RETINOSCOPY HANDBOOK
FOR CLINICIANS
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Section I: The Retinoscope

What can retinoscopy be used for?

- Identifies opacities
- Objectively assesses refractive error
- Assesses accommodative posture (Monocular Estimation Method)

Types of retinoscopes:

- Streak Retinoscope
- Spot Retinoscope

Parts of the retinoscope:

- Eyepiece
- Sleeve: rotates beam angle and alters focusing position (pictured here in sleeve up position)
- Battery/handle
- Practitioner’s viewing point
- Mirror
- Condensing lens (sleeve down)
- Light bulb
- Mirror
- Condensing lens (sleeve up)
- Light bulb
Section II: Preparing the Patient and Room

When do I dilate?

The vergence of light entering the eye can be altered by accommodation (focusing power of the eye), therefore, practitioners must suspend a patient’s accommodation to ensure the objective refractive error reading is accurate, but is cycloplegic always necessary?

“Wet retinoscopy” refers to the suspension of accommodation with a cycloplegic drop.

Different dilation drops have various cycloplegic/accommodation suspending effects:

- **Atropine Sulfate 1%-0.5%**
  Strong cycloplegia, peak cycloplegia 60–180 minutes, mydriasis recovery 7–10 days

- **Cyclopentolate 1%-0.5%**
  Good cycloplegia, peak cycloplegia 20–75 minutes, mydriasis recovery 12–48 hours

- **Mydriacil/Tropicamide 1%**
  2 drops 5 minutes apart, adequate cycloplegia, peak cycloplegia 20–35 minutes, mydriasis recovery 6 hours

- **Neosynephrine/Phenylephrine 2.5%**
  Cycloplegia weak, mydriasis recovery 6 - 7 hours

Disadvantages of cycloplegic include temporary photophobia and blur (reduced near vision and, in hyperopes, decreased distance vision), adverse allergic reactions to medication, and anterior chamber angle occlusion in narrow angle patients. Cycloplegic refractions are not always well accepted by patients with active accommodation nor is it always necessary for the accommodative system to be completely relaxed in all patients, therefore, when thinking of prescribing a full cycloplegic refraction in a patient without strabismus or amblyopia, prescriptions should be trialed on the patient in a trial frame without cyclopegia before prescribing.

“Dry” retinoscopy refers to minimizing accommodation by over pulsing the focusing eye by +1.50D and/or by directing the patient’s gaze towards a distant target. Less permanent ways of relaxing the accommodation should be considered if:

1) the patient is responsive,
2) the patient’s age suggests the accommodation system is not at it’s peak,
3) the clinical setting does not allow for checking of anterior chamber angles, and/or
4) if you plan to refract and binocular test the patient after completing retinoscopy.

Preparing the room

- Preform retinoscopy in the dark or dim lighting, if possible, to reduce distractions and provide contrast for the reflex.

- Have the patient sitting comfortably, not standing as standing patients will sway slightly altering the practitioner’s working distance.

- Present a large and non-accommodative target at the furthest point in the room. This is often well achieved by presenting the largest letter on the visual acuity chart.

- Adjust the trial frame or phoropter in front of the patient prior to beginning.

- Have the practitioner’s chair adjusted in front of the patient to ensure they are at eye level with the patient.

- Decide if you will place working distance lenses in the trial frame or phoropter before beginning, or find gross refractive error then minus the working distance power (page 8).
Section III: Static Retinoscopy

With: reflex moves in the same direction of the streak

Against: reflex moves in opposite direction

Neutral: no movement but brightly fills pupil with light

Take note of the brightness and speed of the reflex – what is happening as you get closer to neutral?

Closer to the neutral point the faster, wider and brighter the reflex becomes!

When you are very far from the neutral point the reflex is so dull and slow that it almost looks neutral!! Be wary of that!
The Focusing System – Sleeve Down versus Sleeve Up

Light entering the eye from the retinoscope is reflected from the patient’s retina towards the practitioner. The reflex characteristics (direction, speed and brightness) observed by the practitioner allows the practitioner to assess whether the eye is focused at infinity when looking towards the distance. If the patient’s eye is not focused at infinity, the practitioner needs to add corrective lenses in front of the patient’s eye to move the patient’s far point to infinity – the amount of power required to shift the patient’s far point to infinity is the patient’s refractive error.

