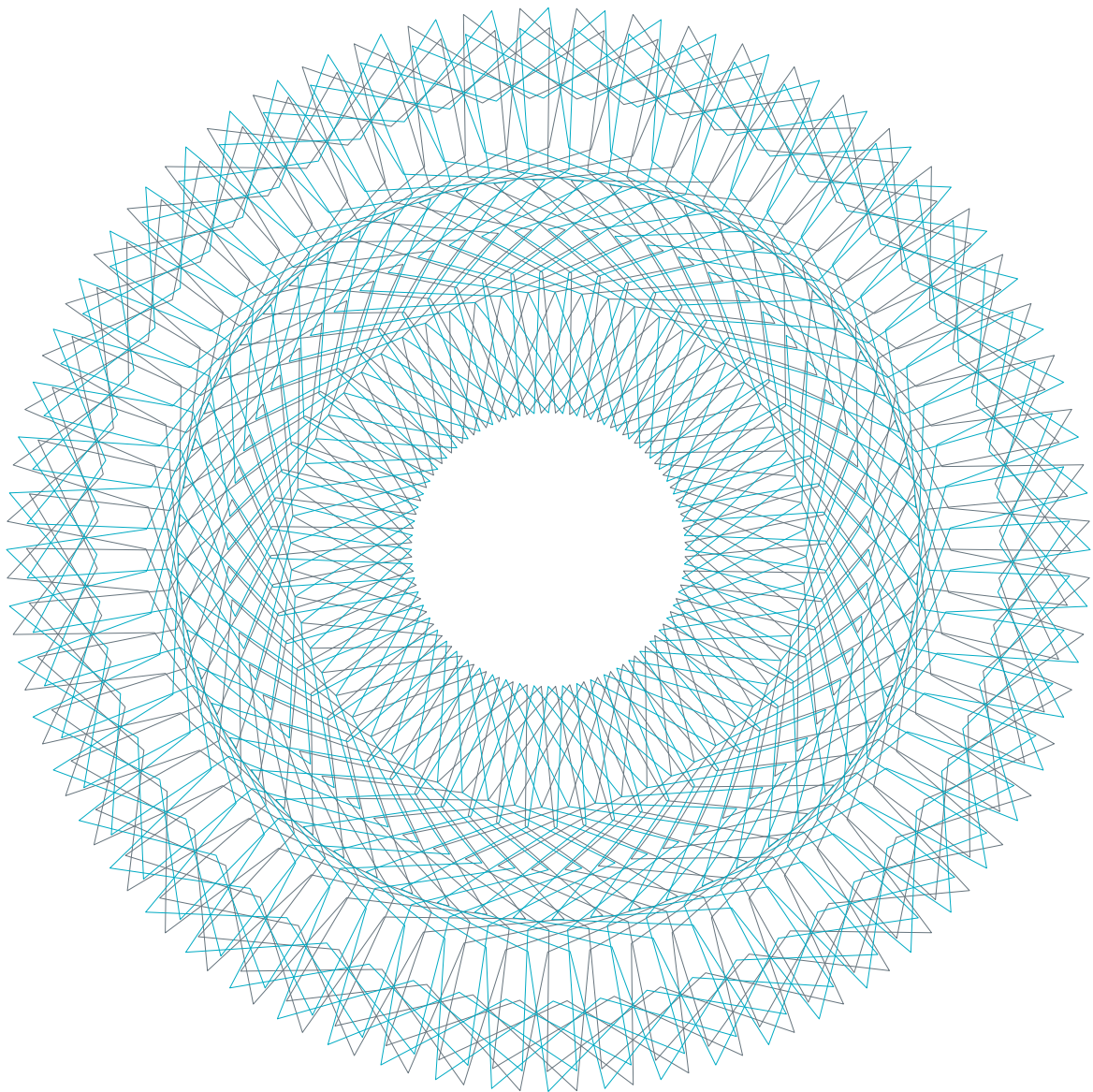


The UK Guide to Laser Eye Surgery



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Table of contents

About the authors	4
Professor Dan Reinstein, MD MA (Cantab) FRCS(C) FRCOphth DABO	4
Mr Glenn Carp, MBBCh (WITS), FC Ophth (SA) (WITS)	6
How the eye works	8
Myopia · Short-sightedness	9
Hyperopia · Long-sightedness	9
Astigmatism	9
Presbyopia · Ageing Eyes/Reading Glasses	10
Understanding visual acuity — What does 20/20 mean?	10
Understanding prescriptions	11
How does laser eye surgery work?	11
Common misconceptions about laser eye surgery	12
Safety considerations of laser eye surgery	13
How safe is laser eye surgery?	13
How is safety measured?	14
Questions to ask when considering laser eye surgery	15
Patient checklist:	15
- Does the surgeon monitor your individual patient outcomes on an ongoing basis?	15
- Did the surgeon undergo formal refractive surgery training and for how long?	16
- Will the clinic conduct all of the necessary pre-operative tests to ensure my suitability for laser eye surgery?	16
- What aftercare regime is provided for my particular treatment plan?	17
- Will I have access to the surgeon post treatment?	17
Questions about technology	17
What is topography?	17
What is a pachymeter?	18
What is pupillometry?	18
What is wavefront aberrometry?	19
What is a keratome (mechanical and laser)?	19
What is an excimer laser?	20
A laser eye surgery technology primer	20

Frequently Asked Questions	32
Q: Can laser eye surgery treat the loss of reading vision?	32
Q: Why can some people have LASIK, whilst others can only have PRK / LASEK?	32
Q: How long should I be out of contact lenses before consultation with my surgeon ('consent appointment')?	32
Q: Are both eyes treated at the same time?	32
Q: What will I feel during and after the laser eye surgery procedure?	33
Q: How long does laser eye treatment take?	33
Q: What happens if I look away, blink, cough or sneeze during the procedure?	33
Q: What is the risk of a complication during laser eye surgery?	33
Q: Can I take a tranquiliser or sedative (e.g. Valium) prior to the procedure?	33
Q: Do laser eye surgery results differ between prescriptions?	34
Q: What is wavefront?	34
Q: I have astigmatism, can I still have laser eye surgery?	34
Q: Is my prescription too high?	34
Q: What range of prescriptions can be treated?	35
Q: Am I too old/too young?	35
Q: Does everyone get presbyopia?	35
Q: What are the risks of laser eye surgery?	35
Q: What causes glare and halos and can it be treated?	36
Q: How does the flap stay in place in LASIK?	37
Q: What conditions may prevent me from having laser eye surgery?	37
Glossary	42

About the authors

Professor Dan Reinstein, MD MA (Cantab) FRCS(C) FRCOphth DABO

Professor Reinstein is the founder of London Vision Clinic. He is one of the few full-time Consultant Ophthalmic Surgeons in the UK to dedicate his entire professional life to laser eye surgery. The February 2003 issue of *Health Which? Magazine* states, "Dan Reinstein is one of very few ophthalmologists working in the UK who is a fellowship trained specialist refractive surgeon." Professor Reinstein completed his undergraduate education at Cambridge (1981 to 1984) and went on to earn his medical degree from Cambridge University - an M.B. B.Chir (1989). He has received extensive post-doctorate fellowship sub-specialty training first in corneal surgery and then in laser eye surgery, including:



- Research Fellowship in Ophthalmic Epidemiology (Institute of Ophthalmology, London 1991)
- Fellowship in Ophthalmology (The Weill Medical College of Cornell University, New York 1994)
- Residency in Ophthalmology (Mount Sinai School of Medicine, New York 1996)
- Refractive Surgical Fellowship (under Zaldivar, Arbelaez, Chacon and Barraquer, 1997)
- Fellowship in Cornea, External Disease and Refractive Surgery (University of British Columbia, Canada 1999).

Professor Reinstein is a recognised international expert in laser refractive surgery

He is one of the few laser eye surgeons in the UK who is a recognised international expert. He is on the specialist register of ophthalmic surgeons in the UK and a board-certified ophthalmologist in the USA and Canada. He holds professorships and consultant posts in New York (Weill Medical College of Cornell University), London (St. Thomas Hospital – Kings College) and Paris (Centre Hospitalier National d’Ophtalmologie des Quinze-Vingts, Université de Paris VI). Professor Reinstein is an experienced research scientist and has made major contributions to the field. To date, he:

- Has published over 75 articles in peer reviewed medical journals
- Has published over 100 articles for the Ophthalmic Press
- Has published over 30 book chapters
- Has delivered over 350 lectures at professional meetings on five continents
- Has presented or published over 200 scientific papers or abstracts.

He is the former Chief Medical Officer of a group of 60 laser eye surgeons across 30 clinics throughout North America. During his tenure, the group grew to become the largest provider of laser vision correction in the world (performing over 100,000 procedures per year).

Professor Reinstein has appeared frequently on television as the laser eye specialist for *Extreme Makeover UK* as well as *10 Years Younger*. He has also appeared on *BBC Breakfast*, *SKY News* and *BBC Radio 4*. He has been featured in *The Times*, the *Financial Times* and the *Sunday Times Magazine*.

Mr Glenn Carp, MBBCh (WITS), FC Ophth (SA) (WITS)

Mr Glenn Carp has undergone one of the most rigorous training programs of any laser eye surgeon in the UK. Mr Carp was born and educated in South Africa. He qualified as a doctor in 1996 in Johannesburg. He is on the UK Specialist Register.

He began his career in Ophthalmology as an Ophthalmic Senior House Officer, followed by a year spent as a Research Officer in Ophthalmology at the University of the Witwatersrand in South Africa.

In 2000, he commenced his specialist registrar training at the St John Eye Hospital in Johannesburg, Africa's largest eye hospital. Mr Carp was the recipient of the Tetski Patterson Award for clinical research and received the Elli Dahan Registrar of the Year Award in recognition of his outstanding performance over the four years of specialist training.



Mr Carp has undergone one of the most rigorous training programs for any laser eye surgeon in the UK

On completion of his training Mr Carp remained on as a consultant ophthalmologist at the St John Eye Hospital in Johannesburg. His areas of interest over and above that of general ophthalmology included specialist work in the glaucoma and surgical retina units. He also held a post at the Johannesburg Eye Hospital as a private consultant. Following completion of this tenure Mr Carp left South Africa to further his training in the United Kingdom through fellowship training in corneal and refractive surgery.

Mr Carp's UK ophthalmic experience includes:

- The Western Eye Hospital
- Maidstone General Hospital
- Preston Royal Hospital
- Worcester Royal Hospital

He was selected for a prestigious one-year fellowship in Cornea and Anterior Segment pathology and surgery at London's Western Eye Hospital under the guidance of Miss Melanie Corbett and an 18-month fellowship in Laser Refractive Surgery at London Vision Clinic under the guidance of Professor Dan Reinstein.

Mr Carp is registered with the General Medical Council (GMC). He is also a member of the South African Medical and Dental Council and is a fellow of the College of Surgeons in Ophthalmology (South Africa) and is on the specialist register of Ophthalmic Surgeons in the UK.

