The heart and soul of ophthalmology is cataract surgery. Approaching 4 million surgeries a year, cataract surgery is the most common operation performed in the United States. It is also one of the most effective, safe, and life-changing procedures in all of medicine. Cataract surgery, in turn, has been dominated by a remarkable procedure for more than a generation: phacoemulsification.

To celebrate the 50th anniversary of phacoemulsification, ASCRS will celebrate this milestone with a special Sunday Summit, multiple seminars, and an ASCRS Foundation phaco timeline at this year’s ASCRS•ASOA Symposium & Congress in Los Angeles.

Phacoemulsification is also a perfect example of how industry and clinicians can work together to benefit patients. The disruptive innovation was the use of ultrasound in the eye, but literally hundreds of subsequent incremental improvements in technology have improved the safety and efficacy of this procedure, bringing us to where we are today.

Every ophthalmologist goes through a special rite of passage. Part of that trial by fire is performing their first phacoemulsification. As I read through this issue of EyeWorld, I enjoyed hearing from four of our most prominent cataract surgeons, as they described their introduction to cataract surgery. Their recollections took me back to my first experience.

I particularly enjoyed reading the article, “Phaco turns 50.” Jack Dodick, MD, another pioneer in phacoemulsification and personal idol, recalls being a senior resident at Manhattan Eye, Ear, and Throat Hospital when Charlie Kelman, MD, performed his first procedure. Ann Kelman, Charlie Kelman’s wife, shares information about the man behind the invention, and Charlie Kelman’s biography provides insights into the man behind the legend. Finally, Richard Lindstrom, MD, and Doug Koch, MD, provide commentary, detailing the transition of phacoemulsification from a radical, risky procedure to the gold standard it has become today. The multiple luminaries in ophthalmology who created this pathway are quoted and their contributions recognized.

This year we celebrate the 50 years since Charlie Kelman invented phacoemulsification and that makes this issue of EyeWorld and the upcoming events in Los Angeles very special indeed.

Remembering its development, critical reception, and evolution into the gold standard of cataract surgery

It was 1967, a Saturday morning. A shade was pulled down on the window that looked into the operating room from the hallway. On the door were signs: “Do Not Enter,” “Infected,” and a picture of a skull and crossbones.

Jack M. Dodick, MD, then a senior resident at Manhattan Eye, Ear, and Throat Hospital in New York, wasn’t allowed in the room but was at the hospital when the procedure was taking place.

“I desperately wanted to see what was going on,” Dr. Dodick, clinical professor, Department of Ophthalmology, New York Langone Medical Center, New York, recalled of his interest in the novel procedure taking place that, while controversial at the time and in the decades that followed, would go on to become the most commonly performed elective surgery among Medicare beneficiaries in the United States.1

The operation taking place under such secretive conditions was performed by Charles D. Kelman, MD (1930–2004), 50 years ago. It was the first phacoemulsification on a human patient.

This first phaco took 76 minutes in a hospital OR.2 Today, the average phaco cataract surgery takes 18 minutes and is the most common diagnosis seen at ambulatory surgery centers.3 What used to be a highly invasive procedure with a lengthy hospital stay, a long subsequent recuperation period, and poor visual outcomes now is an outpatient procedure with visual gains observed in just hours following surgery and added refractive potential with new technologies.

Developing phaco

The gold standard in the 1960s was intracapsular cataract surgery, which involved opening the eye 160–180 degrees and removing the cataract with the capsule and lens material intact.

Postop, the patient required a week or more in the hospital and further recuperation at home.4 Thick, “coke bottle” glasses were the standard for visual function afterward, Dr. Dodick said.

“Patients didn’t undergo surgery until vision in not one but both of their eyes had deteriorated to the point where it was extremely difficult to function, and cataract surgery was therefore done in lenses that were very advanced,” he added.

In a paper published in 1994, Dr. Kelman recalled how decades earlier he questioned why the incision for cataract removal had to be 180 degrees.4 “Wouldn’t a radical reduction in incision size benefit the patients enormously? Couldn’t the recuperative period be effectively eliminated?” he asked.

In the early 1960s, Dr. Kelman received a 3-year grant from the John A. Hartford Foundation, which supported, among other research, developing a technique that would reduce the incision in cataract surgery and require no hospitalization.

