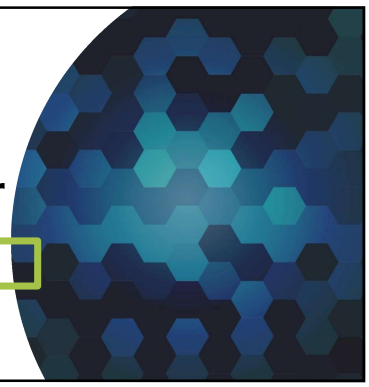
Let's Strip Bare: Essentials for Progressive Lenses



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Financial disclosure

- I Valerie Manso am President of Manso Management Resources, Inc. A consulting company specializing in business and people development in the ophthalmic industry. I currently have an ongoing contract with PECAA, as Director of Staff Education

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Objectives

1. Describe the major reference points of a progressive lens and list their purposes
2. Comprehend the benefits of using position of wear measurements
3. Comprehend how the optics of progressive lenses work
4. Explain the differences between varying design philosophies

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Objectives

5. Explain how free form progressives improve overall design flexibility and results over conventional progressive lenses.

6. Evaluate the patient's lifestyle tasks to recommend the most appropriate PAL designs:
   a. General purpose
   b. Computer
   c. Near to mid-range working area
   d. Sports
   e. Millennial accommodative relief

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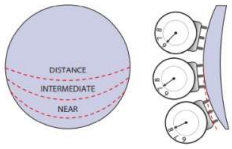
Agenda

- Progressive lenses – the past
- Progressive lenses – speak the same language
  - Major reference points
  - Fitting concepts
  - Position of wear
- Progressive lenses – the now



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The Past

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History of progressive lenses

- Developed in 1959 by French engineer Bernard Maitenaz, named The "Varilux" – the first no-line multifocal.
- At the same time, Ernst Lau and Rolf Riekher at the Institute for Optics and Spectroscopy at the German Academy of Sciences began work on "eyeglass lenses with a progressive diopter number." Their 1959 patent used the term "progressive diopter numbers for the first time to describe this new type of lens.
  - Günter Minkwitz joined this work group in the same year. His "Minkwitz theorem" is considered the basis for the understanding and design of progressive lenses to this day.
  - Indeed, it is no coincidence that Minkwitz was not a physician or ophthalmologist, rather he was a mathematician and grappled with the astigmatism problem of these lenses from a fresh perspective.

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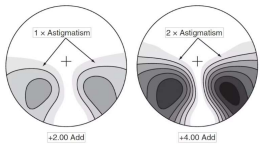
History continued

- One consequence of the Minkwitz theorem is that the maximum astigmatism in the lens increases proportionately to the addition. The practical consequence of setting the addition as low as possible is known to every optometrist and ophthalmologist



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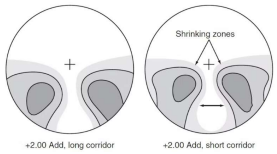
History continued

- Minkwitz' second conclusion is that shorter progression corridors require greater astigmatism or smaller visual zones. Shorter progression lengths – indeed for narrower eyeglass frames were to present optical designers with further challenges.
- These astigmatism drawings were incidentally used in the USA for the first time in the 1970s, since comparative advertising was allowed there, and new designs were therefore promoted in comparison with competing products.



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History continued

- A distinction between "soft" and "hard" surface designs, which however hardly fits the characterization of progressive lens designs anymore, originates from this time, the 1970s.
- The terms referred to the distribution of astigmatism. In principle, this could not be avoided, but it was possible to reduce it and above all to spread it differently. In "soft" designs, the astigmatism is pulled into the near and distance vision zones. This avoids relatively sudden blurring for the moving eye when glancing to the side. In "hard" designs, the visual zones are expanded, thus the astigmatism increases more significantly at the edges.

