Optimizing the Refractive Outcome: Correction of Astigmatism in Cataract Surgery

By:

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General Considerations

Lens extraction with the implantation of an intraocular lens is the most commonly performed refractive procedure in the world today. Since the invention of the intraocular lens by the late Mr. Harold Ridley of England in 1949, lens implantation has been the primary correction of the most common refractive error, aphakia, which occurs as a result of cataract extraction. In 1995, I published my experiences and results on the technique of clear corneal cataract surgery with the simultaneous correction of myopia, hyperopia and astigmatism. The results then, as today, demonstrated that we could do a good job of improving people's visual acuity with the cataract procedure. Today, cataract surgery is looked upon more often as a refractive procedure that is used to improve preexisting refractive error and optimize uncorrected visual acuity than it is used solely to treat a clouded crystalline lens.

Refractive Error Correction

Utilized in combination with the automated keratome to create a corneal flap under which is removed small layer of cornea by the laser, LASIK as it is called (laser-in-situ-keratomilleusis), has gained in popularity over the past decade. The difficulty of using a mechanical device to create a consistent corneal flap, and the limitations of removing corneal tissue without compromising the corneal integrity, has
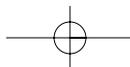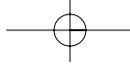
lead surgeons to embrace an additional approach to the correction of high orders of refractive error. Today's cataract procedure with IOL implantation, can fill the need. Much work has been undertaken on the use of refractive implantable lenses for cataract surgery and now for phakic refractive correction, either in the anterior chamber, iris supported, or in the posterior chamber. This approach has held promise also for the correction of presbyopia, the natural loss of accommodative ability that comes with age.

Incisional Astigmatism Correction

Smaller incision surgery has motivated the IOL industry to develop newer intraocular materials to replace the rigid polymethylmethacrylate (PMMA) lenses of yesterday and replace them with newer acrylic, thermoplastic and hydrogel materials that can be injected through these microincisions.

Coincident with these advances in microincision cataract surgery has been the increasingly superior visual results that patients have achieved. Myopia and hyperopia are eliminated with the IOL and astigmatism can be corrected with the use of a toric IOL with or without arcuate keratotomy incisions (the so-called limbal or peripheral corneal relaxing incisions – Figure 1). Smaller incision surgery has meant better results for the patient and less complications and worry for the surgeon.

I have performed and adhered to a single incision-single instrument approach to cataract surgery that has benefited my patients over the years, which utilizes a clear corneal microincision, in-the-bag phacoemulsification with a mini-phaco flip maneuver, and injection of the IOL through the unenlarged incision (Figures 2-4). Eighty-nine percent of patients are spectacle-free for most tasks and twenty-nine percent can read without the need for a near correction. The refractive outcome achieved by following these techniques are the best we have ever achieved, and with incision sizes approaching one millimeter, this technology holds promise for even greater advances in the not too distant future.

