
Ophthalmology Department

Corneal transplantation

Introduction

A cornea transplant is an operation used to remove all or part of a damaged cornea and replace it with healthy cornea tissue from the eye of a suitable donor. A cornea transplant can improve sight and relieve pain in a damaged or diseased eye.

A cornea transplant is often referred to as a keratoplasty.

What is the cornea and what does it do?

The cornea is the clear outer layer at the front of the eyeball and acts as a window to the eye. The coloured iris and the pupil (the black dot in the centre of the iris) can be seen through the cornea. It is made up of three delicate layers:

- the outer layer (the epithelium)
- the thick middle layer (the stroma)
- the inner lining which removes fluid from the cornea to keep vision clear (the endothelium)

The cornea lets light in at an angle that helps it focus on the retina at the back of the eye. This 'picture' is in turn transmitted to the brain.

When the cornea is damaged it can become less transparent or its shape can change. This can prevent light from reaching the retina and causes the picture transmitted to the brain to be distorted or cloudy. A corneal transplant may be recommended when you start to lose your sight.

Why would you need a corneal transplant?

The most common reason for needing a cornea transplant is to improve your vision, but a transplant may sometimes be used to relieve pain or in an emergency if your cornea is damaged.

There are a number of health conditions that can lead to a cornea transplant, such as keratoconus, a rare condition that causes the cornea to change shape, or Fuchs dystrophy that leads to a cloudy cornea.

How is a transplant done?

Due to advances in technology, a full cornea transplant is not always needed and there are several options available depending on which part of the cornea is damaged, or how much of the cornea needs replacing: These include:

- a full transplant of the cornea (penetrating keratoplasty (PK))
- replacing or reshaping the outer cornea (anterior procedures)
- replacing inner parts of the cornea (stromal procedures)
- replacing deeper parts of the cornea (posterior procedures)

A cornea transplant can be carried out under general anaesthetic (where you are unconscious) or local anaesthetic (where the area is numbed) and is normally performed as day surgery.

Either the full cornea or part of the cornea is removed and replaced with the donated cornea. The new cornea is then held in place with stitches.

You should not feel any pain or be able to see through the eye during the operation as the anaesthetic temporarily stops the eye from working.

There are risks associated with a cornea transplant, such as the new cornea being rejected by the body, failure of transplant, infection and glaucoma. Very rarely, a significant bleed during surgery could result in loss of vision.

Recovery

The recovery time for cornea transplant depends on the type of transplant you have. A full cornea transplant can take up to two years to return to full vision whereas transplants of only part of the cornea may only take between four to eight weeks before you're able to see well.

Why it is done

The main reason for having a corneal transplant is to improve your eyesight, alleviate any pain, or repair any damage to the cornea. There are also a number of medical conditions that can lead to the need for corneal transplantation.

Cone shaped cornea

Keratoconus is a condition that causes the cornea to weaken, get thinner and change shape; it affects about 1 in 500 of the population. The exact cause is unknown, possibly passed down through the family, or as a result of an allergy. It's one of the most common reasons for corneal transplantation in younger patients and doesn't usually appear until the early teens, but can occur earlier in a few patients.

Many cases of keratoconus are mild and can be managed by using contact lenses or glasses, but in some patients it can progress to the point where corneal transplant is necessary.

Degenerative conditions

Certain conditions may affect the eyes and cause them to slowly develop problems over time. One example of this is Salzmann's nodular degeneration, which has been known to develop in the corneas of patients who have had measles, scarlet fever and other viral diseases. This causes small nodules to appear on the surface of the cornea which need to be removed. These types of conditions are different to age-related macular degeneration.

Dystrophies

Dystrophy conditions that affect the eyes are a common reason for older patients needing a corneal transplant. One example is Fuch's endothelial dystrophy which reduces the amount of cells in the cornea at an earlier age than normal. As cells decrease, they do not get replaced and instead of clearing excess fluid, it allows it to build up, causing cloudy vision.

Other reasons

Corneal perforation

Perforation is when a small hole is created on a thin surface. If the surface of the cornea is damaged or pierced, it may be necessary to have a cornea transplant to repair the damage and prevent infection.

Changes in the shape of the cornea may also lead to a transplant to stop the cornea weakening, which increases the risk of perforation.

