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Understanding Prism

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Alex Yoho, ABOM

Alex Yoho has no financial interests to disclose.

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What is Prism?

• Prism is a Wedged shaped piece of transparent material that refracts (bends or deviates) light rays toward the “Base, or, thicker part.

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What is Prism?

• The image, however, is observed toward the “Apex”, or thinner part

[Diagram of light ray and image]
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In An Ophthalmic Lens

- A prism is still a wedge, but curved.

- Minus Lens
- Plus Lens

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What is it used for?

- A prism is used to place the image on the proper place on the retina.
- This can correct conditions such as diplopia by moving the images together.
- Or, on a damaged retina, prism can put the image on a more usable area.

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A bit about lenses

- Lenses are made up of prism wedges all put together and curved to produce power.
A bit about lenses

- Plus lenses have all the bases of these prisms in the center which makes the center thick and the edges thin.

Light rays passing through the center of a lens are not deviated.

As light passes through points away from the center, a prismatic effect, or, bending toward the base occurs.
Now, let’s apply what we’ve learned

A bit about prism

- The optical center must be placed directly before the eyes which is why we take a PD.

A bit about prism

- When the PD is wide on a minus lens, base in prism is induced.
- When the PD is wide on a plus lens, base out prism is induced.
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A bit about prism

- When the PD is narrow on a minus lens, base out prism is induced.
- When the PD is narrow on a plus lens, base in prism is induced.

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A bit about prism

- Normally, when prism is ordered horizontally, both lenses are base in or base out.

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A bit about prism

- However, when prism is ordered vertically, one lens is base up, and the other, base down.
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A bit about prism

* In some cases horizontal and vertical prisms are combined, i.e. 2 Δ BU, 1 Δ BI

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Combined Prism

* 1 Δ BU, 1 Δ BI
* = 1.5 @ 45°

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A bit about prism

* Once in a blue moon you will see an Rx for “yoked” Prisms, i.e. Base Right O.U., or, Base Down O.U. and sometimes Base@165
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**Using Prentice’s Rule**

- Power times decentration divided by 10
- Example: +2.00 x 3mm / 10 = 0.6∆
- Example: +0.25 x 3mm / 10 = 0.075∆
- **NOTE:** The stronger the power, the quicker the prismatic effect develops. This is why a 0.25 Diopter lens can be off PD 13mm and still be acceptable under ANSI standards! (+0.25 x 13mm / 10 = .325∆)

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**Examples**

A pair of +2.50 Sph W/1.5∆ In OU. Desired PD is 60. 
OD spots 1.0mm narrow  OS spots 2.0mm narrow  
**Usable?**

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**Examples**

A pair of -2.50 Sph W/3.0∆ Out OU. Desired PD is 60. 
OD spots 2.0mm narrow  OS spots 2.0mm wide  
**Usable?**
Other uses for Prentice's Rule

- Decentering a lens when edging to create prism prescribed.
- \(10\) times prism divided by power = Decentration Amount.

Example:

R. – 2.00 – 2.50 \(\times\) 180  \(\Delta\) \(3.00\)  
\[10 \times 3.00 / 2.00 = 15\text{mm}\]  
(The lens is decentered \emph{out} to create Base In)

Other uses for Prentice's Rule

- Determining need for Slab-off to correct vertical imbalance at near point when lenses are more than 2.00 Diopters different power between each eye in the vertical meridian. (We'll address this later)

The Standard

5.1.4 Prism Reference Point Location and Prismatic Power

The prism reference point shall not be more than 1.0 mm away from its specified position in any direction. In addition, the prismatic power measured at the prism reference point shall not exceed 0.33\(\Delta\). This tolerance applies to lenses both with and without prescribed prismatic power. When prismatic thinning is used, it is treated as prescribed prism. Measurement shall be done using the method in 8.4.
The Standard

5.2.1 Prism Imbalance
In the cases where prismatic thinning is used, the prism thinning prism is considered to be a prescribed prism.

5.2.1.1 Single Vision and Multifocal Lenses
Vertical prismatic imbalance of mounted pairs of single vision and multifocal lenses with refractive power from 0.00 D to ±3.375 D in the vertical meridian shall not exceed 0.33 Δ. Pairs with refractive power greater than ±3.375 D in the vertical meridian shall not have more than 1.0 mm difference in the height of the two lenses prism reference points. Measurement shall be done using the method specified in 8.5.1.

