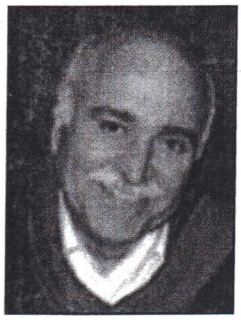


Prof. Ioannis Pallikaris,
University of Crete - School of Health Sciences, Institute of Vision and Optics (IVO),
Vardinoyiannion Eye Institute of Crete (VEIC),
Crete - Greece.

Fyoderov performed radial incisions in a pattern like the spokes of a wheel to remove glass pieces. After the glass was removed (by this method) and the cornea healed, he found that the patient's refractive error had reduced significantly. This became the foundation for modern Radial Keratotomy (RK).

Fyodorov popularised RK and possibly had the greatest impact in Refractive Corneal Surgery in his times. He was known for his innovative ideas e.g. assembly line operation system as in an industry. It was because of Fyodorov and RK that refractive surgery got to new heights of popularity amongst surgeons and masses. In 1980, National Institutes of Health (USA) sponsored the PERK (Prospective Evaluation of Radial Keratotomy) study, which demonstrated that post RK hyperopic shift with resultant corneal instability. RK is now sparsely performed as better modalities are in place.

B. Lamellar refractive surgery – Pre-excimer era

In 1949 Barraquer (Columbia) treated refractive errors by changing the cornea's shape by removing a disc of the anterior portion of the cornea with 'microkeratome'. After freezing this disc, and grinding it into a new shape with a 'cryolathe', it was resutured onto the stromal bed. This was termed as 'freeze keratomileusis'. 'Keratomileusis' is a Greek word meaning 'changing shape of cornea'. Afterwards, in the mid-1980s, as the microkeratomes became automated, Casimir Swinger developed a non-freeze keratomileusis.

Then in 1987 Luis Ruiz revolutionized lamellar refractive surgery by creating 'nasally hinged flap' by automated microkeratome. He resected underlying corneal stromal lenticule of predetermined optical diameter and thickness to treat refractive errors, followed by

reposition of flap. This avoided all complexities of earlier procedures and also made it more predictable, reproducible, acceptable and sutureless. This procedure, called Automated Lamellar Keratoplasty (ALK), was used to correct high levels of myopia and hyperopia. But it still lacked precision and the evolution to find better answers continued, which were then fulfilled by Excimer lasers.

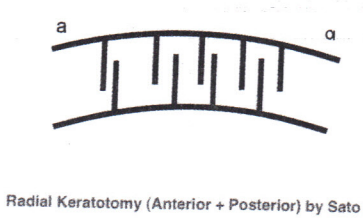
IV. Modern refractive surgery – Excimer Era

A. Excimer application on cornea

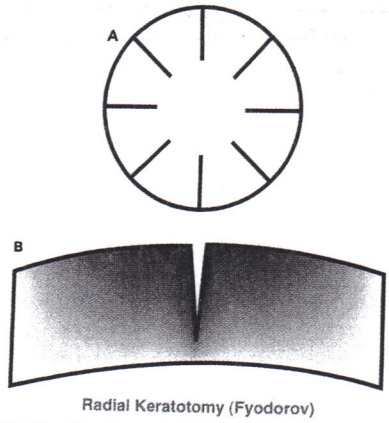
Development of excimer lasers and their applications in corneal refractive surgery opened the most glorious chapter in the evolution of refractive procedures. We should be proud of the contribution from Indians. Dr. Bhaumik created world's first efficient excimer laser in 1973. In those days it was used to etch microchips for computers. Later In 1981, Rangaswamy Srinivasan discovered that this excimer laser (argon-Fluoride:193 nm) can be used to etch a living tissue precisely, without causing any thermal damage to the surrounding area. He demonstrated this effect on his own hair. Steve Trokel (ophthalmologist) and Srinivasan proposed applying the excimer laser to reshape corneal tissue for correction of refractive errors. First, the excimer laser was used for performing radial keratotomy, which was not successful. This was followed by successful surface ablation to change corneal shape.

B. Excimer laser in Photorefractive Keratectomy (PRK)

Theo Seiler (Germany) in 1985 applied excimer laser surface ablation (PRK) for the first time on human eye. Later on Margaurite McDonald (USA) performed first PRK on sighted eye. She performed PRK on a myopic woman who had corrected 6/6 vision but her eyes were going to be enucleated because of choroidal

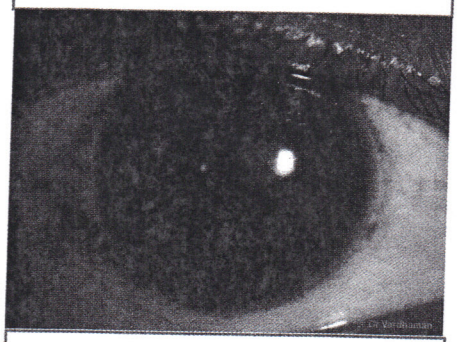


Radial Keratotomy (Anterior + Posterior) by Sato



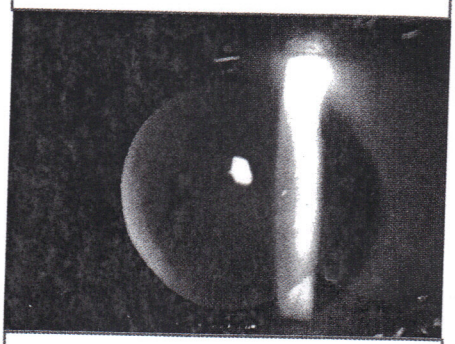
Radial Keratotomy (Fyodorov)

