



The ROYAL COLLEGE of
OPHTHALMOLOGISTS

Consultation Document

Patient Information: refractive lens exchange

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1 What is Refractive Lens Exchange?

- 1.1 A cataract is a misting up of the natural lens, which sits just behind the pupil and helps to focus light on the retina. Cataract surgery involves replacing the misty natural lens with a small, clear synthetic implant called an intraocular lens (IOL). The focusing power of the IOL can be chosen to suit your eye.
- 1.2 Refractive Lens Exchange (RLE) is identical to modern cataract surgery. Both operations involve replacing the natural lens with an IOL. The only difference is that cataract surgery is performed primarily to correct blur or light scatter caused by a misty natural lens; whereas RLE is performed primarily to reduce the need for spectacles or contact lenses.
- 1.3 IOL implantation is a bit like building your spectacles or contact lenses into your eyes. There are two main IOL types:
- *monofocal IOLs* – monofocal IOLs aim to reduce spectacle dependence for distance (driving) vision.
 - *multifocal IOLs* – multifocal IOLs aim to reduce spectacle dependence for a wider range of activities, including intermediate (computer screens) and near (reading) vision.
- 1.4 If you are suitable for RLE, your surgeon will discuss which IOL type is the best option for you.

2 What are the benefits?

- 2.1 About four out of five patients are completely free of spectacles after RLE with widely used contemporary multifocal IOLs.
- 2.2 Where help from spectacles is still required after surgery, it is usually for a specific activity in the near, intermediate or distance range.
- 2.3 Approximately 95% of patients are satisfied with the outcome of surgery, and many describe it as life changing. Although RLE is often bracketed with cosmetic surgery procedures, the benefits are primarily functional. It is designed to make you less dependent on spectacles and contact lenses, helping you to lead an active lifestyle more easily.
- 2.4 RLE eliminates the need for cataract surgery in later life, and it is often preferred to laser vision correction for patients in the retirement age group in whom the early stages of cataract formation are often already present.
- 2.5 In the absence of a new health problem in the eye, vision normally remains good and the spectacle prescription normally remains stable after RLE, but a one-off minor laser procedure called YAG capsulotomy is commonly required at some stage, often several years after surgery.

3 How much does RLE cost?

- 3.1 Surgery to correct the need for spectacles or contact lenses is not available as an NHS procedure and is not covered by private health insurance schemes.
- 3.2 Your clinic should be clear from the outset about the total cost of the procedure. Factors affecting cost include the type of IOL used and the use of femtosecond lasers to assist surgery. Monofocal IOLs are normally the least expensive, whereas the cost of multifocal IOLs varies widely. Femtosecond lasers are now often used to cut the templates accurately as an additional stage prior to RLE. Femtosecond laser assisted RLE has no proven benefits, but it may be easier to perform safely than conventional microsurgery.
- 3.3 Follow up clinic visits and treatment for any problems resulting from surgery are usually included in the procedure cost for up to six months after surgery. Laser adjustments to focus are often required to obtain the best result from RLE. These are also normally included in the procedure fee.
- 3.4 Most clinics do not accept an open-ended liability and will charge for additional treatment relating to natural prescription changes or a new problem with eye health. An additional fee is normally charged for YAG capsulotomy, a one-off minor laser procedure that is often required months or years after RLE.

4 Who is suitable for RLE?

- 4.1 If you are over 50 years of age with a spectacle prescription higher than the normal range for laser eye surgery, you are likely to be suitable for RLE.
- 4.2 Almost any level of myopia (short sight) or hyperopia (long sight) can be corrected by RLE, and IOLs with built in astigmatism correction are available. Lens implantation techniques can be combined with laser eye surgery in suitable patients to extend the range of astigmatism treatment or fine-tune the focus outcome.
- 4.3 You may not be suitable for multifocal IOL implantation if you have pre-existing problems with your eye health.

5 What are the alternatives?

Vision correction surgery alternatives

- 5.1 RLE is one of three main categories of operations to correct vision. The other two are laser vision correction and phakic intraocular lens (PIOL) implantation.
 - Laser vision correction does not require a lens implant, and works by altering the curvature and focusing power of the front surface of the eye.

- PIOLs are lens implants that sit in front of the natural lens rather than replacing it.

