

The Science of Lasik Surgery

Lasik is laser-assisted in situ keratomileusis, and is a type of refractive laser eye surgery performed by ophthalmologists. It is used for correcting myopia (near-sightedness), hyperopia (far-sightedness), and astigmatism (blurred vision resulting from irregular conformation of the cornea).

The Technology

The Lasik technique was made possible by the Colombia-based Spanish ophthalmologist Jose Barraquer, who, around 1950 in his clinic in Bogotá, Colombia, developed the first microkeratome, used to cut thin flaps in the cornea and alter its shape, in a procedure called keratomileusis. The general term for changing a patient's optical measurements by means of an operation is Refractive Surgery. Later technical and procedural developments included RK (radial keratotomy), and PRK (photorefractive keratectomy). (RK is a procedure in which radial corneal cuts are made, typically using a micrometer diamond knife, and is completely different from LASIK).

In 1980 it was discovered that an ultraviolet Excimer laser could etch living tissue in a precise manner with no thermal damage to the surrounding area. The first use of the laser was to change the surface shape of the cornea, known as PRK. Scientists theorized the benefits of performing PRK after the surface was raised in a layer to be known as a flap. The blending of a flap and PRK became known as Lasik. It quickly became very popular, since it provided immediate improvements in vision and involved much less pain and discomfort than PRK.

Today, faster lasers, larger spot areas, bladeless flap incisions, intraoperative pachymetry, and wavefront-optimized and -guided techniques have significantly improved the reliability of the procedure compared to that of 1991.

Wavefront-guided Lasik is a variation of Lasik surgery in which, rather than applying a simple correction of focusing power to the cornea, an ophthalmologist applies a spatially varying correction, guiding the computer-controlled Excimer laser with measurements from a wavefront sensor. The goal is to achieve a more optically perfect eye, though the final result still depends on the physician's success at predicting changes which occur during healing.

The Procedure

Preoperatively, patients wearing contact lenses are usually instructed to stop wearing them, for varying lengths of time. Before the surgery, the patient's corneas are examined with a pachymeter to determine their thickness, and with a topographer to measure their surface contour. Using low-power lasers, a topographer creates a topographic map of the cornea, which also detects astigmatism and other irregularities in the shape of the cornea. This information allows the surgeon to calculate the amount and the locations of corneal tissue to be removed during the operation.

The operation is performed while the patient is awake and mobile, however is usually given a mild sedative and anesthetic eye drops. Lasik is performed in three steps:

- Flap creation – a corneal suction ring is applied to the eye, holding the eye in place. Once the eye is immobilized, the flap is created using either a mechanical microkeratome using a metal blade, or a femtosecond laser microkeratome (a procedure known as IntraLasik) that creates a series of tiny closely arranged bubbles within the cornea. A hinge is left at one end of this flap. The flap is folded back, revealing the stroma (middle section of the cornea). This process can sometimes be uncomfortable.
- Laser remodeling – this is done with an Excimer laser to remodel the corneal stroma. The laser vaporizes tissue in a finely controlled manner without damaging the adjacent stroma. No burning or cutting is required. The tissue layers removed are tens of micrometers thick. During this step, the patient's vision will become very blurry once the flap is lifted and he/she will be able to see only white light surrounding the orange light of the laser. Current Excimer lasers use a system which track the eye's position up to 4,000 times per second, adjusting the laser pulses for precise placement.
- Repositioning of the flap – after the laser reshapes the stromal layer, the Lasik flap is carefully repositioned. The surgeon checks for air bubbles, debris, and proper fit on the eye. The flap remains in position by natural adhesion until healing is complete.

After the surgery, patients are given antibiotics and anti-inflammatory eye drops. They are also advised to sleep more than usual, and are given dark glasses to shield their eyes from bright lights, as well as protective goggles to prevent rubbing of eyes while asleep, and to prevent dryness. Post-operative care is essential to ensure success of this procedure. Ocular discomfort is usually mild and subsides within a few days of the surgery. Some patients experience blurry vision, or dry, gritty eyes, but most return to normal activities within one to two days. Full healing occurs in six weeks. Fewer than 2-3% of all Lasik patients experience any long-term side effects, however these can include under or over correction, regression, glare and halos, infection, problems with night vision, keratitis, corneal bulging, or dry eye. These effects are rare, and the procedure is generally considered to be safe and effective. NASA has even approved Lasik surgery for astronauts!

***This information has not been verified by Science Alberta Foundation, and is for general informative purposes only. For more information about your eyes or Lasik surgery, please talk to your optometrist. ***