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### **GOLDMANN VISUAL FIELDS: A TECHNICIAN'S GUIDE**

By

Carol J. Pollack-Rundle, BS, COMT

## **INTRODUCTION**

This article will serve as an introduction for ophthalmic personnel who wish to perform Goldmann visual field testing, a manual method of measuring a patient's peripheral vision.

## **OBJECTIVES**

1. The reader will be able to describe the procedure for performing static and kinetic testing using the Goldmann perimeter.
2. The reader will be able to describe the steps used in calibrating the Goldmann perimeter.
3. The reader will be able to list the equipment necessary to perform a Goldmann visual field.

## **DESCRIPTION OF TEST**

In Goldmann perimetry, an isopter is plotted kinetically by moving the test target from the periphery or non-seeing area to an area where it is seen by the patient. The test target is also projected statically at a single location and the brightness increased until the patient sees it. These two methods are then used to determine a patient's field of vision, or the actual area within which the eye is able to detect the presence of an object or stimulus.

About 30% of all patients with pathology cannot be tested with static perimetry. Part of the problem is that the reliability of that test is not guaranteed because of the variability of the answers the patients will give.

The procedure for performing a Goldmann visual field with set isopters, is as follows. Before the patient comes into the room:

1. Make sure the machine is properly calibrated (see below).
2. Have paper inserted, (line up the lines on the paper with the grooves in the paper holder) and the projector arm to the side of the machine so that the patient does not bump into it.
3. Set the fixation mirror on the small mirror (tiny metal handle on the right side of the eyepiece where it meets the bowl. Handle should be in "down" position). For low vision patients it may be necessary to use the larger fixation mirror.
4. Make sure the machine is level.
5. Get out the appropriate lenses and place them in the lens holder, with the lens holder in the proper position for the eye being tested.
6. Review the patient's chart to determine the diagnosis, if current refraction was done and whether Goldmann visual fields were performed previously.

## **PREPARATION OF PATIENT**

1. Seat the patient facing the perimeter.
2. Explain the test to the patient thoroughly, emphasizing the necessity for full cooperation, the need to press the buzzer as soon as the white light is seen, and the importance of maintaining fixation on the center target.
3. Choose the proper lenses for checking the CENTRAL 30 degrees ONLY. Take the current distance RX and add the amount of sphere indicated by Goldmann's table below. If your trial lens set does not contain the exact lens, round up (more plus) to the nearest 0.25 Diopter.

## GOLDMANN'S TABLE

<u>Age</u>	<u>Add</u>
40-44	+1.50 DS
45-49	+2.00 DS
50-54	+2.50 DS
55 & older or cyclopleged	+3.00 DS

Use cylinder correction of +1.00 or more. If cylinder = +0.50D or +0.25D, add +0.25 to sphere and use spherical equivalent.

Example:

Best corrected distance Rx for 41 year old OD -2.00 +2.00 X 120

OS -3.25 +0.75 X 090

Use: OD -0.50 +2.00 X 120

OS -1.50 sphere

### **REMOVE THE LENSES WHEN CHECKING OUTSIDE THE CENTRAL 30 DEGREES!!**

4. Turn the machine on and the room lights off.
5. Patch the eye that is not being tested. Generally, the right eye is tested first unless it is the poorer eye and the patient has never had a visual field before. If, on the basis of your assessment, you do not think the patient can tolerate the testing of both eyes at one sitting, you may choose to begin with the poorer eye if that is the eye the doctor is more interested in.
6. Bring the patient up to the machine. Adjust the chin rest and table height for proper alignment and patient comfort.
7. Look through the viewer by pulling the eyepiece out or in as needed for seeing the patient's eye clearly.
8. Check the patient's vision in the bowl with the lenses chosen to be sure you have the best visual acuity possible. Over-refract with +0.50 or -0.50 sphere for patients with better than 20/50 vision. By this time, the patient should have

become adjusted to the background luminosity and should be ready to begin testing.