Preoperative Evaluation and Surgical Plan

All patients who present for cataract surgery undergo a comprehensive ophthalmic evaluation which includes dilated funduscopy. In devising the surgical plan, cycloplegic refraction, combined with corneal topography (Figure 5) and ultrasonic biometry, is used to select the best IOL power for complete refractive correction. The strategy is to correct the sphere fully for distance, eliminate less than one diopter (D) of astigmatism with a single incision that doubles as the cataract incision
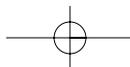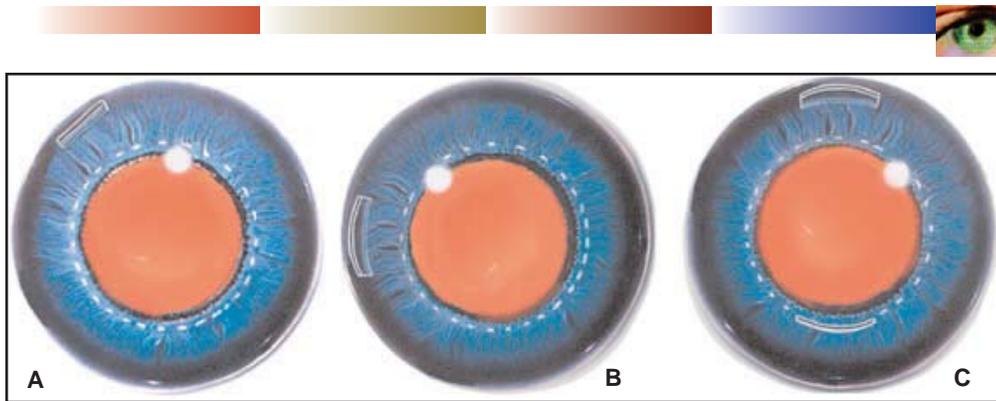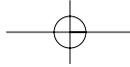
Figure 1. Location and architecture of clear corneal arcuate astigmatic incisions. Kershner. **a**) Single, clear corneal 2.5 mm planar, stab incision on the oblique or   temporal limbus for astigmatic neutrality. **b**) Single, clear corneal 2.5 mm arcuate incision on the steepest axis at the 10mm optical zone to correct 1 D or less of astigmatism or a single 3.0 mm arcuate inci- sion on the steepest axis at a 9 mm optical zone, to correct 1-2 D of astigmatism. **c**) Two arcuate keratotomy incisions are placed according to the nomograms to correct greater than 2 D of astigmatism. *(Reprinted from: Kershner, RM. "Clear Cornea Cataract Surgery and the Correction of Myopia, Hyperopia and Astigmatism." Ophthalmology 1997;104:381-389.)*
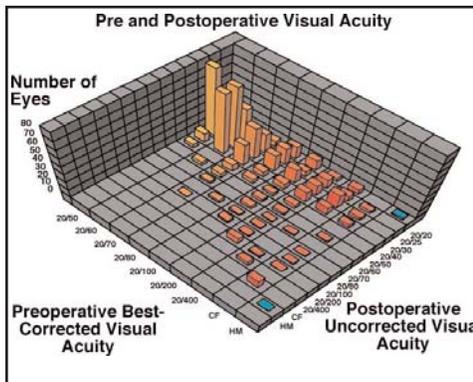
Figure 2. -Comparison of preoper- ative best corrected and postopera- tive uncorrected visual acuity. n=690. Kershner. *(Reprinted from: Kershner, RM. "Clear Cornea Cataract Surgery and the Correction of Myopia, Hyperopia and Astigmatism." Ophthalmology 1997;104:381-389.)*

Figure 3. - Comparison of preoper- ative and postoperative refractive sphere (D). Kershner. *(Reprinted from: Kershner, RM. "Clear Cornea Cataract Surgery and the Correction of Myopia, Hyperopia and Astigmatism." Ophthalmology 1997;104:381-389.)*
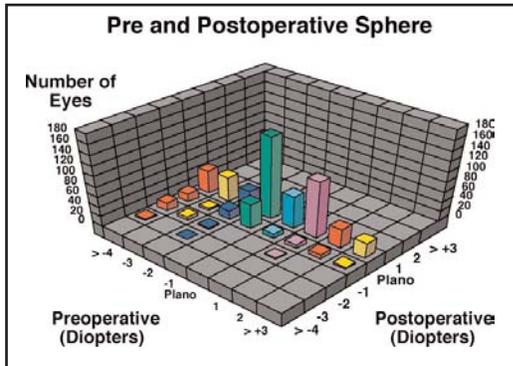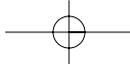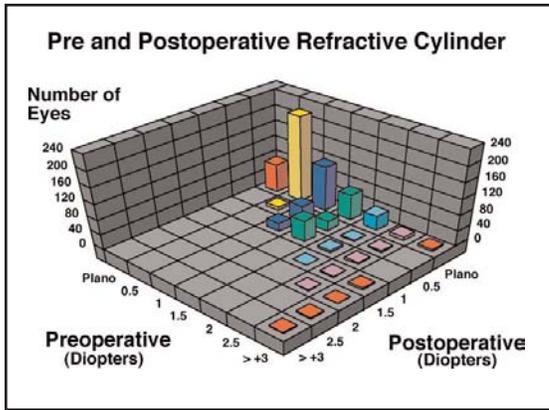
Figure 4. -Comparison of preoperative and postoperative refractive cylinder (D). Kershner. *(Reprinted from: Kershner, RM. "Clear Cornea Cataract Surgery and the Correction of Myopia, Hyperopia and Astigmatism." Ophthalmology 1997;104:381-389.)*
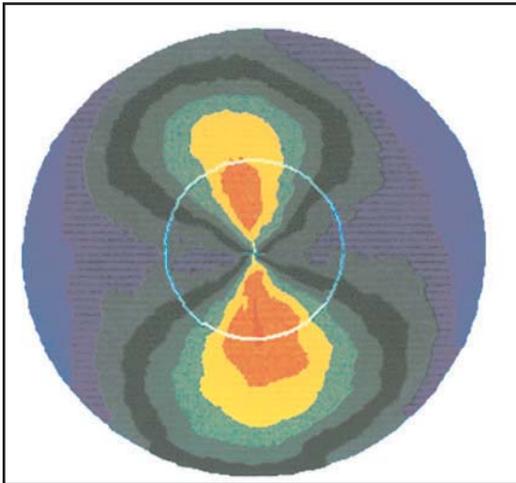
Figure 5. -Preoperative topography shows an ideal candidate for refractive correction with cataract surgery. Kershner.

