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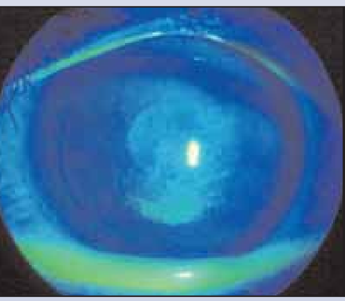

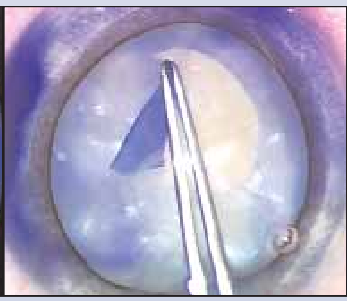

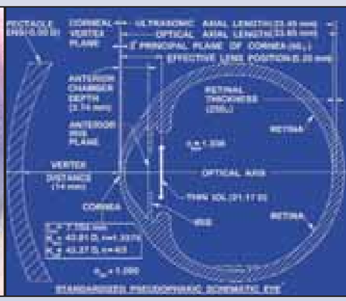

Practical pearls to optimize surgical outcomes.

IOL Power Calculations for Multifocal Lenses

BY JACK T. HOLLADAY, MD, MSEE

How to Avoid an Errant Tear

BY ROSA BRAGA-MELE, MED, MD, FRCSC

Dry Eye and Refractive Surgery

BY RICHARD W. YEE, MD

Jointly sponsored by The Dulaney Foundation and *Cataract & Refractive Surgery Today*

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STATEMENT OF NEED

Certain surgical practices deserve periodic review and reinforcement. This CME program presents the latest on IOL power calculations, preventing capsulorhexis tears, and identifying and treating dry eye in refractive surgery.

Careful IOL power calculations are essential to meeting refractive multifocal IOL patients' high expectations for postoperative visual performance. To ensure accurate IOL calculations in any type of eye, surgeons must know how to manipulate and apply multiple mathematical measurements and formulae.[1,2]

The capsulorhexis has been called the most crucial step in cataract surgery.[3] Because a torn capsule will complicate any surgery, cataract surgeons must master this step in all types of eyes. Instrumentation, the use of ophthalmic viscosurgical devices, and techniques for managing the anterior chamber all factor into preventing capsular tears and are vital tools in the cataract surgeon's armamentarium.[4,5]

Dry eye disease is gaining attention among refractive surgeons as more of them come to recognize the health of the ocular surface as a critical component in postoperative outcomes.[6-8] In addition to learning how to test and optimize the tear film, new research is examining how ocular anatomy may contribute to dry eye symptoms.[9] Continuing study in this area could lead to recommendations for pairing specific anatomical expressions with types of corneal surgeries that will have the least negative effect.

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TARGET AUDIENCE

This activity is designed for anterior segment ophthalmic surgeons and other ophthalmologists.

LEARNING OBJECTIVES

Upon successfully completing this learning program, participants should be able to:

- understand the variables in axial length measurements, the differences between IOL predictive formulae, and the benefit of a personalized A Constant.
- Identify surgical techniques to avoid a capsulorhexis tear and the complications for both routine and complex cases.
- describe the comprehensive management of dry eye with medical treatments.
- recognize the characteristics of dry eye based upon physiological and anatomic differences between races.

METHOD OF INSTRUCTION

Participants should read the learning objectives and continuing medical education (CME) activity in their entirety. After reviewing the material, please complete the self-assessment test, which consists of a series of multiple-choice questions. To answer these questions online and receive real-time results, please visit the Web site **www.dulaneyfoundation.org** and click "Online Courses." Upon completing the activity and achieving a passing score of over 70% on the self-assessment test, you may print out a CME credit letter awarding 1 *AMA PRA Category 1 Credit.*™ The estimated time to complete this activity is 1 hour.