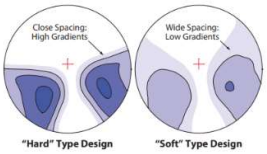

Image created by Darryl Meister, ABOM, Fundamentals of Progressive Lens Design, 2006

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History continued

- Essilor – Wide variety of "Varilux" designs
- American Optical – Truvision to Omni
- Sola Optical – VIP, Compact, Ultra and Max
- Zeiss – First to introduce asymmetric design
- **All were molded front surface designs**

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Progressives – Speak the same language

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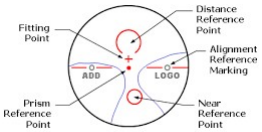
Progressive nomenclature – Major reference points

- **Fitting Point/Cross** - place at the center of the pupil, while the patient's facial plane is in its natural position, i.e., normal posture.
- Correct centration typically causes alignment with the wearer's visual axis.
- Intended for general purpose and specialty progressive designs.



Major Reference Points of a Progressive Lens

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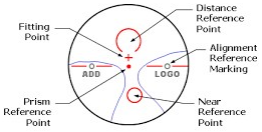
Progressive nomenclature – Major reference points

- **Distance Reference Point** – Used to verify the distance prescription, the DRP is located 6mm above the fitting cross.



Major Reference Points of a Progressive Lens

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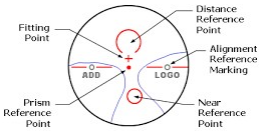
Progressive nomenclature – Major reference points

- **The Prism Reference Point** - The specified point for measuring the prescribed prism or prism thinning in a progressive lens (PRP). Also known as the Major Reference Point (MRP) unless a prism is present, and then it is the point on the lens used to verify the prism.
- The terms are interchangeable. The PRP is located centrally between the alignment reference engraved markings.
- This is the lens designer's point of reference for optical calculations and lens alignment.



Major Reference Points of a Progressive Lens

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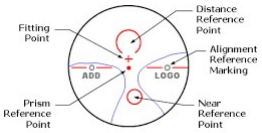
Progressive nomenclature – Major reference points

- **Alignment Reference Markings** – Or the alignment engravings, are positioned 34 mm apart, 17 mm from the center PRP and at the same height as the PRP.
- These engravings are used for verifying the correct axis alignment of the progressive lens and for marking and remarking the lens for finishing and final lens verification. The add power is indicated under the temporal engraving.



Major Reference Points of a Progressive Lens

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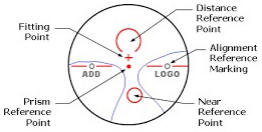
Progressive nomenclature – Major reference points

- **Near Reference Point (NRP) -**The designated region for verifying the prescribed reading power



Major Reference Points of a Progressive Lens

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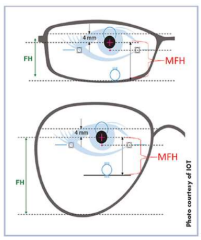
Progressive nomenclature – Fitting Concepts

- **Fitting Height and frame shape -** Fitting height refers to the measurement from the fitting cross to the deepest portion of the frame. As you can see with some frame shapes this measurement may not be straight down from the pupil.
- Narrow PDs and steep nasal contour may cause you to select a lens design with a shorter corridor to ensure adequate reading area.



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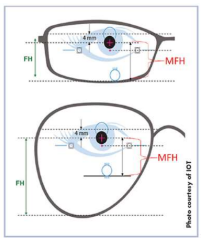
Progressive nomenclature – Fitting Concepts

- **Minimum Fitting Height** – (MFH) is provided by the lens manufacturer. The MFH is the distance from the fitting cross to the near reference point, plus a minimum an allowance of 4 mm.
- Typically, select a frame that would allow the addition of 4 mm allowance to the MFH to ensure the full reading utility is available for the wearer.
- Note: The corridor length is based on the MFH. You can choose from the design's corridor length options; otherwise, the design's internal algorithm automatically chooses a corridor length.