He is a member of many professional organisations including:

- The European Society of Cataract and Refractive Surgery (ESCRS)
- The British Society for Refractive Surgery (BSRS)
- Treasurer of the Medical Contact Lens and Ocular Surface Association (MCLOSA)
- The Ophthalmological Society of South Africa (OSSA)
- The South African Society of Cataract and Refractive Surgeons
- The South African Society for the Prevention of Blindness - providing cataract surgery to poor communities
- Member of United Kingdom & Ireland Society of Cataract & Refractive Surgeons (UKISCRS)

Mr Carp is a regular attendee at both national and international meetings and congresses around the world. He has delivered presentations at the ESCRS congress for the past 7 years and has also been invited to give lectures at various instructed courses including the workshop in visual optics. His interest in keratoconus has also brought him to participate and lecture at the annual International Congress of Corneal Cross Linking on several occasions. He had laser eye surgery at London Vision Clinic with Professor Reinstein in 2006.

How the eye works

Your eye is like a camera. Your eye has:

Your eye is like a camera

- A variable opening called the pupil;
- A lens system, which includes the transparent covering called the cornea and a spherical lens (LASIK eye surgery procedure is performed on the cornea);
- A reusable “film” called the retina;
- Various sets of muscles (the muscles control the size of the opening, the shape of the lens system and the movements of the eye).

On the back of your eye is a complex layer of cells known as the retina. The retina reacts to light and conveys that information to the brain. The brain, in turn, translates all that activity into an image. Because the eye is a sphere, the retina has a curved surface.

In the retina, sensory cells called rods and cones change the photons of light into electrical signals. Nerves transmit these signals to the brain, which interprets them. The ability to focus the light on the retina depends on the shapes of the cornea and the lens. Inherent shapes, stretchiness or elasticity, the shape of the eyeball and sets of attached muscles influence the shapes of these anatomical components. Therefore, when you look at something, muscles attached to the lens must contract and relax to change the shape of the lens system and keep the object focused on the retina, even when your eyes move. Your nervous system controls this complex set of muscle movements.

When you look at something three things must happen:

- A reduction in the image to fit onto the retina
- The scattered light must come together—that is, it must focus at the surface of the retina
- The curving of the image to match the curve of the retina.

The light passes through the cornea and pupil. The lens bends (refracts) the light and it then comes to a point (focus) on the retina. As light enters the eye, it is focused on the retina. To do this, the eye has a lens between the retina and the pupil (the “peep hole” in the centre of your eye that allows light into the back of the eye) and a transparent covering or cornea (the front window). Thus the lens and the cornea work together to focus the image onto the retina.

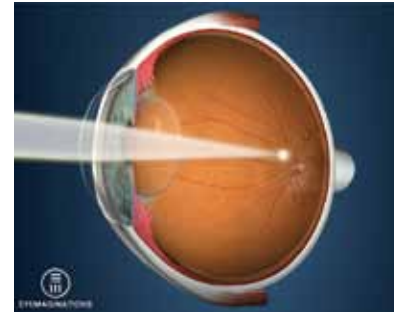
Most vision problems occur when the eye cannot focus the image onto the retina. The most common problems are Myopia (short-sightedness), Astigmatism, Hyperopia (long-sightedness) and Presbyopia. In most cases, laser eye surgery corrects these vision problems.

Myopia · Short-sightedness

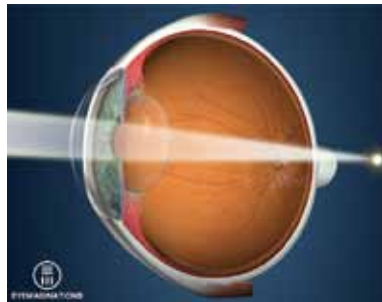
Myopia is the technical term for short-sightedness

Myopia occurs when your eye is too deep compared to the curvature (focusing power) of your cornea or the cornea is more curved. The result of this is that light focuses short of the retina.

This means you cannot see distant objects clearly, such as the numbers on the front of buses. Laser eye surgery can correct this by changing the shape of the cornea so that its focusing power is matched to the depth of the eye.



Hyperopia · Long-sightedness



Hyperopia occurs when your eye is too shallow compared to the curvature (focusing power) of your cornea or the cornea is less curved, so light focuses behind the retina. When younger many hyperopic eyes can self-focus by utilising the "zoom" intended for reading, to compensate for the

distance blur. As the eye ages, this "zoom" gets weaker, near vision becomes blurred and later distance vision becomes blurred as well. So people with hyperopia often require reading glasses before their 40's and often require both reading and distance glasses (or bifocals) in their 40's. Laser eye surgery can correct this by changing the shape of the cornea so that its focusing power is matched to the length of the eye (see also presbyopia below).

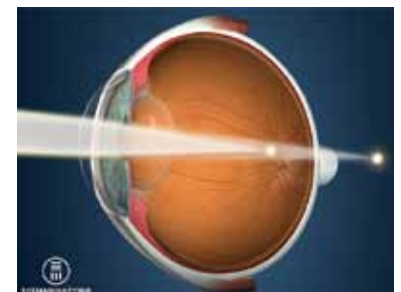
Long-sightedness can be treated with laser eye surgery

Astigmatism

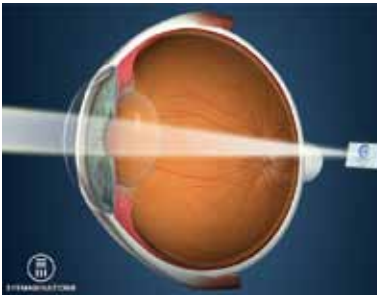
Laser eye surgery has been correcting astigmatism for many years

Astigmatism occurs when your cornea is more oval shaped (like a rugby ball) than spherical. The result is that light is focused at two different planes inside your eye. Images appear blurred or ghost images can result. Approximately half of all people with myopia or

hyperopia have astigmatism as well. Laser eye surgery can correct astigmatism, whether it is accompanied by myopia, hyperopia or present alone.



Presbyopia · Ageing Eyes/Reading Glasses



Everyone develops presbyopia during their life. Most people, whether they have previously worn glasses or not, experience the symptoms of presbyopia in their 40's. Effectively, the zoom system that allows your eyes to change focus from distant to near objects

The need for reading glasses can now be corrected with laser blended vision treatment

becomes weaker. Your ability to read small print (e.g. newspapers) diminishes and you require different lenses for focusing on close and distant objects. Traditionally people have used reading glasses, bifocals or varifocal lenses to correct this, however, some of the more advanced laser systems coupled with surgical expertise can now treat the symptoms of presbyopia.

Understanding visual acuity — What does 20/20 mean?



In the most common visual acuity test, an optometrist places an eye chart at a standard distance (twenty feet or six metres, depending on the customary unit of measurement). At this distance, the symbols on the line representing "normal" acuity on the eye chart, designated 20/20, are the smallest line that a person with normal acuity can read at a distance of twenty feet.

It is possible to see better than the normal acuity level, expressed as a visual acuity of 20/16 or better. Three lines above the normal acuity line, the letters have twice the dimensions of those on the 20/20 line. The chart is at a distance of twenty feet, but a person with normal acuity can usually read these letters at a distance of forty feet. We call this line 20/40 (or 6/12). If this is the smallest line a person can read, the person's acuity is "20/40," meaning, that this person needs to approach to a distance of twenty feet to read letters that a person with normal acuity could read at forty feet.

A "legally blind" person cannot see the biggest letter on an eye chart (20/200) with glasses or contact lenses. Many people with refractive errors have the misconception that they have "bad vision" because they "can't even read the E at the top of the chart without glasses." However, in most situations where acuity ratios are mentioned, they refer to best corrected acuity. Many people with moderate myopia

It is possible to see better than the norm

“cannot read the E” without glasses, but have no problem reading the 20/20 line or 20/15 lines with glasses.



In laser eye surgery, the surgeon’s goal is to get your vision without glasses after surgery to the same level as your best-corrected acuity (with glasses or contact lenses) before surgery, or better. When optometrists or surgeons say “gaining or losing a line of vision”, they mean the change in ability to read a line on the eye chart without glasses after surgery, from the ability to read the line with glasses before surgery.

Understanding prescriptions

Optometrists measure disorders of the eye, such as myopia, hyperopia, astigmatism and presbyopia in units called dioptres. Dioptres show the amount of correction you need to see normally. One dioptre is the equivalent of a lens that can focus on an object one metre away. The more short-sighted, long-sighted or astigmatic you are, the higher your prescription in dioptres. A typical prescription has three numbers such as -5.00 / -1.50 x 180.



- The first number (-5.00) identifies your degree of short-sightedness or long-sightedness. The minus sign in front of the number identifies you as short-sighted. A plus sign shows you are long-sighted.
- The second number (-1.50) identifies your amount of astigmatism. This is written with either a plus sign or a minus sign (usually minus in the UK).
- The third number (180) indicates the axis in degrees, indicating the direction of your astigmatism. An axis of 180 degrees, for example, means the astigmatism is horizontal.

A prescription of -5.00 / -1.50 x 180 indicates that the patient is moderately short-sighted, with a moderate degree of astigmatism in a horizontal direction.

How does laser eye surgery work?

Any operation that corrects the focusing of the eye is called refractive surgery. Laser eye surgery is simply a form of refractive surgery that uses a beam of ultraviolet light to reshape your cornea – the transparent, curved window at the front of the eye. Adjusting the curve of your cornea allows light to be focused correctly on the retina at the back.

Laser eye surgery uses a beam of ultraviolet light to reshape your cornea

Refractive surgery is the world's most common elective surgical procedure. The most popular method is LASIK, which is carried out on more than 95% of patients. The surgeon uses either a femtosecond laser or a mechanical device called a microkeratome to create a very thin corneal flap, about a tenth of a millimetre thick. They lift this corneal flap back on a hinge and the laser sculpts the bed of the cornea. It can flatten the cornea to correct short-sightedness, make it steeper for long-sightedness and create better symmetry to correct astigmatism. When the surgeon puts the corneal flap back, it takes on this new shape.

With LASIK, the healing process is surprisingly short. In the vast majority of patients, the skin of the cornea (the epithelium) automatically seals the corneal flap within hours of surgery, so no stitches are needed. Most patients feel little or no discomfort as their eyes heal. People notice significant vision improvement immediately – the 'wow' effect. The rapid visual recovery time means most patients can return to work the next day.



Lasers are also used to correct vision without the creation of a flap. These surface procedures known as PRK (photorefractive keratectomy) or LASEK (laser sub-epithelial keratomileusis) or Epi-LASIK (epithelial laser in-situ keratomileusis) are performed starting from the surface of the cornea once the epithelium (surface skin) of the cornea has been removed to expose the area to be treated.

To the patient, the main difference between LASIK and surface procedures (PRK, LASEK, Epi-LASIK) is the healing time. After a surface procedure, a patient's eyes will heal and vision will stabilise in approximately 5-7 days.

