BrienHoldenVisionInstitute

RETINOSCOPY

THINK

Retinoscopy is an objective refraction technique that can estimate a person's refractive error without them needing to say anything to you.

Retinoscopy should be done for every person that you examine as it gives you information that you cannot get any other way. It is also extremely useful for people who cannot communicate with you – such as young children or people with mental disabilities – because you can estimate their refractive error without needing to do a subjective refraction.

Doing retinoscopy for every person that you examine will make your refraction faster, more efficient and more accurate.

AIM

This unit will teach you how to perform retinoscopy to measure a person's refractive error objectively.

LEARNING OUTCOMES

When you have worked through this unit you should be able to:

- explain why retinoscopy is a good refraction technique
- describe the parts of a retinoscope and know how it works
- describe the appropriate set-up for doing retinoscopy
- use a retinoscope to scope the principal meridians of an eye
- recognise "with", "against" and neutral ret reflexes
- neutralise the ret reflex using trial lenses
- explain what to do if you have problems seeing the ret reflex.

REVIEW: RETINOSCOPY

LENSES	• Lenses refract light to form a focus. • Spherical lenses can be plus or minus lenses. • Plus lenses are also called: positive lenses, convex lenses, or converging lenses. • Minus lenses are also called: negative lenses, concave lenses, or diverging lenses. • Astigmatic lenses can be cylindrical or sphero-cylindrical.
POWER MERIDIANS OF LENSES	• A spherical lens has the same refractive power along all of its meridians. • A cylindrical lens has a refractive power along only one of its meridians. • A sphero-cylindrical lens has power in two different principal meridians.
FOCAL LENGTH	• The distance between a lens and its focal point is called the focal length. • To find the focal length of any lens there is a formula: **$f = 1/F$ or $F = 1/f$** Where: f = focal length (in metres [m]) F= lens power (in dioptres [D])
ASTIGMATIC EYE	• There are two types of astigmatism: – regular astigmatism – irregular astigmatism. • Usually when we refer to “astigmatism” we mean regular astigmatism. • Regular astigmatism is the most common type of astigmatism. When we refer to “astigmatism” we usually mean regular astigmatism. • There are two perpendicular principal meridians in an eye that has regular astigmatism. • For each of these principal meridians we refer to its: – “meridian” direction → this is where the focusing power is – “axis” direction → this has no focusing power. • Irregular astigmatism is very rare and is usually caused by: – corneal trauma, or – keratoconus (an eye health problem). • An eye with irregular astigmatism has principal meridians that are not perpendicular to each other. • Because the principal meridians are not perpendicular to each other, it cannot be completely corrected with an astigmatic spectacle lenses.
INTERPUPILLARY DISTANCE (PD)	• Interpupillary distance (PD) is the distance (in mm) between a person’s pupils. • The PD measurement must be accurate so that the: – refraction examination is accurate – spectacles are made correctly.
RETINOSCOPY	• A retinoscope and a trial lens set are used to determine the refractive error of the eye objectively. • Good to do before a subjective refraction to use as a starting point.

RETINOSCOPY

Taking a case history is the first step that you take when you examine a person's eyes.

It helps you to understand the person's problems and concerns.

DEFINITION	Retinoscopy refers to the use of an instrument (called a retinoscope) to measure a person's refractive error. Retinoscopy is an objective method of refraction – which means the person does not need to tell us about how they see. When we ask questions about how the person sees, it is called subjective refraction.
WHY DO RETINOSCOPY?	You should do retinoscopy on every person that you examine. Retinoscopy allows you to: • estimate a person's refractive error before you begin your subjective refraction → it provides a starting point for your refraction. • estimate the refractive errors of people who have problems communicating with you, such as: → babies or young children → people with a physical or mental disability → people who speak a language that you do not understand → deaf or mute people. • detect some eye diseases (like cataract or corneal opacities) that can affect a person's vision and your refraction examination.
HOW IT WORKS	When we shine the light of a retinoscope into a person's eye, we can look at the light reflected back from the retina. This reflected light is called the retinoscopic reflex (or simply, the "ret reflex"). The ret reflex looks like a red light inside the person's pupil. Depending on the person's refractive error, when we move the retinoscope the ret reflex will move in a particular way inside the pupil. Trial lenses can be used to measure the amount of movement that a ret reflex has so that the refractive error can be estimated accurately.
TYPES OF RETINOSCOPES	There are two types of retinoscopes: • **Spot retinoscopes:** → have an ordinary light globe that gives a "patch" or "spot" of light. • **Streak retinoscopes:** → have a special globe that gives a line, or "streak", of light.

