NCLE Advanced Contact Lens Review
Domain II - Design, Fit and Dispense Standard and Specialty Lenses (31%)

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Presented by the National Federation of Opticianry Schools – NFOS

Time: 2:45 PM - 4:45 PM

NCLE Advanced, Domain II: Design, Fit and Dispense Standard and Specialty Lenses

Lens Type and Selection is based on Pre-fit Findings

-Ocular Health
-Ocular History
-Slit Lamp Findings
-Keratometry and relationship between spectacle Rx and Keratometry readings

Residual Astigmatism - is an astigmatism left over after a contact lens is placed on the eye

Symptoms of Residual Astigmatism: Reduced acuity, Shadows around images and Asthenopia

What is Astigmatism?

What causes Astigmatism?

How common is Astigmatism?

Types of Astigmatism:

Total Astigmatism

Corneal Astigmatism

Lenticular Astigmatism

Total Astigmatism = Corneal Astigmatism + Lenticular Astigmatism

Lenticular Astigmatism = Total Astigmatism - Corneal Astigmatism

Classification of Astigmatism:

With-the-Rule

Against-the-Rule

Oblique Astigmatism

What is Residual Astigmatism?

What cause Residual Astigmatism?

Symptoms of Residual Astigmatism?

Calculation of Residual Astigmatism?

Calculated Residual Astigmatism = Total Astigmatism - Keratometer Astigmatism
CRA = TA - KA

Case Studies

Example 1

Rx -3.50 -.75 x 180, "K" 43.50 @180/44.25 @ 90

Rigid Lens

CRA = TA - KA
-.75 x 180 - -.75 x 180
-.75 x 180 +.75 x 180
= 0

Soft Lens

CRA = TA - KA
-.75 x 180 - 0
= -.75x180

Example 2

Rx -4.00, "K" 42.25 @ 180/ 42.25 @ 90

No residual with either a rigid or soft lens because there is not astigmatism either on the cornea or internal.

Example 3

Rx -3.75 -1.50 x 90, "K" 43.50 @ 180/ 43.00 @ 90

Rigid Lens

CRA = TA - KA
-1.50 x 90 - - .50 x 90
-1.50 x 90 + . 50 x 90
= - 1.00 x 90 Residual

Soft Lens

CRA = TA - KA
- 1.50 x 90 - 0
= - 1.50 x 90 Residual

Example 4

Rx - 2.75 - 1.00 x 90, “K” 42.50 x 180/ 43.50 @ 90

Rigid Lens

CRA = TA - KA
-1.00 x 90 - - 1.00 x 180
-1.00 x 90 + 1.00 x 180
-1.00 x 90 - 1.00 x 90
= -2.00 x 90 Residual

Soft Lens

CRA = TA - KA
- 1.00 x 90 - 0
= - 1.00 x90 Residual

Example 5

Rx - 3.50, “K” 44.00 @ 180 / 46.00 @ 90

Only fit a soft lens because you not neutralize corneal astigmatism. If you fit a rigid lens and neutralize the corneal astigmatism, you will 2.00 of residual astigmatism.

Example 6

Rx - 2.75 - 1.25 x 90, “K” 41.50 @ 180/ 41.50 @ 90

CRA = TA - KA
- 1.25 x 90 - 0
= - 1.25 X 90 Residual

If you fit either a soft or rigid lens, you will have an anticipated amount of residual astigmatism of - 1.25 x 90. The astigmatism is all internal because there is no corneal astigmatism.

Example 7

Rx - 3.25 - 1.75 x 90, “K” 42.00 @ 180/ 42.50 @ 90

Rigid Lens

CRA = TA - KA
-1.75 x 90 - - .50 x 90
-1.75 x 90 + .50 x 180
-1.75 x 90 - .50 x 90
-2.25 x 90 Residual

Soft Lens

CRA = TA - KA
- 1.75 x 90 - 0
-1.75 x 90 Residual

Example 8

Rx -3.00 - 3.75 x 180, “K” 41.00 @ 180 / 44.75 x 90

Bitoric lens Design when astigmatism is over 3.00 Diopters.

Soft Lens Fitting

Soft lenses should achieve a “3 point touch”

Criteria for a Well Fitted Soft Lens

- Good centration and corneal coverage
- Adequate Movement
- Stable and Consistent Vision
- Comfort
- Undistorted Keratometer reflex
- Good Retinoscopic Reflex

FITTING EVALUATION AND RECOMMENDATIONS

Characteristics of a LOOSE FIT

a. Variable Vision
b. Excessive awareness
c. Excessive movement
d. Edge standoff
e. Lens falling out
f. Lens displacement
g. Vision is clear before the blink and blurs after the blink
h. Keratometer reflex blurs after the blink and patient's vision is distorted

Correction of a LOOSE FIT

a. Switch to a larger or steep base curve or combination of both

Characteristics of a TIGHT FIT

a. Corneal indentation or compression of the sclera
b. Blanching
c. Ocular Redness as the day goes on
d. The lens becomes more uncomfortable as the day goes on
e. Vision clears after blinking but then blurs before next blink
f. Keratometer reflex blurs before blink and clears after blink