(keratolenticuloplasty - KLP), and supplement the astigmatic correction for over 1D with the toric IOL. The goal of astigmatic treatment is to fully correct or slightly undercorrect the cylinder, and not overcorrect or shift the cylinder axis. To achieve the proper correction a preoperative surgical plan is developed (See worksheets) (Table 1).

Table 1

Kershner Operative Worksheet

V R20/___ V R20/___ J R____
sc L20/___ cc L20/___ L____

Patient Name:_____
Age:_____ Occupation:_____
Dominant Eye:_____ Date:_____

C R ___.___ + ___.___ X _____

_L ___.___ + ___.___ X _____

WEARS: R____.____ + ____. X_____
K R ___.___ V ___.___ H_____ °   Glasses: L____.____ + ____. X_____
                                              ADD:_____ Last Rx_____

_L ___.___ V ___.___ H_____ °

WEARS: R____.____ + ____. X_____
        Glasses: L____.____ + ____. X_____
Last Rx: _____

O.D.
O.Z. ___.___ mm   ARC LENGTH ___.___ mm
AXIS:_____

O.S.
O.Z. ___.___ mm   ARC LENGTH ___.___ mm
AXIS:_____

OPERATIVE EYE:_____

IOL Style_____ Power_____

90
120   45

180

5 6 7 8 9 10 11mm

PACHYMETRY_____

PACHYMETRY_____

The Procedure

Use Topical Anesthesia

With topical anesthesia, patients can feel that which they could not feel with anesthetic blocks. Always inform the patient that although they will feel pressure, see the light of the operating microscope, and feel the surgeon touching them, they will not have pain. I always tell the patient when I am about to start the phaco (infusion causes a proprioceptive sensation of pressure) and when I am about to inject the IOL (as the bag distends, pressure is felt). As long as the patient is informed, they will not startle or move or feel discomfort.
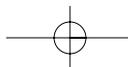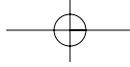
After cycloplegia and surgical scrub, instill several drops of 2.5% proparacaine or tetracaine. Avoid the longer acting anesthetics such as bupivacaine as they are hyper-osmotic, burn and last much longer than required. Following this, apply one drop of 2.5% hydroxypropylmethylcellulose, (HPMC), rather than balanced salt solution irrigation. We coat the cornea with HPMC instead of forcing our scrub technicians to direct a stream of balanced salt solution over the ocular surface to keep it clean and moist. Remember to always warn patients about what you are going to do to them ahead of time. For instance, when placing a speculum, you may want to alert the patient that "you are about to feel some pressure on your eye."

