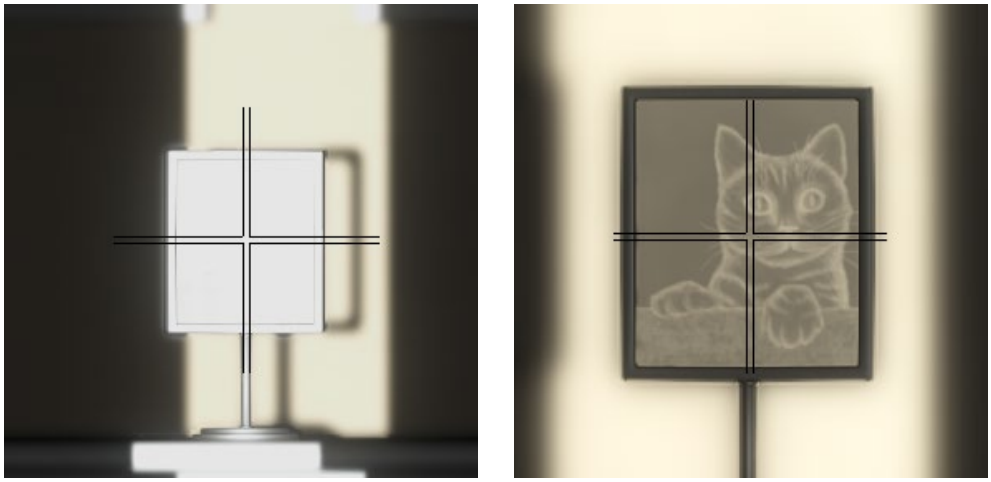


Fig. 30: By decentering the slit lamp, a slide can be illuminated from behind

2.5.5 Slit light inclination

In this task, trainees learn how to tilt the slit lamp by examining the coffee mug again. Further, they will create a horizontal optical section in the snow globe. In gonioscopy, a horizontal optical section is helpful to examine the nasal and temporal chamber angle.

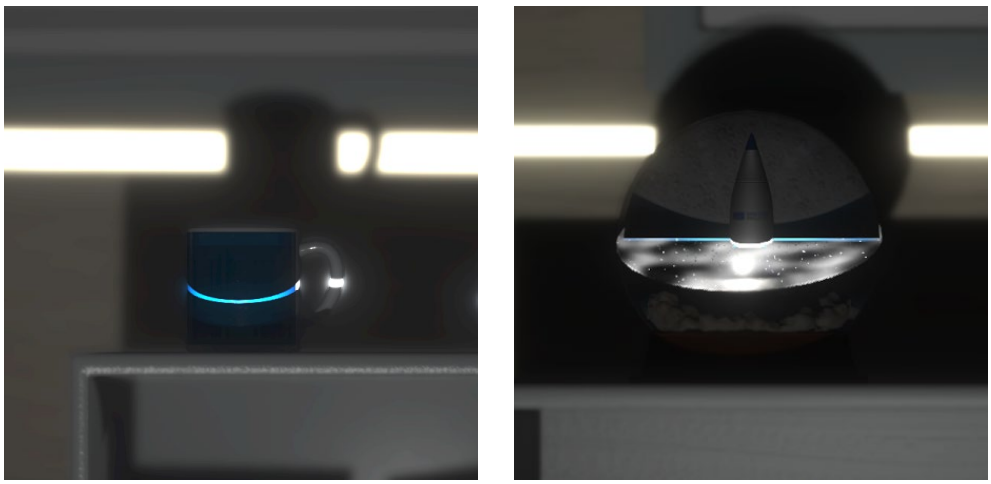


Fig. 31: Inclining the illumination arm with a horizontal slit

2.6 Background and diffuse illumination | simulator course

2.6.1 Background illumination intensity

Trainees use the background light of the slit lamp in this task as an addition to a narrow slit on a vase. The background illumination provides context and orientation in the scene.

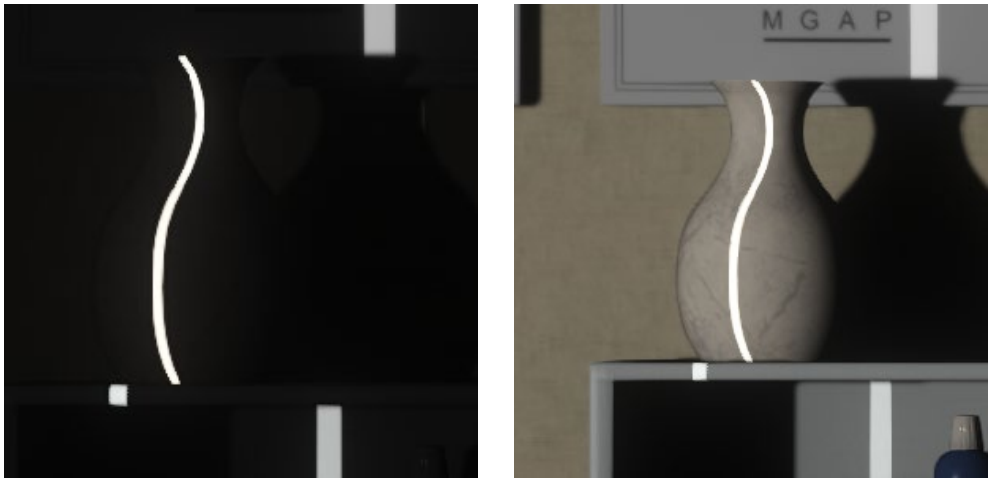


Fig. 32: The background illumination provides a better overview while the slit light is still visible

2.6.2 Background illumination blue filter

A blue excitation filter is also available for the background illumination, similar to the slit light. Trainees use the blue filter to find and mark fluorescent objects in the office scene.

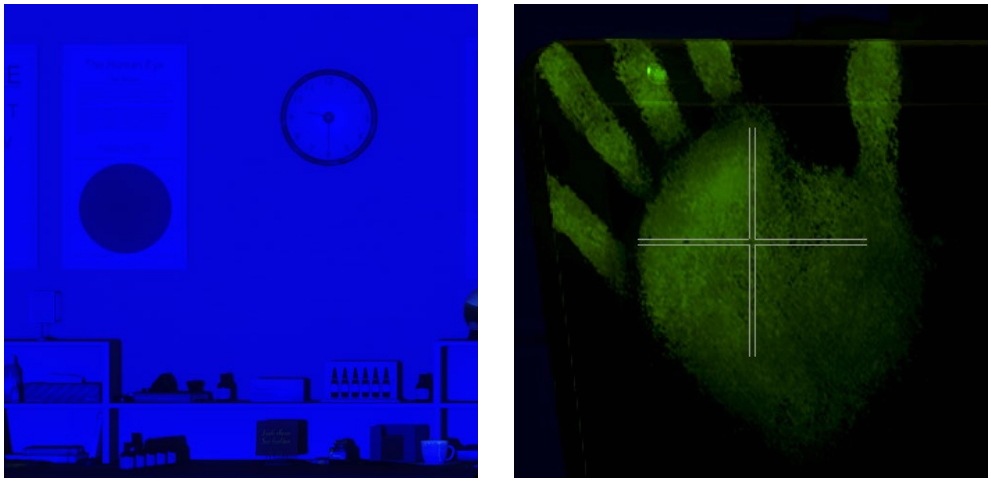


Fig. 33: Looking out for fluorescent objects in the doctor's office

2.6.3 Diffuse illumination

In this task, trainees learn to generate diffuse illumination by combining the slit light with the diffusor or by using the background illumination. The brightness level can be set by changing the slit width and length. The diffuse illumination provides an overview of the external and anterior eye.

Fig. 34: Diffuse illumination of different brightness levels

3 Tier A2: Illumination techniques

The basic skills tier A2 introduces the optical phenomena of reflection, refraction, scattering, and absorption and teaches how to use them on the slit lamp to visualize transparent material. The most common illumination techniques, for example, optical section or specular reflection, are explained. Currently, A2 contains an online course and four simulator courses (to be extended).

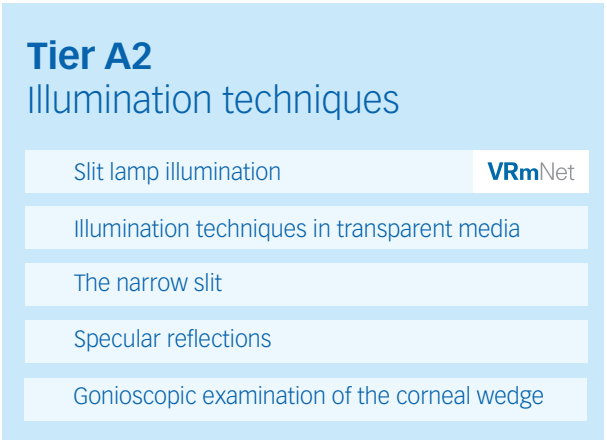


Fig. 35: Courses of tier A2; courses marked with "VRmNet" are online courses.

3.1 Slit lamp illumination | online course

3.1.1 Physics of light

This online task introduces the basic behavior of light (absorption, reflection, scattering, refraction) to better understand the slit lamp and the illumination techniques used to examine the eye.

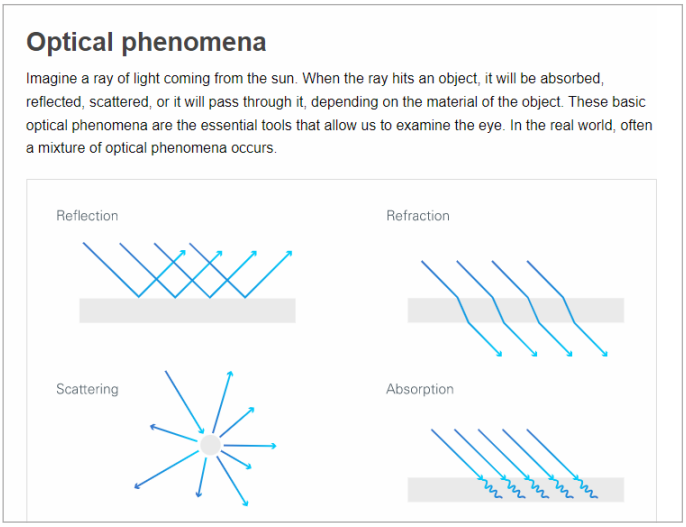


Fig. 36: Screenshot from the online task

3.1.2 Illumination techniques

This online task explains how to set up the slit lamp to translate the four optical phenomena into illumination techniques useful for common examination purposes.

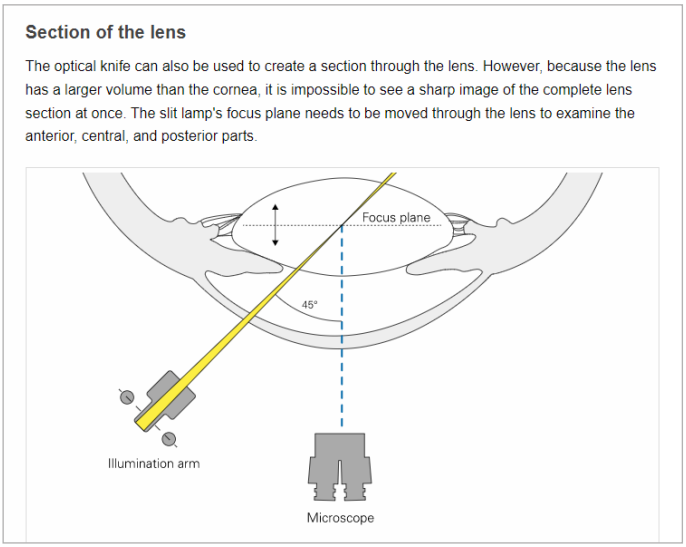


Fig. 37: Screenshot from the online task

3.2 Illumination techniques in transparent media (learning) | simulator course

3.2.1 Scattering

Through the microscope, trainees can see an abstract scene with a flat glass panel in front of a checkerboard pattern. The space in between is filled with light scattering particles. Trainees make the particles become visible through a large illumination angle and a narrow slit.

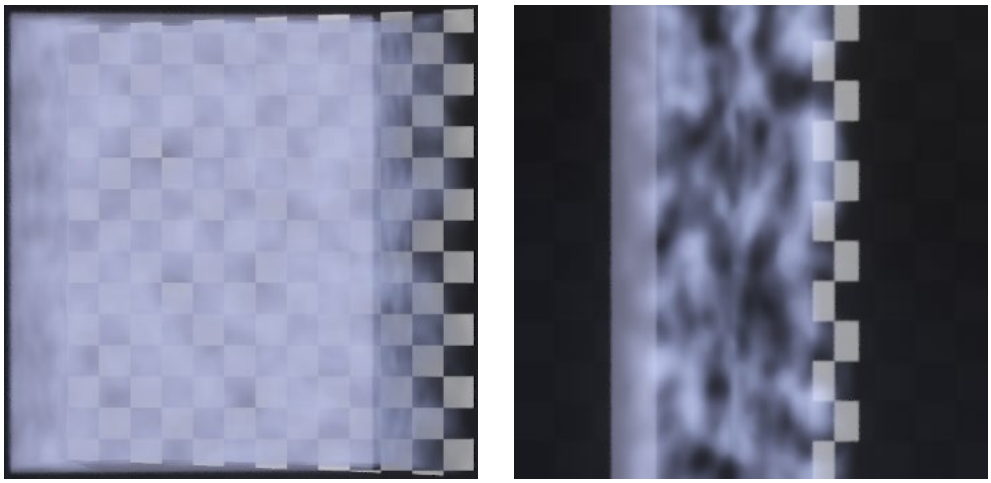


Fig. 38: Light-scattering particles

3.2.2 Specular reflection on flat surface

Trainees learn how to create a specular reflection of the slit light on a glossy, flat surface. The reflection makes the surface become visible. On a flat surface, the reflection is visible only in one eyepiece at a time.

Fig. 39: Specular reflection with a narrow and a wide slit.

3.2.3 Specular reflection on curved surface

A specular reflex has to be created on a curved surface, a glass hemisphere. The task serves as a preparation for creating the reflex on the cornea. Students learn how the light on a curved, reflective surface behaves differently in contrast to a flat surface.

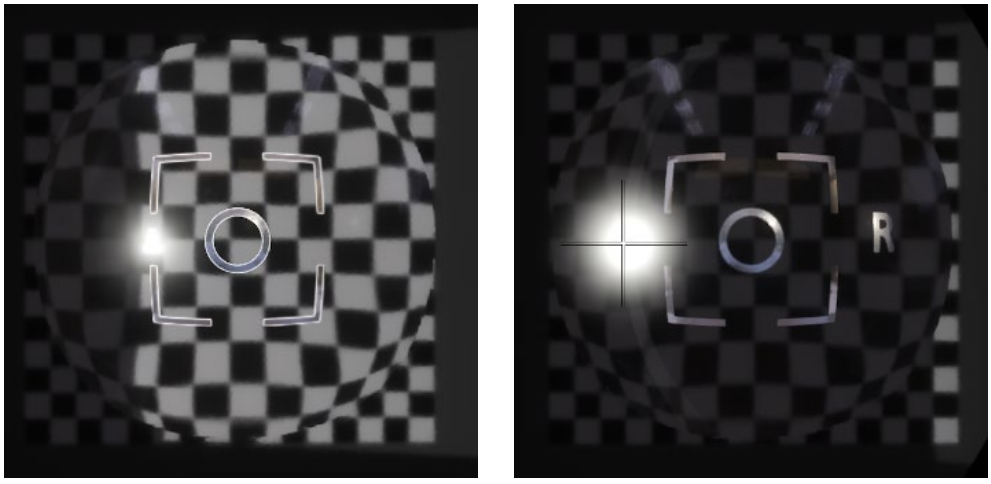


Fig. 40: Specular reflection on a curved surface

3.2.4 Refraction at raindrops

This task illustrates how transparent objects (in this task, raindrops on a glass surface) can be made visible by taking advantage of their refractive properties. With retroillumination, the raindrops act as microlenses that create an image of the illuminated scene behind. If the scene is distinctive enough, like the light-dark border in this case, refracting transparent objects become visible.

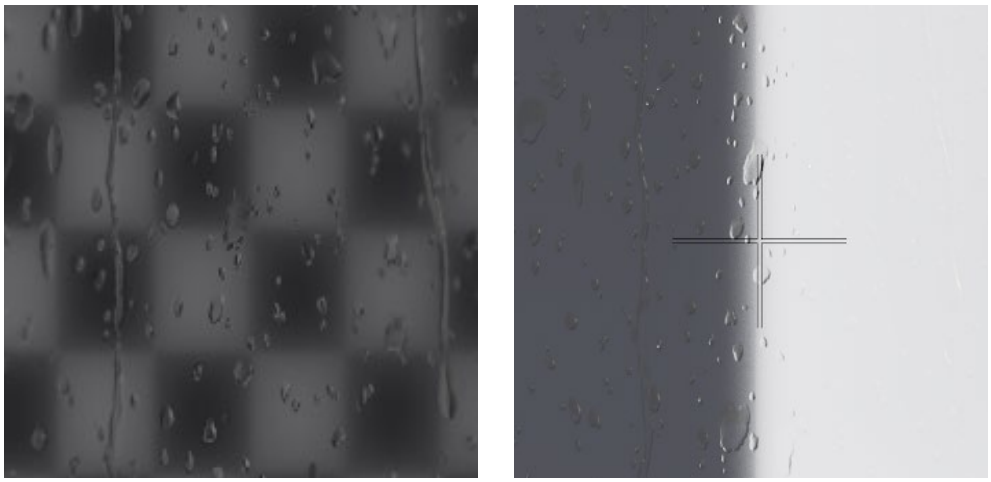


Fig. 41: Raindrops seen under direct (left) and retroillumination (right)

3.2.5 Refracting spheres

This task shows two transparent spheres floating in water. One of the spheres has a higher refractive index, the other a lower refractive index than water. Trainees use direct illumination and retroillumination to examine the spheres and detect the differences. The sphere with the higher refractive acts as a converging (magnifying) lens and inverts the image, while the other sphere behaves the opposite way.

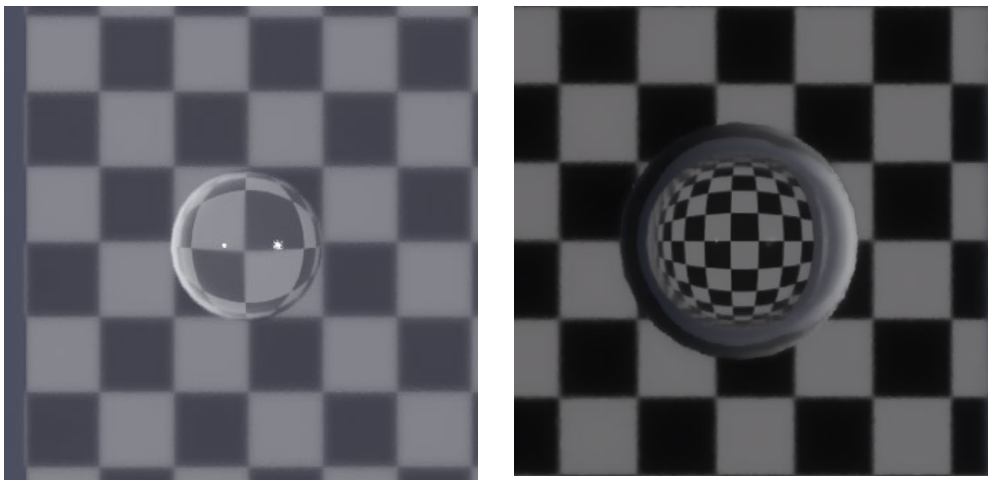


Fig. 42: Two spheres with different refractive indices

3.2.6 Absorption

The scene in this task shows three blue spheres. In direct illumination, all spheres look the same. With retroillumination, trainees discover the differences in opacity. This task demonstrates that objects may have different properties when illuminated from behind compared to direct illumination. This is useful when trying to visualize, for example, a posterior subcapsular cataract or defects in the iris.

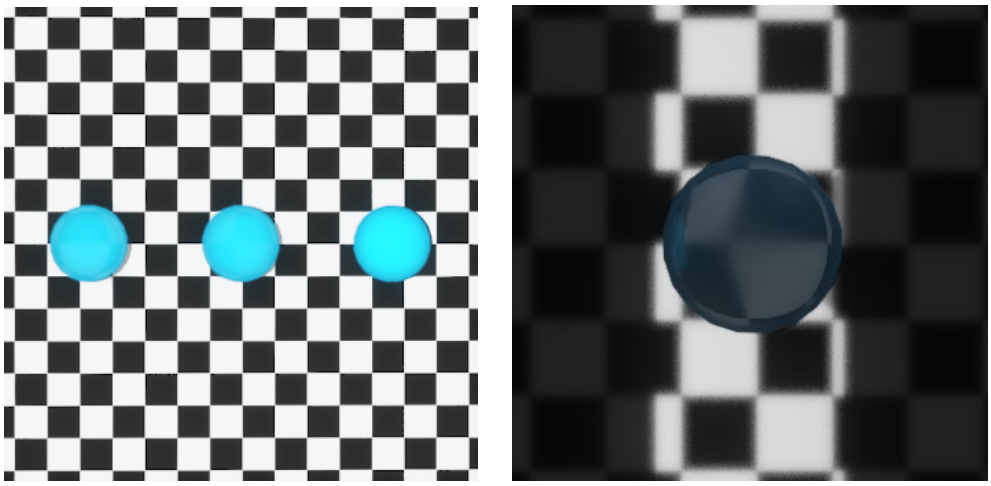


Fig. 43: The spheres have different opacities if examined with retroillumination

3.3 The narrow slit (learning) | simulator course

3.3.1 Optical section of the cornea

For the first time in the curriculum, users are introduced to a "real" human eye. Trainees will learn how to use the narrow slit to scan the cornea. By looking out for abstract markers and objects in the cornea, trainees get used to create sections in different parts of the cornea.

