On behalf of Vision Expo, we sincerely thank you for being with us this year.

Vision Expo Has Gone Green!

We have eliminated all paper session evaluation forms. Please be sure to complete your electronic session evaluations online when you login to request your CE Letter for each course you attended! Your feedback is important to us as our Education Planning Committee considers content and speakers for future meetings to provide you with the best education possible.

vision expo

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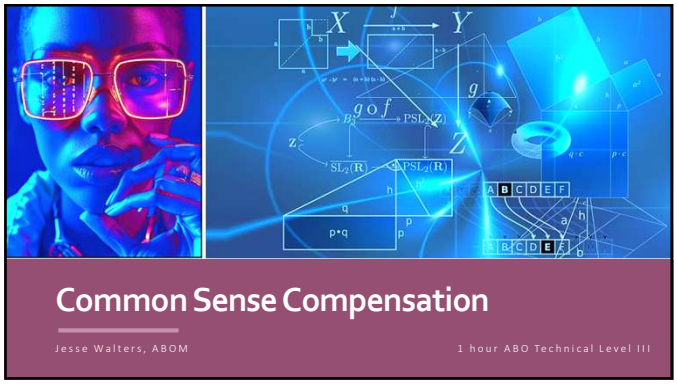


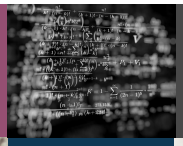
3

Learning Objectives

Why does the prescription need to be changed?
How do the position of wear measurements change the final prescription?
When is it most important to utilize?
What potential problems can occur?

Calculating Prescription Behavior

Effective Power Formula
Compensated Power Formula
Martin's Tilt Formula

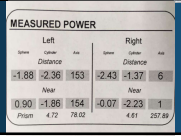


Verifying Compensated Lenses

Reading Measured Power
Evaluating Compensations

Alignment

OC Height
Prism Compensation
Adjustments



Potential Problems

Record Keeping
Prescription Evaluation
Identifying Digital Design

4

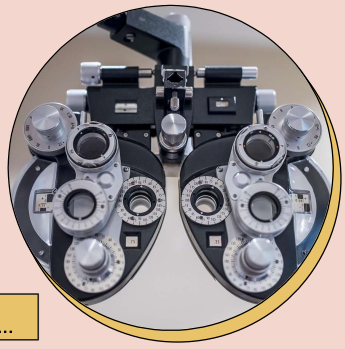
Compensation Defined:

A compensated prescription is any intentional change in lens power or prism alignment from the doctor's original Rx with the objective to more accurately correct vision through a pair of glasses.

5

The Doctor's Refraction vs Real World Wear

An optometrist's refraction utilizes a small round lens sitting perpendicular to the eye at a fixed distance having the patient looking directly in front of them at a well-lit chart mounted at 20 feet.



The prescription is written from these carefully controlled conditions and then…

6

To Deliver the Promised Prescribed Rx:

…Every patient is fit into small, round, flat frames that are adjusted to sit at the exact distance of the phoropter.

7

Medical Device vs Fashion Accessory

The prescription is filled in lenses of all different sizes, shapes and curves…





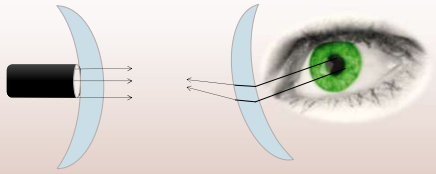
… mounted into frames that fit closer or farther from the eye with any extreme of tilt, face-form or wrap.

8

"The **Effective Power** is the actual correction viewed by a patient as a result of how a lens is positioned in front of the eye."

9

When the compensated lens is then mounted perpendicular at a fixed distance in a lensometer it will read differently…



The patient is viewing the prescribed Rx as a result of how the lens is positioned in front of the eye.

