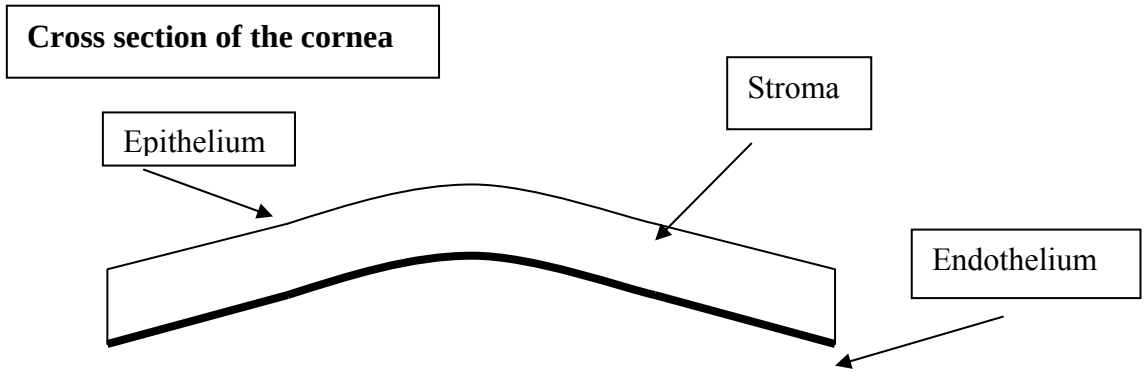
PATIENT INFORMATION ON CORNEAL GRAFT (TRANSPLANT) SURGERY **M ANANDAN**

What is the cornea?

The clear "window" of the eye approximately 0.5mm thick and 12mm across. It lies in front of the fluid filled anterior chamber of the eye and the coloured iris. It is like the lens of a camera - any opacity or distortion results in a poorly focused image. It has **3 layers**:

1. The thin surface "skin" (or **epithelium**)
2. The thick central layer (or **stroma**) and
3. The single layer of cells on the back surface (or **endothelium**) – this last layer is made of cells that are not replaced through life (when damaged the place of the dead cells is taken by enlargement and movement of their healthier neighbours.



All of these layers must be clear and smooth for the cornea to work as a window. The cells of the back surface layer (**endothelium**) pump fluid out of the cornea to maintain its thickness at about 0.5mm – if this layer stops functioning normally the corneal thickness increases and when it reaches about 0.6mm it starts to become opaque (**corneal failure or decompensation**), at about 0.8mm the cornea becomes water-logged resulting in blistering of the "skin" (**bullous keratopathy**) leading to pain in addition to blindness.

What can go wrong with the cornea?

All the layers can be affected individually or in combinations.

More commonly:

- The central layer (**stroma**) may become scarred (as a result of **injury or infection**) or irregular in shape as a result of conditions that are probably genetically determined such as **keratoconus** and **keratoglobus** or due to dystrophies such as **lattice**, **granular** and **macular**.
- The back surface layer (**endothelium**) may become inadequate to maintain its pumping action (**corneal failure or decompensation**) as a result of genetically determined conditions such as **Fuch's dystrophy** or **injury** from trauma or surgery.

Less commonly:

- It may develop a hole (perforation) in the central layer (**stroma**) as a result of inflammation or infection; if this is not treated quickly the eye usually becomes blind.
- It may become opaque due to damage to the "skin" (**epithelium**) making tissue around the edge of the cornea (limbus) usually as a result of severe inflammation or a chemical injury.

Why have a corneal graft (transplant)?

To replace a damaged cornea (see the commoner causes of this above) with a donated cornea. It is the only available treatment for severely damaged corneas (apart from artificial corneal transplants (keratoprosthesis) which are only for very badly damaged eyes when conventional graft surgery is known to fail or to have already failed)

This is only worth doing when the inside of the eye (retina and optic nerve) are still functioning adequately (the camera analogy is that there is no purpose in replacing the lens in the camera if the film is not working). Conditions that may have damaged the inside of the eye are **glaucoma**, **optic nerve disease**, **retinal detachment**, **severe inflammation or infection inside the eye**.

An eye with **potential vision** can always detect light well even when the cornea is completely opaque.

What type of corneal graft (transplant) should I have?

There are two principal types: **partial thickness** (**or lamellar**) or **full thickness** (**or penetrating**). Penetrating grafts are the most widely used but lamellar grafts are increasingly used as an alternative to penetrating grafts in many, but not all, situations.

Penetrating (full thickness) corneal grafts have been the most widely carried out for all types of corneal disease for 40 years. However this type of graft is only mandatory if there is deep corneal scarring OR when the corneal disease involves both the **endothelium** and the **stroma** . For epithelial and stromal diseases it is carried out because it is easier to replace the whole cornea rather than a layer and because the vision is possibly better after a full graft; **The down side** of the penetrating graft for stromal and epithelial disease is that it is the transplanted **graft endothelium** that is the principal stimulus for rejection, which is the commonest complication of this type of graft, and leads to graft failure in some. Also the donor endothelium has a limited lifespan.