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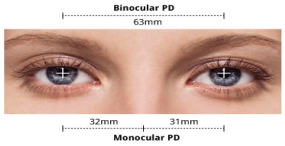
Progressive nomenclature – Fitting Concepts

- **PD Measurements –**
- Use a pupilometer for measuring pupil distance
- If a pupilometer isn't available:
  - Position yourself at the patient's eye level, making sure they are looking directly into your eyes
  - Mark the pupil center on the demo lens in the frame
  - Place the demo lens on the centration chart and read the monocular PD



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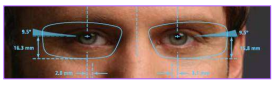
Progressive nomenclature – Fitting Concepts

- **Minimum Reading Area -** Experience has shown that a progressive reading area less than 5 mm in height is detrimental to good function.
- **Minimum Distance Area -** Experience has shown that a distance viewing area less than 10 mm in height is detrimental to good function.



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Present Day

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Progressive lens market - Global

- Valued at $29.9 billion in 2021
- Expected to reach $38.64 billion by 2027
- Lens materials: CR39, Polycarbonate, High and Mid-index, and Trivex
- Applications: Myopia, Hyperopia, Presbyopia and Astigmatism
- Distribution channels: Optical retail stores, Optometric businesses, Ophthalmological clinics, Opticians and On-line stores
- Geography: North America, Europe, Asian/Pacific, Latin America, middle and east Africa

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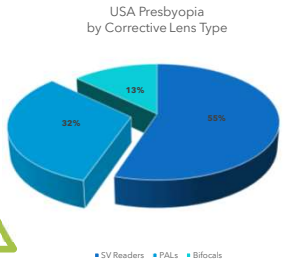
Progressive Lens Markets - 2021



- Europe – 48%
- Australia – 45%
- United Kingdom – 42%
- Canada – 35%
- USA – 32%

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Today's Target customers

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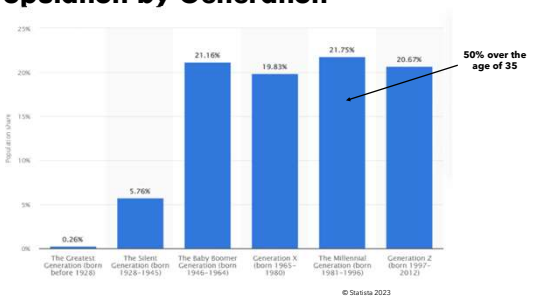
US Population by Generation



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Patient Acceptance – All Ages

- Recent studies show current PAL designs perform very satisfactorily
- PALs are the preferred modality for most presbyopes
  - Especially true for bifocal wearers
- Patients prefer vision through progressives compared to other presbyopic corrections

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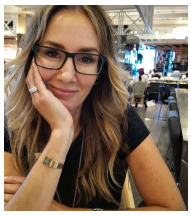
Millennials – Visual and health challenges

- Over 12 hours per day on screens
  - Smartphones – 13 inches
  - Tablets – 16 inches
  - Lap-Tops – 25 inches
  - Smartphones checked 96 times per day (Every 10 minutes)
- All day exposure to indoor and outdoor blue light:
  - Eye fatigue
  - Sleep disruption
  - Increased incidence of headaches and migraine
- Top 5 health conditions (Harris Poll, 2021)
  - Migraine
  - Depression
  - Asthma
  - Type 2 diabetes
  - Hypertension/high blood pressure



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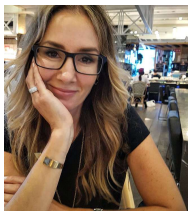
Patient acceptance - Millennials

- Lower add designs have fewer aberrations
  - Often easier to fit
- Includes many people who have never worn eyeglasses
  - Sensitive to blur and confined vision
- The first modality is often the final modality – get them wearing progressives sooner rather than later.
  - Offer free form lenses – latest tech
  - Variable power due to screen usage
  - UV and Blue light blocking with AR
    - Improved sleep
    - Visual comfort
    - Long term protection



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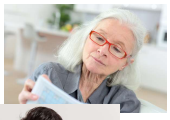
Patient acceptance - Reader wearers

- Often are emmetropes who don't like glasses (Millennials and Boomers)
  - Presbyopes who buy OTC readers
- Accustomed to very wide field of view at near
- Many use digital devices – extol the benefits of progressives to see at all viewing distances
- 50% of 40+ year olds wear readers. The opportunity is HUGE!



