Keratoconus Group

Newsletter Summer 2021

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Next Zoom meeting Saturday 9th October 11am

Results of the Keralink trial - Professor Frank Larkin

Our Autumn Speaker meeting will be held on **Saturday 9th October at 11am** on Zoom. At that meeting **Professor Frank Larkin** will present the results of the Keralink trial into the safety and effectiveness of corneal crosslinking (CXL) in young people aged 10 to 16, which is so important for the future treatment of KC. We have asked Professor Larkin to make this presentation via Zoom, so that members can join the meeting wherever they live in the UK. We will also record the event so it will be available on our website for those who cannot join us on the day. To join the meeting please request a link by email to chair@kcgroup.org.uk. If you have previously attended one of our KC Coffee mornings you will be automatically sent a link so there is no need to send a request.

In addition, Moorfields Biomedical Research Centre is planning a Keratoconus Day in November at which Professor Larkin will present the results to the young people who took part in the trial and to their parents. KC Group members will also be invited to attend the day, which will include further presentations on research into keratoconus. The venue for this event is likely to be a lecture room in University College, London. The date has not yet been fixed and the programme is currently being

planned. So if you're longing to meet up with other people with KC in person again, and interested in what promises to be a fascinating day, do keep an eye on our website, where we'll announce details as soon as they are available.

Keratoconus - its past, present and future

"KC affects all populations though it is more common in certain groups"

This is a summary of the talk given at our AGM in March by **Ms Bita Manzouri**, Consultant Ophthalmologist at Queen's Hospital, Romford. You can see and hear the full talk on our website www.keratoconus-group.org.uk

As cross linking (CXL) was covered recently by **Dan Gore** (see our Winter 2019 newsletter) and contact lenses by **Vijay Anand** (Spring 2020 newsletter), Bita gave a brief overview of KC, finishing with her area of special interest, corneal transplants.

KC affects all populations, though it is more common in certain groups eg those with severe allergies or with Down's Syndrome. It is often detected in late childhood or early adulthood, underlining the importance of eye checks. The first accurate description of KC was in 1854 by John Nottingham. The cause is unknown, but it is thought to be a combination of genetic, environmental and possibly hormonal factors. No one gene is responsible, but several that work in conjunction with one another. KC tends to progress to early 30s when 'natural' crosslinking occurs, with the cornea becoming stiffer so that the bulge doesn't progress further. The responsibility of eye clinics is to monitor progression and decide the best time to intervene with treatment.

Ms Bita Manzouri

For a patient whose vision can be adequately corrected with spectacles, no other treatment is necessary, other than

monitoring to make sure it doesn't get worse. Bita always advises her patients not to rub their eyes, but to use artificial tear drops and reach for those instead of rubbing. It is also important to control allergies - KC is often found in people who have hay fever, rhinitis, asthma, eczema. Irregular astigmatism may mean that glasses will not correct the vision and rigid gas permeable or scleral contact lenses are needed. In advanced stages, if contact lenses fail or cannot be tolerated, surgical options are considered (ring inserts or grafts). At all stages, progression is monitored and treated with CXL where possible, to stabilise the shape of the cornea and prevent the need for a higher tier of treatment.

Other options

1. thermokeratoplasty (using heat to alter the shape of the cornea) had many problems and has been abandoned.
2. intrastromal ring segments
3. refractive laser procedures can be used to improve the shape, and CXL can then be used to stabilise that shape and prevent progression
4. corneal transplantation, either lamellar or penetrating

Intrasomal rings

Intrasomal ring segments are small devices made of plastic implanted in the corneal stroma to induce a change in the shape of the cornea. Essentially they work by flattening the cornea that is too steep. There are several devices on the market *e.g.* Intacs and Ferarings. The thickness of the ring determines how much of a change is induced in the cornea. It is very important to have stability of KC before use of the rings, or to crosslink afterwards in order to stabilise the shape. Even with these inserts people may still need contact lenses but there will be a flatter cornea so in theory the fit should be easier. Advantages are a minimally invasive procedure and the devices are removable and don't prevent future transplant surgery. But there are disadvantages. The technology is still quite new and there are emerging complications. Sometimes patients complain of diurnal

