



chapter 1

The Foundation and Aims of a New Society

By Drs. Carmen Barraquer Coll, Miles H. Friedlander and Richard C. Troutman

Today, excimer laser corneal refractive corrections are among the most performed ophthalmic procedures and form the basis of the refractive surgery subspecialty. Lamellar excisional surgical procedures, developed decades earlier, led to the genesis of this exciting subspecialty, ultimately leading the way for the advanced surgical procedures that exist today.

Many surgeons agree that a primary goal of refractive surgery is to address visual impairments that can affect an individual's quality of life in profound, sometimes life-altering ways. Patients are motivated to improve their quality of life by ridding themselves of spectacles for reasons ranging from the freedom to practice certain sports or professions to improved self-image.

It was not very long ago that the mainstream ophthalmic community viewed modern refractive surgery with skepticism. Early innovators like Drs. José I. Barraquer, Miles H. Friedlander, Casimir A. Swinger, Richard C. Troutman and Richard A. Villaseñor worked tirelessly to secure a place for refractive surgery in the annals of ophthalmic history.

International Society of Refractive Keratoplasty

New Orleans, one of the most culturally diverse and international cities in the world, was a fitting birthplace for the International Society of Refractive Keratoplasty (ISRK), today known as the International Society of Refractive Surgery of the American Academy of Ophthalmology (ISRS/AAO). Like the city of New Orleans, the ISRS/AAO is a product of worldwide contributions and influences, renowned for its international tenor and flavor. Therefore, it is appropriate that global refractive surgery leaders will convene during the 2007 American Academy of Ophthalmology's Annual Meeting in New Orleans,



Dr. Barraquer



Dr. Barraquer's 1949 paper, "Refractive Keratoplasty"



Barraquer Institute in Bogotá, Colombia

nearly three decades after the Society's foundation, to celebrate its seminal role in refractive surgery's past, present and future. The ISRS/AAO is the only global scientific society solely dedicated to refractive surgery, conceived shortly after two of Barraquer's early students, Troutman and Swinger, broke new ground by performing the first refractive surgery procedures in the United States.

These early procedures formed the bedrock of a new subspecialty and the new scientific society that supported its continued development. As the number of ophthalmologists interested in Barraquer's work increased, it became apparent that there was a need for a mode of exchanging ideas and building upon the foundation that Barraquer created.

Modern Refractive Surgery

While earlier innovators arguably attempted to correct optical errors surgically, many regard Barraquer's prescient work as a definitive contribution in modern refractive surgery history. While working with keratoconus patients, Barraquer observed that the placement of a 12-millimeter lamellar corneal graft flattened the patient's cornea, resulting in a considerable reduction of myopia. He also observed that refractive changes occurring from different corneal diseases and ametropias were often associated with extreme corneal curvature values (flat corneas associated with hyperopia and myopia from steeper corneas). This confirmed the possibility of correcting refractive defects by modifying the corneal curvature radius.

These observations led to Barraquer's manual alteration of the shape, or thickness, of donor corneal tissue in lamellar procedures, thus confirming the validity of his hypothesis. Recognizing the potential impact of his research, Barraquer published his definitive 1949 paper, "Refractive Keratoplasty," in English, French, German and Spanish.

Barraquer's observations of corrected ametropias, or keratoplasty-induced ametropias, led him to propose two concepts: (1) the use of lamellar methods on the cornea to modify refraction in ametropic eyes and (2) the possibility of modifying refraction using intralamellar inserts in the cornea. His procedures for the surgical correction of spherical ametropias included keratomileusis for myopia and lower-power hyperopic ametropia and keratophakia for aphakic ametropia. They involved the precise, mathematically calculated turning or shaping of corneal tissue in order to change the corneal curvature and correct spherical refractive errors.

From the Barraquer Institute in Bogotá, Colombia, Barraquer's ideas incited what would become a scientific revolution in ophthalmology—perhaps defined by some as an insurrection—as he was the first ophthalmic surgeon to propose changing the optical power of the cornea by removing or adding tissue, an alteration that produced a new anterior curvature.

