Helping Patients Understand Cataracts

Content written by: June Smith-Jeffries – FCLSA, NCLE, COT

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Introduction

In Canada, more than 2.5 million people have cataracts. This number is expected to increase to 5 million by 2031 according to recent statistics provided by The National Coalition for Vision Health.

Statistics from the World Health Organization state cataracts remain the leading cause of blindness world-wide and un-operated cataract is listed as the second major cause of visual impairment globally. Most of the people who are blind or visually impaired from cataracts live in developing countries. How fortunate we are to live in a country where few people are blind from this condition?

Cataract Risk Factors

There are several risk factors that may make a patient more susceptible to developing cataracts. Some of these risk factors are:

- Certain diseases such as diabetes
- Prolonged exposure to UV light rays – it is estimated that at least ten percent of cataract cases are directly attributable to UV exposure
- Smoking and excessive alcohol use
- Exposure to some types of radiation
- Certain medications, such as steroids
- Family history

Proteins and Cataracts

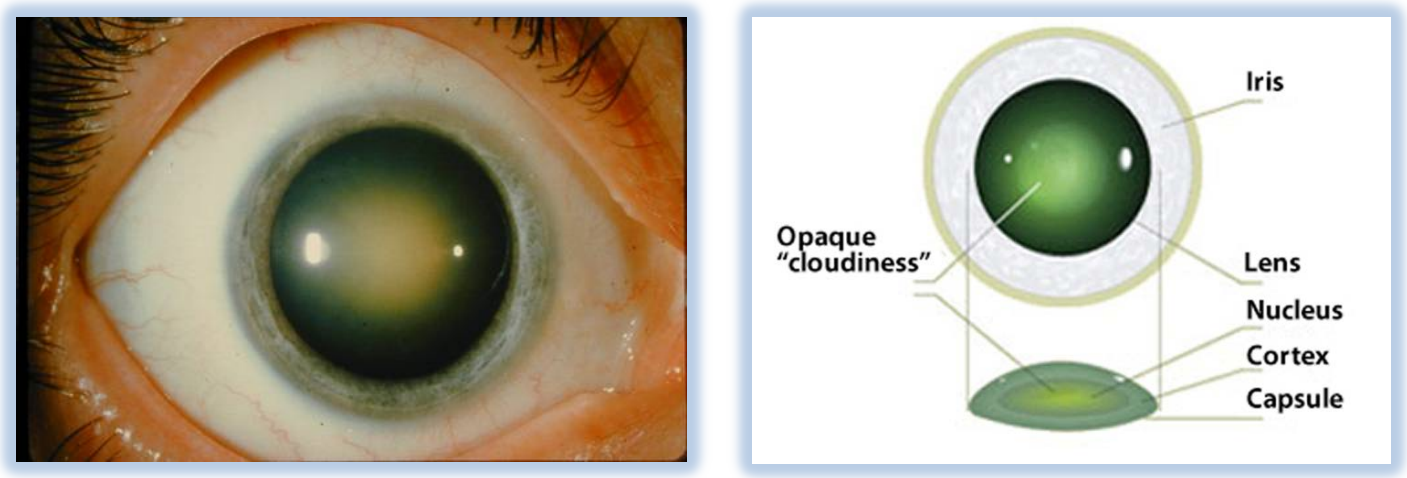
“It has long been known that human eyes have a powerful ability to focus because of three kinds of crystallin proteins in their lenses, maintaining transparency via a delicate balance of both repelling and attracting light. Two types of crystallin are structural, but the third – dubbed a "chaperone" – keeps the others from clumping into cataracts if they're modified by genetic mutation, ultraviolet light or chemical damage.

The researchers painstakingly explored and identified the structures of the normal proteins and a genetic mutation known to cause cataracts in young children. They found that the chaperone proteins bind far more strongly to the mutated proteins in an effort to keep the lens clear. One major problem: every human eye contains a finite number of the helpful proteins. Once they're used up, the researchers learned, weakened ones quickly begin to aggregate and form blinding cataracts. Now that this mechanism has been mapped at the molecular level, the team is hopeful that organic chemists can create sight-saving treatments to prevent such aggregation.” (Quote from eyesmart – *The Portal for the Australian and NZ Eyecare Industry*)