Pay Attention to Your Incision

Unlike scleral tunnel incisions, corneal incisions are not very forgiving. It's easy to distort, tear or stretch a corneal incision, and when you do, it will leak, induce unwanted astigmatism and heal more slowly. Here are a few basic rules:

Size. The most common error made by inexperienced surgeons when con-structing clear corneal incisions is to use a keratome that's too small for the instru-ments they plan on passing through the incision. This causes stretching or tearing of the incision, and striae that can obscure visualization during the procedure. It can also cause post-operative healing problems. Unlike scleral incisions, corneal incisions do not snap back into place after stretching. If your incision is too small, you will likely wind up distorting the incision when passing instruments through it, causing it to gape like a fish mouth rather than seal shut like a paper cut. The easiest way to avoid this is to use a keratome that is properly sized to accommodate your largest instrument (Figure 6). Typically, corneal incisions wider than 3.2 mm will induce flattening and unwanted aberration in the refractive power of the central cornea. These incisions usu-ally do not seal on their own, and require suturing. Incisions 3 mm wide or less seal appropriately.

Blades. Only very sharp keratomes can atraumatically penetrate Descemet's membrane. Many clear cornea surgeons use diamond blades because of their unri-valed sharpness. The cutting edges can be made as thin as 1 μm, enabling these knives to pass through the corneal lamella smoothly and easily, leaving behind an incision as smooth as a paper cut.
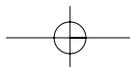
Figure 6: Corneal Tunnel Sutureless Incision. The 3.2 mm corneal tunnel incision (C) creates a valve which is self-sealing. If a corneal incision is made and the surgeon has to convert, the enlargement of the corneal incision to finish the operation as an extracapsular may lead to major astigmatism. It is preferible to close it and create a new superior scleral incision. *(Art from Highlights of Ophthalmology).*
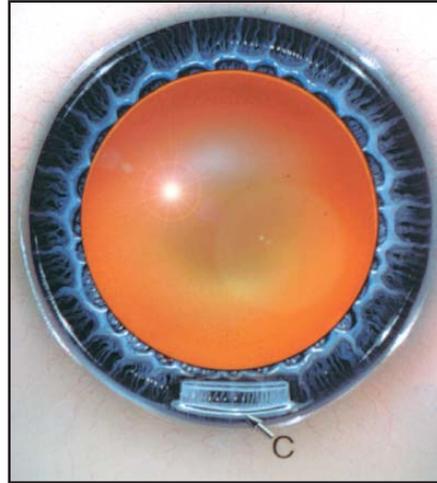
By simply fixing the globe in place, and marking the incision with the inkless marker, the surgeon can properly position the keratome for the ideal incision.

To assure proper geometry and architecture, place the tip of the corneatome on the incision entrance line, aim and line up the blade with the second line mark, then pass the blade into the cornea until it reaches the laser mark on the blade. At this point, the tip will enter the eye at the proper angle and the ideal tunnel length will be achieved automatically. The width to length ratio will be maintained at 3:2, which has been proven to be stable (Figure 7).

Figure 7. A single-plane incision is best for astigmatic neutrality. Kershner.

The keratomes are available in a variety of widths to accommodate whatever phacoemulsification tip and lens insertion method you use. The knife has a specially designed double-bevel slit blade in either angled or straight form for proper clear cornea incision construction. An accurate depth blade preset to 550 or 600 microns by the manufacturer is used to construct the two-step arcuate keratotomy incision (Figure 8).
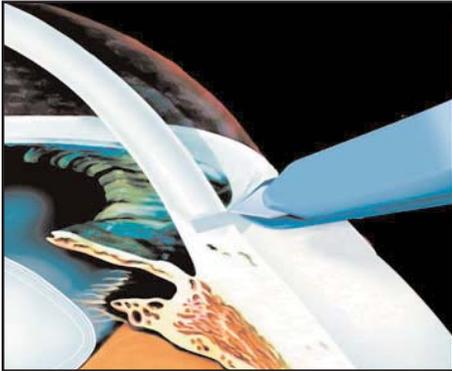
Figure 8. A two-step incision, with a vertical groove, maximizes achieved flattening. Kershner.