5.2 Laser eye surgery or PIOL implantation are generally better options than RLE for younger patients who still have a clear, flexible natural lens. This includes most patients under 50 years old. Laser vision correction is a relatively low risk option for many patients over 50 years of age with a lower prescription; but the balance shifts as you get older and both flexibility and clarity of the natural lens diminish. RLE is the default option for vision correction surgery in the (65+) retirement age group, but laser vision correction may still be a better alternative for patients with no signs of cataract and good eye surface health.

IOL alternatives

5.3 Different lens implants suit different patients, and not everyone will benefit from multifocal IOL implantation.

5.4 Monofocal IOLs may be more suitable for patients with other eye problems or for patients who are worried that they may not cope well with the optical side effects of multifocal IOL implantation. Monofocal IOLs have fewer optical side effects than multifocal IOLs, but do not provide spectacle freedom for such a wide range of activities.

5.5 The most commonly used approach in standard cataract surgery is to select monofocal IOLs to leave the eyes equally focused in the distance. Spectacles are then usually required for reading and near work.

5.6 A common alternative approach using monofocal IOLs is to aim for clearer vision in the distance in one eye, and clearer vision at arms' length in the other. With the two eyes open, binocular visual input combines in our one view of the world to help at least partially restore near vision with relatively little compromise optically. This is sometimes called monovision or minimonovision. Although reading spectacles are commonly still required, variations on this approach are often very effective in helping to preserve spectacle freedom for working with your hands and computer screen work, and can be a good intermediate choice if you would like more freedom from spectacles but do not want, or do not have access to, multifocal IOLs.

5.7 Your surgeon will discuss the pros and cons of different implant choices in RLE with you at your initial consultation.

Continuing in spectacles or contact lenses

5.8 RLE is elective. This means you can choose to proceed with it at any time, or not at all. The alternative is staying in spectacles or contact lenses.

5.9 Spectacles are risk free but may limit the range of activities you can do confidently and comfortably – particularly sport and exercise.

5.10 Although there are many successful lifelong contact lens wearers, comfort and tolerance tends to diminish with age. So varifocal spectacles are often the main alternative to RLE for older patients. Varifocal spectacles have their own optical side effects. For example, having the lower part of the varifocal lens focused for reading can make it difficult to walk downstairs confidently. IOLs provide the range of focus

in a different way, and trouble adapting to varifocal spectacles does not mean that you will also have trouble adapting to multifocal IOLs.

- 5.11 Contact lenses provide good all-round vision. They do not mist over during sport and will help you to be more active; but they can be inconvenient when travelling, make water sports more difficult, and should not be worn whilst showering or during sleep. Contact lens wear is sometimes associated with eye surface discomfort, and may be complicated by sight threatening infection.
- 5.12 Risks, side effects and benefits of RLE should be balanced against those for continued contact lens wear and varifocal spectacles since these are the main alternatives for active people considering sight correction surgery.

6 How is RLE performed?

- 6.1 RLE is performed using drop anaesthetic supplemented by an injection in the back of your hand to relax you if required. Anaesthetic may also be washed around the back of the eye to prevent excessive eye movement. A spring clip holding the eyelids apart allows you to blink safely during surgery.
- 6.2 Your surgeon will be looking through a microscope to perform the surgery. You will be lying down under a surgical tent with fresh air coming in underneath. A sticky plastic drape covers the skin around your eye and sticks the eyelashes out of the way.
- 6.3 Some centres offer surgery for both eyes on the same day. More commonly, second eye surgery is delayed for a week or longer to ensure that the recovery in the first eye is progressing well. The focus outcome in the first eye can also be used to help guide lens selection for the second eye. The surgery typically takes about 20 minutes per eye. You can return home on the same day as surgery.
- 6.4 Strong pupil dilating drugs are given as drops or as a pellet placed under the lower eyelid to prepare your eye for surgery.
- 6.5 Essential steps in surgery are:
- *Entry points* - formation of small self-sealing entry points in the front of the eye at the junction of the white of the eye and the cornea
 - *Capsulotomy* - removal of a circular disc from the front of the membrane covering the natural lens called the lens capsule (think of the skin of a grape and you will have the right mental image of the thin, clear covering of the natural lens)
 - *Phacoemulsification* – liquefaction and removal of the natural lens from within the lens capsule using a high frequency vibrating probe, fluid washing, and vacuum
 - *IOL insertion* - injection of the IOL and unfolding into the natural position within the lens capsule using a supporting gel to fill the front of the eye

- *Wash out and refilling* - wash-out of the supporting gel and refilling with fluid and antibiotics.