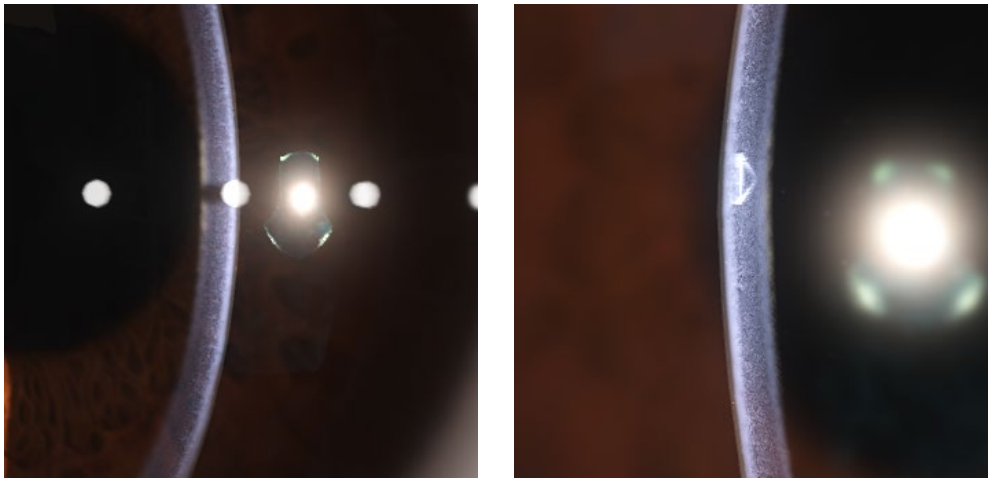


Fig. 44: Finding objects in the cornea using an optical section

3.3.2 Optical section of the lens

Forming an optical section of the lens is essential for detecting, for example, nuclear cataracts. Students learn the slit lamp setting to make use of this technique. The focus is moved through the lens, from the anterior to the posterior capsule.

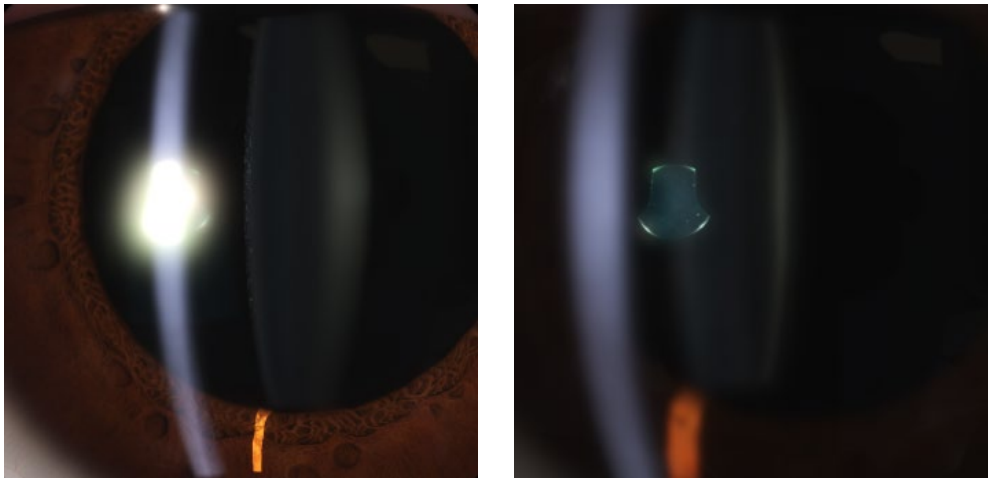


Fig. 45: Optical section of the lens with focus on anterior and posterior capsule

3.3.3 Outline of 3D objects

This task illustrates how a narrow slit can be used to reveal the shape of three-dimensional objects. By separating the illumination direction from the viewing direction, trainees learn how to interpret the shape of the slit light, for example, differentiating a depression from an elevation.

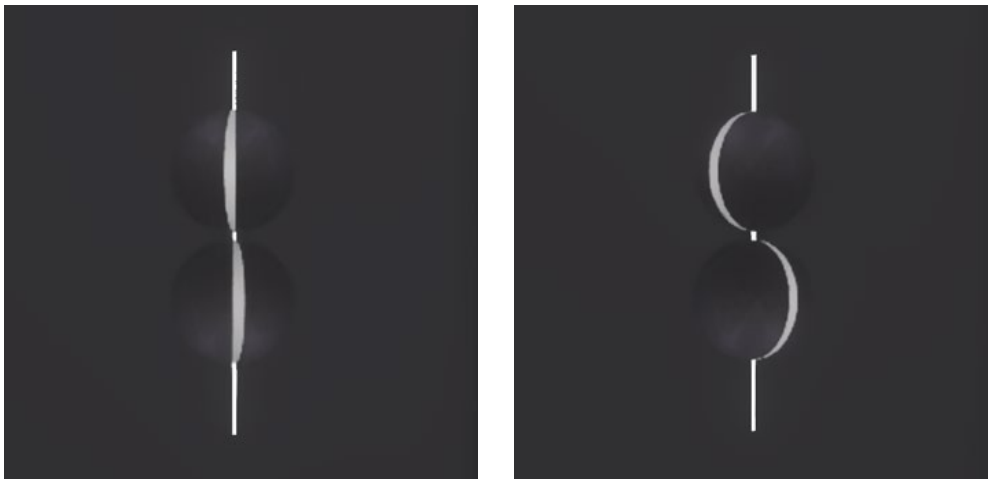


Fig. 46: A narrow slit, viewed from the side, reveals the shape of an object

3.3.4 Outline of iris

What the previous task trained using abstract objects is now applied to the human iris. Trainees will use the narrow slit to visualize the 3D shape of the iris surface. Several bumps are hidden on the iris and need to be found by the examiner.

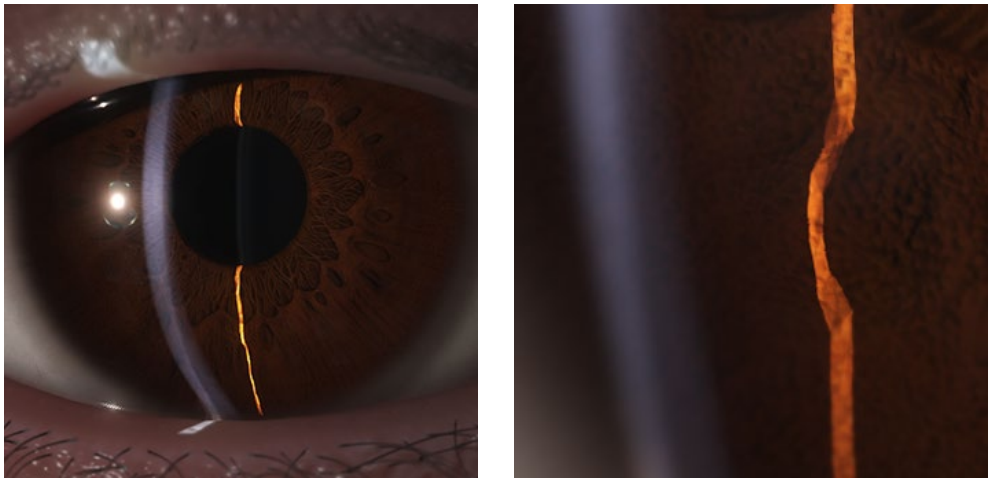


Fig. 47: Detecting irregularities on the iris using a narrow slit

3.4 Specular reflections (learning) | simulator course

3.4.1 Specular reflection on tear film

The specular reflex is an excellent tool for examining surfaces that are usually hard to see. In this task, trainees use the reflex to find a hidden symbol on the cornea and visualize the tear film on the corneal epithelium.

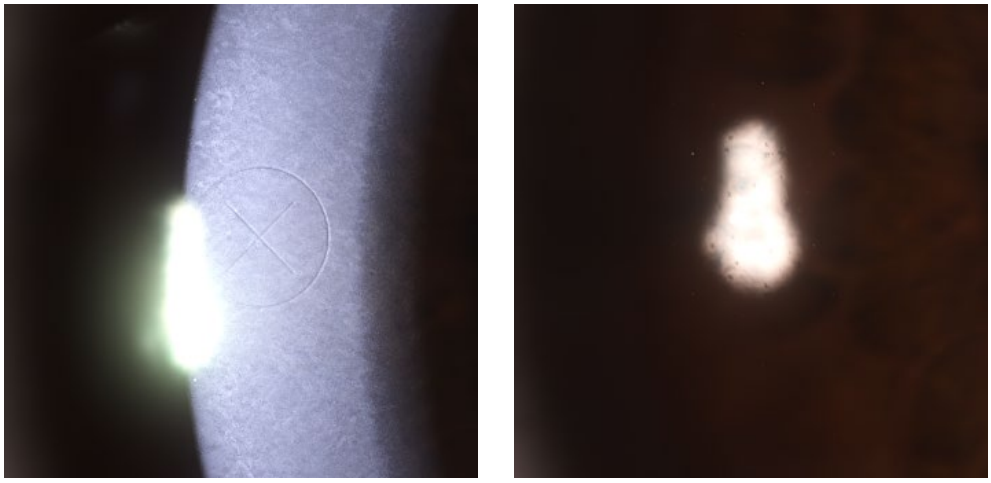


Fig. 48: Using the specular reflection to visualize the cornea surface and the tear film

3.4.2 Specular reflection on endothelium

The layer of endothelial cells on the inner cornea surface can also be examined in the specular reflex. After learning about the Purkinje images, trainees first generate a reflex on the epithelium to find a hidden symbol. Then, with high magnification, they focus on the endothelial cell layer. This technique helps detect endothelial diseases like Fuchs' dystrophy.

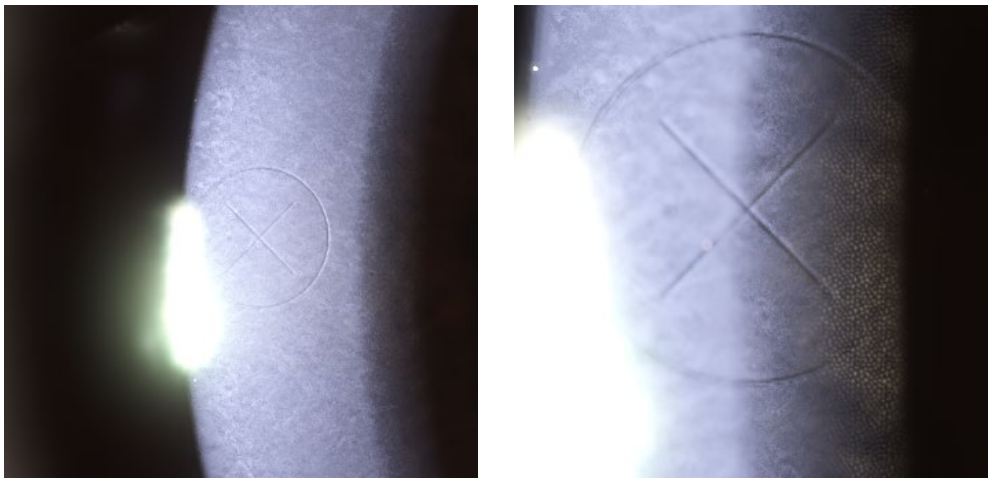


Fig. 49: Focusing on the epithelium to find a symbol (left), focusing on the endothelium (right)

3.4.3 Specular reflection on lens

In this task, a specular reflection is used to examine the surface of the lens. Students learn to create specular reflections on the anterior and posterior lens surface without blinding the patient.

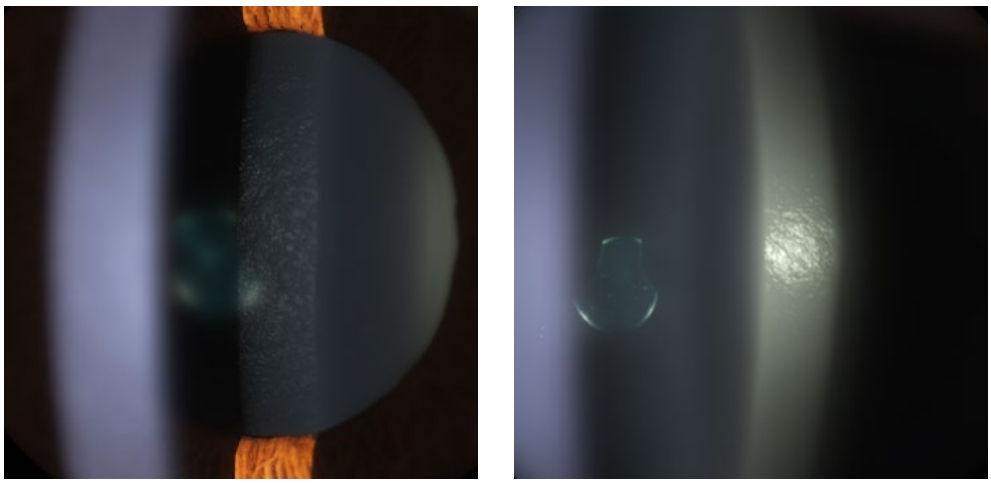


Fig. 50: Specular reflections on the anterior and posterior lens surface

3.5 Gonioscopic examination of the corneal wedge (learning) | simulator course

3.5.1 Basic gonioscopy

The trainees are introduced to the basic handling of a gonioscopy lens. They learn how to set the slit light without blinding the patient during a goniscopic examination and correctly position the gonioscopy lens on the patient model eye. By focusing on the trabecular meshwork in the chamber angle, they get a first impression of the gonioscopic examination.

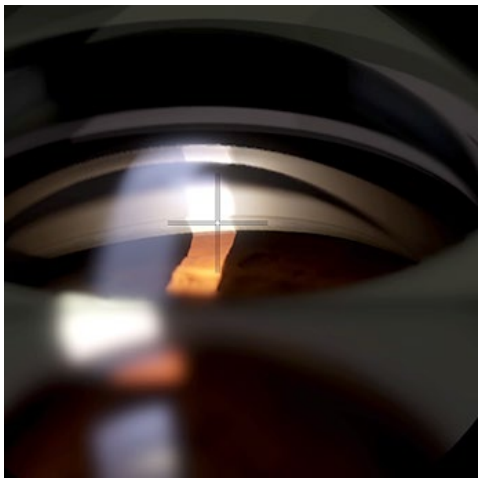


Fig. 51: Focusing on the chamber angle

3.5.2 Corneal wedge: superior, inferior

After repeating to focus on the trabecular meshwork, the examination becomes more challenging: The trainees need to use the corneal wedge technique and rotate the lens to discover Schwalbe's line in the inferior and superior segment of the chamber angle.

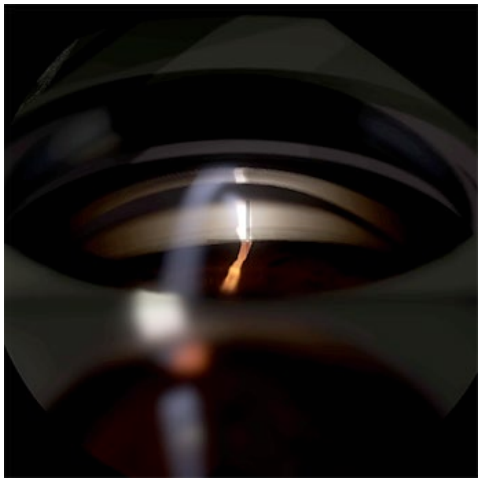


Fig. 52: Corneal wedge in the inferior segment of the chamber angle

3.5.3 Corneal wedge: nasal, temporal

The examination continues at the 3 o'clock position with the slit light upright. Then, the students visualize Schwalbe's line in the temporal and nasal chamber angle. To create the corneal wedge, the students need to rotate the slit light and tilt the illumination column.

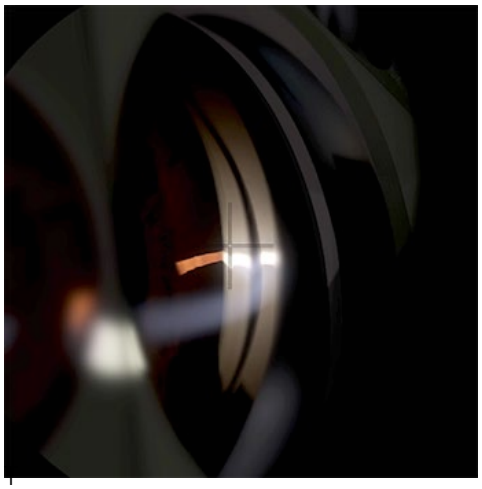


Fig. 53: Corneal wedge in the nasal segment of the chamber angle

3.5.4 Corneal wedge around the clock

A 360° gonioscopic examination provides more practice. The examination starts at the 12 o'clock position and continues in steps of 45°. This way, students learn how to create the corneal wedge in all 8 segments of the chamber angle.

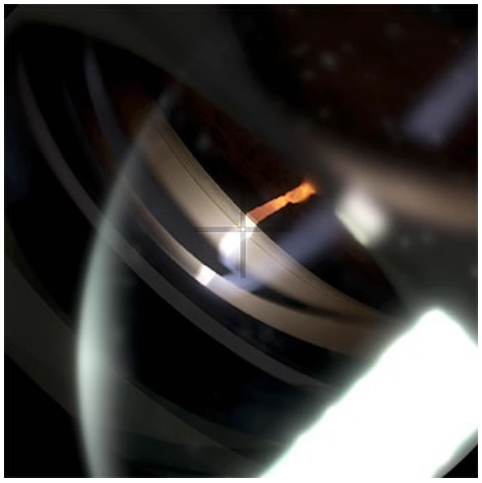


Fig. 54: Examining the corneal wedge around the clock

4 Tier B: Visualizing the healthy eye

Tier B teaches users how to use the slit lamp to visualize specific anatomical structures of the healthy eye. Trainees are presented with variations of normal eyes, such as different iris pigmentations, retina pigmentations, or chamber angle structures.

INFO	**Tier B to be extended**
Tier B currently contains two simulator courses. More training content will be added in the next software releases.	

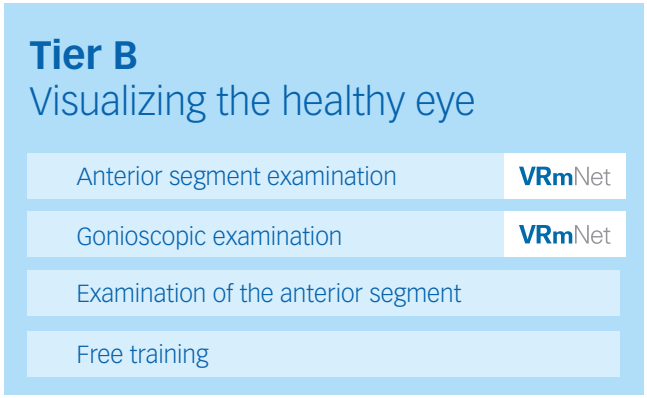


Fig. 55: Courses of tier B; courses marked with “VRmNet” are online courses.

4.1 Anterior segment examination | online course

4.1.1 Anatomy of the eye

This online task reviews the most important anatomical features of the eye.

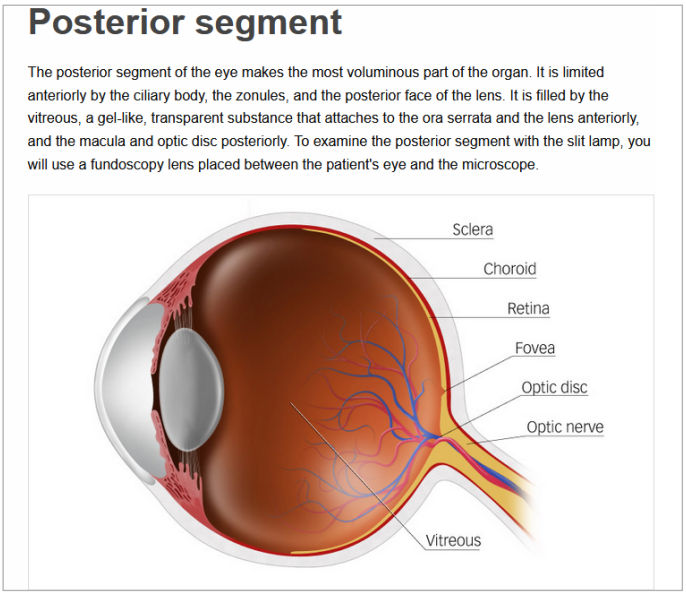


Fig. 56: Screenshot from the online task

4.1.2 Introduction to the slit lamp examination

This online task introduces the basic principles and steps of the slit lamp examination.

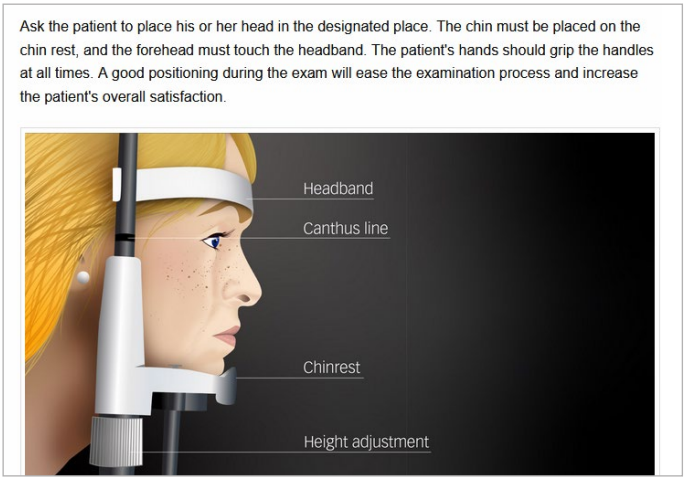


Fig. 57: Screenshot from the online task

4.1.3 Examination procedure

This online task explains how to examine the anterior segment of the eye using only the slit lamp microscope.

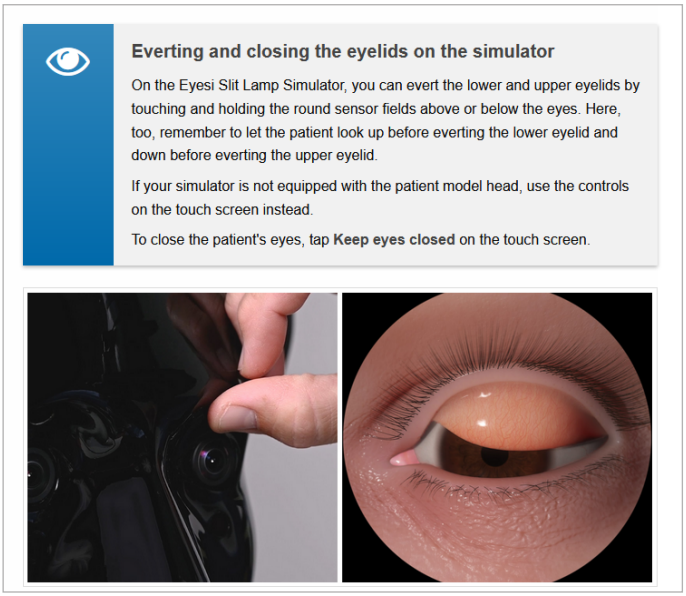


Fig. 58: Screenshot from the online task

4.2 Gonioscopic examination | online course

4.2.1 Introduction and angle anatomy

Trainees will review the most important anatomical features of the anterior chamber angle and the different ways of examining it in this online task.

