# Refractive surgery: Where are we today?

The journey began in 1898 when L.J. Lans conceived the idea of corneal remodeling by creating multiple incisions in the stromal tissue. Thereafter, the field of refractive surgery has witnessed numerous advancements in technique and technology.

The techniques in refractive surgery have diversified, with enhanced indications in eyes deemed unsuitable for refractive correction in the past. Lens-based procedures including phakic intraocular lens (IOL) and multifocal IOLs, alone or in combination with corneal based procedures (bioptics) have extended the spectrum of refractive errors and ectatic disorders that can be treated safely and effectively.

The role of preoperative assessment and screening can never be underestimated, with greater importance lying in detecting patients who should be rejected, rather than selecting those who are safe. Advancements in the field of optical coherence tomography (OCT) has expanded its application in refractive surgery, wherein epithelial mapping could potentially provide the earliest signs of ectasia.[1] Combining corneal biomechanics with tomography adds the fourth dimension to preoperative assessment, detecting subtle subclinical ectasia.[2] Artificial intelligence and machine/deep learning are on the horizon wherein population-based data analysis and specifically designed algorithms enhance preoperative and postsurgical decision making.[3-5] Understanding and implementing wavefront aberrometry plays an important role in giving us the "supervision," however, a shift from the current monochromatic to polychromatic aberrometry is imminent.

Over the past decade, a gradual shift from flap-based keratorefractive procedures to flap-free lenticule extraction has occurred. This novel technique provides superior biomechanical strength and lower postoperative dry eye vis-à-vis its earlier predecessors, with comparable, if not better, visual outcomes.[6-9] Innovative procedures utilizing the extracted lenticule from Small Incision Lenticule Extraction (SMILE) have been described including customized stromal expansion for cross-linking thin corneas, stromal implants for keratoconus, and treatment of hyperopia and presbyopia.[10-15] Potential advantages include a more physiological treatment wherein the properties of the lenticule are similar to the underlying stromal tissue. Decellularized lenticule further reduces the risk of rejection.[11] However, further studies establishing long-term safety and efficacy are warranted.

Treatment of presbyopia has additionally witnessed numerous advancements over the past decade including laser blended vision, corneal inlays, trifocal IOLs, and multifocal phakic IOLs.[16] The refractive surgical world stands in very exciting times where the pharmacological treatment of refractive errors is also being assessed. Developments have been made in "reversing" presbyopia using eye drops, wherein the crystalline lens can be made "younger" by making it more flexible. Pharmacological management to arrest the progression of myopia has been tried with controversial results.[17] Breakthrough advancements in the pharmacological field can change the history and future of refractive surgery forever.

With cataract surgery providing us exceptional and predictable visual outcomes, it is now considered under the spectrum of refractive surgery. Cataract surgery is reaching new frontiers with both surgeons and patients striving for excellence. The post-laser vision correction cataract patient is now routine and expects postoperative unaided emmetropia. The concept of refractive index shaping (RIS) has been introduced wherein the refractive power of the intraocular implant can be altered postoperatively utilizing a femtosecond (FS) laser.[18] The FS laser creates an increase in hydrophilicity and a decrease in refractive index in the treated area, as the laser builds a RIS within the lens. RIS has also been shown to create an area of multifocality in monofocal lenses. This concept is being extrapolated for keratorefractive surgery in the form of laser-induced refractive index change (LIRIC).[19] LIRIC uses an FS laser at lower energies, and at a wavelength of 405 nm, to alter the collagen fibril density of the cornea, thereby altering the refractive index. It can be used to treat myopia, hyperopia, astigmatism, and higher-order aberration profile.

The current generation of refractive surgeons experience the unfortunate burden of complications of the refractive procedures of yesteryears, in addition to their own. We must aim at a perfect refractive surgery model, wherein the future generations can seamlessly connect with our patients, as their own, with minimal complications.

In conclusion, the field of refractive surgery is perhaps one of the most exciting avenues in ophthalmology with rapid advancements in technology and the optimization of preexisting techniques.

***Mahipal S Sachdev***

Managing Editor, Indian Journal of Ophthalmology;
President, All India Ophthalmological Society;
Chairman, Centre for Sight, B-5/24, Safdarjung Enclave,
New Delhi - 110029, India.
E-mail: drmahipal@gmail.com

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## About the author

**Prof. Mahipal S Sachdev, MD**

Prof. Mahipal Singh Sachdev, an alumnus of and a former faculty at the Dr. Rajendra Prasad Centre for Ophthalmic Sciences, All India Institute of Medical Sciences, New Delhi, is an Ophthalmic entrepreneur with deep academic passion. He received specialty training in Cornea at the Georgetown University, USA. He is the current President of the All India Ophthalmological Society and is the founding Chairman and Medical Director of Centre for Sight, a nation-wide network of 43 specialty eye hospitals. Dr Sachdev was one of the youngest to chair the All India Ophthalmological Society Scientific Committee; he was also the Secretary and President of Delhi Ophthalmological Society, and Secretary and Chairman, Scientific Committee of the Intraocular Implant and Refractive Society of India. Dr. Sachdev was honored with Padmashri award by the Government of India in 2007 for his contributions to Ophthalmology. Dr Sachdev is the Managing Editor of the Indian Journal of Ophthalmology.