Education

A medical student's guide to the slit lamp examination

Sunil Ruparelia BSc[1], Devin Betsch MD[1,2], Lesya Shuba PhD MD[1,2]

1. Department of Medicine, Dalhousie University
2. Department of Ophthalmology & Visual Sciences, Dalhousie University

Abstract

The slit lamp is an essential tool for the diagnosis of common eye pathology. Despite many eye conditions presenting initially to primary care, medical students do not typically receive formal training with the slit lamp in standard medical education curriculum. This guide provides a consistent, systematic framework that may be used by students and clinicians when approaching a slit lamp examination. Additionally, suggestions intended to optimize examination outcomes are described. It is our hope that this guide serves to enhance medical student comfort and proficiency with eye examinations, be it in an ophthalmology clinic, primary care, or emergency department setting.

Introduction

Far too often, slit lamp examination (SLE) is thought to be used exclusively by eyecare specialists. However, the slit lamp is also frequently found in many emergency department and primary care settings[1,2]. Previous studies have found that medical school graduates do not receive sufficient exposure to SLE and lack confidence in their eye examinations[3]. Given the high proportion of eye complaints that present first to primary care offices, it is important for all physicians in training to have a standard approach to operating the slit lamp. This guide outlines a systematic, standard approach to SLE which may be used in eye examinations in any required care setting. It is our hope that this will increase proficiency and confidence in diagnosing and managing common ocular conditions.

First formally introduced in 1911[4], the slit lamp has undergone many changes to evolve into the tool used today. The slit lamp is a microscope with a bright illuminating light. It is used to closely examine different parts of the eye. The slit lamp operates by focusing a beam of light, which may be adjusted in width, height, and angle by the slit lamp operator. This beam of light allows the examiner to visualize in detail the 3-dimensional structures of the eye to identify potential pathology. This, in combination with clinical history, is key to the diagnosis of many ocular conditions. In this guide, we outline a stepwise approach to be used by examiners when operating the slit lamp to investigate eye pathology.

Anatomy of the Eye

This section provides a brief overview and description of the anatomy of the eye. Knowledge of basic eye anatomy is key to identifying landmarks and describing findings during SLE. A comprehensive review of anatomy, including illustrations, may be found in the referenced text[5].

Orbit – Bony structure that contains the globe. Made up of seven bones: sphenoid bone, ethmoid bone, lacrimal bone, frontal bone, palatine bone, maxillary bone, zygomatic bone.

Palpebral Fissure – The ellipsoid space between the eyelids (palpebra).

Lateral Canthus – Where the upper and lower eyelids meet temporally.

Medial Canthus – Where the upper and lower eyelids meet nasally.

- *Caruncle* – Pink, globular structure at the medial canthus of the eye.
- *Superior punctum* – A superior opening at the medial canthus through which tears drain into the lacrimal ducts.
- *Inferior punctum* – An inferior opening at the medial canthus through which tears drain into the lacrimal ducts.

Conjunctiva – A clear mucous membrane that covers the sclera (bulbar conjunctiva) and the inner surface of the eyelids (palpebral conjunctiva).

Sclera – The white, collagenous structure of the eye that serves as protective covering. Extends from the border of the cornea (limbus) to the optic nerve.

Cornea – Clear, avascular tissue that transmits and refracts light.

Anterior Chamber – The anterior portion of the eye between the cornea and iris.

The Iridocorneal Angle – Where the iris meets the cornea. The iridocorneal angle contains trabecular meshwork and Schlemm's canal through which aqueous humour drains from the eye. Various angle pathologies can lead to diverse types of glaucoma. For example, obstruction of the angle by the iris results in a rapid increase in intraocular pressure in acute angle closure glaucoma.

Lens – Biconvex, avascular structure located behind the pupil and suspended by the zonule. Refracts light onto the retina.

Uvea – The middle vascular layer of the eye, including the iris, ciliary body and choroid.

- *Iris* – Forms the anterior portion of the uvea. Contains a central aperture (Pupil) which dilates and constricts to regulate the amount of light that enters the eye.
- *Pupil* – Central aperture of the iris.
- *Ciliary Body* – A ring-like structure located behind the iris. Forms the middle portion of the uvea. Attached by zonule to the lens. Contraction and relaxation of ciliary muscles allows for lens accommodation.
- *Choroid* – The highly vascular portion of the uvea that extends from the ciliary body posteriorly to the optic nerve.