For endothelial disease penetrating grafts have been the only procedure available until this millennium. However for patients with a healthy stroma and endothelium the deep endothelial lamellar keratoplasty (DLEK, DSEK and DSAEK – see below) have been developed as alternatives.

Lamellar (partial thickness) corneal grafts have been very infrequently used in recent decades but are again increasing in popularity for reasons outlined below. They may be **anterior** OR **posterior**.

> **Anterior lamellar grafts** have become more widely used because of the **benefits** of a **greatly reduced risk of rejection and late graft failure**. They are only suitable for use in conditions affecting the front layer (epithelium) and central layer (stroma) of the cornea. A lamellar graft will not become "clear" if the posterior layer of the cornea (endothelium) is diseased or damaged. **The down side** is that the technique of deep lamellar keratoplasty is technically difficult and if the endothelium is perforated during the surgery the vision may not recover without a penetrating graft – the surgeon can convert to a full (or penetrating) graft at the time if this happens. Also the vision is not as good following a successful lamellar graft as after a successful penetrating graft although the difference is small and patients can expect to meet the driving standard after both types.

Posterior lamellar grafts are a recent innovation. This type of graft has been called the Deep lamellar endothelial keratoplasty (DLEK). Descemet's stripping endothelial keratoplasty (DSEK) and Descemet's stripping automated endothelial keratoplasty (DSAEK) are both variations of DLEK. I am currently carrying out DSEK. The **benefits** are a smaller operation for the eye (but technically more demanding) which is carried out through a 5 mm incision and requires only one or two stitches to close the wound. This leaves the eye much stronger than after a penetrating graft and also eliminates the problems of regular and irregular astigmatism that accompanies all penetrating grafts. This speeds up the recovery period. The **down side** is that the vision is not as good as after a penetrating graft and is only good enough for driving in a limited number of cases. Also the techniques for attaching the transplant to the back of the patients cornea have not been perfected and transplants may dislocate in the first 24 hours in up to 50% of cases. It is an unsuitable technique for a patient with corneal scarring for whom the **penetrating graft** will treat both the scarring and the endothelial failure.

Generally I will recommend a **deep anterior lamellar graft (DALK)** if your cornea has a normal posterior layer (endothelium) and scarring or thinning that is limited to the anterior half of the stroma. I recommend a **deep endothelial lamellar keratoplasty (DLEK)** for patients with endothelial disease only (Fuch's dystrophy or pseudophakic bullous keratopathy) for whom driving a car is no longer important. I do **penetrating grafts (PK)** if the cornea is very thin and/or scarred or if posterior layer is diseased in the presence of diseased anterior layers.

Other types of corneal transplant: include epikeratophakia, peripheral lamellar or penetrating therapeutic transplants and stem cell transplants. These are less widely used and if you require one of these I will give you additional information.

Why not to have a corneal graft (transplant)?

- **If you are not prepared for a long recovery period and numerous follow up visits**: a corneal graft operation is a major procedure for the eye (although not for you – it can be done under local anaethesia) and the recovery period for good vision is very prolonged (18-24 months) for PK and DALK although most patients will notice an improvement within a few days of surgery. A minimum of 10 visits is needed after surgery and the average is higher.
    - 15% of patients need contact lenses for best vision and
    - 10% require astigmatism correction with surgery

- Patients having **DLEK** can expect stable vision within 2-4 months after surgery but will still require eye drops for 6 – 24 months or more.

- **If your other eye is healthy** you should think very carefully about having a corneal graft as the quality of vision will seldom be as good in the grafted eye.

- **If you are forgetful about your treatment**: you must be able to take eye drops for a minimum of 4-6 months (depending on the type of graft); forgetting to take medication is a frequent cause of graft failure.

Where does the corneal transplant come from and how safe is it?

- The cornea is human tissue and comes from a donor.
- Unlike other whole organ transplants the cornea can be removed several hours after death – only a small proportion are taken from "brain dead" donors.
- Donor corneas are provided by eye banks who are members of Eye Bank Associations with agreed national and international standards.
- Donor transplants are not released for use until the donors have been shown to have:
    - no antibodies for hepatitis or AIDS (there is a very small risk of donors having these disease but having no antibodies but NO donor has ever transmitted AIDS via a corneal graft)
    - no medical record of an undiagnosed neurological disease or degenerative neurological disorder such as Parkinson's disease or Creutzfeld-Jacob disease (there have been only 3

reports in which recipients of corneal donor material MAY have developed CJD from corneal donors despite the 30,000 grafts a year carried out in the UK and USA alone. There is a very small risk however

- The donor material is assessed for quality including clarity, and the health of the posterior layer (**endothelium**). Providing the endothelium is in good condition the age of the donor has been shown to be irrelevant ie an 80 year old donor can provide tissue that is expected to last as well as that from a 30 year old donor.

- The donor transplant can be stored for 7-10 days in the refrigerator in purpose designed medium or for up to 4 weeks when cultured in an incubator; both methods are used in the UK and there is no difference in the results using different storage methods.
- Tissue matching – the value of this has been the subject of several studies but the best designed have shown no effect (unlike the situation for most solid organ transplants). However for high risk cases there may be a little benefit from waiting for a tissue matched transplant.

References

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