Small Incision Lenticule Extraction (SMILE) is the latest development in the long evolution of keratomileusis refractive procedure. The refractive lenticule is cut using the state of art femtosecond laser and the lenticule is extracted through a small corneal incision without the need for corneal flap creation, making this procedure bladeless, flapless and minimally invasive.

During the last 2 years, this advanced LASIK procedure has become clinically available in Europe and Asia as an alternative to LASIK for correction of myopia. In the United States, the procedure is currently undergoing clinical trials for approval by the US Food and Drug Administration.

Course Description
Course will discuss in bladeless, flapless Femto-LASIK system. Refractive lenticule Extraction—small incision lenticule extraction eliminates the need for the excimer laser because the entire procedure is performed using a femtosecond laser. No corneal flap is created; the entire surgery is performed through a small incision of 2 to 3 microns through which a corneal lenticule according to the patient’s refractive error is extracted. The course will discuss the various options, advantages, and challenges of this procedure and results and complications through video-based presentations.

INSTRUCTOR
Mahlipal S. Sachdev, MD

FACULTY PROFILE
Dr. Mahipal Singh Sachdev, MD
Chairman and Medical Director, Centre for Sight
Specialisation - Cataract, Cornea and Ocular Surface, Refractive surgery and LASIK

Dr. Mahipal Singh Sachdev, Chairman and Medical Director of Centre for Sight group of eye hospitals is a renowned Ophthalmologist. He has been recognized for his expertise in the areas of Cataract, Cornea & Refractive surgery, both nationally and internationally. Dr. Sachdev pursued his medical education at the graduate and post graduate level at the prestigious All India Medical Sciences (AIMS). He later joined AIIMS as a Faculty Member. In the year 1989, he completed Fellowship at Georgetown University, Washington DC, USA.

Dr. Sachdev is a pioneer in propagating the technique of Phakemulsification (without cataract surgery) in India. He is also widely credited to pioneer the newest generation Femtosecond laser cataract surgery and has done the maximum number of femtocataract surgeries in India. He is a leading refractive surgeon proficient in wide variety of laser vision correction procedures from LASIK to RK, IC & SMILE. He is also one of the fastest surgeons to reach the milestone of performing 50000 LASIK SMILE procedures in the country.

2011, Dr. Rahul Shah was awarded the Shiv Prasad Hinduja award for his work in Refractive surgery by the All India Ophthalmological Society (AIOS). He was also awarded Best Paper of the Year by the American Society of Cataract and Refractive Surgery (ASCRS).

Dr. Rahul Shah has several publications, both in peer reviewed journals, like the Journal of Cataract and Refractive Surgery, and in industry publications like Ocular Surgery News, Ophthalmology Times, CBS Today, and Ophthalmology World Report. In 2010, Ophthalmology World Report nominated him as one of the 25 women who have had the most impact on Indian Ophthalmology.

Dr. Rahul Shah practices in both Vadodara and Mumbai. He has two children.

Dr. Sri Ganesh, M.B.B.S., M.D., D.N.B.
Chairman & Managing Director of Nethradhama Hospital Pvt Ltd
Managing Trustee Shradha Eye Care Trust (SEC), Padmarangha Reger Bangalore.

H.O.D. Place Refractive department
Dr. Sri Ganesh received his basic medical education in Bangalore, Karnataka, and completed his postgraduate training in opthalmology at Regional Institute of Ophthalmology, Minto Ophthalmic Hospital, Bangalore Medical College, Bangalore. He completed DNB in 1999. He was a observer in Phacoemulsification and Lasik - Spectrum Eye Centre, U.K. He was a faculty in Refractive surgery and conducted courses and presented over 150 papers. He has over 100 published articles to his credit. He has also been the editor of the Delta Journal of Ophthalmology and Vision and was on the editorial board of various journals like the Indian Journal of Ophthalmology, Indian Pediatrics, Ophthalmology World Report etc. He has authored over 1 books in the area of eye surgery including the first book on Phaco by any Indian. These books are today referred to by every budding Ophthalmologist.