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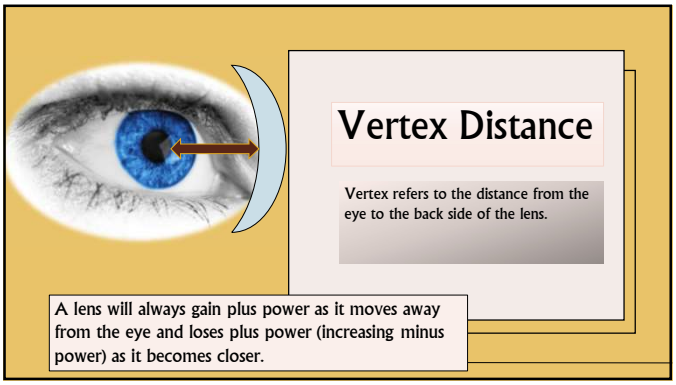

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Effective Power Formula

$$De = \frac{Dl}{(1 + dDl)}$$

De= new power experienced by the wearer

Dl= original lens power

d= change in vertex distance in METERS

If the lens is moved towards the eye "d" is positive

If the lens is moved away "d" is negative

Demonstrates the effective sphere power change as fitting vertex distance is increased or decreased from the refracted vertex

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Example:

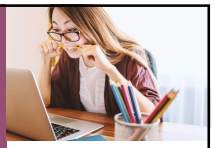
Rx: -7.50 -2.25 x 176

Refracted at 13mm

Fitting vertex measured at 18mm

What is the patient's experienced effective power?

1. Find the powers in the two major meridians
   - **-7.50** @ 176
   - **-9.75** @ 086
2. Calculate the vertex difference in *meters*
   - 13 to 18 is a change of 5mm
   - 5mm= 0.005 meters= **-0.005m** change in vertex
   - The vertex distance in moving *further* so this number will be expressed as *negative*
3. Solve the equation…



$$De = \frac{Dl}{(1 + dDl)}$$

De= new power experienced by the wearer

Dl= original lens power

d= change in vertex distance in METERS

(If the lens is moved towards the eye "d" is positive.

If the lens is moved away "d" is negative).

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Effective Power Formula

What's going on here?

- Minus lenses lose minus effective power as vertex increases
- The patient was prescribed and filled an Rx written at a refracted distance of 13mm, then wears then 5mm further than tested
- The Rx experienced by the patient is weaker than prescribed
- Larger lens powers and/or larger changes in fitting distances will change the effective power more dramatically
- This demonstrates a need to compensate the Rx to deliver the exam acuities…

Rx prescribed & fabricated:

-7.50 -2.25 x 176

$$De = \frac{-7.50}{1+[(-0.005)(-7.50)]} = \frac{-7.50}{1.0375} = \textbf{-7.2289}$$

$$De = \frac{-9.75}{1+[(-0.005)(-9.75)]} = \frac{-9.75}{1.04875} = \textbf{-9.2968}$$

Reassemble the new Effective Power

First # is the new sphere, then find the difference between them for the new cylinder power, keep the axis the same

Rx experienced by the patient as a result of vertex variance:

-7.23 -2.07 x 176

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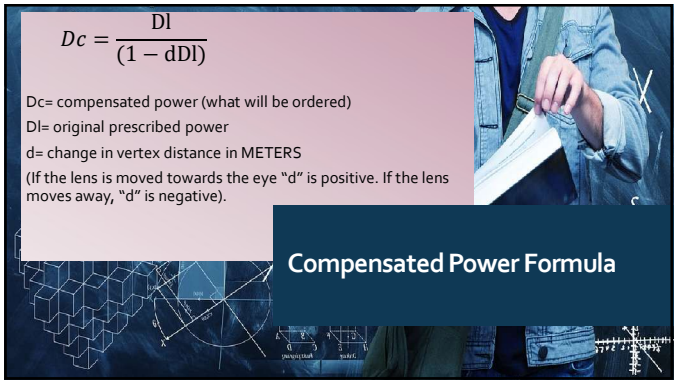

$$Dc = \frac{\mathrm{Dl}}{(1 - \mathrm{dDl})}$$

Dc= compensated power (what will be ordered)

Dl= original prescribed power

d= change in vertex distance in METERS

(If the lens is moved towards the eye "d" is positive. If the lens moves away, "d" is negative).