In his paper, Dr. Kelman described how he first tried to identify a chemical or enzyme that could dissolve a cataracrous lens. These compounds ultimately destroyed the corneal endothelium in the process.

He then experimented with various surgical techniques and tools—encapsulation, drills, rotating devices, vibrators—which were also deemed unfit for the job.

“At the end of 2 years, with most of my grant money spent, the solution to the problem of lens movement and denuding of the corneal endothelium had become more than a challenge: It was an obsession,” Dr. Kelman wrote. “I realized that to be successful, the technique had to ensure that the lens remained stationary in the chamber.”

Dr. Kelman realized that proper acceleration of an instrument into the lens could achieve this stability. Giving the illustration of a knife and a punching bag, Dr. Kelman explained that if the knife is pushed slowly into the punching bag, the bag will move. If quickly stabbed, however, the punching bag will remain relatively still.

For his purposes, “The required high acceleration could be achieved
A year later, Dr. Kelman wrote, a dentist’s chair might not be where most imagine having a eureka moment, but that’s exactly where Dr. Kelman’s came. The dentist used a high-frequency, vibrating device to remove tartar from Dr. Kelman’s teeth.

“I ran out of his office with the doily around my neck shouting, ‘I’ve got it. I’ve got it,’” Dr. Kelman recalled during the speech he gave while accepting the inaugural Laureate Recognition Award from the American Academy of Ophthalmology (AAO) in 2003. Dr. Kelman returned to the dentist’s office later that day with a cataract and used the probe to score lines in it while it rested on his finger. “[T]hat to me meant that I could do a cataract inside of the eye without the cataract spinning up against the corneal endothelium,” he wrote in his paper, recalling the moment.

The ultrasonic probe by Cavitron became the basis for the Kelman phacoemulsification irrigation-aspiration system.

Dr. Kelman proceeded to modify this unit to better perform the surgery, and by April 1966, he was conducting animal experiments. In 1967, he performed phacoemulsification on a consenting blind man whose eye was already scheduled for enucleation.

“This piece of equipment was quite big,” said Cheryl Jalbert, Dr. Kelman’s lab assistant at the time, in Though My Eyes: The Charlie Kelman Story, a documentary that aired on public television in 2010. “I was ready to put it in the OR and for some reason I said, ‘I can’t do this.’ So I put it into the nurse’s locker room and that’s where I slept. I slept there with the instrument. I just didn’t know what was going to happen that night. I was scared to death,” Ms. Jalbert said, referencing the secrecy of Dr. Kelman’s research.

Ms. Jalbert recalled in the documentary that during this operation Dr. Kelman’s hand would start to shake under the weight of the handpiece, and he had to pull it out of the eye to take a frustrated break. Dr. Dodick described the early phaco handpiece as being “very crude,” weighing 2.2 kilograms (4.8 lbs.), and had to be supported with a “sling,” which he said was made from piano wire.

In the end, the first patient’s cornea collapsed dozens of times and the next day, the eye was “a bag of pus,” according to an account by Dr. Kelman. He published his preliminary report on the procedure in the American Journal of Ophthalmology and went back to refining the technology and technique in animal experiments. A year later, Dr. Kelman’s system had a smaller handpiece and a tip that vibrated at 40,000 cycles per second, compared to the earlier iteration’s 20,000 cycles per second. In 1970, the Kelman-Cavitron phaco unit was ready for surgeons to perform small-incision cataract surgery, Dr. Kelman wrote in his paper recalling phaco’s history. It was being manufactured by Cavitron Corporation, which was later bought by Coopervision (Lake Forest, California), followed by Alcon (Fort Worth, Texas).

Dr. Kelman began performing phaco cataract surgery more regularly but at hospitals other than Manhattan Eye and Ear due to a critical reception of the technique from hospital leadership, Dr. Dodick said.

“[Not many] witnessed the early cases that he did. However, in the mid-1970s, he started doing some at Manhattan Eye and Ear, which I observed. I became very fascinated

continued on page 132
with the technique ... and became an early adopter,” Dr. Dodick said.

In contrast to new trainees today who are comfortable with the technique after 10 or so cases, Dr. Dodick said it took him 30 to 50 cases to adjust and feel confident with it. In the early years, Dr. Kelman taught an intense, several-day course for those interested in learning in the new procedure.