9. If the patient's pupil is <3.0 mm in diameter, dilate that eye using Neosynephrine 2.5% unless contraindicated. If pupil does not dilate, add a cycloplegic drop and wait 20 minutes before starting test.

## TESTING

The visual field examination is divided into a central 30-sector and the remaining peripheral portion. It is important to have set guidelines for determining the initial target stimulus, since the test target is based on the patient's best-corrected visual acuity. These should be used routinely. It is helpful to post them on a card on or near the perimeter for reference.

<u>Visual Acuity</u>	<u>Initial Target</u>
20/15	I1e
20/20 - 20/60	I2e
20/70 - 20/100	I3e
20/200 - count fingers	I4e, III4e, V4e
Hand motion	V4e

If too fine a target is used, you may obtain threshold defects, tire the patient unnecessarily, and use up time getting insignificant findings. Never use a target dimmer than the fine intensity "e." If, in your opinion, the target used is large enough and bright enough to be seen outside of 30 degrees temporally but is not seen when checked kinetically, move the target from the other horizontal meridian as well as both vertical meridians. If viewed within 20-30 degrees, the patient most likely has a defect on the temporal side. Use this target. When performing repeat visual fields, whenever possible use the same target as previously used. This will make comparison with earlier fields more meaningful.

## FOR KINETIC TESTING OF THE CENTRAL FIELD

1. Begin by moving the target at a steady rate from 40-50 degrees on the temporal side (at approximately the 330 meridian for OD and the 220 meridian for OS), towards the center. **Always work from a non-seeing to a seeing area.** Ask the patient to buzz as soon as they are fairly sure that they can see the light come into view.

2. Bring the target in twice initially, so as to give the patient the general idea.
3. Mark the second response.
4. Continue testing all meridians, moving superiorly until all four quadrants are completed. One extra point should be checked directly above and below the horizontal meridian on both the temporal and nasal sides for glaucoma fields. For neurologic fields, extra points should be checked superiorly on either side of the 90 meridian and inferiorly at the 270 meridian.
5. Plot the blind spot with eight points or more as necessary. The approximate center of the blind spot is at 12-15 degrees on the temporal side of the fixation point, about 5 degrees below the horizontal meridian.
6. Periodically instruct the patient to close his or her eyes and rest. Quite often when the patient is fatigued he or she will quit responding. You may allow the patient to sit back between isopters but realize that you will have to realign the patient.
7. Map out the isopter and/or color in the blind spot at this time. All shaded areas are non-seeing areas. Explain the next step of static-kinetic testing procedure at this time.

### **FOR STATIC-KINETIC TESTING OF THE CENTRAL FIELD**

1. Starting at 2.5 degrees centrally, show the target for approximately one second and continue to all 2.5, 5, 10, and 15 degree points.
2. Periodically stop to test whether the patient is responding due to habit or picking up a rhythm, and occasionally vary the rhythm or pattern to prevent this.
3. Circle all points missed. If they are missed on the second testing, mark an X in the center of the circle.
4. After checking all 76 points and rechecking any missed points you may, on the basis of the X'd areas, kinetically plot out scotomas by moving the target from the center of the non-seeing area in eight or more directions as indicated (as if plotting the blind spot).
5. While the patient is still fixating on the center dot, move the target slowly within the isopter to confirm the scotoma or discover another non-seeing point not found by checking 76 points.
6. Plot as many points as necessary to map the boundaries of the scotoma adequately.

