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Helpful hints for contact lens laboratory

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Abstract

Currently there is a large number of types of contact lenses. In addition to the now classic rigid (PMMA) lenses and hydrogel lenses, the emergence of rigid gas-permeable lenses has expanded the fitting options for practitioners. The :patient must be fitted with the appropriate lens. The question of which lens to choose IS perhaps the fitters most important decision. Does one go for the short-term reward and choose a soft lens, because it meets with early and rapid patient acceptance or does one consider a rigid gas-permeable lens, which may be superior in the long term with the advantage of Improved vision, durability and easier care? This manual is designed to help the novice fitter answer this question and lessen the apprehension, frustration and confusion of fitting contact lenses.

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soft lens, rigid gas permeable lens, patient selection, keratometer, basic contact lens fitting, application and removal techniques, flourescein evaluation, rigid lens modification and verification, lens care and solutions and follow-up care.

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HELPFUL HINTS
FOR
CONTACT LENS LABORATORY

A THESIS PRESENTED TO THE FACULTY OF PACIFIC UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE DOCTOR OF OPTOMETRY

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ABSTRACT

Currently there is a large number of types of contact lenses. In addition to the now classic rigid (PMMA) lenses and hydrogel lenses, the emergence of rigid gas-permeable lenses has expanded the fitting options for practitioners.

The patient must be fitted with the appropriate lens. The question of which lens to choose is perhaps the fitters most important decision. Does one go for the short-term reward and choose a soft lens, because it meets with early and rapid patient acceptance or does one consider a rigid gas-permeable lens, which may be superior in the long term with the advantage of improved vision, durability and easier care?

This manual is designed to help the novice fitter answer this question and lessen the apprehension, frustration and confusion of fitting contact lenses.

Keywords: soft lens, rigid gas permeable lens, patient selection, keratometer, basic contact lens fitting, application and removal techniques, flourescein evaluation, rigid lens modification and verification, lens care and solutions and follow-up care.

FINDING THE RIGHT PATIENT FOR CONTACT LENS WEAR:

It is always important to determine if the patient is interested in contact lens and, if not, what are the reasons for not wanting them. Case history is an integral part of the contact lens exam in properly identifying potentially successful contact lens patients.

If the patient already wants contact lenses, questions to ask include determining:

- -the wearer's goals and desires.
  - If the patient's expectations are different from the end result, disappointment will occur, regardless of how well the contact lenses are fitted.
- -the prospective wearer's needs and lifestyles.
  - The most common are visual improvement, visual therapy and cosmetic reasons.
- -whether the individual is a suitable candidate for contact lens wear.
  - *See table on patient selection.
- -if the patient is a former contact lens wearer or a dissatisfied present wearer.
  - See table of questions to ask former wearer.

Other factors to consider during case history:

- -history of ocular disease or injury especially thyroid problems and collagen diseases which causes decreased tear secretion.
- -Allergies such as hay fever and asthma, or hypersensitivity to any medications or contact lens solutions.
  - *Note for any regular use of OTC antihistamines which suppresses tear film functions.
  - *Note for women on birth control pills or any hormonal therapy
- -Occupational task and hobbies.

Patient selection for the rigid gas-permeable contact lenses include almost any patient who has both good tear stability and corneal integrity. First time patients as well as patients who have previously failed may be good candidates.

PATIENT SELECTION:

Patients with the best prognosis for successful fitting are those who fit the following criteria:

Best age group: 13 - 38 years of age
Refractive error: > -1.50D, > +1.50D
K readings: 41.00D to 46.00D
Cornea with no significant sequential staining
Regular cornea with no scarring or distortion of corneal mires
Regular low astigmatism: < 1.50D
Good lid position with no scleral show
Adequate manual dexterity
TBUT > 15 secs.
Good tear flow
Good motivation

Patients with reduced prognosis for successful fitting:

History of allergies necessitating antihistamine use
Acute and subacute inflammation of the anterior segment of the eye
Any systemic disease that may affect the eye or be exaggerated by C.L. wear
GPC (These patients should be fitted with RGP lenses)
Poor tear stability
Poor hygiene
Spherical K readings (This is a possibility for soft lenses)
Narrow lid aperture
Decrease blink rate
Radial Keratotomy patients
A pteryguim located such that it is easily aggravated by rigid lens wear
Small refractive error: < 1.25D
Occupational hazards: factory workers in chemical environment
Poor motivation
Avoid the 5 'D's: Dirty, Drunk, Diseased, Disabled and Dumb

QUESTIONS FOR FORMER WEARER OR DISSATISFIED PRESENT WEARER

1. What type(s) of lens materials were previously worn?
2. How many years of wear or contact lens experience?
3. Were the lenses worn successfully or unsuccessfully?
4. What were the chief complaints while the lenses were worn?
5. Were there any other associated problems related to lens wear (e.g. blur, dryness and abrasions)?
6. What is the present or former wearing time?
7. What were the solutions previously used? Any reactions to solutions and chemicals?

Patients on birth control pills may have one or more of the following eye symtoms:

-edema
-fluorescein stain of the cornea not associated with tight lenses and does not respond to the usual lens modification and is slow to resolve.
-K reading changes of $\pm$ 0.50D and blurring of the mires.
-inconsistent or erratic visual acuity
-photophobia inconsistent with subjective findings.
-general subjective complaints in excess of and not correlated with observed signs.

These symtoms usually resolve in 6 weeks after estrogen is discontinued. Suggest to patient to see regular OB/GYN.

After a careful case history, the initial contact lens exam should be done. The patient should have a general comprehensive (21 pt) exam before the contact lens exam is performed.

Initial contact lens exam procedures:

-<u>measure</u>: pupil size (bright and dim illuminations)
palpebral apertures
visible iris diameters
eye color

-<u>Do keratometry</u>:

Must be properly calibrated first before any measurement is taken.
*See keratometer calibration.
Calculate change in K readings.
Note and record distortions and clarity of the mires.

-<u>Do slit lamp evaluation</u>:

Note: light sensitivity
limbal and conjuctival injections
any corneal irregularities
tear viscosity, value and debris
blink rate (10-15X/min is normal)

<u>Instill Fluorescein</u>: *See fluorescein application

Check for: corneal staining
microcysts
permanent dry spots
TBUT

Evert Upper and Lower Lids:

Look for: GPC
Follicle development
Any degree of injection

<u>*Remember to flush out the fluorescein with saline or eye wash before placing a soft contact lens on the eye during lens fitting</u>

-<u>Select appropriate diagnostic lens (trial lens) and evaluate</u>:

Select a lens based on fitting philosohies.

*See fitting philosophies

Place appropriate lens on the eye.

*See application and removal techniques

Allow patient to adapt to the lens

(approximately 10-15 mins or when the tearing has subsided)

Observe lens dynamics

<u>Instill fluorescein and observe pattern for rigid lens fitting</u>.

*See fluorescein evaluation and pattern.

<u>Substitute new trial lens as determined by lens dynamics and fluorescein pattern.</u>

-<u>Perform sphere-cylinder over refraction through trial lens.</u>

Do the following tests:

-Retinoscopy

Check for any unusual light reflexes

-Clock Dial or Radial Line chart

-JCC

-20/40 Balance

-#7 and #7a

<u>Take the cylinder refraction out to check best visual acuity without the cylinder correction.</u>

-Do a 20/40 Balance again

-#7 and #7a

(Also calculate lacrimal lens power for rigid lens fitting)

-<u>Order final lens power</u>.

