



# Ophthalmic

# Lenses

## Materials, Types and Treatments & Measurements

www.EyeSystems.info Mary E. Schmidt, ABOC, CPO mary@EyeSystems.info  
No audio or video recording of presentation allowed

1

---

---

---

---

---

---

---

---

## Single Vision

- Spherical in design
  - All purpose, single focus, may be sphere or cylinder Rx's
- Aspheric in design
  - Improved cosmetics
  - Thinner and flatter
  - Single focus, may be sphere or cylinder Rx's

Original Thinking EyeSystems Unique Solutions

2

---

---

---

---

---

---

---

---

## Aspherical Lens Forms

- Aspheric Plus Lenses
  - Flattens in surface curve towards edge (like an egg)
  - All the standard characteristics of spherical plus lenses
    - Thinner in the center than spherical plus lenses
    - Magnify less (thinner & flatter)
    - Less bulbous
    - More asphericity in higher plus lenses
    - Provides good vision



Conventional Versus Aspheric Lens Designs

Original Thinking EyeSystems Unique Solutions

3

---

---

---

---

---

---

---

---

+33 diopters in 1.74 aspheric



www.kidsbrighteyes.com  
http://www.kidsbrighteyes.com/

4

---

---

---

---

---

---

---

---

### Aspherical Lens Forms

- Aspheric Minus Lenses
  - Steepens in surface curve towards edge (like a frisbee)
- Thinner at the edge than spherical minus lenses
- Minify less in lens periphery
- Flattened



5

---

---

---

---

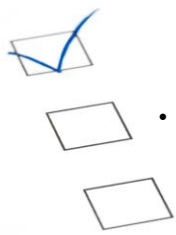
---

---

---

---

### Choosing the Right Design



- Choice is dependent on
  - Prescription
  - Patient want and need
  - Cost
  - Frame size and shape

6

---

---

---

---

---

---

---

---

### Quick Tips – Single Vision



- Fitting and Dispensing
  - Spherical design lenses
    - Monocular PD's
    - OC along frame midline
  - Aspheric lenses
    - Monocular PD's

Original Thinking EyeSystems Unique Solutions

7

---

---

---

---

---

---

---

---

### Bifocals



- Flat Top most commonly used
  - Available in 28, 35, 45mm
- Spherical in design
  - All purpose, double focus, may be sphere or cylinder Rx's
- Aspheric in design
  - Improved cosmetics, thinner and flatter
  - Double focus, may be sphere or cylinder Rx's
  - Only distance portion aspheric

Original Thinking EyeSystems Unique Solutions

8

---

---

---

---

---

---

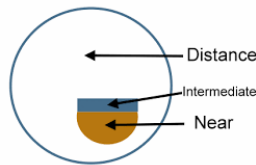
---

---

### Trifocals

- Spherical in design 7x28
  - All purpose
  - Triple focus; distance, mid-range (arm's length) and near
  - May be sphere or cylinder Rx's

#### Trifocal Lenses



<http://www.lank-guider.blogspot.com>

Original Thinking EyeSystems Unique Solutions

9

---

---

---

---

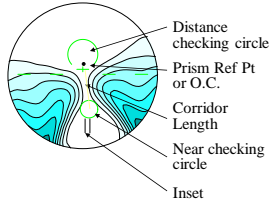
---

---

---

---

### Multifocal Terms



Original Thinking EyeSystems Unique Solutions

10

---

---

---

---

---

---

---

---

### Progressives



#### General Purpose

- Distance and near and all distances in between
- Blending zones
- Hard and soft designs
- Minimum fitting heights vary by manufacturer

Original Thinking EyeSystems Unique Solutions

11

---

---

---

---

---

---

---

---

### Terminology

**FREEFORM PROGRESSIVES**

- Digital Surfacing
- Digitized
- Internal Free-Form
- Fingerprint Surfacing
- Customized
- Precise-Form
- Backside/Back Surface
- Dual-Surface
- Wavefront
- Fully Personalized
- HD
- High Definition

Original Thinking EyeSystems Unique Solutions

12

---

---

---

---

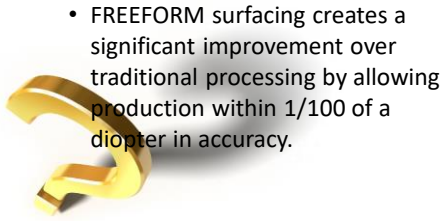
---

---

---

---

## Freeform Progressive



- FREEFORM surfacing creates a significant improvement over traditional processing by allowing production within 1/100 of a diopter in accuracy.