A Dedicated Journey

In modern refractive surgery's formative years, early pioneers persevered against technological, scientific and even ethical challenges. Mainstream ophthalmology often considered these early leaders, who sought to liberate patients from spectacles by operating on a structurally normal eye, to be mad. Ophthalmic visionaries, inspired by Barraquer's early innovations, embarked upon a quest for answers—a decades-long process of discovery colored by debate, controversy and litigation. The Society supported the journey by offering a platform of support that encouraged new friendships and collaborations and linked like-minded surgeons around the globe to the art and science of refractive surgery.

For three decades, members have played key roles in the history of refractive surgery with countless contributions, groundbreaking research and innovation from nearly every continent. These contributions led to a seismic shift in the practice of ophthalmology, the birth of a new ophthalmic industry and a dramatic improvement in the quality of life for millions of patients around the globe.

Simplified Surgery

In Bogotá during the 1960s and 1970s, Barraquer continued to research and refine ideas that were often too advanced for the resources available at the time. In the absence of both surgical instruments and ophthalmic technicians, the always inventive and innovative Barraquer conceived the prototype for refractive surgical instruments, some of which are still in use today.

Barraquer also recognized that the steep learning curve associated with lamellar surgery could impede its acceptance among mainstream ophthalmologists who were unfamiliar with the equipment necessary for lamellar procedures.

In the 1970s, keratophakia and keratomileusis procedures required that ophthalmologists have an understanding of unfamiliar, yet essential, tools such as a:

- ◉ Calculator or computer for the accurate calculation of the lathing parameters.
- ◉ Cryolathe, a CO₂ cooled Levin contact lens lathe modified by Barraquer, for shaping the refractive lenticles.
- ◉ Microkeratome, for the precise removal of corneal tissue from the patient's eye prior to lathing.

In addition to lamellar surgery's mechanical obstacles, Barraquer faced a philosophical resistance from mainstream ophthalmologists who did not believe in operating on a structurally normal and healthy eye.

Because of the limited modes of communication that were available in the 1970s and 1980s, Barraquer's influence was initially confined to published articles and presentations at meetings. Ultimately, his union and fellowship with other interested practitioners of ophthalmic microsurgery hastened the dissemination and acceptance of his ideas.



Cryolathe used for early lamellar surgery

Troutman and Barraquer's First Meeting

In the mid-1950s, José Barraquer's brother Dr. Joaquín Barraquer of the Instituto Barraquer in Barcelona and Dr. Richard Troutman of New York met. The two surgeons had independently explored the utility of dissecting microscopes for anterior segment surgical applications and collaborated on the development of ophthalmic microsurgery instrumentation and techniques.

These efforts eventually led to the formation of the International Ophthalmic Microsurgery Study Group (IOMSG) by Troutman and Professors Heinrich Harms and Gunter Mackensen, like-minded microsurgeons from the Universitäts-Augenklinik in Tübingen, Germany. When the IOMSG met for the first time in 1966 in Tübingen, attendees included José and Joaquín Barraquer and 30 other international ophthalmologists interested in ophthalmic microsurgery.

It was during this meeting that Troutman, who was already investigating the prevention and microsurgical management of corneal astigmatism following cataract surgery and keratoplasty, met José Barraquer, and the two pioneers discovered their common interest in refractive keratoplasty.

In this brave new world of microsurgery, IOMSG organizers sought to create a forum that would provide inventive ophthalmologists with opportunities to exchange their experiences and ideas. Several major ophthalmic instrument manufacturers were also included in the study group because, as Troutman notes, "With so few practitioners—but the potential for many more—the study group sought to educate the ophthalmic industry about the specialized instrumentation that would be required."

A decade later, Troutman would suggest this format for the creation of the International Society of Refractive Keratoplasty Study Group (ISRKSG), predecessor to the ISRK and today's ISRS/AAO.



Drs. Troutman and Barraquer

Keratophakia and Keratomileusis: Not Ready for Prime Time

Throughout the 1960s and 1970s, José Barraquer continued to share his knowledge of lamellar surgery by presenting his research at a large number of scientific meetings in cities that included Bogotá, Chicago, Houston, Los Angeles, Miami, New York, San Francisco and Washington.

Barraquer's paper "Keratophakia and Keratomileusis," presented during a 1976 meeting in Washington, D.C., particularly impressed Troutman, who saw keratophakia as a potential substitute for the anterior segment intraocular implants that were being used for the correction of aphakia—and causing serious postoperative issues.

