LENSOMETRY Handout
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TERMINOLOGY

**Lensometer** – instrument designed to measure the prescription of an optical lens.

**Mires** – lines, thick and thin used as measurement images.

**Power Drum or Power Wheel** – dial used to determine lens power.

**Platform** - stage the frame rests on when lenses are being neutralized
Instrument consists of an ocular for viewing the mires, a flat stage or table for supporting the spectacle frame, a power dial, and an axis wheel.

**Sphere** – lens with optical power being the same in all meridians (conveyed in diopters).

**Cylinder** – lens that has different refractive/optical power in each meridian. It is used to correct astigmatism.

**Axis** – meridian of cylinder with the minimum power perpendicular to maximum power meridian. Expressed in degrees.

**Prism** - a transparent, wedge shaped material with two flat surfaces inclined at a given angle that connect at a point called the apex. The two connected surfaces are resting on the base of the prism. Prisms are used to help the eyes to work together by bending or refracting light.

**Lensometer Functions**

The function of a Lensometer is to determine the characteristics of a lens, including:

1. Power
2. Optical Center location
3. Major Reference Point location
4. Prism power/direction
5. Cylinder axis orientation

The Lensometer is also used to place marks on a lens to ensure proper placement of the lens during the fabrication process.
**Lensometry Measurement:**

**Procedure for Single Vision Lenses**

a. Set power wheel to zero  
b. Set the prism compensator to zero  
c. Focus the eyepiece  
   1. Rotate the eyepiece counterclockwise until the reticle is blurred  
   2. Turn the eyepiece clockwise until the reticle is just clear (so as not to over minus the reticle)  

d. **Check the power calibration**  
   1. Turn the power wheel into the plus, and then slowly decrease the power until the lensometer target just sharply focuses (DO NOT oscillate the wheel back and forth to find the best focus). The power wheel should read zero if the instrument is in proper calibration.  
   2. If the power wheel does not read zero, refocus the eyepiece and check the calibration again. If the power wheel still does not read zero, the error must be compensated for on all future measurements made with the lensometer.  

e. **Measure the lens back vertex power in minus cylinder form** – Always start with the right lens!  
   1. Starting with the right lens of the spectacles, place the lens back surface against the lens stop (temples pointing away from you). The lens must be flat against the stop. Center the lens approximately on the stop.  
   2. Move the lens table against the bottoms of the eyewires.  
   3. Lower the lens holder gently against the lens front surface. If you need to move the lens, always lift the lens holder slightly off the lens to prevent scratching of the front lens surface.  
   4. Turn the power wheel into the plus, and then slowly decrease the power until the target starts to clear. If the target is not centered on the reticle, move the lens around on the lens stop until it is.  
   5. If both sets of target lines focus at the same time, the lens is a sphere. Record the lens power to the nearest 1/8 D (0.12 D) Example: OD: -2.12 DS  
   6. If both sets of target lines cannot be focused at the same time (and/or the lines appear broken), the lens is a sphero-cylinder. To determine the lens power, the sphere and cylinder lines must be focused separately.  
   7. Turn the power wheel into the plus. Slowly decrease the power and rotate the axis wheel until a set of lines are unbroken and in sharp focus. In order to read the lens in minus cylinder form, make the sphere lines come into focus first (i.e. the more positive of the two readings). If the cylinder lines come into focus first, rotate the axis wheel 90 degrees – this will change the clear set of lines to the sphere lines. The power at which the sphere lines focus first is the lens sphere power. Record this measurement.  
   8. Continue focusing into or toward the minus until the cylinder lines are in focus. The axis wheel should not need to be moved. (The cylinder lines must focus at a more minus power reading than the sphere lines. If they do not – change the axis 90 degrees and return to step 6 (1). Note this power reading. The lens minus cylinder power is the difference between this reading and the sphere power reading.  
   9. The cylinder axis is read from the axis wheel.  
10. Record your final result. Example –3.00 – 1.50 x 175  
11. Repeat back vertex power measurement for the left lens.  
12. Note: When using an unfamiliar lensometer, the following rule allows you to confirm the target sphere and cylinder lines: When the cylinder lines are in focus at the more minus power position, the line’s angular position will match the reading on the axis wheel.
Procedure for Multifocal Lenses

a. Note: Most bifocal and trifocals are on front surface design; therefore, to accurately measure the addition power, front vertex powers should be measured. This entails turning the lens around so the front surface is against the lens stop. Even though this is the more “correct” method to measure add powers, clinically it is not used often. When the distance and near powers are both small, most people do not bother to turn the glasses around. However, as powers increase, significant differences between the front and back vertex powers do occur, making front vertex measurements very necessary. In this laboratory, we will measure front vertex add powers when the distance sphere power is greater than +/- 5.00 DS. If the bifocal/trifocal is of back surface design, back vertex add powers should be measured.