ACCREDITATION

This activity has been planned and implemented in accordance with the Essential Areas and policies of the Accreditation Council for Continuing Medical Education (ACCME) through the joint sponsorship of The Dulaney Foundation and *Cataract & Refractive Surgery Today*. The Dulaney Foundation is accredited by the ACCME to provide continuing education for physicians. The Dulaney Foundation designates this educational activity for a maximum of 1 *AMA PRA Category 1 Credit.*™ Physicians should only claim credit commensurate with the extent of their participation in the activity.

CONTENT VALIDATION

In compliance with ACCME standards for commercial support and The Dulaney Foundation's policy and procedure for resolving conflicts of interest, this CME activity was peer reviewed for clinical content validity to ensure the activity's materials are fair, balanced, and free of bias; the activity materials represent a standard of practice within the medical profession; and any studies cited in the materials upon which recommendations are based are scientifically objective and conform to research principles generally accepted by the scientific community.

FACULTY CREDENTIALS

Rosa Braga-Mele, MEd, MD, FRCSC, is Associate Professor at the University of Toronto, Director of the Cataract Unit at Mt. Sinai Hospital, and Director of Clinical Research at the Kensington Eye Institute in Toronto, Canada. Dr. Braga-Mele may be reached at (416) 462-0393; rbragamele@rogers.com.

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FACULTY/STAFF DISCLOSURE DECLARATIONS

In accordance with the disclosure policies of The Dulaney Foundation and to conform with ACCME and the US Food and Drug Administration guidelines, anyone in a position to affect the content of a CME activity is required to disclose to the activity's participants: (1) the existence of any financial interest or other relationships with the manufacturers of any commercial products/devices or providers of commercial services; and (2) identification of a commercial product/device that is unlabeled for use or an investigational use of a product/device not yet approved.

Dr. Braga-Mele is a consultant for Bausch & Lomb, Advanced Medical Optics, Inc., and Alcon Laboratories, Inc.

Dr. Holladay is author of the Holladay Formula and is a consultant for Nidek Inc., Advanced Medical Optics, Inc., and Oculus, Inc.

Dr. Yee is a consultant to Allergan, Inc., Alcon Laboratories, Inc., and Inspire Pharmaceuticals, Inc.

Other staff involved in this activity state that they have nothing to disclose.

CONTENTS

IOL Power Calculations for Multifocal Lenses

Research has identified seven key measurements for success.

BY JACK T. HOLLADAY, MD, MSEE

Ophthalmic surgical patients' expectations of multifocal IOLs are high, because they have been promised little-to-no dependence on spectacles or contact lenses postoperatively. Attaining this goal requires eliminating astigmatism and achieving a precise postoperative plano refraction within ±0.25 D. This article describes techniques for determining the proper IOL power for multifocal IOLs.

The accuracy of predicting the necessary power for an IOL is directly related to the accuracy of several measurements.[1,2] They include central corneal refractive power (keratometry readings), axial length (biometry), horizontal corneal diameter (horizontal white-to-white), anterior chamber depth, lenticular thickness, preoperative refraction, and the age of the patient.

UNDERSTANDING EFFECTIVE LENS POSITION

The term *effective lens position* was recommended to the FDA in 1995 to describe the position of an IOL in the eye (Figure 1), because the term *anterior chamber depth* is not anatomically accurate for lenses in the posterior chamber and can confuse the clinician.[3] Ophthalmologists' ability to predict the effective lens position has evolved in accuracy over the years, due both to advancements in formulas and to the technical skills of surgeons who consistently implant IOLs in the capsular bag. We now know that a 20.00 D IOL that is axially displaced by 0.5 mm from the predicted effective lens position will result in approximately 1.00 D of error in the patient's stabilized postoperative refraction. For piggyback lenses totaling 60.00 D, however, a 0.5-mm axial displacement will cause a 3.00 D refractive surprise; the error is directly proportional to the power of the implanted lens. This direct relationship to the power of the lens is why the problem is much less evident in extremely long eyes, because the power of the implanted IOL is so small to achieve emmetropia after cataract extraction.

