

Descemet's membrane endothelial keratoplasty (DMEK) surgery

This information leaflet tells you what to expect if you have DMEK surgery – an operation on the cornea of the eye – along with its risks and potential benefits. It will help you to make an informed decision as to whether or not you want to proceed with the operation. If you have any queries, please speak to your doctor or nurse.

What is DMEK surgery?

Descemet's membrane endothelial keratoplasty (DMEK) is an operation intended to restore corneal clarity in cases where the innermost corneal layer (the endothelium) has failed. DMEK is a form of corneal transplant, also called corneal graft, which involves the use of human donor corneal tissue.

Many people donate parts of their body after their death, including their corneas, in order to help others. The individual or family consent to the use of the eyes for medical purposes after their death, e.g. by carrying a donor card. The donor cornea is taken from an eye that has been removed from a person who has died.

It is usually necessary to wait for some time until a cornea in the correct condition is available. This may mean waiting for someone to die for 'material' to become available.

Corneas are not taken from donors known to have infectious conditions. All donors are screened for HIV or Hepatitis viruses before their corneas are used. The cornea is treated with antibiotic solution before being used for your operation. Unfortunately, not all conditions can be detected, and it is not possible to guarantee that the donor cornea is free from infection. The risk of CJD (brain disease) from corneal grafting is unknown.

Mr Leyland, Consultant Ophthalmologist and corneal specialist uses donor corneas from the NHS Blood and Transplant Centre in Bristol, which has rigorous procedures to ensure the best quality and safest corneal tissue.

Why do I need DMEK surgery?

The cornea of the eye – the transparent covering at the front of the eye – is a layered structure, with different layers providing different functions. The surface layer is called the epithelium. It protects the cornea and provides a smooth surface for focusing light. The middle layer of the cornea, the stroma, provides strength. The deepest layer, facing the inside of the eye, is the endothelium. This is a single layer of special cells that work as a pump, draining fluid out of the stroma. Without the endothelial pump, the stroma becomes water-logged, leading to an oedema (swelling).

If the corneal endothelium fails, the cornea becomes swollen and cloudy, reducing vision. In the early stages, this may only be noticeable when you first wake up, as eyelid closure overnight reduces endothelial function and allows the cornea to thicken. Blurred vision then wears off after 1-2 hours of eye opening as the cornea clears. With more severe endothelial failure, the cornea remains cloudy all of the time. In the worst cases, blisters of fluid appear on the corneal surface, causing severe pain when they burst, and laying the eye open to infection.

What causes the endothelium to fail?

Endothelial failure most commonly arises because of previous eye surgery, e.g. cataract or glaucoma operations. It may also occur spontaneously in a condition called 'Fuch's endothelial dystrophy'. This is a genetic condition, although not always inherited, whereby patients do not have enough cells to last for life. Patients develop symptoms between the ages of 40 and 60, often in both eyes.

How does DMEK surgery treat endothelial failure?

DMEK is an operation in which the failing endothelium is selectively replaced with a donor graft, leaving the healthy part of the patient's cornea in place. The donor cornea heals onto the patient's cornea and pumps fluid out of it, clearing the vision.

How soon will I know if the surgery was successful?

Good vision is usually achieved after 1 to 2 months. There may be some additional improvement over the next several months.

Glasses prescription does not usually alter very much; if new glasses are required they can be prescribed after 4-6 weeks.

What are the risks of DMEK surgery?

Dislocation of donor graft:

The endothelial graft may come away from your cornea in the first few days after surgery.

If the graft is completely detached, the result is marked corneal oedema (water-logging), causing reduced vision and often painful blisters on the corneal surface. This is seen in up to 20% of cases (1 in 5).

Partial detachment will often resolve spontaneously (rights itself), but major or complete separation requires a return to the operating theatre for an operation known as 'rebubbling'. In this operation, an air bubble is injected into the eye to push the donor graft up against your cornea. The graft may need to be repositioned, and the air bubble kept in place for up to 60 minutes.

In some cases, the donor graft will not adhere (stick), or adheres but does not function. If either of these happens, a replacement graft will be needed. It may be necessary to use an alternative endothelial operation – either a DSEK or a penetrating keratoplasty (PK).

If a 'wait-and-see' approach is adopted for partial dislocation, in most cases the remainder of the graft will attach in a few weeks. In some cases, this fails and repositioning or replacement of the graft is needed.

What complications can occur during surgery?

- **Damage during donor preparation** – preparation of the donor occasionally results in damage to the graft tissue, meaning that it is not safe to proceed with the surgery. If this happens, you would be brought back on another day when replacement donor material was available.

This is identified before starting the operation and does not lead to harm to the eye.

If the donor material has been perforated (punctured) during preparation but is otherwise intact then the operation may proceed, but with a slightly higher risk of graft dislocation.

- **Damage to the donor graft during surgery** – difficulty unfolding or positioning the graft occasionally damages the tissue, meaning that the graft fails, or only lasts a short time before needing to be replaced.
- **Damage to the patient's iris and/or lens** – it is sometimes necessary to make small holes in the iris to manage the air-bubble introduced into the eye during surgery. Visual effects are uncommon, but double-vision and glare may occur. Lens damage may cause cataracts and require cataract surgery at a later date.
- **Intraocular bleeding** – major bleeds are rare (approximately 1:500), but may result in significant loss of vision.

What complications can occur soon after the operation?