KERATOMETER CALIBRATION:

1. <u>Using the Contactometer:</u>
    - -take 2 or 3 readings with the standard balls
    - -compare standard reading with power drum reading (horizontal and vertical)
    - -if keratometer is calibrated properly:
        - -standard ball reading should equal horizontal and vertical power drum readings.
    - -if 0.25D or higher difference is observed between the standard ball reading and power drum reading, plot either the horizontal or vertical drum values or both (if both values are off) against the true radius of the standard ball surface.
    - -compare plot with standard line.

2. <u>Taking patients K reading first:</u>
    - -use when several doctors are using the same keratometer, like in our general clinics.
    - -measure the patient's K.
    - -take the closest standard ball to the patient's K reading and measure it.
    - -Correct the patient's K for the difference between the drum reading and the standard.

3. <u>Dr. Peterson's Method:</u>
    - -take a rough K reading first on the patient.
    - -select a standard ball surface that's closest to the patient's K reading.
    - -turn the power wheels to the value of the standard surface, i.e., set both power wheels (vertical and horizontal to standard ball reading).
    - -back the focus wheel and eyepiece wheel all the way out, leaving the power wheels alone.
    - -now turn the eyepiece and focus wheel in at the same time, only in one direction, until the (+) and (-) mires align.

BASIC CONTACT LENS VERIFICATION FOR RIGID LENSES:

Carefully fitted lens will not be satisfactory if the lens ordered is not manufactured to the doctor's specifications or not properly finished by the lab. Lenses should always be verified from the laboratory and lens stock and be carefully inspected.

There are several techniques available to verify each lens dimension. The most common techniques will be explained:

Overall Lens Diameter (OAD):

-An easy way to measure OAD is using a 7X or 10X hand held magnifier (Peak Scope). The lens is placed on the flat surface of the magnifier, held by the index finger. With the Peak scope held toward a light source, the OAD, optic zone (OZ), and peripheral curves can easily be measured with the visible reticule scale.

-Another method is to use a projection magnifier. The lens is placed in a light beam and the shadow of the lens is projected onto a screen which has a scale.

-Another way is the V-channel gauge. The lens is placed in the gauge at the wide end of the channel where it slides down. The OAD is measured from the scale on the channel where the lens stops.

Optic Zone Diameter (OZD):

-As expalined above the OZD can also easily be seen and measured using the Peak Scope or projection magnifier.

Blend:

-When the transition or junction between two curves is altered either by the addition of a very narrow curve or a series of curves of some intermediate radius, the lens is said to be blended. Beginning and end of the blended area is not easily delineated and hence, is difficult to see. Plus the radius of the blending curve cannot be determined.

Blends are specified as:

Light	Medium	Heavy
1	2	3
A	B	C
0.10mm	0.20mm	0.30mm

With a light blend, it is possible to see the area of the blend as it is relatively narrow (approximately 0.10 mm wide). A medium and heavy blend are increasingly difficult to see.

-The blend is normally inspected using a Peak scope, projection magnifier or microscope. Using the hand held magnifier, the blurred area of the blend can often be seen by moving the head and magnifier back and forth while viewing the lens against a background which has a dark and bright area with the separation line between the two perpendicular to the scale of the magnifier, like the fluorescent lights above.

Peripheral curve widths (PCW) and Secondary curve width (SCW):

Again the PCW can be measured using the hand held magnifier or projection magnifier. If the junctions of the curves are blended, the widths will be difficult to determine, and with heavy blends, practically impossible.

When only one peripheral curve is present, the PCW is one-half the difference between the OZD and OAD.

For example:

OAD = 9.50mm
OZD = 7.50mm
PCW = 2.0/2 = 1.0mm

OZD + 2(PCW) = OAD

When several peripheral curves are present, the same procedure can be used.

For example:

OAD = 9.50mm
OZD = 7.50mm
3rd Curve + 2nd Curve = 2.0/2 = 1.0mm

Using a Peak scope, the tertiary curve width equalled 0.20mm. Therefore, the secondary curve width on a tricurve lens should be 0.80mm.

OZD + 2(2nd Curve) + 2(3rd Curve) = OAD on a tri-curve lens

Base Curve Radius (BCR or simply BC):

The most common and one of the most accurate methods of measuring the BC is to use the radiuscope or microspherometer. A clean and dry lens is floated on a small drop of cleaning solution or water in the depression of the holder on the stage of the radiuscope. (The small drop of fluid is used to reduce the reflection of the light from the front convex surface of the lens.) Make sure there are no bubbles or excess fliud before the reading is started. Next, the stage is moved by hand until the spot of light, viewed without looking in the microscope, is centered on the contact lens. Then, looking through the instrument, it is aligned to give the brightest image. Using the coarse focusing knob, rack the microscope up to slightly higher than the expected base curve. Now slowly focus the instrument downward with the coarse focusing knob until the spoke pattern (aerial image) comes into focus. This is the aerial image of the pattern reflected from the concave lens surface. Move the stage again until the spoke pattern is centered in the field of view or aligned with the reference marks. Continue to focus downward; the image of a "zigzag" bulb filament will come into view, but is ignored. Focus the scope further downward until the spoke pattern is again in focus. Bring this pattern into sharp focus with the fine focusing knob.

Set the measuring dial on the left of the instrument to zero. If the dial cannot be set on zero, place the index line on +1 or +2 on the scale and this value is then added to the final reading. Once zeroed, the microscope is focused upward, using the coarse focusing knob, past the image of the filament to the second spoke pattern. Use the fine focus to get the sharpest image. The value on the scale dial to the right is the BCR of the lens.

If the contact lens is warped or has a toric base curve, all the spokes of the aerial image will not come into focus at one time. <u>If one measures two readings in the radiuscope and finds a sphere reading in the lensometer, assume the contact lens is warped.</u> Zero the instrument on the lens surface as with the spherical lens. When the radiuscope is then focused upward to the second spoke pattern (aerial image), a reading is taken when the first spoke appears in focus. This is the radius of the steepest meridian. The microscope is then focused farther upward until the spoke 90 degrees from the first one is in sharp view. This reading is the radius of curvature of the flattest meridian. If the two focal lines of the aerial image do not make a straight line, rotate the contact lens holder until they do.

The accuracy and calibration of the radiuscope should be checked periodically by using a thick back surface buttons with a known radii. The buttons are placed on the stage and do not need to be floated on liquid.

The keratometer can also be used to measure the BC of the lens using the same principles as when measuring the corneal curvature. A special holder can be used, consisting of a clamp that mounts to the headrest of the instrument, a depression to hold the lens, and a front surface mirror. Alignment of the mires and the dioptric power reading of the drum are noted and the power converted into millimeters. The lens can also be mounted vertically on the occluder using toothpaste and read.

Center thickness (CT):

It is important to verify the CT of all contact lenses ordered, because a lens that is thicker than desired will have a greater mass, which may adversely affect wearing performance. A lens which is too thin may have a tendency to warp and cause vision problems.