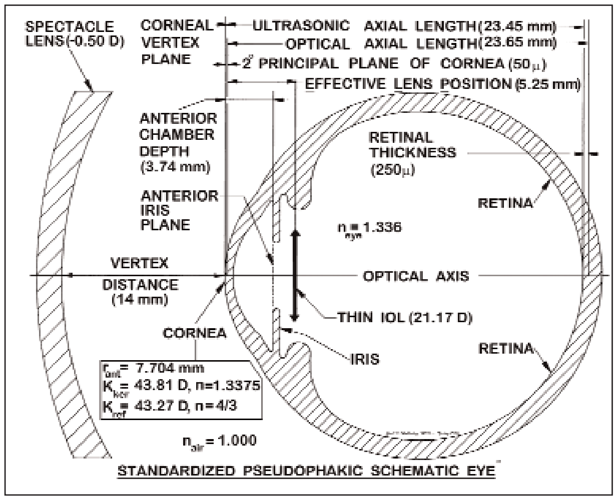

Figure 1. The effective lens position is measured from the corneal vertex plane to the plane of the thin IOL.

The Holladay 2 formula (Holladay Consulting, Inc., Bellaire, TX) provides more predictable results in normal and unusual eyes than other recent formulas due to its application of seven preoperative variables that my colleagues and I found to be useful for significantly improving the prediction of the effective lens position in eyes ranging from 15 to 35 mm (Figure 2). Once these additional measurements become routine for clinicians, I expect that a new flurry of prediction formulas using seven or more variables will emerge, similar to the activity following our two-variable prediction formula in 1988.[2] The standard of care will reach a new level of predictive accuracy for extremely unusual eyes, just as it has for normal eyes. Calculations on patients with axial lengths of between 22 and 25 mm with corneal powers of between 42.00 and 46.00 D will do well with current third-generation formulas (the Holladay 1,[2] SRK/T,[4] and Hoffer Q[5]). For cases outside this range, the Holladay 2 should be used to ensure accuracy.

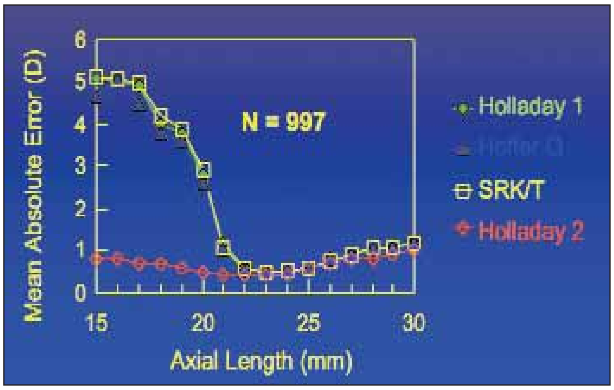

Figure 2. This graph compares the mean absolute predictive error (diopters) of the Holladay 1, Hoffer Q, and SRK/T formulas (two-variable predictors of effective lens position using measurements of keratometry and axial length) with the Holladay 2 formula (seven-variable predictor of effective lens position using measurements of keratometry, white-to-white, anterior chamber depth, lenticular thickness, age, and refraction).