- **High eye pressure** - an air bubble is left inside the eye at the end of the operation to hold the donor tissue in place until it sticks. The air bubble can cause high eye pressure develop, causing pain and possibly damage to the iris or optic nerve. The eye pressure is checked after surgery to avoid this, but if the eye becomes very painful in the first 24 hours after surgery it is important to inform nursing or medical staff so that the pressure can be treated.
- **Excessive inflammation after surgery** – inflammation (swelling) is normal and is usually controlled by the use of steroid drops alone. Severe inflammation is uncommon and unpredictable, but can be

controlled by a course of immunosuppressant medication (tablets). Although this type of treatment commonly has short term side-effects, the treatment is usually only necessary for 3-4 months and usually works well.

- **Infection** – infection is rare following DMEK, and is similar to that after cataract surgery (around 1:1000). Infection within the eye is serious, and may result in significant loss of vision.

What complications can occur any time after surgery?

- **Corneal graft rejection** – occurs less often than with other forms of corneal graft, but may be seen in around 5% (1 in 20 cases). It is important not to stop post-operative steroid eye-drops unless told to do so (and to obtain a prescription from your GP before you run out). Rejection requires prompt therapy and patients need to attend the Eye Casualty at the Royal Berkshire Hospital, the Oxford Eye Hospital or a local eye unit within 24 hours. Most rejection episodes can be treated with steroid drops alone. In a few cases, oral steroids (tablets) may be needed.
- **Glaucoma** – raised eye pressure may result from corneal graft surgery itself, or from the need to use steroid eye drops. In some cases, glaucoma medicines or surgery are required to control the eye pressure and prevent damage to the eye.
- **Donor graft failure** – some grafts may work beautifully for years and then fail, usually gradually. Sometimes, late failure results from further eye surgery, such as cataract surgery. If this occurs then the failed donor graft may be removed and replaced with a fresh donor graft.

What alternative treatments are available?

- **No surgery** – if your vision remains reasonable, it may not be necessary to have any surgery at all. However, there are currently no effective medical (non-surgical) treatments for endothelial failure. This may well change in the future, with experimental eye drop treatment

(such as Rho-kinase inhibitors) looking hopeful, but this is very much a treatment for the future, and is not available at present.

- **Descemet's stripping endothelial keratoplasty (DSEK)** – this operation is similar to DMEK, but uses a slightly thicker piece of donor tissue. DSEK may be recommended if the recipient cornea has a lot of opacity (cloudiness) or the patient is unable to lie flat for the prolonged period necessary after DMEK.
- **Penetrating keratoplasty (PK)** – full-thickness corneal transplantation may be a better option for a small proportion of eyes, particularly in complex eyes with multiple previous operations. PK is also sometimes necessary in the case of repeated failure of DMEK or DSEK, for example due to non-adhesion of a DMEK or DSEK graft.

DMEK surgery: what preparation is needed and how is it carried out?

Before surgery

Around two weeks before surgery it is necessary to make a tiny hole in the iris (coloured part of the eye, around the pupil) using a laser, to prevent eye-pressure problems during surgery. This procedure is called a 'peripheral iridotomy'. The laser rarely causes problems, but occasionally, there is post-laser inflammation of elevated eye pressure that requires treatment. Bleeding from the laser site is uncommon, and usually minor/self-limiting. Larger bleeds and damage to the eye or vision are very rare.

Cataract surgery

If you also need cataract surgery this is usually carried out at the same time as DMEK.

Anaesthesia for DMEK surgery

DMEK surgery is best performed under local anaesthetic (you are awake, but the eye is numbed to prevent pain and reduce vision during the operation) and requires one night's stay on the day of surgery. It is

also possible to carry out the operation with the patient asleep under general anaesthesia.

The operation

The donor graft will be prepared first. If graft preparation fails, then the operation cannot go ahead, and will need to be postponed.

Placing the donor graft into the eye, unrolling and positioning takes around 60 minutes.

For the next 24-hours, it is important to remain face up for 55 minutes out of each hour, with 5 minutes out of each hour to sit up or stand e.g. for toilet and meal breaks.

You will be examined on the ward on the day of surgery, and then at one week post-op in the Outpatient Clinic. You will be prescribed eye drops to prevent infection and inflammation. Further eye drop treatment will be explained in clinic, but it is most important not to stop the steroid drops until advised that it is safe to do so, as otherwise corneal graft rejection may occur.

Contacting us

If you have a minor eye problem, please seek advice from your GP, optician or pharmacist. If urgent, please attend Eye Casualty or call 111.

Eye Casualty (Reading):	Mon-Fri 9am to 5pm; Sat & Sun & bank holidays 9am-12.30pm; Closed Christmas Day and New Year's Day.
Eye Casualty: Prince Charles Eye Unit (Windsor):	Mon-Fri 9am to 5pm; Sat 9am-12.30pm; Closed Sun & bank holidays.
Dorrell Ward (Reading):	0118 322 7172 (24 hours a day)
Eye Day Unit (Reading):	0118 322 7123 (Mon-Fri 7am to 6pm)

Outside of Eye Casualty hours, you should telephone your GP's out of hours' service, ring NHS 111 or if you have serious concerns, visit your nearest Emergency Department (A&E).

Further information

- NHS Website www.nhs.uk

To find out more about our Trust visit www.royalberkshire.nhs.uk

Please ask if you need this information in another language or format.

M Leyland, RBFT Ophthalmology, February 2023.
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