The retinoscope sleeve controls the vergence of light from the retinoscope by moving the retinoscope’s condensing lens closer or further from the retinoscope’s light source (page 4). This allows the light projected to be converging (sleeve up) or diverging (sleeve down) changing the placement of the far point.

When the sleeve is down, “against” motion is observed by the practitioner when the far point is between the practitioner and the patient, “with” motion is observed by the practitioner when the far point is virtual (located behind the practitioner’s entrance pupil), and “neutral” is observed by the practitioner when the patient’s far point is at the practitioner's entrance pupil.

When the sleeve is up the opposite occurs: “against” motion is observed by the practitioner when the far point is virtual (located behind the practitioner’s entrance pupil) and “with” motion is observed by the practitioner when the far point is between the practitioner and the patient. However, “neutral” is still observed by the practitioner when the patient’s far point is at the practitioner’s entrance pupil.

<table>
<thead>
<tr>
<th>Motion Seen</th>
<th>Sleeve Down Far Point Location</th>
<th>Sleeve Up Far Point Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Against</td>
<td>Between examiner and patient</td>
<td>Behind examiner</td>
</tr>
<tr>
<td>With</td>
<td>Behind examiner</td>
<td>Between examiner and patient</td>
</tr>
<tr>
<td>Neutral</td>
<td>At examiner's entrance pupil</td>
<td>At examiner's entrance pupil</td>
</tr>
</tbody>
</table>

**EXAMPLES:**

Sleeve up you see “with” reflex motion. The far point is located in front of you, the examiner, between you and the patient. You add negative lenses until you see a neutral reflex motion.

Sleeve up you see “against” reflex motion. The far point is located behind you, the examiner. You add positive lenses until you see a neutral reflex motion.

**EXAMPLES:**

Sleeve down you see “with” reflex motion. The far point is located behind you, the examiner. You add positive lenses until you see a neutral reflex motion at +2.00DS.

Sleeve down you see “against” reflex motion. The far point is located in front of you, the examiner, between you and the patient. You add negative lenses until you see a neutral reflex motion.

**PLEASE NOTE THAT ALL EXAMPLES FROM THIS POINT IN THE MANUAL WILL BE WITH THE RETINOSCOPE SLEEVE DOWN**
Working Distance Power - Gross Retinoscopy vs Net Retinoscopy

Refractive error is defined as the correcting lens that places the patient’s far point at infinity. However, since it is not practical for the practitioner to sit at infinity, we stimulate infinity point this by adding a working distance lens in front of the patient’s eye that equals the dioptric distance the practitioner is sitting from the patient. Once the reflex is neutralized, to find the patient’s refractive error we must minus the equivalent dioptric power of the practitioner’s working distance. Typically, practitioners use either a 50cm or 67cm working distance, which equates to -2.00DS and -1.50DS working distance lens, respectively.

“Gross retinoscopy” is the combined power of the working distance lens and the corrective lens that shifted the patient’s far point to the practitioner’s entrance pupil (simulated infinity).

“Net retinoscopy” is the power of the correcting lens that shifted the patient’s far point to infinity, the patient’s distance refractive error (gross retinoscopy value minus the working distance lens).

EXAMPLES OF WITH REFLEX MOTION:

Sleeve down at working distance of 50cm you see with. You add positive lenses until you see a neutral reflex motion at +2.00DS. True (net) refractive error is plano.

Sleeve down at working distance of 67cm you see with. You add positive lenses until you see a neutral reflex motion at +5.50DS. True (net) refractive error is +4.00DS.

Sleeve down at working distance of 50cm you see with. You add positive lenses until you see a neutral reflex motion at +0.25DS. True (net) refractive error is -1.75DS.

EXAMPLES OF AGAINST REFLEX MOTION:

Sleeve down at working distance of 67cm you see against. You add negative lenses until you see a neutral reflex motion at -2.50DS. True (net) refractive error is -4.00DS.

Sleeve down at working distance of 50cm you see against. You add negative lenses until you see a neutral reflex motion at -5.00DS. True (net) refractive error is -7.00DS.

EXAMPLES OF NEUTRAL REFLEX MOTION WITHOUT LENSES:

Sleeve down at working distance of 67cm you see neutral. True refractive error is -1.50DS.

Sleeve down at working distance of 50cm you see neutral. True refractive error is -2.00DS.

TRUE REFRACTION = NEUTRALIZING LENS - WORKING DISTANCE
Astigmatism

If there is no astigmatism the direction of the retinoscope streak makes no difference, as the power of the eye is the same in all meridians. As the practitioner moves the retinoscope streak around 180 degrees, the reflex speed, brightness, width and motion will be identical at all points.