13

---

---

---

---

---

---

---

---

## Terminology



14

---

---

---

---

---

---

---

---

## Terminology

- “FIXED” Progressive – Corridor length remains the same – reading area changes.



15

---

---

---

---

---

---

---

---

Terminology

- “VARIABLE” Progressive

Reading area remains the same – corridor length changes.



Original Thinking EyeSystems Unique Solutions

16

---

---

---

---

---

---

---

---

Freeform

Fixed Design	Seg	Trans (Int)	Reading	Variable		
				Seg	Trans	Reading
11mm	11	6	5	11	6	5
	12	6	6	12	7	5
	13	6	7	13	8	5
	18	6	12	14	9	5
	21	6	15	15	10	5
13mm	13	8	5	16	11	5
	14	8	6	17	12	5
	15	8	7	18	13	5
	20	8	12	19	13	6
15mm	15	10	5	20	13	7
	16	10	6	21	13	8
	17	10	7	22	13	9
	21	10	11	23	13	10
18mm	18	13	5	24	13	11
	19	13	6	25	13	12
	20	13	7			
	21	13	8			
	25	13	12			

Original Thinking EyeSystems Unique Solutions

17

---

---

---

---

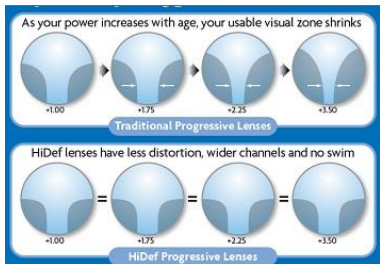
---

---

---

---

Power Changes and Patient Impact



Original Thinking EyeSystems Unique Solutions

18

---

---

---

---

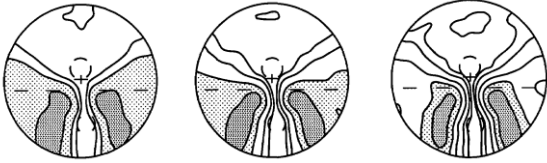
---

---

---

---

## Comparison



Original Thinking EyeSystems Unique Solutions

19

---

---

---

---

---

---

---

---

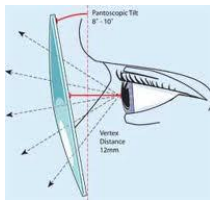
---

---

## Considerations for Freeforms

These considerations allow for an optimized wearing experience:

- Pantoscopic angle (PA)
- Vertex or Back Vertex Distance (BVD)



**Usage:**  
**Picture A:** Adjust try to select appropriate frame that suits face and fit then adjust it on the patient's face before taking the measurement. Measure the PA, as shown, you will get the Pantoscopic Angle (PA) with the needle. Adjust the frame if required to achieve recommendation for patients comfort.  
**Picture B:** For best result, Specialty for Progressive Addition Lenses it is necessary to have Patient's IPD along with BVD and PA.  
 BVD Recommended as minimum as possible  
 PA: 8° to 12° average 10° (recommended)  
**Picture C:** The BVD (Back Vertex Distance) is the distance between the back of a correcting lens and the Cornea. The Scale for the BVD allows the measurement from both sides as the Zero is placed in the middle.