Sato's Radial Keratotomy

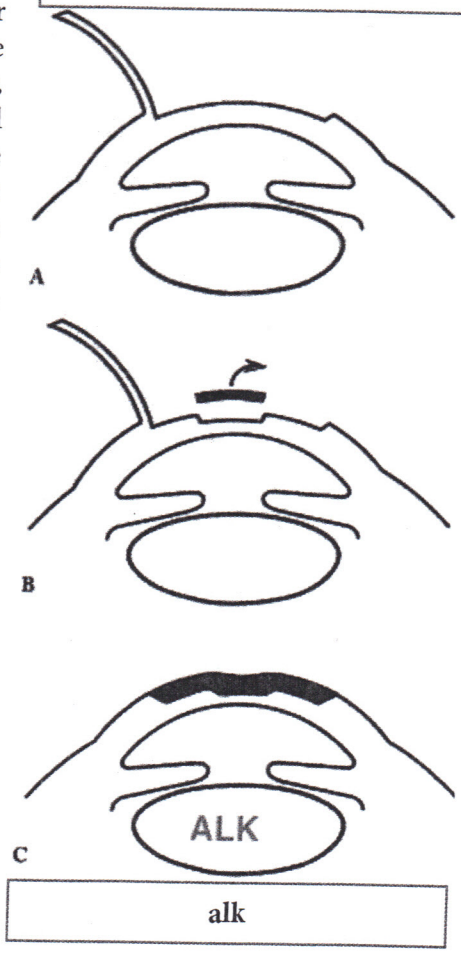


RK

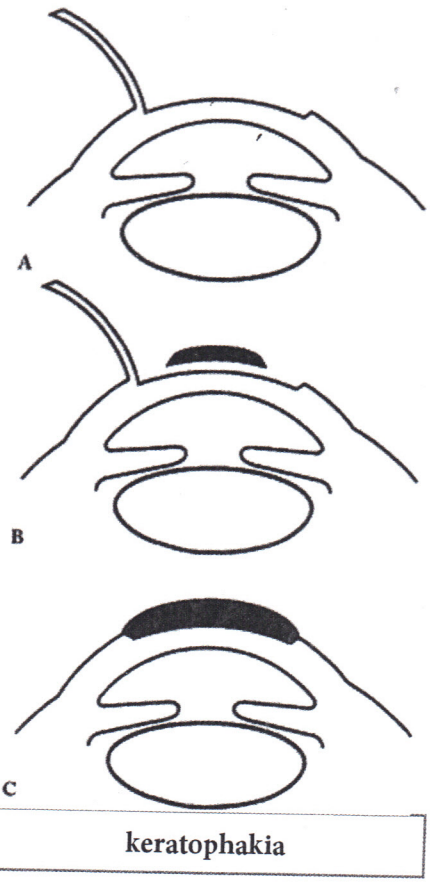
Radial Keratotomy (Fyodorov)



Post ALK Dew drop sign



alk



keratophakia

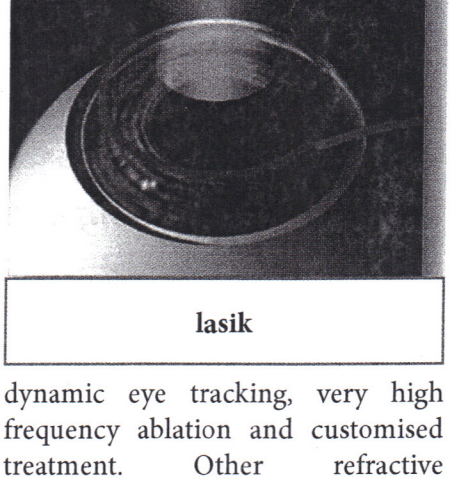
melanoma. Her study revealed accuracy of PRK and provided first histopathology report. PRK demonstrated versatility in treating myopia, hyperopia and astigmatism but had nagging problems due to ablation on the surface: i.e. pain, slow visual recovery and haze. This necessitated developing new procedure to address these problems.

C. Birth of LASIK

The big landmark in refractive surgery occurred when in 1990, Ioannis Pallikaris from Greece used the 'microkeratome' to create a hinged corneal flap and applied excimer laser onto 'stromal bed' to correct refractive errors. He coined this novel procedure as LASIK; meaning "LASer" (excimer laser), "In situ" (in the corneal bed under the flap), and "Keratomileusis" (to carve the cornea). The LASIK addressed problems of PRK (pain, delayed visual recovery, haze and regression) and gave wings to the space-age dream of a relatively quick, virtually pain free, highly accurate addressing wide range of refractive errors.

And the evolution continues

As with most of medical science, research continues refining corneal refractive surgery. We have witnessed resurgence of Advanced Surface Ablation (PRK with mitomycin C, LASEK and EpiLASIK) and evolution of Sub-Bowman Keratomileusis to address shortcomings of LASIK. Microkeratomes are more refined creating planar, more reproducible flaps. Femtosecond lasers have put a new dimention to accuracy and safety in LASIK. And Excimer lasers are more sophisticated incorporated



lasik

dynamic eye tracking, very high frequency ablation and customised treatment. Other refractive procedures like INTACS, CK and Phakic IOLs have created their own niche in the quest for perfect vision. And finally, refractive surgery today stands as one of the most common and widely accepted elective procedures on human body.