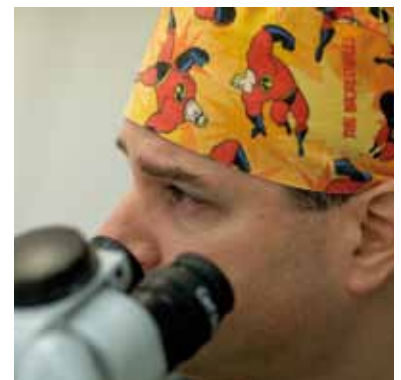
Common misconceptions about laser eye surgery

1. Complications are common and serious

Laser eye surgery is very safe. Of course, no procedure is entirely without some level of risk – the point is that the relative risk of laser eye surgery is extremely low when compared to the relative benefits. In the hands of an expert surgeon using the best technology, the chances of even just a small compromise to the vision is in the order of 1 in 1,000.

2. Laser eye surgery is only for short-sighted people

With today's technology patients who are short or long-sighted, astigmatic or presbyopic can be treated.



3. Laser eye surgery cannot help people aged 40+ who need reading glasses

The latest advances in laser technology allow for the correction of long and short-sightedness with or without astigmatism together with presbyopia for people who use reading glasses.

4. The treatment is not permanent

Long-term follow-up studies have demonstrated that once the shape of your cornea is changed to correct your vision, the change is permanent. Of course, your eye is a living organ and alters over the years, just as the rest of your body does. Everyone's eyes change, to some degree, even if they have never needed glasses. But studies have shown this effect is very small. Once you reach the age of 50, your prescription will only change by an average of half a dioptre every decade.

5. You can be too old for laser eye surgery

Technically, there is no upper age limit for laser eye surgery as long as the eye is healthy.

6. You can go blind

This is practically impossible. Realistically, the chance of going blind from laser eye surgery in the hands of an expert surgeon using the best technology is next to nil.

7. You could end up with worse vision than you started with

This question deals with two issues:

Vision without glasses – uncorrected vision loss: There is virtually no chance that after laser eye surgery your vision without glasses would be worse than before surgery without glasses.

Vision with glasses – best corrected visual acuity: Your maximum clarity with glasses before surgery is your best spectacle corrected visual acuity (BSCVA). In expert hands, the chance that the BSCVA will be reduced by even a small amount is in the order of 1 in 1,000.

Safety considerations of laser eye surgery

How safe is laser eye surgery?

Laser eye surgery in the right hands, with the right technology and aftercare, is extremely safe. The National Institute for Health and Clinical Excellence (NICE) is the official body that produces guidance for UK doctors on the effectiveness of medical treatments. In 2006, NICE completed a two-year, in-depth study of laser eye surgery. It concluded that laser eye surgery "is safe and efficacious for use in appropriately selected patients".

All surgery carries some risk of complications (a complication is defined as an unexpected occurrence), which leads to decreased vision. Only 1 in 1,000 procedures result in even a small

loss of BSCVA. Thus, complications and post-operative side effects are largely manageable; expert surgeons are able to manage and correct complications so that virtually all patients have a satisfactory outcome.

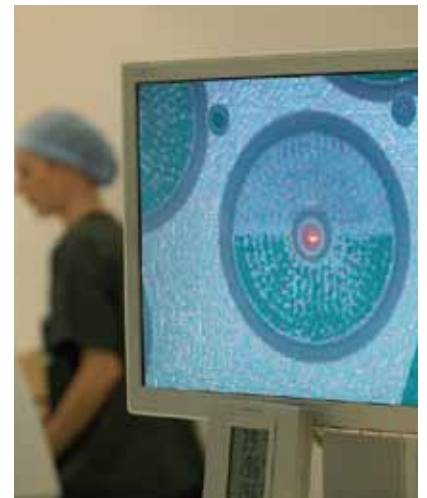
How is safety measured?

Safety involves avoiding 'compromise' to your vision. Visual compromise is defined as blurring, doubling or distortion that cannot be corrected by glasses to achieve the same level of eyesight you had before surgery with glasses. This is different from a situation in which vision is improved after surgery but there is some blurring, which can be corrected with glasses. In this case the vision is not compromised, it is simply not fully focused (and can be corrected by glasses or a simple enhancement procedure).

What kind of visual compromise is significant? The standard is to measure blurring by the number of lines off the bottom of the eye chart that the patient is no longer able to read. For example, if before surgery you were able to see 20/16 with glasses and after surgery your vision, even with glasses, is 20/25, this would be classified as a loss of two lines of best corrected vision. The NICE report looked at the results of studies published in medical journals. It found that on average, less than 1% of LASIK patients lost more than two lines of best corrected vision with glasses.

For expert surgeons, the likelihood of an eye losing two lines of best corrected vision is 1 in 1,000 (0.1%) and the chance of losing more than this is less than 1 in 1,000.

The best way to ensure that your treatment is done to the most exacting safety standards is obviously to have treatment with an expert surgeon who chooses to operate with the best technology and the best diagnostic preparation and follow-up.



Questions to ask when considering laser eye surgery

Checklist for evaluating a laser eye surgeon's qualifications:

- A Fellow of the Royal College of Surgeons / Ophthalmologists or equivalent
- Fellowship specialty training in corneal surgery
- Fellowship sub-specialty training in refractive (laser eye) surgery
- On the General Medical Council's Specialist Register

You are looking for a surgeon who can show you statistics that reflect individual surgeon outcomes

No one wants to compromise on their vision. Ideally, you would like to find the surgeon who combines the right level of professional training using the most current technology combined with a wealth of experience in the specific procedure that you are undergoing.

You are looking for a surgeon with experience in the specific procedure you seek. While laser eye surgery is a sub-specialty of ophthalmology, not all ophthalmologists are versed in all the different types of refractive surgery, including LASIK, LASEK/PRK and non-laser procedures such as IOLs (Intraocular Lenses),

CK (Conductive Keratoplasty). Not all surgeons can treat all prescriptions; if you have a more unusual prescription some surgeons will, very appropriately, refuse to treat you, because they lack the experience or technology to treat the particular condition.

You are looking for a surgeon who can show you statistics that reflect their individual surgical outcomes. Examine quoted statistics carefully to determine if they are relevant to your particular prescription. For example, results for patients between $-1.00D$ and $-3.00D$ of short-sightedness will have little relevance to you if you have $-6.00D$ of short-sightedness. Statistics for short-sighted patients are often better than statistics for long-sighted patients. Therefore, if you are long-sighted, you will want to ensure you are looking at the right group of patients to evaluate surgical results properly. For people who need reading glasses, bifocals or varifocals, surgical results rarely include reference to a patient's near vision after laser eye surgery. If you are over 40 years of age, you will want to look at surgical results for near vision as well as distance vision.

Patient checklist:

The checklist below is designed to help patients evaluate their choices.

- Does the surgeon monitor your individual patient outcomes on an ongoing basis?**

Monitoring outcomes enables a surgeon to objectively measure their performance against an appropriate standard. It is a sign of a surgeon who is concerned about quality. Ideally, a surgeon

should be able to provide you with a results table or statistics that are specific to your prescription. This is important as results vary significantly between prescriptions, between surgeons and between technologies.

Did the surgeon undergo formal refractive surgery training and for how long?

During the 1990's many surgeons began to do laser surgery after attending one or two weekend courses, with or without supervision on their first few cases. In 2007, the Royal College of Ophthalmologists introduced training and accreditation in laser eye surgery into the curriculum of trainee eye surgeons. A number of specific refractive surgery fellowships also exist. Fellowship training in refractive surgery prepares the surgeon for dealing with all the complications of refractive surgery, so that when they encounter any complications, they are prepared.

Will the clinic conduct all of the necessary pre-operative tests to ensure my suitability for laser eye surgery?

The pre-operative examination is an excellent opportunity to examine the eye fully, including some of the following tests that are not routinely carried out in laser eye surgery assessments:

- Corneal topography (including back surface)
- Dry eye
- Pupil size
- Corneal thickness
- Wavefront analysis
- Blended vision assessment (if you are presbyopic)
- Contrast sensitivity
- Very High-Frequency Ultrasound (if necessary)
- Dilated eye examination
- Night vision simulation
- Intra-ocular pressure.

After conducting all of the necessary tests, the clinic should provide you with a clear assessment of your suitability. If it determines that you are not suitable for treatment, it should provide you with a comprehensive explanation for this. You may want to ask if there is another provider that may have technology or expertise to treat you safely, even if that may not be possible at their practice (for example some lasers are much better at treating hyperopia than others, whilst other practices will not treat patients over 40 years of age).

❑ **What aftercare regime is provided for my particular treatment plan?**

The immediate aftercare will depend on the recommended treatment. Further aftercare should be provided until the one-year visit. Some surgeons offer ongoing ophthalmic care thereafter. Generally, LASIK aftercare is performed in the following way:

- 1st day after surgery
- 1-4 weeks after surgery
- 3 months after surgery
- 12 months after surgery
- Surface PRK / LASEK patients should be closely monitored during the first five days after surgery.

❑ **Will I have access to the surgeon post treatment?**

This is important. You should have access to the surgeon if required. A surgeon is directly responsible for the care of patients. Even if he or she has delegated some aspects of the aftercare to his or her optometrist.

Questions about technology

There are six technologies that most laser eye surgeons use. These are:

- Topography
- Pachymetry
- Pupillometry
- Wavefront aberrometry
- Keratome (mechanical and laser)
- Excimer laser.

Here we explain what these technologies do, how they measure your eyes, the readings they produce, how accurate they are and the effect they have on your treatment.

What is topography?

Topography measures the depth of the surface of your eye, i.e. your cornea. The picture produced by a topography machine looks like a map of a mountain range with the different elevations shown in contrasting colours.

Topography is one of the most important safety factors

Topography is one of the most important safety factors in determining how suitable you are for laser eye surgery. The most basic kind of topography measures the shape of the surface at the front of your eye. The most detailed topography measures the shape of both the front and back surfaces of your cornea. Common topography machines are the Galilei™, Orbscan™ and the Pentacam™.

The Pentacam™ machine provides the most detailed topography. This is the very best option for determining changes in the shape of your cornea. It provides a 3D map of your cornea, which is essential for determining whether it is too thin for surgery to be safe. Topography should be performed both before and after treatment.

What is a pachymeter?

A pachymeter is a hand-held device used to measure the depth of the thinnest point of your cornea. Along with front and back surface topography, the thickness of your cornea is one of the most important safety factors in laser refractive surgery. During your pre-operative screening, the technician or optometrist should take these measurements, topography and pachymetry to make surgery as safe as possible.

Using a pachymeter together with a topography device provides very accurate data and ensures that the thickness of these areas of the cornea is within acceptable safety limits.

The most advanced and accurate device is the Artemis™ VHF digital ultrasound. This measures corneal thickness more accurately than either the Pentacam™ or hand-held ultrasound machines. It produces a 3D image that displays the thinnest point with great accuracy and displays a profile of the depth of your cornea. This technology is currently only available in a handful of clinics around the world.

What is pupillometry?

