# Simplified guide to slit lamp examination for medical students

**Seen Nee Chia**
Senior House Officer in Ophthalmology
Tennet Institute of Ophthalmology
Glasgow

**Lik Thai Lim**
Ophthalmology Registrar
Tennet Institute of Ophthalmology
Glasgow

Dr Seen Nee Chia is a Senior House Officer in Ophthalmology at the Tenet Institute of Ophthalmology in Glasgow. She has a passion for teaching and is actively involved with medical and optometry students.

Dr Lik Thai Lim is a Specialty Registrar in Ophthalmology, at the Tennet Institute of Ophthalmology in Glasglow. Besides enjoying clinical and surgical ophthalmology, he has a keen interest in research and teaching, and a desire to contribute further to the current literature in Ophthalmology.

In medical school the use of ophthalmoscope has been well taught. However, you then discover that the slit lamp is the tool central to ophthalmic diagnosis and management. The ophthalmoscope, though handy, only allows limited view of the retina (fundus), which is why it's also called direct fundoscopy. Its use as a loupe to examine the anterior segment is somewhat limited.

As junior doctors, you might find yourself working in an emergency department with slit lamps. This article is aim to guide non-ophthalmologists to examine the anterior segment of the eye in more detail, to complement direct fundoscopy.

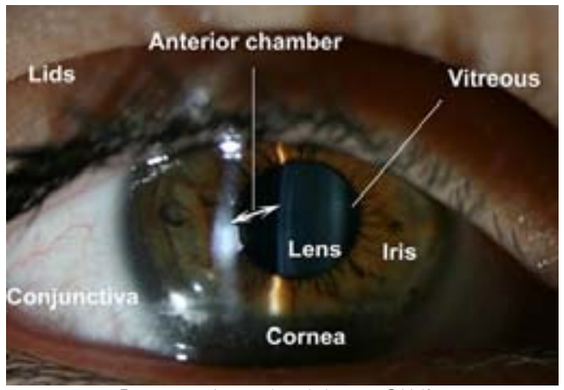
As the name implies slit lamp examination is examination with a slit of light beam. There are many models of slit lamp but the basic operations are similar. The instrument was first devised by an ophthalmologist from Sweden, Allvar Gullstrand, who earned himself the Noble Prize in Medicine 1911 for his invention that has revolutionised ophthalmological practice since.

## GET YOUR ANATOMY RIGHT

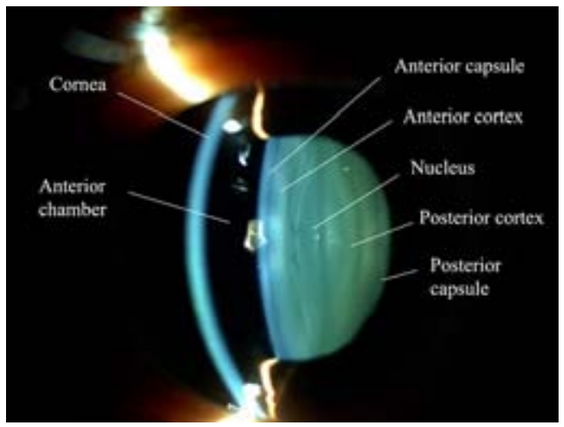
The eye is divided into anterior segment and posterior segment by the lens. You should study the relation of the different structures to each other.

Visual impairment increases three fold with age, with the main causes being cataract, glaucoma and macular degeneration. Cataract is the most common cause of blindness worldwide affecting 15.83 million persons.

Do familiarise yourself with the appearance of the normal and pathological anterior segment and fundus by looking up ophthalmology atlases.




Eye anatomy. Image acknowledgement: G Helfet.