6.6 Femtosecond lasers are sometimes now used in a preparatory stage before going through to the operating theatre. Femtosecond lasers are costly and provide no proven benefit for your vision after RLE or cataract surgery, but they may make some stages of the operation (capsulotomy in particular) easier for surgeons to perform safely and consistently. This additional laser stage takes about five minutes, and is performed using eye-drops to anaesthetize the eye.

7 What are the risks?

7.1 In all forms of eye surgery, problems can occur during the operation or afterwards in the healing period. Problems can result in permanent, serious *loss of vision* (vision worse than the driving standard in the affected eye that cannot be corrected with spectacles or contact lenses). More commonly, problems can be corrected with changes in medication or *additional surgery*. Typically, these additional operations feel like the original surgery and have a similar recovery period.

Loss of vision

7.2 Permanent, serious loss of vision is significantly more common after RLE than after laser vision correction or PIOL implantation, affecting approximately one in 500 patients. In the worst scenario, complete loss of vision may occur in the affected eye.

7.3 Permanent serious visual loss is typically caused by damage to the retina. This can result from infection or an inflammatory response after surgery, retinal detachment after surgery, or bleeding during surgery. Some problems occurring during surgery increase the risk of sight threatening problems afterwards. These include a common complication of surgery called posterior capsular rupture, (breakage of the membrane just behind the IOL). The UK benchmark rate for capsule rupture for all cataract surgeons is just under 1.5%. Experienced surgeons have a lower rate, but all surgeons have at least some cases affected by posterior capsular rupture. It is not always possible to implant a multifocal IOL safely if posterior capsular rupture has occurred, and this may mean greater than anticipated reliance on spectacles after surgery.

Additional surgery

7.4 Second operations may be required to correct a complication from the initial surgery. This could include lens repositioning or exchange, surgery to retrieve lens fragments from the back of the eye, or retinal detachment repair. With or without RLE, retinal detachments are more common if you are very short-sighted; but the risk of retinal detachment is approximately five times higher in the first four years after cataract surgery or refractive lens exchange.

7.5 Statistical techniques (biometry formulae) and eye measurements (biometry) are used to guide selection of the IOL required to correct your vision. Limitations on the accuracy of these techniques mean that laser vision correction to fine tune the focus is often required to touch up the visual result after RLE.

- 7.6 The commonest reason for visual deterioration after RLE is posterior capsule opacification (PCO). This is a gradual misting over of the membrane just behind the IOL, which affects many patients. PCO may occur months or years after surgery, and is normally treated successfully with a one-off minor laser procedure called YAG laser capsulotomy.

Risks of contact lens wear

- 7.7 Continuing in contact lenses is often the main alternative for people considering sight correction surgery. If you follow the right safety advice, contact lens wear is low risk; but approximately one in 3000 wearers each year will develop a serious corneal infection.
- 7.8 To minimize this risk, you should not swim or shower in contact lenses, and should not wash them in tap water. Sleeping in contact lenses, including those designed for overnight wear, increases the risk of infection significantly. Soft, daily disposable lenses are safer than non-disposable lenses.

8 What are the side effects?

- 8.1 Side effects are problems which most patients experience to some degree after surgery. They normally improve with time, but do not always resolve completely.

Vision

- 8.2 You normally experience some light scatter side effects and unwanted images in the early months after RLE.
- 8.3 Visual side effects vary with type of IOL implanted, and are often more noticeable in some lighting conditions than others. Patients are commonly aware of a shadow or shimmering arc of light in their peripheral vision after monofocal IOL implantation. Some types of multifocal IOLs tend to cause halos around lights. Blur or ghost images are more common with others; but almost any form of light scatter side effect can occur. It is generally accepted that all forms of multifocal IOL are associated with more optical side effects than monofocal IOLs. However, multifocal IOLs all produce a greater range of spectacle freedom.
- 8.4 Optical side effects may initially interfere with work or leisure activities, and night driving in particular. But they tend to diminish with time. 19 out of 20 patients are satisfied or very satisfied with their vision 3-6 months after multifocal IOL implantation, and laser procedures to treat residual defocus or posterior capsular opacification (YAG capsulotomy for PCO) are often helpful in accelerating adaptation in the remainder. But approximately 1% of patients cannot adapt, and will elect to undergo IOL exchange, swapping the multifocal IOL for a monofocal IOL.

Eye comfort

- 8.5 Some eye surface discomfort is common in the early months after most forms of eye surgery. This is usually mild after RLE, and highly variable – often affecting one eye more than the other. Treatment and prevention are based on making sure your eye surface is healthy before and after surgery. Lubricant eye drops can be helpful, and

can be taken safely in addition to your other medication when required. For patients with a normal eye surface prior to surgery, lasting problems are unusual.

