UNDERSTANDING A PRESCRIPTION

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SPHERE, CYLINDER, AXIS, and ADD Power: Why these four variables?

- Example Prescriptions:
  - +2.50 SPH
    - Simple SPHERICAL Rx
  - PL +1.75 X 090
    - Simple CYLINDRICAL Rx
  - -2.00 +1.25 X 180
    - SPHEROCYLINDRICAL Rx
  - +1.50 +1.00 X 045 ADD +2.00
    - MULTIFOCAL Rx

SPHERE, CYLINDER, AXIS, and ADD Power: Why these four variables? (cont.)

- SPHERE = correction the WHOLE eye needs; power is 'everywhere' in the lens
- CYLINDER = correction only PART of the eye needs; patient has astigmatism (distortion); power is only in one meridian of lens
- AXIS = location (meridian) in lens the cylinder power will be oriented to ‘fix’ astigmatism
- ADD = ‘plus’ sphere power “added” to the distant Rx to MAGNIFY objects & change the FOCAL LENGTH of the lens (for near work)

SPHERICAL LENSES

Have the same power EVERYWHERE in lens...

SPHERICAL LENSES (cont.)

Have the same power EVERYWHERE in lens...

SPHERICAL LENSES (cont.)

Form a POINT focus...

SPHERICAL LENSES (cont.)

Have the same power EVERYWHERE in lens...
SPHERICAL LENSES (cont.)
• Used to correct SIMPLE MYOPIA (SM)
Example Rx:
OD: -1.00 SPH
OS: -2.50 SPH

SPHERICAL LENSES (cont.)
• Used to correct SIMPLE HYPEROPIA (SH)
Example Rx:
OD: +1.25 SPH
OS: +2.75 SPH

People that only need a SPHERICAL lens are often said to have a cornea that is shaped like a BASKETBALL (has the same curve everywhere!)

SPHERICAL LENSES (cont.)
• Store bought reading glasses (‘magnifiers’) are just PLUS (+) SPHERE lenses!

CYLINDRICAL LENSES
• Have a meridian of MAXIMUM power and - ninety (090) degrees away - a meridian of ZERO power...
**CYLINDER LENSES (cont.)**

Example of Cylinder Rx's:

- **+2.75 -2.75 X 180** (plus cylinder lens)
- **PL - 2.75 X 090** (minus cylinder lens)

**CYLINDRICAL LENSES (cont.)**

- They form a line focus (shown is a plus cylinder)
- **MINUS CYLINDER LENS**
  - Axis Meridian (Zero Power)
  - Virtual line Focal Point

**CYLINDRICAL LENSES (cont.)**

- **A “minus” CYLINDER lens works the same way, only it would produce a “virtual” line focus**
  - Used to correct for SIMPLE ASTIGMATISM
    - Simple Myopic Astigmatism (SMA)
      - Example Rx: PL -1.25 X 090
    - Simple Hyperopic Astigmatism (SHA)
      - Example Rx: +1.25 -1.25 X 180

**SPHEROCYLINDRICAL LENSES**

- Have a meridian of maximum power...and
- ...niney (90) degrees away, they have a meridian of minimum power
- Each major meridian has some power (which is what makes it different than a CYLINDER lens!)

**CYLINDRICAL LENSES (cont.)**

A patient who has only one “meridian” of their vision that is out of focus (astigmatic) would need a Cylinder lens correction

- **EMMETROPIC EYE**
- **EYE w/SIMPLE ASTIGMATISM**
• When you combine a spherical lens with a cylindrical lens, you get a lens that forms two lines of focus, ninety (90) degrees away from each other, and separated by some distance (dependent on the lens power.)

• Sphero-cylindrical lenses are used for people who are not only nearsighted or farsighted, but who also have a ‘distortion’ (astigmatism) in their vision, requiring a slightly different correction than the rest of the eye needs.

• These people would be diagnosed with one of the following refractive errors:
  – Compound myopic astigmatism (CMA)
  – Compound hyperopic astigmatism (CHA)
  – Mixed Astigmatism (MA); this means part of the eye is myopic & part of the eye is hyperopic!

An example of a sphero-cylindrical Rx would be something like this:

-3.00 -2.00 X 175
(this would fix CMA)

+1.25 -0.75 X 180
(this would fix CHA)

Compound myopic astigmatism (CMA)
Compound hyperopic astigmatism (CHA)

• What about “mixed astigmatism” (MA)?
  The Rx would look something like this:

+2.00 -4.00 X 155

Mixed Astigmatism (MA)
SPHEROCYLINDRICAL LENSES (cont.)