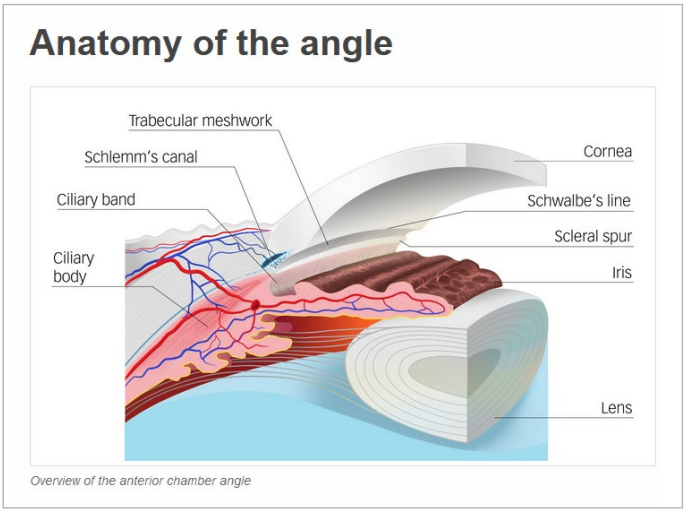


Fig. 59: Screenshot from the online task

4.2.2 Examination procedure

In this online task trainees learn how to perform a gonioscopic examination with the Goldmann lens.

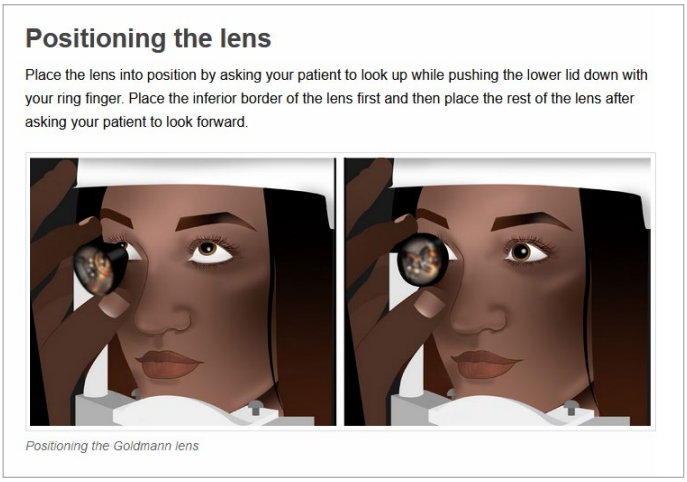


Fig. 60: Screenshot from the online task

4.3 Examination of the anterior segment | simulator course

4.3.1 Anterior segment: basic examination (OD)

This basic examination provides an overview of the anterior eye segment, such as the eyelids, the iris, the conjunctiva, or the cornea. Trainees start with a basic routine examination of the right eye and continue by using more advanced exam techniques.

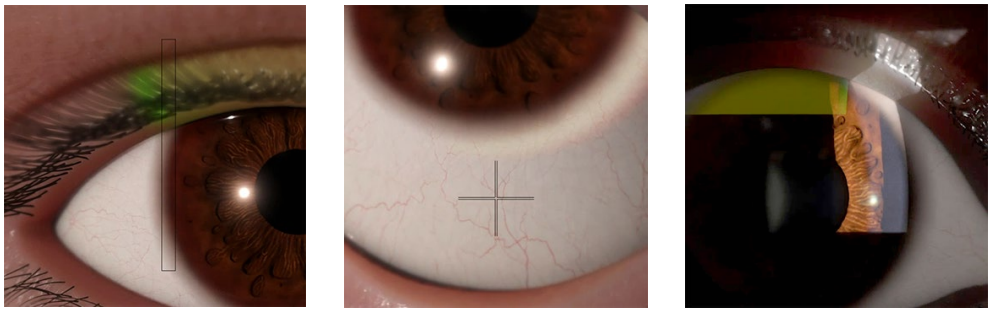


Fig. 61: Examining the anterior eye segment: upper eyelid, conjunctiva, and corneal epithelium

4.3.2 Anterior segment: basic examination (OS)

Trainees repeat the same targets as in the previous task, but on the left eye.

4.4 Free training | simulator course

4.4.1 Healthy patient

Trainees may use this task to apply their new skills and freely explore a healthy eye with the slit lamp microscope, the fundoscopy lens, or the gonioscopy lens.

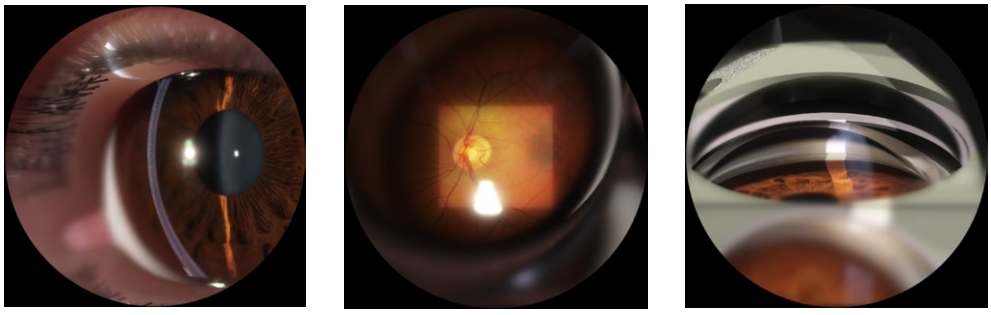


Fig. 62: Examining the healthy eye with the biomicroscope, fundoscopy lens, and gonioscopy lens

5 Tier C1: Findings and diagnoses

This tier presents virtual patients with different pathologies of the anterior and posterior segment.

Fig. 63: Courses of tier C1

Simulator courses (learning mode)

In the learning courses, virtual patients present with disorders of the human eye. Trainees will get to know the typical signs and symptoms of the shown condition. The simulator guides trainees through the examination by showing the required slit lamp settings and highlighting pathological signs in the stereo microscope.

Simulator courses (exam mode)

The exam courses present the virtual patients from the learning courses in random order. Trainees are asked to detect suspicious signs and specify their findings in a multiple-choice form without guidance from the simulator.

5.1 Lids and lashes (learning) | simulator course

5.1.1 Trichiasis

Patient history

The patient complains about a foreign body sensation in his left eye. It started three days ago and feels like something is rubbing against his eye, especially while blinking. He also noticed watering of the left eye.

Disorder

No slit lamp is needed to find the reason for the patient's discomfort: In the lower left eyelid, one single eyelash is pointed towards the eye and rubs on the cornea when blinking. No other findings such as conjunctivitis or corneal injury are visible.

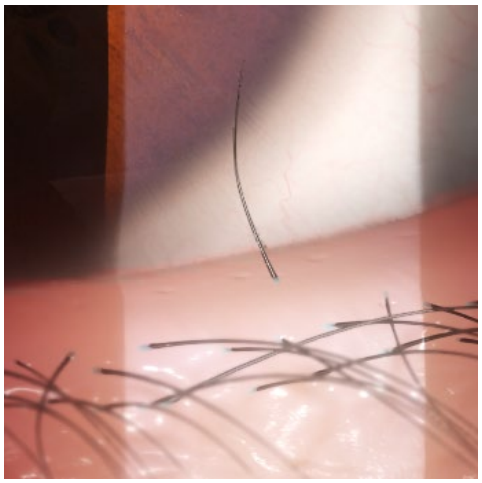


Fig. 64: Eyelash rubbing on the cornea

5.1.2 Trichiasis with corneal erosions

Patient history

The patient complains about a foreign body sensation in his right eye. It started three days ago and feels like something is rubbing against his eye, especially while blinking. He also noticed watering of the right eye.

Disorder

No slit lamp is needed to find the reason for the patient's discomfort: In the center of the lower right eyelid, some eyelashes are pointed towards the eye and rub on the cornea when blinking. The patient also shows conjunctivitis and corneal erosions.

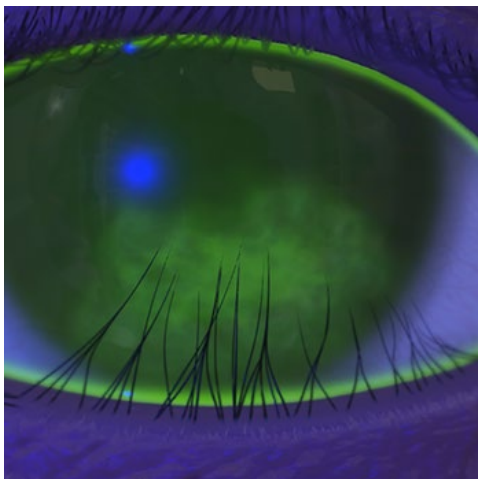


Fig. 65: Corneal erosions seen with fluorescein and cobalt blue light

5.1.3 Ectropion

Patient history

A patient comes to your office for visual examination. He suffered a car accident one year ago, which left scars on his face and right eye. Since then he cannot close his right eye completely. This has been causing watering and irritation of the eye.

Disorder

On examination, you can see that the skin of the face still shows the effects of the accident. There is a visible asymmetry of the mouth and eyes due to several scars on that side. As you ask the patient to close his eyes, you can see that the eyelids do not close completely. On slit lamp examination you see that the inferior eyelid has turned outwards due to the scar.

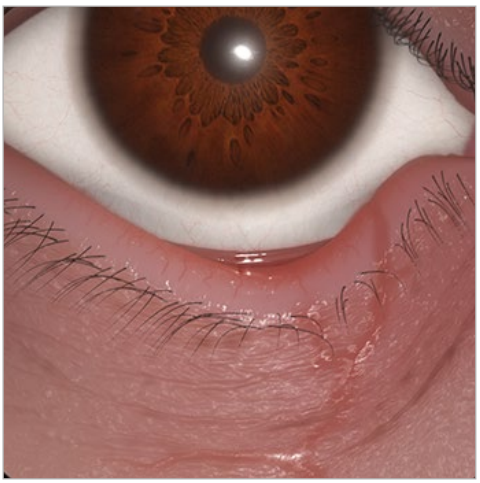


Fig. 66: Ectropion with scar

5.1.4 Molluscum contagiosum

Patient history

The patient tells you that she has a group of small yellowish spots on the skin near her eye which appeared 5 days ago. Some of them are on her eyelids, which bothers her a lot. The spots are not painful. The main problem is that they itch and she wants to scratch them sometimes. She has already scarred some of them. About two days ago she started experiencing irritation in both eyes and blurred vision.

Disorder

You examine your patient very carefully because she is a little nervous. You find a group of small, pearly nodules surrounding the eyelids in both eyes. The nodules are around 1 mm in diameter. The nodules are yellowish and some present a central depression. Some lesions are on the eyelids in both eyes.

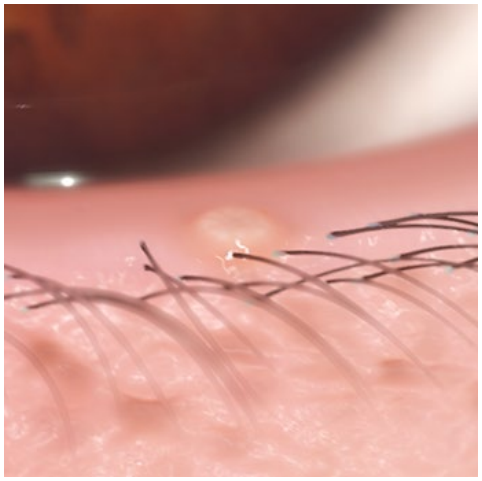


Fig. 67: Nodule on the lower eyelid

5.1.5 Anterior blepharitis (staphylococcal)

Patient history

The patient has a history of recurrent anterior blepharitis, an inflammation of the eyelids. Especially in the mornings, she suffers from burning eyes, crusty debris on her eyelashes, and a foreign body sensation.

Disorder

The debris sticking to her eyelashes is clearly visible. You can see that the conjuntiva is injected in both eyes and that the eyelids are edematous and reddened (blepharitis).

Fig. 68: Collarettes on the upper lid

5.1.6 Anterior blepharitis (seborrheic)

Patient history

The patient has a history of recurrent anterior blepharitis, an inflammation of the eyelids. Especially in the mornings, she suffers from burning eyes, crusty debris on her eyelashes, and a foreign body sensation.

Disorder

The debris sticking to her eyelashes is clearly visible. You can see that the eyelids are edematous and reddened (blepharitis).

Fig. 69: Sebum deposits on the lower lid

5.2 Conjunctiva (learning) | simulator course

5.2.1 Pinguecula

Patient history

A middle-aged man presents in your office with a "yellow patch" in the corner of his right eye. He says he first noticed it two years ago, but it did not seem to grow fast and it did not cause any problems. Still, he would like to know what it is and if it can be removed. You have a suspicion and ask him how much time he spends outside. He answers that he loves being outdoors, for example skiing in winter and driving his motor yacht during summer.

Disorder

Even before starting the slit lamp examination, you can see a small area of yellowish tissue on the conjunctiva, located nasally of the limbus. Through the slit lamp you can see that the tissue is slightly elevated and sharply demarcated, and that it does not look inflamed. As the patient is exposed to intense sunlight quite a lot, this yellow patch is most probably a pinguecula.

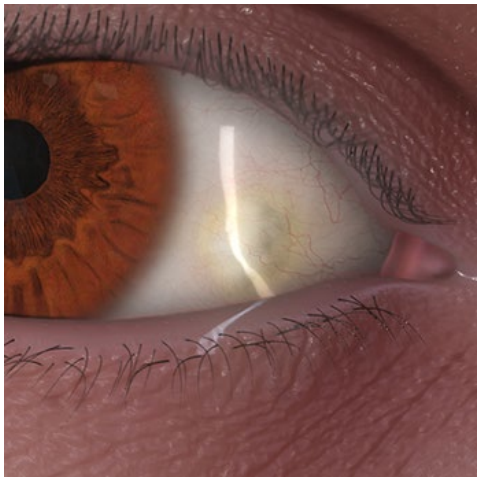


Fig. 70: Pingueculum

5.2.2 Pterygium

Patient history

A middle-aged farmer comes to your office and complains about a strange "skin" growing on his left eye. Until now, he ignored it because it did not cause any trouble. But it keeps growing, and some weeks ago his eye started to feel irritated, as if he had a foreign body in his eye. He also has the impression that his vision has become distorted. Apart from that, he does not like the way it looks. As a farmer, he spends most of his day outside. He does not like wearing sunglasses, as they would only get in his way or break while working.

Disorder

Even before looking through the slit lamp, you can see conjunctival tissue growing from nasal direction about 4 mm onto the cornea. The tissue looks fleshy, has a yellowish color and is well-vascularized. The shape is triangular, with the apex advancing onto the cornea. Considering his job as a farmer and his dislike of sunglasses, a pterygium is the most likely diagnosis.

Fig. 71: Pterygium growing onto the cornea

5.2.3 Molluscum contagiosum (conjunctival lesion)

Patient history

A young patient comes to your office. He complains that his right eye has been red and watering for four days. He feels "something" inside his eye which forces him to rub it constantly. A group of lesions occurred around his eyes and face about 6 days ago. Some of these lesions are on the eyelids. Recently, he has been feeling that his vision was a little foggy.

Disorder

In the eye examination you can see umbilicated nodular lesions on the skin around the eye. Some are on the border of the eyelid in both eyes. With higher magnification, you can see that these lesions are papular and have a characteristic depression in the center. The most relevant finding is an intraocular lesion on the right eye. It is about 3 mm in diameter, round, elevated, and has a dark yellow color. It is located on the sclera near and can be seen close to the lateral cantus.

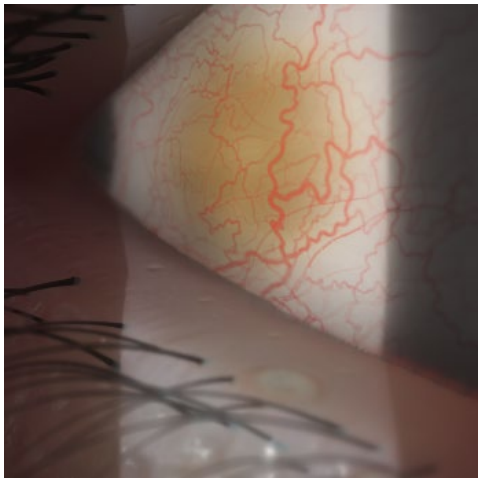


Fig. 72: Conjunctival lesion

5.2.4 Trachoma

Patient history

You see this patient during a medical mission to the Siha district in northern Tanzania. The patient complains about almost permanent tearing in both eyes, accompanied by an occasional mucopurulent discharge. Lately, she also feels a constant discomfort, like sand in her eyes which she attributes to the smoke from cooking with wood. She has had these symptoms several times in the past and has received an unknown medication for it from the community healthcare worker.

Disorder

During the examination it is possible to see some blurring of the peripheral cornea, especially in the upper limbus. This blurriness is interrupted by some depressed spots in the corneal tissue. When everting the eyelids, it is possible to see the signs of follicular conjunctivitis in both eyes. The left eye also presents signs of scarring, and the inflammation is intense.

The World Health Organisation grades trachoma into five stages. Trachomatous scarring (TS) is diagnosed when scars appear in the tarsal conjunctiva.

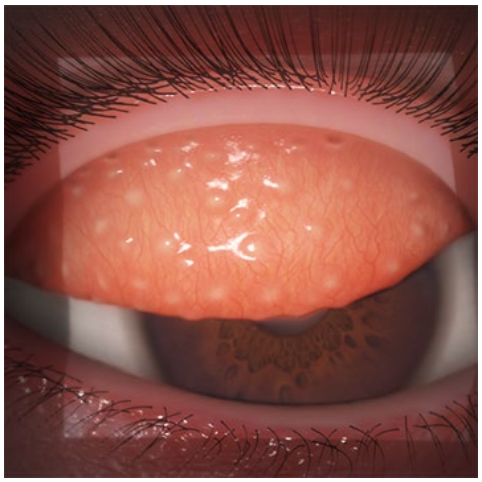


Fig. 73: Follicular conjunctivitis on the upper lid

5.3 Cornea (learning) | simulator course

5.3.1 Herpes simplex

Patient history

This woman presents with blurred vision, a foreign body sensation, and light sensitivity in her right eye. She has a history of herpes simplex infection: recurrent cold sores on lips and a probably related conjunctivitis in the left eye as a child with blisters on the eyelid.

Disorder

Through the slit lamp, you can see an almost transparent, branch-like lesion on the cornea surface of the right eye. This type of lesion is called dendritic ulcer. Dendritic ulcers are the characteristic sign for a corneal epithelial infection with the herpes simplex virus (HSV). The condition is called herpes simplex keratitis and is a major cause of blindness worldwide.

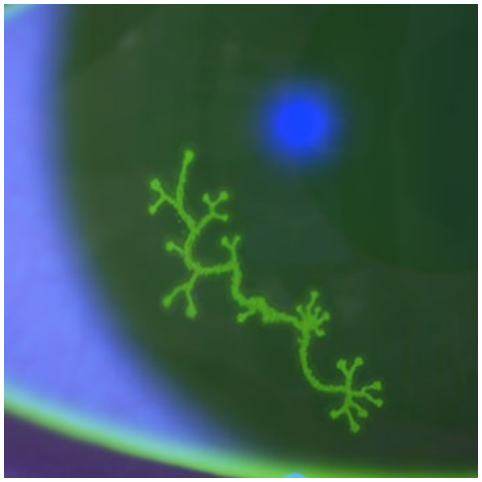


Fig. 74: Dendritic ulcer

5.3.2 Herpes zoster

Patient history

A female patient comes to your office complaining about pain in her right eye that spreads to the ipsilateral forehead. It started 4 days ago as a tingling sensation on the forehead that has progressed into a burning pain. She also tells you that she has swelling on her eyelids and redness in her right eye. Her vision has progressively deteriorated in the right eye during these last days and she feels pain and discomfort with light.

Disorder

During physical examination you discover mild hyperesthesia over your patient's right forehead. When you examine the skin of the forehead, you find a red patch where small vesicular lesions are present. There are several vesicular lesions around the right eye and nose. On eye examination you find conjunctival injection in the right eye.

With the use of the slit lamp and fluorescein staining it is possible to see a 7 mm branched dendritic corneal lesion. The dendritic lesion stains poorly and does not have terminal bulbs.

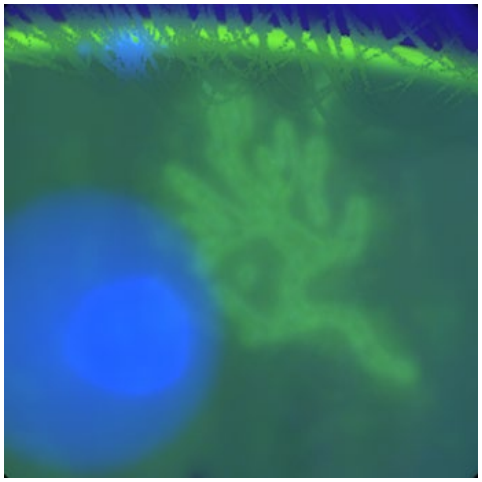


Fig. 75: Dendritic corneal lesion (h. zoster)

5.3.3 Herpes zoster with nummular keratitis

Patient history

You see an already known patient in your office. Approximately 3 weeks ago you saw this patient because of ocular pain, edema and erythema that appeared concomitantly to a vesicular skin rash around the left eye and the root of the nose. During slit lamp examination you found a dendritic lesion on the cornea. Now the patient tells you that the pain has returned in the same eye along with blurred vision, watery eyes, and sensitivity to light.

Disorder

During physical examination you can still see the scars from the vesicular rash on the left side, now resolving. During slit lamp examination you find round lesions in the anterior corneal stroma. They are a group of white opacities disseminated around the cornea. It is still possible to find the dendritic lesion.

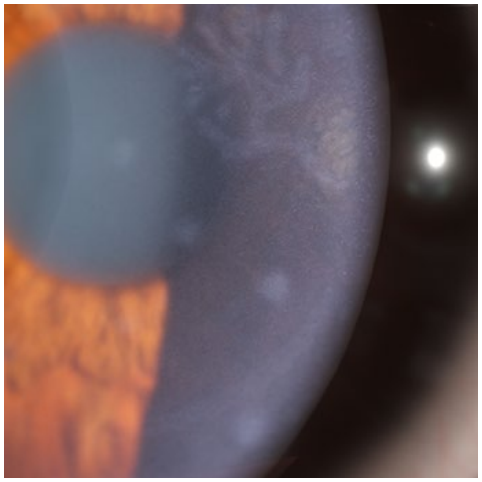


Fig. 76: Round lesions on the cornea

5.3.4 Corneal dellen

Patient history

A middle-aged man sees you for a routine eye examination. He has been without any complaints in the last year, but his left eye has been feeling a bit irritated in the last few days - nothing he would normally worry about or see a doctor for.