If there is astigmatism present, the retinoscope streak needs be aligned with the meridians of each focal point in order to be neutralized. To identify the two principle meridians in an astigmatic eye, the practitioner moves the retinoscope’s streak angle until it is in line with the direction of the reflex.

NOTE:

a. The axis of the meridian you are neutralizing will be perpendicular to your streak angle. For example, when neutralizing a reflex with the retinoscope streak angled at 170 degrees, you will be neutralizing the meridian at 80 degrees.

b. Mostly, principle meridians are 90 degrees to one another.

EXAMPLE 1 (right eye):

Meridian 1: 170 degrees
Meridian 2: 80 degrees

EXAMPLE 2 (right eye):

Meridian 1: 20 degrees
Meridian 2: 110 degrees
Working Out an Astigmatic Patient’s Refractive Error

EXAMPLE 1:

With: neutralize with +1.00DS at 90 degrees  
Against: neutralize with -0.50DS at 180

Gross refraction at 90 degrees
+1.00

Gross refraction at 180 degrees
-0.50

Using a 50cm working distance true (net) refraction at 180 degrees = -2.50D
Using a 50cm working distance true (net) refraction at 90 degrees = -1.00
Patient’s refraction: -1.00 -1.50 x 90

EXAMPLE 2:

Against: neutralize with -1.00DS at 20 degrees  
Against: neutralize with -3.00DS at 110

Gross refraction at 20 degrees
-1.00

Gross refraction at 100 degrees
-3.00

Using a 50cm working distance true (net) refraction at 20 degrees = -3.00D
Using a 50cm working distance true (net) refraction at 110 degrees = -5.00
Patient’s refraction: -3.00 -2.00 x 20
EXAMPLE 3:
With: neutralize with +6.00DS at 135 degrees

Gross refraction at 135 degrees

+6.00

With: neutralize with +5.00DS at 45

Gross refraction at 45 degrees

+5.00

Using a 50cm working distance true (net) refraction at 135 degrees = +4.00D
Using a 50cm working distance true (net) refraction at 45 degrees = +3.00
Patient’s refraction: +4.00 -1.00 x 135

EXAMPLE 4:
Neutral at 170

Gross refraction at 170 degrees

Plano

With: neutralize with +3.00DS at 80

Gross refraction at 80 degrees

+3.00

Using a 50cm working distance true (net) refraction at 170 degrees = -2.00D
Using a 50cm working distance true (net) refraction at 80 degrees = +1.00
Patient’s refraction: +1.00 -3.00 x 80
Static Retinoscopy (Sleeve Down) Step by Step

1. **Decide the method of accommodation suspension** – cycloplegic drop (instill 20mins prior to retinoscopy), distant non-accommodative target or fogging lens over the focusing eye.

2. **Dim** room lighting, if possible.

3. Have the **patient sitting comfortably** and **adjust** the trial frame or phoropter.

4. **Display a large and non-accommodative target in the distance** (large letter, caregiver with large noisy toy, green light on duochrome chart, etc).

5. **Adjust the practitioner’s chair** so the practitioner is eye level with the patient.

6. **Ask the patient to look at the distant target** (if the patient is responsive, the patient should look in the distance regardless of method used to suspend accommodation to keep the patient’s gaze straight).

7. **Suspend accommodation in the focusing eye (left eye)**, by moving the retinoscopy streak across the left pupil and observing the movement to decide if the reflex is with, against or neutral. **Quickly** add lenses in front of the left eye so the reflex motion is close neutral (if using a 67cm working distance) or slightly against (if using a 50cm working distance). This will over plus the left eye by approximately +1.50D, relaxing accommodation.

8. **Assess the reflex of the right eye without lenses, first moving the retinoscope streak around all meridians, looking for a break in reflex indicating the presence of astigmatism.**

   a. If **astigmatism** is present, line the streak up where the reflex is in line with the streak angle. Assess the movement of the reflex – with, neutral or against – and add lenses in accordingly to shift the reflex towards neutrality. Remember this value and axis angle if using retinoscopy racks or trial frame.

   Once the first meridian is neutral, move the streak 90 degrees around from the first meridian’s angle to neutralize the second meridian. Assess the movement of the reflex – with, neutral or against – and add lenses in accordingly to shift the reflex towards neutrality. Remember this value and axis angle if using retinoscopy racks or trial frame.

   b. If the reflex appears to line up in all directions with equal width, movement and speed, the refraction is **spherical**. Assess the movement of the reflex – with, neutral or against – and add lenses in accordingly to move the reflex towards neutrality.