Vitreous – A clear, gelatinous structure that fills the posterior segment of the eye.

Retina – A thin, multilayered sheet of neural tissue that lines the inner portion of the posterior eye.

Macula – The central portion of the retina that has a high proportion of cone photoreceptors.

- *Fovea* – A depression in the central macula that contains a high density of cone photoreceptors. Responsible for "high acuity" vision.

Optic Nerve – Contains over 1 million axons, transmits visual information from the retina to visual pathways in the brain. Also carries the central retinal artery and vein.

Slit Lamp Examination

A systematic approach is an important aspect of a thorough SLE. Keeping this approach consistent can prevent the examiner from missing key findings critical to a correct diagnosis. The slip lamp apparatus with labelled components is illustrated in Figure 1. A systematic, stepwise approach to the SLE is described as follows:

1. Prior to SLE, begin by examining the external structures of the eye. Even in patients with monocular complaints, both eyes are always examined. Look for asymmetry, skin abnormalities, obvious orbital deformities or pathology surrounding the eye.

2. Position yourself such that the slit lamp table is at a comfortable position and height for you and the patient and adjust the oculars to your pupillary distance. Position the patient such that their chin and forehead rest in the correct position on the slit lamp apparatus, and so that their lateral canthi are in line with the landmark markings on the slit lamp. Turn on the light source and unlock the slit lamp.

3. You are now ready to begin the SLE. Conventional examination begins with the patient's right eye, starting with the front part of the eye and moving toward the back. Starting from the medial canthus, sweep the light beam across the superior lid margin. Repeat this for the lower lid margin, starting from the lateral canthus.

4. Examine the palpebral and bulbar conjunctiva by gently lifting the upper and lower lids, sequentially and asking the patient to look in four directions of the gaze. Optional maneuver: use a Q-tip to evert the patient's upper lid to better visualize the superior palpebral conjunctiva. Eyelid eversion is useful in cases with conjunctivitis and in cases with suspicion of a foreign body.

5. Examine the cornea. The cornea should be transparent, and of regular surface. Look for any opacities, surface irregularities, or localized thickness changes. The cornea is better examined with a higher magnification. If indicated, corneal epithelial defects can be visualized using fluorescein dye and using the blue light filter. Visualize the layers of the cornea by narrowing and angling the light beam obliquely.

6. Visualize the anterior chamber by shortening and widening the light beam such that it takes the shape of a square. Toggle between the cornea and iris to focus on the anterior chamber. The anterior chamber is normally optically empty, meaning that nothing should be seen between the cornea and the iris/pupil/lens complex. Look for potential cells and

