High Performance Ophthalmic Lenses
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Impact of Good Vision

- Average eyewear lifespan...
  > 26 months
- Eyewear will be used for...
  > over 30,000 miles of driving
  > viewing 49 or more movies
  > 2.2 weddings / graduations
  > 26 family events & holidays
  > 1 in 3 presbyopes will see a grandchild for the 1st time

High Performance Lenses

- Areas of Performance
  > Design
  > Surface
  > Filter
  > Substrate
High Performance Single Vision Lens Design

- Ashpericity
  - Reduces Optical Aberrations
    - Less magnification for plus power lenses
    - Less distortion
    - Increased field of view
- Cosmetically Flattens
  - Allows for flatter, thinner lenses

Spherical lenses create peripheral distortion because light is unequally refracted across the lens surface...

Aspheric/Atoric lenses use multiple curvatures to reduce peripheral defocus and aberration.
High Performance Single Vision Lens Design

- As Worn or Compensated Single Vision Lenses
  - The Rx is compensated to take into account the following
    - Pantoscopic Tilt
    - Face form (Wrap Angle)
    - Vertex Distance
  - Increases field of view
  - Less distortion

High Performance PAL Lens Design

- High Performance PALs Provide
  - Natural Reading Posture
    - greater comfort while reading
  - Optimized Zone Placement
    - ease of adaptation
  - Binocular Width
    - wider intermediate vision
  - Sharper Distance Vision
    - improved contrast at night
  - Specialized Design
    - task/wearer specific zone distribution

High Performance PAL Lens Design

- Natural Reading Posture
  Shorter progressions provide more natural reading postures...

...a natural reading posture relies primarily on head movements
High Performance PAL Lens Design

- Optimized Zone Placement
  Distance Rx and ADD power determine optimal zone placement...
  [Diagram showing optimized zone placement for hyperopes and myopes]
  ...true multi-design PALs optimize zones for easier adaptation

- Binocular Width
  The ability to maintain fusion is called "binocularity"
  [Diagram showing binocularity]
  ...binocularity determines width- not the spherical area of the channel

- Binocular Width
  New Patented Design Technology allows vertical alignment of astigmatism...
  [Diagram showing vertical alignment of astigmatism]
  ...this increases binocularity- and therefore intermediate width
High Performance PAL Lens Design
- Sharper Distance Vision
  New Design Technology controls aberrations in the distance zone

...control of aberrations provides clinically proven gains in contrast

High Performance PAL Lens Design
- Specialized Design
  Progressions can be designed specifically to a task

High Performance PAL Lens Design
- Specialized Design
  Progressions can be designed specifically to a frame type
High Performance PAL Lens Design

- Specialized Design
  Progressions can be designed specifically to an Rx

- Standard Distribution
  Optimized Zones

High Performance PAL Lens Design

- Specialized Design
  Progressions can be designed specifically to a patient characteristic

- Eye Mover
  Standard Distribution
  Head Mover

High Performance Fitting & Dispensing

- Proper fitting is crucial to the performance of ANY and ALL designs
  > Proper adjustment of the frame
    » Faceform
    » Pantoscopic Tilt
    » Vertex Distance
  > Proper placement of the optics
    » Monocular PD's
    » Monocular Fitting Heights

- An improper fit will compromise the performance of ANY design
  > Fitting increases in importance with design complexity
High Performance Lenses

High Performance Lens Surfaces

- High Performance Surfaces Provide
  - Thermal-cured hardcoat
  - greater durability
  - Multi-layer Anti-Reflective Stack
    - increased night vision
    - better cosmetics
    - sharper vision
  - Hydrophobic & Conductive Layers
    - easier to clean
    - greater durability

High Performance Lens Surfaces

- Thermally-cured Hardcoat
  The lifespan of a lens is determined by the durability of the surface
  [Diagram of substrate layers: Primer, Silica-Resin, Hardcoat]

  ...high performance surfaces are thermally bonded into the substrate
High Performance Lens Surfaces

- Multi-Layer AR Stack
  Performance surfaces include a multi-layer AR for increased transmission
  ...AR also reduces night-time glare and provides superior cosmetics

- Hydrophobic & Conductive Layers
  An AR incorporating a TCO (transparent conductive oxide) will repel dust and other particles
  ...a hydrophobic layer repels water & oil, resulting in fewer cleanings

- Hydrophobic & Conductive Layers
  Hydrophobic durability is a function of coating density...
  ...higher densities lead to a longer effective hydrophobic lifespan
High Performance Lenses

- Include high-performance surfaces on your lenses
  - Nearly all patients want:
    - increased durability
    - ease of cleaning
    - better night vision
    - less noticeable eyewear
- 60% of all US eyewear consumers choose AR when informed of its benefits

Questions? Comments?