Correction of a TIGHT FIT

a. Switch to a smaller or flatter base curve or combination of both

RGP Fitting and Evaluation

Oxygen Permeability/Oxygen Transmissibility

DK = Oxygen Permeability

DK/L = Oxygen Transmissibility

EOP = Equivalent Oxygen Performance

Fitting GP Lenses

Fitter should consider DK value, Wetting Angle, Specific Gravity and Tint Availability

Many GP lenses today come with a UV inhibitor

Fitting Procedure

Health History, Refraction, Pre-fit with Slit Lamp, Keratometry, Lens Options

Methods of Fitting

Empirical – Trial Lens Fitting

FUNCTIONS OF LENS RIGID CONTACT LENS PARAMETERS

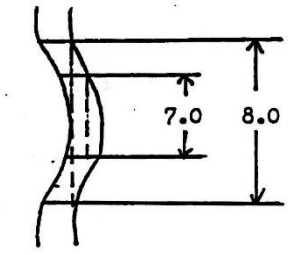
Sagittal depth – is the measurement from the flat plane at a given diameter to the highest point of a concave surface of the contact lens or described as corneal elevation

CENTRAL POSTERIOR CURVE – If the POZ is kept constant and the CPC is made steeper, Apical Vault is increased therefore lens movement is decreased forming a tighter fit. Ex. Change base curve from 7.80 to 7.70 *Any change in the base curve requires a new lens.*

If the POZ is kept constant and the CPC is made flatter, Apical Vault is decreased therefore lens movement is increased forming a looser fit. Ex. Change 7.70 to 7.80

POSTERIOR OPTICAL ZONE – If the CPC is kept constant and the POZ is made smaller, Apical Vault will be decreased and therefore increase lens movement. Ex. Change POZ from 8.0 to 7.0 *If you make the POZ smaller, this does not require a new lens and can be made by adjustment of the original lens.*

If the CPC is kept constant and the POZ is made larger, Apical Vault will increase and therefore decrease lens movement. Ex. Change POZ from 7.0 to 8.0 *If you want to make the POZ larger, you have to order a new lens.*



Small POZ → decrease sagittal value of the lens, decrease Apical Vault → increase lens movement →loosen the fit of the contact lens.

Larger POZ → increase sagittal value of the lens, increase Apical Vault → decrease lens movement → tighten the fit of the contact lens.

DIAMETER – As diameter increased, the POZ is usually increased accordingly. As this occurs, apical vault increases increasing therefore tightening the fit of the lens. *If you want to make the diameter larger this will require a new lens.*

As diameter is decreased, the POZ is usually decreased accordingly. As this occurs, apical vault decreases and loosens the fit of the contact lens. *If you want to make the diameter smaller, this can done by adjustment and does not need a new lens.*

THICKNESS – As thickness decreases, surface tension will increase causing a tighter fit. As thickness increases, this will loosen the fit of the lens. *Any change in thickness requires a new lens.*

PERIPHERAL CURVES – If peripheral curves are made wider, and will decrease the size of the POZ, apical vault will decrease which will loosen the fit of the contact lens. *Widening peripheral curves can be done by adjustment on the original lens. Peripheral curves cannot be made smaller and will require a new lens. If the fitter wants a larger POZ, a new lens will have to be ordered*.

POWER – corrects the patient's refractive error. In a minus lens, up to 1.00 D of minus can be added to the original lens with reordering a new lens. *It is recommended that no more that .50 D of power be added to an original contact lens.* For plus lenses, up to .50 D of power can be added to the original lens.

AOZ – is the power curve of the contact lens and does not affect the fit of the contact lens.

When the contact lens fitter uses the terms **TIGHT** and **LOOSE**, this refers to movement of the lens.

When the contact lens fitter uses the terms **STEEP** and **FLAT,** this refers to apical vault and the amount of tears under the lens. A lens that is tight is steep and a lens that is flat is loose. These terms also refer to the central lens corneal relationship that was discussed in previous lectures.

DIAMETER AND PERIPHERAL CURVE DESIGN FOR RIGID CONTACT LENSES

Choosing a lens diameter for the potential rigid lens fitter is not always a cut and dry decision or following specific rules that will always work. However, with clinical experience, choosing an initial diameter for the potential contact lens wearer will become easier. Here are some specific guidelines that can be followed to start the process:

1. The specific lens variables that will influence the fitter's decision on diameter are the CPC and POZ, the thickness, and the peripheral curves and their widths.

2. Patients with large palpebral fissures usually require a larger diameter lens. Patients with smaller palebral fissure usually require a smaller diameter lens.

3. Patients with large corneas 12.0 > usually require a larger diameter of 9.5 or or greater.

   Patients with an average size cornea 11.0 – 11.5 usually require a lens diameter

   Between 9.0 - 9.5.

   Patients with smaller corneas < 11.0 require a smaller diameter below 9.0.

4. The amount of corneal toricity or corneal astigmatism can also influence the overall diameter selection. As a rule of thumb, patients with flatter corneas of less than 45.00 D usually require a large diameter. In addition, patients with corneas that are steeper than 45.00 D may require a smaller diameter.