Troutman shared his desire to learn lamellar surgery and remembers Barraquer's response, "I'm not yet quite ready to show you how to do it." However, Barraquer indicated that he would be ready to share his work in the near future, and Troutman responded optimistically by purchasing a cryolathe and microkeratome (one of the first units sold in the United States) while he awaited Barraquer's invitation.

Preparing for Students

Before he could formally share his work with other ophthalmologists, Barraquer understood the need to automate and simplify lamellar surgery procedures, which required surgeons to perform the necessary mathematical calculations in "real time," during surgery, in order to lathe the frozen tissue with accuracy. In addition, approximately 100 consecutive steps were required to complete each procedure.

To address these issues, Barraquer learned to program a Texas Instruments electronic calculator with the mathematical calculations that he had painstakingly and manually developed based upon decades of experience with the biomechanics of frozen, shaped and implanted living corneal tissue.

Barraquer's calculations compensated for corneal tissue expansion during freezing, and contraction from the cutting tip of the lathe, both critical to obtaining an accurate optical result. Introducing the calculator into lamellar surgery was a turning point as it facilitated Barraquer's ability to share his work with qualified ophthalmologists.

In addition to becoming familiar with new equipment, Barraquer developed a tool to help surgeons remember the many steps required for each procedure. Inspired by the recorded checklists used by airline pilots for takeoff and landing, Barraquer produced a tape recording that played the required steps for keratophakia and keratomileusis on a foot pedal-operated tape deck during the surgical procedure.

Early Barraquer Courses

In July 1977, Barraquer invited Troutman and two other ophthalmologists to participate in the first one-week course on lamellar surgery in Bogotá. Troutman invited his corneal and refractive surgery fellow, Casimir Swinger, to accompany him because he believed that Swinger's past experience as an aerospace electrical engineer would provide additional insight into the mathematical and engineering aspects of Barraquer's work and technology. Troutman later recognized that he had made an inspired choice. He recalls, "Dr. Swinger proved to be an exceptionally accomplished and prescient surgeon and innovator."



Drs. Troutman, Beale, Barraquer, Osio, Swinger and Pannu at first lamellar surgery course in Bogotá



Drs. Barraquer and Swinger



Mrs. Friedlander and Drs. Barraquer and Friedlander

Swinger remembers their week in Bogotá as “difficult and busy...watching surgery, examining patients and spending many hours in the laboratory learning to use the equipment.” After the weeklong course both Troutman and Swinger were enthusiastic and confident about the future of refractive keratoplasty.

Swinger remained in Bogotá with Barraquer for another month to study the finer details of the equipment and other aspects of lamellar surgery. He was the first in a succession of Troutman cornea and refractive fellows.

In September 1977, students in the second Barraquer course in Bogotá included Drs. Miles Friedlander and Perry S. Binder. Ms. Nicole Friedlander accompanied her husband to Bogotá and looked forward to sightseeing while Dr. Friedlander studied. However, Colombia declared martial law the day after their arrival, putting an abrupt end to her plans.

Instead, Ms. Friedlander remained at the Institute observing Barraquer’s course, which “began a lifelong fascination with refractive surgery and the risk-takers who pushed this new subspecialty forward.” She was instrumental in the formation of the early ISRK, often acting as the Society’s unofficial secretary.

Binder returned to the United States and wrote the first National Eye Institute (NEI) sponsored grant for the study of refractive corneal surgery. The day after his return, Binder received a phone call from Dr. Herbert E. Kaufman asking for Binder’s opinions on the future of lamellar refractive surgery. Binder believes he made a convincing case because Kaufman attended the next Barraquer course.

Many of Barraquer’s students wished to remain in contact, to share ideas and discuss research and techniques, after they returned to their respective cities, which could be challenging in the absence of advanced communication technologies such as the Internet. Friedlander remembers, “Those of us who studied with Dr. Barraquer remained in close contact. Several of Dr. Barraquer’s early students—Drs. Richard Elander, James J. Salz and Richard Villaseñor—came to New Orleans where we had dinner at Arnaud’s restaurant in the French Quarter. An immediate camaraderie struck up, resulting in the eventual formation of the ISRK.”

Refractive Keratoplasty Arrives in the United States

In August 1977, after an extended stay in Bogotá, Swinger returned to New York and wrote a NEI grant that would support a refractive surgery research laboratory for the next 13 years. After extensive practice on eye bank corneas, he and Troutman performed the first case of refractive keratoplasty in the United States in October 1977—a keratophakia procedure on an aphakic patient unable to tolerate spectacles or contact lenses.