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Baby Boomers – Visual and health challenges

- Over 10 hours per day on screens
  - Smartphones – 13 inches
  - Tablets – 16 inches
  - Lap-Tops – 25 inches
- All day exposure to indoor and outdoor blue light:
  - Eye fatigue
  - Sleep disruption
  - Increased incidence of headaches and migraine
- Top 3 visual concerns
  - Presbyopia
  - Color distinction problems (Black Vs Blue)
  - Time to adjust to changing light conditions

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Patient acceptance - Baby Boomers

- Usually love the ability to focus at varying distances
- Very open to new technology
  - Free form lenses
  - UV Blocking
  - Blue blocking
  - AR Treatment
  - Polarized sun lenses
  - Changeable tint

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Patient acceptance - Bifocal Wearers

- Studies show >95% success in switching to progressives
- Most report improved overall vision Vs their previous flat-tops

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Patient acceptance - Choice of Frames

- Usual minimum fitting height is 22 mm
- But lower heights may work for many people
- New 'short intermediate' PALs work well
  - Success depends upon area of effective near vision and adequate distance vision

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The most important optical technology in the last 100 years – Freeform lenses!

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Freeform™ Progressive Lenses

- **1997 – Seiko Optical patent for freeform™ technology on the P1 Progressive lens.** While this patent has since expired; today there are no limits to what we can achieve. We can customize a lens based on the wearer's individual needs.
- What is Freeform processing?
  A revolutionary digital manufacturing process that uses computer-aided design and surfacing to create high-level, customized eyeglass lenses with your unique prescription. Think of it as a tailor for your eyes.

Darryl Meister - Memo to Vision Council Technical Committee, 2013

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Freeform™ Progressive Lenses

- **Benefits of Customized Free-form Lenses**
  Many leaders in the vision industry agree free-form technology is leading this next revolution in vision correction. In addition to the improved visual clarity that customized free-form lenses provide, you can expect:
  - **Exceptional night/low light vision:** Free-form lenses can reduce glare and halo effects caused by light sources at night, such as car headlights.
  - **Exceptional contrast perception:** Free-form lenses can sharpen vision.
  - **Exceptional color vision:** Free-form lenses can maximize the optics built into your lenses, providing brighter and more intense colors.
- While everyone can benefit to a certain extent from customized lenses, people with complex prescriptions and progressive wearers will notice the greatest visual improvements. Especially if we use "Position of Wear" measurements

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Why Position of Wear Measurements?

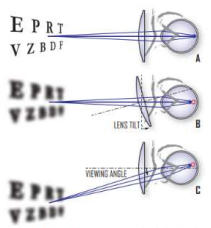

Figure 1. A) Oblique astigmatism is not produced when the line of sight is coincident with the optical axis of a spectacle lens; however, astigmatic power errors that the wearer perceives as a change from the desired sphere power and unwanted cylinder power occur when the line of sight forms an angle to the optical axis of the lens as a result of either B) tilting the lens in the position of wear or C) looking through the periphery of the lens at an off-axis viewing angle.

The position of wear or as-worn position refers to the position of the **fitted spectacle lens relative to the visual system of the wearer**. Due to the optical effects associated with oblique refraction through a spectacle lens, the **position of wear of the lens has important visual consequences for the wearer**. When the line of sight is incident upon the lens at an angle to the optical axis of the lens, **an optical aberration known as oblique astigmatism is produced.** Oblique astigmatism results in unwanted sphere and cylinder power errors that are perceived by the wearer as deviations from the desired prescription. **Oblique astigmatism is introduced when either the lens is tilted in the position of wear, (B) or the wearer views an object through the periphery of the lens. (C)** In either case, the line of sight forms an angle to the optical axis of the lens

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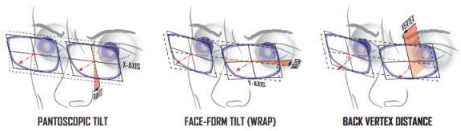
Why Position of Wear Measurements?