The Standard

Horizontal prismatic imbalance between mounted single vision and multifocal lenses with refractive power from 0.00 D to ±2.75 D in the horizontal meridian shall not exceed 0.67 Δ. The horizontal distance between the prism reference points of single vision and multifocal lenses with refractive power greater than ±2.75 D in the horizontal meridian shall not differ from the specified distance interpupillary distance by more than 2.5 mm. Measurement shall be done using the method specified in 8.5.2.

Checking the Amount of Prism

- First we need to know where the optical center is supposed to be.
- This means the patient's PD for horizontal prism.
- Or, where the optical center is supposed to be vertically.
- Prism is determined by the distance the actual OC is away from where it should be.
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Checking for Horizontal Prism

- Spot the P.D. in the lensmeter
- If the P.D. is not as specified, re-spot at specified P.D. using a progressive chart and check there to determine the amount of prism induced.

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Examples

A pair of +10.00 Sph OU. Desired PD is 60. Lensmeter spots it at 70

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Examples

A pair of -6.50 Sph OU. Desired PD is 58. Lensmeter spots it at 64
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Examples

A pair of Plano Sph W/5.0Δ Base Left OU. Desired PD is 60. OD spots anywhere W/5.0Δ Base In OS spots anywhere W/5.0Δ Base Out Useable?

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Checking for Vertical Prism

• On SV lenses check at the middle of the lens vertically.
• On lined multifocals, check at the same distance above the line on both lenses (checking the strongest lens first).

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Check vertical prism

• First center the lens with the most power vertically, then, without changing the lensmeter table, switch to the other lens. This will indicate the true vertical imbalance between the lenses.
The Standard

5.2.1.2 Progressive Addition Lenses

Vertical prismatic imbalance of mounted pairs of progressive addition lenses with refractive power from 0.00 D to ±3.375 D in the vertical meridian shall not exceed 0.33 Δ. Pairs with refractive power greater than ±3.375 D in the vertical meridian shall not have more than 1.0 mm difference in the height of the two lenses prism reference points. Measurement shall be done using the method specified in 8.5.3.

Horizontal prismatic imbalance between mounted Progressive Addition lenses with refractive power from 0.00 D to ±3.375 D in the horizontal meridian shall not exceed 0.67 Δ. For lenses with greater refractive power, the horizontal position of each lens’s prism reference point shall not differ from the specified position by more than 1.0 mm. Measurement shall be done using the method specified in 8.5.3.

Understanding progressives

- Prism Reference Point
- Use lensometer inker

Check for distance Rx Here
Check prism at this point (will be blurry)
Check for addition here (turn lens around to check)
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**Slab-Off Prism**

- Corrects vertical imbalance at near point when lenses are more than 2.00 Diopters different power between each eye in the vertical meridian.

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With eyes Looking through the Optical Centers the image is not deviated

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With eyes Looking down from the Optical Centers the image is deviated and vertical diplopia occurs
With a slab off, the images are aligned and vertical diplopia is corrected at near.

**Slab-Off Prism**

- When the lenses for each eye are different by 2.00 Diopters or more.
- Example: R. +2.00  L. - 1.00
- Difference = 3.00 Diopters
- If we assume a 9mm reading drop then 3.000 times 9mm divided by 10
  = 2.75 Slab-off
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Slab-Off Prism

- When the lenses for each eye are different by 2.00 Diopters or more.

Example:

R. +2.00 -2.00 X 120 (12% used)  L. - 1.00

0.12 X 2.00 = -0.24D  -0.24 + 2.00 = +1.76

- Difference between eyes = 2.76 Diopters

- If we assume a 9mm reading drop then

  2.76D times 9mm divided by 10

  = 2.484D Slab-off (order 2.50Δ Slab-off)

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Other Effects - Vision Therapy

- Base Down Prism
  - to stop Thumb sucking
  - Improve posture

- Base In Prism
  - Relief of anxiety / Panic Disorder
  - Relief of pain between the eyes due to Exophoria

- Yolked Prism
  - For traumatic Brain Injury Therapy

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Questions