One year later, armed with more than 100 refractive surgery cases, Troutman and Swinger delivered a preliminary report on keratophakia at the 1978 American Academy of Ophthalmology's Annual Meeting in Kansas City that generated interest among some colleagues. Troutman recognized that there was a need for an organization that would bring together surgeons around the world who were interested in refractive keratoplasty procedures.

In Kansas City, Troutman and Swinger organized a breakfast meeting for a small group of interested surgeons that eventually formed the basis for the ISRKSG. The first breakfast meeting, held as a forum for the free exchange of ideas, sought to promote ways to educate surgeons who wished to learn these new procedures.

Patterned after the earlier IOMSG, the ISRKSG was initially limited to 40 members and conducted small breakfast meetings for several years—until the ISRK absorbed the ISRKSG to create one, unified scientific society.

Like the IOMSG, the ISRKSG also encouraged scientific knowledge and study, the production of quality publications and research and participation in worldwide educational courses and meetings. A close collaboration developed with ophthalmic manufacturers, to fulfill the urgent need for accurate instrumentation development in the up-and-coming field of refractive keratoplasty.



Drs. Ruíz and D'Amico



Drs. Villaseñor, Troutman, Elander, Binder, Barraquer, Curtin, Krumeich, Swinger, Goldstein, Friedlander, Gaster, Rich and Osio

Radial Keratotomy Arrives in the United States

In 1978, radial keratotomy (RK), a procedure fine-tuned by Dr. Svyatoslav Fyodorov in Russia, was introduced to U.S. surgeons by Dr. Leo Bores, an American ophthalmologist and Fyodorov's student.

The RK procedure decreased refractive error by creating radial incisions in the cornea, which flattened and reshaped it, promising immediate results with no serious complications.

RK's ease of use and apparently good outcomes stimulated greater interest in refractive surgery and soon gained traction among some ophthalmologists.

Many of the reasons for RK's appeal in the 1980s and 1990s later influenced LASIK surgery adoption—surgeons could master it with minimal training, it offered the potential to help many patients and it could be very lucrative in a period of declining reimbursements.

Radial keratotomy's popularity also led to the emergence of “quasi-scientific” groups, criticized by some as being more interested in the promotion, rather than the study, of this appealing technique.



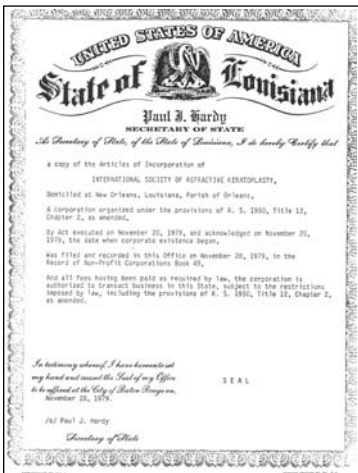
Dr. Fyodorov



Drs. Barraquer, Swinger and Troutman



Mission Statement of ISRK



ISRK Article of Incorporation

ISRK Launch

The February 1979 New Orleans Academy of Ophthalmology Meeting featured paper presentations by Barraquer, Swinger, Troutman and Troutman's fellow, Dr. Ronald Gaster, on their continuing experience with refractive keratoplasty. Binder, the youngest guest speaker at the New Orleans meeting, presented results of his clinical study of orthokeratology for the correction of low myopia. He recalls, "It was the largest cornea meeting of its time, attended by over 500 doctors."

Early in the meeting, Troutman and Swinger learned that a coalition of radial keratotomy proponents was organizing a new group, the Keratorefractive Society, with the goal of increasing RK's popularity and accessibility among ophthalmologists.

This new organization offered Drs. Barraquer and Troutman honorary officer positions, which they declined. Like Swinger, they were wary of the enthusiastic conclusions favored by early RK adopters, supported by what appeared to be anecdotal rather than objective data. Barraquer, Swinger and Troutman were also concerned that lamellar refractive surgery, with its more supportable scientific basis and greater long-term promise, might be abandoned in the haste to promote the simpler and more lucrative radial keratotomy procedure.