Correct Astigmatism-Don't Make it Worse

Where you make the incision is just as important as how you make it. Prior to surgery note in the chart the position of the patient's steepest meridian on the cornea (see worksheet- Table 1). As all transverse or arcuate corneal incisions flatten the corneal architecture, always locate your incision on the steepest meridian. Can't determine the steepest meridian? Simply refract the patient in plus cylinder or analyze a corneal topographic map. Placing the incision anywhere other than the steepest part of the cornea will make the astigmatism worse. Since most elderly patients have against-the-rule astigmatism, temporal incisions typically work well for most, but not all patients. These incisions are also best if the patient has a spherical cornea. The temporal limbus is located further away from the optical center than is the superior limbus, such that temporal incisions will create less induced corneal astigmatism. Patients with significant pre-existing astigmatism will benefit from astigmatic keratotomy (keratolenticuloplasty- Table 2) at the time of surgery.
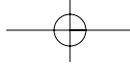
Table 2

Keratolenticuloplasty Procedure

1. The goal of surgery is to undercorrect the pre-existing astigmatism. You can always do more surgery later if needed, but it may be difficult to undo what you have already done if you have done too much and overcorrected the cylinder or shifted the axis. Remember, in older patients, the less elastic cornea responds with greater changes in curvature for a given amount of surgery.

2. Keep the incisions at the limbus or slightly onto the dome of the cornea. Avoid arcuate incisions inside the 7-mm optical zone. If it is possible to achieve the same degree of correction with a larger arc at a 10mm optical zone at the limbus, this is to be preferred over a smaller arc at a 8-mm or 9-mm optical zone. Larger incisions are always preferred further away from the optical zone than smaller arcs nearer the central cornea. Remember, the effect of corneal incisions to flatten decreases as the distance from the optical zone increases.

3. Arcuate incisions should never exceed 60° in length at any optical zone and, ideally, the largest arc should be no greater than 45° or 3.5 mm at an optical zone of 10mm.

4. To achieve the maximum flattening and best neutralize the astigmatism, incise the cornea to a depth of 85% to 95% of corneal thickness. Measure pachymetry at the proposed incision site and set the diamond blade to 90% of this measurment or simply use the disposable accurate depth metal blade preset at 550 or 600 microns. Do not over cut into cornea as perforating the cornea makes phacoemulsification and maintaining the anterior chamber more difficult. If perforation should occur, it may be necessary to suture the incision. This will diminish corneal flattening, but the suture can be removed at the slitlamp in a few days.

5. Whenever possible, a single arcuate incision will be preferable to using two smaller incisions.

6. Always use the arcuate incision closest to the surgeon for the keratotomy into the anterior chamber. Place this incision anterior to the limbal vascular arcade at a 11mm, 10 mm, or 9 mm optical zone. Avoid using the arcuate incision for the subsequent cataract surgery if it is closer to the optical center of the eye than the 8 mm optical zone.

7. To avoid full thickness penetration, avoid pressing on the globe with another instrument during the creation of the arcuate incision. To stabilize the eye use the disposable fixation ring if needed. Mark the proposed position of the incision at the steepest plus-cylinder reading.

8. It is easier to visualize the marks and incise the cornea if the cornea is kept dry. Avoid using marking inks. They obscure visualization for subsequent procedures of cataract surgery. A clean marker gently pressed onto the epithelium will create a visible mark that will be more than satisfactory as a guideline to creating the incision.

9. Always place the arcuate corneal cataract incision on the axis of steepest (+) astigmatism. Operating on the incorrect axis will always make the refractive result worse. Axis is crucial. Never operate greater than 15° off axis.

10. Keep the keratome fully applanated perpendicular to the surface of the cornea. Aim the blade towards the center of the globe and follow the curvature of the cornea closely following the mark until the full excursion of the incision is completed.

11. The slit blade, sized for the phacoemulsification tip and injection system, is placed at the base of the arcuate incision to enter the eye plane-parallel to the iris. The handle should be aimed at the center of the pupil to assure an incision which self-seals and has the proper architecture for the best refractive result.

How do arcuate astigmatism incisions differ from limbal relaxing incisions? Limbal relaxing incisions, because they are placed far peripherally in the corneal scleral limbus, have less flattening effect for a given length. As a result they must be large to have any substantial effect on corneal curvature. When limbal incisions traverse 120 degrees or arc, they effectively denervate the cornea. In an elderly patient, this
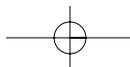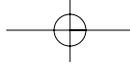
can mean an anesthetic cornea, severe dry eye and corneal breakdown. Smaller, arcuate incisions have more effect with less surgery, and as long as they do not approach the optical center of the cornea, are less problematic. (Tables 3A and 3B).

