

Clear Lens Extraction with Intra-ocular Lens Implantation for Hypermetropia

Optics of the Eye

In a normal eye, rays of light are brought into focus on the retina at the back of the eye. The path of the light rays entering the eye is determined by the cornea and the lens. Most of the bending of the light rays occurs on the surface of the cornea at the air/tissue interface where there is a big change of refractive index. Because the lens inside the eye is surrounded by fluid, its optical power is less, and it acts to fine tune the focus for near and distance vision.

With age the focussing ability of the lens declines, so that people who have not previously required spectacles find that they need reading glasses after the age of about 40 (presbyopia). If a hypermetropic (long-sighted) person in the presbyopic age group has their hypermetropia fully corrected in both eyes they will still require glasses for near vision.

High Hypermetropia

Hypermetropia is a condition where the eyeball is a little too short for the optical power of the cornea and lens to bring rays of light into focus at the back of the eye. Sometimes if the hypermetropia is not too severe, the optical defect can be compensated for in young people by making a focussing effort, but since the focussing ability of the lens declines with age, hypermetropes always eventually become reliant on spectacles or contact lenses to give clear vision.

If the cornea is not spherical in shape this creates an additional optical defect – astigmatism – which cannot be compensated for by the focussing power of the lens. When optical defects in the eye are not corrected in infancy the visual potential of the eye may not develop fully, and this can lead to 'lazy eye' or amblyopia, and this may also cause a squint.

Amblyopia can be treated by patching (occlusion) therapy up to the age of around eight, but after that the vision in a lazy eye can never be improved beyond that achieved with spectacles or contact lenses. High hypermetropia can be corrected by exchanging the natural lens of the eye with a smaller, but optically more powerful intra-ocular lens implant. This also prevents the risk for hypermetropes of developing narrow angle glaucoma in old age, when the growth of the natural lens of the eye can cause obstruction of the aqueous drainage channels in the front of the eye.

Ocular Biometry

To calculate the correct power of the intraocular lens implant it is necessary to make measurements of the eyes preoperatively, including an assessment of the length of the eye by ultrasonic biometry. This information allows the surgeon to predict with a fair degree of accuracy what the final optical state of the eye will be. The surgeon can then discuss the possibilities of the various optical outcomes from the surgery with the patient, and select an appropriate lens to achieve the desired result.

Types of Lens Implant

The majority of lens implants used are of fixed focus (monofocal), but there are also multifocal implants which give vision for both distant and near objects. However if monofocal lenses are implanted in both eyes with one eye left a little short-sighted, a similar range of vision can be achieved.

In people who have a significant amount of astigmatism, special toric (aspherical) intraocular lenses may be required to achieve the desired optical outcome, or incisions can be made in the cornea at the

time of surgery in order to reduce the astigmatism (astigmatic keratotomy). Alternatively the surgery can be followed by laser surgery to the cornea (e.g. LASIK), to correct the astigmatism.

Anaesthesia

Clear lens extraction surgery can be carried out with local anaesthesia – drops to anaesthetise the eye and injections beside the eye - to stop the eyelid and eye movement during the surgery. Since local anaesthesia has little effect on the patient's general condition, they are fit to return home shortly after the procedure, and in-patient hospital stay is not usually necessary. Alternatively the surgery can be carried out under a general anaesthetic.

Phakoemulsification

The natural lens of the eye has a diameter of around 12mm, so if it is to be taken out in one piece, the incision into the eye must be at least this long. When a large wound is created in the eye, there is almost always distortion of the corneal shape during the wound healing process and this creates optical distortion – astigmatism – which then requires spectacle correction. To overcome this problem it is preferable to break up the lens inside the eye and then remove the lens matter a little at a time through a small incision. The phakoemulsification instrument has a small probe connected to an ultrasonic transducer. The ultrasonic vibrations fragment the lens matter and the emulsified fragments are then aspirated in a flow of saline solution. Once the lens matter has been removed the intraocular lens implant is introduced through the same small incision. Made from deformable plastic, the implant is rolled or folded up and injected into the eye. Inside the capsular membrane (remnants of the natural lens), the lens implant unfolds and its optical part is held centrally behind the pupil by supporting loops or plates (haptics).

Complications

In by far the majority of cases lens extraction has a favourable outcome. Very rarely the surgery may be complicated by problems such as inflammation or infection. Occasionally, the function of the retina can be impaired by the lens extraction surgery – for example, central visual function may be permanently impaired by leakage of fluid into the retinal tissue (cystoid macular oedema). Lens extraction surgery can lead to the vitreous jelly breaking away from the back of the eye (posterior vitreous detachment), with an increase of 'floaters' in the vision. A small proportion of patients suffering posterior vitreous detachment go on to develop retinal detachment, which if left untreated can cause irreversible visual loss.

Lens capsular opacification

In phakoemulsification surgery 98% of the lens is removed, leaving only the outer lens capsular membrane. This membrane is used to support the intraocular lens implant. After some time, usually some years, the lens capsule can become hazy in around 30% of patients. When the problem arises it is simply remedied by the use of a YAG laser. This invisible infra-red laser beam is focused on to the capsular membrane and vaporises the tissue – so clearing the optical path for light rays to reach the back of the eye. A YAG capsulotomy takes only a few minutes to perform, is entirely painless, and ensures that the visual pathway remains clear of capsular membrane indefinitely.