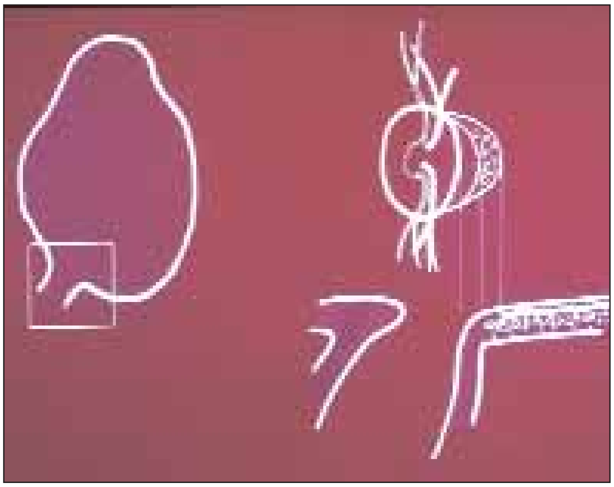

Figure 3. An eye with an axial length of more than 26 mm has a posterior staphyloma, resulting in the anatomic axial length measured from the anterior to posterior poles that is much different than the optical axial length from the corneal vertex to the fovea. (Reprinted with permission from Slack Incorporated. Holladay JT. *Quality of Vision: Essential Optics for the Cataract and Refractive Surgeon*. Thorofare, NJ: Slack Incorporated; 2007:54.)

PRIMARY CATARACT SURGERY OR REFRACTIVE LENS EXCHANGE

The intraocular power calculations for refractive lens exchange are no different than those for cataract surgery. Refractive lens exchange is usually reserved for patients who are outside the range of other forms of refractive surgery. Consequently, the measurements of axial length, keratometry, and so forth are usually quite different from those in typical cataract surgery patients because of the exceptionally large refractive error and younger age of patients undergoing refractive lens exchange. In most highly myopic eyes, the axial lengths are extremely long (> 26 mm), whereas highly hyperopic eyes have very short axial lengths (< 21 mm).

In eyes with myopia exceeding -20.00 D, removing the crystalline lens often results in postoperative refractions near emmetropia with no IOL. The exact result depends on the power of the cornea and the axial length. The recommended lens powers range from -10.00 to +10.00 D in the majority of these cases. The correct axial length measurement is very difficult to obtain because of the abnormal anatomy of the posterior pole. Staphylomas are frequently present in these eyes, and the macula is often not at the location in the posterior pole where the A-scan measures the axial length[6] (Figure 3).

It is especially important to measure the axial length of highly myopic eyes with optical coherence tomography to ensure a measurement from the macula (fovea) to the corneal vertex. I have personally seen refractive surprises of 3.00 to 4.00 D, because the macula was on the edge of the staphyloma and the A-scan measured to the deepest part of the staphyloma. Such an error results in a hyperopic surprise, because the distance to the macula is much shorter than the distance to the center of the staphyloma. The third-generation theoretical formulas yield excellent results if the axial length measurement is accurate and stable.

In eyes shorter than 21 mm, it is equally important to use optical coherence tomography, because the measurements must be more precise than in normal eyes to achieve the same accuracy in the postoperative refraction.

PIGGYBACKING IOLs TO ACHIEVE POWERS ABOVE 34.00 D

For patients with axial lengths shorter than 21 mm, I recommend performing IOL power calculations with the Holladay 2 formula. In these eyes, the size of the anterior segment is unrelated to the axial length in 80% of cases.[7] Oftentimes, the anterior segment is of normal size, and only the posterior segment is abnormally short. In a few individuals (< 20%), however, the anterior segment is proportionately small compared with the axial length (nanophthalmos). The differences in the size of the anterior segment in these cases can cause an average hyperopic error of 5.00 D with third-generation formulas, because they predict that the anterior chamber will be very shallow. Using the newer Holladay 2 formula can reduce the predictive error in these eyes to less than 1.00 D.

> "One should never piggyback two multifocal IOLs, or the near power will be double what was intended."

Accurate measurements of axial length and corneal power are especially important with piggyback lenses, because any error will be magnified by the extreme dioptric powers of the IOLs. With foldable IOLs, the surgeon places one implant in the bag and the other in the sulcus to avoid interlenticular membranes and posterior capsular opacification. When piggybacking a multifocal IOL, the surgeon may place the lens in front of or behind the monofocal IOL to achieve the best results, although the stronger-powered IOL is usually placed in the bag and the weaker IOL in the sulcus. One should never piggyback two multifocal IOLs, or the near power will be double what was intended. Choosing a monofocal IOL with a lens constant that is equal to the multifocal IOL's reduces the variability in the piggyback calculation.

