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IOLs and the Pediatric Cataract

A renowned surgeon panel shares its techniques for congenital cataracts.

IOLs and the Pediatric Cataract

Surgeon Panel:

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Lens Designs and the Pediatric Cataract

Explore the benefits of using Rayner's line of IOLs in this patient population.

BY CHARLES CLAOUÉ, MA(CANTAB), MD, DO, FRCS, FRCOPHTH, FEBO, MAE

Rayner Intraocular Lenses Ltd. (East Sussex, United Kingdom) is credited with designing, producing, and manufacturing the first effective IOL. More than 60 years after Sir Harold Ridley implanted Rayner's original lens design in the human eye, the company continues to act as a driving force behind innovative lens designs, expanding its product line to include two lens platforms and various optic designs. This supplement will focus on the available lens designs and explore how each can be used in pediatric cataract surgery.

I have extensive experience with both of Rayner's lens platforms, the first of which is designed for capsular fixation and includes monofocal (C-Flex and Superflex), multifocal (M-Flex), toric (T-Flex), and multifocal toric (M-Flex T) optic designs. Each lens is also available with an aspheric optic. The Superflex and C-Flex are similar, but the Superflex features a larger optic and a longer overall length.

The second platform that Rayner has produced is for sulcus fixation. Like the lenses in the capsular fixation platform, this supplementary lens, the Sulcoflex, is also available with an aspheric, multifocal, or toric optic. This lens is designed to correct residual refractive errors without inducing the additional trauma and surgical risk associated with IOL exchange. What is unique about this supplementary lens platform is that, because it is not implanted in the capsular bag, it decreases the amount of contact between the two IOLs and thereby minimizes the induction of refractive errors and optical aberrations.

The beauty of these two platforms is that every lens can be implanted with the same single-use disposable injector. In Europe, this is the Raysert injector, which allows the surgeon to implant the lens through a sub–2-mm incision.

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CAPSULAR FIXATION PLATFORM

All of Rayner's capsular-fixated lenses have a closed-loop haptics design that provides good lens centration. Rayner calls this technology *anti-vaulting haptics*. There is very good evidence that these lenses center extremely well and extremely predictably. Another byproduct of the anti-vaulting haptics design is good rotational stability, making this platform a good choice for toric correction.

Most modern one-piece lens designs are weak at the haptic-optic junction, thereby leaving an incomplete barrier to posterior capsular opacification (PCO). But with Rayner's capsular-fixated lenses, incorporation of the Amon-Apple Enhanced Square edge reduces PCO by creating a 360º square edge to act as a physical barrier to cell migration.

SULCUS FIXATION PLATFORM

Ophthalmologists have been implanting IOLs in the sulcus for many years, but the problem is that historically the lens designs were meant for in-the-bag fixation. When using an in-the-bag lens design in the sulcus, the square edge may rub the posterior surface of the iris, causing pigment dispersion and possibly resulting in secondary open-angle glaucoma. There have also been problems using lenses designed for capsular fixation in the sulcus because they are made of materials that are too springy and therefore erode into the soft ciliary body.

Piggybacking two capsular-fixation lenses causes lens touch and produces deformation and hyperopic defocus. In contrast, the Sulcoflex, which is the brainchild of Michael Amon, MD, of Vienna, has a concave posterior surface to the optic. Therefore, there is no optic-optic touch and no hyperopic defocus. The Sulcoflex's rounded edge prevents trauma to the iris tissue. Additionally, being made of Rayner's soft hydrophilic acrylic, there are no reports of it eroding into the ciliary body.

CHOOSING THE PROPER LENS

I have always followed the same simple guidelines to facilitate choosing the proper IOL based on a patient's needs. First, I discuss the array of possible optical outcomes and ask the patient what he or she wants to achieve after surgery. For instance, if the patient is not comfortable using reading glasses, then I am more apt to pick a multifocal lens.

Second, I always examine the patient's eye. If there is significant corneal astigmatism, I ask the patient to consider a toric lens. With the Rayner platform, I can offer the patient a wide variety of lenses, including a multifocal toric. It is a very friendly series of lenses to implant.

But what if the eye is already pseudophakic and the patient is not happy with the optical result? We have all seen patients like this—patients who had a monofocal IOL implanted years ago but want to see like their friend who has a multifocal IOL and can read without glasses. The beauty is that now I can implant the Sulcoflex multifocal IOL without touching the old capsular-fixated lens in these patients. This is a very safe procedure. I can also treat other patients' refractive surprises and residual astigmatism in the same way.

PEDIATRIC CATARACT SURGERY

Within the following pages, four surgeons well versed in the art of pediatric cataract surgery share their considerations for choosing the appropriate lens design in the young eye. Although I do not perform cataract surgery in children, I am particularly interested to learn more about using the Sulcoflex in this population.

Because refractive error changes as the eye grows, pediatric cataract surgeons have the conflicting demands of making the eye see well in the amblyogenic period as well as once the eye is fully grown. However, if the surgeon chooses an IOL power that makes the eye emmetropic in childhood, the eye eventually becomes myopic. The Sulcoflex is a unique solution, because it can be used in a secondary procedure to correct the myopia or it can be used as a piggyback lens in the primary procedure to create emmetropia.

CONCLUSION

Rayner's extensive line of advanced IOL designs compliments the surgical techniques we use today and provides our patients with superb visual outcomes after surgery. Whether these lenses are implanted in adults or children, the procedure is safe and effective and the final result is nothing less than spectacular. Even in cases with stubborn residual refractive error, we can now implant the Sulcoflex as a supplementary IOL to avoid inducing additional surgical trauma and to keep our patients happy. ■

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Two Sides to Every Story

IOL or contact lens for congenital cataract?