“To test our dexterity and steadiness of hand, we were all required to insert a fine copper probe through a small electrified coil without touching its inner surface,” wrote Eric Arnott, DO (1929–2011), in his book A New Beginning in Sight. Dr. Arnott attended the course in 1971 and brought the first Cavitron phaco unit to the U.K., the fourth in the world. “At this time, only 5% of surgeons who attended phaco courses went on to practice this type of surgery—such was the degree of new skills that were required.”

Ann Kelman, Dr. Kelman’s wife, described how her late husband tested those who wanted to take the course.

“Charlie didn’t want surgeons to perform the procedure unless he was confident they were precise, steady, and comfortable using the heavy hand-piece in the eye, under a microscope. Operating microscopes weren’t commonly used in cataract surgery before phaco. Charlie felt that any bad results would not only be irresponsible, but would crush the endeavor,” Mrs. Kelman said.

**Critical reception, to say the least**

Dr. Kelman’s work to develop this small-incision phacoemulsification technique for cataract surgery was met with criticism from the start, Dr. Dodick said. Even that first phaco procedure was scheduled over a weekend to avoid the eyes of the ophthalmology chairman.

Richard Packard, MD, Windsor, U.K., wrote in a chapter for The Eye in History that phaco was considered “ridiculous” or even grounds for “malpractice” at the time. The National Eye Institute deemed phaco experimental, eliminating reimbursement for the procedure. Dr. Packard added that surgeons were slated to present about poor experience with phaco, despite a lack of experience with it, at the 1973 at the Welsh Cataract Surgical Congress, and “patients with bad results were paraded at the event.”

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Dr. Kelman pictured with early pioneers who took his phaco course. 
Source: A. Kelman

Illustration depicts the grooving made by a phaco probe. 
Source: A. Kelman

**The man behind the ophthalmoscope**

It’s well-known that ophthalmology was not the first love of Charlie Kelman, MD. From a young age, Dr. Kelman, born in Brooklyn, New York, wanted to be a musician, a performer, a showman. In the end, one could argue that he became all three, though perhaps not in the way he would have imagined.

“You know, I always wanted to be an entertainer, and when I was a kid my dad caught me sneaking out of the house to run away and go play with Louie Prima. He said, ‘Charlie, it’s your life. You can do whatever you want with it. You can be a saxophone player, you could be a singer, you can be a songman—whatever you want—but first, you’ll be a doctor,’” Dr. Kelman quipped from a stage in a recording that was featured in the documentary Through My Eyes: The Charlie Kelman Story, which aired in Jan. 20, 2010, on public television in New York, WLIW-TV.

Dr. Kelman did indeed put himself on track for medical school, first attending Tufts University in Boston for his undergraduate degree. He went on to medical school at the University of Geneva in Switzerland, and he completed residency at Wills Eye Hospital in Philadelphia.

While Dr. Kelman was an ophthalmologist by day, he continued to write songs and compose music. In 1960 under the pseudonym Kerry Adams, Dr. Kelman and Chancellor records released his single “Telephone Numbers,” which received recognition on national billboard charts.

After devising phacoemulsification as a method to perform small-incision cataract surgery, Dr. Kelman brought news of his innovation, as well as his performing skills, to television shows like those hosted by Johnny Carson, Dick Cavett, David Letterman, and Oprah Winfrey. EW

Ann Kelman, Dr. Kelman’s wife, described how her late husband...
David Chang: My first phacoemulsification

As the son of an anesthesiologist, I went to medical school planning to be a general surgeon. My third-year general surgery rotation in 1978 at the Peter Bent Brigham Hospital, Boston, burst that bubble, however, and I was suddenly without direction. After a sleepless night on call I was forced to attend mandatory Saturday grand rounds, during which an ophthalmologist presented a 35 mm film of a new method of cataract surgery. It was of Charlie Kelman performing phacoemulsification. That was my light bulb moment, and I immediately signed up for an ophthalmology rotation at the Massachusetts Eye and Ear Infirmary, Boston. I read Kelman’s textbook on phaco from cover to cover and excitedly arranged to observe my attending perform cataract surgery one Saturday morning. Imagine the emotional letdown when I watched him and his assistant perform an intracapsular cataract extraction (ICCE) with loupes! Where were the microscope and the phaco machine?