CHOOSING THE POSTOPERATIVE REFRACTIVE TARGET

Determining the desired postoperative refractive target for multifocal IOLs is slightly different than for monofocal IOLs, where a slight amount of myopia may be beneficial. With refractive and diffractive multifocal IOLs, the target should be exactly zero (plano) or the nearest hyperopic choice to zero. Patients' near vision with each of these lenses is excellent, but slight myopia moves the near point too close for comfortable reading.

For an accommodating IOL, the refractive target may be slightly myopic (-0.50 D) for the patient's "reading eye" to achieve slightly better near vision. This choice must be discussed with patients, however, especially if they may compare their two eyes for distance. They should understand the possibility of a slight sacrifice in depth perception to have near vision in one eye.

PERSONALIZED LENS CONSTANT

Every surgeon who offers premium IOLs (aspheric and multifocal) must personalize his IOL constants for these lenses. Although the design of the IOL is the primary factor in the constant, variations in surgical technique such as the placement of the IOL, the location and design of the incision, and differences in the calibration and design of axiometers and keratometers also affect the personalized lens constant. Most surgeons must perform 20 to 40 cases in order to personalize their lens constant. This process is the only way to achieve superior results with these IOLs and accuracy to within ±0.25 D for 95% of patients.[2,3]

SUMMARY

Optimal refractive outcomes with multifocal IOLs can only be achieved through the selection of appropriate patients, precise measurements with keratometry/topography and axiometry, and the employment of the other five variables discussed herein to ensure the correct sizing of the anterior segment and the accurate prediction of the effective lens position. Personalizing the lens constant is critical to eliminating the systematic variations that are present in all ophthalmic instruments and surgical techniques. Using these techniques will make excellent results and happy patients the rule with multifocal lenses. ■

Jack T. Holladay, MD, MSEE, is Clinical Professor of Ophthalmology at Baylor College of Medicine in Houston, and he is Founder and Medical Director of the Holladay LASIK Institute in Bellaire, Texas. He is author of the Holladay Formula and provides consultations for A-scan companies that use his formulas. Dr. Holladay may be reached at (713) 669-9153 (fax); holladay@docholladay.com; http://www.docholladay.com.

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How to Avoid an Errant Tear

It is imperative to proceed carefully during the CCC to avoid this complication.

BY ROSA BRAGA-MELE MED, MD, FRCSC

Continuous curvilinear capsulorhexis (CCC) is one of the most important steps for successful phacoemulsification and IOL implantation.[1] The main cause of an errant capsular tear is a shallowing of the anterior chamber, with a subsequent excursion of the rhexis' peripherally along the path of least resistance. Thus, the surgeon should ensure that the anterior capsule is flat during the entire CCC procedure. This article describes measures to follow to complete a successful surgery.

SURGICAL STEPS

Incisions

First, the surgeon needs to ensure that the speculum or drape is not causing any unnecessary pressure on the orbit and thereby shallowing the chamber. Next, he should make sure a proper main incision is constructed so that the chamber does not inadvertently shallow when the wound is decompressed. A surgeon needs to make a good shelved, self-sealing wound that is constructed appropriately for the type of eye that he is treating. If the surgeon is operating on an eye that is very myopic or long, he should make the main incision slightly shorter than average (about 2 mm) to prevent putting undue pressure on the wound with the Utrata forceps. This step is important, because the chamber tends to be deep and one needs to angle down to reach the capsule. Alternatively, a longer-than-average incision will help stabilize the chamber in a more hyperopic or shorter eye.

Injecting Viscoelastic

It is necessary to be certain that the anterior chamber is completely filled with viscoelastic, either dispersive or cohesive, before performing the rhexis. Refill the anterior chamber with viscoelastic as necessary. If the chamber is particularly shallow, the surgeon may opt for a visco-adaptive viscoelastic to aid in the deepening and stabilizing of the chamber. Of note, when performing a CCC with an adaptive OVD, the rhexis tends to want to turn inward, and thus an errant tear is less likely to occur. The surgeon should account for this and lead the rhexis in the direction needed more frequently or use a small amount of balanced salt solution directly on top of the rhexis as described by Steve A. Arshinoff, MD, FRSCS, of Toronto (ultimate soft-shell technique).[2]

Managing the Rhexis

It is imperative to regrasp the rhexis frequently with any procedure, at least every 90º or less, and the surgeon must ensure that he is holding it close to the edge of the flap on the free edge. Viscoelastic can also be used to direct the leading capsular flap into an optimal direction and position.