Hand held gauges or those on small stands calibrated in millimeters are routinely used to measure the CT of the lens. A lens clock can also be used to measure the CT. The gauge is first place on a flat surface or glass microscope slide to make sure the gauge reads zero. Then the contact lens with the concave surface up is placed at the middle post of the gauge with the two outer posts against a flat surface. The reading will be in diopters. Convert this to millimeters:

One diopter = approx 0.10mm

Another technique employed to measure CT is with a radiuscope. Place the contact lens with the concave surface up on a glass surface placed on the stage. There will two images of the spoke pattern, one from the front of the lens and the second from the back surface. The instrument should be focused on the upper image and read. Then remove the contact lens, being careful not to move the glass surface. Measure the distance to the glass surface. The difference in the readings is the thickness.

Edge contour:

For patient comfort and acceptance of contact lenses, the shape of the edge is an important parameter. Dr. Peterson suggested 0.10 - 0.125 mm edge thickness for comfortable lid acceptance.

Instruments used to measure and inspect edge contour includes:

- -Slit lamp with the advantage of high magnification
- -Stereomicroscope with a high intensity light source
- -Hand loupe or inverting the Peak scope
- -Projection magnifier

Lens Power:

The lensometer is commonly used to measure lens power. The procedure is generally the same as is employed with spectacle lenses.

If one measures two readings in the radiuscope and finds a sphere reading in the lensometer, assume the contact lens is warped. Toric lenses, such as a toric back central optical portion or bitoric design with toric curves on the front surfaces, can have a cylindrical prescription. The total power in each meridian is stated for that meridian.

For example:

BCR = 7.40mm and 8.00 mm
Corresponding powers equalled to
-6.00D and -2.00D, respectively.

This should be written as:
7.40/-6.00 and 8.00/-2.00

Not usually written as -2.00 -4.00 X ?

Peripheral Curve Radius (PCR):

The PCR is normally very difficult to verify, and one usually must rely on the lab to furnish a specified radius. Very few lenses have a peripheral curve width (PCW) wide enough or well polished enough to use a radiuscope. However, if the PCW is large enough, 0.8 mm or more, and of good optical finish, and no blend, then one can approximate the PCR with the use of a radiuscope.

Follow the procedure as in measuring the BCR, except tilt the lens mount slowly on the stage so that the junction between the central and peripheral curve and then the edge of the lens come into view.

A practical way to approximate the PCR is to put wet ink on a known radius lap; rub the lens on the lap and observe how the ink deposits on the curve radius. If the lap radius is flatter than the curve radius, the ink will deposit on the outside of the curve. If the lap radius is steeper than the curve radius, the ink will deposit on the inside of the curve. If they are the same, the ink will deposit evenly on the curve.

APPLICATION and REMOVAL TECHNIQUES:

The novice lens wearer worries more about the handling of a lens than any other consideration. There is a natural reaction for the head to recoil, eyes to look away or lids to close. Hence, a regular patient is suspicious and fearful. The fitter must be gentle and reassuring at all times. The patient must be told what to expect so as to avoid the shock of any unpleasant feelings. The lens should be placed upon the cornea by the fitter initially to help the patient dispell their fears. Remember to tell the patient that you are placing the contact lenses "**ON**" and NOT "IN" the eye.

Application by the Fitter:

1. The patient should be given something to look at. Controlled fixation invariably makes application easy. Both eyes should be kept open.
2. Retract the upper lid; place the lens on the cornea after rinsing the lens in slightly warm water.
3. Forewarn the person that the eye may feel irritated, be light sensitive, and tear after the lens have been placed on the eye.

Helpful hints on application:

1. Placing a drop of wetting solution on the lens before insertion should not be done. Most patients are more comfortable if the wetting solution is washed off with water prior to application of the lens. Wetting solution stings some patients and increases tearing.
2. For those who cannot keep their lids open, try asking the apprehensive patient to open their mouth during the initial lens application. Forced closure of the lids is very difficult to do with the mouth open.
3. Retract the upper lid gently. A forceful maneuver invites a strong lid closure response.

Removal by Fitter:

1. Squeeze the lens off by the thumb of each hand by applying pressure on the upper or lower lids, respectively.
2. Alternatively apply the fingers of one hand to the outer canthal region, resting on the upper and lower lids. The patient's eye should be kept wide open so that the lid margin can engage the lens. A voluntary blink coupled with a lateral jerk of the lids to increase tension is usually sufficient to dislodge the lens.

Application by Patient:

1. Depress the lower lid by the middle finger while the index finger carrying the lens is gently applied to the cornea.
2. Slowly release the lids to avoid accidental ejection of the lens. Release the lower lid first and then the upper.

A mirror is most helpful as the patient can watch his or her own eye. However, try not to use a mirror, except as a last resort, to decrease the chance of the patient being dependent on it.

Alternate approaches:

1. Retract the lids with the fingers of one hand, the index finger retracting the upper lid, the middle finger depressing the lower lid. Carry the lens on the index finger of the other hand.
2. For the nervous patient the lens-carrying finger is the middle one. It is supported by the fourth finger, upon which it rests as the lens is carried toward the cornea.

Helpful hints on application:

1. Most lenses are lost or damaged in the first few months because of clumsy handling techniques. Tell the patient to be extra careful during this period. Drains should be closed before the lenses are rinsed with water. A dropped lens should not be grasped directly between the thumb and forefinger; instead the finger should be moistened and the lens lifted. Application and removal should initially be

done over a desk covered by a white towel so that the lens is easy to find if it falls and so that it can be cushioned by impact.

2. Suction-cup devices may be employed by an assistant in dealing with children or the elderly. They should not be given to a new lens patient. If the lens happens to be de-centered upon removal, a suction cup may take off the corneal epithelium.
3. The patient should be told to be gentle and that the lens will adhere to the eye if brought close enough. Some patients will try to ram the lens on the cornea and will abrade the cornea.

Removal by patient:

1. Look downward, open the lids wide so that the edge of the lid will engage the edge of the lens, draw the lid tight by a lateral pull of the index finger, and blink. The lid should dislodge the lens.
2. Cup the other hand under the eye to catch the lens.

Alternate approaches:

1. One-handed method: Draw the upper lid up and out with the thumb while the same hand is cupped under the eye to catch the lens.
2. Scissors technique: Hold the upper lid by the index finger and lower by the middle finger, apply lateral traction to the lids, and squeeze the lens off by a scissors motion.

Helpful hints on removal:

1. Tell the patient never to panic when the lens cannot be removed or when the eye turns red.

What to do if the lens cannot be removed:

1. Add a few drops of saline, artificial tears, Comfort drops or water that will loosen the lens from the eye.
2. Use an eyecup with saline or eyewash, or glass full of water to wash out the lens.
3. Place the head in a basin of water with the drain closed and blink forcefully once or twice.

4. Have a friend or relative use a small rubber suction cup to remove the lens.
5. Tell the patient not to be afraid if the lens in on the sclera. It can stay on the sclera without being lost behind the eye.
6. Also, do not work excessively to get the lens off. This may cause a corneal abrasion or ulcer. Leave the patient with an emergency number if the techniques above fail after one or two passes.
7. Lastly, make sure the patient is reassured never to panic. Let them be aware that there is little likelihood of permanent damage to the eye if the lens cannot be removed by themselves.