- Pantoscopic tilt represents the vertical angle between the plane of the frame front and a vertical plane orthogonal to the line of sight in primary gaze, which results from a rotation of the plane of the frame front around the horizontal X-axis.
- Face-form tilt represents the horizontal angle between the horizontal midline of the lens aperture and the plane of the frame front, which results from a rotation of the lens aperture around a vertical Y-axis in the plane of the frame front.
- Back vertex distance represents the longitudinal distance along the line of sight from the apex of the cornea to the back surface of the lens with the line of sight perpendicular to the plane of the frame front or, alternatively, in primary gaze.



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Why Position of Wear Measurements?

- The orientation of the lens aperture is determined by the Pantoscopic (vertical) tilt of the plane of the frame front around the horizontal X-Axis and the face-form (horizontal) tilt of the lens aperture around a vertical Y-Axis in the tilted plane of the frame front, while the position of the lens is determined by the back vertex distance along the line of sight from the apex of the cornea to the back surface of the lens with line of sight perpendicular to the plane of the frame front, or alternatively, with the line of sight in primary gaze.

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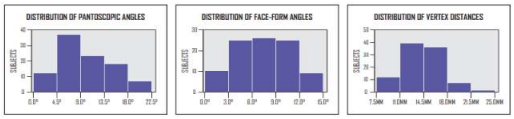
Why Position of Wear Measurements?

- The position of wear of the fitted eyeglass frame can vary significantly from frame to frame and from wearer to wearer.
- Indeed, the range of possible measurement values associated with each fitting parameter underscores the potential importance of customizing the optics of the lens design for the position of wear. Of course, because frame adjustments will influence the position of wear, the frame should be properly fitted to the wearer, prior to any measurements.



Measurements with a video central device from one study with 100 subjects demonstrates the variability. This emphasizes the potential benefits associated with optical customization for the position of wear.

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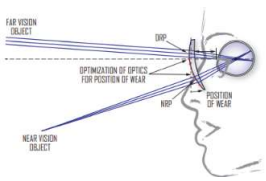
Why Position of Wear Measurements?

- For the most advanced free-form progressive lenses that are optically optimized for the position of wear, the net optical effect produced by the combination of oblique astigmatism due to off-axis viewing and surface astigmatism due to the progressive optics is calculated at numerous points over the lens design by ray tracing the eye-and-lens model.
- Variable asphericity is then applied to each point over the lens design in order to provide the correct optical powers at every angle of view in the position of wear. Afterward, compensated prescription and addition powers are calculated at the distance and near reference points of the lens for power verification using a conventional focimeter



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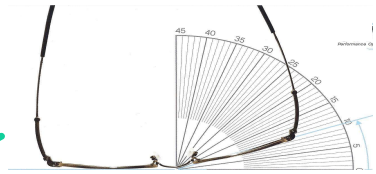
How to - Position of Wear Measurements

- **Frame Wrap Angle:** The correct measurement of face-form wrap is important because it will increase the fields of vision and help to reduce the awareness of back side reflections



Place the frame top-down on the tool, align the bridge center and left lens, as indicated on the tool, and measure the wrap angle from the base. If no angle is specified an average value of 5˚ will be used

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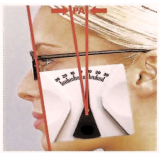
How to - Position of Wear Measurements

- **Pantoscopic Tilt:** The measurement of pantoscopic tilt is important, as lens tilt will cause oblique astigmatism, resulting in unwanted cylinder power

Front Measurement



Back Measurement

After proper adjustment of the frame, ask the patient to look straight ahead so you're looking at their profile. Place the vertical edge of the QuickFit Tool against the plane of either the front or the back of the frame. The pendulum of the tool will automatically line up vertically and show the pantoscopic angle of the frame

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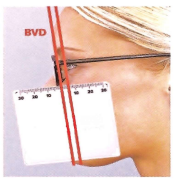
How to - Position of Wear Measurements

- **Vertex Distance:** The measurement of vertex distance is crucial as the patient's Rx is intended to be fit at that distance from the patient's eye to the back of the lens so they can experience the clearest vision possible



After proper adjustment of the frame, ask the patient to look straight ahead so you're looking at their profile. Place the ruler edge of the QuickFit Tool along the frame temple with the zero edge at the lens plane. Measure the distance in millimeters from the back of the lens to the front of the eye