Pupillometry measures the size of your pupils, the “windows” that let light into your eye. The measurement of your pupil size takes place in a darkened room to ensure that your pupils are open to their full extent.

Accurate pupillometry is critically important because the laser is only capable of treating a defined area. Typically, this is a circle with a diameter of 6mm to 8mm, depending on the laser used. If your pupils were larger than the area that can be treated by the laser, you would be left with an untreated ring around the smaller circle corrected by the laser. It would be like looking through a clear patch in the middle of a smeared window.

The most advanced and accurate device is the Artemis

This is why pupillometry is such an essential part of the assessment before surgery. The results will determine the type of laser eye treatment you need. Some people with large pupils can only be treated by specific lasers that are capable of covering larger areas.

What is wavefront aberrometry?

This measures the unique imperfections of the surface of your eye called 'higher order aberrations'. These irregularities of your cornea and optical system affect the finer quality aspects of your vision, beyond the normal refractive errors of short-sightedness, long-sightedness and astigmatism.

A wavefront aberrometer records data from several spots on the surface of your cornea. This produces a map of the imperfections on the surface of your cornea, as well as a visual system analysis that can be fed into the laser to achieve better results. The laser must be able to receive these measurements and then apply them directly onto the cornea.

Wavefront treatment has received a lot of publicity

Different aberrometers measure different numbers of spots, ranging from as low as 60 to as high as 650. A low-resolution aberrometer is like a watercolour painting. It provides a general impression of the landscape. It measures just a few points and then uses a mathematical formula to work out an approximate image of the rest.

A high-resolution aberrometer will give as sharp a picture as a photograph. It records much more data, giving a more accurate map of the number and location of imperfections. This means the surgeon can plan your treatment precisely.

Wavefront treatment has received a lot of publicity. Some clinics promote wavefront as if it could cure any imperfections – in reality it just measures your eyes.

What is a keratome (mechanical and laser)?

The keratome is a high-precision, computer-controlled instrument that the surgeon uses for the first stage of the LASIK operation. With it, they create the corneal flap that is necessary to perform LASIK.

Today, the majority of surgeons use a femtosecond laser instead of a mechanical microkeratome when creating a LASIK flap. Common brand names of this technology include Intralase, Z-LASIK™ and Visumax™.

What is an excimer laser?

There have been significant strides made in laser technology over the last five years, but finding a surgeon who has the experience and expertise to use that laser is critical to successful treatment. Some laser brands are Alcon, Bausch and Lomb, Nidek, Schwind, VISX, Wavelight and Zeiss.

A laser beam will be a certain size and a certain shape. The point where the laser touches the eye is called a spot. The smaller the spot, the more focused it is, creating a higher intensity beam that moves around the eye at a faster rate. This means the laser only removes the material it needs to, providing a more precise treatment.

Your eye will move during surgery. Eye tracking technology ensures your safety when this happens. Compensating for eye movement is a key factor in ensuring that the laser will be delivered to exactly the right place. There are different methods (video infra-red, 3D and LADAR), all of which involve detecting the position of your eye. There is a small time lag between the laser noticing that your eye has moved and compensating for that movement. To date, all trackers provide approximately the same level of delay time – most operate with a delay of less than ten milliseconds (one hundredth of a second).

Eye tracking technology ensures your safety when your eye moves during surgery

A laser eye surgery technology primer

Technology: Topography

What is it for?

Measuring the shape of your corneal surfaces.

When is this done?

Initial screening and during post-operative appointments.

What actually happens?

You rest your chin on a padded support and stare straight into the examining instrument. The clinician sits in front of you and shines a bright light into your eye to help align the instrument properly. They will ask you to open your eyes widely to take a number of multi-coloured pictures that are printed and added to your pre-operative report. The different colours on these pictures, like a topographic map, will show the different elevations of your corneal surface(s) and the thickness profile of your cornea.

How does it feel?

You feel nothing as the instrument does not make contact with your eye.

What does it do?

The topographer captures an image of your eye to create a topographic map of the front and in some units also the back surface of the cornea.

How does it benefit you?

Topography is one of the most important safety factors in determining how suitable you are for laser eye surgery. The most basic kind of topography measures the shape of the surface at the front of your eye. The most detailed topography measures the shape of both the front and back surfaces and the thickness profile of your cornea. In very irregular corneas topography guided treatments are performed to provide a more regular corneal shape.

Technology: Wavefront aberrometry

What is it for?

Measuring the optical imperfections of your eye that are not correctable with glasses alone (the higher order aberrations in your visual system).

When is this done?

Initial screening and during post-operative appointments.

What actually happens?

You will rest your chin on a padded support and stare straight into the examining instrument. The clinician sits in front of you and shines a bright light into your eye to help align the instrument properly. They will ask you to open your eyes widely. They will then take one or more readings of the wavefront of each eye.

How does it feel?

You feel nothing as the instrument does not make contact with your eye.

What does it do?

A Wavefront analyser or aberrometer allows the surgeon to evaluate your suitability for Wavefront Guided treatment as well as for detecting certain eye conditions that would preclude you from getting an optimal result.

How does it benefit you?

It allows your surgeon to decide if a Wavefront Guided treatment would benefit you more than a standard treatment (see technology: Wavefront Guided treatment below).

The quality of commercial wavefront sensors varies tremendously; like digital cameras, the best aberrometers have ten times the resolution (like camera megapixels) than the lowest quality units.

Technology: Pupillometry

What is it for?

Measuring your pupil size in dim lighting.

When is this done?

Initial screening.

What actually happens?

You will be positioned with both eyes viewing a spot light source through the padded eyepieces. The technician will then measure the size of each pupil over a two second period using an infrared camera in three different light levels.

How does it feel?

You feel nothing as the instrument does not make contact with your eye.

What does it do?

The pupillometer measures the average pupil size, variation in pupil size over a fixed time frame and difference in pupil size between the two eyes in three different light levels.

How does it benefit you?

Like all measurements in laser eye surgery accuracy is important. Accurate pupil size measurements for dark and dim lighting conditions allows the surgeon to optimise your treatment plan so that he or she can minimize the risk of inducing night vision changes such as halos and starbursts around lights. Not all pupillometers are accurate. Some lasers have better capabilities of minimising these risks than others.

Technology: Pachymetry

What is it for?

Measuring corneal thickness.

When is this done?

Initial screening and during post-operative appointments.

What actually happens?

Hand-held ultrasound probes: A topical anaesthetic drop is placed in each eye. This will numb the surface of the one eye for approximately 15 minutes. The optometrist then sits or stands in front of you and will gently hold open the one lid. They will then use a hand-held probe which is gently touched onto the surface of the eye to take several readings of the corneal thickness of each eye.

Very High-Frequency Ultrasound 3D scanning: In Very High-Frequency Ultrasound (VHFU), you will have your eyes numbed, with anaesthetic drops and have your eye positioned over a water tight rubber eyepiece which is then filled with warm saline solution (like artificial tears). Several arc scans of the entire cornea are made to the thickness profiles of the individual layers within the cornea including the thickness of the corneal flap following LASIK.

Optical pachymetry devices (incorporated in Topographers that map front and back surfaces): There are several optical devices, which can measure the thickness of the cornea. They can measure the profile of the total corneal thickness although due to the assumptions made when calculating the thickness from the measurements they can be less accurate than ultrasound in providing the correct thickness values. However, they do provide 3D thickness profile information and this is important for screening for keratoconus.

The gold standard for corneal thickness measurement is ultrasound.

How does it feel?

Hand-held ultrasonic pachymetry is not painful because of the use of anaesthetic eye drops, so you will not feel the probe touching the eye.

In VHFU the eye is very comfortable in the warm eye bath; there is no contact with the eye as the soundwaves travel through the saline.

Optical Pachymetry – see Topography.

What does it do?

Hand-held pachymetry is used primarily to measure the central area of the cornea where the cornea is thinnest. It takes point measurements of the total corneal thickness.

VHFU is the most precise way to measure the thickness of the cornea. In addition it provides 3D thickness profiles of the individual layers of the cornea, allowing improved diagnostic capabilities for both preoperative (candidacy) and postoperative analysis.

How does it benefit you?

Along with front and back surface topography, the thickness of your cornea is one of the most important safety factors in laser eye surgery. Your surgeon uses these measurements to determine if you are suitable for surgery and which type of treatment is your safest option.

VHFU scanning is also one of the most sensitive ways of diagnosing keratoconus, an eye condition which prevents any laser eye surgery.

Technology: Tonometry

What is it for?

Measuring your intraocular pressure.

When is this done?

Initial screening and during annual eye exams.

What actually happens?

In the air-puff method, you will rest your forehead on a padded support and stare straight into the examining instrument. The instrument will blow a brief puff of air at your eye. The instrument estimates the intraocular pressure (IOP) from the change in the light reflected off the cornea as it is temporarily indented by the air-puff. A clinician may perform the procedure several times for each eye.

Alternatively or additionally an optometrist may use the Goldmann tonometry (or similar applanation) method. Anaesthetic drops containing a fluorescein dye are placed in the eyes to numb the surface. Your optometrist will ask you to stare straight ahead whilst resting your chin and forehead against special supports on an instrument called a slit lamp. A slit lamp is a special microscope with a light source to which a tonometer is attached. The optometrist will direct a broad beam of blue light from the slit lamp into your eye while they gently move the slit lamp forward until the tonometer probe lightly touches your eye. By adjusting a tension dial on the tonometer he or she can directly measure the IOP of your eye.

How does it feel?

In air-puff tonometry nothing but air directly touches the eye. You will hear the puffing sound and feel a coolness or mild pressure on your eye.

Goldmann tonometry is not painful. The optometrist will use anaesthetic eye drops to numb the surface of your eyes so that you will not feel the instrument touching your cornea during the test.

What does it do?

Tonometry is a measure of the intraocular pressure (IOP) or pressure inside the eye. The inside of the eye is nourished by the production of fluid which drains out of the eye. If there is an imbalance between the rate the fluid is produced and the rate it is drained away the IOP may increase or decrease from its normal level. Changes to the IOP may affect other structures in the eye such as the optic nerve. Increased pressure is often associated with glaucoma.

How does it benefit you?

Optometrists and ophthalmologists perform tonometry as part of a routine eye examination to screen for eye diseases such as glaucoma.

Technology: Contrast Sensitivity Testing

What is it for?

Measuring your ability to see grey-on-grey or your ability to distinguish objects in low contrast situations.

When is this done?

Initial screening and during aftercare appointments.

What actually happens?

Following the refraction you will be shown images of grey stripes or letters of reducing size and contrast. You will be challenged to recognise the stripes and letters as the contrast decreases until it is so faint that you can no longer recognise that there are stripes or what the letters are. You will be asked to do this over 1 to 4 different sized stripes or letters depending on the test.

How does it feel?

You feel nothing.

What does it do?

Using this test, the optometrist can assess your ability to see contrast between images in low lighting conditions. This provides an important measure of visual function at night. It gives your surgeon an understanding of how you see things in the real world as opposed to just black-on-white (100% contrast) letters on a chart. Occasionally people complain of poor vision, particularly in dim lighting conditions yet they have normal or very near normal (black-on-white) visual acuity. This is often because they have reduced contrast vision.