Recentering a displaced lens:

1. With the lids closed, gently dab around the lids until the displaced lens is located.
2. Manipulate the lens by the fingers through the closed lid until it is centered.
3. Move the eyes in a direction opposite to the position of the lens. The lens is centered by manipulation and held there; then the eye is rotated centrally, sliding under the held lens.
4. Push the lens into position by using the upper and lower lid margins. This method applies only to superiorly and inferiorly displace lens.
5. Confine the lens by the index fingers of both hands by pressure through the closed lids and rotate the eye slowly and deliberately toward the lens until the cornea moves under the lens.

Lost lenses:

If a lens have been lost and the patient is sure it is still on the eye, check the upper fornix. There have been reports of lost lenses found in the upper fornix and even embedded in the conjunctival tissue above the tarsus. A complete search includes eversion on the lids.

Helpful hints on recentering:

1. The patient should manipulate the lens gently through the lids. If too much pressure is applied, the lens becomes more

adherent to the conjunctiva and is almost impossible to dislodge. If this occurs, the best advised is to use a suction cup or put some eye drops onto the eye to relieve the suction effect of the lens upon the eye.

2. If the lens is difficult to find, the most common hiding place is the superior cul-de-sac. Lid eversion is required. Fluorescein stain can be used to accent the presence of a lost lens.

FLUORESCEIN EVALUATION and PATTERN:

Once the proper rigid lens selected has been placed on the cornea and the tearing has subsided, the fit of the lens can be evaluated. First try to evaluate lens dynamics and centering without fluorescein. Then a common way to visualize lens fitting is to use fluorescein. A fluorescein strip is first moistened with a drop of saline, irrigating solution or water and not with hard lens wetting solution, other viscous solutions, or ones containing benzalkonium chloride (BAK) preservatives. The strip is gently laid against either the superior or inferior conjuctiva, being careful not to add excess fluorescein onto the eye which may cause eye irritation, or give the appearance of a greater amount of clearance between lens and cornea than actually exists. Lay the edge of the strip gently against the conjunctiva. Do not rub the strip back and forth across the eye.

An ultraviolet lamp, or black light (Burton lamp) is held in front of the eye to evaluate the fluorescein pattern. A biomicroscope with the advantage of higher magnification and a dark cobalt blue filter in place is used more commonly. The advantage of using a Burton lamp is being able to evalute both eyes simultaneously.

Under the UV light, the yellow-orange fluorescein dissolved in the tears becomes a green color. Using a wratten filter #12 enhances the fluorescein pattern to a glowing golden-yellow color even with minute amount of fluorescein.

The edge of the lens, and consequently the lens position, can be quickly ascertained. There should be a bright band of fluorescein stained tears around the edge of the lens corresponding to the peripheral curves of the lens. Depending on the relation of base curve radius to the corneal radius, there may or may not be fluorescein pooling in the center of the lens.

If the lens has a longer radius than the flattest corneal radius (Kf) a dark area will be seen in the center with fluorescein pooling in the periphery (apical or central bearing or touch). When the base curve has a shorter radius than the Kf, tears will pool in the center of the lens (apical or central clearance). An alignment fit occurs when the base curve radius of the lens selected is the same as the Kf (apical or central alignment).

With a spherical base curve lens on a toric cornea, an irregular or dumbell fluorescein pooling will be seen. If the base curve of the lens is the same as the flat corneal meridian, there will be no pooling in this meridian, but pooling will develop in the extremes or steeper meridian 90 degrees away. In the case of with the rule (WTR) toricity the dark band of no fluorescein pooling is horizontal with pooling at the top and bottom. Against the rule toricity (ATR) will create a vertical dark band of no pooling with fluorescein pooling at the steeper horizontal meridian.

There are numerous fitting philosophies which all work depending on the doctor, patient and types of lens available. To the novice fitter this only causes confusion, frustration and lack of confidence as to which type of fitting system to use. Regardless of which fitting philosophy used, the fitter should always concern himself or herself with the three basic criteria to lens fitting:

1. The patient must achieve good vision. Good depends on the patient's required acuity and subjective best VA.
2. Patient comfort
3. Health and safety of the patient's eye. The cornea must receive adequate tear circulation to carry nutrition and oxygen to the epithelium to prevent the occurrence of edema and overwear syndrome.

Fitting Philosophy:

The fitting of rigid lenses should be kept simple. In selecting the initial appropriate diagnostic lens, as a rule of thumb the following applies:

If the OAD is:	then the diagnostic base curve should be:
9.5 mm or >	flatter than Kf
8.9 to 9.4 mm	on Kf
8.8 mm or less	steeper than kf

Just remember:

1. Excessive apical bearing, a flatter BC than Kf, should be avoided as corneal molding can occur, possibly resulting in distortion or warpage and abrasion.
2. Excessive apical clearance, a steeper BC than Kf or a steep secondary curve, can result in midperipheral corneal bearing and a decrease in tear flow to the central cornea and in the removal of waste products away from the cornea.
3. If excessive apical clearance or bearing is seen, select another trial lens. The following rule of thumb applies:

   If the contact lens is too steep and forms bubbles under the lens:

   TRY: **A SMALLER OAD LENS**
   OR FLATTER BC with the same OAD

If the lens is too flat and sinks:

TRY: **A BIGGER OAD LENS**
OR STEEPER BC with the same OAD

4. An OAD from 8.4 to 8.6 mm is the diameter that bothers most patients due to the upper lid touches the edge of the lens. Usually an OAD of 8.5 mm is "no mans land."
5. Advantages and disadvantages of small and large rigid lenses:

Small lenses:	**Large lenses**
-rapid adaptation	-slow adaptation (needs wearing schedule)
-more gas exchange -due to whole cornea gets uncovered during blink	-always a part of the cornea that is covered up when blinking
-edge contour is critical -travels farther and the lens comes down faster	-edge contour not nearly as critical
-must center properly	-doesn't have to center properly for patient's to see through lens
-not as critical during sleep	-will bother eyes after sleeping with the lenses on
-not as comfortable initially	-more patient comfort

The ideal fit for any gas-permeable lens is one in which the lens position is slightly high, even when the lens overlaps the superior limbus. The upper lid should cover a position of the lens during the full cycle of each blink to tuck the edge of the lens under the lid to avoid lid impact, which is a major cause of patient discomfort. This "full sweep" blink also enhances lens surface wetting.

A low riding lens is unsatisfactory causing reduced blink rate and incomplete blinking, and is a source of lid gap, which causes 3 and 9 o'clock staining of the cornea.

Other Techniques in lens fitting

Interpalpebral Fitting:

-centered rigid lens between upper and lower lids
-small OAD: 8.0 to 8.6 mm range
-fit steep or tight BCR (one-third to one-forth steeper than Kf)

Corneal Cylinder (change in K readings)	BCR of diagnostic lens
0.0 to 0.75D	0.25D steeper than Kf
1.00 to 1.50D	0.50D steeper than Kf
1.75 to 2.50D	0.75D steeper than Kf
2.75 to 3.25D	1.00D steeper than Kf

-avoid excessive movement
-a 1 to 2 mm lens lag with blink is sufficient with RGP lens
-larger movement can cause subjective complaint of flare

This fitting system is indicated for steep corneas (45.00D or greater)
(From Bennett and Grohe, Rigid Gas-Permeable Contact Lenses, Prof Press, 1986, pages 204-5.)