RETINOSCOPY (cont.)

TYPES OF RETINOSCOPES (cont.)

In this unit, we will focus on the streak retinoscope and its use.

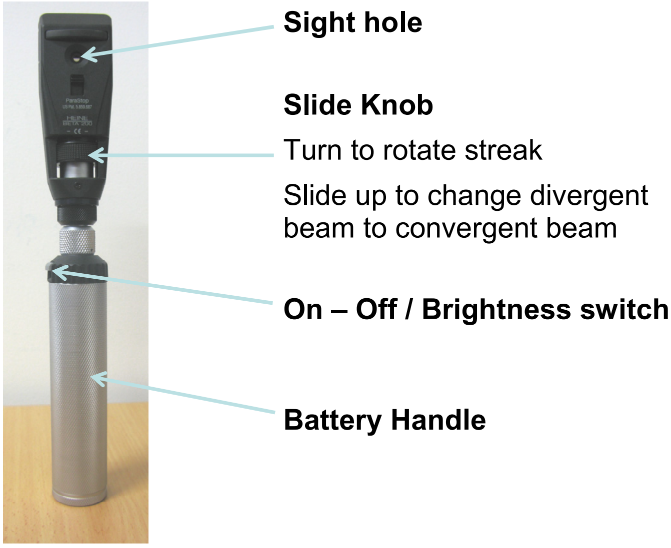
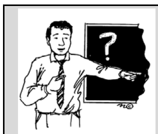


Figure 16.1: *Streak retinoscope.*

PARTS OF A RETINOSCOPE

- **Power switch**
  → turns the retinoscope on and off
  → controls the brightness of the light.
- **Small globe (light bulb)**
  → provides the light.
- **Electrical supply**
  → batteries (disposable or rechargeable) in the retinoscope handle, or
  → a power cord to connect the retinoscope to the main electricity.
- **Mirror**
  → reflects light from the globe into the person's eye.
- **Sight hole (viewing hole)**
  → allows the ret reflex to be seen.
- **Slide knob or sleeve**
  → rotates the axis of the retinoscope's light, and
  → changes the light beam from divergent to convergent light.

If a retinoscope is not working, it is usually because:
- it needs new batteries, or its rechargeable batteries need to be recharged.
- the light globe needs changing – each globe usually lasts for several years.



Retinoscope light globes are made especially for retinoscopes. You must buy your retinoscope light globe from the retinoscope manufacturer.

RETINOSCOPY (cont.)

<table>
<tr><td>STREAK RETINOSCOPE</td><td>
There are several different models of streak retinoscopes, but they are all similar to the one shown in Figure 16.1.
The streak of light can be changed by moving the slide knob or sleeve. It can be:

rotated to any axis position (by rotating the sleeve)
made thicker or thinner in width (by moving sleeve up or down)
changed from convergent to divergent light (by moving the sleeve up or down).

Most retinoscopes produce convergent light when the sleeve is up and divergent light when the sleeve is down.
 Retinoscopy is usually performed with the divergent light.
</td></tr>
<tr><td>SPOT RETINOSCOPE</td><td>
A spot retinoscope makes a “spot” of light instead of a “streak” of light.
The spot of light can be changed by moving its slide knob. It can be:

made larger or smaller in diameter (by moving sleeve up or down)
changed from convergent to divergent light (by moving the sleeve up or down).

Most retinoscopes produce convergent light when the sleeve is up and divergent light when the sleeve is down.
 The spot light of a spot retinoscope does not need to be rotated (like the streak retinoscope) to examine different axis directions.
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</table>

MOVEMENT OF THE RETINOSCOPE REFLEX

SWEEPING

The refractive error of an eye can be estimated by moving the light from the retinoscope across the person's eye. This movement is called "sweeping". Sweeping is done to "scope" (search) for refractive error in a person's eye.

Sweeping should be a smooth, repetitive movement. It should be done several times back-and-forth, up-and-down and in oblique directions. Sweeping in different directions lets us look for astigmatism and measure the refractive error of the eye in different power meridians of the eye.