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How to - Position of Wear Measurements

- **Vertex Distance:** Using a Distometer

Image, Andrew Bruce, ABOM

Ask the patient to close their eyes. Place the end of the device between the lid and the lenses. Slowly press the plunger and the two ball ends will separate. When they touch the lid and back surface of the lens, read the scale. Add a mm for the thickness of the lid and you have the vertex distance

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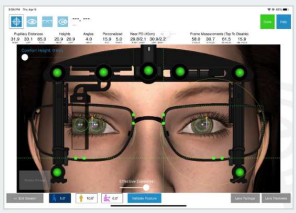
Optikam



1 Picture 10 Measurements

In the time needed for an ECP to obtain two measurements using a pupillometer and a Sharpie, OptikamPad provides the ten measurements needed for Position of Wear:

- Monocular Pupillary Distance (PD)
- Multifocal Seg Heights
- Pantoscopic Tilt (Panto)
- Rear Vertex Distance (RVD)
- Wrap (Face Form Tilt)
- Near Pupillary Distance
- A, B, ED/MBS and DBL values

These measurements, when accounted for in the fabrication of the patient's lenses, offer the best visual experience, thus moving patients into superior lens products.

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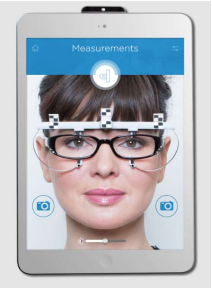
Essilor: Eye-Ruler 2

- Monocular pupillary distance
- Fitting heights
- Eye-lens distance – vertex
- Pantoscopic tilt
- Wrap angle



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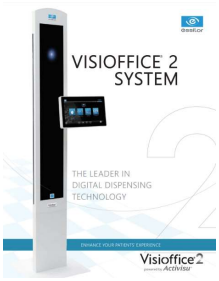
Essilor: VISIOFFICE 2 SYSTEM

- Dispense premium personalized lenses which consider the shape, size and fit of a patients' frame to deliver optimal vision
- Ability to measure your patient for any lens solution from single vision to the entire range of personalized Varilux® Progressive lenses



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Zeiss: iTerminal

- ZEISS iTerminal 2 offers high reliability thanks to the convergence control of the laser speckle - a patented ZEISS technology². It is very user-friendly and fast, offering precise centration results.
- ZEISS iTerminal 2 captures and calculates your patient's individual parameters with the click of a button and a precision of 0.1 mm
- Zeiss iTerminal mobile is a digital centration solution operated with an iPad®

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Fitting Defaults

- If there are no measurements submitted with a lens order, the following are typically used as default specifications:
  - Frame wrap: 5°
  - Pantoscopic Tilt: 9°
  - Vertex: 13mm

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Present Day – Camber Front Surface

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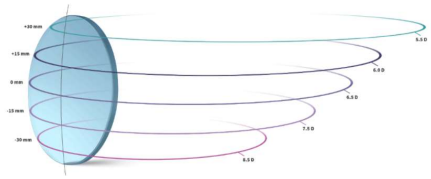
Camber Front Surface

The Camber lens blank features a **variable base curve, a front surface innovation that provides the optically ideal base curve in all viewing zones**

- Expanded Rx range
- Offer better cosmetics (flatter) for many prescriptions
- User-preferred near vision performance.



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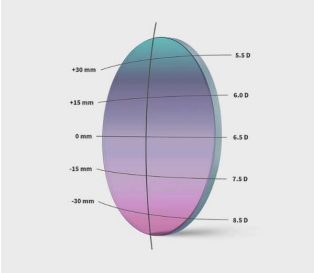
Camber Lenses – 3 Components

1. **The Camber Lens Blank**
   - With variable base curve by Younger Optics, the Camber lens blank **improves on the spherical lens blank**, by offering a continuously increasing base curve that is better suited for progressive prescriptions.