Dr. Bennett's fitting philosophy:

-superior central lens fit
-OAD of 9.0 - 9.2mm tucked under the upper lid
-fit flatter than Kf in most cases
-a 1 - 2 mm lens lag is required
-tetracurve design with an edge lift of 0.10 to 0.12 mm

Corneal Cylinder	BCR of trial lens:
0.0 to 0.25D	0.75 flatter than Kf
0.50 to 1.00D	0.50 flatter than Kf
1.25 to 1.50D	0.25 flatter than Kf
1.75 to 2.00D	On Kf
2.25 to 2.50D	0.25 steeper than Kf
2.75 to 3.50D	0.50 steeper than Kf

(From Bennett and Grohe, Ibid. pages 207-9.)

Dr. Peterson's Modified Dyer Nomogram:

- -use the Dyer Size Chart
- -fit steep
- -PCW should be 0.4 mm and with B blend
- -for (-) contact lens, 7.84 mm radius is the determining point for PCR
  - -if base curve is steeper than 7.84, use 10.5 mm tool for PCR
  - -if flatter than 7.84, use 12.5 mm tool
- -cut off point for (+) lens is 8.03 mm

	Delta K(diopters)			
	0.0 - 1.00	1.12- 2.00	2.12 - 3.00	≥3.00
Flattest K				
< 42.50 D	+0.50	+0.75	+1.00	+1.25
42.50-45.00	+0.75	+1.00	+1.25	+1.50
> 45.00 D	+1.00	+1.25	+1.50	+1.75

Other methods of fitting include: the calculated method from the K readings and refractive findings, and tables or nomograms.

FOLLOW-UP EXAMINATION:

The care of the contact lens patient after the initial dispensing of the lenses is extremely important. The lens desingn selected must be evaluated over a long period of time. Problems may arise days, weeks, or even years after the initial fit. To prevent serious ocular health problems and to be sure the patient is successful, it is important that the patient be seen on a regular basis. The schedule of visits will vary depending on the type of patient, as well as the fitting and wearing regime selected. For the typical, young, healthy patient fitted with a daily-wear lens , the follow-up exam schedule might be: 1 week, 2 weeks, 1 month, 3 months, 6 months, and 1 year following dispensing. Then every 6 months after the 1 year appointment.

Once again the case history during each follow-up exam is very important in determining the patient's comfort and success. Adaptive symtom complaints from the patient usually go away after a week and decrease with time. Abnormal symtoms become worst or stay the same with time. The following questions should be asked during the follow-up visit:

1. Has anything unusual like abnormal redness, tearing, blinking, or staring occurred while wearing the lens, and if so, for how long did it last?; when did it occur?
2. How many hours per day do you wear your contact lens? How many hours today have you worn your lenses?
3. Do you have blurring of vision, especially at the end of the day? (Late blur is usually a sign of central corneal clouding.)
4. After taking the contact lenses off, do you see halos around lights, or is your vision blurred? (Again, these are signs of CCC.)
5. Can you still feel the lenses on during the day, especially at the end of the day or night?
6. Do you like the contact lenses?
7. Have you had any reaction to the contact lens solutions?

Questions regarding the cleaning, disinfecting and storage of lenses should also be asked during the first two or three follow-up visits. Have the patient show exactly how these tasks are performed.

A sample written questionnaire below can be given to the patient at the follow-up exam.

Contact Lens Patient Questionnaire
(Follow-Up Examination)

I. Wearing time today (hrs)..
Average daily wearing time (hrs)..
Maximum wearing time (hrs)..

		YES	NO
II.	**Comfort**		
	1. No sensation or awareness..		
	2. Slight awareness..		
	3. Moderate awareness..		
	4. Not tolerable..		
	5. Pain...		
	6. Excessive tearing..		
	7. Excessive movement..		
	8. Greater light sensitivity..		
	9. Burning..		
	10. Unusual eye secretion..		
	11. Itching..		
	12. More than normal blinking..		
III.	**Visual Performance**		
	1. Better than spectacles...		
	2. Equal to spectacles...		
	3. Worse than spectacles...		
	4. Variable vision..		
	5. Distance vision blurred..		
	6. Near vision blurred...		
	7. Reading problem...		
	8. Flare..		
	9. Ghost images..		
	10. Halos around lights..		
	11. Night vision problem...		
	12. Require repeated cleaning..		
IV.	**Vison with spectacles (after contact lens removal)**		
	1. Normal..		
	2. Reduced (if so, for how long?)...		
V.	**Handling Problems**		
	1. Placement problem..		
	2. Removal problem...		
	3. Cleaning problem...		
VI.	**General Health**		
	1. Have you had any recent illness?.......................................		
	2. Are you taking any medication? (If so, please list them.)........		

After the case history:

-Check VA with contact lenses on

-Do over-refraction (refraction over C.L.)

- -Start with retinoscopy and check for any unusual reflexes
- -CD or RL, JCC, 20/40 Equal., #7, #7a
- -Check best acuity without cylinder refraction
  - -take the cylinder refraction out
  - -go to 20/40 equal again
  - -do #7 and #7a again

***if one gets a (+) over-refraction on one side and (-) on the other, the patient may have switched lenses.**

-Use the slit lamp:

-Check for: edema or central corneal clouding
hyperemia not noted before
new vascular growth
normal and complete blink rate (10-15X/min)

-**Instill fluorescein on rigid lenses**

- -observe lens dynamics and centration
- -note central and edge pattern:
  - -edge pattern should be feathered on the inside with the tear meniscus going straight back on the outside.

-Use the keratometer:

-grade distortion and clarity of mires.

Keratometer reading changes after one week:

- -0.75D change than original K is normal.
- -between 0.75 to 1.25D change means the lens may need blending.
- - >1.25D change in one week is abnormal. A major modification or a new lens may be required.

K changes after one month:

- -0.50D change from original K. The fitter should carefully observe the patient.

-0.75D change is a problem. A modification or a new lens may be needed.

-<u>Lens-off refraction</u> (with the contact lens removed)

- -the acuity should be the same as base line acuity
  - Refractive error changes in one week:
    - -a ± 0.75D change from baseline refraction. The fitter should be careful
    - -a ± 1.00D change is bad news

RIGID LENS MODIFICATION:

Most successful practices do in-office rigid lens modification. Such lens changes can be made in just minutes, or even seconds, saving the time and cost of returning the lenses to the laboratory. Such capabilities afford complete care and prompt service which provide more convenience for patients. Lens modifications are not difficult to perform if proper procedures are followed.

Only a small amount of equipment and investment is necessary to do most in-office modifications. One basic piece of equipment is a spindle unit, consisting of a small electric motor that can be mounted on a table, box or steel or plastic tub. The small motor of 1/20 to 1/4 horsepower can either be of constant speed or variable. A rate of 500-1500 rpm is required for modifying rigid lenses. (To prevent RGP lenses from deterioration, rpms less than 1000 should be used.) The tools to be used on the unit can be mounted on the motor by either a spindle adapted with a male taper or by a Jacob's chuck. The use of a taper allows more rapid interchange of tools on the spindle unit than does the Jacob's chuck. Several companies manufacture adjusting or modification units.

