Product Spotlight - HOYA iD Lifestyle 3

Designing a Better Visual Experience for the Progressive Lens Wearer

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1 Hour ABO Technical Level II

This course addresses the importance of continuous advancements in progressive lens design technologies. And, the need to improve the progressive lens wearer's visual experience. We will learn how the new iD Lifestyle 3 progressive lens design distributes progressive optics between the front and back surfaces of the lens to improve the vertical and horizontal visual experience for the patient in a progressive lens. We will learn about Binocular Harmonization Technology where each lens is compensated individually to produce optimal binocular lens performance. We’ll learn how this combination of technologies in a progressive lens design optimizes both the front and back surface progressive design and balances the power progression in the corridor, individually for both left and right lenses, so that both eyes work synergistically regardless of prescription power differences, to form equivalent images on the left and right retinas.

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Course Objectives:
1. Learn how iD dual side progressive lens design technology improves the patient's visual experience
2. Learn how Binocular Harmonization Technology improves binocular fusion of images in the brain
3. Learn the effect of unequal power between left and right lenses (with anisometropia) on prismatic image displacement and lens power magnification differences.

Why Improve PAL Technology:

1. First a question; Why continue to develop new progressive lens technology to improve the progressive lens wearer’s optical experience? In a word ‘need.’
   a. Every eight minutes someone in the USA turns 40 and begins to discover that reading material is out of focus. Around this same time, they realize that moving the material further away to bring the print into focus is no longer working. Those with extra-long arms can hold out longer than most but presbyopia catches up with us sooner or later.
2. “With lifespans increasing, most people in the western world can look forward to spending almost half their lives as presbyopes.” Charman WN. Developments in the correction of presbyopia I: spectacle and contact lenses. Ophthalmic Physiol Opt 2014; 34: 8–29. doi: We need to provide a better progressive lens visual experience. Progressive lens design is not a one-size fit all. Why? There are varying degrees of presbyopia. This is why companies like HOYA offer lens designs specific to the type of presbyope, i.e., an emerging presbyope will love single vision with a boost in the lower half of the lens for near and intermediate work. The adapted general progressive wearer can benefit from the addition of an indoor-specific companion progressive for computer working distance. And in this course, we’ll review the technical advances in progressive lens design available in HOYA’s iDLifestyle 3. The progressive lens technology combines the iD dual side digital optimization technology with 3 Lifestyle specific designs and advanced Binocular Harmonization Technology for optimal binocular balance between left and right lenses. This course will familiarize you with dual side digital lens design optics and the management of binocular vision and its effects on progressive lens wear.
The advantages of splitting progressive optics between the front and back surface of the lens. Commonly, progressive lens designs are based on one surface technology. However, science tells us that there are benefits to distributing the vertical progressive design elements on the front of the lens and the horizontal design elements on the back surface. Hoya’s patented iD technology distributes the Add power over two surfaces.

1. iD technology includes image recalculation that neutralizes distortions on one surface by optimizing the other surface, minimizing peripheral distortion in the lens.
   a. Without image recalculation, a round object will look elliptical in oblique gaze directions, and the wearer will experience this as a swaying sensation. With iD Free Form Design calculation we can modify the lens surfaces so that the object does not deform so badly, and therefore will create less sway.

2. Placing the vertical progressive design elements on the front of the lens allows for more comfortable eye rotation while placing the horizontal progressive design elements on the back surface results in a wider field of view.
   a. Most progressive lens designs put all the progressive change on either the front or back surface. When the progressive optics are on the front, the corridor is shorter so the patient will rotate their eyes less, which makes the transition between distance and near more seamless. However, when the progressive optics are on the front, it narrows the corridor and decreases the usable field of view. **So with a front surface PAL, the corridor is short, yet narrow.**
   b. By moving the progressive optics to the back surface, the corridor can be made wider. However, this results in increased eye rotation for the eye to reach the full add power. This may result in the wearer struggling to find the full add power and exaggerated neck tilt. **So with a back surface PAL, the corridor is wider – but the corridor length is consequently longer.**
   c. By splitting the progressive optics between the front and back surfaces, the iD design provides an optimal progression from the distance power zone in the top of the lens to the near power zone in the bottom, while providing a wide usable intermediate and near area in the lens.
Binocular Harmonization Technology

1. With binocular harmonization technology, the lens design balances the power progression individually for right and left lenses to produce equivalent image size and prismatic displacement. Allowing our eyes to work together binocular, in all the possible prescription combinations.

