Introduction to Slit Lamp Imaging Basics
By Jeremy Graziano, O.D.

Ocular photography in the optometric office plays a key role in patient records, communication between eye care professionals, and in patient education. Clarity and accuracy of imaging is crucial. The paraoptometric is often asked to perform the imaging. Photography in itself is an art. When you add the dimension of taking the imaging with the use of a slit lamp, the technique requires the skills of being proficient with the slit lamp and the art of being a photographer. Follow along as you learn the steps to obtain the most defined and clearest imaging.

How to Get the Best Focus When Imaging

Perhaps the most frustrating experience when capturing an image is to see a structure in perfect focus through the oculars but the resulting image is blurry. How do I know if it's me or the device? How do I fix it? Follow along below to get this problem under control!

Install the Focusing Rod

First, you need to have your focusing rod. This should have come as standard equipment with your Slit Lamp. They are usually interchangeable between brands so if you need to, grab one from a different unit. It goes into the hole where the lamp and ocular arms pivot. The flat side faces towards the oculars.

The red arrow is the location of the focusing rod
Focus the Oculars for Your Eyes

Most all of us have some correction necessary. This is how to set the oculars properly for your eyes.

1. Move the magnification drum to 16x.
2. With the focusing rod in place, narrow the beam until it is a moderate slit (~2 mm wide).
3. Turn the oculars as far to the negative as you can (that is, as far counterclockwise as possible).
4. You need to do this part of the procedure with only one eye open at a time. (If needed, put a piece of paper in front of one of the oculars.) While looking through the microscope with just one eye, slowly turn the ocular towards the plus (clockwise) until you FIRST see the focus rod come into focus. Do not adjust or fine tune - if you go past the first point of focus, start over. You do not want to adjust beyond the first point of focus because your eyes can accommodate and invalidate the calibration.
5. Repeat for the other eye.
6. Take note of the numbers on the oculars - if you have multiple users on the slit lamp you'll need to set the oculars before you begin to take any pictures, and you can use those numbers on other slit lamps.

You now know that your eyes are parfocal with the slit lamp.

Ensure the Camera is Focused

Now, confirm that the imaging system and the slit lamp are indeed parfocal (when the slit lamp is properly in focus the image will be as well). If the imaging system has a Live View, bring it up on the screen and check the focus. The image of the focusing rod should be in clear focus. If the system does not have a Live View setting, then take a picture. The image should be clear and in focus.

If your Live View or picture is not clear, you should stop now - the camera needs to be focused. The system is not parfocal and needs to be calibrated for you to have success moving forward. You may need to contact the manufacturer.

Still Not Right?

The camera, the slit lamp, and the oculars should now all be parfocal; however, you may still find your images come out blurry! What could be happening?

Your own eye's focusing system may be getting in the way - you may be accommodating. This allows you to move the slit lamp closer to the subject than the parfocal point.

You have two options at this point.
The first requires a special focusing ocular with a reticle. The correct focus position is when both
the subject and the reticle are in focus. This method is reliable but requires additional equipment
and requires concentrating on two subjects at the same time.

A simpler method I found to be very effective is to thwart the eye's accommodation reflex:

1. Find the area of interest and then pull the slit lamp back a tiny amount until it is slightly
out of focus.
2. Push the slit lamp forward until the subject FIRST comes into focus and immediately
take the shot.

The trick is to not continue driving forward as that is when you are accommodating. You can
experience this easily by simply getting into that point of first focus and continue pushing
forward. You will notice the subject remains clear for a short distance. This is why your images
may be blurry when the subject looked so clear in the oculars.

![Move the slit lamp towards target and stop at first point of focus](image)

A well-focused image is a beautiful thing. A little set-up and a couple of simple habits can
ensure it will be yours.
When and How to Use the Diffuser

The slit lamp has a beam spot size that is much smaller than the viewable area at low magnifications. Slit lamps can have spot sizes ranging from 8 mm up to around 14 mm but this can leave a great deal of information for the photographer in an unlit area.

![No diffuser at 10x mag](image)

Doctors will often want to not only see the lit area but also the surrounding tissue for a greater point of reference.

Enter the Diffuser

An external light source can be an excellent method to fill in the dark zones, but sometimes one may not be handy. Fortunately, the majority of slit lamps come with a diffuser that can spreads out the light.

![Red arrow show the diffuser in up (engaged) position.](image)

The diffuser is very effective on reflective tissue such as the eyelid, conjunctiva, and even the iris. It is not a good option for the cornea except in the case of capturing fluorescein.
The Difference

The effects you can expect are:

1. Some reduced reflection
2. A loss of shadow and perceived depth
3. An extension of the spot beam to fill in most of the viewable area.

A likely limitation of the diffuser is that, unlike with an external light source, the center of the lit area is the brightest with it dimming some as it spreads outwards.

Watch Out!

A common mistake for photographers using a flash-based photo slit lamp is to have the diffuser into place before opening the slit up to a full spot. To ensure adequate lighting, one should first open the slit and then move the diffuser into position. Do not narrow the slit until you capture the image you want.
A Useful Tool

The diffuser is an excellent tool when taking images of the eyelid, conjunctive and iris regions and should be avoided with cornea or lens photography. It can be more forgiving than imaging with a slit, more valuable information can be often captured, and some of the annoying reflections can be mitigated.