Infection

In rare cases a cornea transplant might be needed if there is an infection in the cornea which doesn't respond to antibiotics and keeps returning.

How it works:

Until recently, nearly all cornea transplant operations involved transplanting the full thickness of the cornea. New advances in technology mean that although full transplant it is still commonly used, there are often alternative options.

Penetrating keratoplasty (PK)

This is a 'full thickness' transplant, performed under local or general anaesthetic.

A central, circular piece of the damaged cornea is surgically removed and replaced with clear, healthy donor tissue. In selected cases, femtosecond lasers are used to prepare the incisions prior to removal of cornea. In a laser assisted corneal transplant procedure, patients will be treated in the laser room firstly and then taken to the operating room for completion of the surgical procedure.

The new cornea is held in place by tiny stitches which form a star-like pattern around the edges. You may be able to see them faintly after the operation. The stitches are gradually removed, which usually takes about a year, but can sometimes take longer.

The operation can take between one to two hours. On average, penetrating keratoplasty gives the new cornea a survival rate of 10-15 years depending on the original diagnosis.

Inner layer (stromal procedures)

Deep anterior lamellar keratoplasty (DALK)

This is used in cases where the lining (endothelium) of the cornea is healthy but the thick middle section (stroma) is abnormal. The most common condition causing this is keratoconus. Some infections and inherited diseases of the cornea may also cause the cornea to become cloudy while the lining remains healthy. Deep anterior lamellar keratoplasty allows the diseased stroma to be removed and for the patient to keep the healthy lining of their cornea. During surgery, the front part of the diseased cornea is removed and replaced with the new donor cornea, which is fixed with fine stitches. The donor cornea sits on top of the patient's own corneal lining.

Patients having a DALK corneal transplant take longer to recover but recent surgical advances have shown results that match those of a full thickness transplant (penetrating keratoplasty (PK)). The advantage is that because the inner layer of the cornea is still in place, the risk of rejection is lower and the long-term survival of the transplant may be better.

Deepest layer (posterior procedures)

Endothelial keratoplasty (EK)

This is a newer procedure available in the UK. It is commonly used for patients whose corneas have become waterlogged because the cells in the deeper layer of the cornea have failed (endothelial failure).

EK removes and replaces the inner cell layer of the cornea. The majority of the patient's cornea is left intact and cornea tissue from a donor is inserted into place. Instead of stitches, a temporary air bubble holds the donor tissue in place until it bonds to the patient's own cornea. It is usually performed under general anaesthetic, local anaesthetic is sometimes used with suitable patients.

Because EK only exchanges the inner cell layers of the cornea, it has little or no effect on its external shape which means that sight is returned faster and better than with a conventional corneal transplant.

The exact way the procedure is performed varies depending on which the surgeon feels is appropriate. The specific techniques are listed below:

- Descemet's stripping endothelial keratoplasty (DSEK) – prepares the donor's cornea to decrease the chance of rejection
- Descemet's membrane endothelial keratoplasty (DMEK) – A thin layer termed Descemet's membrane is prepared from the donor cornea by manual dissection by the surgeon.

Risks

There are several risks and complications involved with having a cornea transplant. Some symptoms will show up early and need emergency treatment while others may be spotted during follow up appointments.

Rejection

Rejection happens when the patient's own immune system recognizes the donor cornea as a foreign body and attacks it. Rejection is quite common, occurring in one in five corneal transplant patients.

Most cases of rejection can be treated effectively so that the transplant survives and continues to function. The key is to start treatment as soon as you notice symptoms. You should seek specialist advice as an emergency case.

Early symptoms of rejection can start within 24 hours of surgery. The main symptom is a cloudy cornea (when the surface of the eye looks clouded instead of see-through) within an eye that is not red or painful. This may also cause blurred vision in the affected eye. This can be a result of damage during the surgery or a problem with the donor tissue.

Rejection can happen any time up to a year after the transplant. Late symptoms can include:

- red eye (when the whites of the eyes become red)
- a cloudy cornea

Treatment is usually with steroid eye drops and sometimes steroid tablets or injections.