9. **Confirm neutrality** by changing the sleeve direction to up (reflex should remain neutral), move forward slightly and reflex should change to “with” motion, add +0.50D and the reflex should change to an against motion.

10. **Leave the right as gross refractive error** (do not remove working distance power yet) to suspend the accommodation of the right eye, which will now become the focusing.

11. **Assess the reflex of the left eye and neutralize** as per steps 8–9.

12. **Remove the working distance power from both eyes** - remove 2.00D (working distance 50cm) or 1.50D (working distance 67cm) from the sphere result.
**Section IV: Retinoscopy on kids**

**Mohindra Retinoscopy**

Mohindra Retinoscopy can be preformed on non-verbal children where cycloplege is contraindicated and the practitioner is having difficulty maintaining the child’s attention in the distance.

This technique is preformed at 50cm from the child in totally darkened room. Since the room is dark the child’s gaze is attracted to the light of the retinoscope.

This technique is preformed monocularly so occlude the opposite eye when preforming retinoscopy on each eye.

Use loose lenses or retinoscopy racks to neutralize the reflex (do not use a phoropter).

To calculate the true/net refraction, minus 0.75D for infants and 1.25 for toddlers.

Although not found to be as reliable as static cycloplegic retinoscopy, Mohindra can be used as a screening tool or when cycloplegia is contraindicated in non-verbal children.

**Clinical Pearls for Preforming Retinoscopy on Kids**

- If you are unable to get a full prescription on a young child, prioritize the most important refractive information:
  1. Check if there is astigmatism greater than 1.00D by scanning the meridians without lenses, looking for significant changes to reflex width, speed and brightness.
  2. Check refractions are equal between the eyes (in all corresponding meridians if you’ve identified significant astigmatism) without lenses.
  3. With loose lenses or a retinoscopy rack, check if the sphere power is between +2.00D and plano.
  4. Then, if you can, narrow down to get the exact prescription.

- Consider what target you are using in the distance – use something engaging that makes noise and/or displays lights.

- If children are not cyclopleged, pay attention to the pupil size. A small pupil size is often indicative of over accommodation and you should suspect moderate hyperopia.

- Have the child sit on their care-giver’s lap.

- Retinoscopy lens racks can be very helpful tools for community screenings, examination under anesthesia, and children/adults unable to wear the trial lens frame or sit behind a phoropter.
Section V: Clinical Pearls

1. If the patient has a large pupil, watch the center of the reflex.

2. Go slower when close to neutralization to identify if the reflex as the retinoscope beam begins to enter the pupil is entering from the same or opposite side. If neutral, the pupil will immediately fill with light as the retinoscope beam crosses the pupil.

AGAINST  WITH  NEUTRAL

3. When neutralizing, add in lenses 1.00D at a time. Continue adding lenses 1.00D at a time until the reflex reverses, then go back in 0.25D steps.

4. Hold the retinoscopy rack or loose lens very close to the patient’s face so not to change the effective power of the lens.

5. Careful not to block the eye that is focusing in the distance with either your head, hand or retinoscopy rack.

6. Scan all meridians before adding any lenses looking for differences in beam width, speed and brightness – this will help identify astigmatism before neutralizing the reflexes.

7. Try adding a working distance lens (67cm = +1.50D, 50cm = +2.00D) into both the right and left lens wells at the back of the trial frame. When you do this, there is no need to calculate the net result, just remove the working distance lenses when finished. Be sure to remove the working distance lenses before checking visual acuity!

8. You must remain on the patient’s visual axis, so ensure you are at the same height of the patient and using your right eye to assess the patient’s right prescription and your left eye to assess the patient’s left prescription.

9. If you initially think the prescription looks spherical, once you neutralize the reflex be sure to move your streak around all meridians once again to look for small astigmatism.

10. When recording your prescription in negative cylinder, the sphere is the most plus meridian and the cylinder is the most least plus meridian.

11. The longer you take to perform retinoscopy the more likely you are to over minus the patient as you begin to accommodate.

12. Maintain your working distance throughout the entire procedure and know your working distance – when beginning tie a string the length of your chosen working distance to your retinoscope. With time, you will get a feel for your working distance and will no longer need the string in order to maintain your working distance.

13. When in doubt stay a little with motion.