Disorder

The right eye looks normal in the slit lamp. In the left eye, you can see a saucer-like small dent in the peripheral cornea, near the nasal limbus. The sclera adjacent to the dent seems a bit elevated. The surface of the dent is not as smooth and glossy as the normal cornea. On the iris, you can see an abnormal light refraction (caustics) caused by the irregular shape of the affected cornea.

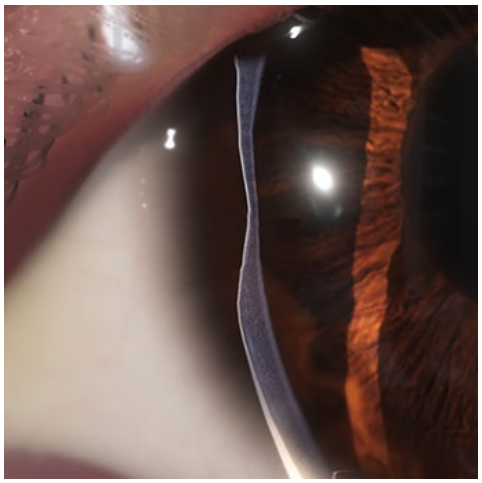


Fig. 77: Corneal dellen

5.3.5 Bullous keratopathy

Patient history

A patient comes to a control consultation. He received an intraocular lens about a week ago on his right eye. He tells you that since yesterday he has been feeling pain in his right eye, and his vision is a bit cloudy. His main complaint is a foreign body sensation in the operated eye and glare and blurriness in his vision.

Disorder

You examine the patient's eye very carefully because you know several conditions can arise during the postoperative period of cataract surgery. You find a big elevated lesion on the upper nasal quadrant of the right eye, a cloudy, edematous cornea, and a reddened conjunctiva.

Fig. 78: Elevated lesion on cornea

5.3.6 Keratoconus

Patient history

This young man presents in your office and complains about blurred vision and multiple ghost images or halos in both eyes. He does not feel irritation or pain, but he has a history of short-sightedness and astigmatism and frequently had to change glasses in the past. He has the impression that vision has decreased rather quickly in the last months.

Disorder

The slit lamp examination shows a pronounced bilateral cone shape of both corneas. The shape explains the patient's vision problems. The bulging cornea shows a thinning in the central and most anterior area. When the patient looks down, the cone-shaped cornea causes a characteristic indentation in the lower eyelid (Munson's sign).

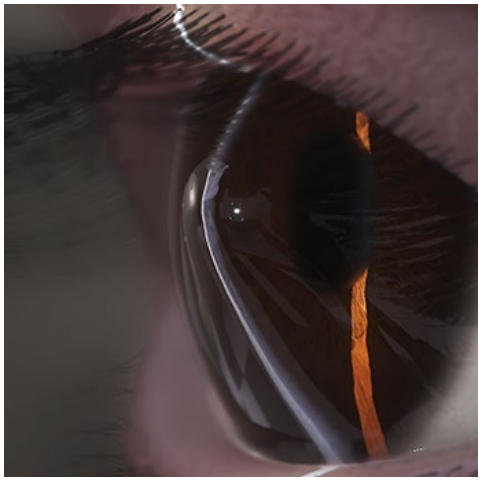


Fig. 79: Cone-shaped cornea

5.3.7 Keratoglobus

Patient history

You see this patient for the first time. He is a migrant worker and speaks your language with difficulty. He explains that he has been having very high myopia since he was a kid. Because of this, he requires very high correction glasses. He wants you to evaluate his condition and write a prescription for new glasses if necessary. During anamnesis, he explains that he has a condition that makes his joints very flexible. He shows you how far he can flex his wrists and fingers. He does not remember the name of the condition but he says it is something like Morphin.

Disorder

This is a very tall and slim patient that has long arms, legs, and fingers. During the physical examination, you perceive a quite important depression on the chest and a slight heart murmur on the mitral valve. You confirm that his joints can bend beyond normal. During the eye examination, you find a clear cornea that looks globular and protruded from the side. With the slit lamp, you evaluate the corneal thickness. The cornea of this patient is thinner than normal.

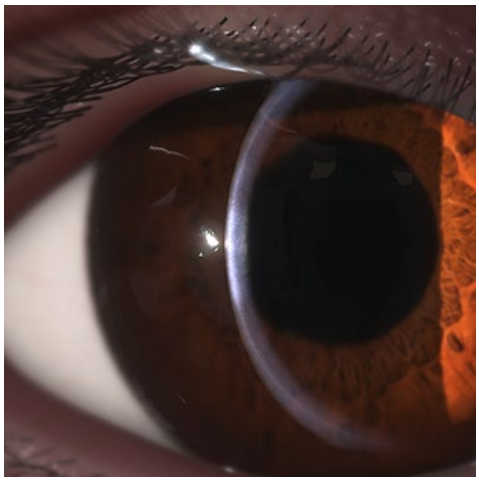


Fig. 80: Globular cornea

5.3.8 Keratoglobus with corneal hydrops

Patient history

This patient with known keratoglobus in both eyes comes for a checkup examination. The keratoglobus was diagnosed when the woman was a small child. Since then, it continuously progressed. The woman wears spectacles but still had a suboptimal BCVA the last time you saw her. Yesterday she experienced pain in the eyes and some amount of clouding.

Disorder

Keratoglobus causes the cornea to protrude in a globular shape and causes extreme corneal thinning, which you can see through the slit lamp. The condition has obviously worsened. The cornea does not only protrude, but now also has an irregularly shaped, wavy surface and still shows some clouding. Her vision must be heavily disturbed.

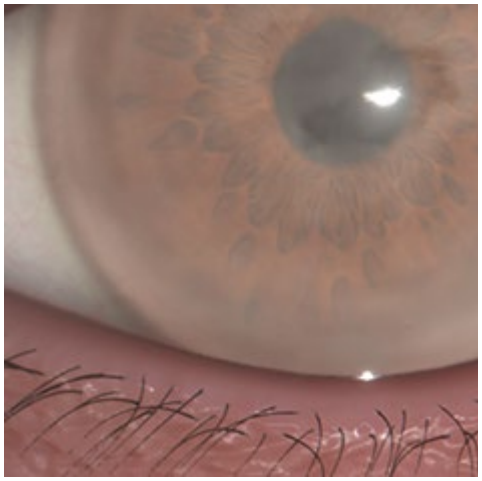


Fig. 81: Cloudy cornea

5.3.9 Fuchs' dystrophy

Patient history

This woman sees you for a routine eye examination. As you ask her about any problems, she says that generally her vision was good. Only in the last year she noticed a slight haziness in both eyes, especially in the mornings after getting out of bed. However, she did not see a reason to worry because vision always returned to normal until midday.

Disorder

As you examine the eyes and focus on the cornea, you can see small irregularities on the inner corneal surface reminding you of orange peel or beaten metal. These irregularities are called guttae, small holes in the corneal endothelium where the endothelial cells have died off. The guttae cause fluid buildup in the cornea (corneal edema), which is responsible for the hazy vision. Another effect caused by the corneal guttae is the scattering of the slit light, which is visible on the iris, and a grainy appearance of the red reflex.

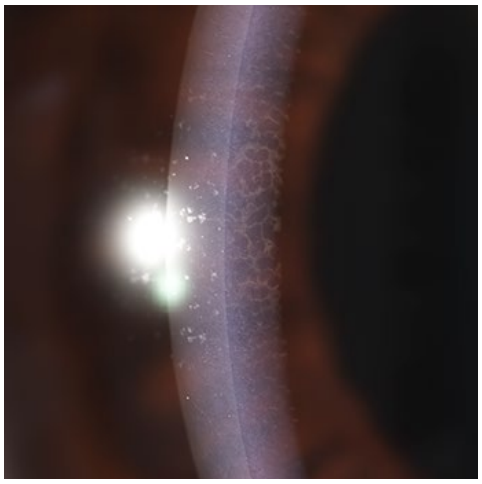


Fig. 82: Corneal guttae on endothelium

5.3.10 Fuchs' dystrophy with bullous keratopathy

Patient history

A patient with known Fuchs' dystrophy presents with clouded vision and strong visual impairment. Fuchs' dystrophy with cornea guttata was diagnosed 9 years ago. At that time, the patient still had a relatively good visual acuity.

Disorder

The cornea is edematous because of the breakdown of the corneal endothelium and has a gray, hazy appearance. Small microcysts and large subepithelial bullae are visible through the slit lamp. The bullae lead to irregularities on the corneal surface. The inner corneal surface has the typical beaten metal appearance, which also influences the red reflex.

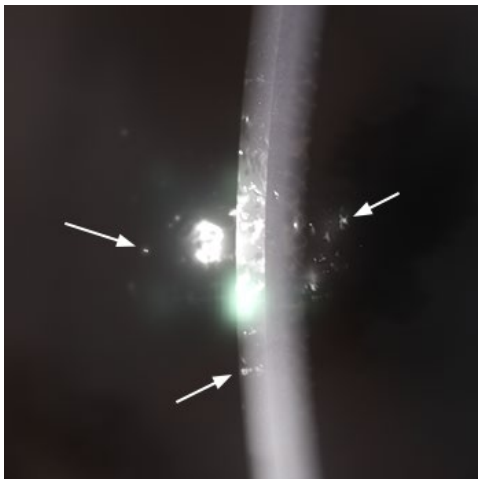


Fig. 83: Epithelial microcysts

5.3.11 Arcus senilis

Patient history

This elderly gentleman has made an appointment because of a "white ring" in his eyes. He has no medical history of note and presents in your office without symptoms. He would like you to have a look at his eyes because the ring has been growing in the last years.

Disorder

The white ring in the corneal periphery is approximately 1-2 mm wide and visible to the naked eye. Through the slit lamp you can see a sharp peripheral edge of the ring next to a thin strip of clear cornea near the limbus. Towards the center, the ring gets diffuse. This condition is called arcus senilis, an age-related, harmless deposit of lipids in the peripheral corneal stroma. Arcus senilis usually starts to develop as arcs in the superior and inferior periphery of the cornea. Eventually the arcs unite and form a ring.

Fig. 84: Arcus senilis

5.3.12 Crocodile shagreen

Patient history

This lady has come for her routine eye examination. For her age her vision is very good with no sign of age-related cataract. As you ask her, the lady states that she is generally happy with her vision, but at night she has problems with glare, especially when cars with bright headlights approach her.

Disorder

In the slit lamp with low magnification, the eye looks perfectly healthy. When you switch to a higher magnification, you see a structure within the central corneal stroma resembling leather or skin. Whitish polygonal opacities are separated by clear, thin lines. Considering the advanced age of the patient, this is most probably the so-called crocodile shagreen.

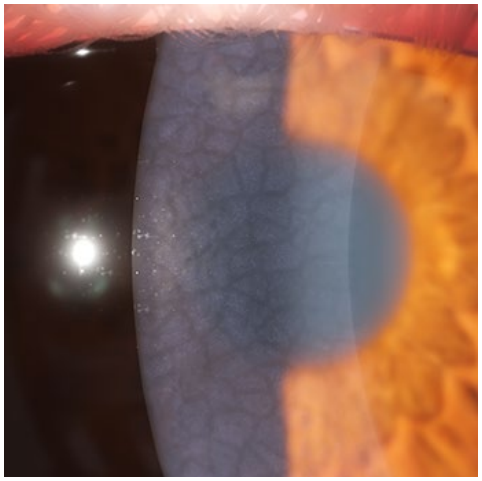


Fig. 85: Crocodile shagreen

5.3.13 Corneal neovascularization

Patient history

A woman sees you for a routine eye examination. From past examinations you know that she wears soft contact lenses every day for up to 18 hours. Sometimes, after work, she is so tired that she forgets to take out the contact lenses before going to bed. The patient has no symptoms apart from an occasional slight irritation when wearing the contact lenses. No disorders occurred in past examinations.

Disorder

In the slit lamp exam, tiny blood vessels are visible within the peripheral corneal tissue of both eyes. These new, abnormal vessels are called neovascularizations. Most probably, they are secondary to the woman's frequent and long use of contact lenses and the resulting corneal hypoxia (lack of oxygen supply). The central cornea is clear and avascular.

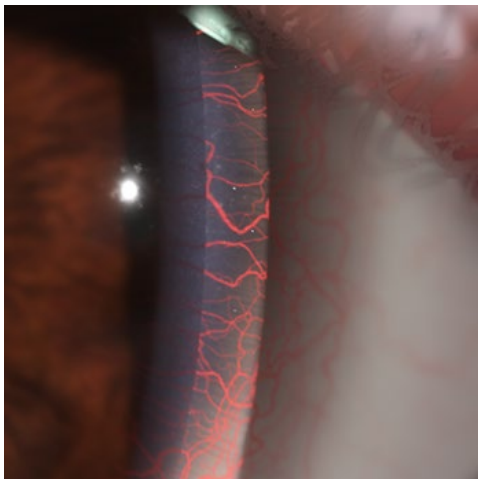


Fig. 86: Tiny new vessels near the limbus

5.4 Lens (learning) | simulator course

5.4.1 Nuclear cataract

Patient history

This patient comes to your office because the vision in her left eye has been getting more and more cloudy during the last year. Especially while driving her car in the night she feels blinded by the headlights of other cars. Strangely enough her close vision, e.g. when reading, seems to have improved.

Disorder

Through the slit lamp you can see a cloudy, slightly yellowish area in the central lens nucleus of the left eye. The more peripheral areas look normal. The age of the woman and the symptoms (cloudy vision, "second sight") strongly suggest a beginning nuclear sclerotic cataract, one of the most common types of age-related cataracts.

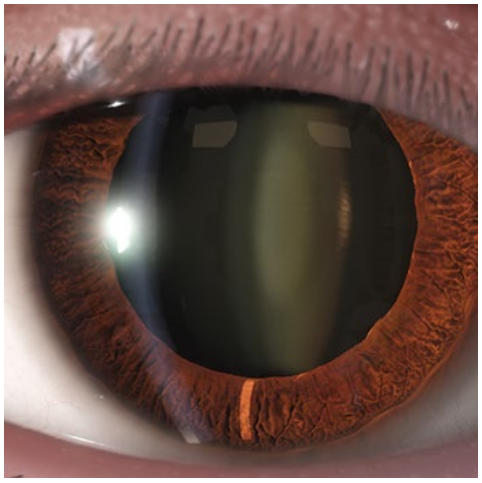


Fig. 87: Cross section through a nuclear cataract

5.4.2 Cortical cataract

Patient history

The patient comes to the consultation because of a slow deterioration of his eyesight during the last 5 years. He tells you that he sees very annoying flashes at night, especially with direct light. In the last couple of years, his vision has deteriorated. He has requested changes on his prescription glasses but the problem persists. His reading difficulties are particularly severe at night because he sees halos around light sources. During anamnesis he tells you that he has retired recently. For the last 20 years he worked as a garbage collector which required him to be outside all the time. He smokes 20 cigarettes per day and drinks between 2-3 glasses of wine every day.

Disorder

The patient is visibly obese, which is confirmed by the body mass index after anthropometric measurements. His blood pressure is also high. During visual acuity examination you confirm that the patient has impaired vision in both eyes. VA is worse in the right eye. During slit lamp examination you see a couple of white opacities at the borders of the iris inside the lens. For a better view, you dilate the patient's pupils, which allows a better view of the opacities. You perform a red reflex test which shows dark, wedge-shaped shadows inside the lens. The shadows seem to extend from the periphery towards the center.

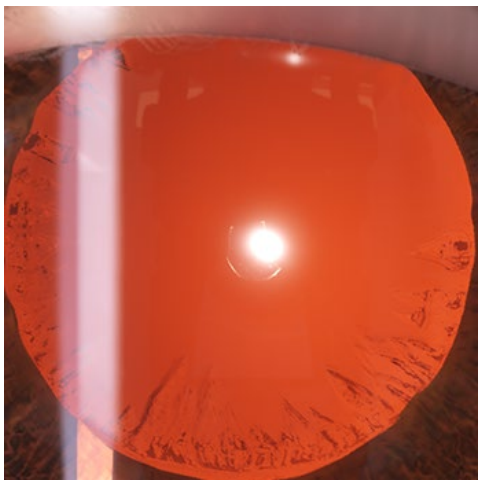


Fig. 88: Cortical cataract (retroillumination)

5.5 Uveitis (learning) | simulator course

5.5.1 Cells and flare

Patient history

A patient comes to your office complaining of blurry vision, photophobia, and ocular pain that started around four days ago. The pain is dull, aching and refers to the peri-orbital region on the left side. She tells you that this is the first time that she feels this, and she cannot think of any specific cause.

Disorder

There are no findings during physical examination. Eye examination confirms that visual acuity is diminished in both eyes. Intraocular pressure is within the normal range on the right eye and slightly low on the left eye. The left pupil shows miosis and areflexia. You decide to look for cells inside the anterior chamber because you suspect the patient may have anterior uveitis.

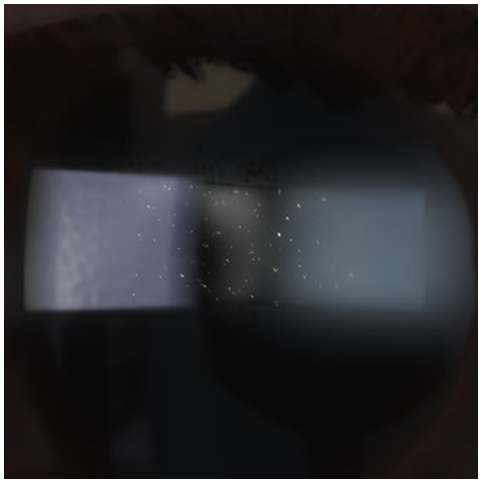


Fig. 89: Cells floating in the anterior chamber

5.6 Glaucoma (learning) | simulator course

5.6.1 Primary angle closure glaucoma

Patient history

A 63 year old lady presents in your office. She complains about the intermittent occurrence of blurred vision and seeing halos in her right eye. She also notes that she has lately suffered from phases of severe headache that often seem to coincide with her vision problems. This is the patient's first consultation of an ophthalmologist for several years and prior to this day there's no history of ocular problems.

Disorder

Using a narrow slit beam projected on the iris one can see that the anterior chamber is unusually shallow. The iris is bulging anteriorly due to the pressure differential between the anterior and posterior chambers. The pressure gradient is caused by a pupillary block. Van Herick's method can be used to assess the depth of the anterior chamber.

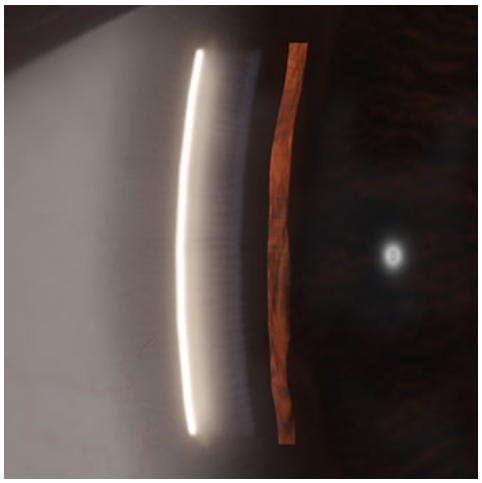


Fig. 90: Examining the chamber angle with Van Herick technique

5.7 Anterior segment cases (exam) | simulator course

This course contains 27 cases from the previous learning courses. The cases are presented in a random order and trainees do not know the specific pathology. After examining the patient, trainees need to specify their observations in a multiple-choice test. More information on learning courses: ➲ section 1.3 on page 10.

5.8 Retina: Optic disc (learning) | simulator course

5.8.1 Optic disc 1 - Color and cup

Patient history

The patient comes for a preventive evaluation. He wears glasses since he was 16, currently without complaints.

Disorder

External examination of the eyes, as well as the anterior chambers, are unremarkable. The right eye's fundus presents a slightly pale, medium-sized optic disc with a cup-to-disc ratio around 0.3 and all other retinal features appear healthy. It is possible to appreciate a pale optic disc in the left eye, with a cup to disc ratio of more than 0.7. Blood vessels in the left optic disc emerge nasally.

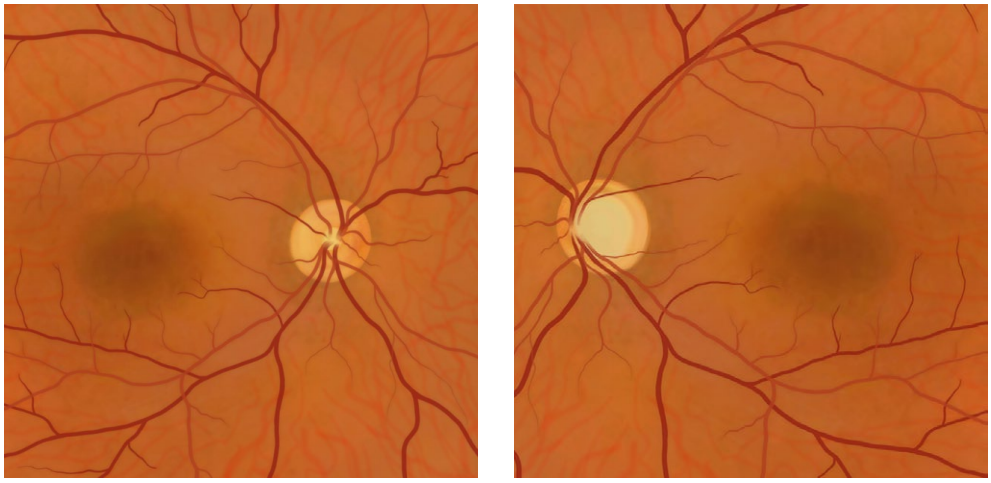


Fig. 91: Right and left retina

5.8.2 Optic disc 2 - Atrophy

Patient history

This patient suffered hydrocephaly during childhood as part of a group of congenital malformations, which resulted in low visual acuity and nystagmus. He comes for an evaluation and prescription of new corrective eyeglasses.

Disorder

In the right eye, the optic disc appears pale. You also notice how the cup-to-disc ratio is altered. At the bottom of the disc, you can see a mesh-like structure. Finally, the distribution of vessels is quite different from the usual. You can observe a larger, yellow to pink optic disc in the left eye. The central part of the disc presents a sharp white excavation. The optic disc vessels appear pushed to the side.