My first cataract operation as a resident at the University of California, San Francisco, was an ICCE in 1982. Nothing in my surgical career ever since has quite matched the tachycardia, tremor, and terror of my first time maneuvering a cryoprobe while trying not to freeze the cornea or iris. After a dozen ICCEs, I advanced to extracapsular cataract extractions (ECCEx) with posterior chamber IOLs, before finally getting to try phaco—at long last—during my second year. None of our attendings did phaco but the chief at our VA, John Stanley, was either curious or fearless enough to let us try. I didn’t really have any strategy other than to keep sculpting, and after I broke the posterior capsule on my second, fourth, and seventh cases I was ready to abandon phaco altogether. In a conversation I’ll never forget, my senior resident, Carl Minatoya, confided that he had also started similarly, and it wasn’t until after 12 cases that it started to click and he understood what to do. Thanks to his encouragement, I kept going and finished my residency in 1984 with a program record of 70 phaco cases. We learned the Kratz technique of prolapsing the nucleus by watching unnarrated VHS tapes of Tom Mazzocco operating. I’m one of the rare ophthalmologists who got to perform ICCE, ECCE, and phaco as a second-year resident.

I still remember my first time seeing Charlie Kelman lecturing in the ASCRS phaco course. He didn’t know my name, but I had just presented a video at an ASCRS free paper session that he was moderating, and he needed a last-minute replacement for his course. Out of this grew our friendship, and he wrote the foreword to my first phaco textbook shortly before he died in 2004. I was honored to be a consultant for the 2010 documentary on Charlie Kelman, Through My Eyes, Dr. Kelman wrote there was a time when “doctors would literally spit on the floor in front of me as I walked the exhibit floors.” Later, some of these same doctors would become devoted supporters.

In addition to having to learn something new—such as using an operating microscope and phacoemulsification technique—phacoemulsification in the 1970s was a significant added expense, it still required opening the wound to 6 mm to accommodate a non-foldable IOL, and complications such as corneal edema and iris damage were higher, recalled Richard Lindstrom, MD, private practice, Minnesota Eye Consultants, Minneapolis.

“It was still very controversial at the time. I would say the number of cataract surgeons doing phaco was maybe 1%. There were maybe 100 surgeons in the entire U.S. doing phaco,” Dr. Lindstrom said.

Given the buzz about it though, the American Academy of Ophthalmology (AAO) commissioned a study to compare traditional intracapsular cataract surgery to phaco outcomes. Douglas Koch, MD, professor and the Allen, Mosbacher, and Law Chair in Ophthalmology, Baylor College of Medicine, Houston, recalled that Jared Emery, MD, was to present the findings at AAO’s 1974 annual meeting, but an individual—who Dr. Koch didn’t name—saw the data were favorable for phacoemulsification surgery and allegedly tried to suppress the talk, Dr. Koch said.

“Emery persisted. He gave the talk and that enabled phaco to get a standing as a procedure of comparable safety. Those against phaco could no longer claim that outcomes were inferior to other contemporary methods,” he added.

“Phacoemulsification is, in all probability, as effective in restoring vision after cataract as our currently practiced techniques, but certainly no more so,” the Academy’s committee chairperson, Richard C. Troutman, MD, said in a recording of the 1974 meeting, aired as part of the Through My Eyes documentary. “This decision is only a draw. The currently practiced cataract operation is, in many cases, not only the preferred method but the only method to be used.”

Even with this conclusion by AAO’s committee about phaco, Dr. Koch said it was a “critical turning point in the acceptance of technique into mainstream ophthalmology.” Though, it didn’t mean a lot of people started to adopt it right away.

The first International Congress on Phacoemulsification and Cataract Methodology in 1975 sponsored by the Foundation for Ophthalmic Education delved into various topics pertaining to cataract surgery at the time. While the pros and cons of phaco, IOLs, and other techniques were discussed, midway through the meeting, Dr. Troutman shared his critical view of phaco at this meeting.

“At the present time, an ophthalmologist trained and equipped to do phacoemulsification, especially when this fact has been widely publicized in the local or general press, feels compelled to attempt this procedure on any cataract patient who presents himself,” Dr. Troutman said. “He is often further corrupted by being able to command, or demand, a greater economic reward.