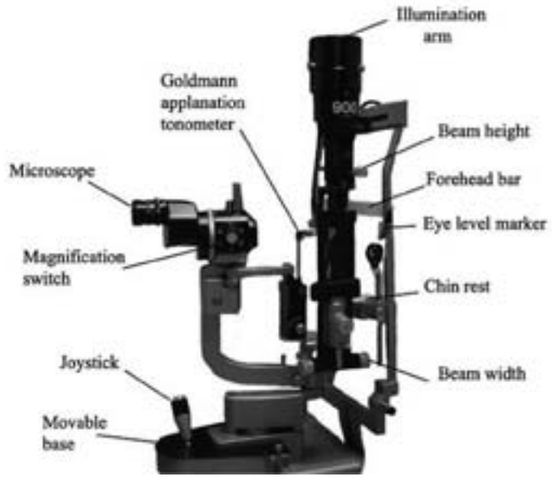



Projecting the slit beam from an angle gives a cross section of the cornea, anterior chamber and lens. Imagine the lens like a cross section of an onion.
Image acknowledgement: Prof Tien Wong

## PARTS OF THE SLIT LAMP

The slit lamp is essentially a combination of the binocular microscope and the illumination arm. Light is directed at the eye and the clinician looks through the microscope.






Basic parts of the slit lamp. Image acknowledgement: Prof Tien Wong

## BASIC OPTICS

The underlying principle of slit lamp examination is optics, which is a branch of physics studying the behaviour and properties of light. The character of the illuminating light can be manipulated to enable the examiner to visualise a particular detail.

There are broadly two illumination techniques employed to visualise different aspects – direct and indirect. Direct illumination is self-explanatory, where light directed is reflected. Indirect illumination uses light reflected from a structure behind to illuminate a structure in front. This is feasible by varying the angle of light directed and the slit dimensions.

## BEFORE STARTING

As in any other clinical examination, explain the procedure to the patient prior to starting. It is important to spend a little time for positioning as patients come in different sizes and heights. A comfortable patient will be more cooperative during examination. The patient's eye should be aligned to the eye level marker, chin on the chin rest, and forehead resting forward against the forehead bar. Make sure you sit straddling the table to prevent backache.

Adjust the eye piece according to your interpupillary distance. Adjust for refractive errors as you would with your ophthalmoscope. You may choose to keep your glasses or contact lenses on.

The power knob is usually below the left side of the table. If the knob has options controlling the intensity of illumination (the brightness of light), start off by using low illumination.

## VISUALISING THE EYE

A systematic 'outside-in' approach, viewing the eye from external to internal, should be routine. The key is to be observant.

### Lids

Large lumps and bumps, swellings and lacerations will be obvious macroscopically. Slit lamp is useful for detecting blepharitis (inflammation of the eyelid margin) and differentiating small lid lumps.

The external eye is best viewed with bright light of the widest width, with infrared filter if available.

The direction of the eyelashes is important as it may cause associated keratitis.

### Conjunctiva

Conjunctivitis is a common condition. Look for injection, which is prominent reddening of vessels radiating around the cornea. Look also for pigmentation, follicles, papillae, foreign body, scar, hyperaemia, chemosis.

Evert the upper lid to assess the underside for follicles, papillae, erythema from inflammation, tumour and foreign body. You would not be expected to carry out the procedure. You should not attempt lid eversion in post-operative patients.

### Cornea

Various illumination techniques are based on light reflection to view abnormalities of the cornea. Firstly, direct illumination of the whole cornea with low intensity light allows detection of gross abnormalities. The normal cornea should be smooth and clear without any opacity.

Using low magnification maximises the depth of focus. A narrow slit beam is then used to reveal a cross-section. Move the slit across the cornea. The light reflex should be clear and unbroken. Observe the shape of the cornea which is steeply curved in keratoconus.

The fluorescein dye is used with the cobalt blue filtered light to highlight epithelial defects and ulcers. As cobalt blue has shorter wavelength it scatters light better. Fluorescein binds to collagen and any epithelial defect which exposes the corneal collagen will light up green. Caution should be taken in contact lens wearers as the dye can stain the lenses.