BY M. EDWARD WILSON, MD

Regardless of how far IOL designs have come in the past few decades, their use in infants with congenital cataracts is still controversial. An IOL replicates the optics of the crystalline lens better than contact lenses; however, implantation may also trigger further complications such as secondary opacification of the visual axis or papillary membranes.

As an investigator for the Infant Aphakia Treatment Study Group (IATS),[1] a US National Eye Institute initiative to determine visual results following unilateral congenital cataract surgery with and without lens implantation, I have treated a lot of pediatric cases and can understand both arguments. Contact lenses may be beneficial in young eyes because of their dynamic refraction and tendency toward myopic shift as they grow, but contact lenses can be difficult to fit and are lost frequently. IOLs, on the other hand, provide partial if not full correction constantly but glasses are often needed for residual refractive error and the IOL may have to be exchanged as the eye's refraction changes. The search for the best treatment is fueled by the fact that, in unilateral cataracts with standard contact lens use, approximately 66% of infants historically have remained 6/60 or worse in the aphakic eye.[2]

Figure 1. The C-Flex is designed for capsular fixation.

PROCEED WITH CAUTION

In short, I have prescribed contact lenses in children, but I have also implanted IOLs with promising results. My best piece of advice to those surgeons interested in implanting lenses in infants is to be cautious until the 5-year visual results from IATS are available. I am impressed with the C-Flex (Rayner Intraocular Lenses Ltd., East Sussex, United Kingdom; Figure 1), and in a cautious manner have begun to implant these lenses in infants as young as 12 months old.

Although the C-Flex is not yet my primary lens for congenital cataracts, I am gaining more confidence every time I implant it. There are a couple of things I am watching in my small sample size of 21 eyes (14 primary and seven secondary implantations). First, in the secondary implantations, I am looking for signs of pigment dispersion and iris chaffing. Because I have not seen any signs in the first few months after implantation, I am now more comfortable implanting the C-Flex into the ciliary sulcus. Second, I am evaluating its use in older children (6 years and above) in whom I have left the posterior capsule intact. I think that this lens design, with its rigid 360° square edge, is impressive and should delay or reduce the posterior capsular opacification (PCO) rate in children. My follow-up is not yet long enough, but if results show a delayed or reduced PCO rate, then the C-Flex may evolve into my primary lens choice.

In my experience, the C-Flex seems to be a favorable lens design for toddlers. Thus far, I have noticed that it causes little inflammation and a low rate of synechia.

SECONDARY IMPLANTATION PROCEDURE

The big plus for me is that the C-Flex appears to be suitable for sulcus fixation, whereas the one-piece hydrophobic lens that I use is only designed for in-the-bag implantation. My typical secondary implantation technique is described below.

The primary cataract surgery procedure consists of phacoaspiration, creation of a posterior capsulorrhexis, and vitrectomy. I then prescribe a contact lens and wait for the eye to get bigger before implanting the IOL. During the second procedure, I reopen and debulk Soemmering's ring, the donut-shaped capsule remnant. At that point, I look to see if the new anterior capsular edge is visible for 360° and decide if I can get the haptics underneath that edge. I always intend to implant the lens in the bag, but if I can't see the edge, I may choose to put the lens anterior to the debulked anterior capsule rather than posterior to it. I used to need two different lens styles ready, because once I made that decision—in the bag or in the sulcus—then I would have a nurse open up the right box. With the C-Flex, I don't have to do that because the same lens is appropriate for either application.

LENS ATTRIBUTES

One nice thing about the C-Flex is that it works well in the capsular bag as well as in the ciliary sulcus. I prefer to

QUESTION AND ANSWER WITH M. EDWARD WILSON, MD

Claoué: *Professor Wilson, do you have any experience with piggyback IOL implantation in children?*

Wilson: I have been using piggyback IOLs in children in select cases since the mid-1990s. I reported on 13 cases in a published discussion in 1999,[1] and then an article in 2001.[2] The term I used in both articles was *temporary polypseudophakia*, since I was putting a permanent IOL in the capsular bag and a temporary one in the ciliary sulcus. I could then achieve emmetropia immediately after surgery and manage to slowly increase myopia rather than slowly decrease hyperopia as the eye grew. I still use that approach when needed, often in unilateral cases when I suspect that compliance with glasses or contact lenses would be poor. I have also done piggyback secondary IOLs in microphthalmic eyes, either bag-sulcus or sulcus-sulcus. I do not recommend bag-bag piggyback implantation in children because of the risk of interlenticular opacification.

Claoué: *How do you do biometry in pediatric cases?*

Wilson: In young children, I do keratometry measurements with a handheld keratometer and then perform immersion A-scan ultrasound globe axial length measurements in the operating room after the child is asleep. I use a customized lens constant and the Holladay formula to calculate IOL power. I keep a large consignment of IOLs in the operating room to choose from. In older children, I perform biometry while they are awake, either with the immersion A-scan or the IOLMaster (Carl Zeiss Meditec, Jena, Germany).

Claoué: *Do you have any comments on the use of multifocal IOLs in pediatric eyes?*

Wilson: Multifocal IOLs are not commonly used in children because the eye is still growing, even in the second decade of life.[3] I discuss the use of multifocals with teenage children and their families, and the few I have implanted have done reasonably well. However, the multifocal technology does not work well when the eye grows and the refraction becomes myopic. Ironically, I have seen myopic children become more spectacle dependant with a multifocal IOL than they would be with a monofocal IOL. Many of our pseudophakic children become mild to moderate myopes with time, and many function well without glasses. As a mild to moderate myope, these same children (if implanted with a multifocal) would have multiple images—not on the retina—and may be wearing their myopic glasses more often (ironically).