The clear cornea incision is here to stay. More and more surgeons are mastering the finesse of the technique and more and more patients are demanding the rapid recovery and clear uncorrected vision this technique provides. By incorporating these six tips into your approach to cataract surgery, you will save time and avoid trouble. You too, will be a believer-clear cornea cataract surgery is the best approach.

The Strategy to Achieve the Best Refractive Outcome from the Clear Cornea Procedure

Most surgeons have been slow to accept the techniques of astigmatism management with their cataract procedure because of a resistance to acquire new skills, or the need for new instrumentation. Astigmatism should be managed however, because it is better for our patients and because it can be predictably and easily corrected with today's techniques. Simply adopting a few sound fundamental principles and a minimal if any additional investment in instrumentation, a surgeon can offer a better refractive result for his patients. The surgical correction of astigmatism along with full refractive correction of the spherical error, reduces the need for spectacle correction postoperatively which translates into increased patient satisfaction and more patients. To assure a precise method to achieve better refractive outcomes we need a philosophy of refractive correction and the discipline to follow a set of rules:

Rule #1. Do not overcorrect the cylinder or shift from the pre-existing axis.
Rule #2. To accurately correct astigmatism, we have to accurately measure it.
Rule #3. Always apply the astigmatic correction on the proper meridian.

How do we Measure Astigmatism?

A full and accurate cycloplegic refraction will allow us to determine the magnitude and the orientation of the cylinder axis. Corneal topography and other corneal scanning measurements can allow us to properly analyze the origin of the astigmatism. Naturally, an individual who has a refractive cylinder that does not appear topographically would not require corneal alteration to correct it. Simply removing the cataract will suffice. If the topographic astigmatism, which is usually measured as less than the refractive astigmatism, significantly disagrees with the power or the orientation of the cylinder, then the surgeon must make a judgment of what refractive
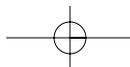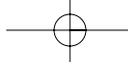
Table 3B

Kershner Arcuate Keratotomy
With Toric IOL System Nomograms

Correction (Diopters)	Optical Zone (mm)	Number of Incisions	Arcuate Incision Length (mm)	TORIC IOL
<1.0	10	1	2.5	
1.0	9	1	2.5	
1.5	9	1	3.0	+2.00 Toric
2.0	9	1	3.0	+2.00 Toric
2.5	9	1	3.0	+3.50 Toric
3.0	9	2	3.5	+3.50 Toric
3.5	8 / 10	1	3.0 / 3.0	+3.50 Toric
4.0	8 / 10	1	3.5 / 3.5	"
4.5	8 / 10	1	4.0 / 4.0	"
5.0	8 / 10	1	4.5 / 4.5	"
5.5	8 / 10	1	5.0 / 5.0	"
6.0	8 / 10	1	5.5 / 5.5	"

This nomogram is to be used when incisions are utilized in combination with the toric IOL to correct the cylinder. They are to be used as a guideline only, surgeons should adjust for the desired result. Corrected for age 60 +. Arcs placed on steepest axis of astigmatism (plus cylinder). Pachymetry at incision site, keratome set to 95% of pachymetry (550-600 microns). Mark arcuate incisions and optical zone with Kershner One-Step Marker. Cataract keratotomy at 10 mm, 9 mm, or 8 mm only.

Table 3A

Kershner Arcuate Keratotomy
Incision-Only System Nomograms

Correction (Diopters)	Optical Zone (mm)	Number of Incisions	Arcuate Incision Length (mm)
<1.0	10	1	2.5
1.0	9	1	2.5
1.5	9	1	3.0
2.0	8	2	2.5
2.5	8	2	3.0
3.0	7	2	2.5
3.5	7	2	3.0
4.0	6 / 10	1	2.5 / 2.5
4.5	6 / 10	1	3.0 / 2.5
5.0	6 / 10	1	3.0 / 2.5
5.5	5 / 10	1	2.5 / 2.5
6.0	5 / 10	1	3.0 / 3.0