Other complications

Early complications (within first two weeks) to watch out for include:

- corneal abrasion (caused by a foreign body in the cornea)
- photophobia (sensitivity to bright lights)
- irritation or pain
- red eye and infection
- decreased or blurred vision

Late complications, which would usually be spotted during follow up appointments at an eye clinic, may include:

- astigmatism (causes blurred vision)
- glaucoma (pressure in the eyes caused by trapped fluid)
- macular oedema (swelling in the eye)
- retinal detachment – occurs in about 1% of penetrating keratoplasty patients and is treatable with further surgery
- wounds from surgery reopening
- original eye disease (eg keratitis) returning
- internal infection due to surgery wounds

After surgery

The care needed after surgery will vary depending on which kind of transplant you have had. A cornea transplant is normally carried out as day surgery, although sometimes an overnight stay is required.

After penetrating keratoplasty (PK)

You may have to stay in hospital for one to two days after a full cornea transplant.

The eye will be covered with an eye pad, which stays in place until the morning after surgery. When the pad is taken away you may find that your sight is blurred, although this is normal.

You have to use steroids or antibiotics daily – normally for around six to nine months, but some patients may need to use them for longer. The drops reduce swelling and inflammation and help prevent infection and rejection. It's important not to rub your eye and you will be given a patch to wear at night for the first few weeks after surgery.

The stitches holding the transplant are left in place to allow the cornea to heal. They are gradually removed, which usually takes about a year, but can sometimes take longer.

The shape of full thickness transplants is often quite irregular. This can cause astigmatism (where the transplanted cornea is rugby-ball shaped rather than football shaped). This limits the quality of vision and so you may need further surgery to improve the shape of the transplant and improve your vision. Most patients still need to wear glasses and many wear contact lenses to see well after a full-thickness corneal transplant.

After deep anterior lamellar keratoplasty (DALK)

After surgery care is very similar to that of a full-thickness transplant (above). The difference with DALK is that there are often fewer complications during recovery than with PK so there should be less risk of further follow up treatment being needed.

After endothelial keratoplasty (EK)

In the first day or two after surgery you may be asked to lie on your back as much as possible to help the air bubble remaining in the eye to push the transplant into position. The air is absorbed after a day or two.

It's important not to rub your eye. It will probably be red and sore for a week or two after surgery. At first, your vision will be hazy, but should begin to clear within two weeks.

You will be given steroid drops to alleviate any inflammation and reduce the risk of rejection.

Recovery

Recovery times depend on which treatment you have had, and although there should not be serious pain, care must be taken to avoid certain activities until fully healed.

Penetrating keratoplasty (PK)

Recovery can be slow and it can sometimes take up to two years for your eye to settle down and return to normal vision.

There should not be serious pain after the operation but there might be some swelling and discomfort. In the first few months, your vision may change between being better and worse than before as the eye heals and returns to normal.

You will need regular follow up appointments at first but these should gradually become less frequent until they are only needed every two to three months. In some cases further surgery (such as laser treatment) may be needed to improve your vision, and you may need to continue wearing glasses or contact lenses.

Sports and activity

There is a lifelong risk of wound rupture after a full cornea transplant. It is important that you do not rub your eye.

You should not take part in any contact sports until the doctor in charge of your care says that it is safe. Protective goggles will also need to be worn when resuming contact sports.

Swimming should be avoided for a minimum of a month. It is possible to have a bath or shower but you should also be careful not to get water in the eye for at least a month.

Deep anterior lamellar keratoplasty (DALK)

Recovery times are similar to a full cornea transplant and can take up to two years. Even after full recovery, contact lenses or glasses may be necessary. Further treatment of the cornea with laser surgery may also be required if vision needs adjusting. The advantage of DALK is that there are often fewer complications during recovery than with a full cornea transplant.

Endothelial keratoplasty (EK)

Your vision should return much faster after EK than with a full cornea transplant. Without complications, your vision should return within 6-12 weeks. This type of transplant is particularly suitable for elderly patients.

Post-operative steroids eye drops

All corneal transplant patients are required to take steroid eye drops following surgery for up to one year and in many cases for lifetime. Please do not discontinue steroid eye drops without clear instructions from the doctors in the corneal team.



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Document history

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Contact number	01223 216500
Publish/Review date	November 2018/ November 2021
File name	Corneal transplantation version4 November 2018.doc
Version number/Ref	4/ Document ID 34363