As the eye completes its growth, some patients may choose multifocal IOLs, and LASIK can be performed for residual myopia if needed. The key for me is that I do not promise spectacle independence when discussing the use of multifocal IOLs, and I make sure the parents know that the benefits for their child may not be worth the extra out-of-pocket expense required when these multifocal lenses are chosen.

1. *J Ped Ophthl Strab.* 1999;36:281-286.
2. *J Am Assn Ped Ophthalmol Strab.* 2001;5:238-245.
3. Wilson ME, Trivedi RH, Burger BM. Eye growth in the second decade of life: Implications for the implantation of multifocal intraocular lenses. *Trans Am Ophthl Soc.* 2009;107:120-126.

place the lens in the bag, and because of the haptic-optic design, it conforms well to any size capsular bag. However, it is nice to know that I can place the lens in the sulcus if I needed to dissect the capsular remnant during the secondary implant procedure.

Another positive attribute is the lens material of the C-Flex. It is not tacky like some hydrophobic acrylic lenses are. When performing a posterior capsulotomy, the lens does not stick to the rhexis, making creation of the posterior capsule opening much easier.

Lastly, I like the way the inserter works. The nurses find that it is simpler to place this lens in the inserter compared with others. They have an easier time learning how to load the lens in the inserter, and I have noticed that it injects very easily through a corneal tunnel.

CONCLUSION

Lens designs have evolved, and along with it so has the treatment of congenital cataracts. I look forward to trying the C-Flex design in a toric implant, which is already available in Europe, and I look forward to the arrival, in the United States, of the iris-claw lens in aphakic powers. The latter is a good alternative for children who lack capsular support. I am encouraged by my recent results with the C-Flex in these young eyes but will continue to proceed with caution, as this lens is likely to stay in the eye for many more years than in the elderly adult. ■

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1. Infant Aphakia Treatment Study Group. A randomized clinical trial comparing contact lens with intraocular lens correction of monocular aphakia during infancy: Grating acuity and adverse events at age 1 year. *Arch Ophthalmol.* 2010;128(7): doi:10.1001/archophthalmol.2010.101.
2. EIVI-FPG Child Development Institute Web site. Visual Conditions and Functional Vision: Early Intervention Issues. http://www.fpg.unc.edu/~edin/Resources/modules/vcm/3/session_files/session_content/VCM3_SessionNotes.pdf. Accessed June 23, 2011.

Duet Implantation With the Sulcoflex

Adhere to a strict protocol for pediatric cases.

BY MICHAEL AMON, MD

Cataract surgery is the most common intraocular procedure performed today, with the majority of cases occurring in adults. Although no two cataracts are identical, it is typical for a surgeon to use a similar—if not the same—protocol for most cases. When confronted with a pediatric cataract, however, this protocol must be replaced with a process that is more suitable for the young eye. For me, this includes using *Duet Implantation*, a term we coined to describe a single surgical procedure combining primary capsular bag lens implantation with supplementary sulcus placement of the Sulcoflex (Rayner Intraocular Lenses Ltd., East Sussex, United Kingdom; Figure 1A).

When choosing an IOL design for a pediatric cataract, the largest factor is the child's age. In children under the age of 1 year old, I perform cataract surgery with a posterior capsulorrhexis, an anterior vitrectomy, and a peripheral iridectomy. I typically do not implant an IOL at that age. In children older than 1 year, I follow the same process but add in-the-bag lens implantation. When only one IOL is implanted in the capsular bag, the postoperative target is emmetropia. However, as the eye grows during the aging process, it becomes myopic. In order to avoid this myopic shift, I have started to use Duet Implantation with a conventional lens and the Sulcoflex (Figure 1B). I only have four cases, but I am very strict with the indications for this procedure.

