

Targeting Perfect Vision with Advanced Refractive Techniques

by Dr Leonard Ang

Modern methods of correcting refractive errors



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Myopia is also known as shortsightedness. This usually occurs when the eyeball is longer and light rays are focused in front of the retina. People with myopia see better at near, while distant objects are blurred. This is the most common form of refractive error among Singaporeans and Asians.

Singapore has one of the highest rates of myopia in the world. At 7 years of age, about 20% of children are myopic and more than 70% are myopic upon completing college. Approximately 10% of Singaporeans have high myopia exceeding -6.0 D (diopters). People with very high myopia may have a higher risk of retinal tears, retinal detachment, cataract or glaucoma.

Astigmatism

Astigmatism occurs when the curvature of one part of the cornea (the central clear part of the eye) is different from another part. This results in light rays being focused at various points in the eye, resulting in blurring and distortion of the image. Most people have some degree of astigmatism.

Presbyopia (Lao Hua)

Presbyopia is the progressive difficulty in focusing at near objects and reading as one grows older. It happens to everyone as part of the normal ageing process and usually starts at about 40 years of age. It is a result of an age-related decrease in the elasticity of the lens and weakening of the muscles of accommodation, and patients lose the ability to focus at near distance.

Advances in refractive surgery for correcting refractive errors

Refractive surgery refers to the surgical correction of the refractive errors of the eye. All forms of refractive errors can be corrected, including myopia (short-sightedness), hyperopia (far-sightedness), astigmatism, and presbyopia (lao hua).

Millions of people around the world have undergone refractive surgery to reduce or eliminate their need for wearing spectacles or contact lenses. The latest advances in refractive surgery have enabled patients to achieve excellent vision with greater precision and safety.

The most common refractive surgical procedures in the world today are LASIK, implantable contact lens surgery and cataract surgery.

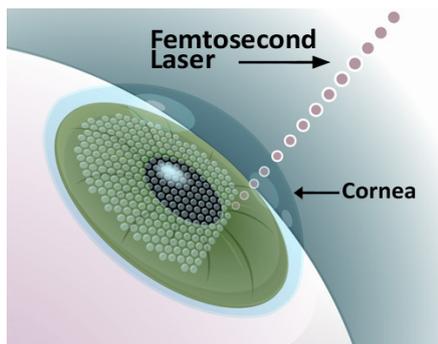


Figure 1. First stage of LASIK: creation of corneal flap using femtosecond laser

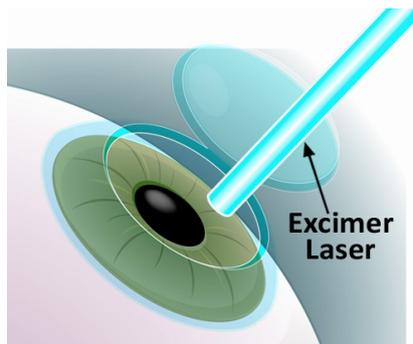


Figure 2. Second stage of LASIK: Lifting the corneal flap using excimer laser

LASIK

LASIK, or laser in situ keratomileusis, is a laser procedure that corrects the refractive errors of the eye by reshaping the cornea. It has gained tremendous popularity and is currently the most commonly performed refractive procedure because of its high success rate, rapid visual recovery and extremely low risk.

It consists of two stages. The first stage is the creation of a corneal flap. This can be done with a motorised blade system, called a microkeratome, or the newer method that makes use of an ultra-precise laser called the femtosecond (FS) laser. The FS laser allows the corneal flap to be created without the use of a blade (bladeless surgery) **[Figure 1]**.

The second stage involves partially lifting the corneal flap and using an extremely precise excimer laser to reshape the cornea tissue underneath the flap **[Figure 2]**. The flap is returned to its original position and the entire surgery is completed in approximately 4 minutes per eye. The whole procedure is essentially painless. The visual recovery is fast and patients can return to work within 1 to 2 days after surgery.

Advances in LASIK surgery

Modern LASIK machines can achieve excellent results. The most advanced system which combines greater precision, customisation and safety is the latest iLASIK treatment. iLASIK is an ultra-precise, completely customised, blade-free, all-laser combination of IntraLase bladeless flap creation and the VISX Advanced CustomVue Wavefront-guided LASIK **[Figure 3]**. It is so precise and safe that it is approved for use in NASA astronauts and US top-gun fighter pilots.

