

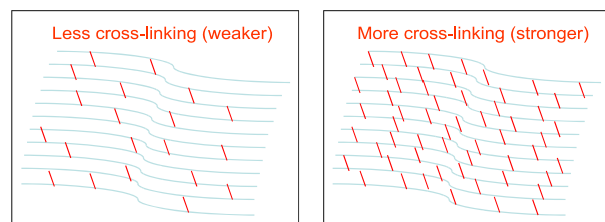
Corneal Collagen Cross-Linking with Riboflavin and UV light.

Ectasia

Corneal ectasia is a condition where the shape of the cornea becomes unusually steep and irregular. This is most commonly seen in keratoconus, but may also occur after laser refractive surgery (LASIK), when the cornea has been thinned to an extent where it is structurally unstable.

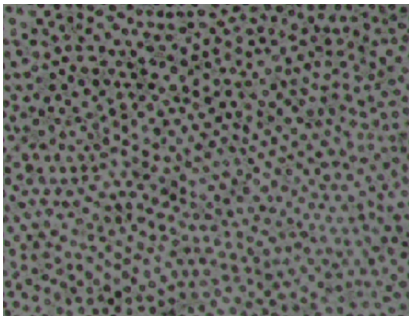
Cross-Linking

Corneal collagen cross-linking with riboflavin is a new treatment that increases the stiffness and rigidity of the cornea and stabilizes ectasia. Patients who previously had progressive ectasia have now been treated and followed for up to five years without evidence of any further



change in their condition. At present it is not known whether the stabilizing effect of cross-linking is permanent, but the treatment could potentially be repeated if it was necessary.

How does cross-linking work?



Cross-linking treatment has been shown to increase the apparent diameter of the collagen fibres when examined under the electron microscope. The effect is most pronounced nearer the corneal surface.

The bulk of the cornea is made from collagen fibres which are arranged in bundles. The strength and rigidity of the cornea is partly determined by how strongly the fibres are linked together. Over the course of a lifetime one's cornea becomes progressively stiffer due to natural cross-linking between the fibres.

Riboflavin (vitamin B₂) is a naturally occurring compound which strongly absorbs UV light. By applying riboflavin to the cornea at the same time as exposing it to a UV light source, the riboflavin not only enhances the cross-linking effect of the UV light, but also absorbs the light to an extent that the inner layers of the cornea and intra-ocular structures are protected from the potentially damaging effects of the light rays.

Benefits of Cross-Linking

Cross-linking seems effective in stabilizing progressive ectasia, and in some patients the treatment gives an additional small measure of benefit in reduction of corneal steepness and irregularity. This in turn means some reduction in the myopia and astigmatism associated with the ectasia.

In the past it was always considered that excimer laser correction of myopia or astigmatism was not possible when ectasia was present, since by removing corneal tissue with the laser the cornea would become even less stable and the ectasia would be made worse. However, once the corneal condition is stabilized by cross-linking it may be possible to perform limited amounts of laser ablation whilst still maintaining structural stability of the cornea. Such treatment would usually be aimed at restoring a more spherical shape to the cornea (custom ablation). Any remaining optical defect could then potentially be corrected by spectacles, or alternatively with soft contact lenses, or by phakic intra-ocular lens implants.

Risks of Cross-Linking

UV light is known to be damaging to cells, and the treatment causes the stromal cells (keratocytes) in the outer layers of the treated part of the cornea to die. However, these cells are replaced by new keratocytes which migrate from untreated parts of the cornea into the central area over a period of some months after the treatment. In theory the UV light could be damaging to the inner endothelial cell layer of the cornea, and this is why the corneal thickness needs to be at least 350 microns if a standard cross-linking treatment is to be undertaken. In clinical studies carried out so far, no evidence of damage to the endothelial cell layer has been documented. Although UV is potentially damaging to the lens and retina, it is believed that the riboflavin blocks the UV transmission to an extent that no measurable damage will occur. At present the long term effects of the treatment are unknown.

How is Cross-Linking treatment given?

The cross-linking treatment is carried out with topical anaesthesia (eye drops). The surface epithelial cell layer is removed from the central part of the cornea, and the riboflavin drops applied. Once the riboflavin has penetrated well into the eye, the UV light is focussed onto the central area of the cornea for 30 minutes.



Finally a bandage soft contact lens is applied. The contact lens is worn for three or four days until the surface epithelial cell layer has re-grown. During the first few days the eye will be sore and watery. Sometimes there is slight haziness under the epithelial layer for the first few months after treatment, but the vision stabilizes within a month or so of the treatment.