

Introduction to Slit Lamp Biomicroscopy: A How-To Guide for Non-Ophthalmologists

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Abstract

Slit lamp biomicroscopy can be an important component of the emergency and/or primary care physician's approach to a variety of ophthalmologic problems, especially when caring for patients in rural or underserved areas where consultation access is limited. However, physicians are often reluctant to use the slit lamp due to lack of familiarity with the equipment, skill deterioration over time, and fear of causing patients harm. In response to this problem this article is a review for non-ophthalmologists on the use of the slit lamp for management of certain acute and chronic ophthalmic conditions, including the acute red eye, chronic inflammation, trauma, and foreign body management. Objectives include: 1) reliable recognition of anterior segment disorders early in the disease course; 2) the improved ability to use magnification to visualize and manage foreign bodies in the cornea; 3) enhanced alertness for cases requiring consultation/referral; and 4) ability to incorporate the slit lamp exam into routine practice.

Introduction

In order to provide comprehensive primary care and to meet the needs of managed care patients and to provide emergency needs, primary care and emergency physicians must be able to perform a variety of services. The slit lamp examination (aka, slit lamp biomicroscopy) is a required skill for residents according to the recommended core educational guidelines for family practice residents.¹ Seventy percent of programs currently include procedural training in the slit lamp according to a recent survey of program directors; as a comparison, this is slightly more than now teach exercise treadmill testing.² Some programs have described the difficulties of teaching this skill due to lack of readily available abnormal pathology in patients that renders the training episodes random and sporadic.³ This paper is a basic review of the use of the slit lamp.

Description of Slit Lamp Biomicroscopy

"Knobology" for Beginners

* *These numbers refer to the nomenclature guide on Figure 1.*

The slit lamp is a three-part ensemble consisting of a table-mounted binocular microscope^{1*} with a special adjustable light source attached,^{2*} and a patient headrest.^{3*} All units are similar in basic design, though inconsequential structural differences do exist. The unit is unlocked^{4*} to allow movement of the parts and the lamp is illuminated.^{5*} The patient is seated and the chin is placed on a padded rest^{6*} with the forehead pressed against a frame bar at the top.^{7*} By use of height adjustment controls,^{8*} the patient's eyes and the binocular eyepieces are brought to equal heights; the lateral canthus should be parallel to the black marker on the headrest apparatus.^{9*} The patient may then close their eyes until the examiner has made all the positioning adjustments to avoid undue eye-strain. The examiner then begins the procedure by focusing on the external lid structures, and when complete, has the patient open their eyes. The lids are then brought grossly into focus by sliding the movable base^{10*} until the lids are found in the target area as viewed through the eyepieces.^{11*} The patient then opens their eyes and those structures are fine tuned into focus with a control known as a joystick^{12*} that moves the scope up and back, side to side, and occasionally up and down, so that the anterior eye and external structures may be scanned. The examiner will need to adjust the intra eyepiece distance to match their own intra-pupillary distance; adjustments can be made on each unit so the examiner may continue to wear glasses or not.^{13*} The patient focuses on a distal object, a flexible target mounted on the unit,^{14*} or on the examiner's earlobe. The light source has several adjustments which allow the beam to be varied from^{15*} narrow slit, hence the name, to a wide beam as well as from short to long^{16*} and dim through bright.^{17*} Magnification can also be varied from 10 to 16x power.^{18*} Because it is a binocular apparatus, the view of the eye structures is in 3-D. The short thin beam is best tolerated by the patient when viewing anterior eye

segments. The wide beam is painfully bright to the patient and is most often used to screen the external parts of the eye. Most practitioners use the tall thin beam as a compromise.