How does it benefit you?

With any but the most advanced laser systems (those using aspheric treatment profiles) night vision disturbances may be induced by laser eye surgery, particularly if the refractive error corrected is high and the pupil size is large.

Measuring your contrast sensitivity provides your surgeon with another measure of how well you already see at night, giving him an indication of how to best plan your treatment in order to avoid night vision disturbances.

Many laser systems, even the latest versions, still do not use aspheric treatment profiles.

Not all aspheric treatment profiles are the same, but in general lasers using these will be safer with respect to changing night vision. Some systems are so well designed that they can even improve your contrast sensitivity and night vision.

Technology: Night vision simulation

What is it for?

Measuring your night vision disturbances.

When is this done?

Initial screening and during aftercare appointments.

What actually happens?

The optometrist will ask you to look at a computer simulation of common night vision disturbances, such as halos and starbursts around light-emitting objects (e.g. oncoming car headlamps and street lights). They will be able to vary the size and brightness of these disturbances to try to simulate how you see at night.

How does it feel?

You feel nothing.

What does it do?

This test provides your surgeon with a picture of how your vision is affected by glare at night so that they may design a customised treatment plan to maintain or enhance your night vision after surgery.

How does it benefit you?

This provides your surgeon with the subjective feedback which they then match with the objective measurements that have been taken of your wavefront, refraction and topography so they can custom design the perfect treatment for you.

Technology: Ocular dominance and loose lens testing

What is it for?

Assessing your tolerance for laser blended vision.

When is this done?

Initial screening.

What actually happens?

Following the refraction the optometrist will focus your non-dominant eye for near vision while leaving your dominant eye focused for distance. He or she will then measure your binocular vision at distance and at close proximity to determine if you are likely to be suitable for a blended vision correction.

How does it feel?

You feel nothing.

What does it do?

This test provides the surgeon with your tolerance for blended vision, which will enable him to design a customised treatment plan that will correct both your distance and near vision at the same time.

How does it benefit you?

If you are over 40 years of age, blended vision can reduce or eliminate your dependency on reading glasses, bi or varifocals.

Technology: Wavefront Guided treatment

What is it for?

Trying to improve on the optical imperfections of your eye beyond that which glasses alone can correct.

When is this done?

Before surgery.

What actually happens?

The measurement obtained from Wavefront Aberrometry is combined with the prescription in your glasses using software that delivers a customised shape change to the cornea.

How does it feel?

You feel nothing.

What does it do?

Wavefront Guided treatments usually (but not always) result in better outcomes. It is still an evolving field – some Wavefront Guided treatments actually work less well than the standard treatments on the same laser. Asking surgeons to provide data on the relative benefit of Wavefront Guided treatment is recommended, as often these are provided at an extra charge.

How does it benefit you?

The potential benefits of some Wavefront Guided systems include:

- Greater chance of achieving 20/20 vision
- Greater chance of achieving better than 20/20 vision
- Reduced chance of losing best corrected vision
- Reduced chance of losing visual quality or contrast sensitivity
- Reduced chance of night vision disturbances and glare
- Increased ability to restore best corrected vision if healing problems develop.

Technology: Bespoke Wavefront treatment planning software

What is it for?

Individualising the treatment to each of your eyes beyond just the prescription in your glasses.

When is this done?

Before surgery.

What actually happens?

Bespoke Wavefront treatment software goes beyond 'generic' Wavefront Guided treatments. In simple terms it is the difference between a standard "off the peg" suit that you would find on the High Street and a bespoke suit that has been custom-tailored on Saville Row.

Using specialised software, your surgeon can change the parameters of your treatment based on the Wavefront measurement to create an even better result than that obtained by simple Wavefront Guided treatment.

How does it feel?

You feel nothing.

What does it do?

Bespoke Wavefront treatment planning software allows surgeons to provide the highest level of customisation for each individual eye, based on night vision simulations, contrast sensitivity and other corneal and ocular parameters.

How does it benefit you?

Customised treatment planning increases your chance of achieving the best possible visual acuity result. This reduces your risk of night vision changes such as glare, halos and starbursts to the absolute minimum and maximises the depth of focus achievable by a blended vision treatment.

Technology: Keratome

What is it for?

Creating the corneal flap in LASIK.

When is this done?

During surgery (LASIK only).

What actually happens?

You lie down on the laser bed facing up. After anaesthetising your eyes with eye drops, the surgeon holds your eye open using a lid holder. The keratome holds your eye steady by creating suction between it and your cornea. Either an oscillating blade or a femtosecond laser beam makes a circular corneal flap with a hinge. The surgeon folds the flap back to expose the inner surface of the cornea which is then ready for reshaping.

How does it feel?

During this part of the operation, you will feel the pressure caused by the suction. As this happens, your vision may dim or go dark for a few seconds. Aside from this pressure, you will not feel pain but it can be uncomfortable for a very short period.

What does it do?

The keratome is a high-precision, computer-controlled instrument that the surgeon uses for the first stage of the LASIK operation. With it they create the corneal flap that is necessary to perform LASIK.

How does it benefit you?

The benefits of a flap in LASIK is that the healing and recovery time is reduced to only hours following the procedure.

Technology: Active Eye Tracking

What is it for?

Tracking and compensating for your eye movements during surgery.

When is this done?

During surgery.

What actually happens?

The eye tracker monitors your eye's natural micro-movements and calculates positional corrections needed to place the laser spots in the right place on the cornea. In addition, should your eye move outside of the treatment zone, the eye tracker enables the laser to stop firing until the eye is back in position (passive tracking).

How does it feel?

You do not feel the eye tracker.

What does it do?

The purpose of the eye tracker is to enable the laser spot to be delivered to the right position on the cornea.

How does it benefit you?

Eye tracking is essential to optimise results of laser eye surgery as there are always small eye movements, even when you are looking directly at a target light. Eye tracking means that even if you move your eyes the treatment is not affected.

Technology: Excimer laser

What is it for?

Laser refractive surgery for the correction of refractive error.

When is this done?

During laser eye surgery.

What actually happens?

You simply lie back and relax as the laser begins firing. In the space of seconds, the laser vapourises corneal tissue to alter the optical focusing properties of the eye by altering the curvature of the cornea.

How does it feel?

You do not feel the laser sculpting the tissue from your cornea.

Some patients do detect a “burning” odour, similar to the scent sometimes emitted from a hair dryer. The smell comes from the breaking of carbon bonds in the tissues of the cornea and is not from the burning of corneal tissue.

Patients also report that they see a kaleidoscopic light as the laser pulsates.

You will hear the buzzing sound of the laser as it operates.

What does it do?

In short-sighted treatments, the laser flattens the cornea in the central zone. In long-sighted treatments the laser flattens the cornea in the peripheral zone. In astigmatism the laser flattens or steepens the cornea in one meridian (direction) more than the meridian 90 degrees to make the cornea more spherical (round instead of oval).

How does it benefit you?

Essentially, the excimer laser is an extremely high-precision sculpting tool that changes the focusing of the eye. It enables specialist eye surgeons to reduce or eliminate the need for glasses or contact lenses.

Frequently Asked Questions

Q: Can laser eye surgery treat the loss of reading vision?

Yes. The loss of reading vision beginning during the 40's and is known as presbyopia or 'ageing eyes'. A technique used to correct presbyopia is called Blended Vision. With this technique one eye is treated to view objects mainly at distance and a limited amount up close and the other is treated to view objects mainly up close and a limited amount at a distance. The brain puts the two images together and enables the individual to see distance and up close without effort. In most cases, the brain is able to compensate and you will experience an excellent depth of focus and overall visual acuity without the need to wear glasses or contact lenses.

Q: Why can some people have LASIK, whilst others can only have PRK / LASEK?

The vast majority of patients undergoing laser eye surgery worldwide are suitable for LASIK. Approximately 5% of patients have LASEK or PRK. The main consideration when recommending LASEK or PRK over LASIK is corneal thickness. Secondary considerations include the patient's pre-operative prescription. Since the development of the femtosecond laser, surgeons are now able to create thinner corneal flaps during a LASIK procedure. The surgeon has more corneal tissue beneath the flap to extend the range of correction.

Q: How long should I be out of contact lenses before consultation with my surgeon ('consent appointment')?

Contact lens type		Length of time lenses need to be out before the consent appointment with the surgeon
All soft contact lenses		At least 1 week before
Extended Wear Soft Lenses		At least 1 week before
Toric Soft Lenses		At least 2 weeks before
Rigid gas permeable (RGP)	worn for 0 - 10 years	At least 4 weeks before
	worn for 10 - 20 years	At least 8 weeks before
	worn for 20 - 30 years	At least 12 weeks before
True Hard Lenses (Polymethyl methacrylate)		At least 12 weeks before

Q: Are both eyes treated at the same time?

Yes. Large scale studies conducted ten years ago demonstrated that there was no difference in safety between single-eye surgery and bilateral surgery. In fact, some evidence suggests that it is

safe to treat the second eye immediately following the first eye. There are, of course, certain situations where your surgeon may suggest doing one eye at a time, but this will generally be due to specific medical issues.

Q: What will I feel during and after the laser eye surgery procedure?

There is no pain involved. You will be given a topical anaesthetic so what people usually report is feeling pressure and some pushing. Most LASIK patients do not experience discomfort after surgery, those that do, experience minor discomfort including grittiness, light sensitivity and eye watering that lasts 2-3 hours. PRK patients take a few days to heal, but paradoxically experience less in the way of discomfort as they are wearing bandage contact lenses and are using more pain-killers during the healing process.

Q: How long does laser eye treatment take?

The operation takes only minutes and the laser itself is only active for seconds.

Q: What happens if I look away, blink, cough or sneeze during the procedure?

Nothing. Although your eye will move during surgery, eye tracking technology ensures your safety when this happens. Compensating for eye movement is a key factor in ensuring that the laser will be delivered to exactly the right place. Eye trackers work by detecting the position of your eye and compensating for this at a very fast rate to make up for eye movement.

Q: What is the risk of a complication during laser eye surgery?

Laser eye surgery is safe, but no surgery is entirely without some level of risk. The fact is that an expert surgeon will have the knowledge to manage complications properly and will usually be able to correct any complications that do occur. In the hands of an expert surgeon, the chance of something going noticeably wrong is around one in 1,000 procedures. The chance that such a surgeon would be faced with a situation he or she would not be able to correct satisfactorily is about one in 30,000.

Q: Can I take a tranquiliser or sedative (e.g. Valium) prior to the procedure?

Practice patterns vary in this regard. Generally it is better to not use sedatives as these can alter patient cooperation during the procedure. However, patients who suffer from psychological disorders such as panic attacks, claustrophobia etc. may benefit from judicious use of sedatives.

Q: Do laser eye surgery results differ between prescriptions?