Types of Cataracts

Nuclear Cataract

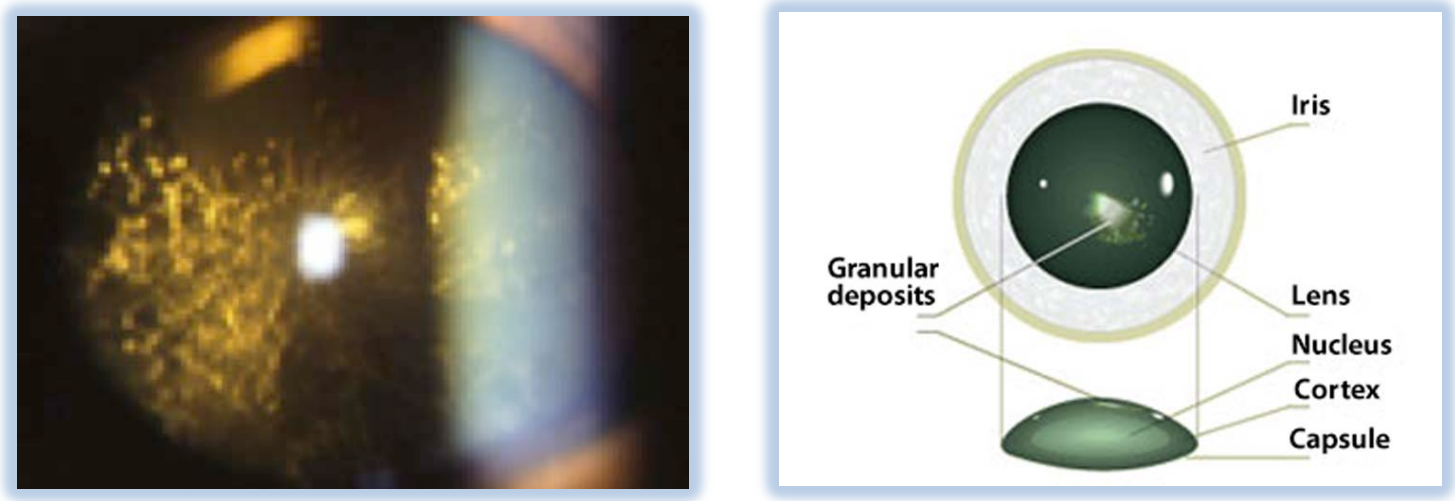
As the name suggests, nuclear cataracts form deep within and harden the central nucleus of the lens and are usually associated with aging. The opacity that accompanies nuclear cataracts has a yellow-green discoloration and usually develops slowly over a period of years.



Nuclear Cataracts

Posterior Subcapsular Cataract

A posterior subcapsular cataract begins as a small opaque or cloudy area on the "posterior," or back surface of the lens. It is called "subcapsular" because it forms beneath the lens capsule, which is a small "sac," or membrane, that encloses the lens and holds it in place. People with diabetes or those taking high doses of steroid medications have a greater risk of developing a posterior subcapsular cataract. They form quickly and are usually found in younger patients. This type is also known as PSCP.