Newer and safer bladeless surgery

A safer and superior method of flap creation is with the use of a femtosecond (FS) laser. The IntraLase FS laser is the world leader in terms of safety, effectiveness and precision. The latest version of the IntraLase, the 5th generation iFS 150Hz

Advanced FS Laser, is much faster and more precise, enabling surgeons to attain an extremely high degree of surgical control and customisation. The laser beam is focused just beneath the corneal surface and creates a uniform layer of microscopic bubbles that interconnect to create a corneal flap.

The recovery is faster and there are fewer LASIK flap related complications. The flap diameter, depth, edge angle and morphology can all be programmed and customised to suit each person's cornea to achieve a superior visual result.

The iFS laser delivers outstanding results, with more patients being able to achieve 6/6 vision or better. Patients reported better quality of vision overall in the day and night, with less visual disturbances such as glare and halos.

Wavefront guided LASIK provides exceptional vision correction

A standard LASIK corrects a person's basic refractive errors such as myopia and astigmatism. Wavefront-guided LASIK is a customised excimer laser treatment that not only corrects these refractive errors, but also unique



Figure 3. The iLASIK system

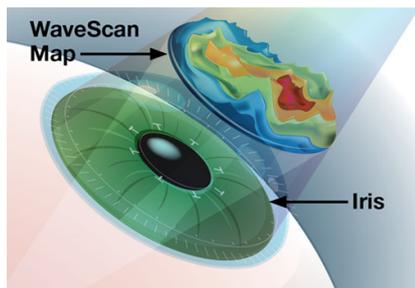


Figure 4. The new iDesign Wavefront analyser precisely measure refractive errors and higher order aberrations of the eye

imperfections of the eye (higher order aberrations) that cannot be corrected with glasses, contact lenses or standard LASIK surgery.

The new iDesign Wavefront analyser is the latest ultra-precise diagnostic machine that can precisely measure all the refractive errors of the eye and higher order aberrations [Figure 4]. The iDesign technology delivers the highest resolution available, thereby resulting in the most accurate and individualised

treatment possible for the widest range of indications. The information captured from iDesign is then transferred to the excimer laser to design an individualised treatment.

The combination of iDesign technology and the Advanced CustomVue Wavefront-guided treatment helps to ensure greater precision and accuracy in treating refractive errors and higher order aberrations, so that patients can achieve superior vision in the day and night compared to standard LASIK, with sharper and higher quality vision, as well as less glare, halos and starbursts at night. In US Food and Drug Administration (FDA) studies, 98% of patients could see 6/6 or better.

These advances in LASIK technology have significantly improved the safety, accuracy and precision of laser vision correction.

Implantable contact lens (ICL) or phakic intraocular lens

Another safe and effective method of correcting vision is the implantation of a phakic intraocular lens. The operation involves inserting an artificial lens into the person's eye. The most widely established phakic intraocular lens is the Visian implantable collamer lens, or more commonly called, implantable contact lens (ICL). The lens is completely biocompatible as it is made from collamer, which is a polymer with collagen. Once implanted, the lens is invisible to the naked eye and patients can resume all their normal activities.

ICL can correct a wide range of refractive errors of up to 1,900 degrees of short-sightedness and 500 degrees of astigmatism. It is particularly useful for people with high refractive errors (i.e. those above 900 degrees) or people who

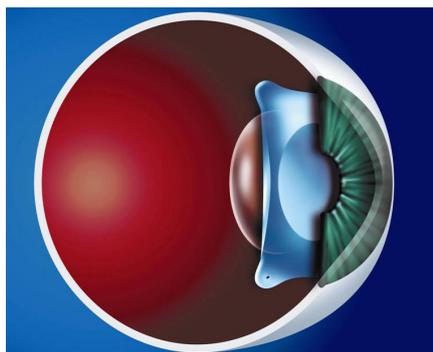


Figure 5. In ICL surgery, the ICL is inserted through a small incision at the edge of the cornea and is placed behind the iris and in front of the natural crystalline lens of the eye

are not suitable for LASIK due to very thin corneas. For people with very high degrees, ICL surgery can give patients high definition vision in the day and night, with less night vision phenomena (e.g. haloes and starbursts) compared to LASIK.