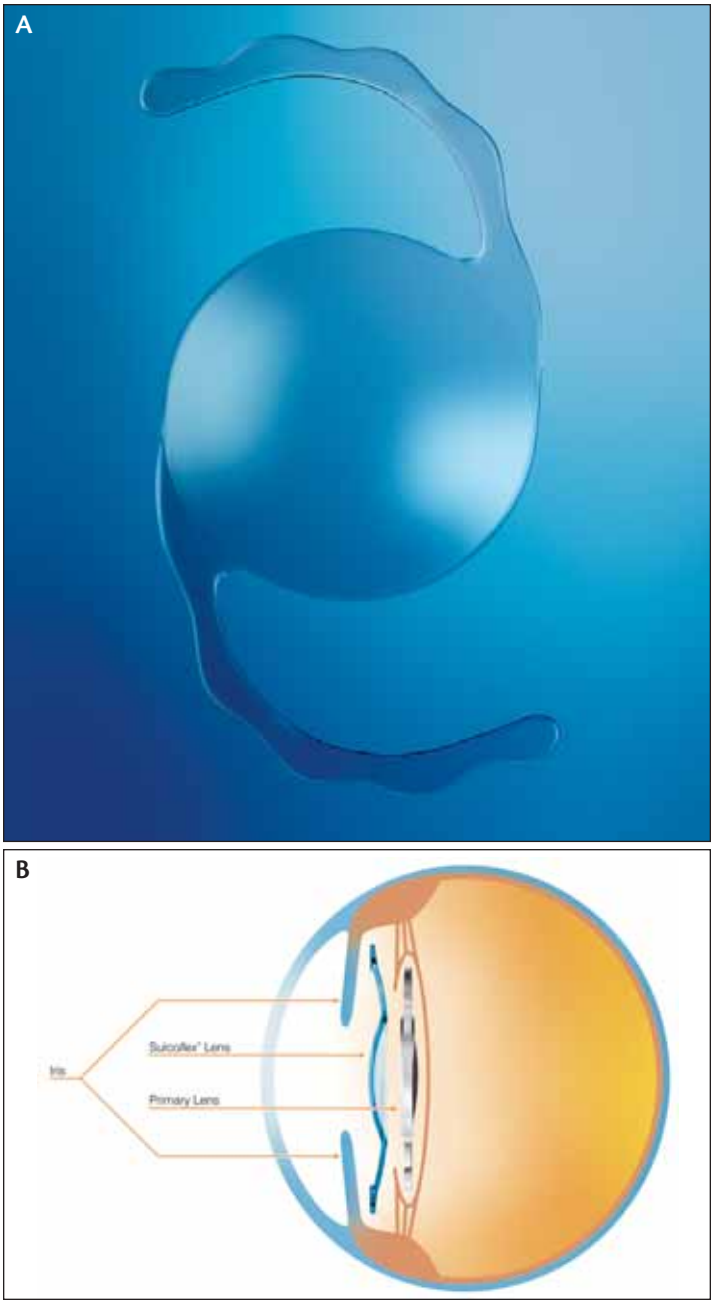

Figure 1. (A) The Sulcoflex. (B) This lens can be used for Duet Implantation.

IMPLANTATION PROTOCOLS

I use a strict protocol when implanting the Sulcoflex in pediatric cases. First, the child must be between the ages of 1 and 5 years old. Second, a peripheral iridectomy is mandatory. Third, because most children with a congenital cataract have amblyopia, follow-up must include amblyopia therapy so that

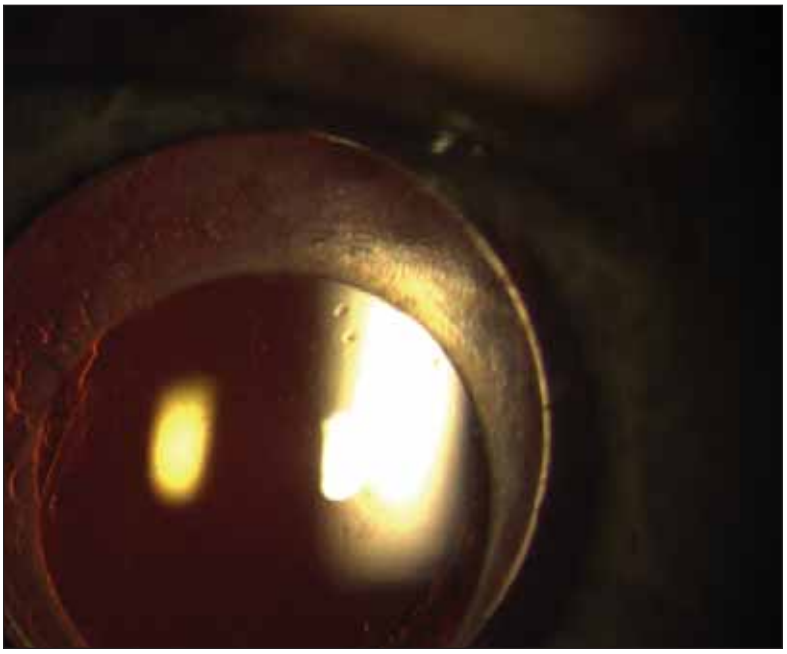

Figure 2. At 3 months postoperative, the primary IOL has signs of anterior capsular opacification with two foreign-body cells. The Sulcoflex is clear, and there are no signs of cellular reaction.

the eye has the best possible chance to grow correctly. Fourth, it is best to perform surgery as early as possible when you find a cataract in a pediatric patient, because the earlier the cataract exists, the more severe the amblyopia will be. There are two implantation strategies, which are described below.

Duet Implantation. The power of the first lens is calculated to make the child emmetropic once the eye is full-grown. I usually use the AcrySof (Alcon Laboratories, Inc., Fort Worth, Texas), implanting it in the capsular bag. The Sulcoflex is then implanted in the sulcus, on top of the conventional lens, to provide an opportunity for the child to reach emmetropia immediately after surgery. This procedure is beneficial because it allows the child to have a good refraction right after surgery and when the eye grows.

As the eye grows and becomes more myopic, the aim is to keep the refraction stable. This can be achieved in one of two ways: we can explant the Sulcoflex or exchange it for another lens. Although Duet Implantation is very new and not yet the gold standard of care in the pediatric population, so far in our experience it has overcome the problem of myopic shift in the growing eye of children.

To date, I have performed Duet Implantation in four children. In each case, the eye tolerated the lens nicely, with good refractive results (Figure 2). My first case was a 2-year-old boy with a unilateral cataract. Over the past 1.5 years, his eye developed quite nicely. The good eye can be occluded, his refraction is almost emmetropic (the result I wanted to achieve), and his vision is adequate. It has been a promising result.

Secondary implantation. The other option is to implant the Sulcoflex as a secondary procedure; however I typically use this approach in adults.