Sweeping the Horizontal Meridian:

- Use the slide knob to turn the streak to a vertical direction (90°).
- Move the streak of the retinoscope from side to side (along the horizontal meridian).

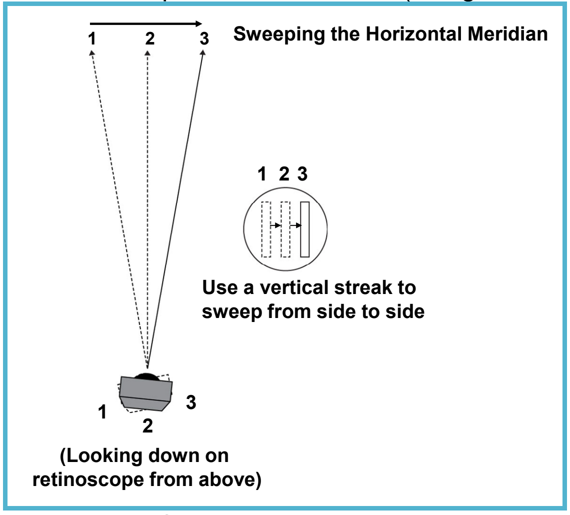


Figure 16.2: *Sweeping the horizontal meridian*

Sweeping the Vertical Meridian:

- Use the slide knob to turn the streak to a horizontal direction (180°).
- Tilt the retinoscope up and down (along the vertical meridian).

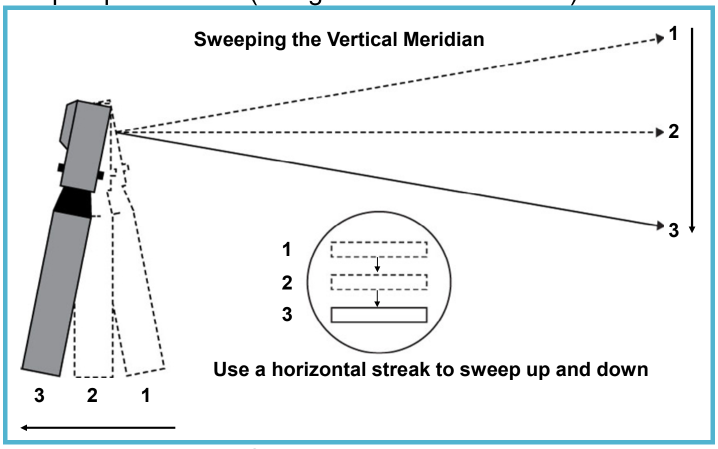


Figure 16.3: *Sweeping the vertical meridian*

Sweeping Oblique Meridians:

Oblique meridians are neither horizontal nor vertical, but they are at an angle.

- Use the slide knob to rotate the streak to an oblique angle (for example, 45°).
- Move the retinoscope in a direction that is at right angles to the streak direction (for example, 135°).

Practice sweeping by shining the streak on a wall and sweeping the horizontal, vertical and oblique meridians.

LOOKING AT THE RETINOSCOPIC REFLEX MOVEMENTS

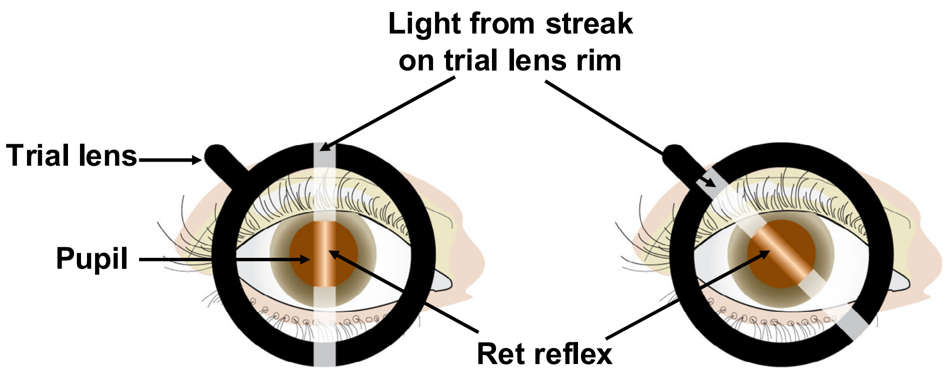
<table>
<tr>
<td>VIEW THROUGH THE SIGHT HOLE</td>
<td>
When you look through a retinoscope at a person’s eye you will see the red ret reflex when you shine the light into their pupil. The ret reflex usually looks like a narrow band of red light that covers part of the pupil.
If you have trial lenses in the trial frame, you will also see the light reflected on the rim of the trial lens.