As a result, Barraquer, Swinger and Troutman met with Friedlander, who shared their concerns. The four surgeons agreed, "The challenge of systematically evaluating and disseminating refractive surgery required the formation of a scientific society with an elected board of committed, trained investigators reporting to an open informed membership."

Together, they founded the International Society of Refractive Keratoplasty (ISRK) and specifically wished to emphasize "international" in the new society's name to "recognize and encourage the international contributions that had given birth to refractive keratoplasty." They determined that the Society would seek to represent the ethical and scientific aspects of all forms of refractive surgery. Today, this approach remains a cornerstone of the Society's philosophy.

Incorporation of the ISRK

Friedlander hired an attorney in New Orleans to draw up the necessary papers, and the ISRK incorporated on November 20, 1979. According to the incorporation papers, the primary purpose of ISRK was to "promote, aid, encourage and foster the advancement of ophthalmology with an emphasis on refractive keratoplasty."

Because only three names were required for the legal documents, the four founding members agreed to list Barraquer, Troutman and Friedlander as the ISRK's incorporators. While not listed on the legal documents, Swinger played an integral and critical role in the Society's formation and subsequent expansion.

Thus, Barraquer's protégés created a scientific society dedicated to the values, interests and promotion of education and the scientific method—a need foreseen by Troutman after performing the first refractive procedure in the United States in 1977.

At the American Academy of Ophthalmology's 1979 Annual Meeting in San Francisco, the four ISRK founders invited ophthalmologists interested in refractive surgery to attend a breakfast meeting to elect officers. Barraquer was elected as the ISRK's first president (1980–1982); Troutman, president elect; Friedlander, secretary; Swinger, scientific and program chair; and Villaseñor, program coordinator.

The first board of trustees included future Society presidents, Drs. Binder, Kaufman and Villaseñor. Other board members included Drs. Elander, Angel Hernandez, Robert J. Kelley, Jorg Krumeich, Anthony Nesburn, Randall Olsen, James J. Rowsey and José M. Varas.

According to Troutman, the ISRK would “investigate and promote refractive keratoplasty procedures through education and research—especially the Barraquer techniques—while adhering to strict scientific standards.” Annual membership dues were set at \$75 USD to assist with expenses, such as the newsletter and annual meeting.

Barraquer Courses in the United States

December 19 through 23, 1979, Barraquer, Swinger and Troutman conducted the first Barraquer course in the United States at the Manhattan Eye, Ear and Throat Hospital (MEETH) in New York City. Swinger worked closely with Barraquer to create a course manual and Barraquer flew to New York to observe the course.

The faculty included former Barraquer students who were actively performing lamellar procedures. Students were required to bring their own supply of eye bank eyes, and Barraquer student, Dr. Daniel S. Durrie, still remembers the shocked expressions of fellow passengers as he moved down the airplane aisle, toting a container labeled “Warning: Human Eyes.”

After the first U.S. course at MEETH, Barraquer students, Elander, Friedlander, Swinger and Villaseñor taught formal courses in several locations that included Chicago, Los Angeles, Maui and New Orleans.

Villaseñor remembers, “I was appointed to organize courses on RK and the use of the microkeratome. I publicized the courses in flyers on a regular basis. My wife assembled the Styrofoam heads, knives and microkeratomes used in the courses and sent them to different course locations. Other core instructors included Drs. Barraquer, Binder, Elander, Friedlander, Larry Rich, Salz, Swinger and Troutman. In addition to teaching courses, these surgeons also worked in the lab.”

Many Barraquer-trained refractive surgeons began to focus solely on myopic keratomileusis (MKM), while also seeking ways to simplify the procedure. Lamellar surgery advocates never doubted that the Barraquer principles would eventually lead to the development and advancement of accurate, reproducible procedures that would enjoy adoption and application by a broader group.