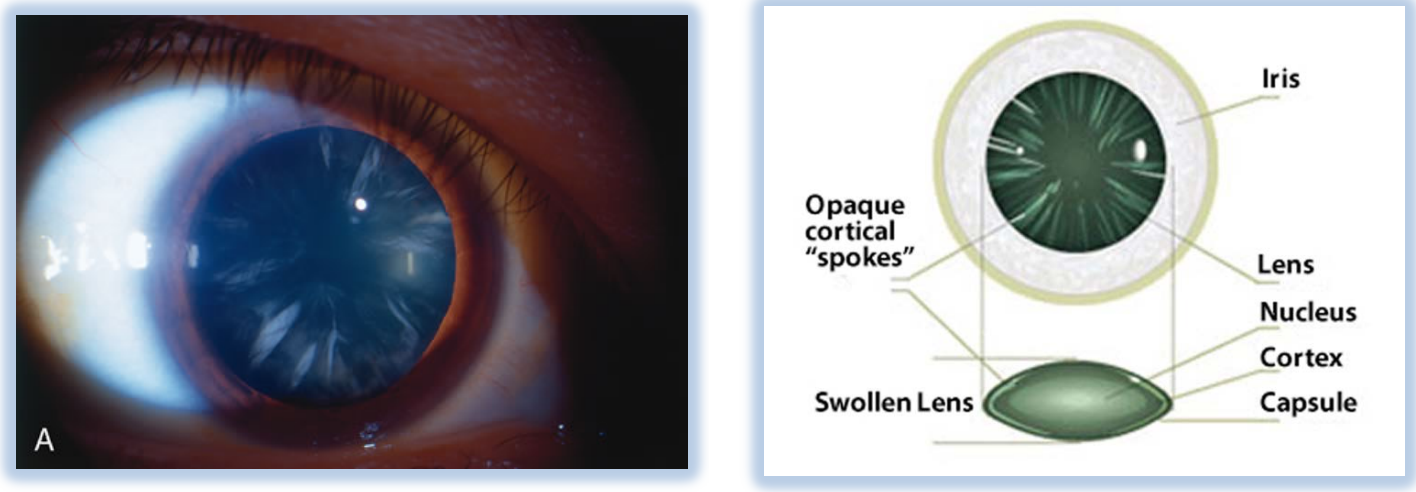


*Posterior Subcapsular Cataract*s

Corticol Cataracts

Often referred to as cortical spoking, corticol cataracts occur within the cortex of the lens. They are characterized by white, wedge-like opacities that begin in the peripheral portion of the lens and as they gradually move toward the

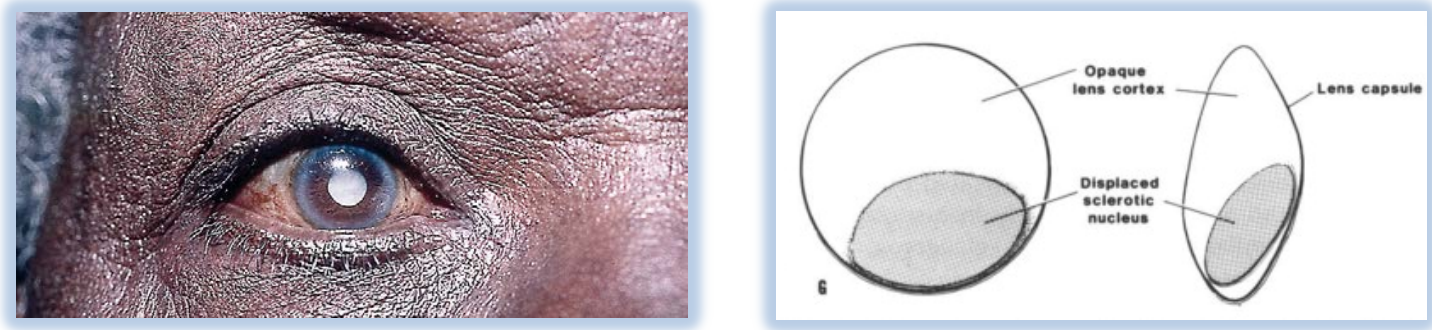
center, they have the appearance of spokes, such as in a bicycle wheel. These progress more quickly than nuclear opacities and can affect younger as well as older patients.



Corticol Cataracts

Hyper-Mature (Morgagnian) Cataract

Hyper-Mature cataracts, also known as Morgagnian, occur when the cortex becomes liquefied while the hard dark nucleus becomes displaced. This type of cataract rarely occurs in North America today, but can often be found in people living in third world countries who do not enjoy the benefit of the adequate medical facilities and a sufficient number of ophthalmologists necessary to perform surgeries.



Hyper-Mature (Morgagnian) Cataracts

Traumatic Cataract

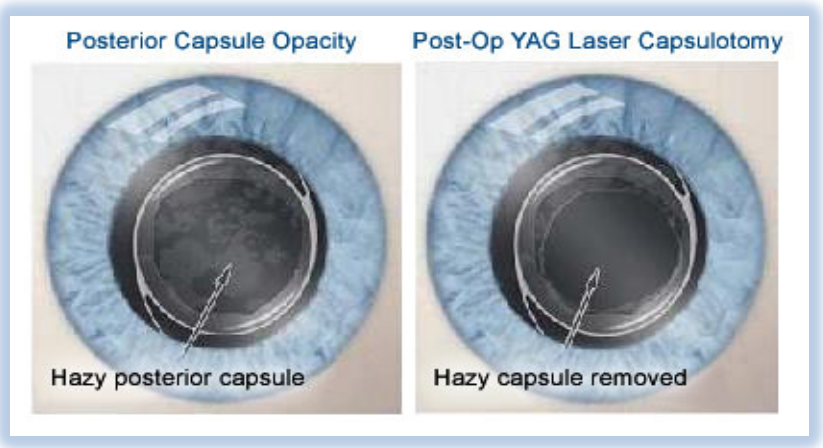
Traumatic cataracts are secondary to serious injury including blunt or penetrating trauma to the eye. This type of cataract may develop immediately or may occur years after the injury.

