



Corneal cross-linking

Corneal cross-linking (CXL) is a treatment which prevents keratoconus getting worse. Keratoconus is a non-inflammatory eye condition in which the normally round dome-shaped clear window of the eye (cornea) progressively thins, causing a cone-like bulge to develop. CXL treatment is successful in more than 90% of cases. After treatment, you will still need to wear spectacles or contact lenses. Your eye will be sore for a few days after the procedure. Although vision is often hazy at first, most patients can return to work after one week. As with all operations, there are risks: CXL is safe, but there is a small chance (less than 3%) of a reduction in vision afterwards.

What is CXL?

Keratoconus gets worse because the cornea weakens. CXL, also known as C3R, uses ultraviolet light and vitamin B2 (riboflavin) drops to stiffen the cornea. Used together, they cause fibers within the cornea to cross-link – or bond more tightly. This treatment mimics the normal age-related stiffening of the cornea, which is known as natural cross-linking.

Which patients benefit from CXL?

The treatment is usually recommended only for patients whose corneal shape scans show that their keratoconus is getting worse. In order to obtain the most accurate scans, we ask that you remove your contact lenses prior to your scan (two weeks for hard contact lenses, one week for soft contact lenses).

If, however, you are unable to manage without your lenses, cross-linking treatment may still be available to you. In this situation, so long as the cornea is not too thin, treatment may be offered based on an evaluation of your risk of disease progression. Age is the most important factor in determining this risk: because of natural cross-linking as you get older, keratoconus usually stops getting worse by the mid-30s, so CXL is not normally required for older patients.

What evidence is there that it works?

Collagen cross-linking is the only treatment currently available that appears to stop keratoconus from getting worse.

Evidence from three randomised clinical trials one year after CXL showed success in halting keratoconus progression in more than 90% of



treated eyes. Longer term results (up to 10 years) from different studies suggest a similarly high success rate in preventing keratoconus progression. Moorfields' own results since 2013 when we began treating patients with CXL show a success rate of approximately 94%, with less than 1% requiring a repeat CXL treatment. Up to date results can be found on the hospital website:

www.moorfields.nhs.uk/condition/keratoconus

Which type of CXL is Moorfields performing?

We perform an accelerated version of 'epithelium-off' CXL known as 'epithelium-off' or 'rapid' CXL, which is an up-to-date and potentially safer variation of standard CXL. Standard CXL involves 30 minutes of ultraviolet (UV) light treatment. Rapid CXL speeds this process up by delivering the same total amount of UV light energy in eight minutes.

Rapid CXL is widely used, but as with any recent variation in treatment, long-term results are not yet available. You will be monitored for up to five years to confirm that your corneal shape has stabilised. CXL can be repeated if the shape does not stabilise after your first treatment.

Moorfields does not currently offer transepithelial ('epi-on') CXL, where the front surface of the cornea - the epithelium is not removed. To date, the only randomised controlled trial comparing this with standard 'epi-off' CXL concluded that it does not work.

Will I have both eyes treated at the same time?

If you need CXL for both eyes, we can offer you treatment for both eyes at the same time. If you would prefer to delay the second eye treatment, please request this at the clinic appointment prior to your treatment.

What happens during CXL?

CXL is performed as a day-case procedure by a senior ophthalmic nurse. Although the procedure takes less than 30 minutes, there is usually some waiting time before treatment and you will also need to stay for a short while afterwards so we can check that you have everything you need to go home, such as all your medications. Please be prepared to spend up to half a day in hospital.

During the procedure, you will be asked to lie flat on the treatment table.

Anaesthetic drops are used to numb the surface of your eye before a small clip is placed to keep your eyelids open. The surface skin of your eye (epithelium) is gently brushed clear and riboflavin drops are applied every few minutes for at least ten minutes.

Following this, the ultraviolet light is shone at your eye for eight minutes. A soft 'bandage' contact lens is placed on your eye at the end of the procedure.

What happens after CXL?

You will be given eye drops to use after the procedure. The soft 'bandage' contact lens will remain in your eye until the surface has healed (about seven



days). If the bandage lens falls out during this time, please throw it away – do not attempt to reinsert it. There is no need to have the lens replaced before your first follow up appointment at one week.

