

# Fundamentals of Soft Contact Lens Fitting

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1

## Optical Advantages of CTL over Spectacles

- Field of Vision
- Anisometropia
- Distortion



2

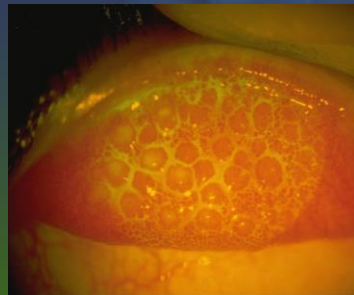
## Indications for Soft Lenses

- Part-Time or Social Wear
  - Sports
  - Outdoor activities
- Gas Permeable Lens Failures
  - Patient's that can not adapt and obtain comfort
- Children
  - Initial lens comfort better and may be more motivated to wear a soft lens over a gas permeable lens
- Athletes
  - Large diameter makes them less likely to dislodge
- Dusty Environment
  - Less likely for debris to get trapped under lens because of large diameter

3

## Challenges for Soft Lenses

- Irregular Astigmatism
  - Soft lens can not neutralize the irregular surface like a gas permeable lens
- Adverse Environments
  - Exposure to chemicals or fumes
- Giant Papillary Conjunctivitis
  - An allergy to surface deposits
  - Less occurrence with disposable lenses
- Dry Environment
  - Hydrophilic lenses must remain hydrated to provide good comfort and vision



4

## Possible Systemic Contraindications to Contact Lenses

- Respiratory Disorders
- Diabetes
- Endocrine Changes
- Thyroid Disease
- Sjogren's Syndrome
- Rheumatoid Arthritis and Lupus

5

## Respiratory Disorders

- Rhinitis, sinusitis, hay fever, and asthma tend to produce conjunctival injection and ocular sensitivity
- Patients may be unable to wear lenses during an active attack
- Can cause photophobia, itching and burning
- Increased tear debris can degrade lens quicker
- Most successful with single use lenses

6

## Diabetes

- When the corneal epithelium sustains an abrasion, healing will take place within 24 hours. A large area may take several days before the healing is complete.
- However, patients with Diabetes generally have a slow healing process
- A patient fit with contact lenses must be informed that an abrasion may take longer to heal
- Extended wear is not advisable

7

## Endocrine Changes

- Pregnancy and Menopause affect the Endocrine system
- Due to the fluctuations in the endocrine system, the fluid balance of the body is altered during hormone changes
- Since the cornea is 75% fluid, significant corneal changes can occur
- Complications that can occur are refractive changes, dry eye symptoms and contact lens intolerance

8

# Thyroid Disease

- Thyroid disease can cause “proptosis” or protrusion of the eyeball
- When the upper lid does not reach the upper limbus, a gas permeable lens can not move and center adequately
- Centration is more easily achieved with a soft contact lens but the dry eye condition must be considered.
- The patient may be better indicated for scleral lenses.



9

# Sjogren's Syndrome

- Sjogren's Syndrome is a chronic disease in which white blood cells attack the moisture-producing glands.
- The hallmark symptoms are dry eyes and dry mouth, but it is a systemic disease, affecting many organs and may cause fatigue.
- Patient's with Sjogren's often times experience severe dry eye symptoms.
- The patient may be better indicated for scleral lenses.

10

## Rheumatoid Arthritis and Lupus

- Rheumatoid Arthritis and Lupus are both autoimmune diseases that cause inflammation.
- Both of these diseases cause pre-corneal tear film abnormalities which are critical for safe and comfortable contact lens wear.
- Rheumatoid Arthritis can cause poor manual dexterity for lens handling, insertion and removal. Some of these patients may prefer extended wear lenses, however with the tear film abnormalities, it is not recommended.

11

## Systemic Medications and Ocular Side Effects

- Oral Antihistamines and Decongestants
  - Can cause increased dry eye symptoms.
- Acne Medications
  - Accutane: an oral medication used in the treatment of acne. FDA does not recommend contact lens wear due to increased dryness.
- Diuretics
  - Used to treat edema and hypertension. May cause photosensitivity, decreased vision and increased dryness.