5. The entrance pupil of the cornea is another consideration that the contact lens fitter must take into account. The POZ must be large enough to accommodate the entrance pupil in dim illumination when the pupil dilates. If the POZ is to small, the pupil will pick up the edge of the POZ resulting in lens flare. Flare is the prismatic displacement of light that the patient experiences when the POZ is to small in dim illumination.

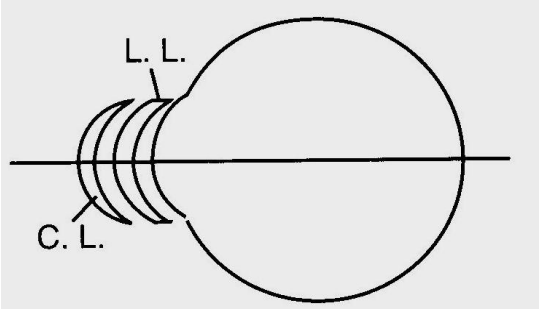
   In all of the above factors, trial lens fitting is recommended to evaluate the overall fit and movement of the contact lens before ordering.

   With this mind, here are some simple rules for designing a rigid contact lens.

CONTACT LENS CALCULATION FOR RIGID (Intrapalpebral) CONTACT LENSES

When a rigid contact lens is fit to the cornea, optically the practitioner is fitting two lenses to the eye.

1. The Contact lens 2. The Lacrimal lens



Dioptric power for all rigid spherical lenses can be calculated if the following rules:

On "K" Procedure

1. Spectacle Rx is put in minus cylinder form. (Spectacle cylinder is dropped)
   -3.00 + .50 x 90 → -2.50 -.50 x 180

2. Convert Keratometer readings from diopters to mm. (Use conversion chart)
   "K" 43.25 x 180 / 43.75 x 90

   7.80 7.70

3. When the principal corneal meridians differ by .20 mm or less, the flattest corneal meridian is fitted. Fitting on "K" means fitting the flattest corneal meridian.

   7.80 (The difference is .10 mm therefore 7.80 is the starting base curve)

   7.70

   .10

4. A corneal contact lens having a CPC identical in curvature with the flattest corneal meridian would require a dioptric power identical with the spectacle

   sphere power in the transposed Rx. (-2.50 is sphere power of the transposed Rx)

5. Therefore, the starting base curve and power would be **Answer: 7.80, -2.50 Power**

6. Vertex Power – When the sphere power of the transposed Rx is +/- 4.00 or more in

the spectacle plane, the effective power at the corneal plane is needed.

(Use Vertex conversion chart)

Minus power at the corneal plane will always require less power compared to power at the spectacle plane.

Plus power at the corneal plane will always require more power compared to power at the spectacle plane.

Example #1: -5.00 @ 12 mm = -4.75 (Use Vertex conversion chart)

+5.00 @ 12 mm = +5.25

Example #2: +3.00 + 2.00 x 90 Vx = 12 mm

"K" 43.75 x 180 / 45.00 x 90

7.70mm 7.55mm

1. Transpose Rx - +5.00 – 2.00 x 180
2. Vertex conversion - +5.00 @ 12mm = +5.25
3. 7.70
   7.55

   .15 mm

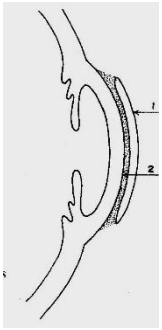
   .15 mm is less that .20 so the starting base curve would be 7.70 mm with a starting contact lens power of +5.25

   Answer: 7.70 mm/ +5.25

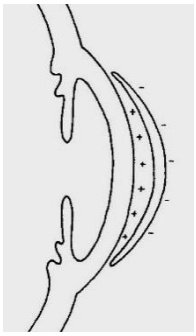
Lacrimal Tear Lens Power – A change in the CPC by .05 mm will also change the anterior curve of the lacrimal lens by and equal amount. This will alter the sphere power of the lacrimal lens by .25 D (Rule of Thumb - .05 mm = .25 D)

Rule of Thumb

. 03 = .12 D
.05 = .25 D
.10 = .50 D
.15 = .75 D
.20 = 1.00 D

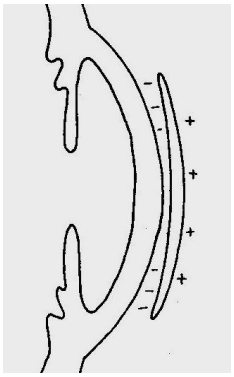


SAM (Steeper Add Minus) – When the CPC is fitted steeper, the tear lens creates plus sphere power, therefore minus power must be added to neutralize the change.



FAP (Flatter Add Plus) – When the CPC is fitted flatter, the tear lens creates minus

Sphere power, therefore plus power must be added to neutralize the change.



MEAN "K" PROCEDURE – When the principal corneal meridians differ by more than .20 mm, the CPC should be fitted steeper than the flattest corneal corneal meridian by one-quarter of the difference between the two principal meridians.

Example #3: Rx –3.75 +2.50 x 90

"K" 43.75 @180 / 46.25 @ 90

1. Transpose Rx to minus cylinder = -1.25 – 2.50 x 180
2. Convert "K"'s to mm 43.75 = 7.70, 46.25 = 7.30 mm
3. Take difference in "K" readings and divide by 4
   7.70

   7.30 7.70

   .40 = .10 mm → .10

   4 7.60 mm

4. 7.60 mm is the new base curve, however because the base curve is being changed from 7.70 to 7.60, the lens is being fit a .10 mm steeper.