This nomogram is to be used when incisions alone are utilized to correct the cylinder. They are a guideline only, surgeons should adjust for the desired result. Corrected for age 60 +. Arcs placed on steepest axis of astigmatism (plus cylinder). Pachymetry at incision site, keratome set to 95% of pachymetry (550-600 microns). Mark arcuate incisions and optical zone with Kershner One-Step Marker. Cataract keratotomy at 10 mm, 9 mm, or 8 mm only.
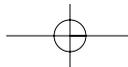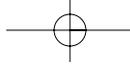
error to correct. Here is where the art of astigmatic correction with cataract surgery departs from the science. The surgeon must be aware that using a cookbook approach for every patient will not work. It is always better not to attempt a correction rather than perform the incorrect treatment.

Topography is extremely valuable in both determining the qualitative appearance of the astigmatism as well as the location of the cylinder (Figure 5), for choosing whether to utilize symmetrical or asymmetrical incisions. Newer methods of corneal and intraocular analysis utilizing wavefront analysis may further provide us with insight into higher order aberrations that could affect postoperative refractive result. If the astigmatism is regular, then it is correctable. Irregular astigmatism, keratoconus, corneal scars and higher order aberrations are best left alone rather than to attempt a correction which could result in an undesirable postoperative irregular cornea.

How do we Correct Astigmatism?

Early methods of astigmatic control at the time of surgery were limited to elaborate suturing techniques and corneal wedge resection. Although this worked in instances where large corneal incisions were utilized for cataract surgery, it has had very little role with today's techniques. All incisions placed onto the dome of the cornea will act as if tissue is added where they are placed. We can use this principle to intentionally flatten the steep areas of the cornea to create a more spherical result. Small, arcuate corneal incisions work best when surgeons wish to flatten the cornea at a given location. Arcuate incisions, which closely follow the corneal curvature, placed on the proper latitude of the globe, can flatten in the meridian in which they are placed. This can be utilized to neutralize preexisting corneal astigmatism (Table 3A-B). The flattening in one meridian usually results in a steepening of the meridian 90° away, this coupling ratio is approximately 1:1 for arcuate clear corneal incisions. Surgeons need not take into account a change in the spherical power of the eye when they perform astigmatic surgery. Biometry is carefully performed preoperatively. The spherical correction required can be calculated and the lens selected without attention to whether the astigmatism will contribute to an alteration in the lens power.
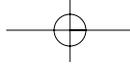
We can maximize the effect of the clear corneal cataract incision to correct astigmatism by inducing intentional flattening in the meridian in which it is placed. Simply by operating on the steepest meridian, we can improve the refractive results for our patients. Operate more than 15º off axis, and you will make the postoperative refractive result worse. That is why it is critical to know on what meridian in which to operate. In evaluating the patient for refractive cataract surgery, I always take into account the cycloplegic refraction, review the topography, and look at the A-scan result. The proper IOL is chosen; the location of the steep meridian is marked on the chart. To identify the proper meridian in the operating room, surgeons can make a note in the chart (see the worksheet in this chapter-Table 1) of the presence of a small nevus or corkscrew vessel which may help identify the 12:00 o'clock meridian. Using this mark as a guide, the proper meridian for the astigmatic correction can be selected. I prefer to use an ocular reticule in the operating microscope that allows me to align the proper axis with the microscope. Alternatively, the surgeon can use a hand-held degree gauge to determine the proper meridian. Taking into account any rotational movement of the eye when the patient is supine is usually not an issue when topical anesthesia is used. If a peribulbar block is used however, this must be taken into account when determining the proper location for correction. It is often best to mark the proper axis prior to administration of the block if one is used.

We can maximize the effect of the clear corneal incision to flatten the cornea by designing its architecture with the goal of intentionally flattening the incision.