Yes. In general, results (the term commonly used in refractive surgery is efficacy) decrease as prescriptions increase. Therefore, when reviewing results it is important to look at results that reflect what has been achieved for specific prescriptions (as opposed to overall results across all prescriptions which are less relevant and are in fact often skewed towards lower prescriptions). Results also differ between short-sightedness and long-sightedness.

Q: What is wavefront?

Wavefront treatment has received a lot of publicity. Not all wavefront systems are as good as each other (see Technology Primer).

Wavefront sensors measure the unique optical imperfections of your eye, called 'higher order aberrations'. These irregularities of your optical system affect the finer quality aspects of your vision, beyond what glasses are able to correct.

A wavefront aberrometer records the optical quality from several positions over the pupil opening. This produces a map of the imperfections of your eye's optics. This information can be fed into the laser to achieve better results. The laser must be able to receive these measurements and then apply them directly onto the cornea.

Different analysers measure different numbers of spots, ranging from as low as 60 to as high as 650. A low-resolution analyser is like a watercolour painting. It provides a general impression of the landscape. It measures just a few points and then uses a mathematical formula to work out an approximate image of the rest. A high-resolution analyser will give as sharp a picture as a photograph. It records much more data, giving a more accurate map of the number and location of imperfections. This means the information is more accurate and therefore more likely to improve the outcome.

Q: I have astigmatism, can I still have laser eye surgery?

Yes. Laser eye surgery can treat astigmatism at the same time as it corrects short or long-sightedness. No extra procedure is needed.

Q: Is my prescription too high?

In most cases, having very poor eyesight will not stop you having surgery. Your vision will improve noticeably, although the extent of this improvement will depend on your current prescription. The range that any surgeon can treat depends on their technology, surgical experience and expertise.

Q: What range of prescriptions can be treated?

The majority of laser eye surgery is performed on patients with:

- Myopia up to -8.00D
- Hyperopia up to +3.00D
- Astigmatism up to -4.00D.

However, some surgeons possess expertise and technology that allows them to safely treat much higher levels with lasers and sometimes in conjunction with intra-ocular lenses to achieve corrections as high as -30.00 D and +15.00 D.

Q: Am I too old/too young?

Patients should be at least 18 years old for laser eye surgery; there is no upper age limit.

Q: Does everyone get presbyopia?

Yes. Typically, during their 40's people begin to need glasses for reading even if they have never worn glasses before. People who previously wore glasses will need a different prescription for reading than for distance (e.g. bifocals).

Q: What are the risks of laser eye surgery?

LASIK is generally considered to be safe, but (as with all surgical procedures) there are some risks to consider. Fewer than 3% of LASIK procedures result in any complications. The chance of having a serious complication is much less than 1% generally and probably less than 0.3% with an expert surgeon.

Fewer than 1 in 6,000 patients will develop free or loose caps. If the microkeratome device creates a free cap instead of a flap it is simply laid back in place after the laser has reshaped the bed of your cornea.

In about 1 in 1,000 cases, the flap is too short, thin or uneven. If this occurs, the flap is put back in place to heal. The surgeon will not use a laser on your eye but you can try surgery again in a few months.

Wrinkles in the flap (striations) occur in about one in every thousand patients. Striations can cause astigmatism. The most likely causes are either rubbing your eyes before they are fully healed or the surgeon not lining up the flap properly when it is replaced. If the wrinkles are causing astigmatism, a second procedure can be done to lift and smooth out the flap. If they are not causing any problems they can be left untreated.

In about 3 in every 1,000 cases, patients develop astigmatism after surgery. Contact lenses can usually correct this form of astigmatism (glasses will not). People who have very high prescriptions have a higher risk of this complication. Astigmatism can happen even if the surgery is perfect, but your risk is increased if you have an inexperienced surgeon or one who does not use the best equipment.

Most patients experience some temporary dryness after treatment. In certain people, the condition is long-lasting. Eye drops can provide relief. Up to 5% of patients have persistent dry eye symptoms.

Glare and halos are probably the most common and most feared side-effect of laser eye surgery. These are visual disturbances (see 'Glossary' for more information). In fact, most patients experience some level of glare and halos at first, but they generally go away over a period of a few weeks to a few months. Those who do have lasting effects usually only experience symptoms at night and most say they are not debilitating.

Q: What causes glare and halos and can it be treated?

Few people develop side effects from laser eye surgery. Of those who do, problems such as glare and halos, affecting night vision, are among the most common. There are several reasons.

If the shape of your eye has not been changed enough during your first procedure, you may still be slightly short or long-sighted and/or still have a minor astigmatism. A follow-up procedure or wearing glasses at night can help.

The size of your pupils can be another cause of glare and halos. If a patient's pupils dilate (open) beyond the area of the cornea that has been treated during laser eye surgery, this can cause glare and halos in low light conditions. This can be prevented by measuring your dilated pupil size before surgery. The surgeon can determine whether or not they can effectively treat a large enough area of your cornea with the laser. If this is not possible then you would not be considered a suitable candidate for surgery.

If you do have glare and halos at night following surgery because of your pupil size, there are a few techniques that can help. Some patients find that, when driving, keeping the overhead light on inside their car stops their pupils dilating so much that it affects their vision. Some people find medicated eye drops that stop their pupil from dilating fully alleviate the problem.

Finally, glare and halos can be caused if the area of your cornea treated by the laser is off to one side (off-centred ablation). Choosing a properly qualified and experienced surgeon can help to minimise the risk of this serious complication. This is especially important since to date there is no entirely satisfactory solution available. Using Wavefront technology may significantly reduce the risk of glare, halos and night vision difficulties.

Q: How does the flap stay in place in LASIK?

Initially, the flap is kept in position by a vacuum effect. The cells lining the inner surface of your cornea, known as endothelial cells, pump water out to the inner part of the eye. This suction holds the flap in place. During the first few hours after surgery the outer surface of the cornea, known as the epithelium, seals the edges of the flap. Over the ensuing weeks, natural substances inside your cornea bond the flap to the underlying tissue.

Q: What conditions may prevent me from having laser eye surgery?

The following list includes conditions or circumstances that prospective patients commonly ask about when discussing their suitability for laser eye surgery.

Condition or Circumstance	Can the person have laser eye surgery at the London Vision Clinic?
Older than 60?	Yes. There is no upper age limit for laser surgery, as long as your eyes are healthy. Some older patients experience a longer healing period after laser surgery, but this can be discussed at your initial screening.
Pregnant or breastfeeding?	Yes. However, laser treatment is inadvisable until 4 weeks after breastfeeding is complete. Increased hormonal activity during pregnancy and breastfeeding can affect visual outcome and increase the need for enhancement surgery. The drugs used in consultation and post treatment can pass across to the baby although are not harmful to the unborn child.
Taking prescription drugs?	Yes. You should indicate what drugs you are taking, be they prescription or not, when you are having an initial screening. Laser eye surgery may be contraindicated while taking certain medications but this is rare.
Younger than 21?	Yes. However, the lowest age of consent without adult involvement is 18.

Condition or Circumstance	Can the person have laser eye surgery at the London Vision Clinic?
<p>Have amblyopia (lazy eye)?</p>	<p>Yes. Laser eye surgery cannot specifically treat a lazy eye. In general it cannot make that eye see more clearly than with glasses, when completely neutralising the focusing error in that eye. This does not mean that you are unsuitable for laser eye surgery. Many patients with a lazy eye have had very successful outcomes after laser surgery. Laser eye surgery can focus the vision in both eyes fully so that you can see much more clearly without glasses. Occasionally spectacles are not prescribed to fully correct the vision in a lazy eye because the difference in the prescriptions between the two eyes would be too difficult to tolerate. Laser eye surgery can often fully focus the vision in a lazy eye and achieve better vision than achieved with uncorrected spectacles. Fully correcting the vision in the lazy eye also has the benefit of improving the peripheral (side) vision in the lazy eye. If you have a prescription, contact a patient care coordinator consultant to discuss this over the telephone. However a final determination cannot be made without an initial screening with us.</p>
<p>Have astigmatism?</p>	<p>Yes. Laser eye surgery has been used to treat astigmatism since 1994.</p>
<p>Have a cataract?</p>	<p>Yes. Whilst laser eye treatment does not correct this problem, if the cataract is only mild and not significantly affecting the vision, laser eye surgery is a safer and more effective treatment than cataract surgery to correct the vision. Should the cataract worsen you can still have successful cataract surgery after laser eye surgery. Often laser eye surgery is used in conjunction with cataract surgery to treat astigmatism or fine tune any residual focussing error in the eyes. It can also be used to provide "blended vision" so people can see at distance and read without spectacles.</p>
<p>Have a collagen vascular disease?</p>	<p>Yes. You should indicate this when you are having an initial screening.</p>
<p>Have a compromised immune system?</p>	<p>Perhaps. We assess this on a case-by-case basis and will provide you with an answer at the initial screening.</p>

Condition or Circumstance	Can the person have laser eye surgery at the London Vision Clinic?
Have a connective tissue disorder (i.e. rheumatoid arthritis)?	Perhaps. These conditions can be associated with altered healing responses by the body and therefore present a slightly higher risk of complications after laser treatment. There is a possibility that you may be suitable if the connective tissue disorder is controlled. We assess this on a case-by-case basis and will provide you with an answer at the initial screening.
Have had a detached retina?	Yes. However, it depends on the severity of your condition. Laser eye surgery does not treat a detached retina.
Have dry eyes?	Perhaps. Your suitability for laser eye surgery depends on the cause and severity of the dry eye. A surface treatment (PRK / LASEK) may be recommended for cases of moderate dry eye. If you have significantly dry eyes without contact lenses you may be better suited for an intra-ocular procedure to correct your vision. However, this is a rare indication for this form of surgery.
Have epilepsy?	Yes.
Have glaucoma?	Yes. Laser refractive eye treatment is not a treatment for glaucoma and your surgeon will work in conjunction with your glaucoma specialist to ensure your glaucoma management is not affected by laser refractive surgery.
Have hepatitis C?	Yes. You should indicate this when you have your initial screening.
Have HIV?	Yes. You should indicate this when you have your initial screening.
Have or have had herpes infection of the eye?	Yes. However, only if there has not been a reoccurrence of the infection for at least 12 months prior to having the procedure.
Have diabetes?	Yes. If the diabetes is controlled and you don't have any signs of active diabetic retinopathy. To be sure, you'll need to be examined for this at your initial screening.
Have had iritis?	Perhaps. Iritis is a condition whereby the iris becomes inflamed. Suitability for laser eye treatment is only likely if there has not been a reoccurrence in the 12 months preceding treatment. We assess this on a case-by-case basis and will provide you with an answer at the initial screening.
Have keloid scarring?	Yes.