Dr. Ramamurthy Dandapani
MBBS from JIPMER, Pondicherry
M.D. Ophthalmology from R.P. Center, AIIMS, New Delhi
D.N.B. in Ophthalmology
Fellowship in Vitreoretinal SURGERY
He was the CHAIRMAN - SCIENTIFIC COMMITTEE of All India Ophthalmological Society (AIOS) which is an association of 13,000 Ophthalmologists from all over India. As Chairman he was in charge of coordinating the entire scientific activities of the association from 2008 - 2011. He has further been re-elected unanimously for a period of 3 years from 2011 to 2014.

Chairman of:
- THE EYE FOUNDATION, which has branches in Chimakurthy, Tuni and Delhi.
- The Ramamurthy Dandapani Eye Research Foundation which is a registered not-for-profit organization dedicated to the cause of blindness, especially to the restoration of vision to individuals with visual impairments.

He has been honored with Padma Shri award for his excellence in the field of Medicine by Hon. President of India Dr P. A. K. Abdul Kalam on March 25, 2007. He has received numerous awards and distinctions in India and abroad for his contribution to Ophthalmology. He has been recognized globally with fellowships and scholarships from the 17th International Symposium on Immunopharmacology, Japan, “International Society of Eye Research”, “Research to Prevent Blindness”, “New York,” “Favor award by the Contact Lens Association of Ophthalmologists,” USA amongst others. In India he has won the “R A C Appalaraj Memorial Trophy”, “CII Ranagachery Certificate”, “Rishiv Sudan Singh Trophy”, “Dr. Vishwanath Chandra Jabara Award” to name a few.

Dr. Dandapani has been active in imparting surgical training to the ophthalmic community. He has conducted several live surgery demonstrations in the remoter locations of India to teach and popularize the art of safer cataract surgery. He is the secretary of the Delhi Ophthalmological Society from 1979 to 1995 and the president for the same society in the year 2000. Under his stewardship the society was transformed from a small local body to an organization of national eminence which influences the practice of Ophthalmology in a major way both in India and abroad.

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Within the laser suite, with the surgeon and the patient moving from one laser to another.

The femtosecond laser can be used to create a lenticule within the corneal stroma. The corneal lenticule can then be extracted from the corneal stroma, either by creating and lifting a hinged flap similar to LASIK or by vestibulating it using a manual incision in the cornea. Various techniques of femtosecond lenticule extraction are known as Femtosecond lenticule extraction (FLE) and small-incision lenticule extraction (SMILE), respectively. Both techniques represent all-in-one femtosecond laser refractive surgery because they represent novel integrated surgical techniques to perform corneal laser surgery in one step and need only one laser to perform laser refractive surgery and have various clinical, practical, and economic advantages over the traditional 2-laser solution.

Selection criteria

Currently, Bausch+Lomb SMILE is available to treat myopic errors of up to 1200 spherical equivalents (equivalent to 1200 diopters), and with or without astigmatism up to 90 degrees. It is presently not available for hyperopic correction. Patients are generally selected using the same criteria as LASIK.

The Technology

The VisuMax femtosecond laser is used to perform Bausch+Lomb SMILE procedure. The VisuMax is capable of creating refractive lenticules within the cornea with high degrees of accuracy. The VisuMax software allows the calculation of the refractive lenticule needed for the correction of a particular refractive error, and it also automates all stages of the procedure.

released the surgical microscope eye pieces in both cases to allow for full visual control during the entire procedure.

A sterile curved contact lens is attached to the laser optical system, and the patient is positioned at a distance in front of the contact lens system. The patient's eye is adjusted in relation to the contact lens system. The surgeon monitors whether the centration is appropriate. If the surgeon considers that the centration is correct, suction is initiated to hold the cornea against the contact lens interface.