12



## Discussion with Patient to Set Realistic Expectations

- Ability to wear lenses
  - Advise patient that there are many factors that affect contact lens success
  - Importance of patient motivation
- Contact lens comfort
  - Initial lens awareness
  - Adaptation period
- Visual outcomes
  - Vision through the optical center and elimination of optical aberrations
  - Increase in photophobia and importance of sunglasses
- Adjustment period
  - Realistic expectations for the patient depending on soft or gas permeable lenses

13

## Discussion with Patient to Set Realistic Expectations

- Safety
  - Importance of patient education
  - Don't just tell them NOT to; tell them WHY
- Occupation
  - Importance of artificial tears if using the computer all day
  - Awareness of work environments; chemicals; toxins
- Hobbies/Sports
  - Prolonged near work (needlepoint, reading)
  - Outdoor activities; importance of sunglasses
  - Possible increased dryness
- Importance of compliance and follow-up
  - In order to stay safe, patients must follow proper lens care and hygiene; and proper follow-up care

14

# Material Selection

- Oxygen Permeability
  - The Dk value for any given lens can be found in the manufacturer's literature
  - D stands for diffusion
  - k stands for solubility
- Dk/t
  - Central transmissibility taking into account center thickness
  - Three components that affect oxygen permeability
    - Water content
    - Lens Thickness
    - Surface Deposits

15

# Material Selection

## Water Content

- Low water content
  - Needs less tears to remain fully hydrated during wear
  - Patient must replenish moisture with tears; artificial tears
- High water content
  - In general, more water makes softer; flexible lens
  - But lens flexibility can decrease optical quality
  - Higher water content, increased oxygen permeability
  - But high water attracts lens deposits; and reduce permeability

16



# Material Selection

## Lens Thickness

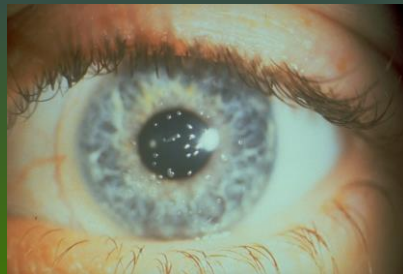
- Thin lens benefits
  - Increased lens comfort
  - Increased oxygen permeability
- Thicker lens benefits
  - Easier handling with insertion and removal
  - Increased durability
  - Visual stability
- Increased lens thickness = decreased oxygen permeability

17

# Material Selection

## Surface Deposits

- Reduce oxygen flow through a lens
  - Causes discomfort
  - Increases lens dryness
  - Loss of visual clarity
- GPC



18

# Material Selection

## Deposit Resistance

### ○ Ionic vs. Non-Ionic

- Ionic lens materials have a negative charge on the material surface. Tear proteins have a positive charge and are therefore attracted to the lens surface.
- Non-ionic materials are treated to convert the material surface to have a positive charge therefore repelling deposits.

19

# Soft Lens Replacement Schedule

- Conventional
  - Annual
- Frequent or Planned
  - Biannual (6 months)
  - Quarterly (3 months)
- Disposable
  - Monthly
  - 1-2 week
  - Single Use/Daily Disposable

20

# Wearing Schedule

- Daily Wear
  - Removed before sleeping
  - Cleaned and disinfected prior to being worn again
- Continuous Wear
  - Worn overnight
  - Not all materials are FDA approved
  - Not all patients are good candidates

21

# FDA Classification of Soft Lens Materials

## GROUP 1

(low water <50% H<sub>2</sub>O, nonionic polymers)  
 Soflens (polymacon 38% Dk = 9)  
 Cibasoft (tefilcon 38% Dk = 9)

## GROUP 2

(high water >50% H<sub>2</sub>O, nonionic polymers)  
 CSI (crofilcon 13% Dk = 13)  
 Proclear (omafilcon A 59% Dk = 33)  
 Focus Dailies (nelfilcon A 69% Dk = 26)  
 Soflens 66 toric (alphafilcon A 66% Dk = 32)

## GROUP 3

(low water <50% H<sub>2</sub>O, ionic polymers)  
 Soft Mate B (bufilcon A 45% Dk = 16)  
 Durasoft 2 (phemfilcon A 38% Dk = 9)  
 Freshlook (phemfilcon A 45% Dk = 16)

