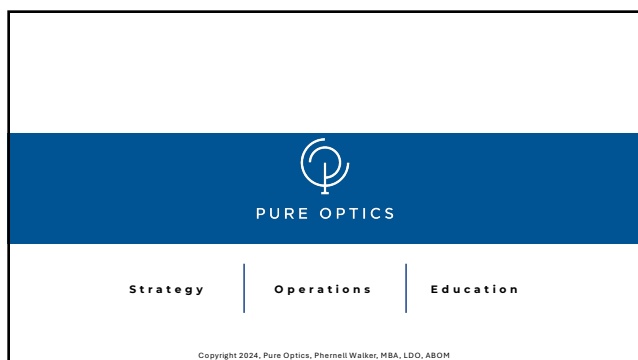
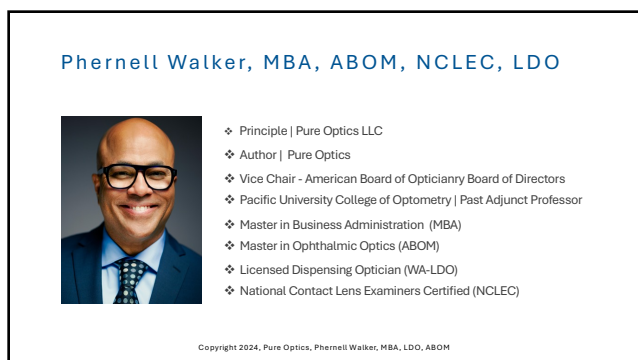




1



2

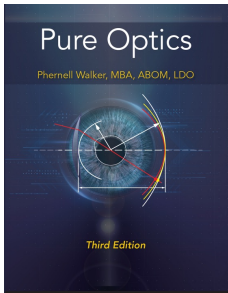


3

Reference Resource

Pure Optics

by
Phernell Walker, MBA, ABOM, LDO




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4

Prism Optics

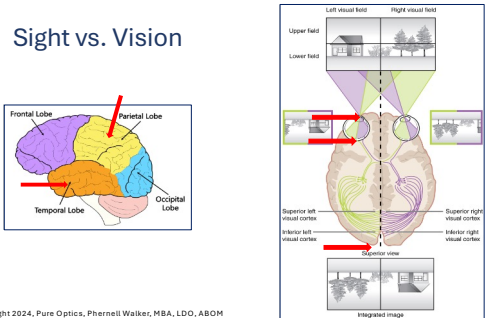
- Transparent wedged-shaped, materials change the direction (refracts) of light
- Lenses are made of interconnecting prisms
- Prisms are afocal
- Prism Refract Light



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5

Sight vs. Vision




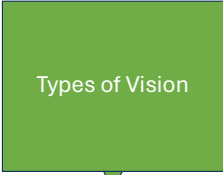


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6

Types of Vision


- Monocular**
Vision with only one eye
- Bi-ocular**
Vision with 2 eyes
No coordination
- Binocular**
Vision with 2 eyes
Coordination



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7


Two Eyes Are Better than One



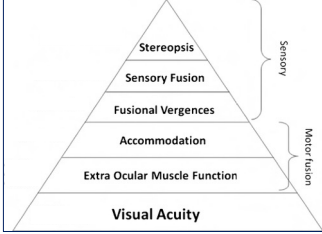
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Normal Binocular Vision



Coordination between the two eyes to produce a single mental impression



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Visual Acuity

A threshold measurement of the eye's ability to distinguish an object correctly.

Level 1

Optical Blur

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4 Basic Eye Movements

- Saccades
 - Involuntary rapid movement to change fixations
 - Conjugate
- Smooth Pursuits
 - Voluntary slow tracking movement
 - Conjugate
- Vergence
 - Involuntary/Voluntary slow movement
 - Align foveas to target
 - Disjunctive
- Vestibulo-Ocular
 - Reflexive fast stabilizing movements during head movement
 - Initiated by semicircular canals