In these cases, 4 different tissue disruption planes are created for the procedure. These include (a) the posterior surface of the stromal bed, with a predefined diameter based on the optical zone selected; (b) the 150-degree corneal length vertical edge of the refractive lenticule, with a depth equivalent to the thickness of the edge of the lenticule; (c) the anterior surface of the refractive lenticule, which is extended by about 0.15 mm beyond the optical zone design; (d) the 50-degree horizontal edge of the cornea in contact with the surface of the cornea, with a depth up to the edge of the anterior part of the lenticule. The entire procedure takes less than 30 seconds, practically independent of the refractive error to be corrected. The spherical aberration of the lenticule generated thus is corrected for refractive errors. The anterior surface of the lenticule can be programmed to be more than 0.15 mm higher than the corneal surface, similar to the flap thickness in LASIK. The lenticule diameter can be 8.0 to 7.5 mm wide for treating myopia or myopic astigmatism. The minimum thickness of the lenticule edge is 5 to 15 microns to support easier manual manipulation of the lenticule edge. In SMILE, the cut-off incision can be 30 to 50 degrees.
Once the femtosecond laser cutting procedure (treatment mode) is finished, the suction is automatically switched off, and the patient eye is released from the contact glass and moved under the microscope (observation mode). The side cut incision is generally created superiorly or superonasally to preserve the neurovascular and tear layer of the anterior chamber configuration. A small sharp instrument is used to open a small portion of the side cut incision. A small blunt spatula is inserted in the side cut incision, and the anterior surface of the lenticule is scraped from the underlying stroma. A blunt spatula is then inserted through this edge below the lens and used to separate the posterior part of the lenticule from the underlying stroma. Once the lenticule is free from superficial tissue, a small microspatula is inserted to grasp the lens and extricate it from the corneal stroma. A 24-gauge cannula is inserted into the incision, and the corneal position is flushed with balanced salt solution. A PK eye is used to pick off aqueous fluid from the side cut incision. After 30 seconds, the specular is removed. Both eyes are treated at the same time.

References:

Advantages over Femto-LASIK:
1. There are economic, clinical and workflow advantages of performing only femtosecond procedures like ReLEx SMILE over Femto-LASIK in terms of saving on capital costs, maintenance costs and consumables.
2. In ReLEx, the lenticule is carved out within the cornea by cutting, as opposed to ablation with excimer laser which depends on a number of other factors like corneal hydration levels, atmospheric humidity and temperature and also on the depth in the stroma at which ablation occurs. The scatter in the ablation rates is particularly high, when ablation depth is low as in case of higher refractive error. Because of the femtosecond lasers cutting action, the scatter in the thickness of the lenticule is minimized and it is independent of the refractive error being treated.
3. The refractive predictability with the ReLEx procedure is higher than with an excimer laser, particularly for higher amounts of refractive errors.
4. With femtosecond laser, the peripheral loss of fluorescence is not a factor at all, and no compensation needs to be carried out. So the amount of tissue required per displace of treatment is smaller than that required with an excimer laser which compensates for the peripheral energy loss.
5. The total amount of energy laid down into the cornea is also much less than with an excimer laser. Since there are some evidences that the fast heat generated by excimer laser has some adverse effect on corneal healing, the low energy used in ReLEx SMILE is a welcome benefit.
6. The small incision heals relatively quickly, causes less patient discomfort, and little risk of flap displacement.
7. The small flap diameter and the side-cut cut incision means that there is smaller likelihood of cutting corneal nerves, perhaps leading to less problems of dry eyes.
8. Finally, the procedure saves working time as there is no time loss in switching patients from one laser to another.

Re-treatment following SMILE:
The Circle Scan software, now available helps convert the flap into a flap with a larger diameter than the original flap. This flap may be lifted in the femtosecond-LASIK procedure and excimer laser may then be used for refractive error correction. Otherwise a PKR procedure may be performed.

Tissue Addition Applications
The intact lenticule extracted following SMILE is finding innovative uses. Intrastromal insertion of the lenticule in femtosecond laser created laser pockets can be used to create hyperopia. Sutures technique for crosslinking the ultrathin ectatic cornea describes the use of this lenticule to augment the tissue and also stabilize the zonules while performing UCA ablation for corneal crosslinking. Placement of this lenticule over the apex of the cone allows effective crosslinking in patients with stromal thickness less than 400 microns.

Figure 4: Surgical steps
(a) Posterior tissue disruption plane (lenticule cut)
(b) Anterior tissue disruption plane (flap cut)
(c) Superior flap side cut incision
(d) Anterior plane dissection
(e) Posterior plane dissection
(f) Lenticule removed.