![6.3 mag with diffuser and without diffuser comparison](image)

Basic Cornea Dystrophy Photography Technique

Corneal defects are one of the more tricky images to capture well because you are dealing with a transparent surface. Today’s topic focuses on capturing a defect using direct lighting.

The basic steps to capture a corneal defect with direct lighting are:

**Step 1:**
Position the light stack approximately 45 degrees from the oculars.

**Step 2:**
Adjust slit width to fully cover the defect you wish to capture.

**Step 3:**
Fine tune light slit to ensure the light hitting the iris is not acting as a background to the defect. You want the background to be dark and this means utilizing the pupil if possible.

![Image of cornea with defect](image)

You can see how the defect extending halfway into the illuminated iris thereby making it very hard to see.

Images courtesy of Dr. Mark Mandel, M.D. of Optima Eye Clinic.
To bring the defect into full view, a slight rotation of approximately 10 degrees nicely creates the ideal view.

A wonderful example of capturing a corneal dystrophy using direct lighting after moving the light stack a few degrees further.
Quick tips:

1. Take advantage of the pupil if possible. If the defect is a little off the pupillary axis, having the patient look in the direction that brings the defect more towards the doctor will often place the pupil behind it. It can also improve the depth of field.
2. A dilated pupil helps a lot when you need the dark background.
3. Don’t forget you can move the oculars as well; they do not need to just be facing straight ahead.

Obtaining the most defined and clearest image is an art that can be achieved with practice. By paying attention to the details and utilizing the steps defined in the article, you will be able to enhance the patient record and patient education for the practice.

About our Author
Jeremy Graziano, O.D. graduated Optometric School in 1999 from Pacific University. Subsequently opened a private practice called OGLE until 2010 when he launched Eye Photo Systems Inc, acting as the President. Eye Photo

No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means (electronic, mechanical, photocopying, recording, or otherwise) without the prior written permission of the publisher.
Copyright© 2015 by The American Optometric Association
Introduction to Slit Lamp Imaging Basics

To receive one hour of continuing education credit, those taking the quiz must be an AOA Associate member paraoptometric and answer 7 of the 10 questions correctly. This exam consists of multiple-choice questions designed to measure the level of understanding of the material covered in the continuing education article “Introduction to Slit Lamp Imaging Basics.”

If you are renewing a CPO, CPOA or CPOT certification this year, proof of 18 earned credits and your $95 renewal payment will be due to the CPC by November 1. All quizzes submitted by October 1 will be graded and CE verification forms will be emailed to the paraoptometric by October 15 so that the November 1 renewal deadline can be met. Please note that quizzes submitted after October 1 will not be processed in time for you to meet the November 1 deadline.

Quizzes and order forms can be mailed to AOA-PRC, 243 North Lindbergh Blvd., St. Louis, MO 63141; faxed to 314-991-4101; or scanned and emailed to PRC@aoa.org.

This article is worth one hour of continuing education credit from the Commission on Paraoptometric Certification. Expiration date: Dec. 31st of the current year

To receive continuing education credit, complete the information below and mail with your $10 processing fee, $10 per hour of CE before December 31st of this year to the:
AOA Paraoptometric Resource Center, 243 N. Lindbergh Blvd, St. Louis, MO 63141-7881

Name ___________________________________________ Member ID number ____________
Address__________________________________________________________________________
City __________________________________ State __________ ZIP Code ________________
Phone ___________________________________________________________________________
E-mail Address ________________________________________________________________
Card Type ___________________________ Exp. Date _____________ Security Code ______
Card Holder Name ______________________________________________________________
Credit Card Number ____________________________________________________________
Authorized Signature ____________________________________________________________
Select the option that **best** answers the question.

1: Which of the following structures is NOT a good choice for using a diffuser:
   A. Conjunctiva
   B. Cornea
   C. Eyelid
   D. Iris

2: What magnification should be used when focusing the oculars?
   A. 6x
   B. 10x
   C. 16x
   D. 25x
   E. 40x

3: What does parfocal mean?
   A. When the slit lamp is properly in focus the image will be as well
   B. When the slit lamp is NOT properly in focus the image will not be as well
   C. Your eyes are accommodating and getting in the way
   D. Looking through the microscope with both eyes

4: Which of the following angles would be best to move the light stack when capturing a typical corneal defect?
   A. 10 degrees
   B. 20 degrees
   C. 30 degrees
   D. 40 degrees

5: What structure would be best to have acting as a background when capturing a corneal defect?
   A. Iris
   B. Limbus
   C. Pupil
   D. Conjunctiva

6: How much of a slit should be used when using the diffuser?
   A. ¼ open
   B. ½ open
   C. ¾ open
   D. Full open
7: How should you focus the oculars?
   A. One eye at a time
   B. Both at the same time
   C. In a well lit room
   D. In a darkened room

8: In which direction do you first turn the oculars before you begin the procedure?
   A. Clockwise
   B. Counterclockwise
   C. Inward, closer to the patient
   D. Outward, away from the patient

9: What does a diffuser do?
   A. Increases the shadows and perceived depth
   B. Decreases the shadows and perceived depth
   C. Increase the shadows and decreases depth
   D. Decreases the shadows and increases depth

10: Slit lamps can have spot sizes ranging from:
    A. 1mm up to 4 mm
    B. 5mm up to 7mm
    C. 8mm up to 14 mm
    D. 15 mm up to 18mm