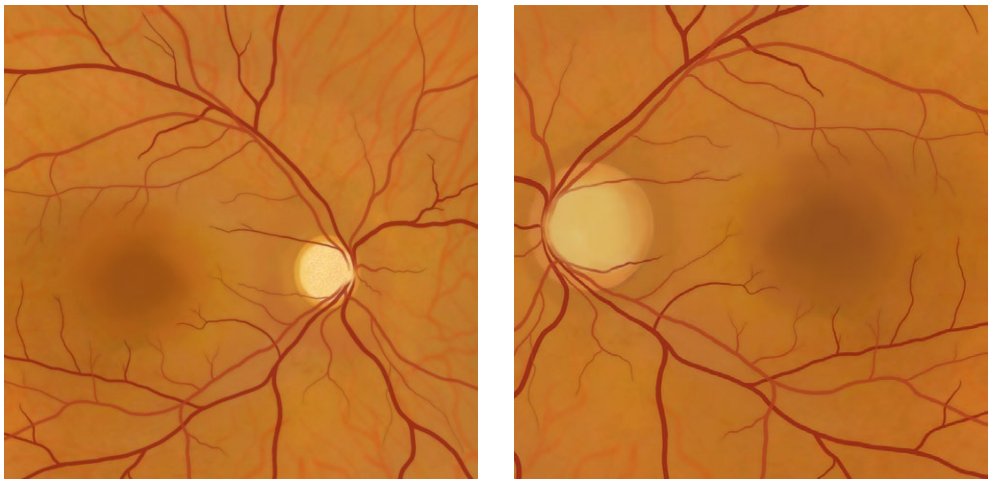


Fig. 92: Right and left retina

5.8.3 Optic disc 3 - Vascular glaucomatous changes

Patient history

A 35-year-old woman comes for an evaluation of her eyes. She was diagnosed with open-angle glaucoma some five years ago and is under treatment with beta-blockers.

Disorder

The intraocular pressure (IOP) remains high despite the pharmacological treatment. You can appreciate changes in the cup-to-disc ratio during optic disc biomicroscopy that modify the blood vessels' trajectory. The right eye shows a pale optic disc with an increased cup-to-disc ratio.

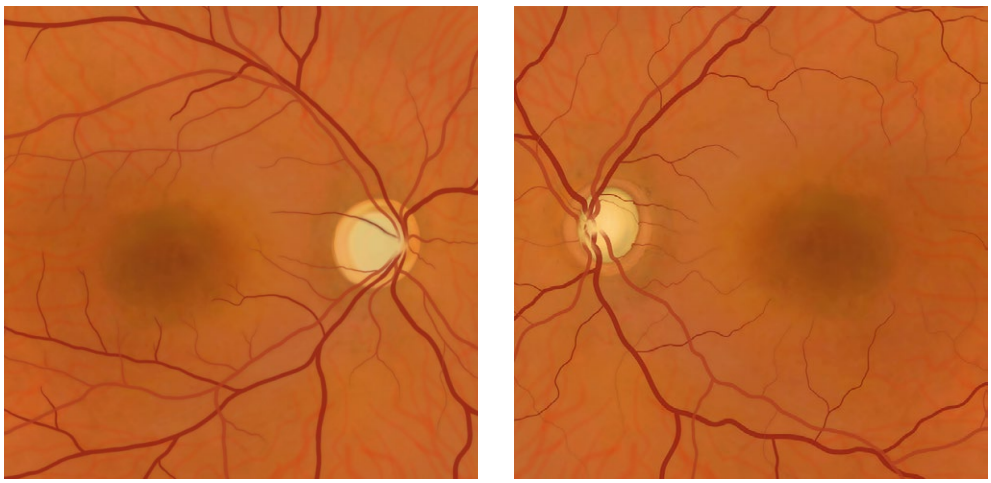


Fig. 93: Right and left retina

5.8.4 Optic disc 4 - Edema and hemorrhage

Patient history

A patient comes to your office with blurry vision complaints that started two days ago and slowly progressed. Today it has been accompanied by severe headache and vertigo.

Disorder

The optic disc border appears blurred in both eyes. The right eye shows a hemorrhage in the disc. The left eye shows hyperemia and increased cupping at the disc. Also, in the left eye, retinal flame-shaped hemorrhages are visible.

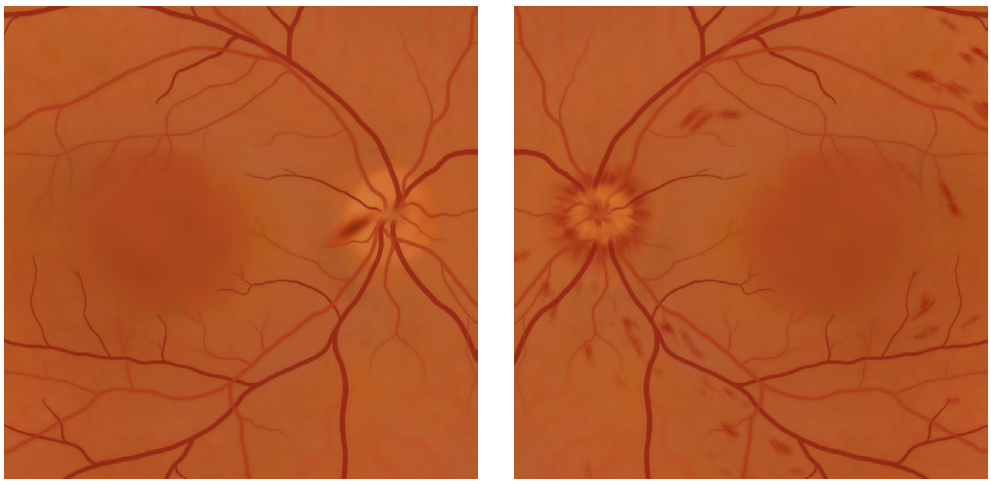


Fig. 94: Right and left retina

5.8.5 Optic disc 5 - Drusen and crescent

Patient history

The patient comes for an eye examination after her primary care physician found something "suspicious" during a fundoscopic assessment. She does not have any complaints, and her vision is normal.

Disorder

The margins of the right optic disc appear altered and irregular. In the left eye, the optic disc shows a hyperpigmented area covering the temporal side.

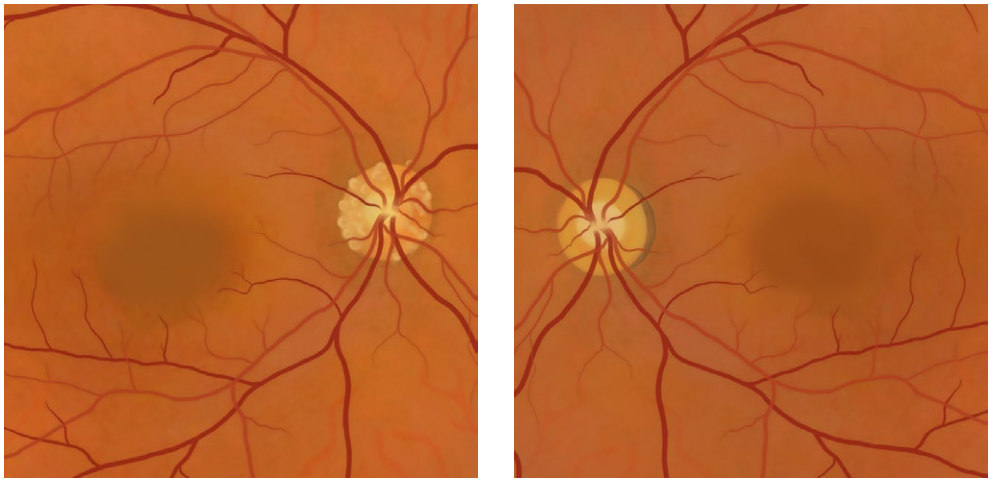


Fig. 95: Right and left retina

5.9 Retina: Optic disc (exam) | simulator course

This course contains the 5 different cases from the previous learning course. The cases are presented in a random order and trainees do not know the specific pathology. After examining the patients, trainees need to specify their observations in a multiple-choice test. More information on learning courses: ➲ section 1.3 on page 10.

5.10 Retina: AMD (learning) | simulator course

5.10.1 AMD 1 - Drusen

Patient history

A patient without major visual complaints comes to the office for preventive control. She explains that the vision on her left eye has diminished during the last year.

Disorder

This patient presents with drusen in her eyes. There are soft drusen in her right eye. Notice the way the borders of these lesions are blurry and ill-defined. The drusen in her left eye are clearly defined, and some appear bright white. These latter are called hard drusen, some of which present a degree of calcification.

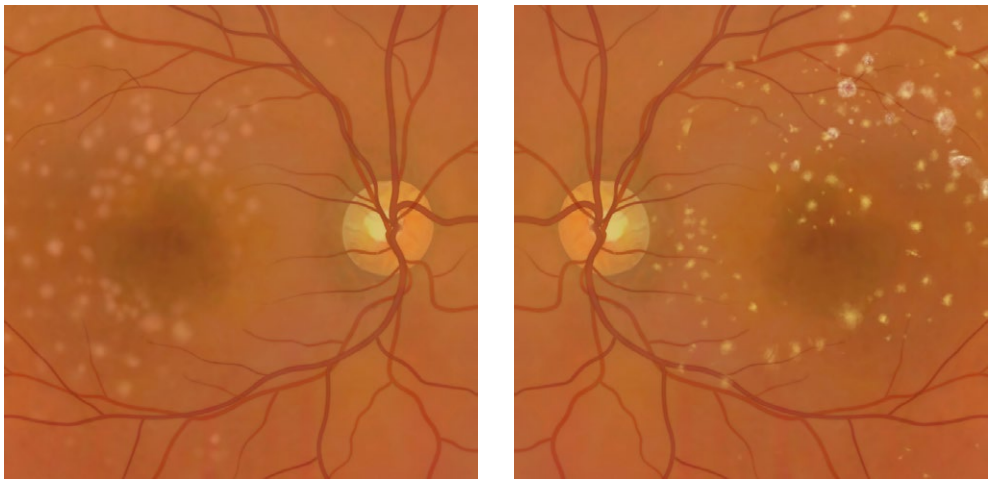


Fig. 96: Right and left retina

5.10.2 AMD 2 - Pigmentary changes

Patient history

The patient experiences a constant, slow-progressing deterioration of her visual acuity. She attributes this to her age and work (writer). Therefore, she wants an evaluation of her vision and corrective glasses, if possible.

Disorder

The macular areas of both eyes present different levels of pigmentary changes and drusen, the macula appears thickened.

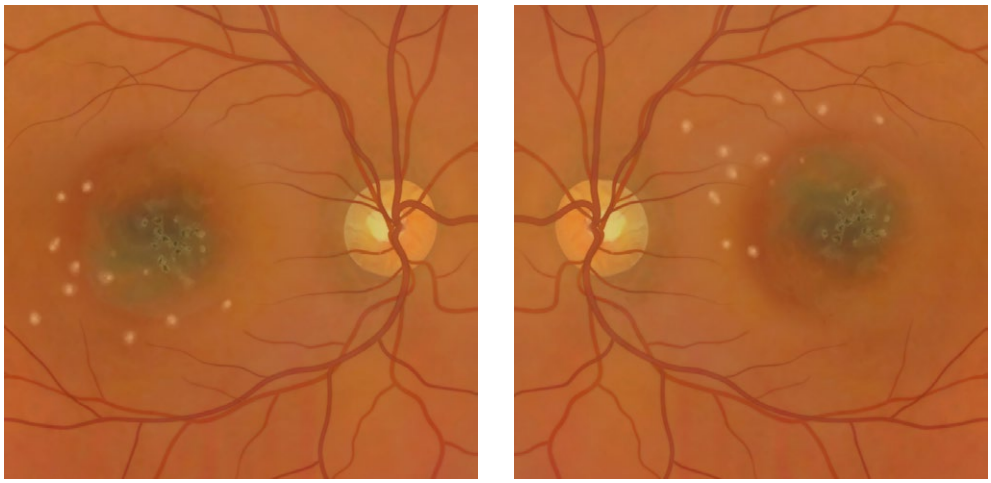


Fig. 97: Right and left retina

5.10.3 AMD 3 - Atrophy

Patient history

This female patient has a long history of visual problems. By now, she has almost lost her vision completely.

Disorder

This patient shows pigmentary changes and atrophies of the macula in both eyes. Both signs are related to dry AMD.

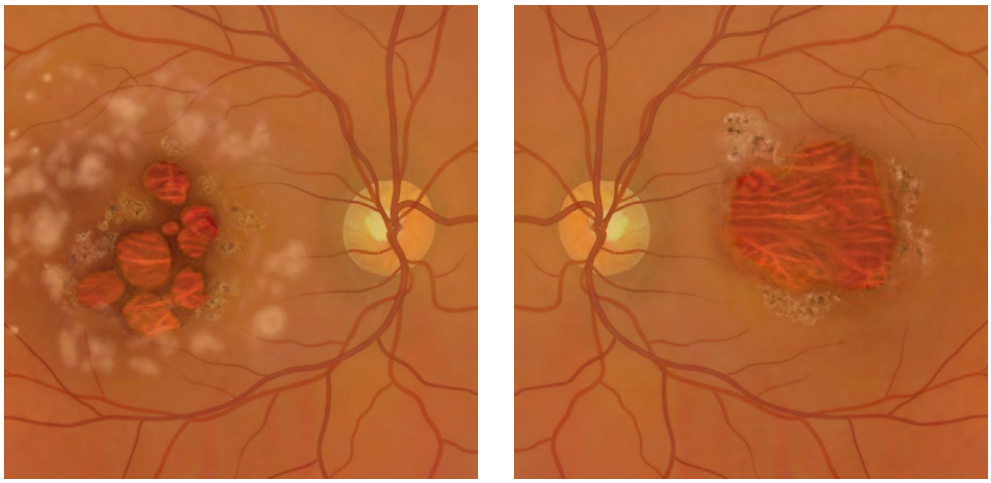


Fig. 98: Right and left retina

5.10.4 AMD 4 - Early wet AMD

Patient history

A patient presents to your office complaining about her vision's deterioration, mainly in her left eye. She noticed a decrease in her previously normal visual acuity about one month ago, but she could not seek advice earlier. She describes her problem as if a "black spot" was placed in front of her eye. She has no relevant ocular history. She has cardiac arrhythmia, systemic hypertension, osteoporosis, and hypercholesterolemia, for which she receives pharmacological treatment.

Disorder

Fundus examination: The right eye presents typical signs of age-related macular degeneration. It is possible to see the three types of drusen. The left eye shows a scar in the macula accompanied by hemorrhages and pigmentary changes.

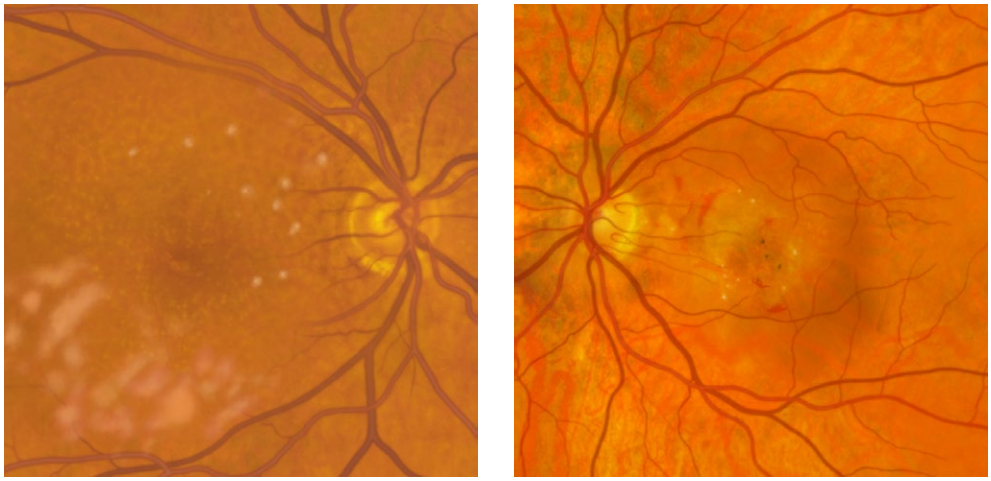


Fig. 99: Right and left retina

5.10.5 AMD 5 - Late wet AMD

Patient history

A 74-year-old female patient comes for consultation complaining about a sudden decrease in her visual acuity. She is a known patient diagnosed with wet age-related macular degeneration three years ago. Her symptoms have deteriorated despite the treatment.

Disorder

During the fundoscopic examination, it is possible to recognize the presence of old signs of the disease. Atrophy and a retinal scar are present, as well as drusen in both eyes. Nevertheless, this time you can see extensive areas with retinal hemorrhage in both eyes.

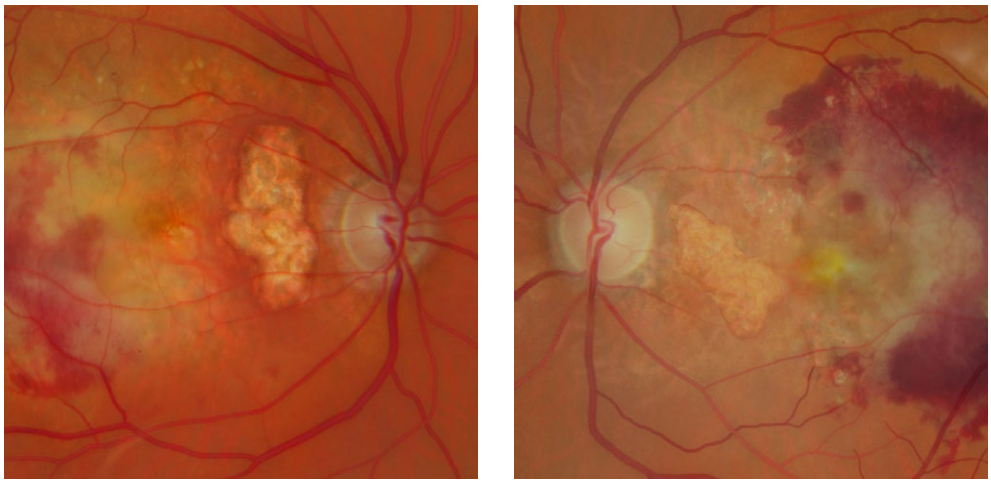


Fig. 100: Right and left retina

5.11 Retina: AMD (exam) | simulator course

This course contains the 5 different cases from the previous learning course. The cases are presented in a random order and trainees do not know the specific pathology. After examining the patients, trainees need to specify their observations in a multiple-choice test. More information on learning courses: ➲ section 1.3 on page 10.

5.12 Retina: Diabetic retinopathy (learning) | simulator course

5.12.1 DR 1 - Microaneurysms and hemorrhages

Patient history

A patient comes for a preventive examination of his eyes. He had type 1 diabetes diagnosed some 30 years ago. He uses insulin according to the scheme given by his doctor, and usually, he is cautious about his disease. Currently, he complains of dry eyes but has no visual symptoms.

Disorder

The patient shows early signs of diabetic retinopathy in his right eye, but some findings in his left eye make you think he already has a moderate stage of the condition. Can you identify the difference?

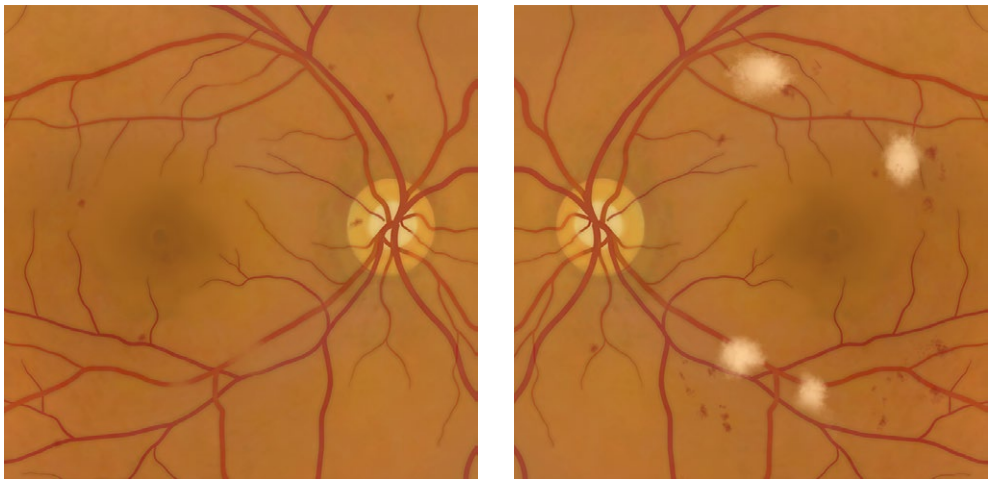


Fig. 101: Right and left retina

5.12.2 DR 2 - Vascular changes

Patient history

The patient complains of a progressive deterioration of his visual acuity during the last two weeks. He describes the presence of floaters in his left eye. The patient is known in the ophthalmology department because he has diabetes and was diagnosed with mild diabetic retinopathy four years ago. Unfortunately, he has not attended his yearly ophthalmologic evaluations since then. His last HbAc1 value is 7.8%.

Disorder

During the fundoscopic assessment, it is possible to see vascular changes in both retinas. There is venous beading in the right eye. In the left eye, you can see microaneurysms and small dot-blot hemorrhages accompanied by venous dilation.

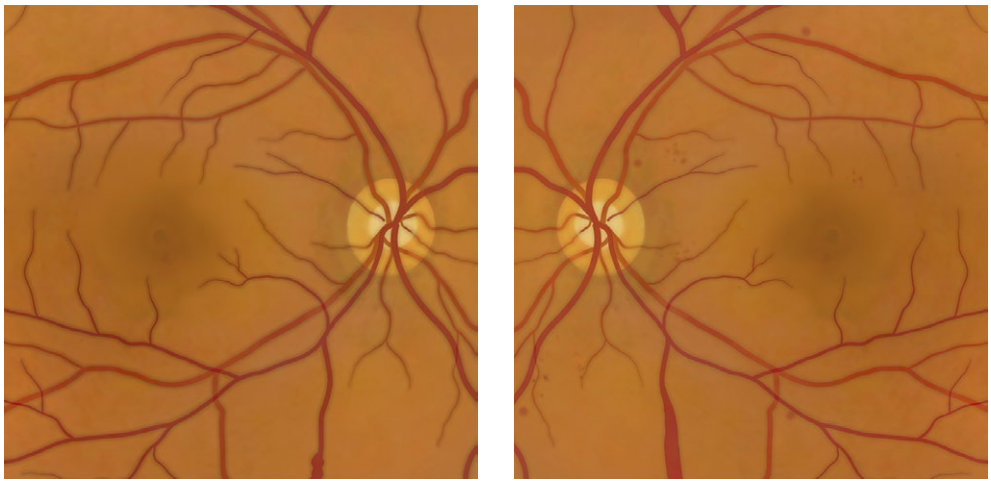


Fig. 102: Right and left retina

5.12.3 DR 3 - 4-2-1 rule

Patient history

A male patient comes to your office complaining about a worsening of his visual acuity during the previous two months. He has type 2 diabetes, which was diagnosed nine years ago. He is overweight (BMI: 28) and has a poor glycemic record.