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When I was a resident at the University of Louisville, in Kentucky, between 1987 and 1989, my first cataract surgery was an extracapsular procedure. It was a nightmare: The patient had asthma and tiny pupils, and every time she breathed her whole body moved up and down. It took me 3 hours to do this one case.

When I was a third-year resident, the veterans hospital received its first phaco machine: a Storz Daisy unit. I had watched Bob Osher’s videos on how to do phaco, and that’s where most of my training came from, just from watching those videos. There were a few staff members who were well-versed in phaco and doing it routinely, but you weren’t always guaranteed that one of those staff members would be with you.

At that point, I had done maybe 60 extracaps and never lost vitreous. Then I did about 40 to 50 phacos and in one out of three I broke the capsular bag, lost vitreous, or damaged the iris; you name it, it happened. Part of it was this lack of someone there knowing how to train you, but part of it was also the machines available. The technology back then was far more primitive. Although the phaco tip was designed to eat the lens, to me it seemed that its favorite food was vitreous and iris.

I was so horrified by my experience with phaco, that I decided I was not going to be a surgeon. I decided I was going to go into neuropsychiatry. After I told this to Bob Osher—I had been a friend of his when I was a medical student—he said, “Come up here, and do a fellowship with me. I guarantee you you’ll be good at phaco.” That’s what changed the direction of my career.

Fellowship with Bobby was quite an interesting thing. For the first 2 weeks, all that I was really allowed to do was observe, position, and then drape the patient. Once I graduated from those tasks, I was able to make the incision and eventually do the capsulotomy. To this day, when I’m not using a femtosecond laser, I use his technique for a capsulorhexis using a bent, 22-guage needle. I also phaco with my left foot, despite being right-handed and right-footed. Bobby always used the phaco pedal with his left foot, so when I was starting cases for him, he insisted I put the phaco pedal on my left foot. I had to retrain my feet as to which was dominant.

I was probably 6 months into it when I started feeling comfortable with phaco. After a year, I thought I could tackle anything. When I look at the surgery I did 1 year after my fellowship, maybe fast forward 10 years, I’m horrified how awful I was 1 year into it. I think we all get better with experience, and that’s certainly true in my case.

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Dr. Kelman’s way of getting the word out was met with anger from the medical community. “Instead of finding its place in ophthalmology through the scientific medical journals, claims for the advantage of this procedure were widely publicized in newspapers, weekly magazines, radio, and television. These articles cited the names of physicians who were performing this procedure and stated that it was a revolutionary improvement in cataract surgery,” A. Edward Maumenee, MD (1913–1998), said at the 1978 “First International Congress on Cataract Surgery, Florence.”

“This hitherto unaccepted method of introducing a surgical technique into the practice of medicine immediately polarized ophthalmologists about the procedure,” he continued.

“It was not the time of the independent entrepreneur,” Mrs. Kelman said. “Today, someone who thinks outside the box is someone we are excited about and hold in high esteem. At the time, the influencers and the decision makers were the accomplished professors in academia and senior surgeons in hospitals.

Charlie was an outsider.”

**Becoming the new gold standard**

Dr. Lindstrom, who was trained in intracapsular cataract surgery during residency at the University of Minnesota in 1974–1977, said though he’d never seen a phaco surgery, he heard about it at meetings and read about it in the literature.

Foreseeing a value in this new procedure and wanting to bring it back to the of the University of Minnesota, Dr. Lindstrom sought out William S. Harris, MD (1921–1995), one of the pioneers of early phaco, in Dallas for a fellowship. Dr. Harris was also using early posterior chamber IOLs at that time, Dr. Lindstrom said.

In the decades following its inception, there were several advances that made phaco cataract surgery safer, more effective.

“First, you really have to complement the manufacturers on how they’ve improved the equipment in terms of cutting efficiency, lower heat generation, vastly improved fluids, and ability to customize settings,” Dr. Koch said.

Dr. Kratz devised and taught a bimanual technique that brought the nucleus out of the capsular bag and the development of a posterior chamber IOL by Steven Shearing, MD (1934–2011), in 1977 were other advances. Even with these improvements, prior to the mid-1980s, there were some who saw little advantage to phacoemulsification when the wound still needed to be enlarged to 6 mm to accommodate a rigid IOL. This all changed, however, with Thomas Mazzocco, MD, who developed a foldable, silicone IOL, affectionately called the “Mazzocco Taco,” which could be inserted in a 3-mm wound. The U.S. Food and Drug Administration would go on to approve this IOL in 1984.