   Follow the SAM rule .10 = .50 D therefore –.50 added to –1.25 which is the sphere power of the transposed Rx. The power need with a 7.60 base curve is -.175 contact lens power

Answer: 7.60 mm, -1.75 Power

RULE: If Power is just added, there is no need to change the CPC.

Example #4: A patient is wearing a CPC of 7.70 mm and a CL Rx = -2.00.

If the Doctor wants an Rx change of -.50 D, What is the new

CPC and Power? **Answer: 7.70 mm, -2.50 D**

RIGID GAS PERMEABLE FITTING (Upper Lid Attachment)

1. Transpose Rx in minus cylinder form.
2. Compensate for vertex distance above +/- 4.00.
3. Take Keratometer readings
4. Select a trial lens consistent with the fitting philosophy and fitting technique with which you feel most comfortable. Based upon your choice of lens diameter and the patient's corneal cylinder, the following rules can be applied for designing a RGP lens.

5. Lens diameters are determined by lid position, pupil diameter and palpebral fissure size. Establish whether you can fit upper lid attachment an upper lid attachment (superior alignment) or intrapalpebral fit. An upper lid attachment will result when the upper lid interacts with the GP contact lens causing the lens to ride slightly under the upper lid. If an upper lid interaction cannot be established, then a slightly smaller diameter may have to be used with a steeper base curve.

   Many contact lens companies provide a recommended fitting chart called a nomogram. This chart used the the amount of corneal astigmatism as a starting point for base curve selection To determine the starting diameter, start with measuring the HVID with a mm ruler.

   The HVID will determine if a patient has a large, average or small cornea. Use the following guide for your initial diameter selection.

   Large Cornea > 12 mm - Choose a diameter 9.5 mm or larger
   Average Cornea (10.5 – 11.5 mm) – Choose a diameter between 9.2 – 9.4 mm
   Small Cornea < 10 mm - Choose a diameter between 8.8 – 9.0 mm

6. Base Curve Radius - Sample Nomogram Based on Overall Diameter

Corneal Astigmatism	9.0 Diameter	9.2 Diameter	9.5 Diameter
0.00 to 1.00D	On K	0.25 D flatter than K	0.50 D flatter than K
1.12 to 2.00 D	0.25 flatter than K	On K	0.25 D flatter than K

7. Diameters from 8.8 to 9.2, subtract 1 mm for POZ. When the difference is 1 mm, Peripheral curves should be .3 and .2 respectively.
8. If the diameter is between 9.2 and 9.8, subtract 1.4mm for the POZ. When the difference is 1.4 mm, peripheral curves should be .4 and .3 respectively.
9. Peripheral Curve Radii - Secondary curve = base curve radius + 1.0 mm.
   Peripheral curve = secondary curve radius + 2.0 mm.
10. Blending tools - Base curve + secondary curve ÷ 2 = 1st peripheral curve
    secondary curve + peripheral curve ÷ 2 = 2nd peripheral curve
11. Center Thickness -

Plano	.17
-1.00	.16
-2.00	.15
-3.00	.14
-4.00	.13
-5.00	.12
-6.00	.12
-7.00	.12

Center thickness will vary by manufacturer.

RGP EXAMPLE

-3.00 +.75 x 90, "K" 42.50 @ 180 / 43.75 @ 90

1. Transpose Rx - -2.25 -.75 x 180, drop spectacle cylinder.
2. Upper lid attachment - choose base curve .50D flatter
3. Starting base curve should be 42.00 (8.04), Power would be -1.75 (FAP)
4. If 9.5 diameter is chosen, subtract 1.4mm for POZ. POZ would be 8.1.
5. Secondary curve = 8.04 + 1mm = 9.04 /.3
6. Peripheral curve = 9.04 + 2mm = 11.04 / .4
7. Blending curves = 8.04 + 9.04 = 17.08 ÷ 2 = 8.54
   Blending curves = 9.04 + 11.04 = 20.08 ÷ 2 = 10.00

8. Center Thickness = .15 round off from Center Thickness Chart

CPC	Power	Diameter	POZ	PPC/ w	PIC/ w	Blend	Thick ness	Tint
8.04	-1.75	9.5	8.1	11.04 /.4	9.04 / .3	8.54 / 10.04	.15	Blue 1

FLUORESCEIN PATTERN EVALUATION

Use of Wratten Filter with GP lenses having a UV inhibitor

Thickness of the PCTF without a contact lens is approximately 3µ microns

Ideal apical clearance with a GP lens is usually between 15 to 20µ microns

GP CONTACT LENS CARE

Must be disinfected for a minimum of 4 hours

Prior to dispensing GP lenses, lenses should be soaked overnight to fully hydrate and make the lenses more wettable

GP lenses should be cleaned and polished at least once a year

CLEANING GP LENSES

Do not use Silvio Polish or any solution that has keytones or alcohol

Use only water based polishing compounds

ADJUSTMENTS ON A CONTACT LENS

All adjustments on a contact lens will tend to flatten the fit of that lens.