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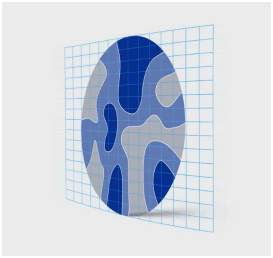
Camber Lenses – 3 Components

2. The Camber Rx Computation

- Camber lens designs are mathematically compensated for peripheral aberrations and include the intelligent use of the wearer's accommodation to drastically reduced aberrations across the entire field of vision. They also incorporate strict control of mean power to practically eliminate spherical error in lateral areas of the lenses, resulting in improved lateral vision and superior image stability..



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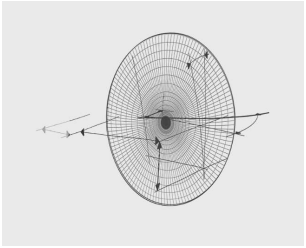
Camber Lenses – 3 Components

3. Personalization - Position of Wear

- The Rx design computation is further enhanced, when desired, by a complete set of individualization parameters that take into consideration the unique attributes of the frame and the preferences of the wearer. The result is a finished lens that is comprehensively customized for each individual patient.



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Present Day – Lifestyle Progressive Lenses

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Lifestyle Progressives – All

General Purpose

- Everyday wear
- Everyday activities – Driving, walking, shopping, etc.
- Lens material dependent on Rx
- Lens enhancements dependent on lifestyle
  - Photochromic
  - AR Treatment
  - Indoor blue blocking
  - Etc.

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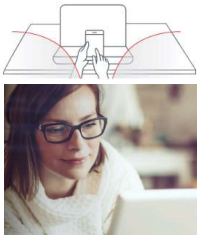
Lifestyle Progressives - All

Computer Progressives

- Designed specifically for digital use, ensuring convenient viewing for 15-27-inch digital zones and easy transition among all viewing zones.
- Facilitates both traditional book and computer display reading, and digital lifestyle-driven smartphone and tablet usage.
- Quick transition of Add power
- Broader reading area



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Lifestyle Progressives - All

- **Reading progressives** – Designed for those who spend a great deal of time focused at near point (Books, hobbies etc.)
  - High near vision clarity, with viewing zones 20% broader than those of standard progressives
  - Backside digital freeform with short corridors
  - Specifically for non-digital devices - great for reading, knitting, or even crossword puzzles
  - The reading area is optimally positioned, so you'll enjoy a more natural posture

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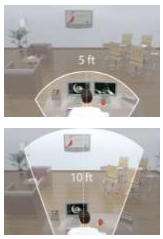
Lifestyle Progressives - All

Workstation

- Lenses are designed to significantly improve visual clarity and comfort in the 15 inches to 5 feet or 10 feet range
- Freeform backside digital
- Include appropriate lens enhancements



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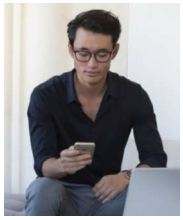
Lifestyle Progressives - Millennials

Accommodative relief

- Features an extra bit of power in its lower surface area for added visual comfort in the 15-to-27-inches digital display viewing zones
- Designed for both Rx and non-Rx
  - High personalization, with lenses customized to eyeglass wearers' visual requirements
  - The broadest possible fields of clear vision
  - Unprecedented support for comfortable digital handheld device and computer viewing
  - Greatly reduced eye strain and fatigue



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Lifestyle Progressives - All

Golf

- Unlike standard progressives, the three vision zones are specifically tailored to the needs of golfers to maximize their viewing: the scorecard in their hand, the ball at their feet and the green in the distance.
  - Clear peripheral viewing
  - Personalized to the patient
  - Designed specifically for wrap frames

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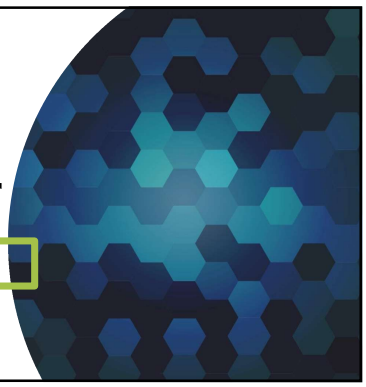
Let's Strip Bare: Essentials for Progressive Lenses



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