Original Thinking EyeSystems Unique Solutions

20

---

---

---

---

---

---

---

---

---

---

## Measuring Vertex Distance



Original Thinking EyeSystems Unique Solutions

21

---

---

---

---

---

---

---

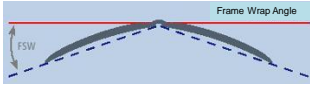
---

---

---

## Considerations for Freeforms

- Panoramic angle and wrap



22

---

---

---

---

---

---

---

---

---

---

## Considerations for Freeforms



23

---

---

---

---

---

---

---

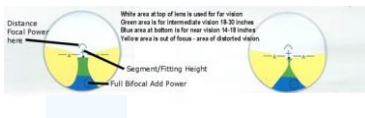
---

---

---

## Progressives

- Short Corridor
  - Designed for frames with narrow vertical dimensions



24

---

---

---

---

---

---

---

---

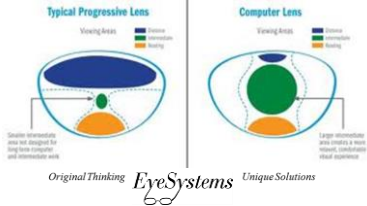
---

---



Progressives

- Computer – NVF – NEURO - Specialty
  - Designed for increased mid-range viewing
  - Often do not have distance portion
  - Require deeper frames for best vision



25

---

---

---

---

---

---

---

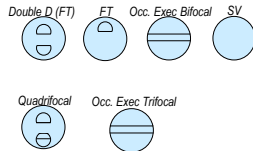
---

---

---

Lens Forms

- Occupational lenses
  - Create custom eyewear to meet occupational needs
- Occupational SV and bifocals
  - Distance and near, mid-range and near, distance and mid-range
- Occupational trifocals
  - Distance, mid-range and near



Original Thinking EyeSystems Unique Solutions

26

---

---

---

---

---

---

---

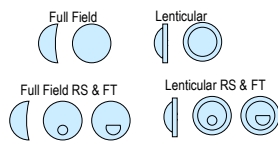
---

---

---

Lens Forms

- Cataract and Low Vision lenses
  - Single Vision
    - Full Field, Lenticular
  - Bifocals
    - Full Field, Lenticular



Original Thinking EyeSystems Unique Solutions

27

---

---

---

---

---

---

---

---

---

---

### Choosing the Right Multifocal

Classes Prescription					
	Sphere	Cylinder	Axis	Prism	Base
DISTANCE	OD	-4.00		0.5	down
	OS	-5.00	-0.50	180	0.5
ADD	OD	+2.00			
	OS	+2.00			



Original Thinking EyeSystems Unique Solutions

28

---

---

---

---

---

---

---

---

---

---

### Important Eye Measurement

- Interpupillary distance or PD
  - Distance between the visual centers of the patient's two eyes
  - Used for proper centering of lenses
  - Measured best by corneal reflex pupillometer



Original Thinking EyeSystems Unique Solutions

29

---

---

---

---

---

---

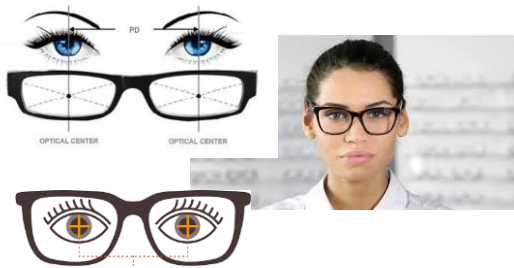
---

---

---

---

### Measuring for Optical Center



Original Thinking EyeSystems Unique Solutions

30

---

---

---

---

---

---

---

---

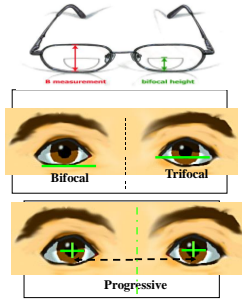
---

---

## Quick Tips – Multifocals

### Fitting and Dispensing

- Bifocals
  - Binocular distance and near PD's
  - Segment ledge at top of lower lid
  - Same segment height for each lens
- Trifocals
  - Binocular distance and near PD's
  - Segment ledge at bottom of pupil margin
  - Same segment height for each lens
- Progressives
  - Monocular PD's
  - Monocular fitting heights