Adjustments that can be made on the original lens are:

1. Reducing the diameter
2. Polishing and refinishing the lens edges
3. Reblending and adjusting the peripheral curves
4. Removing scratches from the surface of the contact lens
5. Change power (minus –1.00D Plus -+ .50D) With today's newer softer and thinner lens materials, Minus power addition should be limited to -.50 D.
6. Reduce optical zone

Modifications, which usually require a new lens:

1. Change thickness
2. Increasing lens diameter
3. Change PCC
4. Certain power changes

Aspheric Lens Fitting and Evaluation

Aspheric Lenses are designed to offer better alignment fitting.

Aspheric Lenses are based on Eccentricity "E" Values, Ellipse, Parabola, and Hyperbola

A shadowgraph or measuring magnifier can be used to check edge profile

"E" value can be verified by an Interferometer

Lenses should position slightly superior and centered

Use Wratten filter if lens has a UV inhibitor

Toric Lenses

Designs

Prism, Truncation, Thin Zones or Double Slab-off, Peri-Ballast and Combination Designs

Toric Cylinder designs are made with curves cut on the front or the back

Axial Misalignment

LARS – Left Add, Right Subtract Counterclockwise – subtract, Clockwise – add

5’ = 30 ◦, 5:00 PM – 6:00 PM and 6:00 PM – 7:00 PM

Observation for measuring orientation is always from the Doctor’s view of the patient

Toric Lens Calculation without Orientation for illustrative purposes

Rx – 1.50 – 1.50 x 180

- Check Lens and Power Availability
- E.g. If cylinder is available in either 1.25 or 1.75
- Option A - -1.50 -1.25 x 180
- Option B - -1.25 – 1.75 x 180
- If you use a higher cylinder power decrease the sphere by .25

Rigid Lenses

Front cylinder lenses

Bi-Toric Lenses

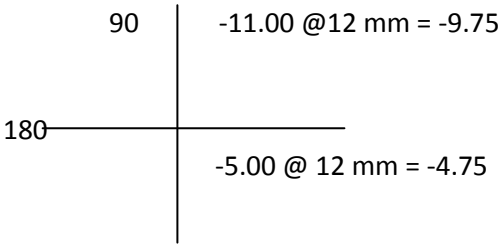
Peri-Ballast Lens

Back Toric Lens

Bitoric Calculation

- -5.00 -6.00 x 180, VX = 12 mm
- “K” 41.50/47.00 x 90
- What is the power at the corneal plane?

-5.00 -6.00 x 180



Answer: -4.75 - -5.00 x 180

Pediatric Aphakic Contact Lens Fitting

Lens malformations occur in conjunction with: Metabolic disorders, Hereditary/Genetic disorders, maternal infection

Standard treatment for either unilateral or bilateral aphakia in newborns is fitting contact lenses

Fitting Silsoft and Silsoft SuperPlus is the preferred lens of choice for newborns

Fitting Considerations

Average diameter of the pediatric cornea is 9 mm – 11 mm

The neonate cornea is usually 50.00 or > Base curve is usually around a 7.5 radius

Evaluation of Fit

The lens should move 1-2 mm, Silsoft can mask up to 2.00 D of astigmatism. Add 2 – 3 diopters if the child is younger than 2 years old

Patching or Occluding is used to allow the weaker eye, to strengthen and form an image in the infant's brain

Contact Lens and Presbyopia

Classifications:

Incipient Presbyopes – borderline or early pre-presbyopes

Premature presbyopes – accommodation becomes difficult at an early age. Possibly due to environmental, nutritional, disease-related or drug induced.

Nocturnal presbyopes – experience decrease in near vision as a result of dim light conditions. Increased pupil size and decreased depth of field.

Absolute presbyopes – have almost no accommodative ability remaining.

Presbyopia, is also known as the "short arm syndrome"

The natural lens can no longer control the eye's way of changing its focusing distance

The lens thickens, increasing its inability to focus close-up.

At about the age of 40, the lens becomes less flexible and accommodation is gradually lost.

It's a normal process that everyone eventually experiences.

Signs and Symptoms of Presbyopia

- Difficulty seeing clearly for close work
- Print seems to have less contrast
- Brighter, more direct light required for reading
- Reading material must be held further away to see (for some)
- Fatigue and eyestrain when reading

Good and Bad Candidates for Bifocal Contact Lenses

Good
Motivated Patients
Vision demands are not very critical
Normal lid tonicity
Good ocular health and good tear quality as previously discussed

Bad
Unmotivated
First time contact lens wearers
Poor tear quality
Irregular cornea
Ambylopia

Presbyopia Alternatives

Reading Glasses over Contact Lenses

Compromise Rx

Compromise Rx with Distance Glasses

Monovision

Bifocal Lenses

Lens Designs:

Alternating Vision (Translating Vision) – Pupil covered by D.V. Zone While viewing distant object, N.V. zone while reading

Simultaneous Vision – Entrance pupil exposed both distance and near

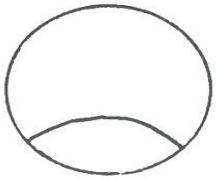
Monovision – One eye for distance, one eye for near

Modified Monovision – S.V. lens for distance, Bifocal for Near / Distance Vision.