Congenital or Infantile Cataract

Some babies are born with cataracts and some develop them in the first six months of their lives. When a baby is born with a cataract it is called a “congenital cataract”. If a cataract develops in the first 6 months of life it is known as an “infantile cataract”. Very dense cataracts can cause blindness in babies if surgery is not performed right away.

Secondary Cataract (Posterior Capsule Opacification)

A posterior capsule opacification, sometimes referred to as a secondary cataract is a fairly common complication after cataract surgery. This occurs when the posterior portion of the lens capsule becomes cloudy and can develop months or years post cataract surgery. This can easily and quickly be corrected with YAG laser posterior capsulotomy. The procedure itself takes only a minute or two after dilation of the pupil and is completely painless. It is done either in an ophthalmology office or in an outpatient or hospital clinic.



You can watch a posterior capsulotomy procedure at: https://www.youtube.com/watch?v=Ir9OYWgmWwQ

Types of Cataract Surgery

Phacoemulsification (Phaco)

Phacoemulsification is the most frequently performed cataract surgery implemented today. It has been performed since the early to mid-1960s when Dr. Charles Kelman perfected the technique. One of the main advantages of this type surgery is the incision size, less than 3 mm, which causes less tissue disruption and consequently, fewer complications, including less astigmatism. The small incision requires no sutures. A sutureless, self-sealing wound closure results in more rapid healing after phacoemulsification surgery than in previous procedures which required sutures.

The surgery is performed under a microscope and uses an ultrasonic titanium or steel tipped instrument that oscillates and emulsifies the lens material. Then an instrument referred to as a chopper cuts the nucleus into smaller pieces. The last step is completed by using an irrigation/aspiration probe to remove the remaining material.

Most of these surgeries are performed as an outpatient hospital procedure, with some being done in a surgical suite of an ophthalmologist's office. Preoperative preparations include the instillation of antibiotic, dilating and anesthetizing eye drops over a period of time before the patient is taken to the surgical area. If the surgeon deems it necessary, mild oral sedation is administered for particularly anxious patients. The surgery itself usually takes between ten and fifteen minutes. Patients usually have excellent vision immediately or on the following day when the post-op evaluation is done.

You can watch a Phacoemulsification with Insertion of Posterior Chamber IOL at: https://www.youtube.com/watch?v=7IQs4M48NmY

Extracapsular Extraction (ECCE)

Extracapsular extraction was the most commonly performed eye surgery until the early 1980s, but the procedure is performed less often in North America today because of the advent and success of the phacoemulsification procedure. It is, however, still commonly performed in underdeveloped countries. This method requires a regional anesthetic nerve block referred to as a retrobulbar block. This is accomplished by injecting a local anesthetic into the retrobulbar space behind the globe. This temporarily blocks cranial nerves II, III and VI and prevents any movement of the globe.

An incision of 8 to 10 mm is made and the posterior capsule remains intact which allows for the insertion of a posterior chamber IOL. The cortex can be removed by hand method or by the use of an irrigating/aspirating unit similar to the method used in phacoemulsification. The nucleus is expressed and sutures are placed in the cornea or corneoscleral wound.

Induced astigmatism is significantly higher in ECCE procedures than in the phacoemulsification procedure due to the large incision and suturing. Sutures are usually removed in four to six weeks which helps to reduce the induced astigmatism. Visual recovery is usually much longer than with the phacoemulsification procedure.

In North America, this type of surgery is performed mostly on patients who have advanced or dense cataracts. Because of consumer knowledge and the success rate of cataract surgery today, few people allow their vision to get to the point that this procedure needs to be performed.

You can watch an ECCE procedure at: https://www.youtube.com/watch?v=RJtw4VL17fc

Intracapsular Cataract Extraction

Intracapsular extraction removes the crystalline lens and the entire lens capsule. The risk of complication is much greater with this type of surgery including vitreous leakage or detachment, retinal detachment and glaucoma. The procedure is rarely performed today.

Bladeless Cataract Surgery

The use of femtosecond laser combined with imaging techniques such as optical coherence tomography (OCT) provide advantages in cataract surgery including less dexterity needed by the surgeon, relaxation of limbal incisions, which reduces astigmatism, more consistent corneal incisions and more exacting lens placement within the eye. This provides a more predictable refractive outcome.

Bladeless cataract surgery is relatively new; however, several laser-based systems have already been FDA approved and the procedure may, in time, become the most commonly performed type of cataract surgery.