Compensated Power Formula

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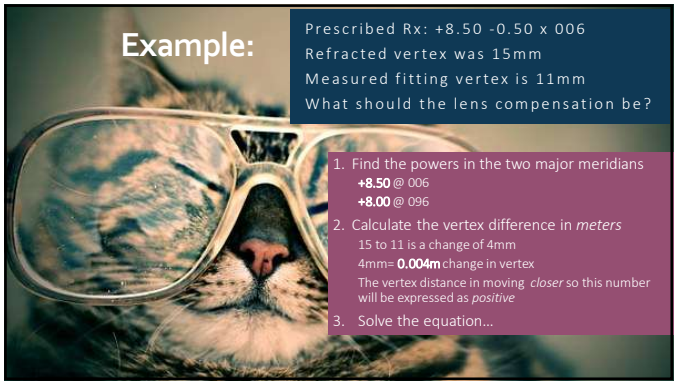

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Compensated Power Formula

What's going on here?

- Plus lenses lose effective plus power as vertex decreases
- The patient's prescribed power must be compensated and fabricated with a stronger plus power
- The Rx experienced by the patient is weaker than compensated, so the effective power translates as the original written Rx
- Larger lens powers and/or larger changes in fitting distances will change the effective power more dramatically

Rx prescribed:
+8.50 -0.50 x 006

$$De = \frac{+8.50}{1-[(0.004)(8.50)]} = \frac{+8.50}{0.966} = +8.7991$$

$$De = \frac{+8.00}{1-[(0.004)(8.00)]} = \frac{+8.00}{0.968} = +8.2644$$

Reassemble the new Compensated Power

First # is the new sphere, then find the difference between them for the new cylinder power, keep the axis the same

Rx experienced by the patient will match the prescribed Rx if fabricated as this compensated Rx adjusted for the fitting vertex:

+8.80 -0.53 x 006

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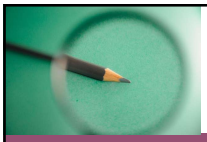


Calculating Compensated Add Powers

Lens Compensations Also Adjust Add powers

Compensated Add Power

Calculated as the difference between the distance and near measured powers

Right: +3.56 – (+1.25) = +2.31

Left: +2.25 – (-0.25) = +2.46

Often the compensated add is what is laser engraved under the temporal progressive watermark

Because add powers are at the bottom of the lens, they sit at an increased vertex which often causes plus powers to be weakened

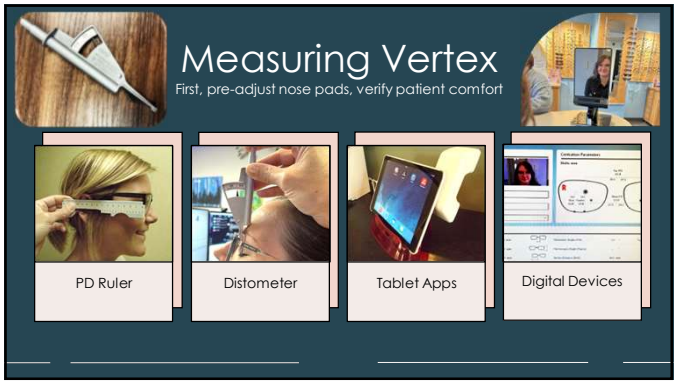
Rx DATA

Right	1.25	-1.25	175		2.50	32.50
Left	-0.25	-0.50	178		2.50	32.50

MEASURED POWER

	Left			Right		
	Distance			Distance		
	-0.25	-0.50	178	1.25	-1.25	175
	Near			Near		
Prism	2.21	-0.48	178	3.56	-1.27	178
	0.00	0.00		0.00	0.00	

18


Measuring Vertex
First, pre-adjust nose pads, verify patient comfort
PD Ruler
Distometer
Tablet Apps
Digital Devices

