Current Status of the Treatment of Cataract

Gerald D. Faulkner MD, FACS

Cataract, a leading cause of blindness, has been successfully treated by surgery since ancient times. Surgical methods have evolved from couching, to extraction, to phacoemulsification. Cataract surgery is now an outpatient procedure that can be performed with topical anesthesia. Intraocular lens implants restore natural vision without thick glasses and contact lenses. Current procedures are highly successful in restoring vision.

Cataracts have been the leading cause of blindness throughout history. They have been treated surgically since ancient times, but the most significant progress in treatment has occurred within the last thirty years.

A cataract is a clouding of the natural lens of the eye. As a cataract advances it can cause changes in one's eyeglass prescription, i.e. blurring, increased glare, increased sensitivity to light, and eventually total blindness. While radiation, steroid therapy, trauma, chronic uveitis, and some syndromes are known causes, most cataracts are related to aging and unknown etiology.

The first written account of cataract treatment was a description of the couching procedure by Celsus, Roman (c.25BC-AD50). He described how a sharp needle was used to penetrate the eye and push the cataract out of the pupil. This ancient procedure is still practiced today in some primitive areas of Africa and India. Amnar (1000 AD), an Arabian, describes removal of a soft cataract by suction through a hollow needle.[1]

A French surgeon, Jaques Daviel, performed the first known cataract extraction on a human eye in 1750. Like most new surgical procedures, it took a long time, in this case almost a 100 years, before it was widely accepted throughout the civilized world. It became embroiled in nationalism with the French favoring extraction and the British continuing to do couching. The Germans then joined the fray with a modification of couching called reclination. In 1864, von Graefe modified the incision to reduce gaping of the wound as no sutures were used. These incisions for cataract extraction extended halfway around the limbus of the cornea, and were allowed to heal without the benefit of sutures. Sutures to close the incision were not used until the early twentieth century.

The extraction procedure of cutting the lens capsule and washing out the contents was called extracapsular cataract extraction (ECCE). Another way was to remove the cataract with its capsule or intracapsular cataract extraction (ICCE). This method is as old as ECCE but did not become popular until early this century.

Cataract surgery was done without anesthesia until topical cocaine was first used in 1884. General ether anesthesia was begun about the same time. In 1928, retrobulbar injection, which anesthetized and immobilized the eye, was introduced. The eyelids were immobilized directly either by injection of the eyelid muscles or by blocking the ophthalmic division of the VIIth nerve. Currently, some surgeons perform cataract surgery through small corneal incisions using only topical (eye drops) anesthesia.

With the natural lens removed, most eyes cannot focus. While gross vision (where only large blurred objects could be seen) was an improvement over total blindness, the more developed societies used eyeglasses to replace the focusing power of the natural lens. These eyeglasses were quite thick and powerful. They magnified images about 30%, affected mobility and reduced the field of vision. Aphakic patients were totally dependent on these glasses. Thus, as we entered the second half of the twentieth century, cataract surgery, while curing blindness, imposed the disability, of distorted vision from aphakic glasses. Contact lenses were an alternative for some, but most elderly patients were unable to or unwilling to use them.

In 1949, Harold Ridley, a British ophthalmologist, fashioned a lens from polymethylmethacrylate (PMMA) and inserted it into the eye of a patient following cataract removal. In 1968, Charles Kelman, an U.S. ophthalmologist, invented an instrument to perform an extracapsular (ECCE) cataract extraction (It could emulsify the lens material with an ultrasonically vibrating needle and remove the lens material by suction[2]). This procedure is called phacoemulsification or Kelman phacoemulsification (KPE). Both the Ridley and Kelman procedures had a stormy course of development and created as much controversy as the couching versus extraction procedures of the 18th century. Many ophthalmologists considered these procedures malpractice because of the high rate of complications during their early development. However, dedicated individuals persisted in using and improving these procedures. A survey of members of the American Society of Cataract and Refractive Surgeons found 87% of cataract surgeons using phacoemulsification and almost 100% inserting intraocular lenses.[3]

The refinements in extraction and the development of safe intraocular ocular lens implants have resulted in better vision, faster and more natural rehabilitation and higher success rates. Current methods of cataract surgery are dependent on technological advances. The microsurgical procedures are now performed by using specialized operating microscopes, diamond knives, and solid state phacoemulsification instruments. The axial length of the eye is determined by ultrasound and the corneal radius is used to compute lens power.

