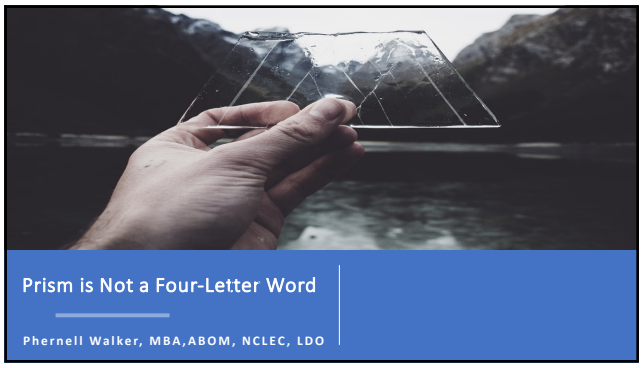


1

PURE OPTICS

Strategy | Operations | Education

2

Phernell Walker, MBA, ABOM, NCLEC, LDO

- Principle | Pure Optics LLC
- Author | Pure Optics
- Chair elect American Board of Opticianry Board of Directors
- Pacific University College of Optometry | Former Adjunct Professor
- Master in Business Administration (MBA)
- Master in Ophthalmic Optics (ABOM)
- Licensed Dispensing Optician (WA-LDO)
- National Contact Lens Examiners Certified (NCLEC)

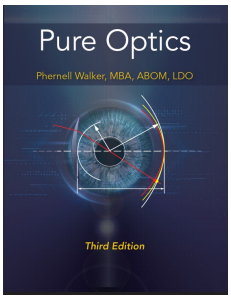
3

Reference Resource

Pure Optics

by

Phernell Walker, MBA, ABOM, LDO



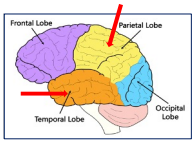
4

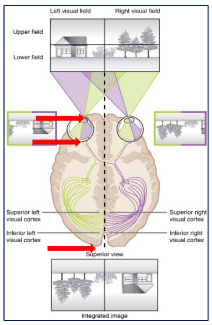
Prism Optics

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

5

Sight vs. Vision





6

Types of Vision

Monocular
Vision with only one eye

Bi-ocular
Vision with 2 eyes
No coordination

Binocular
Vision with 2 eyes
Coordination

7

Two Eyes Are Better than One

8

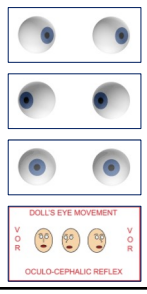
4 Basic Eye Movements

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



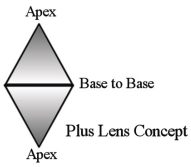
9

Binocular Vision Conditions

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

10

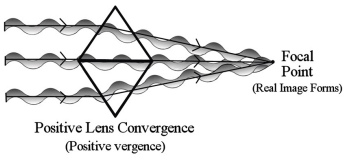
Fundamental Plus Lens Design



- + Plus Lenses - used to correct hyperopia and/or presbyopia
- Two prisms connected base to base

11

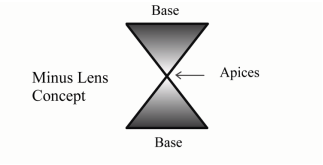
Forming Real Images



- + Plus Lenses
  - Converge light
  - Prism's base is located at the lens center
  - Create a real image located behind the lens

12

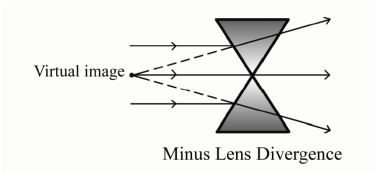
Fundamental Minus Lens Design



- - Minus Lenses - used to correct myopia
- Two prisms connected apex to apex

13

Forming Virtual / Imaginary Images

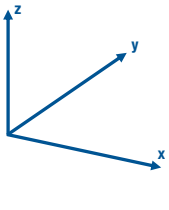


- - Minus Lenses:
  - Diverge light
  - Create virtual images located in front of the lens