## GROUP 4

(high water >50% H<sub>2</sub>O, ionic polymers)  
 Acuvue (etafilcon A 58% Dk = 28)  
 Biomedics 55 (ocufilcon A 55% Dk = 20)

## SILICONE HYDROGELS

(low water <50% H<sub>2</sub>O)  
 Air Optix Plus (lotrafilcon B 33% Dk = 110)  
 1 Day Acuvue Tru Eye (narafilecon B 48% Dk = 55)  
 Air Optix Night and Day (lotrafilcon A 24% Dk = 140)  
 Acuvue Oasys (senofilcon A 38% Dk = 103)  
 Ultra (samfilcon A 46% Dk = 114)  
 Biofinity (comfilcon A 48% Dk = 128)

## WATER GRADIENT

Dailies Total 1 (delefilcon A Dk = 140)  
 Total 30 (lehfilcon A Dk = 154)

22

## CL Nomenclature

- The Basics of Contact Lens Fitting
- No matter what lens you fit, they all have the same basic components

23

## Optical Zone (OZ)

- The chord diameter over which the base curve extends on the posterior surface of the contact lens
- Described in millimeters of diameter
- Determines the refractive power of the lens



24

## Secondary / Intermediate Curves

- ⦿ Lies between the base curve and the peripheral curve on posterior lens surface
- ⦿ Usually .70mm to 1.50mm flatter than base curve
- ⦿ Allows the lens to better align the flatter portion of the cornea



25

## Peripheral Curve

- ⦿ Outermost curve on posterior lens surface
- ⦿ Function is to clear the flatter periphery of the cornea to prevent impingement at the Limbus
- ⦿ Noted as a radius of curvature in mm and width in mm



26

## Soft Lens Diameter

- Overall width of the lens from one edge to the other
- Measured in millimeters
- Range from 13.8mm to 20mm

27

## Center Thickness

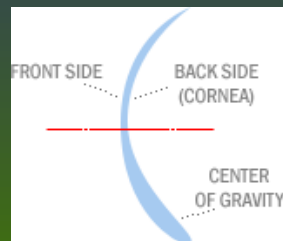
- The measurement in millimeters from the anterior to the posterior surface of the lens at the geometric center
- Varies depending on lens power
- *Example*
  - Lens Power = -3.00 D
  - C.T. = .13mm
  - Lens Power = +13.00 D
  - C.T. = .45mm

28



## Prism Ballast

- “Watermelon seed” principle
- After lens insertion, the lens rotates as the patient blinks and the lens “falls to gravity” as the thicker portion rotates to six o’clock
- This can take up to 15 minutes
- Manufacturers add lens markings for practitioner to see if lens rotation occurs



29

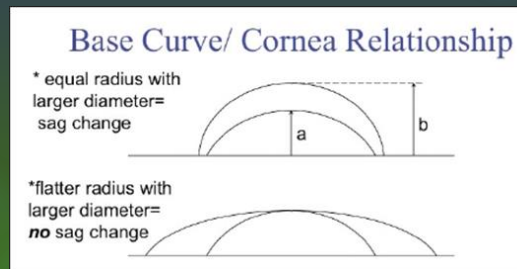
## Parameter Selection

- Base Curve
- Diameter
- Power

30

## Base Curve

- The distance between the posterior surface of the central area of the lens and the flat surface
- Diopters (D) of surface power
- Millimeters (mm) of radius of curvature



31

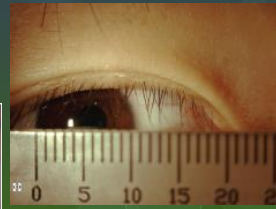
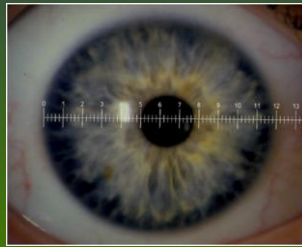
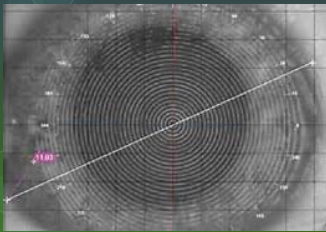
## Base Curve