Eye Appearance

- 8.6 Red blotches are often visible on the white of the eye after any form of eye surgery. These are called subconjunctival haemorrhages, and are caused by a small leak of blood under the mucous membrane covering the white part of eye wall. Although they can be quite unsightly, red blotches are temporary, and do not affect eye health; but they can take up to six weeks to go away completely.
- 8.7 Most IOLs are not visible. But people may occasionally notice a glint in your eye caused by a reflection from the front of the IOL within the pupil.

9 Will RLE affect my future eye health care?

- 9.1 If you develop a new eye health problem in later life, RLE implantation should not prevent you having successful treatment. Common eye health problems like glaucoma, diabetic retinopathy, and age related macular degeneration can be monitored and treated as normal after RLE.
- 9.2 Many patients with hyperopia (long sight) have a relatively small space for fluid circulation through the front of the eye. The space narrows as the natural lens expands with age, leaving these patients vulnerable to a form of glaucoma caused by blockage of fluid flow that can lead to sudden, painful loss of sight ('angle closure glaucoma'). In patients with this predisposition to later problems called 'a shallow anterior chamber', RLE can both reduce the need for spectacles and remove any risk of future problems due to angle closure. This is because IOLs are thinner than the natural lens. So RLE or cataract surgery creates more space for fluid circulation in the front of the eye.

10 How can I reduce the risk of problems?

- 10.1 Most patients have IOL implantation under local anaesthetic. You can eat and drink normally before surgery, and should take any regular medication as usual.
- 10.2 Most surgeons work with an anaesthetist to monitor your health during surgery and optimize your comfort, administering sedation where necessary. Keep your breathing calm, stay as relaxed as you can, and try to keep your head still after the surgeon has positioned it comfortably.
- 10.3 You can help your surgeon apply the drape and stick your eyelashes out of the way by opening both your eyes wide at the beginning of surgery. Blinking is no problem after the draping is complete. Just look straight up ahead to the bright operating light with both eyes open, but blink when you need to. Looking up to the bright microscope light helps to keep your eyes in the best position.

- 10.4 Your surgeon will talk you through the procedure, encouraging you at every stage. Let your surgeon know if you feel any discomfort, and tell your surgeon if you need to cough, sneeze or take a break.
- 10.5 For the preliminary laser stage in laser assisted cataract surgery, your eye is normally held still and the eyelids are kept out of the way with a suction ring. But the same principles apply. To help the surgery go smoothly, simply stare straight up ahead with both eyes open. Try not to squeeze the eyes shut, but blink whenever you need to.
- 10.6 A clear plastic shield is normally taped over the eye at the end of surgery to protect the eye on the way home. Nursing staff will show you how to wear the eye shield at night (normally for one week after RLE).
- 10.7 You can wash and shower normally from day one after RLE. Most surgeons recommend no swimming for a week and no contact sports for a month. Non contact sports such as gym and jogging can be resumed from day one after surgery.
- 10.8 Set a smart phone reminder and use the antibiotic and anti-inflammatory drops as prescribed to help the eyes to heal well. It is good to leave at least two minutes between different types of eye drop so that they each absorb well before the next drop is applied. If you miss the first time or you are not sure, applying a second eye drop is no problem.
- 10.9 Some variability of vision and comfort is normal in the early weeks after RLE, and patience is required. But discomfort is usually mild, and vision normally recovers substantially within two to three days once the pupil dilating drugs have worn off.
- 10.10 Report to your surgeon or an eye casualty department without delay if you have increasing aching pain, light sensitivity, redness, blur after surgery.
- 10.11 Other danger signs, particularly relevant to highly myopic patients undergoing RLE, relate to the warning signs of a retinal detachment. These are a sudden new shower of floaters, flashes of light (even with the eyes closed) and visual field loss (a shadow or curtain spreading across your vision). Most retinal detachments can be repaired without detriment to your vision, but the chances of success are much higher if the detachment has not spread across the centre of your vision.
- 10.12 You may not be aware of a problem that requires treatment in the healing phase. So make sure you attend your review appointments even if your eyes feel good.

11 Glossary

ICI	Intralocular Collamer Lens
PIOL	Phakic Intraocular Lenses
PCO	Posterior Capsule Opacification
RLE	Refractive Lens Exchange