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Course title: Wavefront-guided individualized vision correction for keratoconus and presbyopia

Course Description: This course will review fundamental aspects of wavefront technology, how the technology enables us to improve vision in eyes with poor ocular optics, and factors affecting visual outcomes of the wavefront-guided contact lens.

Course objectives:

1. Understand optical concepts of wavefront
2. Learn the impact of lower- and higher-order wavefront aberrations on visual performance
3. Explain how the ocular wavefront sensing techniques work and their role in evaluating and improving ocular optics and vision
4. Describe significance of individualized vision correction

Course Outline

I. Wavefront and aberration
   a. Optical definition of wavefront
      i. Light properties
      ii. Light phase
      iii. Wavefront as an imaginary surface
   b. Wavefront aberration
      i. Aberration: deviation from reference wavefront
      ii. Types of aberrations: lower and higher orders
      iii. Relationship with refraction and irregular astigmatism
   c. Mathematical and graphical representations
      i. Zernike polynomials and coefficients
      ii. Surface and color maps

II. Quantifying wavefront aberrations
   a. Types of wavefront sensing techniques
      i. Laser tracing technique
      ii. Shack-Hartmann technique
   b. Specifications of Shack-Hartmann wavefront sensor
      i. Measurement sensitivity vs dynamic range
      ii. Tradeoffs with sampling resolution
      iii. Wavefront reconstruction: how many aberrations?

III. Wavefront-guided optometric lenses
   a. Principle
      i. Light propagation: phase delay vs advanced
      ii. Optical surface and wavefront
   b. Spectacles vs soft vs scleral contact lenses
      i. Gaze
      ii. Stability
   c. Correcting higher order aberrations in keratoconus patients

IV. Individualized presbyopia correction

a. Current approaches and limitations
    i. Uncorrected aberrations: astigmatism and higher order aberrations
    ii. Positional and rotational variability of contact lenses
    iii. Multifocal designs
b. Extended depth of focus technology
    i. Refractive vs diffractive
    ii. Wavefront-guided + individualized correction
c. Discussion on additional factors
    i. Neural adaptation
    ii. Real-life visual tasks vs visual acuity & contrast sensitivity

V. Conclusion
a. Wavefront-guided vision correction improves retinal image quality and quality of life especially in eyes with pathologic conditions.
b. The personalized presbyopia correction is another exciting application of the wavefront-guided technology
c. The technology is no longer just for research laboratories