In addition to the modification unit, other accessories that are required includes: radius tools (laps) made of plastic or brass, polishing sponges, lens holders, polish, a spinner or suction cups, double sided tape, and wax solvent.

Polishing compounds such as X-Pal,ALOX-721, Sil-O_2-Care and Boston Polish are especially designed for rigid gas-permeable lens modifications. X-Pal and ALOX-721 consist of a fine powder that must be mixed with water, preferably distilled water. Sil-O_2-Care and Boston Polish are premixed. They used to increase the rate of plastic removal and to prevent heat formation during modification, and thus, preventing the chance of changing the lens optics. A 1:1 mixture between powder and water is sufficient for polishing lenses.

Silvo, a silver-polishing compound used for PMMA modification, **should not be used for gas-permeable lenses**. Also, any polishing compound containing ammonia or alcohol is contraindicated with RGP lenses because of its surface degradation potential.

Modification procedures:

1. Decreasing OAD: This procedure is designed to increase lens movement and/or improve centration.
2. Peripheral curve application/blending: This increases lens movement to provide better alignment with the cornea and/or to allow increased tear exchange.
3. Edge shaping/polishing: This enhances comfort and/or facilitate lens-lid acceptance.
4. Surface polishing: To enhance optical performance.
5. Power changes: To incorporate necessary refractive correction.

Lens diameter (OAD) reduction:

The easiest and quickest way to reduce lens diameter is with a cut-down tool. This tool is a 60, 90 and 110 degree hollow cone covered inside with tape or impregnated with diamond dust. A 60 degree cone is used only for cutting down lens diameter; a 90 degree cone for both cutdown and producing an anterior or CN bevel; while, the 110 degree cone for CN bevel only.

The lens must be positioned in the cone so that it is touching evenly and not tilted in any direction to ensure even and symmetrical plastic removal. A spinner or suction cup can be used with the lens concave side down. The diamond cone must also be cooled down and lubricated with water only and not polish. **Never use polish on a diamond tool.** The tape tool does require polish. Care should be taken not to generate any heat during each modification procedure, especially with RGP lenses because distortion or fracture can result.

*Remember to cut down 0.2mm larger than the desired finished OAD for minus lenses. For example:

If the final OAD selected is 9.0mm,
cut down to 9.2mm OAD.

-0.2mm will be removed by polishing and edging of the lenses.

For plus lenses cutdown to 0.3 mm larger than the final OAD.

Other methods of lens reduction include the use of a razor blade, swiss file or emery board. These tools are held perpendicular to the lens edge or at a slight angle to the direction of lens rotation with the lenses mounted on a motor shaft using double-sided tape.

Peripheral Curve Fabrication:

To apply a peripheral curve, several devices can be used for holding the lens, including suction cup, spinner, or a mounting button. The radius tools are made of plastic or brass and maybe coated with diamond dust. They are commercially available in 0.1mm steps. A minimum set of radius tools should include base curves from 7.6 to 8.8 mm at 0.2 mm steps, and 9.0 to 10.0mm at 0.3 mm steps, and an additional curves of 10.5, 11.0,11.5 and 12.0mm.

To create a smoother surfaces, adhesive tape or pellon pad should be attached to the surface of the non diamond radius tools. Others use a soft velveteen material. **Do not put tape on a diamond tool.** The velveteen or pellon pad add an approximate 0.15 mm to the radius, while the adhesive tape adds 0.1mm. Thus, if an 8.8 mm curve is desired, an 8.6 mm tool with velveteen or pad, or 8.7 mm with tape should be used.

The proper radius tool is placed on the spindle. It should be completely wet with polish and water at all times during the PC fabrication. Use water only, not polish, with a diamond tool.The convex side of the lens to be modified is attached to a lens holder and rotated lightly against the rotating tool. Be careful not to get dirt or grit on the surface of the polishing compound, radius tool, or lens because it will produce fine surface scratches. One should periodically check the lens' central alignment on the holder, and also peripheral curve finish with a Peak scope.

An angle of 30 degrees to the vertical should be employed while holding the lens with a suction cup. Also, rotate the suction cup with the fingers evenly and smoothly to prevent heat from developing in one area. Excessive pressure should be avoided. Since RGP lenses are thin and flexible, too much pressure may cause lens distortion and produce curves that is steeper than desired.

The first curve to put on the lens is the one closest to the base curve. Then apply the desired peripheral curve up to the calculated optic zone diameter with the addition of 0.10mm when using a diamond tool and to the exact OZ when using tape or pellen.

Another alternative method is to use a spinner. The lens is placed on the center of the spinner and held at a 30 degree angle to the vertical. Keep the lens spinning at all times with continuous addition of polish.

In determining the radius tool necessary for peripheral curve fabrication, most recommend:

SCR(2nd Curve Radius) = BCR + 1.5mm
PCR(Peri Curve Rad) = BCR + 3.0mm

Others specify: SCR = BCR + 1.2mm
PCR = BCR + 3.5mm

With a quadracurve Dr. Bennett suggested:
SCR = BCR + 0.8mm
ICR = BCR + 1.8mm
PCR = BCR + 3.2mm

Blending the lens:

The transition between two curves is sharp and forms a ridge, causing dimpling if placed on the cornea. This ridge needs polishing or blending to create a smooth transition. A lens can be blended by placing it on a polishing lap with a radius between the two curves. For example:

If BCR = 7.50mm
and SCR = 9.50mm

the radius tool required for blending this junction is:
(7.50 + 9.50)/2 = 8.50mm

The radius tool should be covered with a soft pad to obtain a more complete, gradual blend. In a light blend, or touch blend, only a few seconds or a few touches on the soft pad is necessary. Medium and heavy blends, which are both difficult to measure, require more time. The lens is held on the lap as explained above for PCR fabrication.

Edge Contouring:

The edge contour is extremely important in obtaining a comfortably fitted lens. Both inside and outside edges should be rolled and tapered. One easy method in edge shaping is described by Dr. Peterson:

Place the lens on the suction cup with the convex side on the holder. Using a flat top disc covered with velveteen material, place the lens on the center of the rotating pad wet with polish and move the lens around in a circle without turning. Then using the outer edge of the pad tilt the lens and holder at an angle 22 degrees from horizontal and rotate the lens twice; and again at angles of 45, 67, and 90 degrees. Also, try to go far below the edge with two more turns.

Turn the lens around, the concave side on the holder. Tilt the lens holder at an angle of 45 and 67 degrees, turning twice; and again at 90 degrees with the lens flat on the pad. Go far below the edge again.

Now measure the OAD and edge to the specified diameter.

Other methods of edge shaping are carefully described in Bennett and Grohe's textbook "Rigid Gas-Permeable Contact Lenses", pages 258-63.