Disorder

The patient has several findings in his retina. He is a poorly managed diabetic patient; therefore, he has a high probability of diabetic retinopathy progression. It is essential to identify the stage of the disease to define the best therapeutic course. Use the 4-2-1 rule to determine if your patient has a moderate or a severe stage of NPDR.

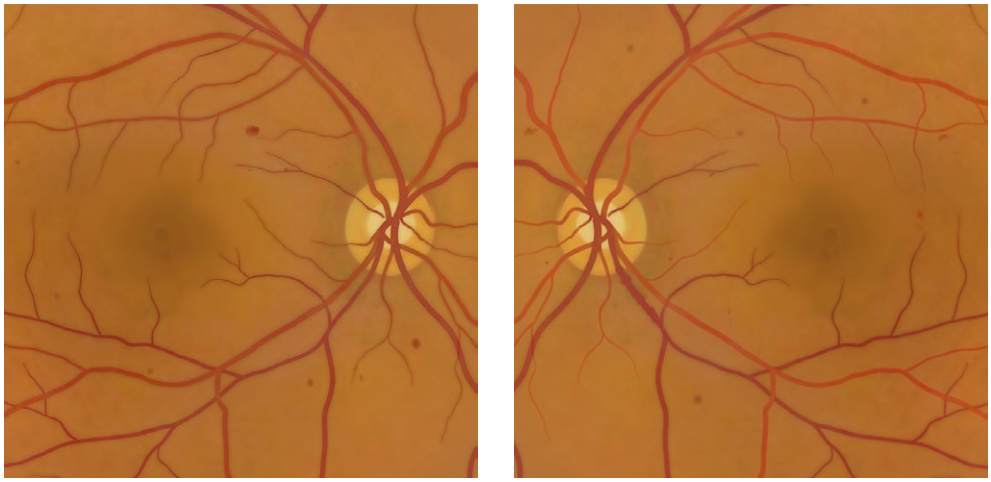


Fig. 103: Right and left retina

5.12.4 DR 4 - Vascular proliferation

Patient history

A diabetic patient comes to the office for an evaluation of her retinas. The patient has long-standing diabetic retinopathy and is usually non-compliant with the treatment. This time she complains about a deterioration of her visual acuity.

Disorder

A thorough examination of the retinal fields will allow you to find signs of proliferative diabetic retinopathy. Look out for changes in the retinal vasculature and in the optic disc.

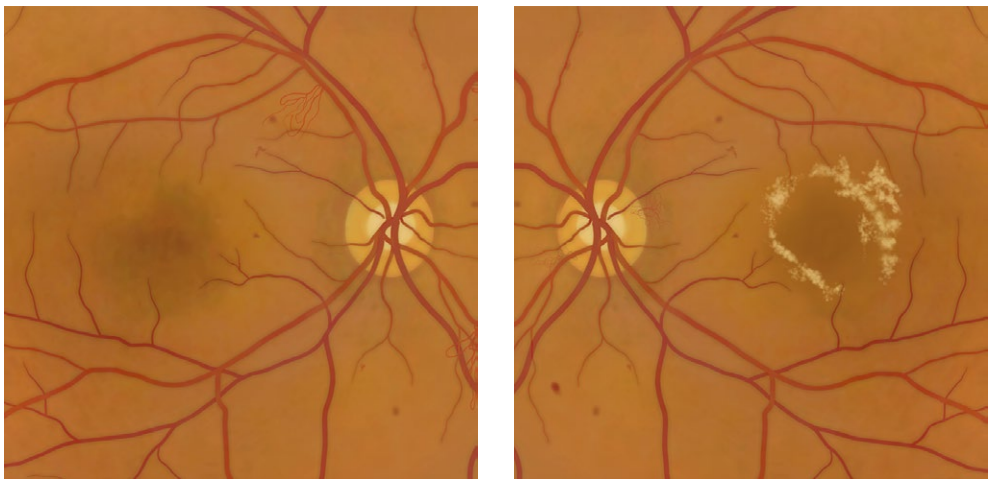


Fig. 104: Right and left retina

5.12.5 DR 5 - High risk PDR

Patient history

The patient requires an eye evaluation because he has type 1 diabetes. He was diagnosed at nine years of age and uses insulin. His glycemic record shows sustained hyperglycemia, and his last HbA1c result is 8%.

Disorder

The patient's optic disc shows an area of neovascularization and a small preretinal hemorrhage in the right eye. It is possible to see an area of neovascularization in the retina (NVE) with no recent bleeding signs in the left eye. There is also an area with intraretinal microvascular abnormalities (IRMA). Note the difference between NVE and IRMA.

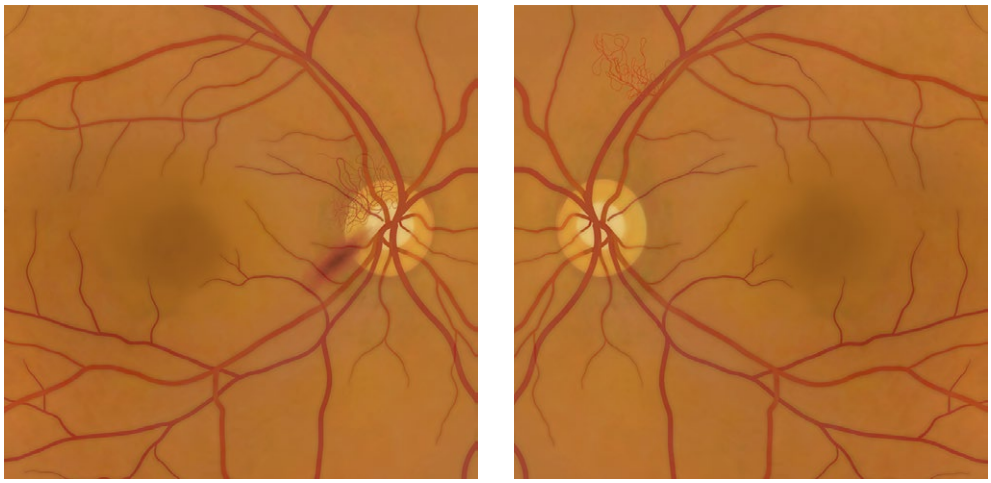


Fig. 105: Right and left retina

5.13 Retina: Diabetic retinopathy (exam) | simulator course

This course contains the 5 different cases from the previous learning course. The cases are presented in a random order and trainees do not know the specific pathology. After examining the patients, trainees need to specify their observations in a multiple-choice test. More information on learning courses: ➲ section 1.3 on page 10.

5.14 Gonioscopy (learning) | simulator course

5.14.1 Pseudoexfoliation syndrome

Patient history

This patient presents a visual deterioration in the last few months. She has no other symptoms.

Disorder

During slit lamp examination it is possible to see dust-like deposits that cover the inner border of the iris and the anterior lens capsule. Therefore you pay special attention to the iris and the angle.

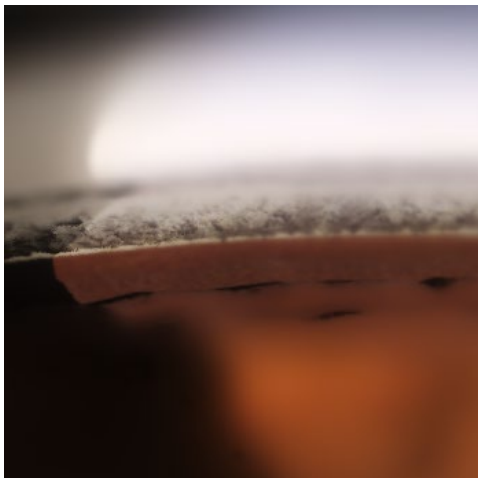


Fig. 106: Angle pigmentation due to PEX

5.14.2 Iris nevus

Patient history

The patient comes for control of a pigmented lesion in the iris of her left eye. The lesion was first noticed five years ago and has remained stable. You have been keeping control over the lesion's characteristics and growth. She does not have any other symptoms or complaints.

Disorder

Under the slit lamp, you can study the characteristics of this lesion. The lesion appears to penetrate the iris stroma, generating a change in its shape. The lesion's surface appears at the same level as the rest of the iris. During gonioscopy, you find an unremarkable angle.

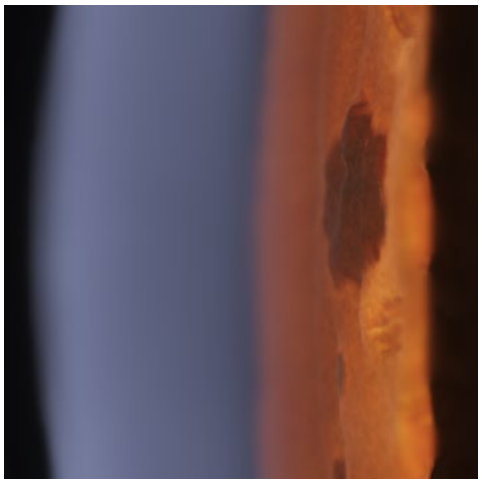


Fig. 107: Iris nevus

5.14.3 Iris melanoma

Patient history

A 45-year-old patient comes for a routine checkup. He has never required glasses, for this reason, he has not undergone any ophthalmological examination. Currently, he reports only increasing presbyopia, which has become cumbersome for his daily activities. Upon specific questioning, he tells you that he noticed a "mole" in his left eye a couple of years ago. He wants you to take a look at it.

Disorder

A clearly demarcated pigmented lesion in the left eye is perceptible during direct examination of the eye and orbit. However, the patient says it has been there for years and has not interfered with his ability to see. During slit lamp examination, you can study the mass in more detail. You encounter an elevated, irregular, hyperpigmented mass on the iris. The lesion is located between 4 and 6 o'clock and covers about 3 mm into the iris. It distorts the stroma of the iris and produces corectopia. During gonioscopy, it is possible to see that the mass does not reach the angle nor presents seeding into the periphery. The trabecular meshwork appears free of any pigmentation.

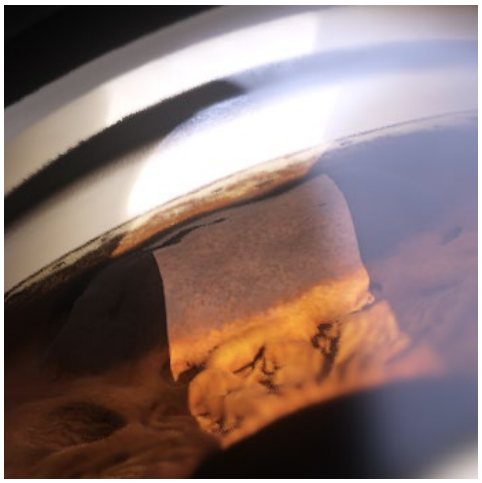


Fig. 108: Iris melanoma

5.14.4 Elevated episcleral venous pressure

Patient history

The patient complains about redness in the right eye, which started four months ago without discharge or pruritus. The condition appeared progressively after a car accident in which he suffered a direct hit to his head. He was evaluated at a general practice office where they diagnosed conjunctivitis and prescribed antibiotic drops without any improvement.

Disorder

On examination, you can see a heavily injected right eye with dilated vessels. On the episclera, the dilated vessels appear tortuous, resembling a corkscrew. Some vessels reach the limbus. During gonioscopy, you can observe a faint pink area at the bottom of the angle. The left eye appears normal.

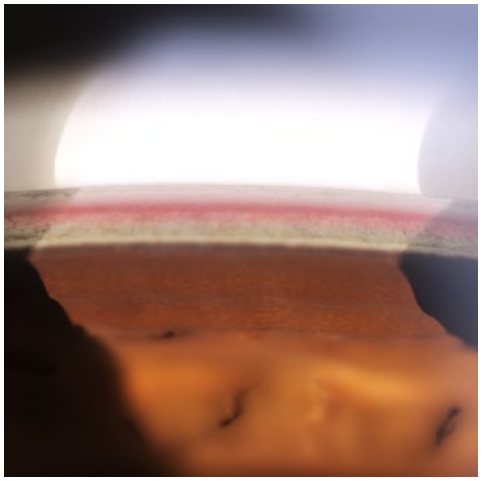


Fig. 109: Blood in Schlemm's canal

5.14.5 Rubeosis iridis

Patient history

An already known diabetic patient comes for a follow-up examination of her retina. The patient was diagnosed with type 2 diabetes around ten years ago. Despite treatment and close follow up she is overweight and has poor glycemic control. During her previous examination, she presented signs of non-proliferative diabetic retinopathy. She says that her vision has deteriorated in the last six months.

Disorder

You perform a complete evaluation. The patient's visual acuity has deteriorated in the last year compared to your records. During slit lamp examination, you can see a network of tiny blood vessels at the inner border of the iris. During gonioscopy, you can see vascular proliferatons in the angle. However, there are no peripheral anterior synechiae.

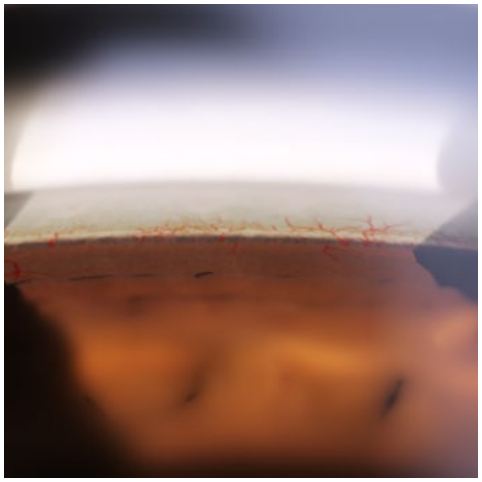


Fig. 110: Chamber angle neovascularizations

5.14.6 Pigment dispersion syndrome

Patient history

The patient has visited your practice in the past. He has myopia and has been to your office for examination, control, and prescription of new glasses. This time, however, he says that he has experienced sudden episodes of blurry vision.

Disorder

The patient's eyes present several changes compared to previous examinations. At first sight, there seems to be a darkening of the left eye. On closer examination, you can see pigment accumulation on the iris that forms concentric circles around the pupil. Corneal examination shows pigment deposits on the endothelium that form a vertical line. The iris also shows mild transillumination evident with retroillumination.

During gonioscopy, you can perceive a wide angle with a concave iris. The angle shows a deeply pigmented trabecular meshwork. After dilating the eye, you can see pigment deposits accumulated on the posterior zonules near the lens.

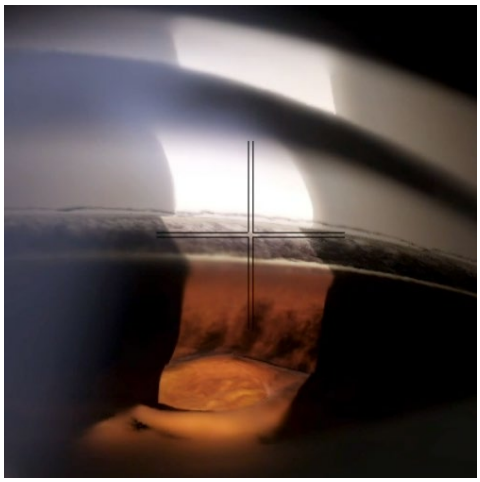


Fig. 111: Iris concativity, intense angle pigmentation, and Sampaolesi's line

5.15 Gonioscopy (exam) | simulator course

This course contains the 6 different cases from the previous learning course. The cases are presented in a random order and trainees do not know the specific pathology. After examining the patients, trainees need to specify their observations in a multiple-choice test. More information on learning courses: ➲ section 1.3 on page 10.

6 Tier C2: Grading and classification

In tier C2, standard grading and classification schemes are introduced. Trainees practice the detailed assessment of diagnostic findings. Different virtual patients will present with pathologies of the anterior segment and chamber angle. Two online course introduce the grading systems before they are presented in several simulator courses.

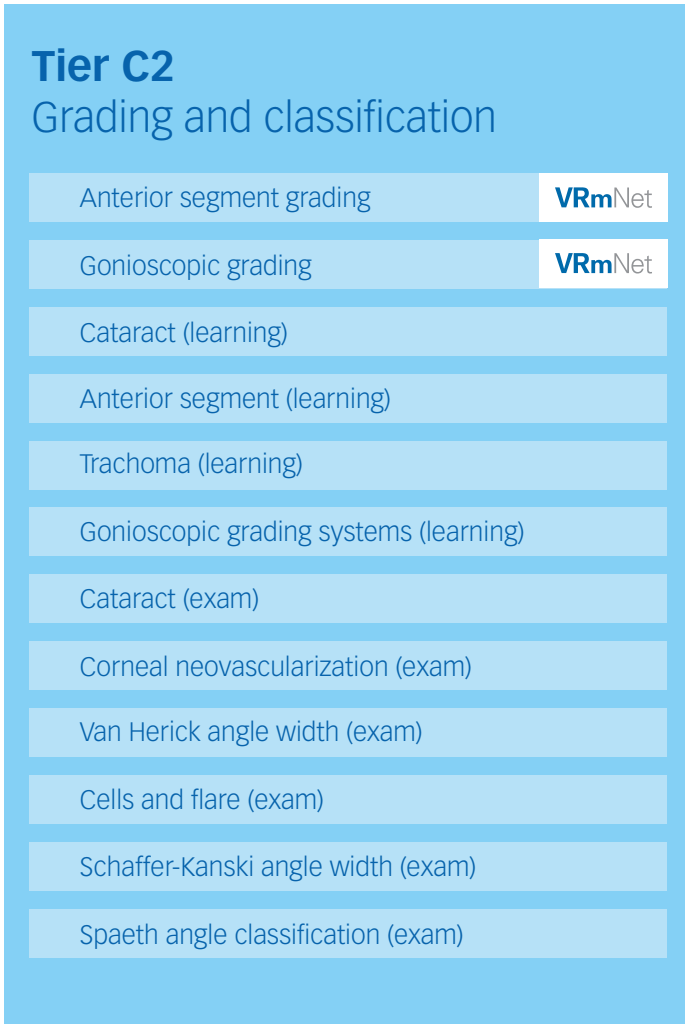


Fig. 112: Courses of tier C2; courses marked with "VRmNet" are online courses

The following grading systems are part of tier C2:

- Lens Opacities Classification System III (LOCS III) for cataracts
- Efron grading scale for corneal neovascularization
- Van Herick grading for anterior chamber angle (primary angle-closure glaucoma)
- Standardization of Uveitis Nomenclature (SUN) Working Group Grading of Anterior Chamber Cells
- WHO grading system for trachoma
- Shaffer-Kanski angle width grading
- Spaeth angle classification

6.1 Online course: Anterior segment grading

6.1.1 Cataract: LOCS III

Learn how to grade nuclear and cortical cataracts using the slit lamp and the Lens Opacities Classification System III.

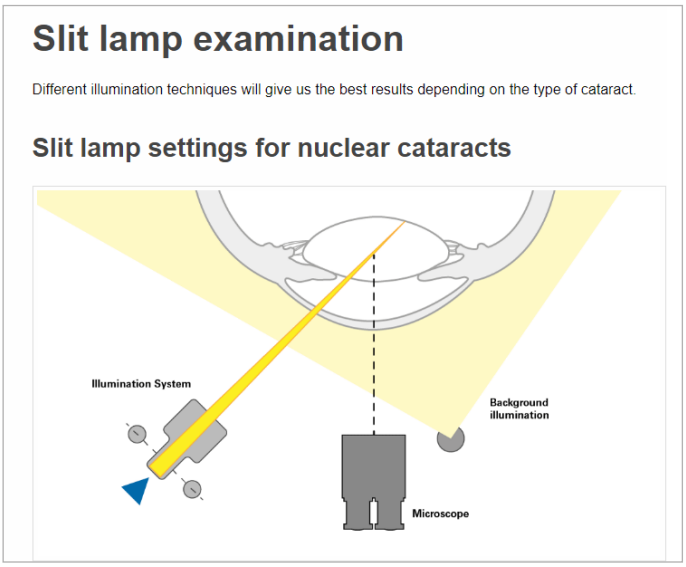


Fig. 113: Screenshot from the LOCS III online task

6.1.2 Corneal neovascularization: Efron

Learn how to grade the severity of corneal neovascularization using the slit lamp and the Efron grading scale.

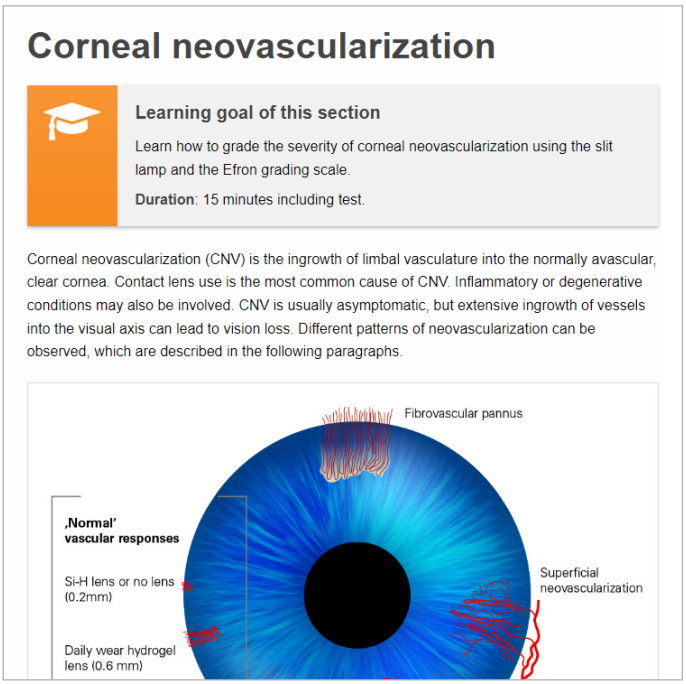


Fig. 114: Screenshot from the Efron grading online task

6.1.3 Chamber angle: Van Herick's technique

Learn how to determine if angle closure is probable using the Van Herick technique.