Figure 16.4: View through the sight hole of a streak retinoscope
When you move the retinoscope, the ret reflex also moves. The movements of the ret reflex may be “with”, “against” or “neutral”.
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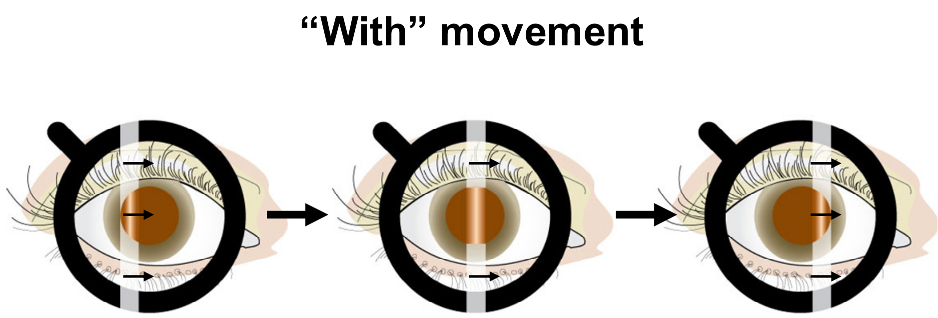
<tr>
<td>“WITH” MOVEMENT</td>
<td>
When the ret reflex moves in the same direction as the sweeping motion of the retinoscope streak, it is called “with” movement.


Figure 16.5: A ret reflex showing “with” movement
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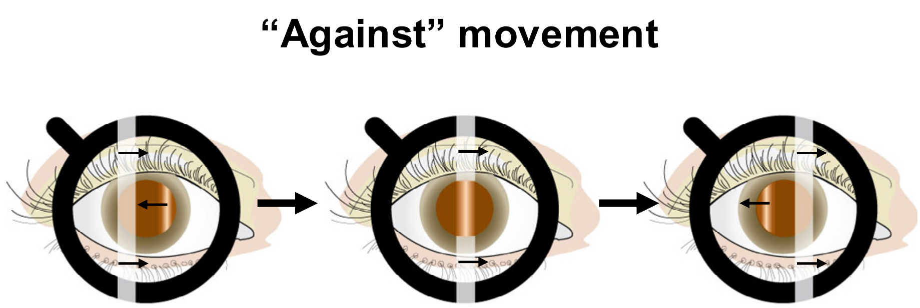
<td>“AGAINST” MOVEMENT</td>
<td>
When the ret reflex moves in the opposite direction to the sweeping motion of the retinoscope streak, it is called “against” movement.


Figure 16.6: A ret reflex showing “against” movement
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LOOKING AT THE RETINOSCOPIC REFLEX MOVEMENTS (cont.)

<table>
<tr>
<td>NO MOVEMENT (NEUTRAL)</td>
<td>When the whole pupil is filled with light and there is no movement of the ret reflex during sweeping, it is called the “neutral” point or “neutrality”.

Neutrality is what you aim to get when you are doing retinoscopy. When you have found the neutral point you can estimate the person’s refractive error.

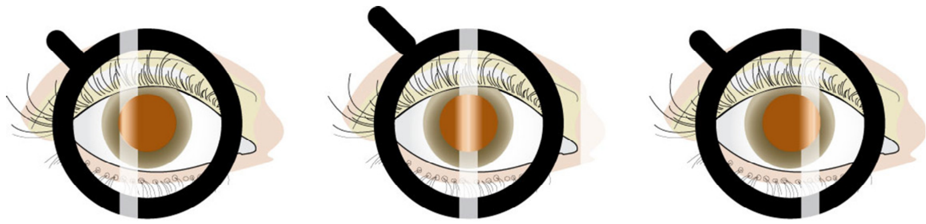

Figure 16.7: A ret reflex showing neutrality</td>
</tr>
<tr>
<td>“SCISSORS” MOVEMENT</td>
<td>Very rarely you will see an unusual ret reflex movement that is called “scissors” movement.