Condition or Circumstance	Can the person have laser eye surgery at the London Vision Clinic?
Have keratoconus?	No. Keratoconus is a progressive disease that results in the thinning of the cornea, therefore removing corneal tissue with laser treatment is inadvisable as it will further destabilize the shape of the cornea. However, London Vision Clinic can successfully stabilise the keratoconus or protect patients from further progression through a corneal cross-linking treatment.
Have large pupils?	Yes. With our custom-programmed treatments we have now successfully treated patients with very large pupils without inducing night vision disturbances (which would have previously disqualified patients with very large pupils).
Have macular degeneration?	Yes. However, it depends on the severity of your condition. Laser eye surgery does not treat macular degeneration. If your central vision is significantly depressed as a result of macular degeneration, laser eye surgery may provide little improvement to your uncorrected central vision although it is likely to improve your uncorrected peripheral vision.
Have night vision disturbances?	Yes. Some clinics have the technology and expertise to correct these problems.
Have nystagmus (involuntary eye movements)?	Yes. Laser eye surgery will not treat the nystagmus, but can be safely performed with the use of sensitive eye tracking systems fitted to most modern lasers.
Have one good eye?	Yes.
Have prism?	Yes. However, you may still need prism glasses if you have double vision with contact lenses or without the prism in your spectacles.
Have squint?	Yes. Squint is another name for strabismus.

Condition or Circumstance	Can the person have laser eye surgery at the London Vision Clinic?
Have strabismus?	Yes. However, laser eye surgery techniques alone will not resolve a strabismus problem unless the strabismus is a fully accommodative squint. This is seen in some long-sighted people whose eye turns in without their glasses or contact lenses but is perfectly straight with glasses or contact lenses. Refractive surgery attempts to change the refractive error of each eye individually. Strabismus is not automatically a contraindication for LASIK or PRK/LASEK, however there are several considerations that need to be evaluated before making a decision about refractive surgery. If amblyopia (or lazy eye) has developed due to strabismus, refractive surgery is unlikely to be able to restore vision beyond that which is attainable with corrective lenses, i.e. glasses or contact lenses.
Have systemic lupus erythematosus?	Yes. Only if well controlled. Your surgeon will assess your suitability on a case-by-case basis.
Have thin corneas?	Perhaps. If you have been turned down for laser surgery due to corneal thickness, it is worth having a complete preoperative assessment with us, including a VHFU examination with the Artemis, to rule out keratoconus. If you have thin corneas, but do not have keratoconus, you may still be a candidate for laser refractive treatment. Alternatively you may benefit from an intra-ocular procedure.
Have uncontrolled diabetes?	No. Patients with uncontrolled diabetes are not suitable for laser eye surgery.

Glossary

— A —

Ablation

The removal of organic material from the cornea by an excimer laser in laser eye surgery.

Accommodation

The automatic adjustment of the eye for seeing at different distances effected chiefly by changes in the convexity of the crystalline lens.

Acuity

The sharpness or clarity of vision. The most common measure of visual acuity is the Snellen acuity chart used by optometrists and ophthalmologists. Normal acuity is 20/20 (6/6 metric version).

Artemis

A trade name for a Very High-Frequency Ultrasound (VHFU) manufactured by UltraLink LLC that measures corneal thickness to the accuracy of 1 micron. It produces a 3D image, which means it detects the thinnest point of the cornea with great accuracy and displays a profile of the depth of the cornea.

Astigmatism

A condition in which the surface of the cornea is not spherical, but shaped like a rugby ball. An astigmatic cornea focuses incoming images on two separate points in the eye, creating a distorted image. The second number on your glasses prescription refers to your degree of astigmatism.

— B —

BSCVA or Best Corrected Visual Acuity

A measure of your sight whilst wearing corrective lenses, such as glasses or contact lenses.

Bifocals

Corrective lenses that have two powers of correction. Typically, most of the lens is used for distance vision while a smaller area is for near vision. Bifocals and trifocals are normally prescribed for individuals with Presbyopia.

Binocular Vision

The blending of images seen individually by each eye into a single image.

Broadbeam

A beam of excimer laser energy applied across the entire ablation zone of the cornea at one time. See also variable beam and flying spot.

— C —

Central Ablation Zone

See Optical Ablation Zone.

Clear Lens Exchange (CLE)

A surgical procedure, similar to cataract surgery, in which a surgeon removes the crystalline lens from the eye and replaces it with a clear plastic intraocular lens (IOL). The IOL corrects the refractive error.

Conductive Keratoplasty (CK)

A surgical procedure for hyperopia and mild long-sightedness in which a surgeon uses a probe to apply high-frequency radio waves to the corneal tissue, causing it to shrink by heating. This controlled shrinkage reshapes the cornea to correct its refractive error.

Contrast Sensitivity

The ability to perceive differences between an object and its background, i.e. the ability to distinguish a grey object on a grey background.

Cornea

The transparent anterior part of the external coat of the eye covering the iris and the pupil and continuous with the sclera. The dome-like cornea provides approximately two-thirds of the optical power of the eye. Light passes into the eye through the cornea and is reflected out of the eye, making the iris and pupil of the eye visible.

Corneal Abrasion

A scratch or similar trauma to the outer surface of the cornea.

Corneal Haze

A condition in which the cornea develops hazy scarring that can reduce contrast sensitivity and visual acuity.

Corneal Topography

The process of mapping the surface shape of the cornea with a camera or computer system.

Crystalline Lens

The natural lens of the eye, located behind the iris, helps rays of light to focus on the retina. The lens is transparent, but with age, it can become cloudy (a cataract). The lens has the ability to vary its power to focus light from objects at different distances.

Custom Cornea

A trade name for the use of Wavefront Guided laser eye surgery, using the LADARVision™ excimer laser built by Alcon.

Customvue

A trade name for the use of Wavefront Guided laser eye surgery with the VISX S4 excimer laser.™

— D —

Decentration

A potential complication of laser eye surgery. In perfect centration the centre of the corneal ablation exactly coincides with the centre of the visual axis. This is like looking through the very centre of your spectacle lens, allowing for sharp, in focused vision. If you look through the periphery of your spectacle lens the optics are distorted. Decentration can cause various symptoms, including edge glare or even monocular double vision. Other factors, such as the size of the pupil, whether it is dark outside (so your pupil will enlarge) or the size of the ablation zone will affect the severity or presence of symptoms.

Diffuse Lamellar Keratitis (DLK)

DLK is an inflammation under the LASIK flap of the cornea, which is caused by a response to the presence of sterile inflammation in the flap interface. The complication occurs in the early post-operative period. Vision is hazy and at times the eye is painful and teary. Sufferers may also experience intolerance to bright light.

Dilation

The process by which the pupil enlarges, usually in low light conditions.

Diopetre (D)

A unit of measurement of the refractive power of a lens. A one-dioptre (1D) lens will focus parallel light rays one metre from the lens and a two-dioptre (2D) lens will focus half a metre from the lens.

Double Image

Also called ghosting. If you look at a clock and some of the numbers have a lighter image just off to the side, this is a typical double image problem.

Dry Eye

The term dry eye is used to describe a variety of disorders with similar symptoms: discomfort, a feeling of dryness, burning or stinging, grittiness, foreign body sensation and photophobia.

— E —

Ectasia

An outward bulging and thinning of the cornea due to raised internal eye pressure and/or a weakened cornea.

Endothelium

The inner layer of cells on the inside surface of the cornea.

Enhancement

A secondary refractive surgery treatment or retreatment, performed to refine or improve the original visual result. Higher corrections and wider optical zones sometimes result in under-

correction or over-correction. Enhancement treatment is usually a small correction and is generally very accurate.

Epi-LASIK

See Laser Assisted Epithelial Keratomileusis.

Epithelium

The outer surface layer of the cornea, like the epidermis or outer layer of the skin.

Epithelial Ingrowth

A potential complication of LASIK in which epithelial cells under the corneal flap begin to grow and multiply. The most common treatment is lifting the corneal flap, removing the cells, irrigating the interface and repositioning the flap. Most cases, if managed appropriately, have a good outcome.

Excimer Laser

An argon-fluoride laser that emits ultraviolet light in pulses, at a wavelength of 193nm. The term excimer comes from the concept of 'an energized molecule with two identical components'. Each pulse of this cool laser removes 1/4000th of a millimetre of tissue from the targeted surface, by breaking the bonds between the molecules of collagen. It would take about 200 pulses from an excimer laser to cut a human hair in half.

— F —

Far-sightedness

Common term for hyperopia or long-sightedness, i.e. being unable to see close objects clearly.

Femtosecond Laser

A femtosecond laser is a laser that emits optical pulses with a duration that is one 1/4000th of a second. The Intralase laser uses femtosecond laser technology to create a corneal flap in LASIK eye surgery.

Flying Spot

A very small spot of excimer laser energy applied in rapid succession at different locations across the ablation area of the cornea.

Focusing Power

The cornea is responsible for about two-thirds of the focusing power of the eye. As light enters the eye, it is focused by the cornea. Then, as the light passes through the pupil, the lens adjusts the focus, depending on the distance of the object being viewed. Close objects, such as a book or computer screen, require more power than distant objects, such as traffic signs.

— G —

Ghosting

A common term for seeing double images. If you look at a clock and some of the numbers have a lighter image just off to the side, this is ghosting.

— H —

Halos

Images from light sources look blurred with circles radiating outward from the centre. Halos can appear as a complication of refractive surgery but they also occur naturally.

Haze

The cornea becomes cloudy or opaque, rather than clear.

Hyperopia

Also known as far-sightedness or long-sightedness. Hyperopia occurs when the eyeball is too short from front to back or the focusing mechanism is too weak. This causes light rays to be focused behind, rather than on, the retina. People with hyperopia have difficulty seeing objects that are close.

— I —

Implantable Contact Lens (ICL)

The trade name for the STAAR Myopic Implantable Contact Lens (ICL). It is used for the correction of high refractive error and is worn behind the iris in the posterior chamber of the eye. Also known as a Phakic Intraocular Lens (P-IOL), the design of the ICL is very similar to that of intraocular lenses used for cataract surgery. The lens material, known as Collamer, has a history of safe use in approved-standard posterior chamber intraocular lenses.

Intacs

The trade name for Intrastromal Corneal Ring Segments.

IntraLase

A femtosecond laser that uses amplified light energy to cause tiny bubbles to form at a predetermined depth to create a corneal flap in LASIK. Thousands of these bubbles next to each other create an incision. The other technique for making an incision is by using a microkeratome.

IntraLASIK

A marketing term referring to LASIK where the corneal flap is created by a femtosecond or IntraLase laser.

Intraocular

Inside the eye.

Intraocular Lens (IOL)

Silicone, acrylic or plastic lens used to replace the natural crystalline lens of the eye. See Implantable Contact Lens, Phakic Intraocular Lens (P-IOL) and Clear Lens Exchange.

Intrastromal Corneal Ring Segments (ICRS)

Small slivers of plastic implanted at the outer edges of the cornea to flatten the centre and reduce myopia and keratoconus. Trade name Intacs.™

Intraocular Pressure (IOP)

Pressure inside the eye.

— J —

Joules

Joules is the unit measurement of energy.

— K —

Keratotomy

Surgical removal of corneal tissue.

Keratoconus

A disorder that causes thinning and asymmetry of the cornea. The normally symmetrical shape of the cornea becomes distorted. A cone-shaped bulge develops resulting in significant visual impairment.