7. After doing so, continue to recheck X'd points statically by increasing the gross intensity of the test target (arabic numerals I-IV), for example, I2e, I3e, I4e. If the defect is still present with each of these, even if it becomes smaller as the intensity of the target is increased, the target size (roman numerals I-V) should be increased using the brightest intensity, for example, II4e, III4e, IV4e, V4e. The point at which the defect is no longer present, using the above sequence, is called the "can see." For example, if the patient has a defect when tested with a I2e and a I3e but the defect is not present with the I4e, the I4e is the "can see." This defect is a relative scotoma. The next step would be to plot another isopter and blind spot with your "can see" light. It may be necessary to remove the lens for all or part of the testing if it is coming close to or going outside of 30 degrees. If the defect is present using the V4e, there is no "can see." This is called an "absolute" scotoma. If the defect is found to be absolute, it is often helpful to choose another target between the range of the initial target and the V4e to plot the scotoma and another isopter.
8. It is very important to monitor the eye constantly throughout testing through the telescope for fixation and possible head movement.

After completing the central field, have the patient close his or her eyes and sit back and rest. The visual field will be more accurate with these periodic breaks because it is difficult, especially for an elderly patient, to remain in one position for an extended period of time. While the patient is resting, remove the lens, change to the large mirror fixation target, and instruct the patient on the next step of the procedure. Have the patient come back up to the machine and make sure he or she is aligned properly before beginning the peripheral field.

## **TESTING THE PERIPHERAL VISUAL FIELD**

1. Always use the brightest target, 4e. The size is variable, depending upon which size target the patient is able to see at about 80-85 degrees on the temporal side. *Photo #4*
2. Stress to the patient that it is necessary to raise their upper eyelids as high as possible for the superior quadrants to avoid an artificially-induced superior defect. Occasionally it may be necessary to tape the upper lid for a short time (gently), being careful to allow the patient to be able to blink when taped.
3. Kinetically check all meridians, as in central field testing, with the exception of checking two points above and below both horizontal meridians rather than one as done previously (check the superior and inferior meridians this way for neurological fields). Remember to check the horizontal meridian consecutively and carefully on the nasal side for greater accuracy in noting step defects in glaucoma.

4. Move the target slowly within the peripheral isopter instructing the patient to respond if the light becomes dim, flickers, or disappears at any time. This is to detect any peripheral scotomas. If any scotomas are found, plot as stated previously in central field testing.
5. Measure and record the pupil size in millimeters, note if pupil was dilated for test.
6. Have the patient sit back and relax.
7. Remove the patch to allow the covered eye to adapt to the light before testing the fellow eye.
8. Map the isopters by connecting the dots.
9. Indicate the target used and the eye tested. Use a different color pencil or marker for each isopter tested. It is helpful to standardize pencil colors to be used each time with the set isopters.
10. Note that 76 points were checked and whether each isopter was done with or without correction.
11. Record the patient's name, OD or OS, visual acuity, the date, ID number if used, your name, pupil size, whether pupil was dilated and the lens used.
12. Make comments regarding the patient's cooperation, fixation, reliability, or any other significant information such as taping the eyelid.

### **WHO ORDERS THE TEST? WHY IS THE TEST ORDERED? WHEN IS THE TEST ORDERED?**

Doctors order the test to detect any damage to sensory visual pathways and to document the extent of the patient's field loss and/or possible defects. Most commonly performed in glaucoma and neuro-ophthalmology practices.

### **WHO PERFORMS THE TEST? WHAT SKILL LEVEL IS REQUIRED: BASIC, INTERMEDIATE, ADVANCED?**

Any properly trained ophthalmic staff person (technician, nurse, or physician) can perform this test at the intermediate or advanced skill level.

### **ESTIMATED LENGTH OF TIME TO COMPLETE THE TEST**

This test will take approximately 15-45 minutes for each eye, depending on the amount of damage, the documentation needed, and the expertise of the perimetrist. If it takes any longer, the patient will be too fatigued for the results to be accurate.

## EQUIPMENT AND SUPPLIES NEEDED FOR TEST

- Goldmann perimeter or other similar manual perimeter
- Visual field paper
- Colored pencils or markers
- Trial lenses and holder
- Eye patch
- Light meter
- Head strap (optional)
- Bulbs – one large and two small
- Fuses
- Pencil sharpener
- 2 stools or chairs
- Dark room away from traffic where there will be no distractions

## METHOD OF CALIBRATION: (SHOULD BE DONE DAILY PRE-TESTING)

1. Close the door and turn room lights off (same conditions for testing).
2. Turn the machine on.
3. Set stylus arm (sometimes called pantograph arm) handle into the small circle at 70 degrees on the right side of the paper chart. Lock by inserting centering pin into socket.
4. Turn all filter handles to far right (largest, brightest-V4e).