### Iris

The normal pupils are round and reactive to light. As you move your light across the pupil, you should be able to see the brisk constriction of the pupil. Pupil reaction to light is lost in rapid afferent papillary defect (RAPD) and iris spasm/trauma. Inspect for, abnormal pigmentation, defects, rubeosis iridis, and pupillary distortion or displacement.

An indirect illumination method termed transillumination enables you to view any atrophic defects in the iris. This technique is also used to assess patency of peripheral iridotomy typically located superiorly. You must line your illumination beam coaxially with the microscope and the red reflex can be seen through the pupil as well as any hole in or thinning of the iris.

### Anterior chamber (AC)

Diagnosis and monitoring of treatment of anterior uveitis commonly depends on presence of AC cells and flare.

This aqueous-filled space is best viewed with a narrow and short slit beam (1mm x 1mm) of highest magnification power and light intensity. Change the magnification switch to enhance your view. Swing the illumination beam as if to direct the vertical slit beam of light into the centre of the pupil. The anterior chamber is the dark space in between the two slit reflections. The presence of anterior uveitis may give the appearance of dust in front of a projector light, representing AC cells (the dust) and flare (projector light) respectively. AC cells can be better ascertained by asking the patient to look down and then straight ahead again as eye movement floats the cells. This is common post-operatively. Look also for hyphaema (haemorrhage) and hypopyon (pus) which will be seen as fluid level in the inferior.

Subjective estimation of AC depth has importance in glaucoma. The Van Herick's method compares the width of a thin vertical slit beam at the edge of the cornea to the width of the space between the cornea and iris. The peripheral AC is commonly shallow in the presence of narrow iridocorneal angles, giving a risk of acute angle closure glaucoma attacks. Avoid dilating the pupils in such cases.

### Lens

The lens is clear as in normal or opaque (cataract) with increasing age. The eye may well be aphakic (no lens) or pseudophakic (intraocular lens).

By directing the vertical slit beam, but this time focusing behind the anterior chamber, you will note the yellowing or browning of nuclear sclerosis cataract. By retroillumination to obtain the red reflex through the pupil, you can detect the peripheral spokes of cortical cataract or the opaque blob of posterior subcapsular cataract at the centre of the pupil. Cataract is best observed through dilated pupils.

### Vitreous

The anterior vitreous is visualised by using a vertical beam of light focusing behind the lens. 'Tobacco dust', pigmented cells in the vitreous, is a sensitive marker of retinal detachment. It has similar appearance as AC cells though brown in colour and can be encouraged to float by asking the patient to move the eye.

There are many more advanced uses of slit lamp including Goldmann applanation tonometry, gonioscopy and fundoscopy with condensing lenses. These skills are however not expected of a non-ophthalmologist.

### SOME TIPS

1. If you are not in focus, you are either too near or too far from your target. Always navigate the slit lamp backwards so that you do not hit patient's face with the slit lamp, then refocus.

2. Try to use the swing the illumination arm from temporally so that it does not hit the patient's nose.

### SLIT LAMP - A VERSATILE INSTRUMENT

The slit lamp is an instrument that incorporates many functions. There are a whole range of ophthalmological tools for various specific indications. Despite these, slit lamp remains unrivalled as the first line tool in ophthalmology practice.

### FURTHER READING


- James CB., Benjamin L.
  **Ophthalmology: Investigation and Examination Techniques**
- Lim ASM, Constable IJ, Wong TY
  **Colour atlas of ophthalmology**
- Pane A., Simcock P.
  **Practical Ophthalmology: A Survival Guide for Doctors and Optometrists**


### ADDITIONAL SOURCES FOR PDA USERS

- **www.eyepalm.com**

## SUMMARY OF HOW TO USE THE SLIT LAMP

**To position patient and yourself, make the following necessary adjustments:**

- Patient chair
- Chin rest: turn the knob under it to slide it up or down. This is especially useful for eye to chin distance variations.
- Table height: adjust the lever which may be found below the table.
- Examiner chair: make sure the microscope is at your eye level while you are sitting comfortably.