DOLL'S EYE MOVEMENT

OCULO-CEPHALIC REFLEX

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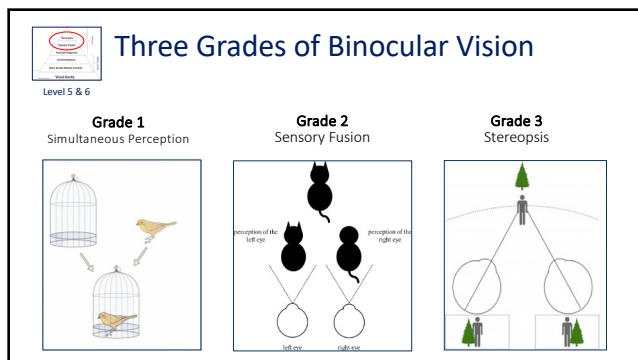
Extraocular Muscle Function

Level 2

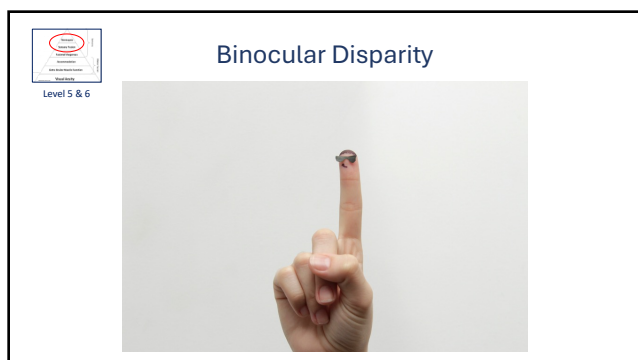
Yoked Extraocular Muscle Movements

Anterior view of the right eye

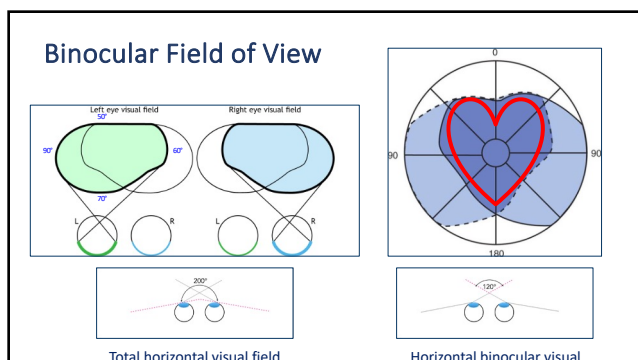
12



13





14



15

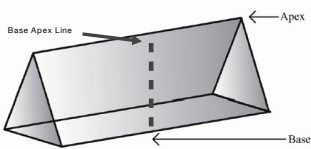
Binocular Vision Conditions

Condition	Treatment
Exophoria	Prism, VT
Esophoria	(+) Lenses, Prism
Vertical Phoria	Prism
Divergence Excess	Prism, VT
Convergence Excess	(+) Lenses, Prism

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Ophthalmic Prism

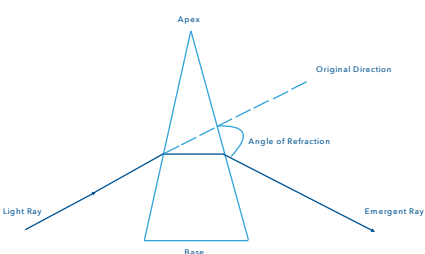


- Prism Base - thickest part of the prism
- Prism Apex - thinnest part of the prism

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Refraction and Deviation



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Power Cross

OD +1.50 -0.50 x 180
OS -1.00 -0.75 x 180
Add +2.75
PD: 32/34

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OD: +1.50 -0.50 x 180
OS: -1.00 -0.75 x 180
Add: +2.75
PD: 32/34

+1.50

+1.00

OD

-1.00

-1.75

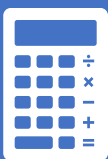
OS

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Meridian of Dioptric Power

Degrees from Axis	Percent of CYL
0	0%
5	10%
10	20%
15	30%
20	40%
25	50%
30	60%
35	70%
40	80%
45	90%
50	100%



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Prentice Rule

$$P = (h_{cm}) (D)$$

P = Prism Diopters
 h_{cm} = amount off in centimeters
 D = lens dioptic power (at axis 180 or 090)

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Accidental Prism

A new pair of glasses measure PD 60 mm in the lensometer.
 Patient's PD is 66 mm

How much prism was induced?