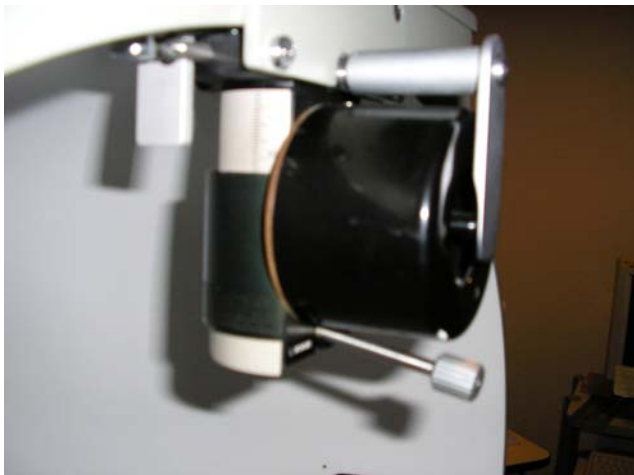
*Technician side of perimeter: Note all filter handles to far right (V4e), paper in proper position.*

5. Insert light meter into slot on left side of bowl.



*Light meter attached to perimeter*

6. Turn on small bulb on left side of bowl for illumination of light meter screen.
7. Open photometer screen by pushing it up out of the way of the light path. Luminosity should register 1000 Asbs (apostilbs) as the target light shines on the light sensitive cells of the light meter (maximum projected light). This can be obtained by turning the rheostat knob for the main bulb. If unable to obtain optimum luminosity, remove main bulb, rotate 180 degrees and re-check. If still not sufficient, change bulb and repeat procedure.
8. Turn off light for light meter screen.
9. Pull handle of photometer screen down. Target light will now be directed to screen. Change one grey filter now to read V1e.
10. Looking through the aperture at the right side of the perimeter, adjust the brightness of the photometer rings to that of the photometer screen by sliding the diaphragm up and down until brightness is the same on the ring as the screen. This sets the background luminance of the perimeter to 31.5 asbs.



Diaphragm for background luminosity.

11. Return photometer screen handle to up position and re-check illumination of target by repeating steps 6 and 7.

The light meter is delicate and should be handled with care. It should not be exposed to bright light and kept in a drawer when not in use.

After calibration, always unlock the projector arm and return it to the side of the perimeter. To preserve the life of the main bulb, turn the machine off when not in use, even between eyes when testing.

*Maintenance and repair of equipment or instruments used in the test. See owner's manual*

### **POINTS TO REMEMBER**

There are two built-in defects on the Goldmann perimeter. Because of the slots on either side of the bowl, it is not possible to plot responses beyond 65 degrees on the 0 and 180 meridians.

The Goldmann perimeter has a built-in central scotoma depending upon target size. If the stylus arm is directed at the very center cross on the paper chart it may only produce only a glow or not be visualized at all by the patient.

When testing, the rate of speed in moving the target is important. It should be moved at a slow, steady pace, a constant rate of about 2 degrees per second. Since perimetry results are entirely dependent upon the subjective response of the patient, it is important to be aware of the individual differences in patient reaction time.

Observation of the patient's fixation is imperative at all times since the normal tendency is to look toward an object, especially one moving in the periphery. If the patient has trouble gripping a buzzer or the buzzer is not functioning, he/she can tap on the table with one finger or other object to indicate when the target light is seen.