Figure 1: Slit Lamp Nomenclature

- | | |
|----------------------|--------------------------|
| 1. Microscope | 10. Movable base |
| 2. Light source | 11. Eye pieces |
| 3. Platform | 12. Joystick |
| 4. On/Off | 13. Focus target |
| 5. Base lock | 14. Beam width |
| 6. Chin rest | 15. Beam height |
| 7. Forehead bar | 16. Beam intensity |
| 8. Height adjustment | 17. Magnification switch |
| 9. Eye level marker | 18. Hand rest |

Utilize the lowest power adequate to accomplish your goal while keeping your patient’s eye discomfort to a minimum. Since the beam, when used as a “slit,” can function as an optical microtome, it provides a cross sectional stereoscopic view that allows the examiner to visualize clearly and to define precisely the location of abnormalities in the anterior segment (cornea, anterior chamber, iris, and lens). External anatomy, such as the lens, lashes, skin, tears, and tear ducts are well seen in addition. The goal is to scan the anatomical segments layer-by-layer, side-to-side, and then proceed to the next target tissue. Visualization of the posterior anatomy such as the vitreous and retina is best accomplished by the fundoscope. In some patient’s conditions it may be necessary to do all parts of a tri-part examination, i.e.- examine the external structures with a flashlight, followed by examination of the anterior structures by the slit lamp, and the posterior structures by the fundoscope.

Anatomy and Pathology

When illuminated by the slit of light and viewed through the binocular lens, the examiner may appreciate the five separate layers of the cornea (epithelium, Bowman’s membrane, stroma, Descemet’s membrane, and endothelial layer), localized defects in those separate areas, and visualized cells or protein floating in the aqueous humor producing flare (figure 2). Additionally, the examiner may perform staining, and define more precisely, defects due to trauma or infection; a blue lens is available to accentuate fluorescence dye used to define these conditions.

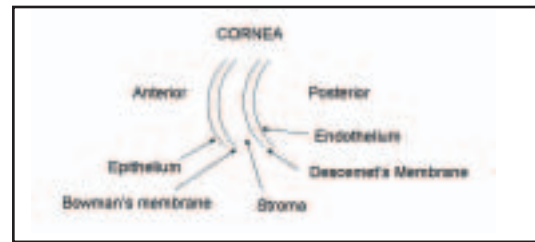


Figure 2: Corneal Cross Section

Foreign Body Examination and Removal

Foreign body visualization and removal is much safer and more effective when using the slit lamp; a hand rest is available on the unit to steady the hand. Resting the fifth digit on the malar prominence is also useful in achieving stability and accuracy (figure 3).



Figure 3

After topical anesthetic administration the needle or eye spud is introduced from the periphery at an angle reducing the likelihood of penetration. The cornea is very tough and there are next to nil misadventures using this technique in removing foreign bodies. One may attempt to remove the rust ring by careful scraping after a metallic foreign body is removed or alternatively a corneal burr may be used (figure 4).

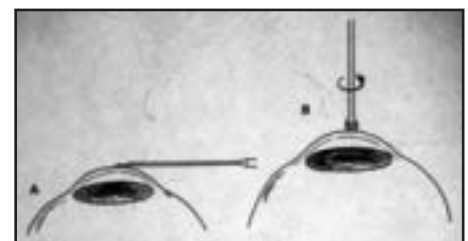


Figure 4

Other Eye Conditions

The slit lamp operator commonly finds the tall narrow beam to be most effective for general inspection, as it allows good visualization without creating undue discomfort to the patient. Other eye conditions seen with this examination include ulcers, abrasions, and keratitic precipitants (KP).

Ulcerations usually lead to corneal edema, which appears as a thickened cloudy area that results from a defect in the epithelium, which is subject to inflammatory changes. Neo-vascularization often follows these injuries. Permanent scarring of course may result from a previous injury, but is differentiated from an active ulceration by its well-defined borders and lack of associated vascularization and pain. Previous scarring may result in some minor visual impairment, but unless it is in the direct focal axis it is usually imperceptible to the patient.

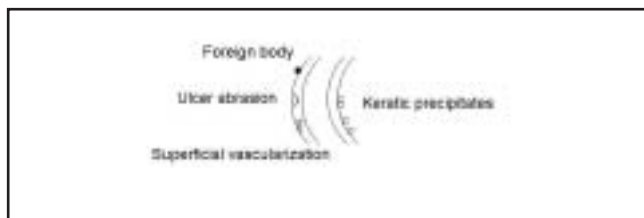


Figure 5: Abnormalities of the Cornea

Abrasions are usually clear based and may be accompanied by vascularization if the lesion does not heal in a few days. Corneal ulceration of course is an ocular urgent situation and requires referral. Though frequent, abrasions usually heal within hours to days, are uncomfortable, but are of minor importance. Both ulcers and abrasions stain with fluorescein.