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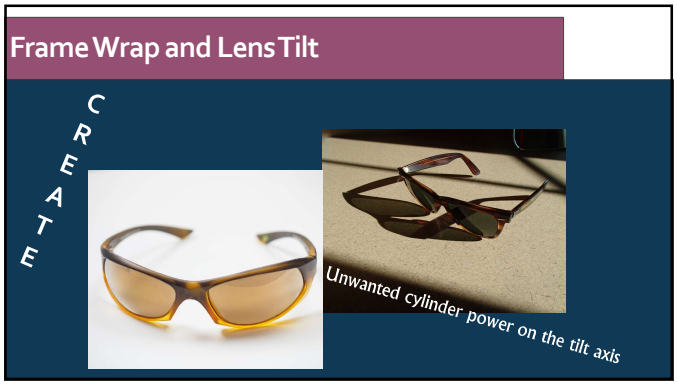
Frame Wrap and Lens Tilt
CREATE
Unwanted cylinder power on the tilt axis

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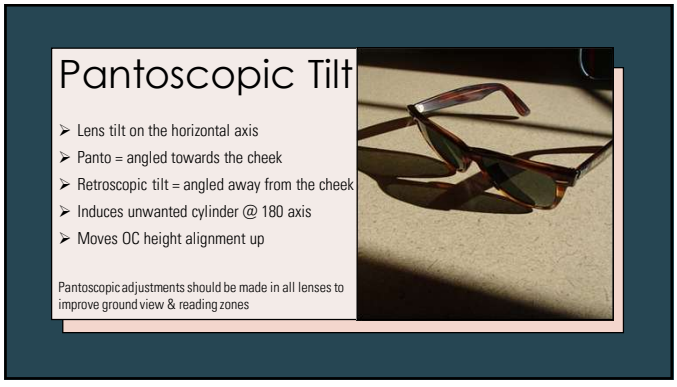
Pantoscopic Tilt
Lens tilt on the horizontal axis
Panto = angled towards the cheek
Retroscopic tilt = angled away from the cheek
Induces unwanted cylinder @ 180 axis
Moves OC height alignment up
Pantoscopic adjustments should be made in all lenses to improve ground view & reading zones

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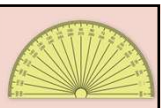
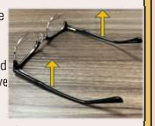
Measuring Panto



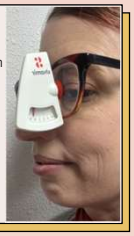
Proper Adjustment

- Always pre-adjust the frame
- Retroscopic tilt should be adjusted to positive panto
- Panto must be measured as worn on the patient



Measuring devices

- All devices measure tilt in relation to the ground, not the eye
- Getting a patient's head and posture accurate is imperative
- Aim for panto between 5 to 10 degrees



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Frame Wrap

- Measured in Degrees of Tilt on the Vertical Axis
- Induces Unwanted Horizontal Prism
- Frame Wrap Panoramic Angle Face-Form Z-Tilt
- Induces Unwanted Cylinder @ 090-Degree Axis

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Measuring Wrap

Wrap Angle in Degrees

Measured with protractor, wrap layouts, or manual devices
Digital measuring devices measure wrap value, some need dark lenses removed
Wrap angle can be measured without the patient wearing the frame

Ophthalmic Wrap vs. Sport Wrap

0-11˚standard range-important for higher powers and corrects unwanted cyl
12-30˚ high wrap- important for all Rxs and corrects for cyl and prism error

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Martin's Tilt Formula

$$S1 = S[1 + (sina)^2/2n]$$
$$C1 = S1(tana)^2$$

S1= new sphere power
S= original sphere power
a= degrees of tilt
n= index of refraction of lens material
C1= induced cylinder power on the axis of rotation

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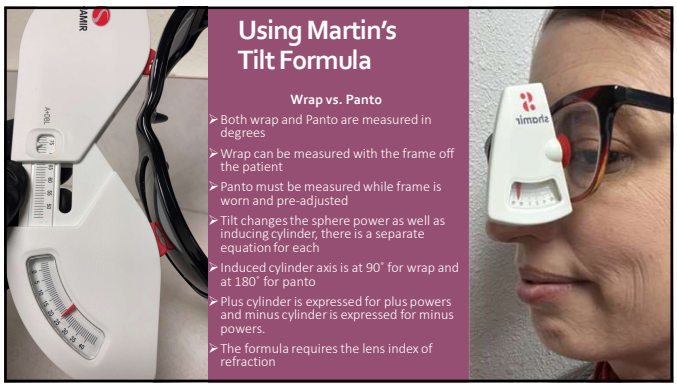