2. HOYA binocular harmonization technology is the first lens technology to provide a binocular design solution that harmonizes the progressive lens power, magnification and prismatic effects of anisometropia in left and right lenses individually to produce equivalent views from both eyes that the brain can fuse into one clear image. Let’s learn more about the important role that binocular vision plays relative to progressive lens comfort and adaptation.

When patients are underwhelmed by their progressive lens’ performance;

1. We’ve all experienced the patient who is underwhelmed with their new progressive lenses. Their complaint is vague, and they can’t quite express what is wrong. In this course, we propose that lack of optimal binocularity due to power differences between the left and right lenses is a contributing factor. We also propose that binocularity can be managed in progressive lenses to provide the brain with equivalent images that can be fused into one clear image. By improving binocular vision the eye strain and discomfort that would otherwise occur with anisometropic prescription lenses can be alleviated. Anisometropic prescription lenses have unequal refractive power between the left and right lenses. Progressive lenses that control the add power distribution for each eye separately will deliver equivalent power and prism as the eyes drop into the intermediate and near zones. Seven out of ten people have different prescription powers between left and right eyes.

What is meant by binocular vision and fusion?

1. ‘Bi’ means two and ‘ocular’ means eyes, so, binocular vision is vision produced by two eyes. Fusion of these two images into one clear image occurs in the visual cortex of our brain. Our eyes form images on our left and right retinas. Each eye sees the world from a slightly different perspective. We have left, right and binocular visual fields. The brain combines these left and right images into one clear image. For the brain to form one clear image from two. The images formed by both eyes must represent an equivalent view of the same thing in space and time. If the images are not equivalent in size or location, the brain will not be able to fuse the images fully, and in extreme cases, diplopia or double images can occur. We see with our brain making it imperative that the images received are equivalent in size and location so that the brain can fuse them into one clear image.

What is anisometropia?

1. Greek origin: an- "not," iso- "same," metr- "measure," ops "eye." Anisometropia is a condition where each of our eyes has different refractive power. When both eyes are myopic or hyperopic, but with a significant difference in refractive power it is termed anisometropia or unequal power. If one eye is myopic and the other hyperopic then it is termed antimetropia (anti means opposite). Anisometropia is considered clinically significant if the power difference is two diopters or higher. But HOYA suggests that sub-clinical values are still an important consideration in progressive lens optics.

How does anisometropia affect the patient’s visual experience when using a progressive lens for reading
and intermediate working distance?

1. We know that prism is the product of distance times power (the distance from the eye’s visual axis to the lens optical axis times the power of the lens). If the left and right lenses have different powers as with anisometropia, vertical prism imbalance is experienced. Let’s see how much vertical prism imbalance is induced when we have

   a. -1.00D in the left lens and -4.00D in the right lens, and the eyes move down (away) from the lens optical axis by 10 mm then the left eye will encounter 1 diopter of prism power, and the right eye will encounter 4 diopters of prism power. This equals 3 diopters of vertical prism imbalance between the two eyes. This imbalance results in magnification (size) and prismatic displacement differences (location). The image formed is larger on the left retina and smaller in the right retina. (minus lenses minify so the less minus lower, the larger the image) The image viewed through the right lens will be displaced higher than that of the left lens.

   b. A problem occurs when we introduce progressive lenses into the anisometropia prescription lens equation. We can’t avoid moving our eye’s away from the lens optical axis in progressive lenses because we use the lower part of the lens to for intermediate and near work. As the eye’s drop lower in the lenses to read, each encounters a different power and therefore different amounts of magnification and prism.