To date, I have performed approximately 80 secondary implantations in adults. In this approach, a con-

QUESTION AND ANSWER WITH MICHAEL AMON, MD

Claoué: *Professor Amon, do you always recommend peripheral iridectomy (PI) for a Duet Implantation procedure? If not, how do you decide when it is necessary?*

Amon: For Duet Implantation procedures, I will perform a PI in children, in very short eyes, and in odd eyes. I will also perform a PI in these same cases if I plan on implanting the Sulcoflex in a secondary implantation procedure.

Claoué: *Children spend a great deal of time on near vision tasks. Is there now an argument for making them myopic to minimize amblyopia since their refraction can be changed so easily by removing the Sulcoflex at a later date?*

Amon: Because this is a reversible procedure, the surgeon can try to make the eye myopic. However, this depends on the individual situation.

Claoué: *You comment on the biocompatibility of hydrophilic acrylic lens material. Do you believe that the capsular-supported IOL should also be made of the same material, and if not what is the logic of your choice?*

Amon: For sulcus placement, the hydrophilic material is of utmost importance. It is not as crucial for a lens that is designed for capsular bag implantation, and therefore such designs can be made from a different material.

ventional lens is implanted to make the patient emmetropic at the time of surgery. With careful observation and as the eye grows and becomes more myopic, the Sulcoflex is used as a secondary intervention, implanted on top of the original lens to compensate for the child's dynamic refraction. The advantage of waiting to implant the Sulcoflex is to see how the child's eye develops.

CONSIDERATIONS

When choosing to implant an IOL for the treatment of congenital cataract, I consider the following:

Lens material. The eyes of children experience more inflammation after surgery, and therefore I prefer a lens with good uveal biocompatibility. Hydrophilic acrylic material, which is what the Sulcoflex is made of, is well accepted in the uveal area. As the lens is implanted in the sulcus, it comes in contact with uveal tissue as well as the capsular bag.

Haptics. The haptics should be soft and gentle to avoid erosion into the ciliary body.

Optics. A round optic will prevent iris chafing and pigment dispersion, as will the posterior angulation of the haptics.

Spacing. Whenever possible, the lens should not touch the iris. I have also noticed a nice distance between the iris and the lens of the Sulcoflex, which is enough to avoid pigment dispersion.

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CONCLUSION

Pediatric cataracts are challenging, even for the most experienced surgeons. However, with aid of the Sulcoflex these cases have become a little easier to manage. As my experience with this lens grows, I believe that I will more often choose Duet Implantation to provide the growing eye with a stable emmetropic refraction. ■

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Correcting Dynamic Refractive Error With the Sulcoflex

This lens provides a solution for refraction changes as a child's eye grows.

BY WILLIAM F. ASTLE, MD, FRCSC

The incidence of congenital cataract varies by region, and although a large number of cases occur in the developing world, approximately 30 in 100,000 babies born each year in the developed world will have a cataract.[1] I have experience treating congenital cataracts in both settings, first for 4.5 years in Saudi Arabia, where the incidence of congenital cataract was rampant due to genetic issues, and now in Canada, where I typically see 30 to 40 cases per year.

Even with the various options in lens designs today, many surgeons remove the congenital cataract and prescribe contact lenses or glasses to avoid IOL implantation. However, as many as 60% of these cases develop glaucoma, which is like trading one major ocular problem for another.[2,3] I started implanting IOLs in pediatric cases in the 1980s when working in Saudi Arabia, as it was impractical to have the child wear contact lenses in the desert, and glasses did not work for a monocular cataract. Despite bigger incisions and older lens styles, our patients had good outcomes. What I continually noticed is that the eyes we implanted with an IOL did not develop glaucoma and seemed to have less myopic shift, fewer refractive surprises, and better optical outcomes.

Today I continue to implant IOLs in congenital cataract patients, and with newer lens designs this practice has only gotten easier and more precise. I still do not have the ability to accurately predict the refractive changes of a growing eye in all situations, but I do have the ability to better correct the refractive errors when they occur by implanting the Sulcoflex (Rayner Intraocular Lenses Ltd., East Sussex, United Kingdom).

CASE STUDIES

The Sulcoflex is not yet approved in Canada; however, I have been able to implant this lens with Health Canada approval for compassionate use.

Case No. 1. In November 2007, I performed cataract surgery in the right eye of an 8-week-old girl, implanting a +29.00 D Sofport Posterior Chamber IOL (LI60AO; Bausch + Lomb, Rochester, New York) and achieving a target refraction of +8.00 D. By January 2008, her refraction shifted to +6.00 D, but by December 2010, her refraction was -7.00 D—totalling a 15.00 D shift over 3 years. The patient's eye was quiet, and the visual axis was clear, but amblyopia treatment was not working even though we were being aggressive. I do not recommend contact lenses in these cases because children tend to be noncompliant, but I did consider laser therapy. Had it not been for obtaining compassionate use of the Sulcoflex, I would have lasered the eye.