If the pupil is small or the iris is floppy and the surgeon decides that iris hooks or pupil rings need to be used, it is easier to insert these devices before commencing the rhexis.

Capsular Staining

If the lens is hypermature or white, a surgeon may want to use a capsular staining dye to guarantee visibility of the anterior capsule during the procedure. Out of the many staining techniques described,[3] I prefer to use trypan blue in a small aliquot painted directly onto the anterior capsule underneath some viscoelastic. Also, if there appears to be any positive pressure produced by the contents of a hypermature lens, it is beneficial to

(Continued on page 10)

"It is necessary to be certain that the anterior chamber is completely filled with viscoelastic, either dispersive or cohesive, before performing the rhexis."

SOURCE

Dry Eye and Refractive Surgery

Some of the causes and options for treatment.

BY RICHARD W. YEE, MD

Success in refractive surgery depends on diagnosing dry eye disease and optimizing the ocular surface both pre- and postoperatively. You must therefore have a firm grasp of ocular anatomy and knowledge of the options for treatment.

THE CORNEAL EPITHELIUM

Produced by the corneal epithelial surface cells, glycocalyx help mucin adhere to the corneal surface, which naturally repels water. Damage to the glycocalyx and corneal epithelial cells therefore results in insufficient mucin, which, in turn, destabilizes and breaks apart the tear film before the eye can blink. Epithelial damage can also result from the increased evaporation of tears or the decreased production of the aqueous component of the tear film, both of which cause increases in osmolarity. Evaporation or the improper spreading of tears leads to the direct exposure of ocular surface cells to external insults, which may lead to their death and damage to the ocular surface.

THE BLINK

Humans blink between eight and 20 times per minute (see *Asian Eyes*), with approximately 7.5 seconds elapsing between blinks. During the blink, the muscles around the meibomian gland contract, causing it to secrete oil. Blinking spreads this mixture of oily and aqueous secretions across the ocular surface. This lubrication is highly important to wound healing and the prevention of haze after refractive surgery.

When patients present with problems related to the ocular surface or haze after refractive surgery, I often find that they have been spending long periods using a computer. The rate at which people blink decreases by more than 60% when they stare at a computer screen.[1] The resultant desiccation of the ocular surface leads to haze and the transcriptional upregulation of cytokines. This may also account for the rarer but very significant late-onset haze. When addressing postoperative problems with the ocular surface, particularly haze, therefore, take environmental factors into account. For example, 3 months after undergoing LASEK to treat -10.00 D of myopia, a patient presented with the aggressive onset of 3+ haze. I asked about his recent activities. I learned that this cycling enthusiast was riding his bike without ocular protection. I aggressively optimized his ocular surface with some of the treatments described later and instructed him to wear isolation goggles (ie, microenvironment glasses), plugged the punctum, and prescribed aggressive steroids. The haze and associated refractive regression resolved completely, and the patient maintained his 20/20 vision.

Figure 1. The inflammatory cascade.

TEAR FILM BREAKUP TIME

You must carefully evaluate the tear film breakup time in candidates for refractive laser surgery. A tear film breakup time of at least 7 seconds ensures that the ocular surface is healthy enough to survive the surgery and ensures proper healing.