   c. Remember prisms (and lenses are prisms) deviate light toward the prism base but displace (move) the image toward the apex. When the power is different between the two lenses, their displacement will be unequal, and they will appear to be in two different locations. The optical axis is the sweet spot in the lens where zero prism occurs. This emphasizes the importance of a correct PD measurement for proper horizontal centration of the lens in the frame opening to ensure that the eyes visual axis aligns with the lens optical axis. But, we are talking about what happens when the eyes move vertically away from the lens optical axis. Lenses with unequal distance power will produce different amounts of prism and magnification. Vertical prism imbalance occurs when the amount of prism experienced in the near zone of a progressive lens is different for right and left eyes. (This also applies to lined multifocal lenses but in this course, we only address progressive lens effects.)

2. It’s easy to avoid vertical imbalance in single vision lenses because the patient can always adjust their gaze to align their visual axis with the lens optical axis. And, we all know that light is un-deviated at the optical axis of a lens, so no prism is produced. The same is true for progressives; when the distance prescription power correction is the same for both lenses. Although the wearers gaze moves away from the lens optical axis both eye’s experience equal or near equal amounts of prism power, therefore the images formed have equivalent sizes and displacement. No difference means no vertical prism imbalance.

3. The problem with traditional progressive lens design is that the Add power progression is regularly and evenly added/layered on top of the distance powers as the eye tracks down the progressive channel/corridor. As our eyes look through the intermediate and reading power zones the power differences between the two lenses result in the brain receiving two different size images in two different locations, making it difficult to impossible for the brain to fuse the two images into one clear image.

4. BHT, Binocular Harmonization Technology, provides a solution. It compensates for virtually all
power differences between the two lenses.

**How is this accomplished?**

1. Using highly technical, patented algorithms that perform computational analysis to calculates the optimal lens surface needed for each lens individually to produce the best binocular vision, in eyewear with progressive lenses. Sophisticated Free Form CNC (computer numeric controlled) generators control the application of complex surface topography guided by the lens design software data-points file. Binocular Harmonization Technology algorithms balance the prism and magnification differences between the right and left eye to create a binocular lens solution. By changing curvature (power) and shortening or lengthening the corridor, both eyes will experience equivalent power throughout the distance area and progressive corridor. BHT balances accommodation support for right and left eyes, regardless of the prescription difference. The wearer's two retinas produce images with overlapping visual fields in which their brain through the fusion of two into one produces the best binocular vision for best image clarity.

   a. Regardless of a prescription difference. Power and aberrations are compensated to create equal image position and size so that the brain can fuse the two images into one clear image.

**To correct the effective power and achieve equal binocular image size and location, HOYA uses:**

![Binocular Eye Model](image)

1. Each lens design is evaluated before going into production using the revolutionary five-step Hoya Binocular Eye Model, a patented binocular performance measurement program
   a. This evaluation program analyzes how the eyes will work together while rotating through the corridor while considering prismatic differences between the right and left eyes

2. The Binocular Eye Model helps Hoya to understand how the lens designs need to be modified to create perfectly overlapping images for the best possible binocular visual experience.

**5 Binocular Maps** of the differences in:
- Accommodation
- Convergence
- Magnification
- Vertical Prism Imbalance
- Clearness Index

This data is used to evaluate the effectiveness of the lens surface calculations relative to the performance of the progressive lens optics.

**Accommodation Map:** Insert map on slide
Compensation values for right and left lenses are based on accommodative differences, fitting and position of wear parameters and the individual prescriptions for right and left lenses. With this data, the algorithm
can predict the variance in accommodative demand caused by the unequal prescriptions of right and left eyes and then equalize the accommodative demand by matching the power along the corridor, for the right and left lens.