Original Thinking EyeSystems Unique Solutions

31

---

---

---

---

---

---

---

---

## Sports Lenses



- Protective eyewear
  - High impact Polycarbonate lenses and nearly unbreakable frames
  - UV absorption, special tints
  - High contrast filters; yellow, vermillion
  - Glare control; polarized lenses
  - Wrap frames for wind and dust
- Special designs
  - Out-of-the-way seg for golf

Original Thinking EyeSystems Unique Solutions

32

---

---

---

---

---

---

---

---

## Lens Materials

Original Thinking EyeSystems Unique Solutions

33

---

---

---

---

---

---

---

---

## Material Choices

- **Hard Resin**
  - Conventional plastic
  - Good all purpose material, tintable
  - Processed to 2.0mm ct
  - Available in virtually all designs
  - Available with scratch resistant and/or AR coatings
  - Cost \$
- **Impact Resistant (Poly, Trivex, Phoenix)**
  - Most impact resistant
  - Thinner and lighter than conventional plastic
  - Can be processed to 1.0mm ct
  - Low abbe: reduces clear field of view in higher Rx's
  - Duty to Warn
  - Cost \$
- **High Index Resin**
  - Thinner and lighter
  - Can be processed to 1.2mm ct
  - Available in most designs
  - Should be scratch and AR coated
  - For patient that wants best in category
  - 1.54, 1.55, 1.56, 1.57, 1.59, 1.60, 1.66, 1.70, 1.71
  - Cost \$\$ - \$\$\$\$
- **Glass**
  - Traditional material
  - Stable and precise optics
  - Good acuity
  - Chemical or heat tempered for FDA compliance
  - Heavy
  - High index available: 1.60, 1.70
  - Cost \$ to \$\$

Original Thinking EyeSystems Unique Solutions

34

---

---

---

---

---

---

---

---

---

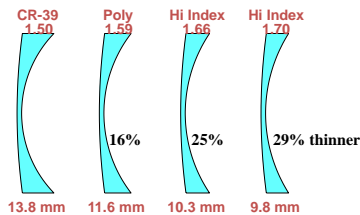
---

---

---

## Thickness Comparisons

- -8.00 D



Original Thinking EyeSystems Unique Solutions

35

---

---

---

---

---

---

---

---

---

---

---

---

## Advising About Materials

- **Lens Type**
  - Lifestyle, Rx and history



36

---

---

---

---

---

---

---

---

---

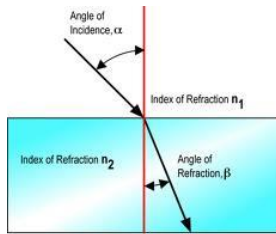
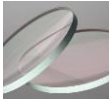
---

---

---

## Refractive Index

- Refractive Index
- the higher the index, the thinner the lens
- but thickness and specific gravity will affect final volume and weight



Original Thinking EyeSystems Unique Solutions

---

---

---

---

---

---

---

---

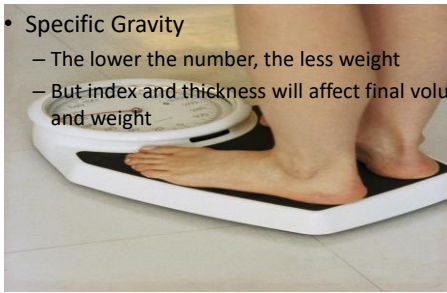
---

---

37

## Specific Gravity

- Specific Gravity
- The lower the number, the less weight
- But index and thickness will affect final volume and weight



Original Thinking EyeSystems Unique Solutions

---

---

---

---

---

---

---

---

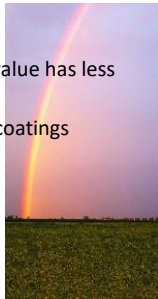
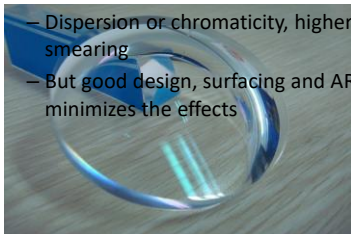
---