1. Fused segments are front surface bifocals
2. One-piece designs are usually front surface, but feel the front and back surfaces. The ‘ledge’ of the bifocal will be felt on the front with front surface bifocals and on the back with back surface bifocals.

b. Measure the back vertex power of the distance carrier as you would a single vision lens and record your results (above the bifocal segment).

c. Focus the most vertical set of target lines (may be either the sphere or cylinder lines). Note the power on the power wheel.

d. Slide the lens up, so that the addition segment is over the lens stop.

e. Add plus power on the power wheel, past the point of focus, and then slowly decrease the plus until the same set of target lines are again in clear focus. Note this power reading on the power wheel.

f. The addition power is the difference between these two measurements (steps c and e). It is always a spherical addition to the distance power. Therefore, there is no need to measure the sphere power, cylinder power, and axis location of an addition segment.

g. Record the total lens power. Example: OD: +2.00-1.00x080 Add: +1.25 Repeat for left lens

i. Note: Usually, BUT NOT ALWAYS, the add powers are equal in both lenses of a spectacle prescription.

j. If the lens is a trifocal, you must complete steps c-f for each segment. The power of each segment is always the difference between the addition power and the distance power.

1. The lowest portion of a trifocal lens is used for near vision. Its power is the lens add power (the add power that is ordered from the optical laboratory).

2. The “middle” segment or the “intermediate” segment is usually used for vision at distances beyond “arm’s length” but not at distance. (i.e. computers, grocery store shelves, etc.) the power of the intermediate power is measured exactly the same as a bifocal segment. Its power is specified as an intermediate power (amount of + power added to the distance power) or as percentage of the near (bifocal/reading) portion of the segment.
Prism:

**Horizontal**

Step 1: Place the glasses on the patient
  - With a felt-tipped pen, mark the center of the patient's pupils
  - Vertical positioning is negligible but should be close
Step 2: Center the mark for the right lens on the lensometer
  - Remove any vertical displacement
Step 3: Any remaining deflection in the x axis is the amount of horizontal prism for this lens
  - Notice the rings that are numbered, each ring represents a degree of prism, the direction of the prism is the direction the mires are when focused (can be up or down for vertical)
  - Record the eye, amount and direction (i.e. 2.5° BO OD)
Step 4: Repeat for the left lens
Step 5: Total horizontal prism is the sum of each eye's prism.
  - *Bases in the same direction are additive (BO/BO or BI/BI)*
  - *Bases in the opposite direction are subtractive (BO/BI or BI/BO)*

**Vertical**

Step 1: Measure lens powers
  - Determine which lens has the highest power in the vertical meridian
  - The higher powered lens will be the reference lens
Step 2: Center the target lines on the center of the reticle
  - Move the lens table so that the eyewire is now resting on the lens table
Step 3: Without moving the lens table, slide the other lens onto the lens stop.
  - Position the second lens so that there is no horizontal prism
  - Rotating the reticle so the “crossline” is vertical makes this procedure easier.
  - The remaining vertical displacement is the vertical prism present in the glasses.
Step 4: Record the amount, base direction and eye when specifying vertical prism
  - This will give you the total prism in the glasses, often prism is split between both eye

**Transposition**

Sometimes prescriptions come in plus cylinder; however, optometry works in neutralizing lenses in minus cylinder form. To convert the lens prescription to a minus cylinder form is called transposition. Transposition can also be used to transpose minus cylinder into plus cylinder.

Step 1:
Algebraically subtract the cylinder from the sphere power; this will be the sphere power of the lens.

Step 2:
Change the power sign of the cylinder (the power will remain the same)

Step 3:
Add 90 degrees to the axis