Herpes simplex creates an epithelial defect that most often creates a dendritic strain pattern. Keratitic precipitants are deposits that adhere to the endothelial surface of the cornea during acute uveitis. They are composed of inflammatory cells and proteinaceous material, are always abnormal, and should lead to prompt referral.

Acute Red Eye Conditions

Patients with an acute red eye, pain, and/or visual loss require special attention. We will now describe several conditions seen on slit lamp examination.

Mucous discharge or tearing, and/or preauricular lymphadenopathy, along with concurrent upper respiratory infection suggests acute viral conjunctivitis (“pink eye”). Thick purulent yellow discharge suggests bacterial conjunctivitis;

gonococcal conjunctivitis is a possibility and gram staining may allow accurate diagnosis. Significant itching, including ropy, white, or watery discharge suggest allergic conjunctivitis. Any discharge or redness associated with a focal corneal infiltrate suggests an infectious corneal ulcer, and immediate referral will be needed.

A mid-dilated and non-reactive pupil with cloudy cornea, local aching pain, possibly accomplished by nausea and headache suggests acute angle closure glaucoma; again a referral is mandatory.

Redness localized in a circular fashion around the cornea with a decrease in vision but no discharge along with photophobia suggests acute iritis.

Redness of the sclera, thickened conjunctiva, with no discharge but possible tearing photophobia and local tenderness suggests scleritis or episcleritis, particularly if there is perilimbar sparing. Consultation for scleritis is needed as it is in acute iritis. And of course so do cases with possible penetrating trauma, other than simple superficial abrasions.

CAUTION:		
RED EYE		
PAINFUL		VISUAL LOSS
Consider Referral/Consultation:		
Acute Visual Reduction/Loss		
Ocular Pain		
Photophobic-Severe		
Circumcorneal Injection		
Corneal Edema		
Corneal Staining		
Corneal Infection		
Hyphema		
Penetrating Trauma		
Abnormal Pupil Size		
Iritis		
Acute Angle Closure Glaucoma		
Abnormal Intraocular Pressure		
Orbital Cellulitis		

Table 1

Summary of Exam Technique

Examination of the anterior chamber is best accomplished in the following manner. Reduce the ambient light in the room to a minimum, yet allow the patient to be able to focus on a fixation point to prevent the eyes from wandering. Reduce the light from the pedestal to a minimum using a narrow beam. Allow the light to enter at an oblique, rather than directly, into the eye. Set the power supply to an intermediate level. Use the joystick to scan the anterior portion of the cornea, sweeping from one side to the other slowly as you keep the lens in focus. This will require the joystick to inscribe an arc pattern as you maintain fine focus on the curved corneal surface. Continue the process with a deeper focus from cornea to iris across the anterior chamber. Most evaluators use two sweeps, one focused on the cornea and the second focused in the mid-portion of the anterior segment. The normal aqueous is very transparent. Any increase in protein content that occurs from inflammation or irritation will increase the diffraction of light in this medium. Findings may range from a faint acellular flair, called Tyndall's phenomena, with individual leukocytes and other cellular matter at one end of the spectrum to hyphema or hypopeon at the other end. It is best to examine with the slit lamp after the patient has been sitting still and upright for several minutes to enhance the layering of RBCs or WBCs. All of these findings indicate acute iritis. Even one single white cell in the anterior chamber constitutes inflammation or infection and requires immediate workup. It should be noted there is a phenomenon in which there is benign sloughing of iris pigment into the chamber; this brown pigment may often be found in the anterior segment after medical medriasis or minor head trauma and is non-pathologic (table 1).

Tonometry

The most common instrument used to evaluate intraocular pressure in the acute care setting is the Schiottz tonometer. While obtaining a lamp mounted applination remains a goal, it is usually far too expensive for most practitioners in the setting in which we find ourselves. A portable handheld applination device is also an extremely accurate instrument which is also quite expensive and also easily misplaced. Most of us are left with either clinical palpation techniques or a Schiottz tonometer. The clinical palpation technique in a setting of a cloudy cornea in a patient who meets the other criteria for acute angle glaucoma is probably sufficient for the diagnosis. For tracking the efficacy of treatment however, tonometry is essential. An estimate of pressure in the globe

can be made by discriminating the difference in pressure between palpation of the patella (resembles acute glaucoma) versus the palpation of the femur through the vastus medialis in most normal habitus patients (resembles normal globe pressure) (Figure 6).