- For corneas that are “average” (42.00 D to 45.00D)
  - It is best to fit the flattest lens possible that results in good comfort and fit, so the lens doesn't become too tight
- Most manufacturers are using 1 BC/Diameter to fit most patients

32

## Horizontal Visible Iris Diameter

- The Horizontal Visible Iris Diameter (HVID) average is 11.5 mm
- Select a lens diameter at least 2mm larger than the patient's HVID



33

## Transposing the RX from plus-cyl to minus cyl

- All contact lenses are in minus cylinder so the spectacle RX must be transposed prior to fitting of lenses
- 1. Add the cylinder power to the sphere
- 2. Change the sign of the cylinder from + to -
- 3. Add 90 degrees to the axis if the original axis is less than 90, or
- 4. Subtract 90 degrees from the axis if the original is greater than 90

34

## Transposing of RX

### ○ Example 1

- Plus cyl form:  $+1.50 + .75 \times 170$
- Minus cyl form:  $+2.25 - .75 \times 080$

### ○ Example 2

- Plus cyl form:  $-9.50 + 2.00 \times 35$
- Minus cyl form:  $-7.50 - 2.00 \times 125$

35

## Vertex Distance

- Have to calculate the difference in the refractive power from the “in air refraction” to the cornea
- Calculate using the mm measurement from the back of the spectacle lens to the cornea (Distometer)
- Calculate it for refractions of  $\pm 4.00$  D
- Use a Vertex Conversion Chart or slide to calculate the contact lens power
- *Example*
  - Spectacle Rx:  $+6.00$  sphere
  - Contact Lens Rx:  $+6.50$  sphere
  
  - Spectacle Rx:  $-10.50$  sphere
  - Contact Lens Rx:  $-9.37$  sphere

36

## Distometer



37

## Calculating Soft Lens Power

- The Lacrimal Lens power is usually zero with a soft contact lens because soft lenses are fit much flatter to the cornea.
- Spherical Equivalent is important to calculate when fitting soft CTL's
  - Use the Spherical Equivalent with cylinder 0.75 or less
  - If cylinder is greater than 1.00 D; use a toric lens

38

## Calculating Spherical Equivalent

- *Example:*

- *Spectacle Rx:  $-6.50 - 0.75 \times 70$*

- *Take half the cylinder power and add it algebraically to the spherical power*

- *Spherical Equivalent:  $-6.87$*

- *V.D. (12 mm):  $-6.50$*

- *Contact Lens Power is  $-6.50$*

39

## Evaluation of Fit

- Corneal Coverage
- Lens Centration
- Lens Movement
- Three Point Touch
- Visual Acuity
- Comfort

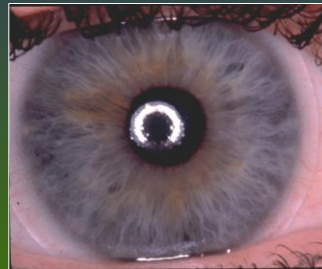
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## Evaluation of Fit

### ○ Corneal Coverage

- Critical to avoid exposure and dryness of cornea
- Diameter of lens should vault the limbus; and extend beyond the visible iris at least 2 mm



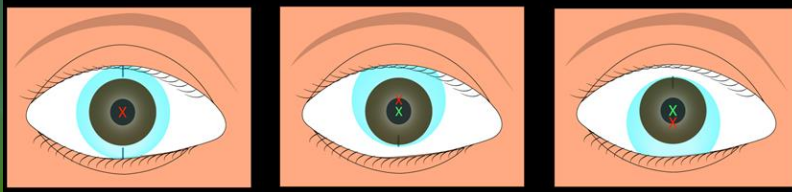
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## Evaluation of Fit

### ○ Lens Centration



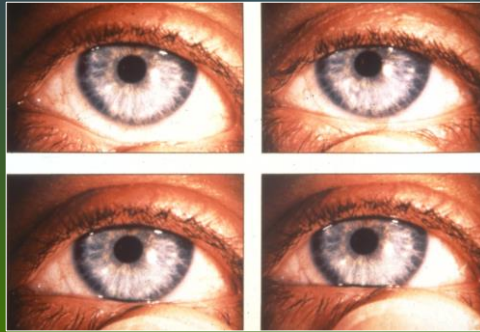
X - Centre of pupil  
X - Centre of lens