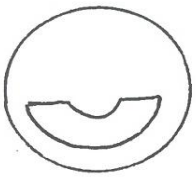
Bifocals that use Alternating Vision / Translating Design

1. 

<u>Crescent Bifocal</u> – Fused Bifocal, requires prism / truncation to stabilize lens from rotating prism 1.5 Δ minimal image jump.

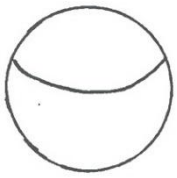
2. 

<u>Camp Bifocal</u> – fused bifocal, requires prism / truncation to prevent lens from rotating. Prism 1.5Δ front surfaces can be used for cylinder correction. Segment area has optical distortion.

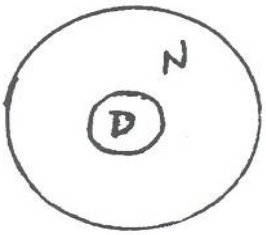
3. 

<u>Pan-o-site Bifocal</u> – fused bifocal, requires prism / truncation to prevent lens rotation prism 1.5Δ

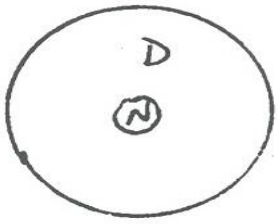
One-piece bifocals that use alternating vision

1. 

Mandell (Monocentric Bifocal) – Monocentrc design eliminates image jump does not have prism on lens blank but utilizes truncation.

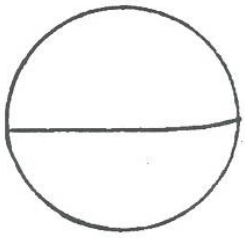
2. 

<u>Annular, Concentric, Di Carle BiFocal</u> – This type of Lens is made from one piece of plastic. Add is cut on either the front or back. Distance in center, near at peripitery. Does not need prism / truncation to stabilize lens. * This lens can be used as a simultaneous lens design. See next section.

3. 

<u>Reverse Contrad</u> – This uses distance vision in periphery and reading vision the center.

* Simultaneous vision design

4. 

Tangent – Streak – Segment translating design. Utilizes a one-piece, no jump design utilizes truncation and prism to prevent lens from rotating (RGP material)

Troubleshooting Translating lens Designs

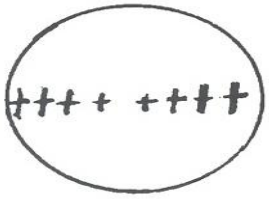
Visual Acuity – compare over-refraction with spectacle Rx

Lens Position – Distance segment too high, if lens is resting on lower lid, truncate to lower lid

If the lens is riding under the upper lid, steepen the base curve, add more prism

Lens Position – Distance segment to low, decrease prism or order a new lens with a high segment

Bifocals that use Simultaneous Vision Design

1. 

Aspheric VFL (Variable Focus Lens)

No segments or prism. Power of lens increases from central area to periphery. This a progressive – addition power lens.

2. The Annular can be used as a simultaneous lens design by making the distance portion smaller. So both distance and near vision are exposed at the same time.

Fitting Pearls for Multifocal Lenses

Start with a steeper base curve

Remind patients that lighting is important and adjust working distance

Use normal room illumination

Let lenses settle for 20- 30 minutes

Use handheld lenses to overrefract, O/R in .25 steps

Overefract with both eyes open and recheck any overrefraction at near and distance

Use everyday reading material

Test vision at the distance required by the patient

It is acceptable to use unequal add powers

It is acceptable to use two different multifocal design

Keratoconus

Keratoconus – is a progressive thinning or bulging of the cornea
Is the most common corneal dystrophy in the United States
Affects 1 in every 2000 Americans
Often appears in teens (16 year old) or early 20's
Keratoconus rarely develops after the age of 30

- Keratoconus is non-inflammatory
- As the cornea steepens and thins, the patient experiences a decrease in vision which can be mild or severe depending on the how much of the cornea is affected.
- In the early stages, vision loss can be corrected by spectacles
- Patients should be informed that eventually they will be need to be fitted with contact lenses
- Although most patients in the early stages can read and drive, patients feel their quality of life is adversely affected about 20% of patients

Symptoms

- Nearsightedness
- Increase in myopic astigmatism
- Frequent prescription changes in glasses and contact lenses
- Blurred vision- even when wearing eyeglasses or contact lenses
- Glare at night
- Light sensitivity and halos around lights
- Eye rubbing

Objective Signs in Diagnosis

- **Retinoscopy**
  - Shows a scissoring reflex
- **Direct Ophthalmoscopy**
  - The cone may appear as an oil or honey droplet when the red reflex is observed
- **Keratometry**

High irregular astigmatism
Mires are distorted
Mire images are smaller
Keratometer range may have to be extended
+1.25 – 9.00 Diopters
Displaced Apex is usually displaced Down and in

Slit Lamp Observation
-Fleischer's Ring
-Vertical Striae

-Corneal Thinning and Scarring
-Corneal Hydrops
-Munson's Sign

Contact Lens Design

-3- Point Touch Design (Spherical Rigid Lenses)

Fluorescein Pattern Analysis

2-3 mm of bearing
Fluorescein pattern should be divided into three areas: Central and Peripheral. Each area should be evaluated independently

Swirl Staining – maybe due to eye rubbing or lens could be too flat, switch to a steeper base curve.