One of my preferred treatments for eyes with an abnormal tear film breakup time is sodium hyaluronate and HP-Guar. These substances are similar to the glycocalyx. I find that they stay on the cornea between blinks, yet shearing force causes them to liquefy, which allows them to facilitate the spreading of the tear film. Studies have shown that, compared with methylcellulose products, sodium hyaluronate increases tear film breakup time and may even improve epithelial wound healing.[2,3]

INFLAMMATION

Regardless of the source of dry eye disease, all affected patients have an abnormal tear film or abnormal tear function. These problems lead to reduced tear clearance, increased osmolarity, irritation of the ocular surface, and the infiltration and production of proinflammatory cytokines. The end result is inflammation.

Once inflammation starts, damage can occur to ocular structures that will perpetuate and intensify a cycle of signs and symptoms (Figure 1).

BENZALKONIUM CHLORIDE

Used to prevent the microbial contamination of multidose containers and to enhance the corneal penetration of certain drugs, benzalkonium chloride (BAK) has little effect on a healthy ocular surface. With chronic, long-term exposure or in the setting of dry eye, however, BAK lessens the integrity of epithelial cells, increases the number of conjunctival inflammatory cells,[4] causes a loss of goblet cells,[4] reduces tear function,[5] and decreases the tear film breakup time.[5]

When patients present with dry eye disease, determine whether they are using any medications preserved with BAK. If so, you may wish to switch them to a BAK-free alternative, if one is available.

TOPICAL CYCLOSPORINE A

Topical treatment with the immunomodulatory agent cyclosporine A inhibits T-cell–mediated ocular inflammation in dry eye disease, and I have seen this to be a very good treatment for patients with meibomian gland dysfunction. You can systematically assess for this condition through a detailed examination of the ocular surface. Check the orifices of the meibomian gland for fine sprigs of vascularity. Invert the eyelid with a cotton-tipped applicator to express meibum to grade flow. Lastly, observe the quality of meibum, ranging from clear to toothpaste-like. If the patient presents a combination of neovascularity, obstructed flow, and cloudy meibum, proceed with treatments for meibomian gland dysfunction.

Cyclosporine was well tolerated in clinical trials.[6] In my own evaluations, I have found that cyclosporine produced a statistically significantly greater improvement in the quality of meibomian gland secretions and a statistically significantly greater decrease in lissamine green staining compared with artificial tears. This approach helps both the aqueous and lipid components during the period of wound healing and remodeling after surface ablation.

ANTERIOR BLEPHARITIS

Posterior blepharitis is a general term for inflammation of the posterior lid segment, and this condition is often related to anterior blepharitis, inflammation of the anterior lid margin. Inflammation on the outer half of the eyelid is mostly bacterial in origin, described as seborrheic and *Staphylococcus* depending on the organisms involved. Seborrheic blepharitis is the more common of the two; it manifests as cylindrical dandruff at the base of the eyelid. The cause of this condition is *Demodex folliculorum*, a mite that is part of the arachnid family. The *Demodex* is also responsible for rosacea. Thus, physicians

ASIAN EYES

Comparative studies have shown that the ocular surface of Asian eyes differs from that of whites.[1] It seems that Asian eyelid anatomy predisposes this subset of patients to having an abnormal tear film. For example, the average tear film breakup time was 8 seconds in the Hong Kong Chinese compared with 11 to 15 seconds in whites. Asians also had lower blink rates, a higher frequency of incomplete blinking, a lower tear volume, and a greater incidence of inferior staining signifying post-LASIK dry eye.

These findings suggest that there may be other differences in treatment effects. A closer look should be taken to find other anomalies between ethnicities that might direct the type of refractive surgeries that would be optimal for the health of the ocular surface. Surgeons should approach surface ablation with special consideration of the ocular surface and environment in order to meet the needs of their diverse patients.

1. Albietz JM, Lenton LM, McLennan SG. Dry eye after LASIK: comparison of outcomes for Asian and Caucasian eyes. *Clin Exp Optom.* 2005;88(2):89-96.

of patients suffering from rosacea should take the time to check their eyelids for dandruff. *Staphylococcus* blepharitis flares up due to a hypersensitivity to the bacteria *Staphylococcus aureus*. Although blepharitis is not a severe disease, it should be taken seriously because of the irritating symptoms associated with the problem.