Cataract surgery can be performed on most patients through an incision of 3 mm or less. If this incision is made through the avascular cornea as many surgeons are now doing, there is no

bleeding, and no need to discontinue anticoagulants. The incisions are usually self-sealing and no sutures are required.

Today, most intraocular lenses are made of polymethylmethacrylate (PMMA), the same material used by Ridley in his first lens implant. In 1984, a foldable intraocular lens made of silicon was introduced. This enabled the surgeon to insert the intraocular lens through the 3-mm incision used for phacoemulsification (KPE). Prior to the introduction of the foldable implant, the incision had to be 6 mm or greater to insert the lens implant and often required sutures. Large incisions and the use of sutures can delay visual rehabilitation by causing distortion of the corneal curve and resultant distortion of vision. Recently flexible PMMA lenses have been introduced thus widening the choice of implants.

Serious complications of cataract surgery have been reduced but not eliminated. Sight threatening complications such as endophthalmitis, expulsive hemorrhage, retinal detachment and corneal clouding still occur but less frequently. Progress has been made in the prevention and treatment of these and other complications.

Current methods of cataract surgery result in significant visual improvement in 95% of patients who have no other ocular pathology. Eighty nine percent of a large series of cataract patients reported significant improvement in their quality of life.[4] Sight reducing complications occur in about 2%.[5] Patients who have cataract surgery not only have restoration of normal vision, but some have better vision than they had before the cataract developed. Patients who had significant nearsightedness, farsightedness and astigmatism can find these problems lessened or eliminated by cataract surgery with intraocular lens implantation. In some European countries and in increasing numbers in the U.S., patients with severe near- and farsightedness are having their lenses replaced with an intraocular lens even though they do not have a cataract.

Thirty years ago, cataract surgery was almost always performed in a hospital operating room. Patients were hospitalized as long as ten days and their physical activities limited for up to six weeks. Only then were they fitted with aphakic glasses and their vision restored; though the thick glasses magnified and distorted their vision. Now cataract surgery is typically performed in an ambulatory surgery center. A small corneal self-sealing incision is used and the surgery performed under topical anesthesia. The patient can go home twenty minutes after surgery without an eye patch. Patients rarely need analgesics. Some experience good vision without glasses the next day, and most within a few days. There are essentially no restrictions on physical activity, and patients resume normal work and recreation 24 to 48 hours postoperatively. Cataract surgery is extended to almost anyone who needs it; at any age and even in poor health.

What about the future? Until a medical cure for cataract is found, treatment improvement will be refinements in surgical technique and in refractive correction.

Multifocal lens implants have been under investigation for several years.[6] Such lens would focus both near and far, and totally eliminate the need for eyeglasses. If these lenses are perfected, people reaching the "bifocal age" might elect to have their clear natural lens replaced with an artificial multifocal implant.

Since the inception of phacoemulsification, people have thought that cataracts are removed with laser. Only recently have phacoemulsification-like instruments been developed which utilize laser instead of ultrasound to breakup the cataract. Laser may offer safer surgery especially for very hard cataracts that challenge current ultrasound instruments.

Current surgery utilizes the capsule of the natural lens to hold the implanted lens. The capsule contains cells that generate lens fibers. In about 50% of cataract patients, these lens fibers will cause clouding of the capsule. This is termed a "secondary cataract "or "after cataract." YAG laser currently treats it by opening the capsule. A bioengineering product to kill these cells is under development and shows good preliminary results.

While 3 mm may seem like a small incision, further reduction of incision size is the goal of many researchers. This involves not only smaller instruments entering the eye, but lens implants that will pass through the smaller incision.

The cataract treatment is one of the great success stories of the last half of the twentieth century. It is interesting to note the treatment cycle: the small incision of ancient times (couching) to the large incision cataract extraction methods; the modern small incision phacoemulsification which utilizes suction (Arabs 1000 AD). Likewise, anesthesia for cataract surgery progressed from no anesthesia to topical cocaine (1884) and general anesthesia, to local retrobulbar injection anesthesia and now back to topical anesthesia.

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