Keratoconus Lens Systems

- Soper Cone Design
- McGwire Lens Design
- NiCone
- Rose K Design
- Soft Lens Hybrid Combinations
- Piggyback Lens Designs
- Rigid/Soft Lens Design
- Scleral Lenses

Surgical Alternatives

Pentrating Keratoplasty
Lamellar Keratoplasty

Corneal Topography and Display Data

- Absolute MAP – This data have preset color scales with minimum and maximum steps in diopters assigned to each instrument
- Normalized MAP – The software identifies minimal and maximum keratometer values for each cornea.
    - This type of map is easier to interpret for the contact lens practitioner in contact lens design and evaluation

- Placido Based Topographer - Multiple light concentric rings are projected on the cornea
- The reflected image is captured on a charge-coupled device (CCD) camera
- Computer Software analyzes the data and displays the results in various formats
- Every map has a color scale that assigns a particular color to a certain keratometric dioptric range
- Warm colors such as red and orange show steeper areas, cool colors such as blue and green denote flatter areas

Axial Map

- Best for defining astigmatism
- Best for apical radius

Tangential/True

- Best for determining curvature shape with smaller, more detailed patterns at a specific point

Scheimpflug Camera

- Rotates to measure the anterior segment and capture a 3-D anterior segment image
- It allows for an analysis for both the anterior and posterior surfaces of the cornea

Wavefront Aberrometry

- Is an objective method of measuring refractive power, using a light source that creates a point source on the retina
- The emerging wave front represents the optical properties of the eye

Pellucid Marginal Degeneration (PMD)

- Pellucid Marginal Degeneration (PMD) - is a condition whereby the lower cornea becomes thinner and the optic surface of the cornea becomes irregular and the vision becomes blurry.
- Typically it is bilateral affecting both eyes.
- Onset of the disease is seen usually in early adulthood.
- Eyeglasses can correct early stages of PMD.
- Fitting contact lenses on an eye with PMD requires a different approach than that of Keratoconus
- Soft Toric contact lenses will fit many PMD eyes provided that they accommodate for the astigmatism resulting from PMD. More severe cases can be fit with a modified gas permeable lenses
- Prognosis of PMD is quite good. Vision restoration with our special contact lenses results in normal vision allowing legal driving with minimal visual distortions. Many eyes can be restored to normal vision even in severe cases.
- Corneal Map - **Crab Claw Pattern and involves more peripheral thinning**

Scleral Lenses

- Fitting the irregular cornea is a major reason for fitting scleral lenses today
- Large diameter contact lenses have their resting point beyond the corneal borders
- Can postpone or even prevent surgical
  intervention as well as decrease the risk of corneal scarring
  Corneal Ectasia of the irregular cornea can be broken down into two groups

- Primary Group
  - Keratoconus, Keratoglobus, Pellucid Marginal Degeneration (PMD)
  - Secondary Group
- Post – refractive surgery
  - Laser assisted in-situ keratomileusis (LASIK)
  - Photorefractive keratectomy (PRK)
  - Radial Keratotomy (RK)

Scleral Lens Categories

- Corneal –Scleral (12.9 mm -13.5 mm)
- Semi-Scleral (13.6 mm – 14.9 mm)
- Mini Scleral (15.0 mm – 18.0 mm
- Scleral (> 18 mm)

- Scleral lenses should completely vault the cornea while aligning the lens to the bulbar conjunctiva
- Fit a lens that has the elevation or sagittal height appropriate for the type of eye being fitted
- Elevation is determined by the rate of curvature as well as the area of the curve
- The peripheral fitting zone of a scleral lens is also known as the haptic zone

Apical Clearance

Typically aim for 200 – 300 microns after settling between 30 – 40 minutes
Maximum of 600 microns but no less than 100 microns

Fitting Guidelines for Apical Clearance

As a rule of thumb, changing the base curve by .1 mm will give you about 35 microns of vault.
Steepening the lens gives you more vault and flattening the lens gives you less vault

Assessing Limbal Vault

At the limbus you want about 30-40 microns of clearance

To increase limbal vault, increase lens diameter without changing apical vault
To decrease limbal vault, decrease lens diameter and you may have to flatten base curve if there is too much limbal clearance

Assessing Edge Periphery

If patients reports that lenses feel tight and eyes get red after a few hours, flatten the edge design
If patient reports that they feel the edges and there is “flutting at the edge”, steepen the edge

Troubleshooting

Lens Fogging – Non Wetting Lens

- Non wetting lens
- Change solutions
- Polish lens surface
- Avoid Lotions with lanolin

Bubbles under Lens

- Too much sagittal depth
- Improper Insertion

Possible Solutions

- Fill bowl completely with solution prior to insertion
- If central bubble persists, decrease sagittal depth

Anterior Seg OCT (Optical Coherence Tomography)

For scleral lens fitting, OCT imaging can be used to:

1. Quantify both conjunctival and scleral compression

Tissue compression with scleral lenses may affect:

- Tear exchange
- Comfort during lens wear
- The extent of conjunctival staining following lens removal
- Potential intraocular pressure given the location of the haptic zone to the Canal of Schlemm

Cross Linking

- In corneal cross-linking, doctors use eyedrop medication and ultraviolet (UV) light from a special machine to make the tissues in your cornea stronger. The goal is to keep the cornea from bulging more.
  It's called "cross-linking" because it adds bonds between the collagen fibers in your eye. They work like support beams to help the cornea stay stable.