Power modification:

Adding minus to the rigid lens can be performed several ways. One method is the use of a diaper material as described by Dr. Peterson: (See adding Minus Power to a Hard Contact Lens, next page)

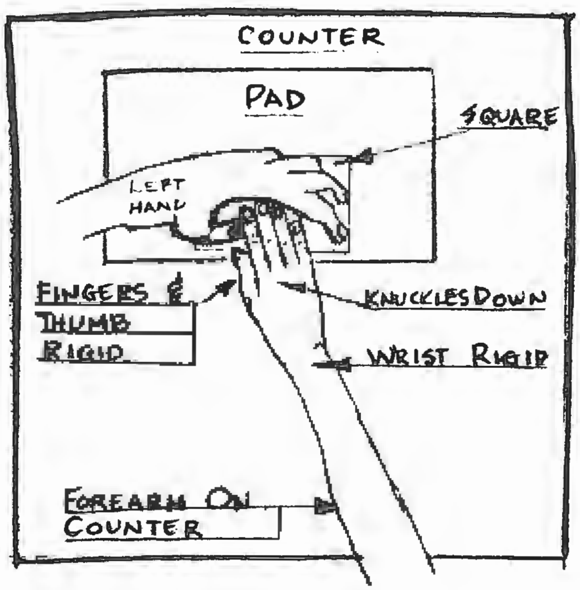
This procedure is slow, but very effective. Plus, it reduces the chance of distorting the lens optics.

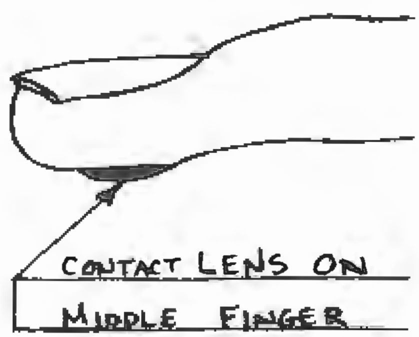
A second technique is holding the lens, convex surface out, with a spinner perpendicular to a soft flat pad near the periphery. Allow the lens to rotate with light even pressure.

Adding Minus Power to a Hard Contact Lens

Place six to eight layers of all cotton baby blanket or diaper material in a plastic bag, remove the air from the bag and seal the bag. This is called the pad.

Cut the rest of the blanket or diaper material into squares approximately 4" x 4". Use one square for each power change and then throw it away. Wet the square with water and squeeze the water out of it. Place the square on top of the pad near the edge of the pad. Place the pad far enough from the edge of the counter so your forearm can rest on the counter.





Stretch the square taut with the fingers and thumb of your left hand leaving a wide space between the thumb and the index finger. Put a puddle of polish (about the size of a quarter) in the center of the square. Dry your right middle finger, then touch the damp square with it. Place the concave side of the dry hard contact lens on the slightly damp fleshy part of the middle finger. Place the lens in the center of the polish puddle and rub it around in a 1" circle for about one (1) minute to add -0.25D to the power of the lens.

It is very important to keep all fingers and thumb of the right hand together, straight and rigid. The circular motion must come from shoulder movement and not the elbow or wrist. The knuckles must be kept rigid; otherwise, the lens will rock and the power will be aberratted.

Up to -0.75D can be added using this technique.

Adding plus power to the lens is more difficult and care must be taken to prevent lens distortion. Using the spinner, hold the lens in the center of the flat polishing pad, allowing the lens to rotate very slowly.

Another procedure to add plus power is with a flat foam pad, cut with a 45 degree 'V' groove on the periphery. The lens is held with a spinner, allowing the lens to rotate inside the groove. This groove only polishes the outer edge of the lens.

LENS CARE & SOLUTIONS:

Summary of preservatives used in contact lens solutions:

This changes rapidly. For updated information, refer to Tyler's Quarterly, P.O. Box 55064, Little Rock, AR, 72225, (501) 664-3788 and Contact Lenses and Solutions Summary, compiled by Paul White, O.D. and Clifford Scott, O.D., The New England College of Optometry, sponsored by CIBA Vsion, from the publishers of Contact Lens Spectrum.

I. Cleaning Solutions for RGP Lenses

Used to remove to the buildup of mucus, proteins, lipids and other materials from the lens which results from tear film and lens handling. Cleaners should be used every day especially after final removal. This is to be supplemented with an enzymatic cleaner approximately once per week depending on the individual's buildup.

II. Wetting Solutions for RGP Lenses

Is used on a lens prior to placement to transform the surface from a hydrophobic to a hydrophilic state. It also helps by acting as a mechanical buffer between lens, cornea and lids. Most patients are more comfortable if the wetting solution is washed off with water prior to application of the lens.

III. Soaking Solutions for RGP Lenses

Prevents tear proteins and mucus from becoming dried on the lens. It allows lens parameters to be kept stable. Contains antibacterial agents to prevent contamination.

IV. Combination Solutions for RGP Lenses

A. Wetting/Soaking
   1. Maintains lens hydration
   2. Maintains disinfection
   3. Acts as a buffer between cornea and lens
   4. Temporarily enhance the lens surface wettability

B. Cleaning/Wetting

C. Cleaning/Soaking

Advantage: Less confusing to the patient, instead of three solutions the patient has only two.

Disadvantage: Overall function of each is somewhat compromised, for example, a combination solution, may not be as good a cleaning solution as a separate cleaner.

Evaluating the Soft Contact Lens Fit

1. Look for good centration. You want a minimum of 1/2 mm coverage past the limbus at all points.

2. Look for good movement (1/2 to 1mm in the primary gaze when the patient blinks). Check lens movement at 5:00 and 7:00 positions using a 1mm parallelepiped.

3. On upward gaze the lens should move 1 1/2 mm, recentering with movement into primary gaze.

4. Check for conjunctival vessel blanching, if apparent, fit a flatter base curve.

5. Check for conjunctival tugging, if present, use flatter base curve.

6. Note: As the lens looses water it will steepen and thus center better. The retinoscope reflex should be clear, visual acuities should be good and the patient must feel comfortable.

Allow the lens to settle (thicker and high water content lenses require longer settling time than thinner and low water content lenses).

Observe using a biomicroscope under low power, or a high power loupe.

1) Coverage:
   a. Completely covers the cornea -------- Limbus to Limbus
   b. Cornea not completely covered -------- nasal exposure, etc.
   c. Coverage with decentration --------- Note de-centration

2) Movement:

a. Primary gaze -------------- Estimate # mm

Note: observe inferior nasal and inferior temporal positions. Movement estimation can be achieved by dividing the cornea into 12 sections along its diameter, noting corneal diameter with respect to lens diameter, or using the slit lamp spot/slit width.

b. Upwards, downwards, temporal and nasal gaze --------------------- Note lag in # mm

Note: "lag" is the backwards sliding of the lens as the eye moves into the various fields of gaze.

3) Other (note any of the following)

a. Scleral binding (lens presses excessively on sclera)
b. Edge liftoff (lens edge curls away from eye)
c. Conjunctival drag (lens drags conjunctiva underneath lens)
d. Vessel blanching (whitening) in conjunctiva (underneath lens)
e. Hyperemia

The fitting is initiated by using a lens that is 2 D to 3 D flatter than central K reading. The fit of the lens should be evaluated after 15 to 20 minutes of wearing time to allow the lens to stabilize on the eye. An optimum fit results in a well-centered lens that moves slightly with ocular movement (1 mm to 2 mm). Good centration will provide a good optical result and the slight movement will allow oxygenated tears to flow under the lens.