OD -3.75 DS
 OS -3.00 - 1.00 x 045

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Horizontal Prism

$P = (h_{cm}) (D @ 180th \text{ meridian})$

$P = (.6 \text{ cm}) (OD -3.75 \ \& \ OS -3.50)$

$P = (.6 / 2) (OD -3.75 \ \& \ OS -3.50)$

OD: $(.3) (-3.75) = 1.12 \wedge D$

+ OS: $(.3) (-3.50) = 1.05 \wedge D$

Total Combined Prism = 2.18 D

Step 1: find Pwr. @ 180

Step 2: subtract lab vs. Patients PD

Step 3: divide / 2

Step 4: change mm to cm

Step 5: multiply pwr. X cm off

Step 6: add OD and OS same direction

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The OC of the OD lens was edged at 30 mm and the OS lens was edged at 26 mm.

How much vertical prism was induced with the Rx below?

OD +4.25 - 1.00 x 060

OS +4.25 - 0.75 x 135


OC: 26 mm

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Meridian of Dioptric Power

Degrees from Axis	Percent of CYL
0	0%
5	1%
10	3%
15	7%
20	12%
25	18%
30	25%
35	33%
40	41%
45	50%
50	59%
55	67%
60	75%
65	82%
70	88%
75	93%
80	97%
85	99%
90	100%



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Vertical Prism

Only calculate prism for the right lens because the OS lens is correct:

$P = (h_{cm}) (D @ 090th \text{ meridian})$

$P = (.4 \text{ cm}) (+4.00)$

$P = 1.60 \text{ D (a little more than 1.50 prism diopters)}$

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Base
Direction

Both Lenses Edged
(same direction)

Plus Lenses		Result
Edged		
Too Wide		Base Out
Too Narrow		Base In
Minus Lenses		Result
Edged		
Too Wide		Base In
Too Narrow		Base Out

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Compounding
Prism

Amounting Prism
(O.D. & O.S. Lens)

- Base In & Base In
- Base Out & Base Out
- Base Up & Down

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Neutralizing Prism

Neutralizing Prism
(O.D. & O.S. Lens)

- Base Down & Down
- Base Out & Base In
- Base Up & Base Up

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Monocular Prism

The lab edged lenses at 31/35mm PD.
How much prism was induced?
OD +3.00 – 0.50 x 090
OS +3.75 – 1.00 x 060
Patient PD 33/33 mm

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Mid-line Shift

$P = (h_{cm}) (D @ 180^{\text{th}} \text{ meridian})$

$P = (OD 31 - 33 = 2 \text{ mm} \ \& \ OS 35 - 33 = 2 \text{ mm}) (O.D. +2.50 \ \& \ O.S. +3.00)$

$P = (OD .2\text{cm} \ \& \ OS .2\text{cm}) (OD +2.50 \ \& \ O.S. +3.00)$

OD Prism = (.2 cm too narrow) (+2.50) & O.S. Prism = (.2 cm too wide) (+3.00)

OD Prism = 0.50 D. B.I. & O.S. Prism = 0.60 D. B.O.

Total Prism = Prism OD + Prism OS

Total Prism = 0.50 D B. I. + 0.60 D. B. O.

Total Prism = 0.10 D B.O. (base out because the stronger prism is Base Out)

32

Convert Degrees to Rectangular Notation


$V = D_e (\text{sine } a)$
 $H = D_e (\text{cosine } a)$

where:

- V = vertical prism
- H = horizontal prism
- D_e = prism dioptic power

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Convert the following prescription neutralized in the lensometer from polar notation to rectangular notation:
 OD +3.25 DS, 4.00^Δ B.I. @ 045

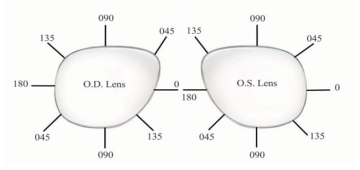
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OD: -3.25 DS, 4^Δ BI @ 045

V = (4.00) (.707)
 H = (4.00) (.707)
 V = 2.82
 H = 2.82

OD: +3.25, 2.82^Δ B.U., 2.82^Δ B.I. Notice the rectangular coordinates for the right eye directly corresponds with the polar coordinate of 045 degrees (fig. 11-5).