- First, you'll get drops that numb your eyes and a medicine to calm you if needed.
  Then, your doctor will put in riboflavin (vitamin B2) eyedrops, which allow your cornea to better absorb light. It takes about 30 minutes for the drops to soak into your cornea.
  Then, you'll lie back in a chair and look up at a light. You shouldn't feel any pain during the procedure because your eyes will be numb.
  The entire treatment takes about 60-90 minutes.

Types of Corneal Cross-Linking

- There are two types: epi-off and the experimental epi-on. ("Epi" is short for epithelium, the outer layer of the cornea.)

- The epi-off technique means your doctor removes the epithelium before she puts the drops in. Many studies have found that this technique works well, but it may also raise your risk of infection and can lead to clouding in your cornea.
  With epi-on, your doctor loosens your epithelium with eyedrops or a sponge before she puts the eyedrops in. There are fewer side effect

- The procedure doesn't reverse cornea changes that have already happened -- it just keeps them from getting worse.

Refractive Surgery

Refractive surgical procedures include any and all procedures that reduce refractive error, i.e., reduction of myopia (nearsightedness), hyperopia (farsightedness), and astigmatism. All of these procedures are designed to minimize dependence on eyeglasses and contact lenses

Glare, halos and starbursts around headlights and street lights can sometimes be a problem after refractive surgery. LASIK and other procedures can also sometimes cause irregular astigmatism, with accompanying blurred vision or distorted vision

- Special computerized instruments (not needed for regular contact fitting) are usually required to obtain highly accurate, point-to-point measurements of the post-surgery corneal surface to obtain the best possible fit for vision correction. These instruments, called corneal topographers or aberrometers, use the same LASIK technology that measures the cornea before laser vision correction.
  These irregularities sometimes can be corrected with a follow-up laser procedure called an enhancement. But if your cornea is too thin for a second surgery, or other problems rule out an enhancement procedure, GP or hybrid contact lenses may be your best solution.

- Special GP lens designs are usually required in these circumstances when altering the shape of the cornea.
- These modified designs may include a larger lens diameter, aspheric optics or a design where the center of the lens is significantly flatter than the periphery (called a reverse geometry design), similar to the gas permeable lens design used for orthokeratology to correct nearsightedness without surgery.

- When fitting GP lenses, select a base curve parallel flatter than “K” from the pre-surgical “K.”
- Choose a lens that is flat enough for apical tear exchange and steep enough to avoid excess bearing in the mid periphery
- Peripheral curves should be about two diopters steeper than the base curve
- Diameter is determined by centration

Orthokeratology

- Pre-teens and teenagers are excellent candidates – Reduces “myopic creep
- The selection process should include factors such as: age, maturity, motivation and health
- Rx should be no more than a -5.00 D of myopia and cylinder power is limited to 1.50 D WTR and .75 ATR
- The Jessen formula can be used to determine the base curve radius and uses the FAP tear lens factor.
- Wait 10-15 minutes before evaluating the fit
- The Patient should be evaluated in the morning
- Corneal Topography should be performed and a bull's eye pattern should be present indicating central flattening

- At the end of the treatment period, lenses should be worn on a retainer basis
- This can vary from every night for higher myopes to once a week for lower myopes
- Applying an artifical tear prior to inserting the lens has been found to help in lens centering and less corneal staining
- Rewetting drops should be applied before removal

Aphakia

Rigid Lens Designs
Single Cut
Standard Plus Lenticular
Tangent Lenticular

Myoflange

Prosthetic Lenses

Indications for Non-seeing and Seeing Eyes

Non-Seeing
- Leukoma
- Traumatic cataract

Seeing
- Aniridia
- Coloboma and Polycoria

THERAPEUTIC SOFT LENSES

Minimal **movement**

- Recurrent corneal erosion
- Bullous Keratopathy
- Corneal Ulceration
- Thermal Burns
- Corneal Lacerations

Normal **lens movement to allow tear interchange**

- Dry eye
- Keratoconus
- Corneal dystrophies
- Entropian
- Trichiasis

MYOPIA MANAGEMENT

Mopia often progresses as a result of axial lengthening

High Myopia can lead to visual impairment and vision loss from glaucoma, cataracts, retinal detachment and choridial neovascularization
Optical myopia treatments are designed to stimulate myopic defocus

OPTICAL TREATMENTS

Spectacle correction – utilizes various lens designs in order to relax accommodative effort
Outdoor Sunlight – Spending more time outdoors.
Low Dose Atropine

CONTACT LENSES

Orthokeratology
Misight Lens – utilizes a duel focus design creating myopic defocus to inhibit myopic progression