42

## Evaluation of Fit

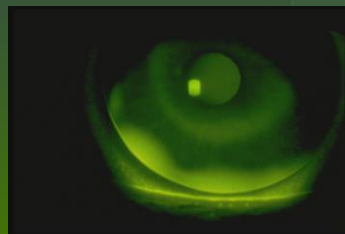
- Adequate Lens Movement
  - Movement pumps old tears and cellular debris from behind lens and brings new tears and oxygen in
  - Should move .5mm to 1mm freely
- Push-Up test
  - Push the edge of the lens with the lid margin, using your finger or thumb



43

## Evaluation of Fit

- Loose Fitting Soft Lens
  - Edge Lift
  - Excessive lens movement
  - Lens lag in upward gaze
  - Complaints of increased lens awareness

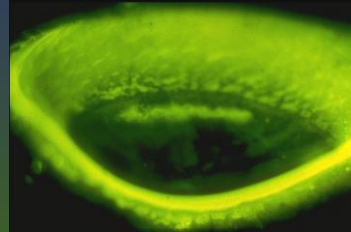


44

## Evaluation of Fit

- Tight Fitting Soft Lens

- No lens movement
- Limbal compression
- Complaints of burning/stinging as day progresses



45

## Over-Refracton using Diagnostic Lenses

- Use diagnostic lenses as close to the proper power as possible
- Use a trial frame and lenses
- Fog the patient first with two or three diopters of plus
- The algebraic sum of the contact lens power plus the trial lens power should equal the desired power

46

## Fitting a Soft Toric Contact Lens

47

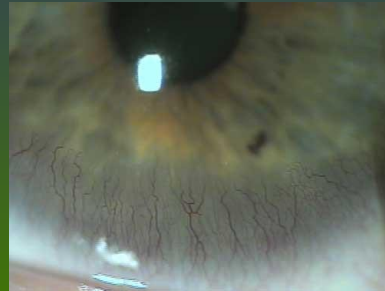
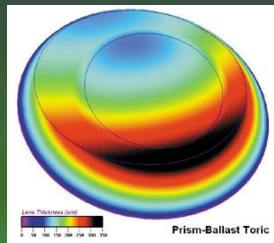
## How does a Toric Soft Lens Work?

- In order to prevent lens rotation with blinking and eye movement, the lens is weighted so that it always orients in the correct meridian
- Have 2 powers in opposite meridians
  - Prism ballast
  - Dynamic stabilization
    - Dual thin zone/double slab off
    - Accelerated stabilization
  - Peri-Ballast
  - Truncation

48

## Decreased Dk

- Soft toric lens wearers have had an increase in Neovascularization and injection due to lack of oxygen at limbus
- Newer designs and materials have improved this significantly but these areas must still be monitored



49

## Dual thin zones/double slab off

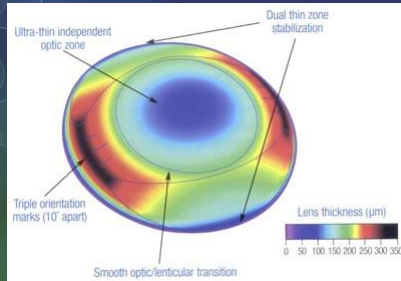
- Dual thin zones or double slab off uses the same theory as 'watermelon seed' principle.
- The top and bottom of the lens are thinned to reduce the thickness for lens stabilization.
- The squeezing pressure exerted by the upper eyelid provides the majority effect with the lower eyelid assisting in stabilizing the rotation
- The central band holds the optic portion that is located within the palpebral aperture. The thickness of the lens plays a role in stabilization; therefore, low-powered lenses do not stabilize as well as high-powered lenses



