Develop a Working Understanding of Digital Compensation

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Traditional Surfacing: Diamond blade, relying on the OC Rx, appropriate curves to make the rest of the lens functional

Digital Surfacing: Percussive Diamond Blade, making over 1000 calculations in the lens to get precision of up to .01D. The same lens can be generated using Traditional or Digital Surfacing

Freeform or Digital Compensation: Manipulates the 1000+ points of Rx to account for the worn position of the lens and gaze angles.

The goal of all digital compensation is to provide the patient the exact Rx the doctor prescribed in as much of the lens as possible given the real conditions of wearing spectacles.

Perfect Conditions: In the exam lane, doctors produce the perfect conditions for measuring the patient Rx: Dark lane, static image, black and white, simulated 20 feet, 10-14mm vertex, with no tilt or wrap, to a flat, glass lens in the phoropter looking at crisp figures.

Real Conditions: Lots of light, frame sitting at an angle, possibly at the same vertex, with some wrap, dynamic subjects, multiple focal distances in a lens, with non-glass materials and a base curve. Compensation addresses these scenarios.

Compensation order of operations: Vertex, Tilt on the 180 (Pantoscopic Tilt), Tilt on the 90 (Wrap)

<u>VERTEX</u>

Formulae for Vertex Compensation:

Effective Power = D^2/ 1000 x (distance moved from the phoropter's measurement in mm)

Where:

D is the Power of the Lens at the prescribed power

Minus: As the lens gets closer, the effect of the power is GREATER, thus we provide LESS minus. As the lens gets farther, the effect of the power is less, thus compensation provides MORE minus.

Plus: As the lens gets closer, the effect of the power is LESS, thus we provide MORE plus in the compensation. As the lens gets farther, the effect of the power is more, thus the compensation provides LESS plus.

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Sign/Direction	Effect of Power	Compensating Shift	Thus
Minus Lens/Closer	Greater/Stronger	Less Minus	Subtract to reduce power
Minus Lens/Farther	Less/Weaker	More Minus	Add to increase the power
Plus Lens/Closer	Less/Weaker	More Plus	Add to increase the power
Plus Lens/Farther	Greater/Stronger	Less Plus	Subtract to reduce the power

PANTOSCOPIC TILT

Tilt will induce cylinder power (if there is any power at the 180 degree meridian). The more tilt and the more power, the more cylinder will be induced. **If the power of the lens at the 180 degree meridian is a plus lens, the induced cylinder will be plus. If minus, the cylinder will be minus.**

To calculate this, we use Martin's Tilt Formula:

New Sphere power = $D (1+\sin^2 a)$ 3

Induced Cylinder power = $D (\tan^2 a)$

Where:

D = the dioptric power of the meridian of tilt (with panto, 180, with wrap, 90)

a = the angle of excessive tilt (remember the phoroptor has no tilt or wrap!)

This gives us the Sphere power and the Cyl Power at the 180 meridian – the axis of tilt . Remember we rotate the lens on the 180 to create pantoscopic tilt and on the 90 to create wrap.

WRAP

Wrap compensation is simply the same process using Martin's Tilt Formula above, but doing so at the 90 degree meridian. Using the power at the 90 degree meridian to find resulting sphere and cyl, and Thompson's Formula to find resulting axis.

BEYOND POSITION OF WEAR

These three pieces of information go into calculating power at the Optical Center only.

Freeform lenses allow us to make calculations for every point on the lens using geometry, trigonometry and calculus. Each lens designer has injected their own assumptions and priorities to be slightly

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different. This technology continues to improve. The best thing you can do as an optician is consistently provide good PDs, OC height, Vertex, Pantoscopic Tilt and Wrap measurements.

Consider that when the eye turns, the vertex to the back of the lens changes, the amount of lens we are looking through changes. Freeform or digital compensation allows us to make compensations for our dynamic eyes in the worn position throughout the lens.

The end result of digitally compensated lenses is that we are delivering the prescription that doctor measured MOST precisely in more of the lens. The result is more useful lens area which leads to the "High Definition" feeling in a lens.

Who benefits from digital lens design? Everyone, even minor Rxes. Your patient will be delighted by the crispest vision in the greatest possible proportion of the lens. Your patient came to you because they wanted the best. Offer it to them! You will earn their loyalty and grow your business when doctor's Rx is translated from the perfect conditions of the exam lane into the real world conditions of wearing spectacles.

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