• The area between the two focal lines produced by a SPHEROCYLINDRICAL lens is called STURM’S CONOID (or the Conoid of Sturm)
• Within that zone is a place where the light rays are relatively focused (but not quite); it is called the CIRCLE OF LEAST CONFUSION

ADD POWER

• It is all about the SPHERE!
  – The “ADD” of an Rx gets ‘added’ to the DISTANT SPHERE POWER; cylinder & axis remain same!
  – The “ADD” is always a PLUS (+) number!
  – Plus MAGNIFIES & Plus SHORTENS Focal Length

  EXAMPLE: -0.50 -0.50 X 090 ADD +2.50
• The DISTANT Rx will be -0.50 -0.50 X 090
  – This will be good for Pt from 10 feet to infinity
• The NEAR Rx will be +2.00 -0.50 X 090
  – This will be good for Pt @16”

MYOPES NEED MINUS

• Q: Where is the focal point for NEARISIGHTED pt’s?
  ➢ A: Before (i.e., in front of) the MACULA
• Q: How do we change the focal point?
  ➢ A: Minus lenses!

SPHEROCYLINDRICAL LENSES (cont.)

If you’ve calculated a “SPHERICAL EQUIVALENT”, you figured out which SPHERICAL lens will focus light rays @ the CIRCLE OF LEAST CONFUSION in the eye!
HYPEROPE NEEDS PLUS

• Q: Where is the focal point for farsighted pt’s?
  ➢ A: After (i.e., beyond or behind) the MACULA

• Q: How do we change the focal point?
  ➢ A: Plus lenses!

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ASTIGMATIC PATIENTS NEED CYLINDER

SIMPLE Astigmatism: One meridian focused on MACULA, but meridian 90 degrees away is focused in FRONT or BEHIND the macula... EXAMPLES:

- PL -3.25 X 090
- +3.25 -3.25 X 090

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COMPOUND Astigmatism: Both meridians are either focused IN FRONT or BEHIND the MACULA, but not @ the same location... EXAMPLES:

- - 1.00 - 1.00 X 091
- +3.00 -1.00 X 001

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MIXED Astigmatism (MA): One meridian is focused in FRONT of the MACULA, & the meridian 90 degrees away is focused BEHIND the MACULA... EXAMPLE:

- +1.50 - 3.00 X 045

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PRESBYOPE NEEDS ADD POWER

• General Rule: By age 40 & older, people need ‘help’

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PRESBYOPE NEEDS ADD POWER (cont.)

• By age 65, virtually all accommodation is lost
  ➢ +2.50 ADD = 16 inch Focal Length (reading dist!)

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LIGHT RAYS FROM NEAR OBJECT ARE VERY “DIVERGENT” WHEN THEY ENTER THE EYE

OBJECT 16 inches from EYE → LENS OF THE EYE CAN’T “ACCOMODATE” ENOUGH TO FOCUS DIVERGENT LIGHT RAYS COMING OFF THE “NEAR” OBJECT
WHAT IS UP WITH PRISM?!?

- When a Pt sees double (or ‘blurred’ vision that is not due to a refractive error) the Eye Doctor will often prescribe **PRISM**
- The prism will “shift” where the image appears to the patient

**Rx as written by Doctor:**

+0.50 -1.75 X 125 ADD +2.00 w/50% int

+0.50 -1.75 X 125 (distant Rx)

+1.50 -1.75 X 125 (intermediate Rx)

+2.50 -1.75 X 125 (near Rx)

**WHAT IS UP WITH PRISM? (cont.)**

*Light* going through a **PRISM** is **ALWAYS DEVIATED TOWARD THE BASE**!
**WHAT IS UP WITH PRISM?! (cont.)**

The **IMAGE** being viewed through the **prism** is always deviated toward the **APEX**!

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**WHAT IS UP WITH PRISM?! (cont.)**

The **IMAGE** appears to move toward the **APEX**.

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**WHAT IS UP WITH PRISM?! (cont.)**

This patient has an **ESOTROPIA** (in this case, the RIGHT EYE deviates **INWARD**).

Doctor will point the **APEX** of **PRISM** toward the problem – so **APEX** goes **IN**, just like the eye does! That means the **BASE** of the **PRISM** will be **OUT**; Doctor will **Rx** **BASE OUT** (**BO**) **PRISM**

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**WHAT IS UP WITH PRISM?! (cont.)**

When **prism** is put in a prescription, it is usually **“split”** between the two eyes.

- For example, the doctor wants to give Pt 8 **prism diopters** ($\Delta$) of **BASE OUT** (**BO**); Rx written like this:
  - OD: **PL SPH 4 $\Delta$ BO**
  - OS: **PL SPH 4 $\Delta$ BO**

- If doctor wanted to give Pt 6 **prism diopters** ($\Delta$) of **BU prism** in **RIGHT EYE** (OD); Rx written like this:
  - OD: **PL SPH 3 $\Delta$ BU**
  - OS: **PL SPH 3 $\Delta$ BD**

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**WHAT IS UP WITH PRISM?! (cont.)**

**PRISMS** can sometimes help patients w/ **head injuries**.

- Doctors can use **“yoked” prism** (same amount of **prism** in each eye, going in the same ‘**direction**’) to help the brain **perceive** the world in a more comfortable way. **EXAMPLES**:
  - OD: **+1.00 SPH 5$\Delta$ BU**
  - OS: **+1.50 SPH 5$\Delta$ BU**

  or, this:
  - OD: **+1.25 SPH 4$\Delta$ BO**
  - OS: **+1.75 SPH 4$\Delta$ BI**