The appearance of scissors movement is:
not neutral, and not “with” or “against”
a “double” reflex that seems to rotate as the streak is swept over the pupil
called “scissors” because it looks like a pair of scissors opening and closing.

Scissors movement is a sign that the person has irregular astigmatism.

A person with irregular astigmatism may:
have poor visual acuity (VA) with spectacle lenses
need a referral to a specialist to see if their vision can be improved.

Irregular astigmatism is usually first detected by an eye examination that includes retinoscopy.</td>
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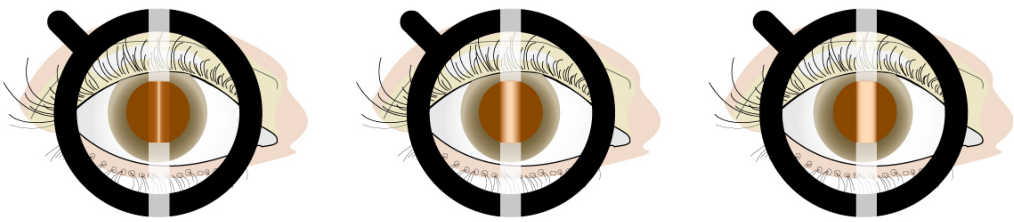
<tr>
<td>CHARACTERISTICS OF THE RET REFLEX</td>
<td>Brightness: Is it bright or dull?
→ The reflex gets brighter as you get closer to the neutral point.
Direction of movement: Is it with or against motion?
→ “With” movement is neutralised with plus lenses
→ “Against” movement is neutralised with minus lenses.
Speed: Is it fast or slow?
→ The speed of the reflex gets faster if it is close to the neutral point.
Thickness: Is it wide or narrow?
→ The ret reflex becomes wider when it gets close to neutrality.


Figure 16.8: As you get closer to neutrality the ret reflex becomes wider</td>
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LOOKING AT THE RETINOSCOPIC REFLEX MOVEMENTS (cont.)

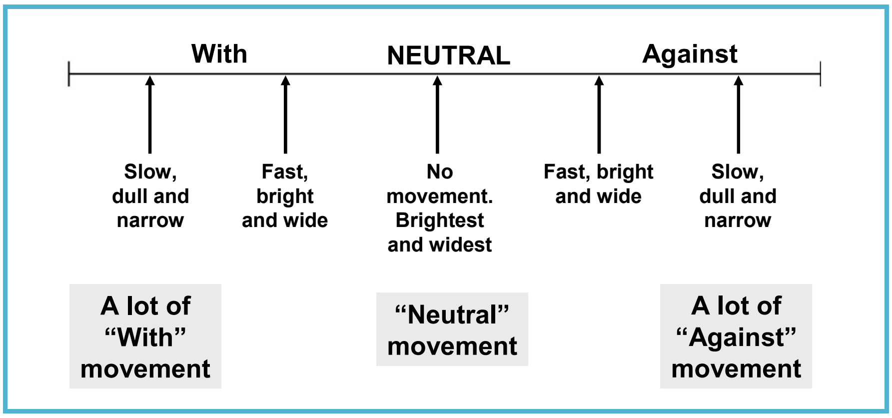
<table>
<tr>
<td>VIEW THROUGH THE SIGHT HOLE</td>
<td>


Figure 16.9: Characteristics of the ret reflex

Meridians: Is the movement the same in all meridians?
→ If the movement is the same in all directions, it is a spherical refractive error.
→ If the movement is different in different directions, it is an astigmatic refractive error.
Break: Is the ret reflex parallel to (aligned with) the streak in all meridians?
→ If it is aligned in all meridians, the refractive error is spherical.
→ If it is not always aligned (if there is a “break”), the refractive error is astigmatic.

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<tr>
<td>NEUTRALISING THERET REFLEX</td>
<td>
The ret reflex can be neutralised by adding plus or minus trial lenses to the trial frame.

Irregular astigmatism is usually first detected by an eye examination that includes retinoscopy.
If you add too much plus:

the movement will change from “with” to “against”
→ this means you have passed neutrality
→ you need to remove some of the plus to go back to the neutral point.

If you add too much minus:

the movement will change from “against” to “with”
→ this means you have passed neutrality
→ you need to remove some of the minus to go back to the neutral point.