14

3D Space

- X = Length
- Y = Width
- Z = Height



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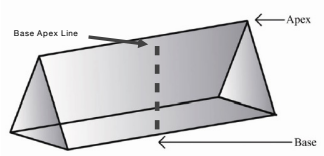
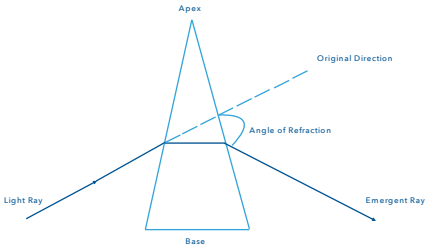
Ophthalmic Prism



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

16

Refraction and Deviation



17

Power Cross

OD +1.50 -0.50 x 180

OS -1.00 -0.75 x 180

Add +2.75

PD: 32/34

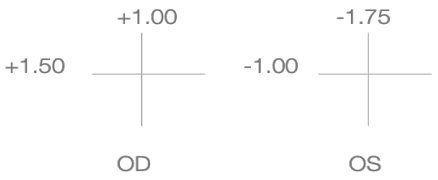
18

OD: +1.50 -0.50 x 180

OS: -1.00 -0.75 x 180

Add: +2.75

PD: 32/34



19

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%

20

Prentice Rule

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

P = Prism Diopters

h_{cm} = amount off in centimeters

D = lens dioptric power (at axis 180 or 090)

21

Accidental Prism

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

How much prism was induced?

OD -3.75 DS
OS -3.00 – 1.00 x 045

22

Horizontal Prism

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

P = (.6 cm) (OD -3.75 & OS -3.50)

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

OD: (.3) (-3.75) = 1.12 ^ D

OS: (.3) (-3.50) = 1.05 ^ 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

23

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

24

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%

25

Vertical Prism

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

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

P = (.4 cm) (+4.00)

P = 1.60 ^ D (a little more than 1.50 prism diopters)

26

Base Direction

Both Lenses Edged
(same direction)

Plus Lenses

Edged	Result
Too Wide	Base Out
Too Narrow	Base In

Minus Lenses

Edged	Result
Too Wide	Base In
Too Narrow	Base Out

27

Compounding Prism

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

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

28

Neutralizing Prism

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

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

29

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

30

Mid-line Shift

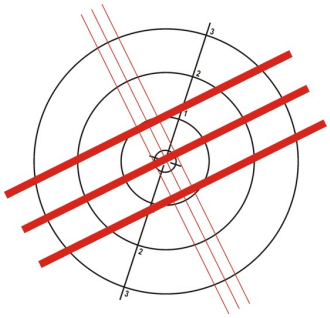
P = (h_{cm}) (D @ 180th meridian)
P = (OD 31 -33 = 2 mm & OS 35 – 33 = 2 mm) (O.D. +2.50 & O.S. +3.00)
P = (OD .2cm & OS .2cm) (OD +2.50 & O.S. +3.00)
OD Prism = (.2 cm too narrow) (+2.50) & O.S. Prism = (.2 cm too wide) (+3.00)
OD Prism = 0.50 D. B.I. & O.S. Prism = 0.60 D. B.O.
Total Prism = Prism 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)

31

Lensometry and Prism

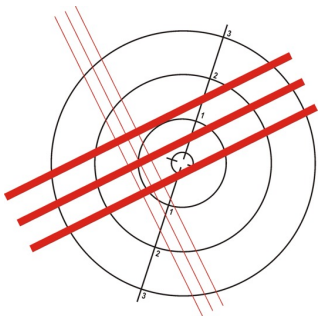
32

Null Generated Prism



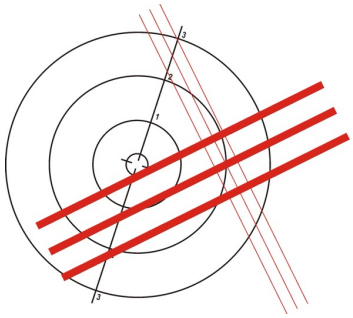
33

Right Lens
1.00^ B.O.



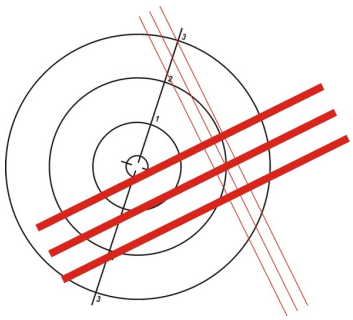
34

Right Lens
2.00^ B.I.