Another step forward for cataract surgical technique was the development of the 360-degree continuous curvilinear capsulorhexis by Calvin Fercho, MD, Howard Gimbel, MD, and Thomas Neuhann, MD. This technique, compared to other anterior capsulotomies, allowed surgeons to place an IOL in the capsular bag with less risk of tearing and improved centration.

Other techniques, such as hydrotomization and improved nucleus disassembly, were devised and ophthalmic viscosurgical devices (viscoelastics) to coat and protect the corneal endothelium and stabilization for the procedure helped increase phaco’s success rate.

“It’s all these little steps, great minds coming up with new instruments, great companies coming up with new technology, and surgeons coming up with new techniques,” Dr. Koch said.

**Recognition: A long-time coming**

"Am I bitter because of the reluctance of the medical profession to accept new ideas? Absolutely not,” Dr. Kelman wrote in the epilogue of his autobiography. “For every bonafide investigator and idea, there are dozens of quacks and entrepreneurs who might, save for this medical conservatism, foist their dangerous ‘cures’ on the unsuspecting public. If one is to do research in medicine, one must learn that skepticism and restraint are a necessary part of the process.”

Mrs. Kelman said she was always amazed by her husband’s ability to persist and persevere throughout phaco’s more contentious times.

“While Charlie felt the pressure, it seemed as if he didn’t let it weigh heavily on his mind; as if he knew it was the right thing to do and he remained focused to persevere through the challenges. It’s important to note that as he trained..."
My first phaco was in animal and cadaver eyes, and that was in Salt Lake City, Utah, when I was working with David Apple in 1987 and 1988. We were working on a technique called the Miyake technique. We would wait all night on call and when a cadaver eye came in, we would come in at 3 in the morning and do phaco and video with the Miyake technique.

At the lab, we were learning phaco from each other, but we would also have guest surgeons from all over—really the who’s who of phaco back in that day—and we would assist them in surgery.

When I was learning phaco, the machines were not nearly what they are today. Incision sizes were much bigger. We weren’t as informed about energy and fluids. We were just starting to research capsulorhexis. Overall, the surgery itself was much more challenging back then, and we were in our infancy of techniques in terms of what’s the safest and easiest way to reliably and reproducibly perform phaco.

My first patient was in 1989 at the University of Kentucky Medical Center, Lexington, at a time when phaco still wasn’t commonly performed at a lot of universities. That was a fun time for me because most residents in training are just learning to do phaco, and I had already done hundreds of cases between rabbit eyes and cadaver eyes.

I think because I already had so much experience, my attendings at the time were giving me a lot more freedom. I didn’t have to go through the process of needing to do so many extracapsular procedures before you can move up to phaco; I went right to phaco.

I was pretty confident with my technique by the time I entered fellowship, having done a fair amount of cases and refining my technique through my mentors—Woody Van Meter in Kentucky helped bring me to another level. But I still had my own technique, which was really not conventional. When I got to Johns Hopkins in Baltimore and was working with Walter Stark, his first question was “Where did you learn to do that?” I very proudly said I learned this from this doctor as they came through Utah and I learned this from this, and he pretty much said, “OK, we’re going to start over, and you’re going to learn to do it the way that I do it.” At the time, it took the wind out of my sails because I thought I was really doing pretty well; but in reality, he was absolutely correct because my technique got so much better, learning a more traditional method.

Phaco has totally changed how we deliver eyecare and specifically cataract surgery. When I first started seeing patients, I wasn’t in the day of sandbags, but we would remove sutures after several weeks, and patients were fitted with glasses. We would use retrobulbar blocks and IV anesthesia. We really didn’t keep them as in patients, but they would refrain from returning to their normal activities for a certain period of time.

Fast forward to today, I don’t even use an IV; we use oral and topical anesthesia. Most patients resume their normal activities that day or the next day, and not only is their vision restored but they can see better than ever without the need for glasses. The era of now truly refractive cataract surgery has certainly come of age, and I can’t think of another surgical procedure that has had such an impact on the quality of someone’s life. Phacoemulsification was the genesis for all of this. We owe Charlie Kelman and phacoemulsification so much.