The surgery is simple and painless and takes about 10 minutes. The lens is inserted through a small incision at the edge of the cornea and is placed behind the iris and in front of the natural crystalline lens [Figure 5]. The wound heals on its own without stitches. Recovery after the ICL procedure is relatively fast with minimal discomfort. Most patients are able to return to work or school within a few days of the procedure.

This procedure does not cause any alteration to the shape and structure of your cornea, thus providing an advantage for people with high myopia and thin corneas. The surgery does not cause dry eyes. It is reversible and the lens can be removed if necessary.

Refractive cataract surgery

The other common method of correcting one's vision is in the form of cataract surgery. Cataract is a condition in which the natural clear lens of the eye becomes cloudy and reduces the amount of light entering the eye. This results in a gradual progressive deterioration of vision.

Cataract is the most common cause of blindness in the world.

Cataract is the most common cause of blindness in the world. Annually, at least 25 million eyes go blind due to cataract. In Singapore, more than 30% of patients above 45 years of age and more than 80% of patients about 60 years of age have some degree of cataract.

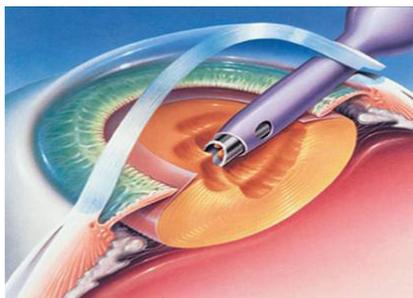


Figure 6. Modern cataract surgery known as phacoemulsification

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Refractive cataract surgery and its benefits

Cataract surgery is no longer just about curing blindness, it is also a refractive surgical procedure that can correct all forms of refractive error, including myopia (short-sightedness), astigmatism, and presbyopia. This enables patients to reduce or eliminate their need for wearing spectacles. In fact, because of how prevalent cataracts are, it is one of the most common ways of correcting refractive errors in patients.

Modern cataract surgery is very advanced and can be performed safely and effectively. In the hands of an experienced surgeon, it is one of the safest and most successful operations in the world.

Cataract surgery can be performed when the blurry vision is affecting or impairing one's vision and affecting one's daily activities. With modern cataract surgery it is no longer necessary to wait for cataracts to "ripen" or for the vision to be bad before performing surgery.

Modern cataract surgery is known as phacoemulsification. It is a painless procedure that takes less than 30 minutes to complete. The cataract is softened and removed

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through a small incision, 2mm at the edge of the cornea **[Figure 6]**. An artificial intraocular lens is implanted immediately following the cataract removal and the wound often seals on its own without the need for stitches.

New and improved intraocular lenses give patients sharper vision and greater freedom from spectacles

Newer intraocular lens technology can give patients better vision after cataract surgery. Better and more accurate machines help give greater accuracy in the lens power measurement. These technologies enable better accuracy in correcting the refractive errors of the patient and give them sharper vision.

Newer lenses allow improved visual outcomes to suit each patient's individual needs, and give patients greater convenience. This includes the use of toric lenses to correct astigmatism and multifocal lenses to correct both distant vision as well as presbyopia. Therefore, with the selection of better lenses, the refractive errors in the eye can be accurately corrected. After cataract surgery, patients can enjoy better vision and greater convenience without spectacles.

Treatment of presbyopia (lao hua yan)

Presbyopia can be effectively corrected with refractive surgery, so that patients can then reduce their need for reading spectacles.

If the patient has cataracts, patients can undergo refractive cataract surgery and have their vision and presbyopia corrected with the appropriate intraocular lens.

For patients who do not have cataracts, refractive surgery can correct the patient's pre-existing refractive error (e.g. myopia), as well as presbyopia. The most common option is to do a LASIK monovision correction. In this situation, the patient's master or dominant eye will be corrected to allow the patient to see far. The other eye (non-dominant eye) is corrected for reading, so that patients are able to see far, as well as read. Because the brain automatically chooses clearer eye to see, patients naturally feel comfortable with it and go about the normal routines without the need for spectacles for both far and near vision.

Conclusion

Modern refractive surgery is very safe and effective. Advances in technology have further improved the success rates, with patients achieving better vision. In the hands of an experienced surgeon, complication rates are negligible. A surgeon who is experienced in the various refractive surgical options will be able to advise patients regarding what would be the best surgical option for them in order to achieve an optimal visual outcome.

With advances in refractive surgery, patients can enjoy better vision and greater convenience without the need for spectacles and contact lenses. **IMG**