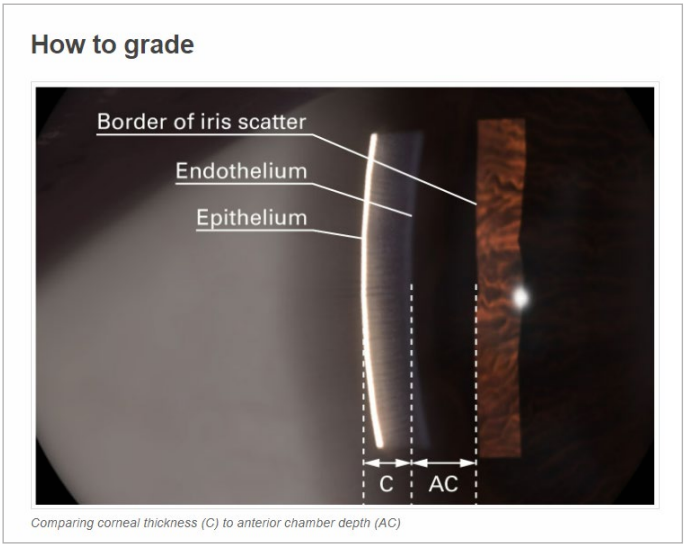


Fig. 115: Screenshot from the Van Herick grading online task

6.1.4 Cells and flare: SUN

Learn how to estimate and grade the number of anterior chamber cells using the SUN working group grading system to understand the degree of inflammation in anterior uveitis.

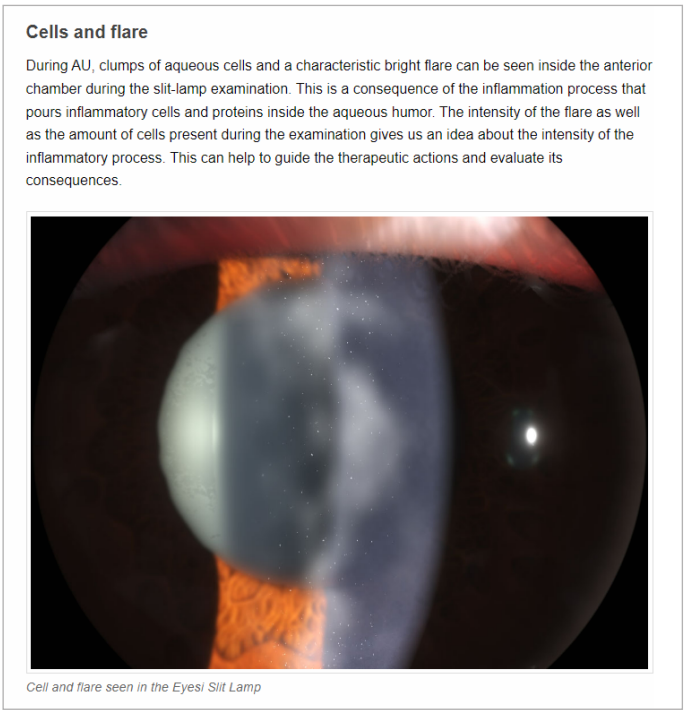


Fig. 116: Screenshot from the cells and flare grading online task

6.2 Online course: Gonioscopic grading

6.2.1 Shaffer-Kanski angle width

Learn how to use the Shaffer-Kanski method to classify the anterior chamber angle width.

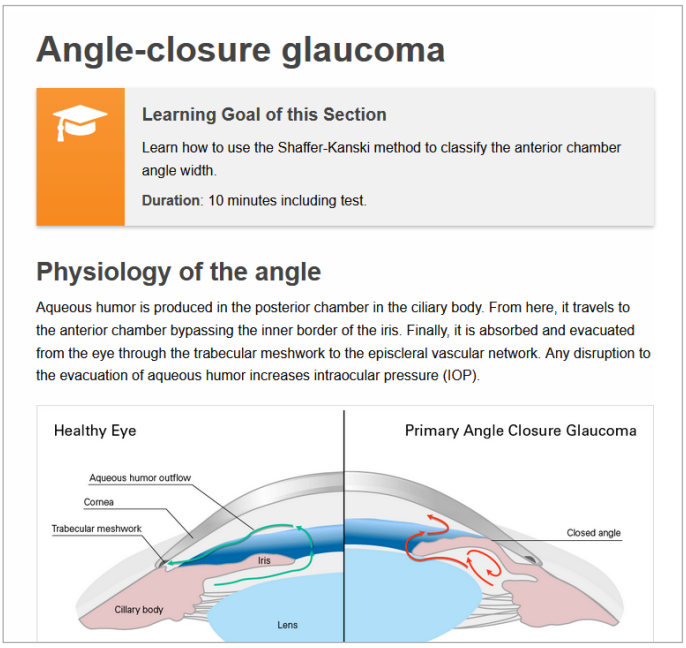


Fig. 117: Screenshot from the Shaffer-Kanski grading online task

6.2.2 Spaeth angle classification

Learn how to apply the Spaeth angle grading system to record information about four different angle characteristics.

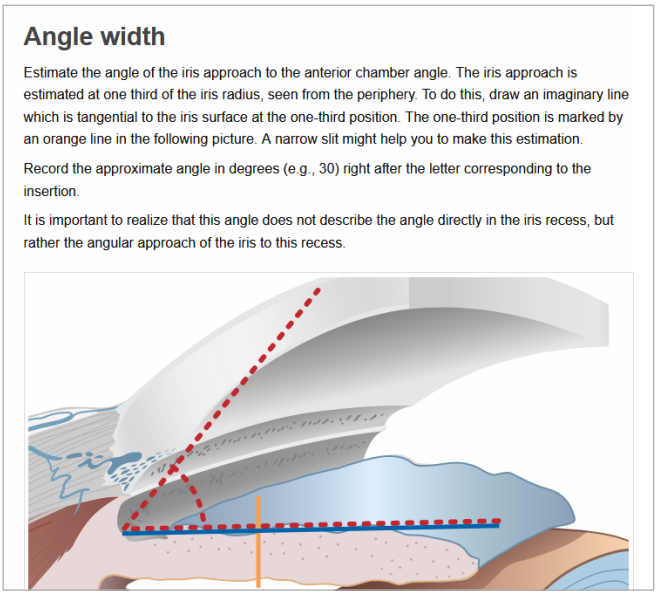


Fig. 118: Screenshot from the Spaeth angle grading online task

6.3 Cataract (learning)

6.3.1 Nuclear cataract grading

Disorder

In this case, the patient presents with nuclear sclerotic cataracts of different grades of severity. Depending on severity, nuclear cataracts have the appearance of a cloudy, slightly yellowish to brown area in the central lens nucleus. The more peripheral areas look normal. Nuclear sclerotic cataracts are the most common types of age-related cataracts.

Trainees can browse through the different grades of color and opacity corresponding to the Lens Opacities Classification System III (LOCS III). The training goal is to remember and be able to recognize the different grades.

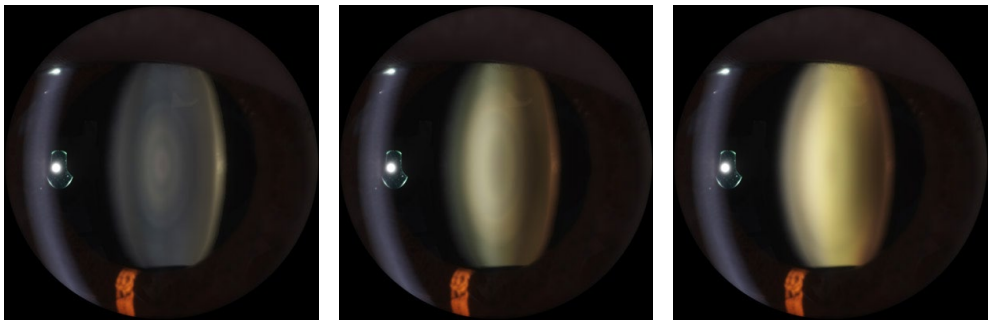


Fig. 119: Nuclear cataracts with different grades according to the Lens Opacities Classification System III

6.3.2 Cortical cataract grading

Disorder

The patient presents with cortical cataracts of different grades of severity. This type of cataract occurs due to opacification of the peripheral lens cortex. The opacities have a spoke-like appearance and point towards the lens center.

Trainees can browse through the different grades of cortical cataracts corresponding to the Lens Opacities Classification System III (LOCS III). The training goal is to remember and be able to recognize the different grades.

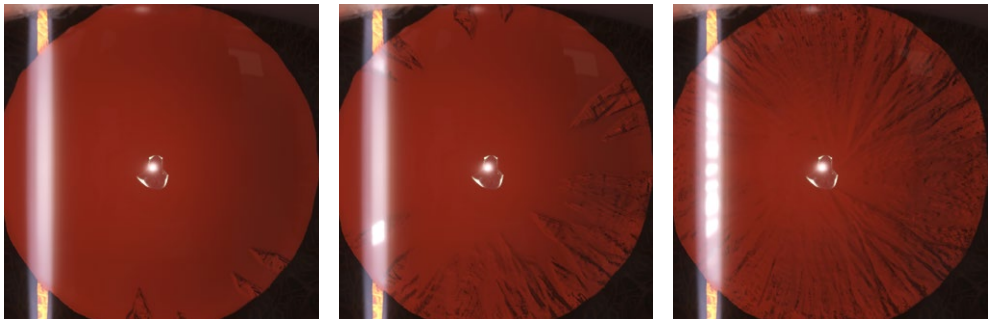


Fig. 120: Cortical cataract with different grades according to the Lens Opacities Classification System III

6.4 Anterior segment (learning)

6.4.1 Corneal neovascularization grading

Disorder

This patient presents with corneal neovascularization in different grades of severity. Corneal neovascularization (CNV) is the growth of new, tiny blood vessels from the limbal vasculature into the normally clear cornea. As CNV progresses, the new vessels grow further into the central cornea.

Trainees can browse through the different grades of corneal neovascularization corresponding to the Efron Grading Scale. The training goal is to remember and be able to recognize the different grades.

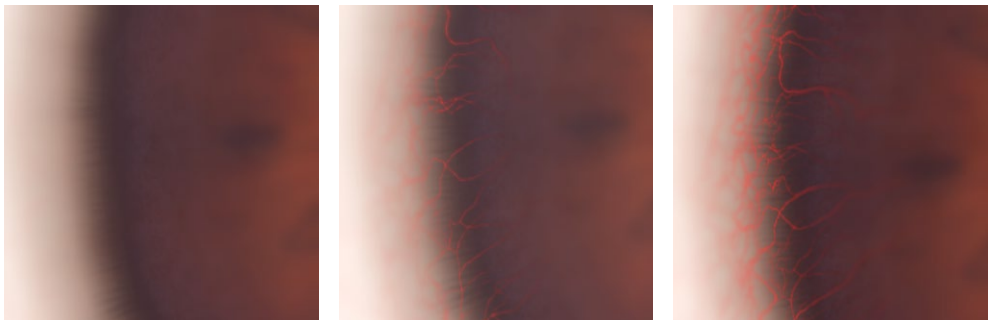


Fig. 121: Different grades of corneal neovascularization

6.4.2 Van Herick angle width grading

Disorder

The patient in this case presents with different anterior chamber angles. In a normal eye, the chamber angle is open (35°-45°). If the iris moves forward, the chamber angle narrows and fluid drainage through the trabecular meshwork may get impaired and lead to an elevated IOP. In primary angle-closure glaucoma (PACG), the angle is completely closed and the elevated IOP causes optic nerve damage.

Trainees can browse through the different anterior chamber depths and corresponding Van Herick grades. The training goal is to be able to estimate the different anterior chamber angles and the likeliness of an angle closure.

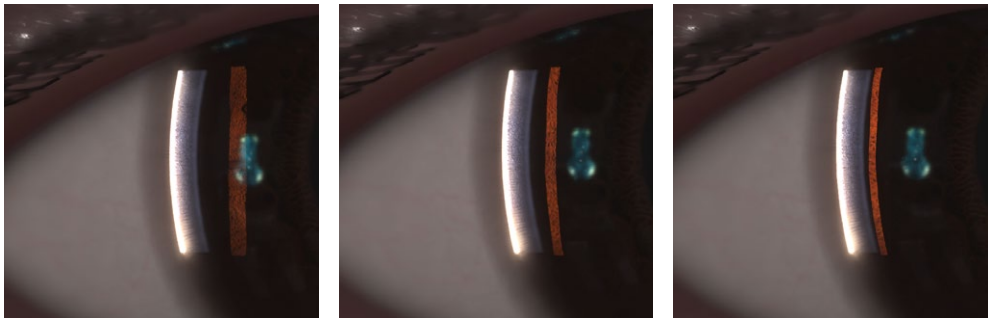


Fig. 122: Different anterior chamber angles viewed with the van Herick technique

6.4.3 Cells and flare grading

Disorder

Anterior chamber cells are a dependable indicator of inflammatory activity (anterior uveitis). This patient presents with different amounts of anterior chamber cells. Grading is performed by estimating the number of cells in a 1x1 mm slit beam field.

Trainees can browse through the different grades for cells and flare of the SUN Working Group. The training goal is to be able to estimate the degree of inflammation in uveitis.

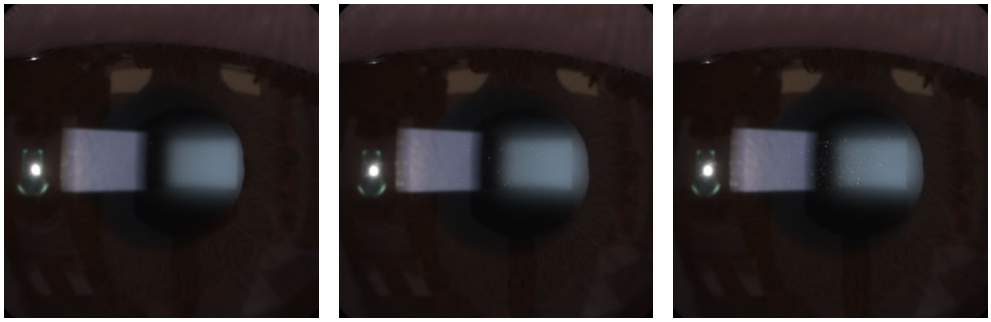


Fig. 123: Different amounts of cells floating in the anterior chamber

6.5 Trachoma (learning)

6.5.1 Trachoma TF

Patient history

You see the patient as part of a medical brigade to rural communities in a rural area of The Gambia. The patient's mother explains that the kid has a 2-month history of eyelid swelling and irritation accompanied by tearing in both eyes. Sometimes he has a thick yellow discharge. She says that this is very common in their community, and sometimes she uses some natural remedies to alleviate the symptoms like the other mothers.

Disorder

Our patient lives in a low-resource setting and is exposed to several possible causes of infectious conjunctivitis. The community where he lives has been known for the presence of trachoma for several decades. Some members of the community are already blind from the disease. Due to the presence of symptoms and the epidemiological data provided by the community and health workers, you diagnose a Chlamydia trachomatis infection of the eye, grade TF.

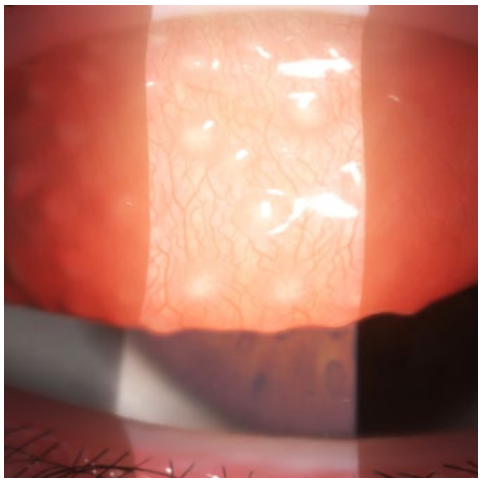


Fig. 124: Follicular conjunctivitis

6.5.2 Trachoma TI

Patient history

You see this patient during a medical mission to Mankien, a small rural town in South-Sudan near the Sudan border. She tells you that she has an almost permanent eye problem. Her eyelids become red and inflamed, and this brings her much pain and discomfort. The problem becomes worse during the dry season. She tells you that other people in the community have the same problem.

Disorder

Due to the presence of symptoms and the epidemiological data provided by the community and health workers, you diagnose a Chlamydia trachomatis infection of the eye. The World Health Organization grades trachoma into five stages. Grade TI is diagnosed when the patient has a pronounced inflammatory thickening of the tarsal conjunctiva that obscures more than half of the deep blood vessels.

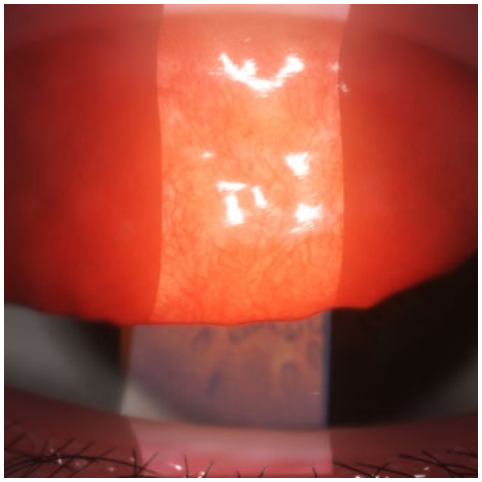


Fig. 125: Intense follicular conjunctivitis

6.5.3 Trachoma TS

Patient history

You see this patient during a medical mission to south-east India. The patient complains about almost permanent tearing, accompanied by an occasional mucopurulent discharge. Answering your questions, she remembers that sometimes the eyes become red and painful, and a foreign body sensation is present, but the condition resolves almost entirely after a few days.

Disorder

The long history of eye symptoms in this patient is very suggestive of chronic inflammation due to autoimmune, atopic, or infectious causes. The presence of Arlt's lines in the upper lid and Herbert's pits in the cornea are suggestive of prolonged Chlamydia trachomatis infection. You diagnose the case as trachoma grade TS. The World Health Organization grades trachoma into five stages. Trachomatous scarring (TS) is diagnosed when scars appear in the tarsal conjunctiva.

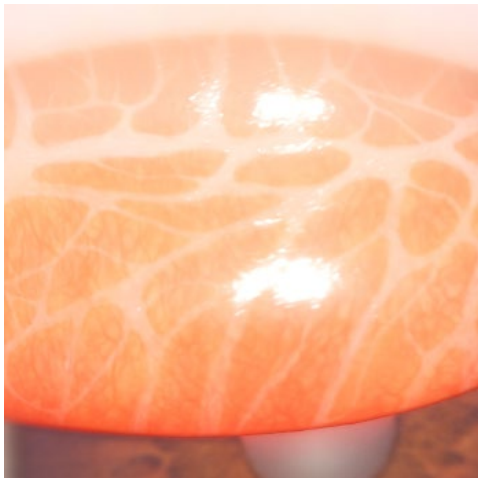


Fig. 126: Arlt's lines in the upper lid

6.5.4 Trachoma TT

Patient history

You see this patient during a humanitarian medical mission to the Marsabit County in northeast Kenya. The patient complains about continuous foreign body sensation in both eyes, accompanied by tearing and gritting. He has had several episodes of eye inflammation throughout his life.

Disorder

The presence of trichiasis and scars in both eyes is compatible with a late-stage trachoma case. The patient lives in an area where trachoma is endemic. Due to the lack of access to water and sanitation, the disease is difficult to control. He probably has received treatment in the past but has been reinfected. Continuous inflammation has led to scarring and distortion of the typical palpebral architecture, which brings eyelashes inwards, affecting the cornea. The patient needs to undergo surgery to extract the inverted eyelids; otherwise, the disease will progress to blindness.

The World Health Organization grades trachoma into five stages. Trachomatous trichiasis (TT) is diagnosed when at least one lash is rubbing the eyeball.

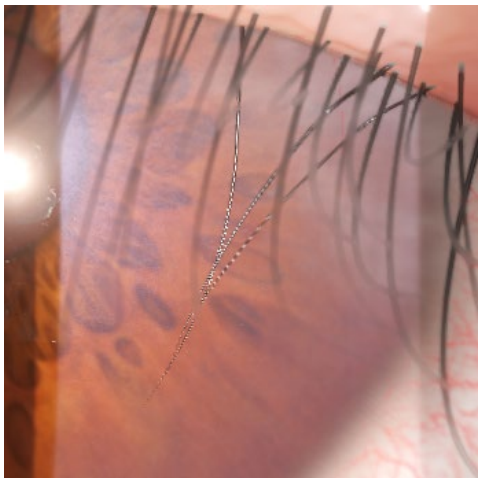


Fig. 127: Trichiasis (lashes touching the cornea)

6.5.5 Trachoma CO

Patient history

This patient has an advanced stage of corneal opacity. She lives in a highly endemic area for trachoma; therefore, this is the most likely diagnosis. Continuous inflammation has led to scarring and distortion of the typical palpebral architecture, which brings eyelashes inwards, affecting the cornea. Repeated injury to the cornea by inverted lashes results in corneal erosion and scarring. Corneal scars are non-transparent, thus blinding the patient.

Disorder

The presence of trichiasis and scars in both eyes is compatible with a late-stage trachoma case. The patient lives in an area where trachoma is endemic. Due to the lack of access to water and sanitation, the disease is difficult to control. She probably has received treatment in the past but has been reinfected. Continuous inflammation has led to scarring and distortion of the typical palpebral architecture, which brings eyelashes inwards, affecting the cornea. The patient needs to undergo surgery to extract the inverted eyelids; otherwise, the disease will progress to blindness.

The World Health Organization grades trachoma into five stages. Trachomatous corneal opacity (CO) is diagnosed when a corneal opacity is easily visible.

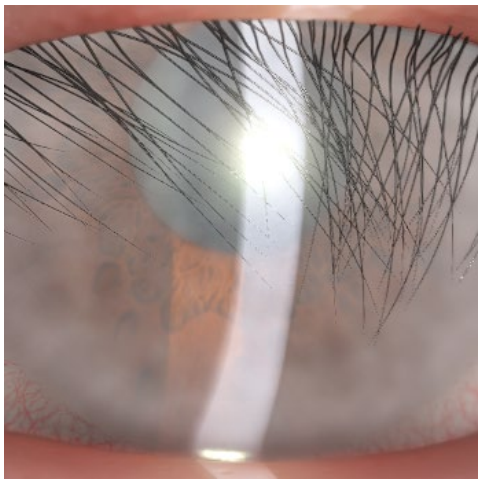


Fig. 128: Corneal opacities due to trichiasis

6.6 Gonioscopic grading systems (learning)

6.6.1 Shaffer-Kanski angle width grading

Disorder

The patient presents with different anterior chamber angles. Examine the whole circumference and learn how different aperture angles may look during gonioscopy.