Kerry Solomon: My first phacoemulsification

Dr. Kelman stands with one of the early phaco units during a 25th anniversary celebration hosted by ASCRS in 1999.

Source: ASCRS

He was alive to be the beneficiary of knowing that’s what the world thought of what he accomplished,” Dr. Dodick said.

Forward thinking

Dr. Lindstrom said there is still plenty of opportunity to improve cataract surgery in terms of reducing intraoperative complications, such as better protecting the capsule and corneal endothelium and preventing cystoid macular edema. What’s more, Dr. Lindstrom said that while the vast majority of cataract surgeries in the United States and developed countries are performed using phacoemulsification, developing countries still perform extracapsular cataract extraction techniques due to the cost of phaco and a lack of training.

“There are all kinds of ways to get this better and will still have to keep training the next generation of surgeons,” Dr. Lindstrom said.

Treatment of cataracts could someday, however, move beyond phacoemulsification.

In his 1994 paper, Dr. Kelman proposed a device that could cut or emulsify from outside the eye using an externally produced magnetic field that spins an internal magnet.

“Imagine a tiny magnetic bead suspended in space and spinning on its own axis,” Dr. Kelman described. “External magnets alter the speed of rotation and change the position of the bead in three dimensions. The spinning bead, placed within the lens, liquefies the nucleus. As the capsule is approached, the rotations would cease. The same is true for the early manufacturers. It was an amazing, dedicated group of people who faced similar resistance from peers in their own communities,” Mrs. Kelman said.

But when his work did start to gain acceptance, changing the lives of millions of patients, and he begun to be recognized for his innovation, it made him feel good, Dr. Dodick said.

Dr. Kelman was awarded the National Medal of Technology by President George H. W. Bush in 1992 for his work on phacoemulsification. He was also inducted into the National Inventors Hall of Fame in 2004, received the Albert Lasker Award for Clinical Research in 2004, and has received recognition from countless ophthalmic organizations for this contribution, including “the Most Influential Ophthalmologist of the Century” at the International Congress on Cataract and Refractive Surgery.

“The American Society of Cataract and Refractive Surgery undertook a worldwide survey of all their membership and asked the question, “What do you think has been the most important contribution to ophthalmology in the past century?” And there were many, many important contributions in retina, cataract, and glaucoma, and unanimously the vote was the introduction of small incision cataract surgery in the eye.
Bonnie An Henderson: My first phacoemulsification

When I started ophthalmology residency at Massachusetts Eye and Ear Infirmary in Boston in 1994, phacoemulsification had become the primary method of cataract surgery in the U.S. Yet many academic centers— including mine—were still going through the transition.

At that time, all residents had to perform about 20 large-incision extracapsular cataract extractions before learning phacoemulsification. I even performed a few intracapsular cataract extractions in patients with loose zonules—capsular stabilization devices hadn’t been developed yet.

The difficult part about the transition was that most supervising surgeons in residency programs didn’t have much experience with phacoemulsification, so if the trainee ran into complications, there was little guidance on how to manage the situation.

My first phacoemulsification surgery was equally thrilling and terrifying. It took about an hour to complete and by the end of the surgery, the scrub nurses had to pry my clenched fingers off the phaco probe. They say the president of the United States ages over his term; I believe the same could be said of attendings who supervise residents—most of whom had experience with phacoemulsification, so if they had to spend 2 hours in the operating room and 1 week in the hospital. Now, we’re doing 4 million a year in the U.S. Can you imagine the resources that would be required if we had to spend 2 hours in the operating room and a 1-week hospital stay?” Dr. Lindstrom said, noting that he has actually calculated the numbers. “It would be about $50,000 per eye to do cataract surgery for a procedure that would give a poor outcome in terms of function and visual rehabilitation. Now, it’s about $1,600 in Medicare reimbursement, a 20- to 30-minute outpatient surgical procedure with patients being functional and seeing well the next day.”

Dr. Dodick said the innovation’s impact was monumental to the broader field of medicine as well.

“When you think about it, Charlie Kelman was the very first surgeon who figured out how to remove unwanted tissue in the human body through a small opening, therefore he became the father of all least invasive, small-incision procedures. “In my mind,” he said, “Charlie Kelman is the grandfather of all least invasive, small-incision surgery in the human body, and that’s huge.”

Editors’ note: The sources interviewed for this story do not have any financial interests related to their comments.

References

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