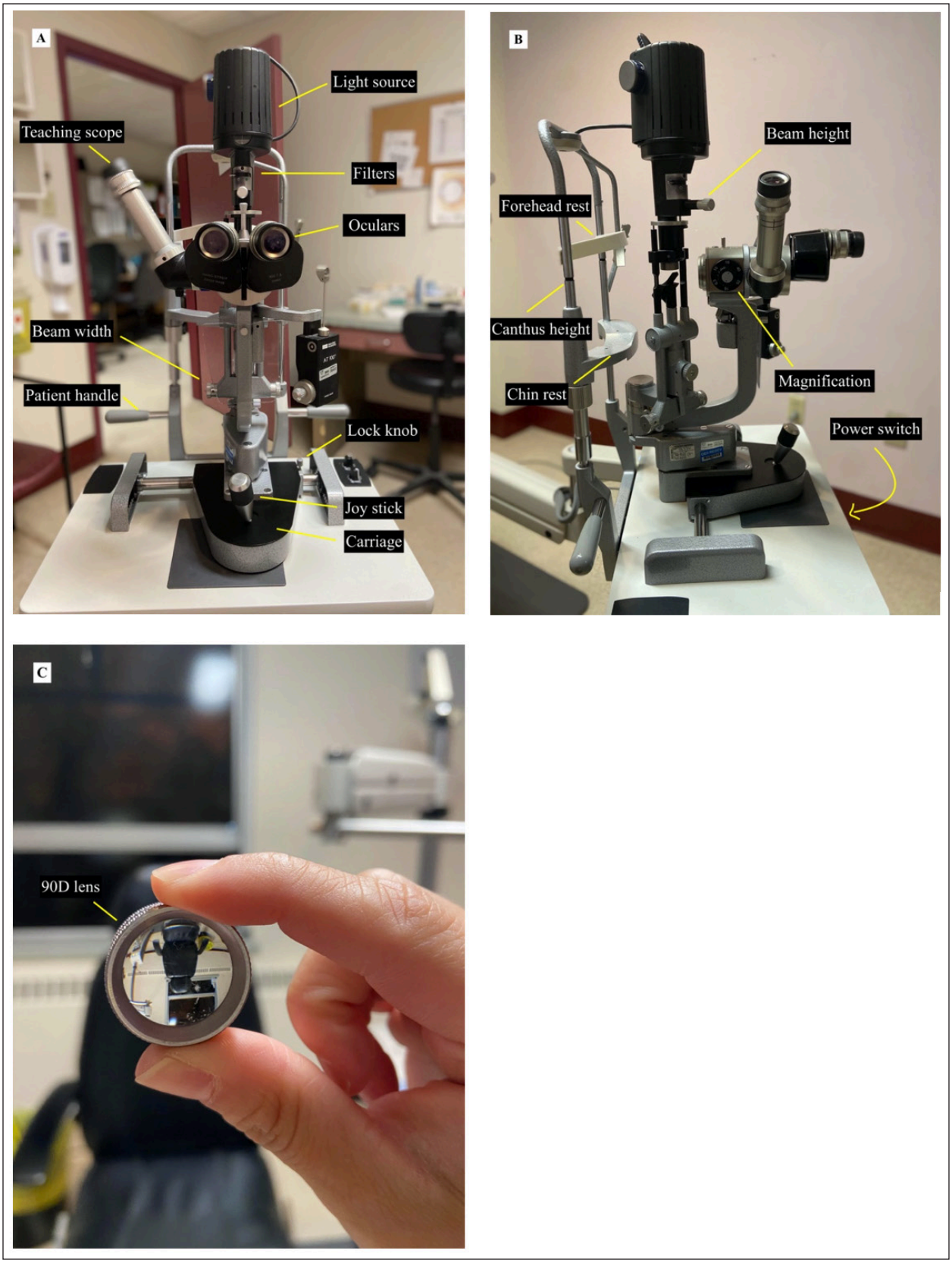

Figure 1. Slit lamp apparatus from examiner's view (A) and lateral view (B) with the 90D lens which is used to examine retina (C).

flare, which may indicate infection, inflammation or hyphema. Cells will appear as floating dust specs, whereas flare appears as a haze. Cells and flare are better appreciated in a dark room and with a high magnification.

7. Continuing posteriorly, visualize the iris, looking for any masses or transillumination defects. To assess for iris transillumination defects, the patient's pupil should be undilated. Narrow the beam of the light source and direct an axial light beam through the undilated pupil. Transillumination is seen as red light reflected back from the retina through defects in the iris. The pattern of transillumination can reveal defects/breaks in the iris and characteristic patterns of certain conditions, such as pigmentary glaucoma, herpetic uveitis and albinism[6].

8. Visualize the lens for any opacities which would be indicative of cataract formation. The lens should be examined using an axial light beam to assess the red reflex, then subsequently with a tangential light beam to visualize the layers of the lens from anterior to posterior.

9. To visualize the vitreous, move the light slightly obliquely and look beyond the pupil. Strands of vitreous should be visible. It may be difficult to visualize the vitreous if the pupil is not dilated pharmacologically.

10. The retina is best visualized when the patient's pupil is pharmacologically dilated. However, if dilation is not possible, the optic nerve head and macula can be examined through a non-dilated pupil in a cooperative patient. A 78 or 90 Diopters lens is required to visualize the retina for any abnormalities. Ask the patient to look with their fellow eye at your ear. Align the light beam coaxially through the pupil and visualize the red reflex. Hold the lens steady between your thumb and index finger about 1-2 cm from the patient's eye. Slowly pull back on the slit lamp apparatus until the retina comes into focus. Visualize the macula and optic disc. You may ask the patient to look in various directions to visualize the retina in its entirety.

11. Complete steps 1-10 for the left eye. Document all findings. Templates for documentation are included as supplemental material. Documentation should describe the location and characteristics of each finding. Locations are typically described in terms of clock hour.