The Shaffer-Kanski grading system assesses the width of the iridocorneal angle based on the visible structures during gonioscopy. For example, if you can see the ciliary body face directly, you assume an angle between 35° and 45°. With this information, you can expect that an angle-closure is virtually impossible. On the other hand, if you cannot identify any structures behind Schwalbe's line, you can expect an angle of less than 10°. With such a narrow angle, angle closure is most likely to happen. After examination, you will record your findings in numbers zero to four ranging from closed to wide open, respectively.

Trainees can browse through the different anterior chamber angle widths corresponding to the Shaffer-Kanski angle width grading system. The training goal is to be able to estimate the different anterior chamber angles and the likeliness of an angle closure.

Fig. 129: Different angle widths according to the Schaffer-Kanski grades

6.6.2 Spaeth iris insertion grading

Disorder

Try to identify the structures visible in the corner of the angle using the gonioscopy lens. Schwalbe's line is the most anterior structure, and the most posterior is the ciliary body face. You will use a capital letter to record your findings according to the following table.

The Spaeth grading system is excellent for systematically describing the anterior chamber angle findings in gonioscopy. The training goal of this task is to get to know the different Spaeth grades.

Fig. 130: Different iris insertion points according to the Spaeth grades

6.6.3 Spaeth angle width grading

Disorder

The iridocorneal angle is made of the iris and the junction of the cornea and the sclera. In most persons, it has between 20° and 35°. People with myopia or aphakia have wide angles. On the other hand, people with smaller angles have an increased predisposition to angle closure.

To estimate the angle, imagine a tangential line to the trabecular meshwork and another tangential to the peripheral third of the iris surface. It might be helpful to create a narrow beam and project it on the angle to better see the borders of the iris and the cornea. The angle is estimated using these two lines, and the result is recorded as a number in the second position of the Spaeth code.

The Spaeth grading system is excellent for systematically describing the anterior chamber angle findings in gonioscopy. The training goal of this task is to get to know the different Spaeth grades.

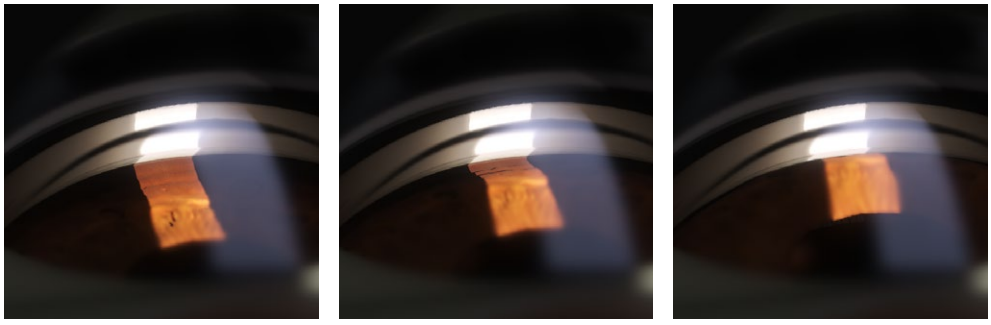


Fig. 131: Different angle widths according to the Spaeth grades

6.6.4 Spaeth iris profile grading

Disorder

The Spaeth system uses four characteristics to classify the iridocorneal angle. An essential part of diagnosing diseases in the angle is the shape of the iris. Under normal conditions, the iris appears flat. It does not bulge forward nor does it present any excavation in its profile. The iris profile is recorded with a lower caps letter (after the angle amplitude).

The Spaeth grading system is excellent for systematically describing the anterior chamber angle findings in gonioscopy. The training goal of this task is to get to know the different Spaeth grades.

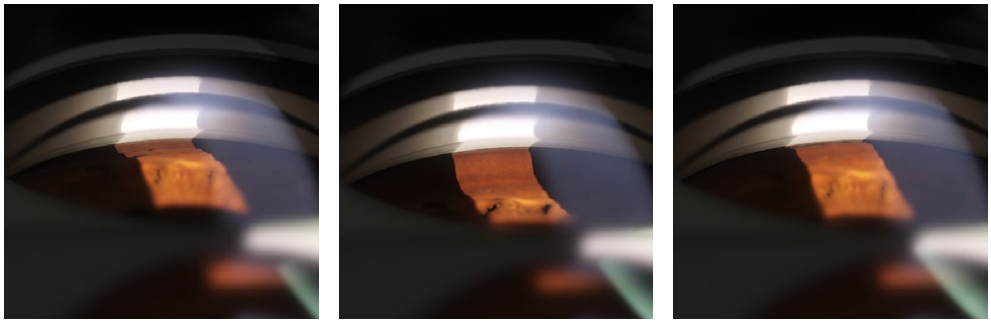


Fig. 132: Different iris surface profiles

6.6.5 Spaeth angle pigmentation grading

Disorder

The last characteristic in the Spaeth classification system is the pigmentation of the angle. The extent and the intensity of the pigmentation will be taken into account. You will use numbers to record your findings. The number four corresponds with the highest level of pigmentation and zero with the lack of pigment in the angle.

Record your findings in the Spaeth code using the numbers in the last position. Numbers one to four are followed by a plus sign to clarify the presence of pigmentation.

The Spaeth grading system is excellent for systematically describing the anterior chamber angle findings in gonioscopy. The training goal of this task is to get to know the different Spaeth grades.

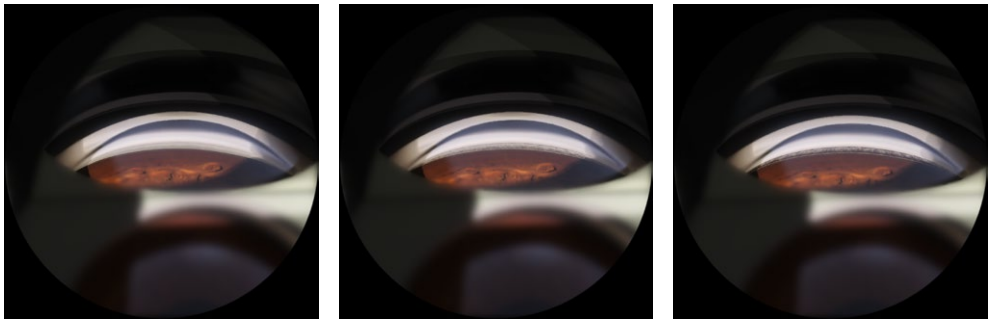


Fig. 133: Different angle widths according to the Schaffer-Kanski grades

6.7 Cataract (exam)

This course contains 15 cases of nuclear and/or cortical cataracts of unknown severity. Trainees have to examine the virtual patients' eyes and classify the severity according to the Lens Opacities Classification System III (LOCS III) grading system. More information on learning courses: ➲ section 1.3 on page 10.

6.8 Corneal neovascularization (exam)

This course contains 10 cases of corneal neovascularization of unknown severity. Trainees have to examine the virtual patients' eyes and classify the severity according to the Efron grading scale. More information on learning courses: ➲ section 1.3 on page 10.

6.9 Van Herick angle width (exam)

This course contains 10 cases with different anterior chamber angles. Trainees have to examine the virtual patients' eyes and estimate the angle width using the Van Herick grading method. More information on learning courses: ➲ section 1.3 on page 10.

6.10 Cells and flare (exam)

This course contains 10 cases with cells and flare of unknown amount. Trainees have to examine the virtual patients' eyes and classify the amount of cells and flare according to the Standardization of Uveitis Nomenclature (SUN) Working Group Grading. More information on learning courses: ➲ section 1.3 on page 10.

6.11 Shaffer-Kanski angle width (exam)

This course contains 10 cases with different anterior chamber angles. Trainees have to examine the virtual patients' eyes and estimate the angle width according to the Shaffer-Kanski angle width grading. More information on learning courses: ➲ section 1.3 on page 10.

6.12 Spaeth angle classification (exam)

This course contains 40 cases with different anterior chamber angles. Trainees have to describe the chamber angle configuration using the Spaeth angle classification. More information on learning courses: ➲ section 1.3 on page 10.

7 Tier D: Clinical cases

Tier D presents virtual patients with clinical case histories and different pathologies of the posterior segment. The cases are based on real patient cases and have been developed and reviewed in close cooperation with university eye clinics.

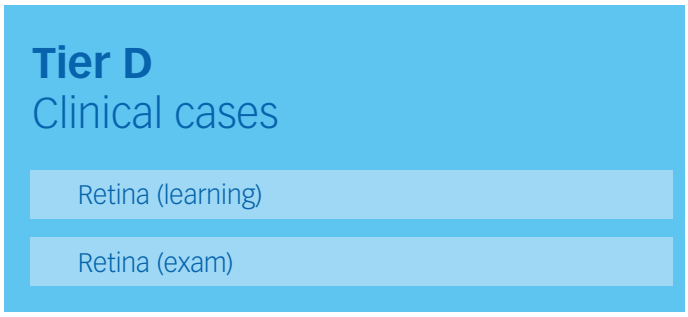


Fig. 134: Courses of tier D Clinical cases

INFO	Tier D to be extended
Tier D currently contains two courses. More training content will be added in the next software releases.	

Simulator courses (learning mode)

Virtual patients present with different disorders of the human eye. Trainees will get to know the typical signs and symptoms of the shown condition. The simulator guides trainees through the examination by showing the required slit lamp settings and highlighting pathological signs in the stereo microscope. Additional medical background information is provided on each found sign. The training goal is learning to recognize ocular pathologies.

Simulator courses (exam mode)

Virtual patients present with unknown disorders of the human eye. With the knowledge acquired in the teaching courses of tier D, trainees are asked to detect suspicious signs and specify their findings and diagnoses without assistance from the simulator.

7.1 Retina (learning)

7.1.1 Toxoplasmosis

Patient history

A 43-year-old woman presents in your consulting hour for a routine exam. Her past medical history includes an insulin-dependent type 1 diabetes mellitus (known for 16 years) and an IgA nephropathy (known for ten years) - she is the only one in her family with these illnesses. Because of both diseases, she is under nephrological treatment. In the extended family case history, you find no other relevant information. Her children (boy seven years old, girl nine years old) are healthy and play outside a lot.

Disorder

Retinal examination shows a seemingly old chorioretinal scar and pigmentary changes. There are disc crescents in both eyes.

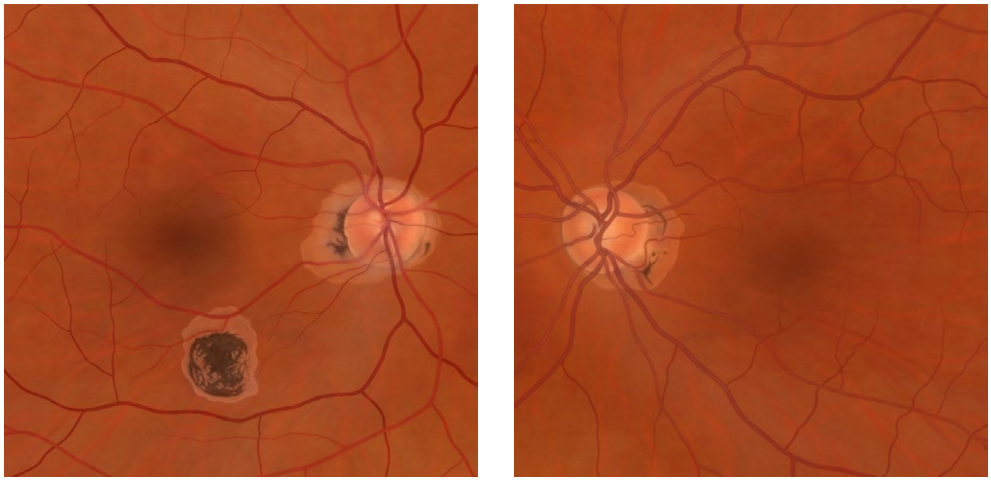


Fig. 135: Right and left retina

7.1.2 Ischemic branch vein occlusion

Patient history

An 81-year-old patient is referred to your consulting hour. He complains of increasing deterioration of visual acuity in his right eye during the last three months. The patient describes having a foggy and increasingly darkening vision in the affected eye. The patient also has arterial hypertension (under medical treatment), an incipient glucose intolerance (under nutritional therapy), and rheumatoid arthritis.

The general constitution is normal for the patient's age. He is 175 cm tall and weighs 70 kg (BMI=22.5). Family medical history shows a shared tendency of arterial hypertension.

Disorder

Fundoscopic examination reveals the presence of flame-shaped hemorrhages and hard exudates distributed across the right eye's retina. The vasculature of the right eye also presents ghost vessels and tortuosity. The left eye is mainly affected by hypertensive changes represented by vascular tortuosity.

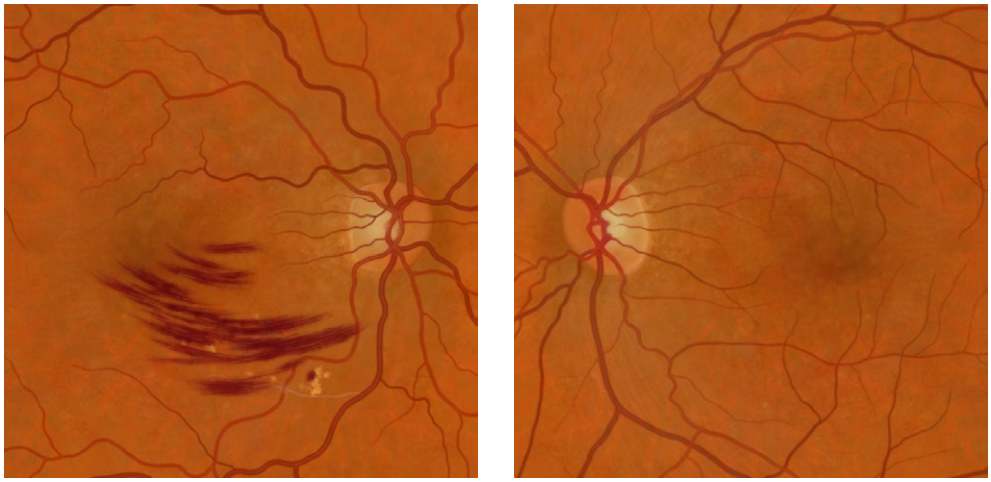


Fig. 136: Right and left retina

7.1.3 Mild hypertensive retinopathy

Patient history

A patient comes to your office, referred by his general practitioner, to undergo evaluation. He was diagnosed with systemic hypertension two months ago after a preventive checkup. It is unclear how long the problem had been present before the diagnosis.

Disorder

This patient's retina shows vascular tortuosity and an increased light reflex of the arteries called copper-wire vessels.

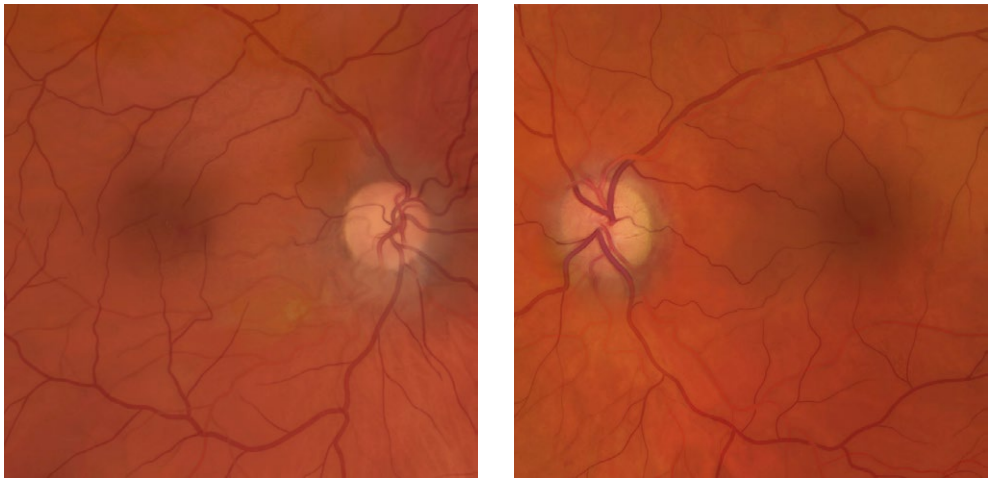


Fig. 137: Right and left retina

7.1.4 Hypertensive retinopathy

Patient history

A 45-year-old patient comes to your office complaining of blurry vision in both eyes since two weeks ago. Two days ago, he noticed a worsening in his visual acuity in the left eye. He also reports severe headaches during the last few days. His blood pressure is 220/200 mmHg.

Disorder

In addition to an increased vascular light reflex in the right eye, you can observe vascular tortuosity, small flame-shaped hemorrhages, and cotton wool spots in both eyes. Also, the optic disc margins are blurred, and some vessels are obscured. Both optic discs seem swollen.

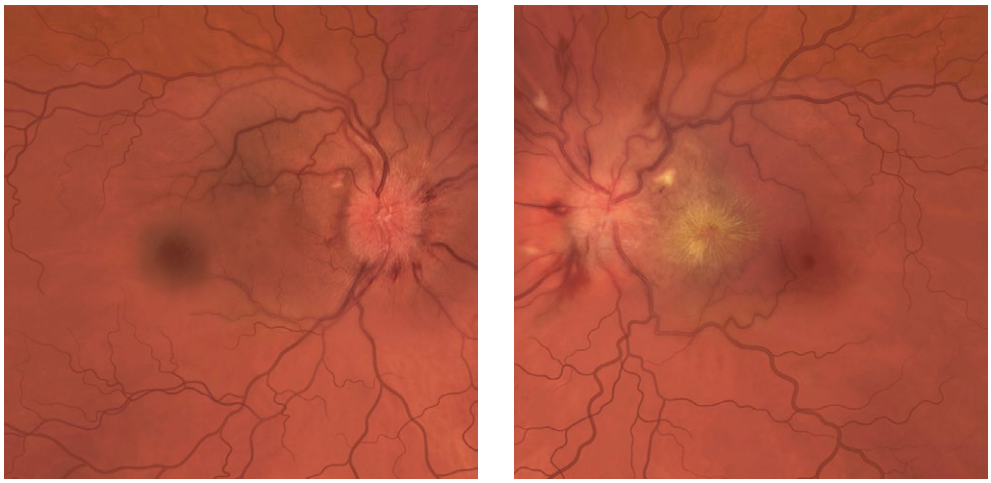
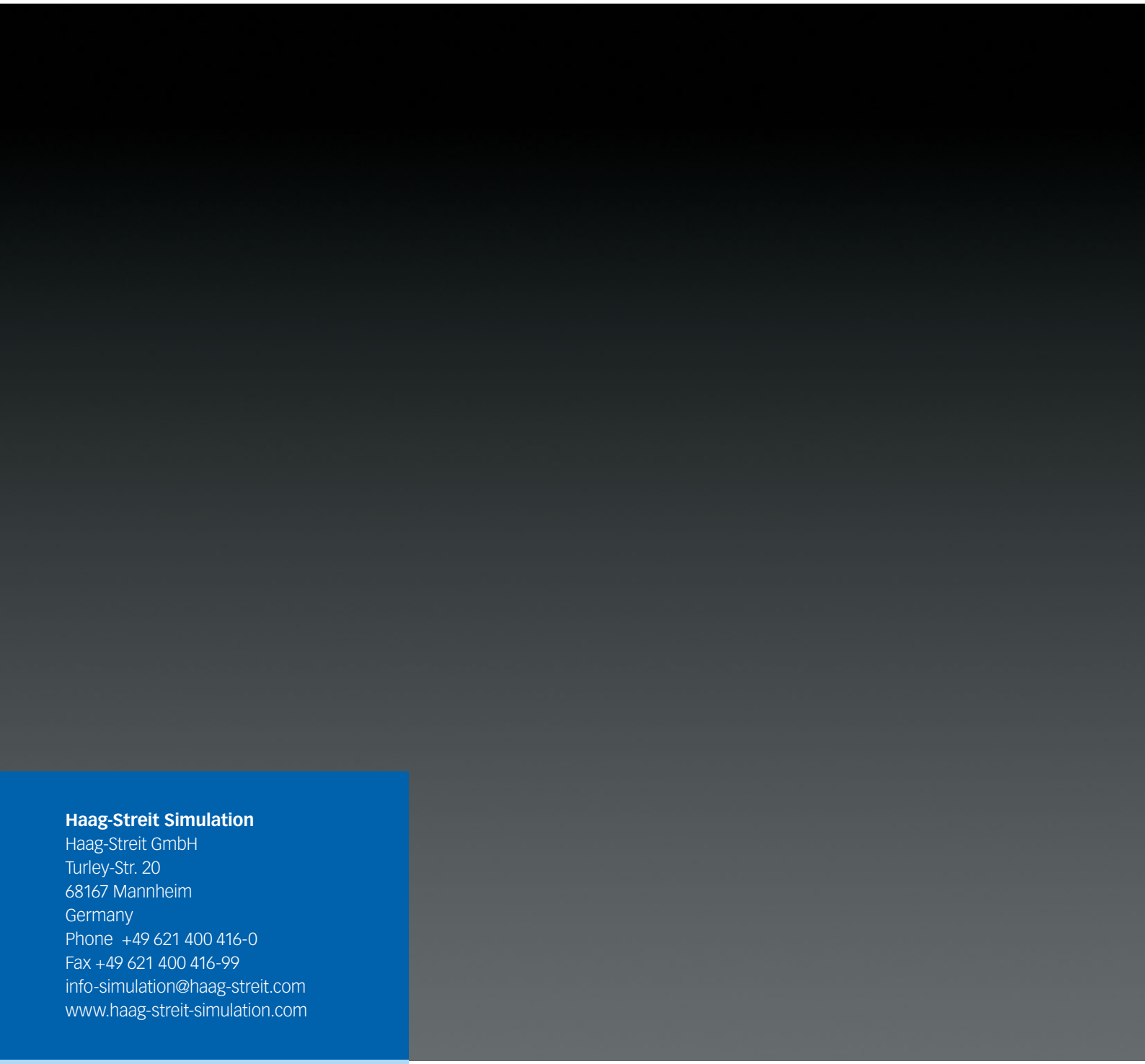


Fig. 138: Right and left retina

7.2 Retina (exam)

This course contains the 4 different cases from the previous learning course. The cases are presented in a random order and trainees do not know the specific pathology. After examining the patients, trainees need to specify their observations in a multiple-choice test. More information on learning courses: ➲ section 1.3 on page 10.



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