If you are interested in more in-depth information on bladeless cataract surgery, the video link below provides a detailed discussion given by an ophthalmologist at Harvard Eye Associates.
You can learn more about bladeless cataract surgery at: https://www.youtube.com/watch?v=PiTwzi_3AZk

The History of Aphakic Correction

Prior to the advent of aphakic contact lenses patients had to wear aphakic eyeglasses after cataract surgery. This presented many problems. The high hyperopic correction induced magnification and distortion of objects being viewed. If only one eye needed cataract removal, the patient could not wear aphakic eye glasses because of image size difference between the aphakic lens and a lower power lens.

PMMA (polymethylmethacrylate) aphakic rigid contact lenses were visually a great improvement over aphakic spectacles; however, the lenses did not allow adequate oxygen transmission (DK/L). Long hours of wear resulted in corneal edema and changes in the curvature of the cornea, which became a major issue.

In the early 1970's Dow-Corning began producing silicone soft contact lenses. Aphakic patients were able to wear these lenses and oxygen transmissibility was much better than with PMMA lenses, but problems existed with these lenses also. Because of diminished vision, aphakic patients had difficulty handling the lenses and with insertion and removal. Eventually, many aphakic patients were fit with extended wear soft contact lenses which usually required patients to see their contact lens practitioner for cleaning and reinsertion on a regular basis.

Intraocular Lenses

Background

During World War II, a British ophthalmologist, Harold Ridley, was the first person to propose the use of artificial intraocular lenses during cataract surgery. He served in the Royal Air Force and saw many wounded pilots who had acrylic plastic shards or splinters from cockpit canopies lodged in their eyes. He observed that the plastic did not trigger rejection as occurred in ocular injuries which involved glass splinters. This discovery led him to have the first IOL manufactured and he performed the first surgical insertion of an IOL in 1950.

He worked diligently to perfect the technique despite persistent opposition from the medical community at large. By the late 1960s he had refined the technique using polymethylmethacrylate (PMMA) and eventually achieved worldwide recognition and support for the procedure. Intraocular lenses did not receive approval by the FDA until 1981.

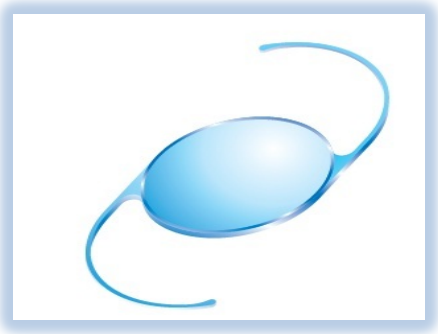
Materials

IOL's are produced from different materials. The type of material determines whether or not the IOL can fold.

To create ***foldable IOL's***, materials must be flexible so. These lenses are used so that the IOL can be inserted through very small incision. There are three basic materials are used for foldable IOL's: silicone, hydrogel acrylic and hydrophobic acrylic. All foldable IOL's are posterior chamber lenses.

Foldable IOL

PMMA is the material used for the manufacture of ***non-foldable IOL's***. A larger incision is required for insertion of these. If a patient's eye requires a stronger than usual power this type of lens is used, as foldable lenses are not always available in unusually stronger powers. Non-foldable IOL's can be implanted in the posterior or anterior chamber.



PMMA Non-foldable IOL

Posterior Chamber VS Anterior Chamber IOL's

The preferred method is to implant an IOL into the posterior chamber. Implantation of anterior chamber IOL's is an established method for eyes in which the capsule is compromised or when there is vitreous loss during the surgery. Anterior chamber IOL's can be used in a primary or a secondary procedure. All anterior chamber lenses are made of PMMA.

IOL Power Calculation

The axial length and the corneal curvature are essential measurements to predict the correct lens power of an intraocular lens. Corneal curvature is measured in the usual manner using a keratometer. A-scan ultrasound measures the axial length of the eye. The combined measurements allow the ophthalmologist to calculate the IOL power needed to give patients the best corrected vision after surgery.

A biometry method uses infrared laser light and provides additional measurements: axial length, lens thickness, anterior chamber depth and corneal curvature. This is referred to as partial coherence interferometry. It also includes software for the calculation of an intraocular lens power by formula selection.

Specialty IOL's

Monofocal

Assuming the patient has no other ocular problems, distance vision is usually greatly improved with a monofocal IOL. The major disadvantage is loss of accommodation which requires patients to have eyeglasses for reading and often for intermediate vision. This type of IOL is still the most commonly used perhaps because the cataract surgery and monofocal lenses are covered by government-funded health care. The additional costs for specialty IOLs are not covered.