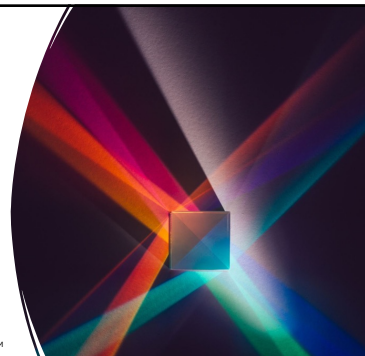


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Combined
 Horizontal &
 Vertical Prism

$\sqrt{P} = \sqrt{V^2 + H^2}$
 $\tan^{-1} a = v/h$



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What is the Net Result?

R_x

OD: -2.00 DS, 1.00 [▲]B.U. & 3.00 [▲]B.I.

OS: -2.50 DS, 1.00 [▲]B.U. & 3.00 [▲]B.I.

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<p>OD:</p> <p>$\sqrt{P} = \sqrt{V^2 + H^2}$</p> <p>$\sqrt{P} = \sqrt{1^2 + 3^2}$</p> <p>$\sqrt{P} = 1 + 9$</p> <p>$\sqrt{P} = 10$</p> <p>$\sqrt{P} = 3.16$</p> <p>$\tan^{-1} a = v/h$</p> <p>$\tan^{-1} a = 1/3$</p> <p>$\tan^{-1} a = 18.43$</p> <p>$\tan^{-1} a = 18 \text{ degrees}$</p>	<p>OS:</p> <p>$\sqrt{P} = \sqrt{V^2 + H^2}$</p> <p>$\sqrt{P} = \sqrt{1^2 + 3^2}$</p> <p>$\sqrt{P} = 1 + 9$</p> <p>$\sqrt{P} = 10$</p> <p>$\sqrt{P} = 3.16$</p> <p>$\tan^{-1} a = v/h$</p> <p>$\tan^{-1} a = 1/3$</p> <p>$\tan^{-1} a = 18.43$</p> <p>$\tan^{-1} a = 162 \text{ degrees}$</p>	<div style="border: 2px solid blue; padding: 5px; width: fit-content; margin: 0 auto;"> <p style="margin: 0;"><u>Determine Tangent Angle</u></p> <p style="margin: 0;">$\frac{a1}{a}$</p> <p style="margin: 0;">Quadrant I $a1 = a$</p> <p style="margin: 0;">Quadrant II $180 - a1 = a$</p> <p style="margin: 0;">Quadrant III $180 + a1 = a$</p> <p style="margin: 0;">Quadrant IV $360 - a1 = a$</p> </div>
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Rectangular Prism Rx

OD: -2.00 DS, 1.00 [▲]B.U. & 3.00 [▲]B.I.

OS: -2.50 DS, 1.00 [▲]B.U. & 3.00 [▲]B.I.

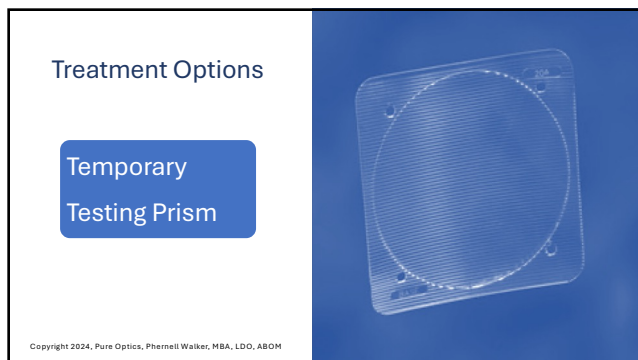
Combined Prism Rx

OD: -2.00 DS, 3.16 [▲]@ 018 degrees

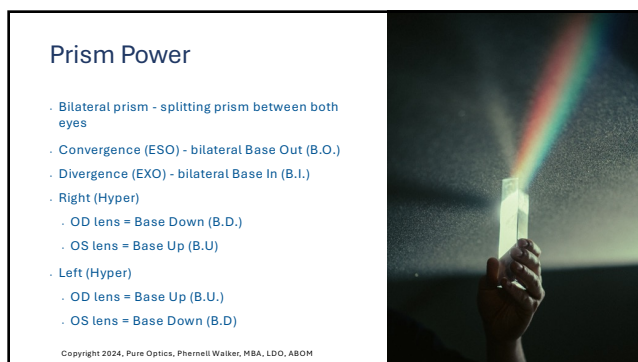
OS: -2.50 DS, 3.16 [▲]@ 162 degrees

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