In February 2011, I implanted the Sulcoflex and performed a membranectomy and peripheral iridotomy to ensure proper aqueous flow (Figure 1). The patient's refraction went from -7.00 to +1.00 D, which is now balanced with the other eye. At each follow-up, I have made sure that there is no damage to the iris and no signs of iris atrophy or shift. The nice thing about the Sulcoflex is that it is vaulted, avoiding interface change between the two lenses. However, at each visit I also look for any membrane formation or inflammation between the two IOLs as well as warning signs of open-angle glaucoma closure. Because the eye has progressed nicely, we reintroduced amblyopia therapy. The patient has slight strabismus, but we would like to optimize her

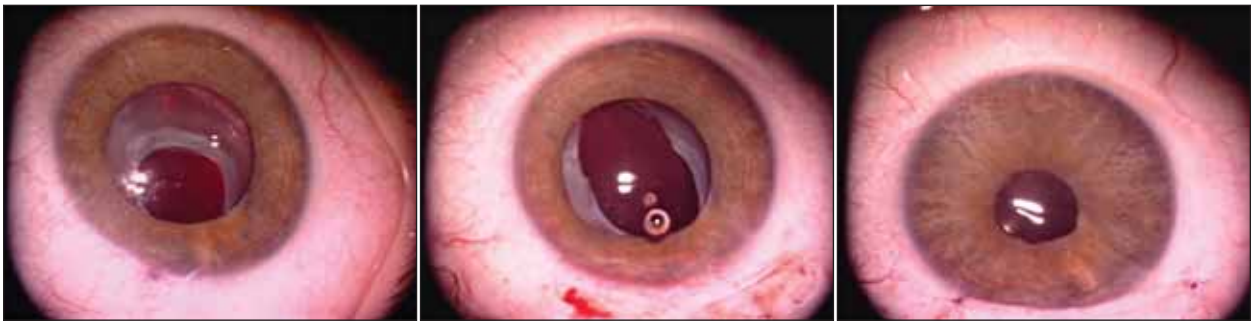

Figure 1. Case No. 1: (Left) Preoperative image of a pseudophakic eye with a secondary membrane. (Middle) The eye after the membranectomy. (Right) The eye after injection of the Sulcoflex.

QUESTION AND ANSWER WITH WILLIAM F. ASTLE, MD, FRCSC

Claoué: *Professor Astle, do you perform an iridotomy for Sulcoflex implantation?*

Astle: At this stage of my surgical experience with Sulcoflex lenses, I have performed iridotomies on both patients to avoid a potential pupillary block. Experience may prove that this is not necessary, but the procedure is straightforward and makes sense to avoid that particular complication.

Claoué: *You are well known for the use of the excimer laser for modulating refraction in children. Do you see the Sulcoflex as a complimentary or competitive technology?*

Astle: I see the Sulcoflex lens as complimentary rather than competitive. It gives the surgeon options for treatment, and this can then be discussed with parents to help them decide how to proceed. In older pseudophakic children I think the Sulcoflex has distinct advantages over laser refractive surgery, because the surgeon can not only adjust for any refractive error present but also multifocal ability can be added at the same time, thus potentially eliminating the need for reading glasses or bifocals.

Claoué: *You suggest a multifocal implant in a 17-year-old. Do you think your threshold for a multifocal will drift down?*

Astle: Yes, and in fact it already has. I have had a few children present to our clinic in an aphakic condition, becoming intolerant to contact lenses in their early teens. As most of these children were amblyopic to some extent, they already had some decrease in contrast sensitivity. I performed secondary multifocal implants with great success in all cases, improving vision, fusion, and near reading ability. Complaints of blurring and decreased contrast sensitivity have not been made.

Another 12-year-old child, a cancer survivor treated with total body irradiation for leukemia, did extremely well with bilateral multifocal IOLs after developing radiation posterior subcapsular cataracts bilaterally. Her vision improved to 20/20, and she could read comfortably without the need for bifocals or reading glasses. In younger children, it is more difficult to say with our present multifocal technology whether theses IOLs can be used effectively, as these eyes experience a larger myopic shift. However, as multifocal IOLs design continues to improve, our threshold for age at implant with a multifocal IOL will continue to drift down.

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vision before proceeding with surgery.

Case No. 2. At the other end of the spectrum, the Sulcoflex can compensate for the dynamic refraction of eyes that previously underwent congenital cataract surgery. For instance, I recently implanted the Sulcoflex Multifocal in an adolescent who underwent successful cataract surgery at age 4 years. At age 17, his BCVA was 20/60, with some residual amblyopia. Over time he became myopic and started experiencing blurry vision and other aniseikonia symptoms related to his anisometropia. Because his eye is probably not going to shift much anymore, I piggybacked a Sulcoflex Multifocal to correct the myopia and the anisometropia plus provide the bonus of getting his eyes to work together better at near without the need for standard readers.

I performed secondary surgery in June 2011. At the day 1 postoperative visit, the eye was quiet and the patient's vision was 20/80, which should continue to improve with healing. He already noted a distinct improvement in his peripheral vision, and the blurring he experienced preoperatively is already gone. His ability to read should improve with his implanted multifocal piggyback IOL.

LOOKING FORWARD

As present lens designs continue to improve, we will enjoy more success in rehabilitating vision in pediatric cases. I anticipate implanting the Sulcoflex more often as the children I have previously treated get older and their refraction shifts. Even though this lens is designed for the adult eye, it is still an attractive option for pediatric cases. I think where the adult implant world is headed with smaller incisions also lends itself well in the pediatric world, because overall the smaller the incision the better it is for the young eye. Although my experience with the Sulcoflex is limited to two cases, I am pleased with the progress both eyes have made. ■

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Pediatric Implantation of a Large-Optic IOL

The larger optic accommodates active pupil movement.

BY JAMAL BLEIK, MD, MSc, FRCS(Ed), FRCOphth

I have been using Rayner's line of IOLs (Rayner Intraocular Lenses Ltd., East Sussex, United Kingdom) in children for approximately 10 years. My early experience was with the C-Flex, but then I switched to the Superflex. Going from a 5.75- to a 6.25-mm optic was a logical choice, because the larger optic diameter not only better accommodates the more active pupil of a young eye but it provides more satisfactory outcomes.