Using Martin's Tilt Formula

Wrap vs. Panto

- Both wrap and Panto are measured in degrees
- Wrap can be measured with the frame off the patient
- Panto must be measured while frame is worn and pre-adjusted
- Tilt changes the sphere power as well as inducing cylinder, there is a separate equation for each
- Induced cylinder axis is at 90° for wrap and at 180° for panto
- Plus cylinder is expressed for plus powers and minus cylinder is expressed for minus powers.
- The formula requires the lens index of refraction

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$$S1 = S[1 + (sina)^2/2n]$$
$$C1 = S1(tana)^2$$

S1= new sphere power
S= original sphere power
a= degrees of tilt
n= index of refraction of lens material
C1= induced cylinder power on the axis of rotation

Example:

Rx: +4.00 sph OU

Patient chose a high-wrap safety frame which measures 25° frame wrap and ordered in a 1.53 Trivex lens.

Using Martin's Tilt Formula, what is the effective power they will experience without lens compensation?

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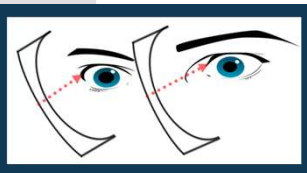
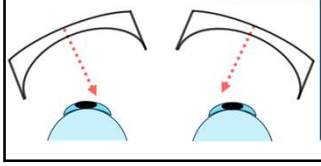
- Tilt changes OC alignment
- Panto moves both OCs **up**
- Wrap moves OCs **in** for both eyes





Alignment & Unwanted Prism

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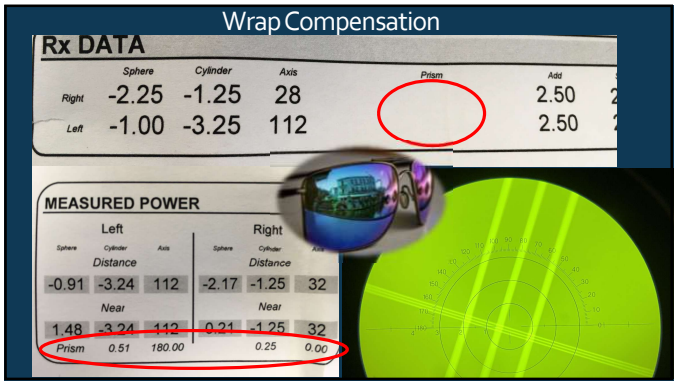
Wrap Compensation



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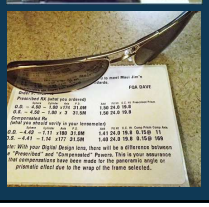
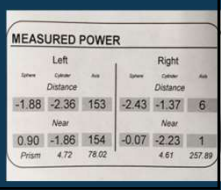
Verifying Lens Compensations



- Verify against the prescription compensation
- ANSI standards get applied to the measured power, not the prescribed
- Trust the math, but know logical outcomes based on measurements
- Double-check values input in the order
- Record lens compensation in the patient record if wildly different from prescribed
- Power is written to 0.01D
- Add is also compensated
- Prism is written in lab notation



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Custom vs. Default Position of Wear Measurements

Digital lenses are often compensated whether or not measurements are provided

Custom values

- Measured vertex, panto, and wrap of pre-adjusted frame
- Manual and digital devices are available
- Personalized for each individual
- Adds value to the patient experience
- Highly valuable for higher prescriptions or frames fit outside normal parameters (i.e. high wrap styles)

Default Values

- Uses average adjustment values of ophthalmic frames
- Improves patient's visual experience based on the common differences between refracted and as-worn lens power
- No need for understanding of measurement devices or extra time in lens ordering

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Common

Sense

Compensation

References:
Stoner, E. D., Perkins, P., & Fergusson, R. (2005). *Optical formulas: Tutorial*. Elsevier.
Meister, D., & Sheedy, J. E. (2002). *Introduction to ophthalmic optics*. SOLA Optical.

Jesse Walters, ABOM
jesse@summitoptical.com

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