Keratomileusis

A refractive surgical technique in which a thin, circular flap of the cornea is removed, frozen, reshaped on a lathe and replaced upon the cornea.

Keratotomy

A surgical incision of the cornea as in Radial Keratotomy.

— L —

LASEK

See Laser Assisted sub-Epithelium Keratomileusis.

Laser

Light Amplification by the Stimulated Emission of Radiation. Laser light is composed of one colour (wavelength), travelling in one direction and each light wave is in step with the next making the laser light millions of times more powerful than ordinary daylight.

Laser Assisted In-Situ Keratomileusis (LASIK)

A surgical procedure to reshape the central cornea, decreasing or eliminating myopia, hyperopia, and astigmatism. The refractive surgeon uses a microkeratome device to cut a thin layer from the cornea. This flap is then lifted like a hinged door and the exposed eye surface is reshaped using the excimer laser. After altering the corneal curvature, the flap is replaced. It adheres quickly, without stitches.

Laser Assisted Sub-Epithelium Keratomileusis (LASEK)

A surgical procedure to reshape the cornea by detaching the epithelium with an alcohol solution that softens it and allows it to be rolled back into a flap. After excimer ablation to correct the vision, the flap of epithelium is repositioned over the cornea.

Laser Blended Vision

A laser eye surgery technique for presbyopia in which one eye is treated to view objects mainly at distance, but a little up close and the other is treated to view objects mainly up close, but a little at distance. The brain combines and enables the individual to see distance and near without effort. In most cases, the brain is able to compensate and you will experience depth of focus and overall visual acuity, without the need to wear glasses or contact lenses.

Laser Thermal Keratoplasty (LTK)

A surgical procedure where an instrument applies rings of laser energy to the mid-periphery of the cornea. Each ring gently heats collagen in the cornea to change the corneal shape. Performed as a non-contact procedure.

Lens

A transparent double convex (outward curve on both sides) structure between the iris and the vitreous humour of the eye. The lens provides focusing power. In people under 45 years old the lens is able to adjust its power, allowing the eye to switch its focus between close and distant objects.

— M —**Micron (m)**

A unit of length equal to one-millionth of a metre.

Microkeratome

A surgical device for creating a flap of corneal tissue, used in LASIK and some transplant techniques. It is fixed to the eye with a vacuum ring, flattens, then cuts the cornea. The mechanical microkeratome uses a very sharp, thin metal blade that oscillates at 1000 rpm. The femtosecond laser microkeratome uses amplified light energy to cause tiny bubbles to form at a predetermined depth. Thousands of these bubbles next to each other create an incision (see intraLASIK).

Monovision

A contact lens technique to overcome the effects of presbyopia by correcting one eye for near vision and the other for distance vision.

Myopia

Also known as near-sightedness or short-sightedness. Myopia occurs when the eyeball is too deep from front to back or the eye's focusing mechanism is too strong. This causes light rays to be focused in front of, rather than on the retina. People with myopia have difficulty seeing distant objects. This refractive abnormality is corrected with a minus (negative or concave) lens.

— N —

Near-sightedness

Common term for myopia.

— O —

Ophthalmic

To do with the eye.

Ophthalmologist

A medical doctor who specialises in the diagnosis and medical or surgical treatment of eye diseases. Ophthalmologists have medical degrees and further specialist training. Ophthalmologists are traditionally surgeons but some choose not to perform surgery and work as medical ophthalmologists. An ophthalmologist may also prescribe glasses and contact lenses.

Optic Nerve

The optic nerve is a bundle of nerve fibres, about the diameter of pencil, which passes through the back of the eyeball and connects the retina to the brain. The optic nerve carries visual messages from the photoreceptors of the retina to the brain.

Optical Zone

The area of the eye through which light passes to the retina. To reach the retina, light must pass through the cornea, the aqueous humour, the pupil, the crystalline lens and the vitreous gel. The optical ablation zone is the area where a laser has created full refractive error correction.

Optician

An expert in the art and science of making and fitting glasses. An optician may also be qualified to dispense and/or fit contact lenses.

Optometrist

An optometrist is a non-medical eye health provider, who specializes in the examination, diagnosis, treatment, management and prevention of diseases and disorders of the visual system. In the UK optometrists complete a three year degree at University. Many optometrists dispense glasses and contact lenses. Optometrists may not prescribe medicine, as they are not medical doctors.

Over-correction

An outcome of refractive surgery in which the resulting amount of correction is more than desired. Over-correction occurs most frequently when healing does not occur as predicted. It is easily treated by an enhancement procedure.

— P —

Pachymeter

A device that measures the thickness of the cornea. Ultrasound pachymeters have a probe that is placed gently onto the anaesthetised corneal surface. It emits an ultrasound probe that measures the thickness of the cornea.

Peripheral Vision

The ability to see objects and movement outside the direct line of vision.

Phakic Intraocular Lens (P-IOL)

This is a tiny lens that is placed inside the eye, in front of the natural crystalline lens, to provide additional refractive change. It is placed either immediately behind or in front of the iris. It is generally reserved for cases where there is an extreme refractive error.

Photoablation

The process of tissue removal using excimer laser radiation at a 193nm wavelength. This extreme ultraviolet wavelength possesses light photons so powerful that the molecular bonds of the target corneal tissue breaks down and flies off the surface. Microscopic pictures show incredibly precise cuts with no evidence of tissue damage in the remaining tissue.

Photorefractive Keratectomy (PRK)

A surgical procedure using an excimer laser to reshape the central cornea, to give a flattened shape for people who are myopic or a more curved surface for people who are hyperopic. Photorefractive Keratectomy techniques may also be used to correct astigmatism.

Plano

No refractive error. Normal vision without the need for glasses or contact lenses.

Presbyopia

Part of the normal process of ageing. As we become older, the crystalline lens begins to lose its ability to zoom from distance to near vision. To compensate for this, people wear reading glasses such as bifocals. Mild myopia effectively counteracts presbyopia. Refractive surgery does not cure presbyopia but it can help with the vision problems that result.

Presbyopic Lens Exchange (PRELEX)

The term Presbyopic Lens Exchange (PRELEX) was created to describe a Clear Lens Exchange using an Intra-Ocular Lens designed to accommodate and alleviate presbyopia.

Pupil

The small black circular space in the centre of the iris. The pupil changes its diameter in response to different light levels, becoming bigger in the dark and smaller in bright light. The pupil controls the amount of light reaching the retina and the depth of focus of the eye.

Pupillometry

A diagnostic test to measure the size of your pupils, the “windows” that let light into your eyes.

— Q —

Quality

Quality of our care and our technology.

Q-Factor

Q-Factor is the measurement of corneal asphericity.

— R —

Refraction

A test to determine the best glasses or contact lenses to correct a refractive error (myopia, hyperopia or astigmatism). The bending of light by the use of a lens or other material.

Refractive Error

A measurement of visual imperfection. The degree to which images received by the eyes are not focused on the retina (causing myopia, hyperopia or astigmatism), measured in dioptres.

Refractive Lens Exchange

Also called Clear Lens Exchange (CLE). The process of removing the natural crystalline lens of the eye and replacing it with a plastic or silicon intraocular lens to correct refractive error. It is similar to cataract surgery. It carries more risk than laser eye surgery as it involves entering the eye. It is generally performed when laser eye surgery is not possible.

Refractive Surgery

Any surgical procedure that alters the focusing power of the eye. Refractive surgery may include corneal surgery such as LASIK, LASEK, ReLEx, PRK, Intacs, CK, RK, LTK or lens surgery such as CLE or P-IOL.

Regression

A return towards the original refractive state. Usually corrected by an enhancement procedure.

Refractive Lenticule Extraction (ReLEx)

A surgical procedure to reshape the central cornea to decreasing or eliminating myopia. Traditional laser surgery involves cutting a flap off the front of the cornea or pushing the outer cells of the eye to one side and using a laser to change the shape of the cornea. With ReLEx there is no flap cut. The Visumax is a laser that goes through the outer surface of the cornea and lays down a series of micro pulses within the centre of the cornea.

This works like focusing the sun's light coming through the window with a magnifying glass onto a piece of paper on a desk – the window in this scenario is the corneal surface. Once the pulses have outlined the tissue that needs removing to correct the vision, the tissue is then removed by forceps through a tiny 3 mm tunnel, (which is also created by the laser). The procedure takes 4-5 minutes; the vision is 80% better instantly and reaches 100% within a few days according to trials conducted on over 1,000 patients between the UK, Germany, France and Denmark.

Retina

The light sensitive layer of cells (rods and cones) on the inner, back surface of the eye that converts light images into nerve impulses. These are then sent along the optic nerve for transmission to the brain. Akin to the film in a camera.

Retreatment

See enhancement.

— S —

Snellen Visual Acuity Test

The Snellen Test is one of many tests used to determine visual acuity. It uses a white chart with the big black letter E at the top and lines of letters that descend in size. The test gives a result such as 20/40, which means that the person can see an item 20 feet away with the same clarity as a normally sighted person can see at 40 feet.

Starbursts

A complication of refractive surgery. Images from light sources blur, with spikes radiating out from the centre. Starbursts may also occur naturally.

Stromal Tissue

This is the layer directly under the epithelium of the cornea. Because it undergoes very minimal regeneration, this is the tissue that allows the excimer laser to make a permanent change to the shape of the eye.

— T —

Topography

A laser is applied in variable spot sizes across the ablation area. See broadbeam and flying spot for definitions of other techniques.

— U —

Ultrasound

Very High-Frequency Artemis Ultrasound.

— V —

Visual Acuity

Seeing clearly. The ability to distinguish the details and shapes of objects, also called central vision.

Visual Field

The extent of an area seen by the eye in a given position of the gaze. The central visual field is directly in front of the object at which we are looking. The peripheral visual field is 'side vision'. The fields in each eye partly overlap.

— W —

WASCA

See Wavefront Supported Customised Ablation.

Wavefront

A technology used to determine and measure high order aberrations. These aberrations affect the quality of vision. Conventional eye examinations can detect two types of error on the cornea: spherical (myopia and hyperopia) and cylindrical (astigmatism). Wavefront diagnostics can detect an infinite set of ocular aberrations. When the laser beam of the wavefront sensor enters the eye, it has a flat wavefront. This flat wavefront is distorted by imperfections as it travels through the eye. Using this information to correct these small irregularities in the optics of the eye can lead to better vision without glasses than previously with glasses.

Wavefront Supported Customised Ablation

A trade name of the Carl Zeiss Meditec WASCA Aberrometer and the MEL 80 excimer laser system, when used for Wavefront Guided excimer laser treatment.

— X —

Xenon

Xenon is one of the noble gases and which is used for retinal photocoagulation.

— Y —

YAG

YAG laser is used as a treatment in general ophthalmology.

— Z —

Zyoptix

The brand name for Wavefront Guided custom ablation on the Bausch & Lomb Technolas excimer laser. See Wavefront Supported Customised Ablation.

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