I switched to the Superflex in pediatric cases after noticing the superb results it produced in senile cataracts. I was able to handle the lens easily inside the capsular bag due to the soft hydrophilic lens material, which also provides high biocompatibility, and the square-edge design produced low posterior capsular opacification rates. I began using the Superflex cautiously in pediatric cases, and my first case was in a 12-year-old child. The result was outstanding, with no lens opacification and no unusual reactions. I slowly started to use this lens in younger patients (Figure 1), and now I am comfortable implanting this lens in babies as young as 6 months old.

Figure 1. In this 32-month-old boy, notice the round pupil and the quiet eye 2 years after surgery.

MORE THAN 80 CASES

I typically implant the Superflex in an average of three cases per month, and I have 48 months' follow-up for a series of more than 57 eyes (40 patients). Improvements in visual acuity were recorded in 47 eyes (82.5%), and 31 eyes (54.4%) gained visual acuity of 20/40 or better at the last follow-up.

In addition to this case series, I have implanted the Superflex in more than 40 other pediatric cases. This lens is my first choice because the larger optic and longer overall length offers several advantages in pediatric surgery, including better adaptation for the more active pupil. Additionally, the lens design reduces the amount of glare and provides a good view of the retina. Although primarily designed for capsular bag fixation, the longer overall length carries the added assurance that ciliary sulcus fixation is a viable alternative.

CHALLENGES OF PEDIATRIC SURGERY

Pediatric cataract surgery is challenging for many reasons. First, the surgeon must compensate for the eye's dynamic refraction. One of the most important differences between pediatric cataract and adult cataract is that predicting IOL power precisely is almost impossible in pediatric cases. The postoperative target refraction is defined depending on the age of the patient, but the most difficult task is deciding what power IOL you want to implant in a child who may have amblyopia and a refraction that is not stable. One appealing option is a supplementary IOL design, such as the Sulcoflex (Rayner Intraocular Lenses Ltd.), which is piggybacked on top of a conventional lens.

Second, there is a risk of glaucoma after IOL implantation in young eyes. For this reason, many surgeons will avoid lens implantation in children under the age of 1 or 2 years old. Many studies have shown, however, that the risk is highest when surgery is performed within the first 2 months of life, and that the risk of glaucoma is not directly related to IOL implantation. As the eye ages, the risk for glaucoma decreases and lens implantation becomes safer.

Third, the eye could develop secondary membranes after surgery. However, performing a posterior capsu-

QUESTION AND ANSWER WITH JAMAL BLEIK, MD, MSc, FRCS(Ed), FRCOphth

Claoué: *Would you do a peripheral iridectomy if you used a Sulcoflex piggy-back/supplemental IOL?*

Bleik: Yes, I think this would be a good idea.

Claoué: *Should children be rendered myopic or emmetropic at time of first surgery?*

Bleik: I think the question is to render these children hypermetropic or emmetropic. Immediate postoperative myopia is not a very good idea in a young patient. The likelihood is that the expected myopic shift will render such an eye highly myopic later on. Several studies have shown that IOLs implanted in infants may produce very high myopia in the future if this myopic shift is not accounted for.

Claoué: *Have you seen any evidence of pigment dispersion when the Superflex is in the sulcus?*

Bleik: It is not always easy to put a young child on the slit lamp, even if a portable slit lamp is used. But for the older children with better cooperation, I have not seen any significant pigment dispersion.

Claoué: *Do you have any comments on the use of multifocal IOLs in children?*

Bleik: As I mentioned earlier, it is already difficult to predict postoperative refraction in children when using monofocal IOLs. For the growing eye with a rapidly changing refraction, using a multifocal IOL would be very challenging, and currently I am not using this type of IOL in children.

lotomy and an anterior vitrectomy at the same time as lens implantation in younger children lowers the incidence of secondary membranes dramatically.

SURGICAL TECHNIQUE

One way to compensate for the challenges of pediatric cataract surgery is to perform a flawless surgical technique—one that is different from adult cataract surgery. The surgeon must know how to handle the posterior capsule, how to perform the anterior vitrectomy, and how to implant the IOL into the capsular bag. Those simple steps, which I outline below, make a huge difference in surgical outcomes.

After an ophthalmic viscosurgical device is injected, a hydrophilic IOL is implanted into the capsular bag or into the ciliary sulcus in cases where implantation into the capsular bag is not possible. The latter is most common in secondary implantation cases. The IOL is rotated horizontally so that the haptics are placed perpendicular to the incision. In children under 6 years old and in cases with central posterior capsular opacification, posterior capsulotomy and anterior vitrectomy are performed using the ocutome that is introduced at that point through the same incision and posterior to the IOL. No peripheral iridectomy and no sideport incisions are required. Performing surgery through a single small incision reduces the incidence of wound-related complications in this physically active age group.

CONCLUSION

The Superflex is my lens of choice in pediatric cases. Its soft material and easy manipulation inside the capsular bag provide me with the flexibility I need to carry out a flawless surgical procedure. Because this lens is also suitable for sulcus fixation, it can be used as a secondary lens implant in children. Long-term follow up for more than 4 years in our case series has shown that it is safe to use this particular lens in children. ■

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Multifocality in Infancy

With the right lens design, the young eye can adapt to a multifocal IOL with no harmful side effects.

BY KEIKI R. MEHTA, MD

I am perhaps in the minority of cataract surgeons when I say that I am comfortable implanting a multifocal IOL in an infant. In my experience, these lenses provide a child with the same benefits as they do for an adult—the most important being spectacle independence.

The customary age at which IOL implantation is considered a safe and reliable option for a child is 2 years old.