For astigmatically neutral clear corneal incisions, a one-step plane parallel clear corneal incision is utilized (Figures 1 and 7). A 2.4mm disposable keratome can be used to create the proper architecture for a clear corneal incision that will be self-sealing and maintain a ratio of 3:2 of width to length. If the width of the incision is 3mm, the tunnel length through the cornea should be approximately 2mm. In the KLP technique, we utilize the cataract incision for all the subsequent steps of the surgery to optimize its refractive result. The cataract incision itself can correct up to 1.0 diopters (D) of astigmatism alone when used in a length of approximately 3mm or less (Figure 1). For an astigmatically neutral incision (A) a single-plane incision is created with the keratome. For less than 1D of astigmatism, (B) a two-step clear corneal incision is utilized to flatten in the meridian in which it is placed. By using an accurate depth blade set at a depth of 550 to 600 microns, the incision is made vertically, perpendicular to the cornea. Position the blade handle towards the center of the globe to create a deep groove approximately 85% of corneal depth. The corneatome selected for the proper size for the phaco tip and the IOL injector is positioned at the base
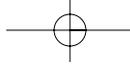
of this keratotomy, and enters the eye in a plane parallel fashion. In this fashion, a two-step clear corneal self-sealing incision is created with the maximum flattening effect.

To correct larger degrees of astigmatism,(C) the incision is coupled with an additional arcuate incision on the opposite meridian from the cataract incision at an optical zone of 9, 10 or 11mm to induce further flattening, or combined with the implantation of the toric intraocular lens (Staar Surgical, Monrovia, California USA). The toric intraocular lens is presently available in two cylinder powers with the anterior surface of the lens delivering the refractive torus. The 2 D lens will deliver approximately 1.4 D of astigmatic correction at the spectacle plane, and the 3.5 D will provide approximately 2.3 D of correction.

The incisions are constructed utilizing the disposable BD limbal relaxing incision system which is comprised of a hinged fixation ring, an inkless marker to mark the proper location for the incision, the accurate depth blade to make the vertical component of the incision and a slit blade to make the proper architecture for corneal entry.

The Operative Procedure

Patients are administered topical 1% tropicamide in combination with 2.5% phenylephrine drops into the operative eye one drop every five minutes for 3 administrations, fifteen minutes prior to surgery. On call to surgery they receive a single drop of 4% topical Betadine suspension. The surgical scrub is performed and a sterile adhesive drape applied to exclude the eyelids and lashes. Several drops of 2.5% tetracaine anesthetic are instilled (if anesthetic drops are used prior to the procedure there may be excessive drying or sloughing of the corneal epithelium making visualization difficult). The Kershner reversible eyelid speculum (Rhein Medical) is positioned under the eyelids and can be rotated out of the way so as to not interfere with the various steps of the procedure. The cornea is kept dry while the proper meridian of the cylinder is identified and marked with the inkless marker. The globe can be fixated with the disposable fixation ring if necessary, and the incisions created. Next, the cornea is coated with several drops of 2.5% hydroxypropylmethylcellulose (HPMC) which covers the cornea, keeps it moist, protects it, eliminates the need for irrigation during the procedure and provides 1.5X magnification. Sodium hyaluronate viscoelastic is injected into the anterior chamber. At this time you can proceed with the phacoemulsification technique as usual.
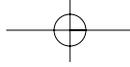
Both the sphere and the cylinder can be predictably corrected with these techniques. The majority of patients have spectacle-free vision following the procedure and can return to normal activities the same day. Because the incision size is so small, the need for long-term postoperative eye drop therapy is unnecessary. This saves both on cost, patient inconvenience and creates a much more satisfied patient.

Conclusions

Today's modern techniques of microincision cataract surgery have enabled surgeons to fully correct refractive error with cataract removal and IOL implantation. Smaller, more flexible injectable intraocular lenses, combined with more efficient methods of phacoemulsification have made it possible to keep incision sizes less than 2.5mm, and as small as 1mm. Judicious selection of the intraocular IOL and careful attention to astigmatic correction, incision construction combined with toric intraocular lenses can maximize the full refractive correction for the cataract patient. This translates into a more satisfied patient with less postoperative complications, less need for postoperative care, and less need for multiple refractive measurements following surgery.

Surgeons have within their grasp today the techniques for optimizing the refractive results of their cataract procedure. Full refractive correction at the time of cataract surgery can and should be accomplished, and must be the goal of every cataract surgeon.

Dr. Kershner has no financial or proprietary interest in any of the techniques or instruments described in this chapter. This presentation received the "Best Paper of Session" award at the 2001 American Society of Cataract and Refractive Surgery Symposium held in San Diego, California.

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