ALTERNATIVE TREATMENTS

Several effective treatment options for dry eye target local inflammatory processes. Topical corticosteroids such as loteprednol etabonate ophthalmic suspension and prednisolone acetate are effective anti-inflammatory agents. Dry eye disease is chronic, however, and the toxicity of corticosteroids limits their potential for long-term use.

Researchers are studying antibiotics such as azithromycin ophthalmic solution 1% and tetracycline for the reduction of the inflammatory processes associated with microbial colonization in dry eye disease.[7] Although antibiotics may be used long term, concerns about these agents include possible phototoxic reactions and increasing bacterial resistance. Also under investigation as possible dry eye therapies are omega-3 fatty acids, flaxseed oil, tea tree oil for anterior *Demodex*-related blepharitis, and autologous serum (used postoperatively during wound healing and in cases of very severe dry eye and nonhealing epithelial defects). Hydroxypropyl methylcellulose eyelid inserts are also helpful in situations when the patient cannot produce enough surface-protective components.

Isolation techniques are critical to the understanding and prevention of acute and late-onset haze. Goggles, wraparound sunglasses, and microenvironment glasses can protect the compromised ocular surface after laser surgery and reduce the cytokines stimulated by the constant desiccation from environmental factors such as wind turbulence from cycling or dry eyes related to chronic staring at a computer screen.

These additional treatment alternatives are important to consider, because it is very important to optimize all aspects of the ocular surface during the 4- to 6-week period of wound healing and surface remodeling that is critical to maximizing visual outcomes following laser refractive surgery. ■

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(Continued from page 7)

decompress the lens with a 25-gauge needle inserted into the anterior capsule prior to beginning a CCC in order to avoid the Argentinean flag sign (ie, capsule tearing centrally end to end).[4] In this case, surgeons can also tamponade the capsule with sodium hyaluronate 2.3%.

> "For capsular staining, I prefer to use trypan blue in a small aliquot painted directly onto the anterior capsule underneath some viscoelastic."

CONCLUSION

The key to avoiding a rhexis tear is to recognize and avoid running into problems and to use an armamentarium of techniques and technologies available to make performing a capsulorhexis a success. If one follows the steps reviewed previously, you should be able to avoid or effectively deal with any potential problems during CCC. ■

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CME QUESTIONS

1. A 20.00 D IOL that is axially displaced by 0.5 mm from the predicted effective lens position will result in what amount of postoperative refractive error?
a. 1.00 D
b. 1.25 D
c. 0.50 D
d. 2.00 D

2. Refractive error is directly proportional to the power of the implanted IOL.
a. True
b. False

3. The size of the anterior segment is unrelated to the axial length in 80% of cases pertaining to what type of eyes?
a. axial lengths longer than 21 mm
b. axial lengths shorter than 21 mm
c. axial lengths longer than 22 mm
d. axial lengths shorter than 22 mm

4. Main capsulorhexis incisions should be shorter in longer eyes and longer in shorter eyes by approximately how much?
a. 1 mm
b. 2 mm
c. 3 mm
d. 4 mm

5. When forming the capsulorhexis, how frequently should the surgeon grasp the edge?
a. at least every 90°
b. at least every 80°
c. at least every 70°
d. at least every 60°

6. What is the critical postoperative period of wound healing and surface remodeling after refractive surgery?
a. 1 to 3 weeks
b. 3 to 5 weeks
c. 4 to 6 weeks
d. 5 to 7 weeks

7. What duration of tear film breakup time ensures that the cornea is healthy enough for surgery?
a. 3 seconds
b. 5 seconds
c. 7 seconds
d. 10 seconds

8. Which product has shown improvements in tear film breakup time and even epithelial wound healing in studies?
a. methylcellulose products
b. sodium hyaluronate

9. According to a study published in *Clinical and Experimental Optometry*, what was the average tear breakup time in Asian eyes?
a. 5 seconds
b. 6 seconds
c. 7 seconds
d. 8 seconds

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