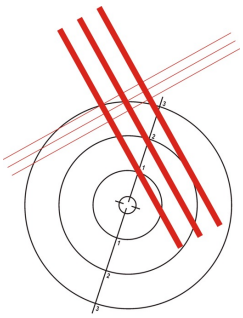
35

Left Lens
2.00^ B.O.



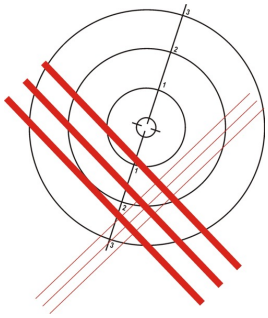
36

Right or Left Lens 3.00^ B.U.



37

Right or Left Lens 2.00^ B.D.



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Convert Degrees to Rectangular Notation

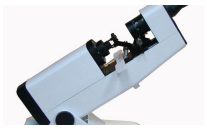
$V = D_e$ (sine a)

$H = D_e$ (cosine a)

where:

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

39



Convert the following prescription neutralized in the lensometer from polar notation to rectangular notation:

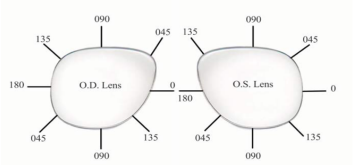
OD +3.25 DS, 4.00 $\blacktriangle$ B.I. @ 045

40

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).

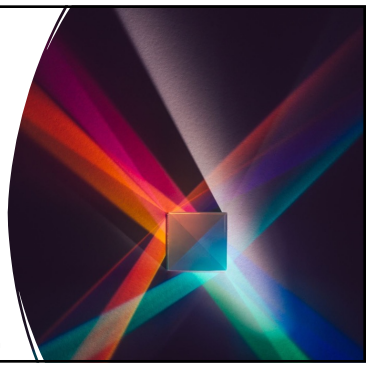


41

Combined Horizontal & Vertical Prism

$\sqrt{P} = V^2 + H^2$

$\tan^{-1} a = v/h$



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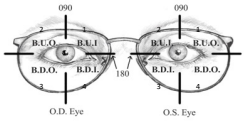
What is the Net Result?

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.



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OD	OS
$\sqrt{P} = V^2 + H^2$	$\sqrt{P} = V^2 + H^2$
$\sqrt{P} = 1^2 + 3^2$	$\sqrt{P} = 1^2 + 3^2$
$\sqrt{P} = 1 + 9$	$\sqrt{P} = 1 + 9$
$\sqrt{P} = 10$	$\sqrt{P} = 10$
$\sqrt{P} = 3.16$	**$\sqrt{P} = 3.16$**
$\tan^{-1} a = v/h$	$\tan^{-1} a = v/h$
$\tan^{-1} a = 1/3$	$\tan^{-1} a = 1/3$
$\tan^{-1} a = 18.43$	$\tan^{-1} a = 18.43$
$\tan^{-1} a = 18$ degrees	**$\tan^{-1} a = 162$ degrees**

Determine Tangent Angle

a_1	a
Quadrant I	$a_1 = a$
Quadrant II	$180 - a_1 = a$
Quadrant III	$180 + a_1 = a$
Quadrant IV	$360 - a_1 = a$

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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

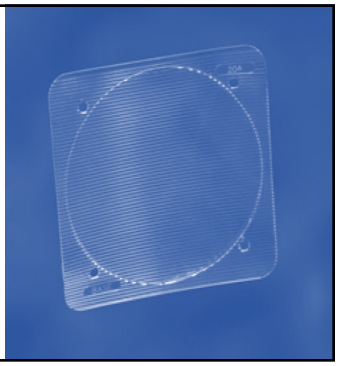
OD: -2.00 DS, 3.16 ▲ @ 018 degrees

OS: -2.50 DS, 3.16 ▲ @ 162 degrees

45

Treatment Options

Temporary
Testing Prism



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Prism Power

- Bilateral prism - splitting prism between both eyes
- Convergence (ESO) - bilateral Base Out (B.O.)
- Divergence (EXO) - bilateral Base In (B.I.)
- Right (Hyper)
  - OD lens = Base Down (B.D.)
  - OS lens = Base Up (B.U)
- Left (Hyper)
  - OD lens = Base Up (B.U.)
  - OS lens = Base Down (B.D)

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