**Slit beam properties:**

- Dimensions: The beam width and height can be manipulated using their respective knobs (refer to the diagram).
- Intensity: The brightness is varied by controlling the voltage using the power knob or the filter control.
- Colour: The filter control has the options of blue-cobalt, red-free (green) or no filter (some have infrared filter which reduces heat from light)

**To focus the slit beam:**

- Joystick: navigate forwards, backwards, diagonally, or laterally with one hand. The other hand is free to manipulate the knobs on either side of the illumination arm, swing the illumination arm or hold a condensing lens in front of the eye for fundoscopy.
- Magnification switch: low magnification is used most of the time. Higher magnification is used to give detailed focus but has the disadvantage of reducing perception depth.

**To manipulate the angle of illumination:**

- Move the slit beam horizontally: steadily hold the beam width knob and swing the illumination arm within a 180° arc.
- Change to orientation of the slit beam: steadily hold the beam height knob and swing the top of the illumination arm within a 180° arc.





# Runway to a dream:
## A flying doctor's story

**Koert-Jan Schonewille**
Emergency Medicine Registrar
Queensland, Australia

Dr Koert-Jan Schonewille is an emergency medicine registrar from Holland currently working in Queensland, Australia. He has successfully combined his two great passions of flying and medicine, and hopes he can inspire others to follow their dreams too!

### Childhood dreams

From a young age I was always attracted to the sky. Airplanes, birds, views from the tall buildings or mountains in Europe, I loved it all. My favourite Lego toy was a yellow rescue helicopter, which I took everywhere. In high school I fantasised about being a rescue diver. I dreamed that I would be picked up by a rescue helicopter from the school's sport ground and depart on life saving adventures!

At the age of 16 I realised that despite a good academic performance at school, I was not happy. Thankfully I discovered gliding and ballroom dancing. These helped me to become more social and a team player. Although these new commitments caused my school marks to drop, my quality of life soared!

In the 1980s I watched the Australian television series 'Flying Doctors' every Sunday night. Although my mum thought I was too young to watch the gory scenes, I had no concerns. I loved it! The adventure, flying, suspense, gossip, romance and heroism were thrilling. I fell in love with Coopers Crossing, the Australian Outback and the pretty sister Kate (ask your dad, I am sure he remembers her too!).

During medical school I tried to organise an elective with the Australian Royal Flying Doctor Service. Countless communications between the Netherlands and Australia ended in no more than "thanks for your interest, but we can't help you". A bit disillusioned I organised a non-flying research programme involving hyperbaric medicine in Sydney. It was mostly for treatment of carbon monoxide poisoning, patients with non-healing wounds and divers with 'the bends'. During those three fantastic months I went gliding, ran a marathon, completed a scuba diving course, and the amazing Landmark Forum and Landmark Advanced courses.

The Landmark Forum is a revolutionary self-education programme focusing on personal and professional growth, training and development. It challenges conventional thinking about ourselves, the world around us and how we interact with it. It filled me with even more passion and drive to take medicine to the sky. I highly recommend this course to everyone!

A few weeks after Sydney I arrived in Christchurch for six weeks of anaesthetics and pain management with Prof Shipton. I'll be honest here; I didn't spend even a few days in the operating theatre! On my first day I mentioned my dream of becoming a flying doctor. Prof Shipton immediately referred me to the Christchurch retrieval specialist, Dr David Bowie. Within minutes I was in his office. He was showing me pictures of the NZ Flying Doctor Service's planes and helicopters when his phone rang. A retrieval job to pick up a patient from Greymouth came through. I couldn't believe my ears when Dr Bowie asked the flight nurse & pilot if I could join them in flight. Within hours on my first day in Christchurch I was flying over the Southern Alps to pick up a patient. My childhood dream was fulfilled!

As a medical student I didn't have any direct responsibility for the patient, but the experience introduced me to the challenges faced when transporting patients by air. I thoroughly enjoyed these flights, when I would accompany the flight nurse and occasionally Dr Bowie. Not all retrieval flights require a doctor. When the Airway, Breathing, Circulation and neurological state of