However, many cataract surgeons believe that this is even too young to implant a foreign object inside of the growing eye. My philosophy is on the other side of the spectrum, and I believe that it is unfair to expect a child to grow up with bifocal spectacles. Therefore, I will implant an IOL, many times a multifocal, in children as young as 2 months old.

PROTOCOL

I am careful to respect the growing eye and follow a strict protocol when implanting a multifocal IOL to treat congenital cataract. I use a dual-implantation technique if the child is under 2 years old, whereby I implant a primary lens (usually the M-Flex; Rayner Intraocular Lenses Ltd., East Sussex, United Kingdom; Figure 1) behind a secondary implant (Hema Dome; IOL Tech India Ltd., India) that will be removed when the patient's refraction reaches -4.00 D.

Using a dual-implantation technique allows me to obtain a higher IOL power than is possible with just one lens. Although the power requirements for a very young eye are high, they diminish rapidly. Therefore, I calculate the power of the primary implant for long-term use, and the secondary lens power is calculated for short-term use to compensate for the dynamic refraction.

Outcomes with the M-Flex are very good. In addition to using a dual-implantation technique, I will implant this lens alone in children who are above the age of 3 years and have done so in 118 eyes. At 6-month follow-up, 84% of patients reported spectacle independence.

CRITERIA FOR IOL POWER CALCULATION

Below is my criteria for calculating IOL power:

1. Under anesthesia, I measure the corneal curvature of the eye using an autokeratometer, turning the child's face to the side to get an accurate measurement.

2. After taking an A-scan axial length reading with the Quantel Avisio Ultrasound (Quantel, Newbury, United Kingdom), I use the SRK-T formula to calculate IOL power.

3. I extrapolate the IOL power required at 2 years of age based on the A-scan reading. For instance, a baby at 3 months who requires an IOL power of 28.00 to 30.00 D will require an IOL power of 23.00 D at 2 years.

3. I implant the M-Flex with the anticipated IOL power in the bag first, followed by implantation of the secondary IOL, which should be calculated to make up the power difference.

Figure 1. This author implants the M-Flex as his primary lens.

CRITERIA FOR SECONDARY IOL REMOVAL

Below is my criteria for removal of the secondary IOL:

1. The secondary IOL should be removed when the child's refraction reaches -4.00 D. For example, if a total of 31.00 D was required for a 3-month-old (23.00 D M-Flex and 6.00 D Anaridia IOL to achieve a 20% undercorrection), the child should reach -4.00 D at 18 months.

QUESTION AND ANSWER WITH KEIKI R. MEHTA, MD

Claoué: *Professor Mehta, do you advise an iridotomy for dual IOL implantation?*

Mehta: We do a very small iridotomy—to be more precise an iridectomy—as regular routine in all small babies. Normally I do not perform iridotomy after the age of 5 years, as the anterior chamber is adequately developed and deep.

Claoué: *The IOL that you use, the Hema Dome, is not well known outside of India. Please tell us about its characteristics?*

Mehta: The Hema Dome is made of a soft contact lens material (hexamethyl methacrylate with cross polymers and EGDA polymers). The lens characteristics are as follows:

- Refractive index: 1.44
- Elasticity at break: 1.40
- Oxygen permeability: 4.43*10 -9
- Saline content: 38.8%
- Water uptake: 62.3%
- Saline uptake: 63.6%
- Temperature resistance: No change in parameters after boiling for 24 hours
- Light transmission: 400-800 nM
- Ash content: 0.1 mg in 3.00 gmashed

The Hema Dome is 9.5 mm in diameter and has a 5.0-mm optic located on the external convex side. Its base curve is 6.8 mm, and a bevel on the external aspect permits easier entry into the capsular bag. It can be easily folded or rolled over for entry and removal via a minimum 2.8-mm incision.

Claoué: *Do you have any experience converting eyes rendered psuedophakic during childhood to multifocal vision using the Sulcoflex Multifocal, and if not do you have any comments on such a procedure?*

Mehta: I have not really thought about it. However, it may make sense to place a multifocal Sulcoflex IOL to add multifocaility if the original implant is a monofocal.

2. We use the *rule of 4*, because a variation of 4.00 D from emmetropia rarely induces significant amblyopia.

EXPERIENCE

We have been implanting the M-Flex (Figure 1) for the treatment of congenital cataract as a routine procedure for the past 7 years. The main benefit of using a multifocal implant is that it avoids the need for bifocal spectacles, which typically leave the child unhappy. Over the course of 7 years, I have come to find that children accept multifocal lenses with absolutely no problems and no visual side effects, including reflection or glare.

I believe our results are a product of the chosen IOL. In comparison to other multifocal lenses, children seem to accept the M-Flex far easier. This multifocal is also much simpler to insert and, even in a smaller capsular bag, fits perfectly and is well centered. The M-Flex does not tend to move anteriorly, which can cause pupillary capture. The Rayner multifocal lens also has soft loops that enable me to manoeuvre the lens without disturbuing the capsule or causing a capsular tear.

CONCLUSION

I prefer multifocal lens implantation for the treatment of congenital cataract whenever possible. The satisfaction of both the child and the parents are reward enough for the challenges of lens implantation in the young eye.

Before proceeding with multifocal lens implantation in this population, I urge surgeons to consider performing axial length and corneal curvature measurements under anesthesia. This facilitates proper calculation of both so that the IOL power is accurate. It is my personal belief that utilizing positive pressure insufflation during anesthesia is the best approach, as it provides a deep chamber and makes surgery very easy and safe. ■

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