

Resident Surgeon Competency

Learning to use the PASCAL laser system; a part of on-going professional development

Alex W. Cohen, MD, PhD, Gina M. Rogers, MD, and Jordan M. Graff, MD

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Introduction:

Becoming proficient in performing retinal laser surgery is an important part of ophthalmology residency training. It should be noted that all physicians who have reached this level of training have already studied the physics and physiology necessary to have a background understanding of the interaction of laser energy with living tissue. This and other related material is reviewed by the resident physician during his or her training before proceeding to practical training sessions and patient care. Many differing types and wavelengths of laser energy are available for the treating physician at the University of Iowa (a comprehensive review will not be undertaken in this tutorial). One of the most recent advances in laser technology available to us is the PASCAL (Pattern Scan Laser) photocoagulator which has application in performing panretinal photocoagulation, focal laser, and treating retinal breaks or tears to name a few. The PASCAL uses 532 nm laser and can be set to rapidly deliver energy in a predetermined pattern, thus allowing for decreased patient discomfort and treatment time.

As part of our training program, residents are required to become familiar with the set up and operation of this and other lasers and demonstrate proficiency in the delivery of safe treatment prior to hands-on observed training by faculty in providing stepwise training for performing laser surgery on patients. The complete training rubric for the resident physician at the University of Iowa will not be reviewed here. For more complete information on retinal laser surgery, we direct the reader to other comprehensive sources (see below).

Here we provide a brief overview of the practical steps in learning to use this laser. To begin simulated training, a mock retina is drawn on a black-backed paper (to facilitate laser uptake). Two situations are simulated, PRP in the virgin eye and demarcation of a posterior flap tear of the retina.

Getting Started:

Turn on the laser using the provided key. The computer and the laser will boot up and eventually the default screen will appear which displays a variety of parameters including power, spot size, and duration. Recommended starting parameters for common situations are listed in Table 1. Input the desired settings by using the touch screen and selecting from those available in the drop down menu. For example, spot size can be set at 60mm, 100mm, 200m, or 400mm depending upon the task. The PASCAL is unique in that the laser can be set to deliver a predetermined pattern of

treatment. This is accomplished by touching the "Pattern" menu on the screen which will bring up a new window. From here select a pattern depending upon the type of treatment desired.

Simulated Exercises:

For the first simulated exercise (treating a posterior flap tear) input the parameters as outlined in Table 1. Select the circular pattern from the "Pattern" menu. The number of spots to be delivered can be adjusted by touching adjoining spots until a 360-degree circumferential pattern is selected. The radius of the circle can also be adjusted as needed to surround the tear. The laser aiming beam is not visible until the "Standby" button is pressed, which changes the mode to "Treat" making the laser active. Align the aiming beam so that the simulated tear is outlined and adjust the radius as needed. Next, the laser power needs to be titrated until an appropriate burn is achieved. For this, touch "Titrate" which will change the pattern to a single spot. The power can be adjusted by using either the touch button on the screen or by rotating a knob on the actual slit lamp. Audible clicks are heard as the laser power is increased or decreased. With the simulated paper retina, much more power is required to achieve a burn than would normally be required when treating actual retina. Once an appropriate burn has been achieved, press "Titrate" again and the full pattern will return. Now the laser is ready to deliver the selected pattern of treatment. The simulated flap tear should be treated with three consecutive circumferential rows. The radius of the circle should be enlarged after each treatment. Any insufficiently treated areas should be filled in by selecting a single spot from the "Pattern" menu and applying laser where needed.

For the second simulated exercise, panretinal photocoagulation, adjust the global settings as described in Table 1 and select either a 3x3 or 4x4 grid from the "Pattern" menu. Use the titrate function again to achieve appropriate burns. Once this is accomplished, press "Titrate" again to switchback to the full grid of treatment. Apply panretinal photocoagulation around the periphery of the simulated retina. Change patterns as needed to fill in any missing areas. It is important to realize that the laser does not apply all of the spots of a pattern at once; rather each is delivered over the set time. Thus, if the patient moves, the spots of the grid will become distorted. Letting up on the foot pedal can abruptly terminate laser delivery during any point of the pattern treatment. In some cases it may be necessary to apply the pattern in smaller segments for improved comfort and safety.

Table 1: Recommended Starting Parameters for Various Treatments

	Power (mW)	Spot Size (mm)	Duration (ms)	Pattern	Lens
PRP	350	200	20	3x3	Super Quad 160 Rodenstock
FOCAL	100	100	20	Single	Super Macula 2.2 Area Centralis
HST	350	200	20	Circle	Super Quad 160 Rodenstock

The real patient:

The resident surgeon first observes several treatments by experienced faculty in a controlled setting. Thereafter, faculty use an observing scope on the laser to guide stepwise training in applying to the real patient the same principles of laser surgery that have been studied and practiced in advance. Residents are provided with oral and written feedback on each treatment until competence has been verified. When treating patients, similar recommendations apply as those outlined above. However, delivering laser to a patient requires the use of a direct contact lens and a coupling agent such as Hypomellose 2.5% (GONAK). Various lenses are available for each type of laser application (see Table 1). Generally, lenses such as the Super Quad or Rodenstock are used for PRP or treating a retinal tear. Lenses such as the Area Centralis or Super Macula 2.2 are used for focal laser treatments. The surgeon should be aware of the magnification power of varied lenses and adjust treatment parameters accordingly (see Table 2). The patient should be given a drop of topical anesthetic prior to placing the lens on the eye. A coupling agent should be applied to the lens, being careful to avoid air bubbles. Once the lens is placed on the patient’s eye and the surgeon has oriented himself to the desired area of treatment, the above outlined protocol should

be followed. It is important to remember that patients may experience pain during laser treatment and this can be minimized by limiting the duration of treatment, lowering the power, or in some instances decreasing the number of spots being delivered at one time. A peribulbar or retrobulbar block can also be used as needed for anesthesia.

Table 2: Laser Retinal Spot Size Multiplier in Emmetropic Eye (adapted from Folk and Pulido, 1997)

Type of lens:	Multiplication factor for spot size:
Three-mirror Goldmann type	1.08
Mainster	1.05
Area Centralis	1.01
Mainster wide-angle	1.47
Panfundoscope 1.41	
QuadrAspheric or Super Quad	1.92

Shutting down:

Once treatment has been terminated, place the laser in “Standby” mode. The specific parameters of treatment, including lens used, spot size, spot number, spot duration and power used, should be recorded. The coupling agent can be cleaned from the patient’s eye with sterile saline if needed. The laser is turned off by selecting “Shut Down” from the screen menu or just turning the key to the “Off” position.

Note:

Accompanying Video is available at www.eyerounds.org/tutorials/PASCAL-Laser-tutorial.htm

This is a brief overview of the practical application of training resident surgeons in using one particular laser technology. This is a small part of a more complete training rubric for the resident physician at the University of Iowa. For more complete information on retinal laser surgery, we direct the reader to other comprehensive sources:

1. Folk JC, Pulido JS. Ophthalmology Monographs 11: Laser Photocoagulation of the Retina and Choroid. San Francisco: AAO, 2003.
2. Weingeist TA, Sneed SR. Laser surgery in ophthalmology: practical applications. Norwalk, Conn.: Appleton & Lange, 1992.
3. Walker JD. Diabetic Retinopathy for the Comprehensive Ophthalmologist. Deluma Medical Publishers; 2009.

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