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<tr>
<td>WORKING DISTANCE</td>
<td>
When you do retinoscopy you are usually 67 cm away from the person (or sometimes 50 cm). This distance is called the working distance.
The working distance is extremely important because you need to remember it when you calculate a person’s refractive error after doing retinoscopy.
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LOOKING AT THE RETINOSCOPIC REFLEX MOVEMENTS (cont.)

WORKING DISTANCE (cont.)

Figure 16.10: *Retinoscopy is usually performed at a working distance of 67 cm*

When you are learning retinoscopy, you can use a piece of string to measure your working distance.

One end of the string is tied to the retinoscope and the other end is pulled tight to touch the person's trial frame. The string should be 67 cm (or 50 cm) long.

This will help you learn to "feel" the correct retinoscopy working distance. With practice you will know the correct distance without using the string.

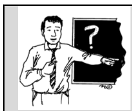
NEUTRALITY AND WORKING DISTANCE

When the neutral point is reached it means that the person's retina is in sharp focus.

If you (and your retinoscope) were 6 m away from the person being examined, the lenses needed to neutralise the reflex would be the same as the person's refractive error. But being 6 m away from the person is impractical (it would be impossible for you to hold the trial lenses in front of the person's eye!) – so you must sit closer to the person.

Usually we choose to hold the retinoscope 67 cm away from the person's eye (or sometimes 50 cm away if you have short arms) – because this lets us hold trial lenses in front of the person's eye with an arm outstretched. If you are any closer than 50 cm to the person, your retinoscopy results will not be as accurate.

Because you are not 6 m or more away from the person, you must compensate for your working distance when you calculate the person's distance refractive error:



If you use a working distance of 67 cm (0.67 m):

→ **subtract 1.50 D from the lens powers that neutralise the ret reflex**

Because: F = 1 / f
= 1 / 0.67
= 1.50 D

If you use a working distance of 50 cm (0.5 m):

→ **subtract 2.00 D from the lens powers that neutralise the ret reflex**

Because: F = 1 / f
= 1 / 0.5
= 2.00 D

LOOKING AT THE RETINOSCOPIC REFLEX MOVEMENTS (cont.)

COMPENSATING FOR WORKING DISTANCE

There are two ways to compensate for the retinoscopy working distance when estimating a person's distance refractive error:

- **Calculation method:**
  - Find the trial lenses that give neutrality.
  - Subtract 1.50 D (or 2.00 D) from the power of these trial lenses (depending on your working distance).
  - This is the power of the lens that will correct the person's refractive error (as measured by retinoscopy).

  Example 1:

  → A +5.00 D trial lens gives a neutral ret reflex at a working distance of 67 cm
  → +5.00 D – 1.50 D = +3.50 D
  → The person's refractive error measured by retinoscopy is +3.50 D hyperopia.

  Example 2:

  → A –5.00 D trial lens gives a neutral ret reflex at a working distance of 67 cm
  → –5.00 D – 1.50 D = –6.50 D
  → The person's refractive error measured by retinoscopy is –6.50 D myopia.

- **Extra trial lens method:**
  - Put +1.50 D (or +2.00 D) trial lenses into the back cells of the trial frame (before you begin retinoscopy) and leave them there.
  - Find the trial lenses that give neutrality and put these lenses into the front cells of the trial frame.
  - Remove the +1.50 D (or +2.00 D) trial lenses from the back cells of the trial frame.
  - The trial lenses that are left in the front cells of the trial frame are equal to the power of the lenses that will correct the person's distance refractive error (as measured by retinoscopy).

The extra lenses that compensate for the working distance are sometimes called the "working lenses".

Example 1:

→ You put a +1.50 D trial lens into the back cell of your trial frame (and leave it there).
→ When you hold a +3.50 D trial lens in front of the trial frame you get a neutral ret reflex at a working distance of 67 cm.
→ You put the +3.50 D trial lens into the front cell of the trial frame.
→ You remove the +1.50 D trial lens from the back cell.
→ The person's refractive error measured by retinoscopy is +3.50 D hyperopia.

Example 2:

→ You put a +1.50 D trial lens into the back cell of your trial frame (and leave it there).
→ When you hold a –6.50 D trial lens in front of the trial frame you get a neutral ret reflex at a working distance of 67 cm.
→ You put the –6.50 D trial lens into the front cell of the trial frame.
→ You remove the +1.50 D trial lens from the back cell.
→ The person's refractive error measured by retinoscopy is –6.50 D myopia.