The anaesthetic drops will wear off later on the day of your procedure, and your eye will be gritty, red and sensitive to light for several days. Everyone's experience of pain is different, with some patients reporting very little discomfort and others describing the first few days as very painful. Your eyes could be light sensitive and many patients find wearing sunglasses helpful.

Your vision will be quite blurred at first, but will clear gradually over the first few weeks.

It is normal to experience fluctuating pain within the first two days after surgery. However, if you experience increasing pain three or four days after the procedure this could be signs of infection and you should visit A&E. Please note that infection is rare, affecting less than 1% of patients.

Do I need to take time off work or studies?

Yes. You should allow at least one week off while most of the surface healing occurs, or two weeks if your job involves a lot of computer work and the treatment is being done on your better eye. You will be putting eye drops in every hour for the first day, and then every four hours for the following days.

If you have exams or other important timelines over the coming months please let us know, as it may be more appropriate to postpone your treatment until afterwards.

Day to day activities such as watching TV or using a computer will not do any damage to your eye, but you might find it more comfortable to rest with your eyes closed early on.

You will be given an appointment the following week to check your eye is healing properly.

What should I do, or not do, after CXL?

It is important to put the eye drops in regularly as prescribed. You may wash and shower, but avoid getting any water in your eyes. You may exercise, but should not swim before the surface of your eye has healed.

We will check your vision in the clinic the week after your procedure to confirm if your vision is good enough to drive. It is normally safe to resume contact lens wear once the eye surface skin layer has healed. This typically happens around the end of the second week after your procedure. If you use spectacles, you are advised to see your local optician no earlier than one month after the treatment if you feel your prescription needs updating. Remember that spectacle prescriptions can take up to a full year to stabilize following cross-linking, although in most cases stability is achieved after around six months.



Vision and spectacle tests, along with corneal shape scans will be repeated in the clinic six months after CXL. We expect most patients' vision to recover to the same level as before treatment. In some cases, vision improves in the longer term. It is important to remember that the main aim of CXL is to stabilise, and not to improve vision.

What are the risks of CXL?

In general, CXL is very safe, but like all operations your eye needs time to heal and problems may rarely occur. Less than 3% of patients may lose some vision in the treated eye. This may improve spontaneously; in rarer cases where there is infection or scarring, this visual loss is potentially reversible with a corneal transplant. Remember that without CXL treatment; at least 20% of all patients with keratoconus will eventually require a corneal transplant. The risk of transplantation for patients whose keratoconus is progressing is probably higher.

Moorfields' CXL information video

A video on corneal cross-linking can be found on our YouTube channel. Please visit:

<http://www.youtube.com/moorfieldseye/videos>

For further information, please visit:
www.keratoconus-group.org.uk

Author: Daniel Gore, Marcello Leucci, Melanie Mason
Revision number: 3
Approval date: March 2018
Review date: March 2020

**Moorfields Eye Hospital NHS
Foundation Trust**
City Road, London EC1V 2PD
Phone: 020 7253 3411
www.moorfields.nhs.uk

Moorfields Direct telephone helpline

Phone: 020 7566 2345
Monday-Friday, 8.30am-9pm
Saturday, 9am-5pm
Information and advice on eye conditions and treatments from experienced ophthalmic-trained nurses.

Patient advice and liaison service (PALS)

Phone: 020 7566 2324/ 020 7566 2325
Email: moorfields.pals@nhs.net
Moorfields' PALS team provides confidential advice and support to help you with any concerns you may have about the care we provide, guiding you through the different services available at Moorfields. The PALS team can also advise you on how to make a complaint.

Your right to treatment within 18 weeks

Under the NHS constitution, all patients have the right to begin consultant-led treatment within 18 weeks of being referred by their GP. Moorfields is committed to fulfilling this right, but if you feel that we have failed to do so, please contact our patient advice and liaison service (PALS) who will be able to advise you further (see above). For more information about your rights under the NHS constitution, visit www.nhs.uk/choiceinthenhs