Toric

Astigmatic IOL lenses came onto the market in 1999. Patients with significant astigmatism who do not want to wear distance glasses after cataract removal have the option of having this type implant. Patients that have irregular astigmatism from corneal scarring, keratoconus, or other corneal abnormalities cannot be corrected with toric IOL's.

Multifocal

This type of IOL allows for focal points at distance and near. These IOL's work well for patients who want both good distance and good reading vision without eyeglasses. The major disadvantage of multifocal IOL is that patients with smaller pupil size are not good candidates for this type of IOL because less light passes through the different areas of the lens which limits the multifocal effect. There are no multifocal IOL's on the market that also correct astigmatism.

Accommodative

This type of lens uses materials and design techniques that allow the IOL to flex via contraction of the ciliary body which alters the focal point from distance to intermediate and from intermediate to near. Accommodative IOLs are best for patients whose goals include good uncorrected distance and intermediate vision, but who find it acceptable to wear glasses for extended periods of reading. For unknown reasons, sustained reading of more than twenty to thirty minutes becomes difficult and reading glasses are required. Also, no accommodative IOL's are presently available to correct astigmatism.

Conclusion

Opticians can be an invaluable source of information for patients who have been diagnosed with cataracts. Some people are frightened and have further questions even after being scheduled for cataract surgery and having had the procedure explained to them by their ophthalmologist or a staff member. Patients may have heard stories about the era when the entire process was risky and much more complicated. Years ago hospitalization was required for up to ten days and heavy sandbags were placed on each side of the head to prevent movement.

As health care professionals we understand cataract surgery is routine and thousands are successfully performed across the country each day. The rate of complication is extremely low. In fact, cataract surgery is one of the most highly perfected and safe techniques among all surgical procedures done today. More than ninety five percent of patients have improved vision after surgery. Simply listening to and having a conversation with concerned patients can help alleviate their apprehension.

Post Test: Helping Patients Understand Cataracts

Complete the following quiz based on the above information and submit the quiz via email, fax, or mail to the ACAO to receive 1EC credit. **Note: More than one answer may apply**

Name: _____

License #: _____

Date: _____

1. What type of cataract begins in the periphery of the crystalline lens in a wedge, spoke-like configuration?

- ◯ posterior subcapsular
- ◯ nuclear
- ◯ cortical
- ◯ traumatic

2. Which of the following may occur after a patient has undergone cataract surgery?

- ◯ nuclear opacification
- ◯ anterior opacification
- ◯ secondary Morgagnian
- ◯ posterior capsule opacification

3. Which of the following are risk factors for developing cataract?

- ☐ steroid use
- ☐ diabetes
- ☐ glaucoma
- ☐ smoking
- ☐ all autoimmune diseases

4. What is the usual amount of time it takes for phacoemulsification surgery to be completed?

- five to ten minutes
- ten to fifteen minutes
- fifteen to twenty minutes
- twenty to twenty-five minutes
- twenty-five to thirty minutes

5. Intracapsular extraction is commonly performed on patients who have advanced or very dense cataracts.

- True
- False

6. Extracapsular extraction removes the lens and the entire capsule.

- True
- False

7. In what year was the first IOL implanted?

- 1945
- 1949
- 1950
- 1952

8. In what year were intraocular lenses approved by the FDA?

- 1970
- 1975
- 1980
- 1981

9. Which of the following materials are used in the manufacture of foldable IOL's?

- ☐ hydrogel acrylic
- ☐ hydrophobic acrylic
- ☐ Polystyrene
- ☐ polymethylmethacrylate
- ☐ silicone

10. All foldable IOL's are posterior chamber lenses.

- ◯ True
- ◯ False

11. Multifocal IOL's flex via contraction of the ciliary body which alters the focal point from distance to intermediate and from intermediate to near.

- ◯ True
- ◯ False

12. The infrared laser light biometry method, referred to as partial coherence interferometry, provides which of the following measurements for calculation of IOL powers?

- ☐ AC depth
- ☐ lens thickness
- ☐ posterior chamber depth
- ☐ corneal curvature
- ☐ corneal thickness

13. In which of the following instances would an anterior chamber IOL be implanted?

- ☐ vitreous loss
- ☐ dense cataracts
- ☐ compromised lens capsules
- ☐ unusually strong IOL power needed

14. The major disadvantage of a monofocal IOL is loss of accommodation.

- ◯ True
- ◯ False