Fitting the Soft Lens

1. Take central K's, making adjustment on the flattest K (Kf).

2. General Rule of Thumb:

OAD	Add to (Kf) in mm.
12.5mm	0.5mm
13.5mm	0.9mm
14.5mm	1.5mm

3. The lens must be at least 1mm larger than visible iris diameter. (VID).

Example:
1. VID = 11.5
2. Must have and overall diameter(OAD) of at least (11.5 + 1mm = 12.5mm
3. Use a 12.5mm OAD add O.5mm to the Kf.
4. If Kf is 43.00D (r=7.84) then add 0.5mm. 7.84 + 0.5 = 8.34mm
5. Then use a contact lens close to a 8.34 base curve.
6. Attempt to fit the lens with the best corneal coverage.

A successful contact lens fit should provide a good, steady visual acuity comparable to that obtained with spectacles, without any discomfort or any major alterations in corneal physiology.

CHARACTERISTICS OF LENS FITTTING

Parameter	Type of Fit: GOOD	FLAT/LOOSE	STEEP/TIGHT
Comfort	Good	Increased lens awareness	Comfortable initially, becomes uncomfortable later during the +day
Vision	Stable	Variable; clear initially, poor after blinking	Variable; clears momentarily after blinking
Centration	Good or slight	Poor lag in primary position	Good
Movement	Slight	Excessive	Poor or absent
Slit-lamp examination	No compression of peripheral limbal tissues	Bubble under lens edge or edge standoff	Vascular blanching at lens edge; later, circumcorneal injection; central air bubble may be present
Keratometry	Clear mires	Clear mires, after blink	Distorted mires, clears immediately after blink
Retinoscopic reflex	Clear	Clear at first, blurs after blinking	Blurred reflex, clears momentarily after blink

Comparison of Spin Casting and Lathe-Cutting Processes for soft Contact Lenses.

	Spin Casting	Lathe Cutting
Manufacture	Liquid plastic is injected into spinning molds, polymerizied, and hydrated	Unhydrated polymeric material is cut into buttons, lathe cut, polished and hydrated.
Lens power Governed by Surface Construction	Posterior lens curvature Bevel is present on anterior surface	Anterior lens curvature Bevel is present on posterior surface
Anterior Optical Zone	Corresponds to front surface of the lens minus the anterior peripheral curve	Corresponds to the optical portion of the lens (i.e., front surface minus carrier portion of the lens)
Posterior Optical Zone	Includes the entire diameter of the back surface of the lens	Is the back surface of the lens, less the posterior peripheral curve

ADVANTAGES AND DISADVANTAGES OF SOFT CONTACT LENSES

Advantages:

Initial comfort and easy adaptation
Option of intermittent usage
Little or no spectacle blur
Easy to fit
Foreign bodies do not get lodged under the lens
Eyes may be rubbed with lenses in place
Less corneal physiological change
Usually does not fall out of the eye (useful in athletics)
Cosmetically excellent
Iris color can be changed with tinted lenses
Corneal or anterior segment pathology can be masked with certain soft lenses

Disadvantages:

Visual acuity may be reduced
Costs more than hard contact lens
Requires meticulous care
Spherical lens does not correct astigmatism
Lenses may tear easily
Drying of the lens can cause blurred vision
Lens replacement more frequent
Storage and cleaning may be difficult while traveling

LENS SELECTION

Choice of Soft Lens: There are currently a vast number of contact lens manufacturers. This page will therefore list the lenses that are provided to the students as complimentary pairs during their 3rd and 4th year. Specific information can be obtained from Tyler's Quarterly and the manufacturer's data sheets.

Manufacturers:

1. Sola/Barnes Hind
2. Bausch & Lomb
3. Ciba Vision Care
4. Cooper Vision
5. Sunsoft
6. Vistakon
7. Wesley Jessen
8. Allergan Hydron

Dispensing & Follow-up visits:

The wearer needs to be instructed about basic skills of application, removal, wearing time and proper lens care: cleaning, rinsing and disinfecting. Also, the wearer needs to be warned of possible complications, the contact lens service agreement, i.e.,. warranties and follow-up care should be explained. Make an appointment for a return visit in 1-2 weeks or have the patient call in sooner if problems or questions arise. Make sure that pertinent lens specification is recorded on the wearer's chart.

The follow-up visit is to check on how the patient is adapting. Questions to consider are as follows:

1. How long are you wearing the lenses each day?
2. Are the lenses comfortable (tearing, burning, diplopia or haloes noted)
3. How do feel about your vision with your lenses?
4. Are there any handling problems, application, removal as well as lens care? Note if there appears to be any signs of redness and/or blanching of vessels.

Take distance visual acuity. Look at the lens position with regard to centration over the cornea, and observe lens movement with blinking. Perform an overrefraction to verify that the lenses are of the proper power and vision is satisfactory. If vision is unsatisfactory because of lens power, a new lens will have to be prescribed.

Common Problems Faced:

1. Poor visual acuity
2. Discomfort
3. Flare
4. Fluctuating, blurring vision
5. Photophobia
6. Lens awareness
7. Burning and dryness
8. Excessive tearing

Physical Findings:

1. Corneal edema
2. Inflammation & infection
3. Intraepithelial hemorrhage
4. Lens loss
5. Damaged lenses
6. Lens deposits
7. Lid edema
8. Lens adherence to the cornea
9. Edge curling out
10. Decentering
11. Bubbles under the lens
12. Lens dehydration
13. Corneal vascularization
14. Change in K readings
15. Scleral injection
16. Abrasion
17. Lens discoloration
18. Red eye
19. Perilimbal dilitation
20. Corneal sensitivity
21. Spectacle blur
22. Chemical toxicity

Special Problems:

Fitting the astigmatic cornea.

If a lens is used to correct residual astigmatism, lens rotation on the eye must be prevented. There are currently several methods used to stabilize a lens. These include:

1. Prism ballast
2. Peri-ballast
3. Double slab off
4. Single truncation
5. Double truncation

We begin by placing an astigmatic lens on the eye and the orientation (degree of rotation) and stability of the lens is assessed by noting the position of small markings placed on the lens surface. You need to assess the degree of rotation after the lens has been on the eye for approximately 10-15 minutes for the wearer to be comfortable and blinking normally. The final order will be refined by the use of the mnemonic LARS. If the contact lens rotates to the observer's left or clockwise, add (LA) the amount of degrees or rotation to the lens off refraction cylinder axis. If the lens rotates to the observer's right or counterclockwise, substract (RS) the amount of degrees of rotation from the lens off refraction cylinder axis.

What about extended wear lenses?

One of the most important criteria that needs to be considered is the amount of oxygen that passes through the lens. This is crucial in the prevention of hypoxia, which can lead to adverse cornea effects. In the selection of the materials and designing a lens to be used, several approaches need to be utilized.

1. Surface characteristics
2. High oxygen transmission
3. Thin membrane lenses
4. Medium to high water content hydrophilic lenses

Factors Influencing Patient Selection:

1. Age
2. Lifestyle
3. General health
4. application & removal
5. Hygiene
6. Ocular Environment

Complications associated with extended wear lenses:

1. Lens deposits
2. Anoxia
3. Lens failure
4. Infection
5. GPC
6. Lens intolerance

The follow-up schedule is very critical in evaluating the cornea for possible complications. After the initial evaluation, the patient is reevaluated every 3 months.

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