Figure 6

The Schiottz tonometer is appropriate in quantitating and assessing intraocular pressure and its usage is readily learned. The patient lays supine with eyes open, looking at a spot on the ceiling. The examiner applies topical anesthetic, waits a few moments, and then with lid retraction supplied by one hand, lowers the Schiottz tonometer onto the cornea for a brief moment while watching the pressure gauge swing to a numerical gauge point. The gauge point number is then checked against a reference page that indicates the intraocular pressure. It is important to ensure that the patient gazes continuously upward with the unexamined eye at the fixation point to avoid them moving the cornea against the surface of the tonometer. The tonometer should rest on the cornea only briefly. Questions concerning sterilization of the equipment remain controversial; they can be autoclaved, while some indicate that alcohol swabbing is sufficient. We keep our tonometer in the narcotic box locked in the department to ensure access and availability.

The Posterior Chamber

One can often see the lens with a slit lamp, but viewing beyond this structure is difficult. The slit lamp is therefore best used for anterior segment inspection. The posterior segment remains the province of the ophthalmoscope, although there are special lenses that can be used along with the slit lamp to do inspection of the retina, however this is not normally considered part of the province of the primary care physician.

Applicable workshop

The teaching of slit lamp biomicroscopy for non-ophthalmologists is facilitated by the use of models and faux anterior segments. A workshop for training small groups of learners can be established using available scopes and a 1:4 teacher-student ratio over a 2-3 hour period with excellent results.⁴

References

1. Conditions of the Eye-Recommended Curriculum Guidelines for Family Practice Residents. (www.aafp.org/edu/guide/rep263.html)
2. www.mainedartmouth.org/pdf_files/Procedure/%20Training.pdf
3. Morris, WR, A Simple Model for Demonstrating Abnormal Slitlamp Findings, *Arch Ophthalmol.* 1998; 116:93-94.
4. References for our curriculum, teaching stations, and mannequin models with faux eyes are available at www.emfellowship.com.

Other Suggested Reading

1. Nemeth SC: Basic Slit lamp Techniques. *J Ophthalmic Nurs Technol* 1996 (Jul-Aug); 15(4):134-41
2. Rosenwasser GO, et al.: Topical anesthetic abuse. *Ophthalmology* 97:967, 1990
3. Leitman MW: *Manual for Eye Examination and Diagnosis*. Blackwell Scientific, 4th ed., Cambridge, MA, 1994
4. Havener WA: *Ocular Pharmacology*. St. Louis, CV Mosby, 1978, 413
5. Parr J: *Introduction to Ophthalmology*. Oxford Medical Publications, Oxford University Press. 3rd ed., 1989, 112-5

6. Miller BW: A review of practical tests for ocular malingering and hysteria. *Surv Ophthalmol* 1973,17:241-7
7. Tate GW, Safir A: The slit lamp: History, principles, and practice. In Duane TD (ed.): *Clinical ophthalmology*. Vol 1. New York, Harper & Row, 1981, ch. 59
8. Samples JR, Hedges JR: Ophthalmologic procedures. In Roberts JR, Hedges JR (ed.): *Clinical procedures in emergency medicine*. Philadelphia, W. B. Saunders, 3rd ed. 1998, ch. 67
9. Janda AM, in: Tintinalli JE, et al. (eds.): *Emergency Medicine*. McGraw-Hill, 4th ed., 1996,1059-66
10. Bresler MJ, Hoffman RS: Prevention of iatrogenic acute narrow-angle glaucoma. *Ann Emerg Med* 1891;10:535-7
11. Lennette EH, Spaulding EG (eds.): *Manual of Clinical Microbiology*. Am Soc Microbiol, 1974
12. Crown LA: Biomicroscopy/slit lamp workshop. Annual Family Practice Review Course, University of Tennessee College of Medicine
13. Pesch TW: Introduction to basic ocular biomicroscopy. Annual continuing medical education lecture and course, Wyoming Valley Family Practice Residency Program, Kingston, Pennsylvania.