## TROUBLE-SHOOTING

The perimeter is a pretty sturdy piece of equipment and with proper care should last many years. Bulbs may need replacing and the bowl should be dusted occasionally, taking care not to scratch the bowl. There is a special cleaner available from the manufacturer but this should only be used perhaps yearly or even less often if the perimeter is kept covered and clean.



*Patient side of perimeter*

Fuses rarely need replacing but check the fuse if the machine does not turn on after checking the plug. Check the target lights in the bowl periodically to make sure they are round and do not contain shadows.

## SUMMARY

The Goldmann visual field perimeter continues to be a valuable tool for ophthalmologists and technicians. Bowl perimetry allows measurement of the full extent of the visual field under highly controlled and reproducible testing conditions.

## RESOURCES

The Field Analyzer Primer, Essential Perimetry, 3rd ed, by A. Heijl & V.M. Patella, 1-877-486-7473 Carl Zeiss Meditec, Inc.

The Visual Fields Manual by Jonathan D. Trobe and Joel S. Glaser. 1983 Triad Publishing

Visual Field Examination by Norma Garber, CO, COMT® Revised Edition, 1991, Slack Incorporated

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By

**Carol J. Pollack-Rundle, BS, COMT**

*CE on the Internet Quiz*

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1. When checking the peripheral vision using the Goldmann perimeter, it is important to:
  - a. Have the patient remove their glasses
  - b. Include corrective lenses in the lens holder
  - c. Remove the lens holder and corrective lenses (if used for central testing)
  - d. Use the V4e target
  - e. Use the I4e target
  
2. The rate of speed when moving the target light should be:
  - a. 0.5 degrees per second
  - b. 2 degrees per second
  - c. 5 degrees per second
  - d. 10 degrees per second
  - e. 15 degrees per second
  
3. When a patient has counts fingers vision, what size test object should be used?
  - a. I4a
  - b. III4e
  - c. V1e
  - d. V4a
  - e. V4e
  
4. When testing a patient with glaucoma, it is very important to pay special attention to this area of the field:
  - a. Nasal inferior
  - b. Superior at 90 degree meridian
  - c. Inferior at 180 degree meridian
  - d. Central 5 degrees
  - e. Nasal at horizontal meridian
  
5. When checking the physiologic blindspot, it is important to check at least how many points?
  - a. 2 points
  - b. 4 points
  - c. 8 points
  - d. 12 points
  - e. 16 points

6. Goldmann bowl perimeters are calibrated to a set background luminance of:
- 1,000 apostilbs
  - 31.5 apostilbs
  - 31.5 decibels
  - 1,000 decibels
  - 180 apostilbs
7. If the patient's pupil is less than \_\_\_\_ it may be necessary to dilate this eye for the visual field.
- Three millimeters
  - Four millimeters
  - Six millimeters
  - One centimeter
  - Three centimeters
8. It is important to do this daily prior to performing a Goldmann visual field test:
- Clean the machine
  - Calibrate the machine
  - Focus the eyepiece
  - Calibrate the light meter
  - Put the lens holder in place
9. When checking the central 30 degrees of a phakic 50 year old, what corrective lens should be used if the patient's manifest Rx is -2.50 sphere?
- +1.00 sphere
  - +2.50 sphere
  - 2.50 sphere
  - No corrective lens needed
  - +2.50 cylinder
10. Light intensity is expressed as a(n):
- Stylus
  - Pantograph
  - Apostilb
  - Scotoma
  - Diopter

# GOLDMANN VISUAL FIELDS: A TECHNICIAN'S GUIDE

## Internet Answer Sheet

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2. \_\_\_\_\_  
3. \_\_\_\_\_  
4. \_\_\_\_\_  
5. \_\_\_\_\_

6. \_\_\_\_\_  
7. \_\_\_\_\_  
8. \_\_\_\_\_  
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c. The material was presented at a level appropriate to my background and level.	5	4	3	2	1
d. Overall, I was satisfied with the article.	5	4	3	2	1

4. What part of the article was **most useful** to you?

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6. What suggestions do you have for improving this article?

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