50

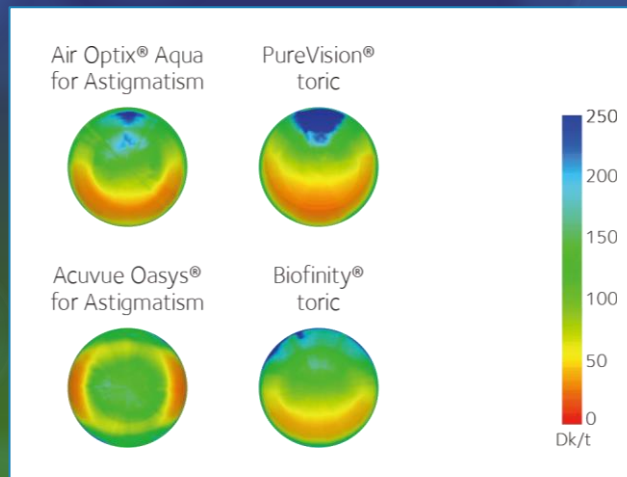


## Dual thin zones/double slab off



51

## Oxygen Profiles



52



## Lens Scribes

6 and 12 o'clock positions

*Johnson & Johnson*

1 day Acuvue Moist for Astigmatism

Acuvue Oasys for Astigmatism



Combination of horizontal and vertical line  
at 3, 6 and 9 o'clock position with thicker  
scribe mark at 6 o'clock position

*Alcon Air Optix* for astigmatism



53

## Lens scribe

Single Line at 6 o'clock

- *Coopervision*
  - Biofinity toric
  - MyDay Toric
- *Bausch & Lomb*
  - Ultra for Astigmatism
  - Purevision 2 for astigmatism



54

## Lens scribe

Horizontal dotted line in the 3 and 9 o'clock position  
*Alcon Dailies Aqua Comfort Plus Toric*



3 lines at 6 o'clock position (30° separation)

*Bausch & Lomb*  
 Purevision toric  
 Soflens toric



55

## Lens Scribe

3 lines at 6 o'clock position (15° separation)

- *Coopervision*
- Proclear toric



56

## How to fit a Toric Soft Lens

- Must transpose the prescription to minus cylinder
- Place lens on eye and let it equilibrate for at least 10 minutes
- Examine the lens for adequate movement, position and rotation
- Is BCVA maximized and stable with blinking?

57

## Troubleshooting Stable Lens Rotation

### ○ LARS

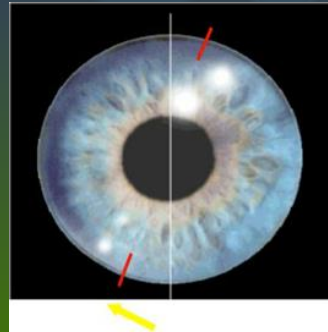
- Use this acronym when determining toric lens rotation
- Looking at the lens marking at 6 o'clock
- As you are looking at the lens, If the marking rotates to the LEFT of 6 o'clock, ADD the amount of rotation to the spectacle axis
- If the marking rotates to the RIGHT of 6 o'clock, SUBTRACT the amount of rotation to the spectacle axis

○ LEFT ADD; RIGHT SUBTRACT

58

## LARS

- 1 clock hour = 30 degrees of rotation
- Select contact lens trial compensating for the degrees of rotation
- The lens will still orient off axis due to the lens aligning with the corneal astigmatism
- Example
  - If the lens is rotated 15 degrees to the left, then add 15 degrees to the axis value of the diagnostic lens



59

## Troubleshooting Unstable/Fluctuating Vision

- If the lens is fluctuating with the blink, then the base curve or lens fit needs to be adjusted before a power change can be implemented
- The lens is either too tight or too loose
- Use spherical soft lens fitting principles to determine how to adjust the lens fit

60

## Troubleshooting Poor Vision

- Assess lens alignment and rotation
  - Is the lens rotationally stable on the eye?
    - Yes: is the lens orienting correctly?
      - Yes: check the lens prescription; check the spectacle prescription
      - No: which direction is the lens rotating?
        - Clockwise (add)
        - Counter-clockwise (subtract)
    - No: is the lens fitting correctly in all other aspects?
      - Yes: change either the design or type of lens
      - No: alter the lens fit

61

## Troubleshooting Poor Comfort

- If the patient is complaining of discomfort, consider changing the lens design
  - Either adjust the base curve or diameter
  - Choose a lens that has a thinner profile
    - Example: moving to a thinner prism stabilized design or from a prism stabilized design

62