---

38

## ABBE Value

- ABBE Number
- Dispersion or chromaticity, higher value has less smearing
- But good design, surfacing and AR coatings minimizes the effects



Original Thinking EyeSystems Unique Solutions

---

---

---

---

---

---

---

---

---

---

39

### Material Comparison Chart

Lens Material	Refractive Index	Specific Gravity	Abbe Number
CR-39	1.499	1.32	58
Trivex (Trilogy, Phoenix)	1.530	1.11	45
HI 54	1.537	1.21	47
HI 55	1.550	1.28	38
HI 56	1.556	1.42	39
Polycarbonate	1.586	1.20	30
HI 60	1.592	1.30	42
HI 66/67	1.660/1.67	1.35	32
HI 70/71	1.700	1.41	36
Crown Glass	1.523	2.54	58
HI 60 Glass	1.601	2.62	40
HI 70 Glass	1.701	2.93	30
HI 80&90 Glass	Discontinued		

Original Thinking EyeSystems Unique Solutions

---

---

---

---

---

---

---

---

---

---

40

### Treatments

- Scratch resistant coatings extend the longevity of the lenses, improve the value of lenses
- Lenses with deep or fine scratches reduce the quality of vision through and scatter light



Scratched versus unscratched lens  
Original Thinking EyeSystems Unique Solutions

---

---

---

---

---

---

---

---

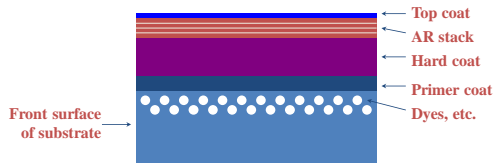
---

---

41

### Scratch Coatings

- Hard coatings are an integral part of a "system," and are engineered for compatibility with additional treatments



A typical system of coatings

Original Thinking EyeSystems Unique Solutions

---

---

---

---

---

---

---

---

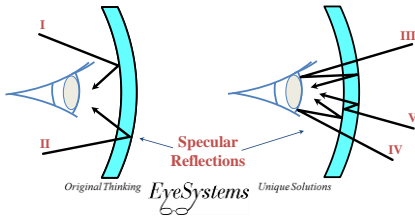
---

---

42

## Surface Reflections

- A spectacle wearer can be bothered by 5 unique specular reflections, which are also affected by the surface curves of the lens



43

---

---

---

---

---

---

---

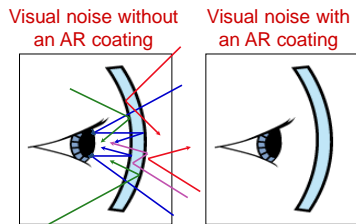
---

---

---

## AR Benefits Wearers

**Wearers look better and see better**



44

---

---

---

---

---

---

---

---

---

---

## Tints

- Tinting plastic lenses:
  - Plastic lenses are immersed in organic dyes, which permeate into the surface of the lens substrate (not affected by thickness)



45

---

---

---

---

---

---

---

---

---

---

## Tints

- Tinting glass lenses:
  - Glass lenses have metallic oxides added to the initial raw mixture, which are dispersed throughout the bulk of the lens



Original Thinking EyeSystems Unique Solutions

46

---

---

---

---

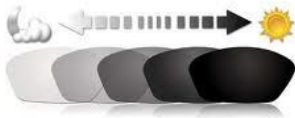
---

---

---

---

## Photochromism



LENSES ARE CLEAR WHEN INDOORS OR AT NIGHT AND AUTOMATICALLY DARKEN TO A SUNGLASS TINT WHEN EXPOSED TO SUNLIGHT.

Original Thinking EyeSystems Unique Solutions

47

---

---

---

---

---

---

---

---

## Temperature Dependence



Original Thinking EyeSystems Unique Solutions

48

---

---

---

---

---

---

---

---



# Implementing Lens Choices *EyeSystems*



- Talk with your patient
- Take the time to make the right choice
- Educate your patient

*Original Thinking* *EyeSystems* *Unique Solutions*

---

---

---

---

---

---

---

---