**Convergence Map:** Insert map on slide
This map shows combinations that force the eyes to converge or diverge to achieve binocularity. When the anisometropia is mild the images overlap adequately within Panum’s Area, enough so that the brain accepts the two images as binocular. It’s the brain’s way to reduce visual confusion and double vision. However, the retinal disparity between images can still contribute to eyestrain and/or blur, especially during sustained periods of digital device usage. Knowing and correcting the differences ensures the best binocular vision.

Binocular harmonization reduces binocular strain as the eyes alternate between distance and near viewing, in the lenses.

**Magnification Map:** Insert map on slide
Because the brain has difficulty merging two images of different sizes, it’s logical that a lower magnification difference between the right and left eye results in better, more stable binocular vision. Likewise, when the individual lenses displace the images by different amounts, they will not overlap, and the brain struggles to fuse them into one clear image. BHT minimizes the image displacement differences.

**Vertical Prism Imbalance Map:** Insert map on slide
Binocular harmonization reduces vertical prism imbalance resulting from the power differences between lenses. The vertical prismatic difference or imbalance can be reduced to a minimal value for each eye by adjusting the progressive power distribution for each eye individually, based on the known power value for each eye. Reducing this difference to the minimum possible ensures more comfort. If all the differences/imbalances are adjusted to their minimums, then one can combine the effects and map the clearness of the lens.

**The Clearness Index Map:** Insert map on slide
The clearness index map estimates how clearly the wearer sees an image through the spectacle lens. Balancing clearness enhances binocular clarity throughout the entire lens.

To summarize, this binocular eye model is a patented binocular performance measurement program. It was designed to guarantee that each design is verified through computational analysis based on a set of algorithms derived from optical science and real-life circumstances. The resulting design is calculated before the lens goes into production so that this ensures unprecedented binocular performance in the resulting two lenses ordered.

**BHT Summary:**
HOYA believes that this is unique in the market. It’s the first design ever to balance corridor length and power distribution according to the prescription difference between right and left prescriptions in the corridor length ordered.

Important note: BHT is a binocular lens solution – as a result, if you need to remake one lens, you need to remake both.

Hoya employs patented Integrated dual side technology (iD) to separate the functionality and performance
of the front and back surfaces, resulting in unsurpassed visual performance. Enabling a natural transition between near and distance viewing and widening visual zones. Now, this digital lens design technology is enhanced further with Binocular harmonization technology to balance the power profile of each lens individually to create the best binocular performance, regardless of the distance prescription; the eyes receive equivalent accommodative support.

In addition to the iD, BHT and Binocular Eye Model technologies HOYA employs:

**View Xpansion Technology**
Decreases aberrations for effortless focus at all viewing angles

- Standard progressive lenses usually offer a sharp image when looking straight ahead. At the edges, however, there are aberrations/distortions
- This can lead to blurred peripheral vision and head turning
- View Xpansion Technology uses a new aspherization process.

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**New Free-Form Aspherization Process**
Better correction of lens aberrations over the whole lens surface for better contrast and image definition

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**Stable View Enhancer**
Reduces deformation or sewing for a secure feeling when moving around and going up or down stairs

- Standard progressive wearers often notice distortion while going up and down stairs or in other precarious situations
- This can make people feel unsteady and uncomfortable
- This problem is dramatically reduced with Stable View Enhancer a digital evaluation method designed to correct dynamic distortion

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Progressive technologies not only must be in a perpetual state of improvement but must also be responsive to wearer needs.

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According to a recent study*, 73% of wearers would like to have their lifestyle taken into account when selecting a lens design.

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iDLifestyle 3 provides the wearer with choices based on their lifestyle; Indoor, Urban and Outdoor. As opticians, we know that today's digital device use and outdoor activities require more than one pair and more than one progressive design to meet all of our lifestyle demands on our visual system.

Well done and congratulations on completing, Designing a Better Visual Experience for the Progressive Lens Wearer course. **VIEW** the end-of-course questions and when ready click on **TAKE EXAM** to complete the 20-question self-assessment exam for 1 Technical Level 2, ABO credit hour.