High Performance Lenses

- High Performance Filters
  - UV Filters
  - Photochromics
    - adjustable filtering
    - UV protection
  - Polarized
    - glare reduction
    - superior contrast
    - sport & vocational applications
  - Fixed Tint
    - neutral & selective filters
Ultraviolet Filters
- There are 3 types of UV
  - UVC < 285nm
  - UVB 286 – 320nm
  - UVA 320 – 380nm
- Only 2 materials do not block UV
  - clear CR-39
  - clear glass

High Performance Lens Filters

- Ultraviolet Filters
  - On average, 80% of UV exposure will occur prior to age 20
  - 100% UV protection is a standard-of-care requirement for all children
    - Polycarbonate of Trivex
    - brimmed hats
    - sunscreen

- Photochromic lenses provide
  - Comfortable vision in nearly all lighting conditions
  - Complete protection from UV
High Performance Lens Filters

- Photochromic lenses provide
  - Comfortable vision in nearly all lighting
  - Complete protection from UV

- Polarized Filters provide
  - Reduction of glare
    - Reflections from flat surfaces are reduced or eliminated
  - Increased contrast sensitivity
  - Selective filtering of glare
  - Sport & vocational applications
    - Watersports
    - Driving

- Reduction of glare
  Non-polarized light contains energy along all axes along its direction

...a polarizing filter polarizes light along a single axis
High Performance Lens Filters

- Reduction of glare

When light hits a smooth transparent surface, polarization occurs...

...water causes horizontal polarization

- Increased contrast sensitivity

Non-polarizing filters attenuate light non-selectively, reducing contrast

Polarizing filters preserve contrast by selectively filtering

- Increased contrast sensitivity
**High Performance Lens Filters**

- **Polarized applications - driving**
  
  Polarized lenses increase contrast perception & decrease reaction times

**High Performance Lens Filters**

- **Polarized applications - driving**
  
  Polarized lenses increase contrast perception & decrease reaction times

**High Performance Lens Filters**

- **Neutral & Selective Filters**
  
  Neutral (grey) filters attenuate light evenly across the spectrum - selective filters may improve contrast
High Performance Lens Filters

Objective of Filters
- Filter out harmful / distracting light
  - UV and/or IR
  - reflected glare
- Transmit useful light
  - preserve contrast
  - manipulate color perception
    - preserve color perception (neutral grey)
    - alter color perception (all other colors)

ALL filters (except UV) reduce light transmission
- including "contrast enhancing" night driving lenses

Questions? Comments?
High Performance Substrates (Lens Materials)

- High Performance Substrates Provide
  - Safety
    - Impact Resistance
    - UV Protection
  - Structural Durability
    - High Tensile Strength (drill mounts)
  - Superior Cosmetics
    - Thin Profile
    - Optical Clarity
  - Superior Comfort
    - Light Weight

High Performance Substrates (Lens Materials)

- Safety
  - Polycarbonate is the only material that retains a constant level of impact resistance in all forms
  - Polycarbonate resists extreme impact level with any surface

High Performance Substrates (Lens Materials)

- Safety
  - All materials MUST pass the FDA drop-ball test
    - (Federal Law)
  - Hard coating and AR coating will greatly reduce impact resistance
High Performance Substrates (Lens Materials)

- **Structural Durability**
  - Tensile strength is a measure of a material's ability to resist "tearing".
  - This equates into resistance to splitting in drill mounts.

- **Tensile Strength By Material**
  - 80.5 kg/f = 1.60 (MR6)
  - 67.3 kg/f = 1.67 (MR7)
  - 61.2 kg/f = Trivex
  - 52.9 kg/f = 1.70
  - 44.9 kg/f = polycarbonate
  - 15.6 kg/f = CR-39

High Performance Substrates (Lens Materials)

- **Superior Cosmetics**
  - High Index Lenses Reduce Thickness
  - Optical Clarity Is A Function Of
    - Transmittance
    - Color Rendering
      - Perception of white target
    - Contrast
      - Ability to perceive contrast near and far
  - Abbe is not a major function of clarity
    - The eye has approximately 1.05D of linear chromatic aberration (which does not impair vision)
    - (-10.00D poly lens viewed at 30° produces <0.50D of linear chromatic aberration)
High Performance Lenses
Dispensing

- Recommending Substrates
  - Polycarbonate for Safety
    - Children
    - Monocular patients
    - Most safety applications
  - Tensile strength for drill mounts
    - 1.60, 1.67
    - Polycarbonate
    - Trivex
  - Higher Index for Thinness
   - Low Specific Gravity for Lightness
    - Polycarbonate
    - Trivex

High Performance Lenses
Dispensing

- Summary
  - Design
    - Binocularity = Width
    - Reduced aberration = Contrast sensitivity
    - Customization = Potential for greater performance
  - Coatings
    - Thermal cure = permanent adhesion
    - AR Coating = Better Vision and Cosmetics
      - Conductive Layer = anti-static
      - Dissymmetric = hydrophobic

High Performance Lenses
Dispensing

- Summary
  - Filters
    - UV
    - Photochromics
    - Polarized
    - Fixed Tins
  - Substrates
    - Polycarbonate for Safety (Trivex)
    - High Index
      - Great for Drill Mounts
Thank You!

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Questions?
Comments?