Drs. Nesburn, Laibson, Jones, Binder, Paton, Fine, Barraquer and Buxton



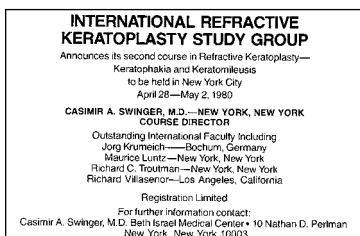
Dr. Gaster, Mr. M. Weinberg, Drs. Swinger, Elander, Levinson and Barraquer, Mr. E. Weinberg, Dr. Krumeich, Ms. Friedlander and Drs. Villaseñor and Friedlander at a lamellar surgery course at Jules Stein Eye Institute in Los Angeles



Drs. Gaster, Salz, Osio, Friedlander, Villaseñor, Steele, Barraquer, Elander, Troutman, Binder, Krumeich and Maguen



Drs. Binder, Krumeich, Troutman,
Elander and Villaseñor



Formal course announcement (1980)



Dr. Binder, Mr. and Ms. Weinberg and
Dr. Troutman



Dr. Swinger

The input provided by early ISRK pioneers led to other procedures, as well as refinements of instrumentation and techniques, such as the nonfreezing techniques developed by Swinger and Krumeich, automated lamellar keratoplasty (ALK) by Dr. Luis A. Ruíz and epikeratophakia by Drs. Theodore P. Werblin, Herbert E. Kaufman and Marguerite B. McDonald. These efforts would eventually lead to the introduction of the excimer laser and laser-assisted refractive procedures that stemmed from Dr. Barraquer's early development of modern refractive surgery principles.

Bogotá: Tertium Forum Ophthalmologicum

In March 1980, Dr. Barraquer hosted the Tertium Forum Ophthalmologicum in Bogotá. The meeting occurred every four years and invited paper submissions from ophthalmologists around the world, which enhanced the ISRK's early global flavor.

This meeting included an ISRKSG meeting in the morning, along with an entire day devoted to RK with scientific papers presented by Drs. John Alpar, Barraquer, Binder, Ángel Hernández, Herbert Kaufman, Krumeich, Werblin, Ruíz and Villaseñor, as well as founders, Friedlander, Swinger and Troutman.

Two newly developed procedures, epikeratophakia and hypermetropic keratomileusis, which used cryo-preserved, pre-cut corneal tissue evoked some interest.

"It Appears that Our Society is Off the Ground"

The first ISRK newsletter, founded by Swinger, noted an announcement of the ISRK's formation in the *American Journal of Ophthalmology* on May 29, 1980. The newsletter added, "Dr. Friedlander has been getting applications and it appears that our society is off the ground, and that the interests of the Society lie in all forms of corneal curvature modification such as the Barraquer techniques, radial keratotomy, surgery for astigmatism, CO₂ laser...we encouraged membership from basic scientists, physicists, programmers or anyone with mutual interests."

Swinger wrote, "Our Society is an international organization, and we eagerly welcome colleagues from all countries. As we grow, we foresee holding meetings in various international cities. We are pioneers in an exciting, new and fertile area, whose ultimate clinical ramifications are vast. In the near future, this area will have an influx of many clinicians and researchers."

Swinger continued, "There may well be a negative, or at best, indifferent attitude toward us by many of our colleagues, and there will certainly be pressure from patients themselves as they hear of exciting new developments. We all desire to move cautiously, yet efficiently. It is important that we remain a cohesive unit, with active sharing of experiences, ideas, successes and failures."



The Society and the American Academy of Ophthalmology

In October 1980, the day before the American Academy of Ophthalmology's Annual Meeting in Chicago, the ISRK conducted its inaugural Annual Meeting with a scientific program.

Organized and chaired by Swinger, the program resulted in formal refractive surgery curriculum based upon submitted abstracts and invited speakers that would continue in future years. It also marked the second year for the presentation of refractive surgery papers on the Academy's scientific program, following the groundbreaking paper presented by Troutman and Swinger in 1979.

Initially, the ISRK continued to meet one day prior to the Academy's Annual Meeting, in the same city. By 1982, ISRK president Troutman believed that the meeting had attained the quality and level of interest appropriate for an annual forum within the Academy's Annual Meeting.

Troutman convinced Dr. Bruce E. Spivey, the Academy's executive vice president at the time, and the Academy's Program Committee to allocate a permanent place for an ISRK session during the Annual Meeting.

Thus, the ISRK became the first international society to achieve recognition by the Academy, a position that eventually led to a closer association in 2003 with the formation of the ISRS/AAO.

Early Courses in Bogotá, Colombia



Drs. Troutman and Swinger



Drs. Gomez and Elander



Drs. Sheets and C. Barraquer Coll



Dr. Binder



Drs. Barraquer and Villaseñor



Drs. Hernandez and Jaffe