Contraindications

There are no absolute contraindications to slit lamp examination. However, there are relative contraindications that are worthy of inclusion. In the event of chemical burn/exposure to a patient's eye, copious irrigation of the eye is recommended prior to examination. Some patients may have physical limitations that restrict their ability to undergo standard SLE[7]. In such situations, portable slit lamps may be used. Patients may ask whether exposure to light from the slit lamp is damaging to the eye. Examiners should reassure patients that the light exposure from the slit lamp may cause some discomfort but is not harmful.

Tips and Tricks

1. Ergonomics is key – Make sure you are positioned comfortably, as well as the patient. A common pitfall is to forget about your own comfort/positioning. This can take a toll on practitioners after repeated examinations[8].

2. Dim the lights – Decreasing ambient light in the room can allow structures to be better visualized during the examination.

3. Fight the fog – When visualizing the retina, the handheld lens can sometimes become clouded when a patient exhales, particularly if the patient is wearing a mask. Taping the patient's mask to their cheek for the duration of the examination can help with this. Stabilizing the hand holding the lens by resting the 4th or 5th finger against the patient's forehead can also help keep the hand steady.

4. Leverage the light – The width and height of the light beam may be adjusted by the user by manipulating the beam width and height knobs labelled in Figure 1. The light source may also be moved up or down by rotating the knob on the joystick.

5. Don't forget to dial in – Glasses-wearers may find it helpful to remove their glasses and dial in their prescription in the oculars.

6. Don't forget the patient's contact lenses – Remember to ask the patient to remove any contact lenses prior to using fluorescein dye.

7. Mentorship can help – Having someone demonstrate the exam and assist your technique can assist in overcoming any difficulties with the examination technique.

8. Be systematic – Always start with the same eye and visualize structures sequentially in a consistent order. Doing so can prevent missing key findings.

9. Practice makes perfect – Many learners have

difficulty with some of the SLE techniques at first, particularly with using lenses to visualize the retina. Practice and repetition with various settings are key.

Conclusions

In this guide we outline a basic, systematic approach to operating the slit lamp to assist with diagnosis of eye pathology. With slit lamps more commonly found in primary care and emergency settings, it is our hope that this guide provides framework to assist students and clinicians with their assessment and approach to basic findings suggestive of ocular pathology.

References

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Supplement 1

nova scotia health authority

Eye Care Centre

Initial Visit

Date

Chief Complaint	Clinician Note

Systemic Medications	Ocular Medications

Allergies

Past Ocular History

☐ Amblyopia	☐ Glaucoma (type)	☐ Laser Treatment (type)
☐ Strabismus	☐ Trauma	☐ Surgery (type)
☐ ARMD	☐ Uveitis	☐ Other
☐ Diabetic retinopathy	☐ CTLs (type/duration)	

Past Medical & Surgical History

☐ Angina / IHD / MI	☐ Diabetes	☐ Lupus	_____
☐ Arrhythmia	☐ Thyroid disease	☐ Rheumatoid arthritis	_____
☐ CHF	☐ Migraine	☐ Cancer	_____
☐ Hypercholesterolemia	☐ Seizure	☐ HIV / AIDS	_____
☐ Hypertension	☐ Stroke / TIA	☐ Hepatitis	_____
☐ Asthma	☐ Inflammatory bowel disease		_____
☐ COPD			_____

Family History		Social History
☐ Glaucoma	☐ Macular degeneration	☐ Smoking (amount)
☐ Retinal detachment	☐ Blindness	☐ EtOH (amount)
		Occupation _____

Assessment Forms

CD0565MR_Rev_06_09

Page 1 of 2

Supplement 2

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Eye Care Centre

Initial Visit

Examination

CC SC	DV$_A$	PH	NV$_A$	W
OD				
OS				

PUPILS	Light	Dark	Acc	RAPD (lu)	T$_P$/T$_A$	Colour	VISUAL FIELDS	MOTILITY
OD							OS OD	OD OS
OS								

CT 1/3 m 6 m

HERTEL

GONIO OD OS

OTHER

OD OS

AC

I/P / Lens

OD **OS**

C/D

☐ Dilated @ _____
With _____

C/D

Vitreous

Impression	Plan	Investigations to Book
	Consults F / U _____	☐ Photos ☐ OCT/HRT ☐ IVF/ICG ☐ VF (10-2/24-2/GVF) ☐ Topography ☐ PAM ☐ Orthoptics **RN/Tech** _____ **Res** _____ **Staff** _____ **Dictation #** _____

CD0565MR_Rev_06_09

Page 2 of 2