Find the KC group

On the web:
www.kcgroup.org.uk

On YouTube:
Keratoconus GroupUK

On Twitter:
@UK_Keratoconus

On Facebook:
Facebook.com/UK.keratoconus

We also recommend
facebook.com/groups/keratoconusGB
[run by a member independently of the KC Group]

"It is very important to have stability of KC before use of the rings"

fluctuations in their vision; it is quite a difficult operation and does have its own challenges.

Rings cannot be used if the cornea is too steep, if there is central scarring, if there is ocular surface disease (eg dry eye syndrome) or if the cornea is too thin. They are not recommended for anyone who gets good vision with contact lenses. Complications can include problems with wound healing, inflammation on the front of the eye, migration of the rings and infection.

"After a transplant, most patients will need correction with glasses or contact lenses."

Laser refractive procedures

The Athens Protocol involves laser refractive interventions to improve the shape of the eye followed by crosslinking so that you maintain that shape. It is important to say that KC is a contraindication to any form of laser refractive surgery to correct the vision. So if you go to one of the laser refractive centres for myopia, one of the tests they do is mapping the front of the eye and if there is any hint of KC they should not be operating on you at all. However, combining laser surgery with CXL is one way of improving the vision in KC.

The Athens protocol uses a laser to scrape the front layer of cells for the cornea. It then uses a different kind of laser to reshape the surface of the eye. A substance called mitomycin C is then applied to prevent scarring from the laser followed by crosslinking to freeze the shape of the cornea. The procedure is suitable for the patient with no scarring of the cornea and could get good vision with contact lenses but has evidence of progression and is contact lens intolerant.

Transplantation

This should be the last resort for KC, after adequate trial of less invasive therapies.
The first transplant was performed in 1905 and transplantation became widely used in the 1940s. In the modern era there have been improvements in retrieval, storage, testing of corneal tissue, improvements in instrumentation and in suture materials (finer than a human hair). There have also been huge advances in microscope technology and in antibacterial and anti

rejection drugs. Not just the cornea, but layers of the cornea can be transplanted.

Corneas are the least donated part of the body and Bita has appeared in some videos for NHS Blood and Transplant encouraging more people to donate. Donation can be up to 24 hours after death and almost anyone can donate. Poor eyesight or cancer do not stop donation of the corneas. There is an informal arrangement for age matching with no more than 30 years difference between donor and recipient.

The cornea has 5 layers - the epithelium, Bowman's layer, stroma, Descemet's membrane and the endothelium. For a penetrating, full thickness transplant (PK) a button of all 5 layers is used. A partial thickness transplant of the front 3 layers is called Deep Lamellar Keratoplasty (DALK). A PK transplant is technically easier to perform and final visual acuity tends to be better. But the risks of infection and rejection are higher than with a DALK, stitches stay in longer and post op use of drops is also longer. There is also greater long term fragility of the eye. With a DALK, leaving the endothelium (the back layer of the cornea) intact reduces the chances of rejection. There is faster visual rehabilitation. But it is more challenging surgically and the final visual acuity is not quite as good as with a PK. A DALK graft isn't possible if there is any form of corneal scarring. The technical difficulty of a DALK means that in about 1 in 8 of cases conversion to a PK may be needed during the operation.

After a transplant, most patients will need correction with glasses or contact lenses. Surgeons vary as to whether a contact lens can be fitted before the sutures are taken out. There will be routine follow up to check the graft and other problems such as glaucoma or cataract.

The surgeon has a responsibility to make sure the transplant patient understands the pros and cons. It is important to be realistic about visual outcomes and expectations and that having a transplant is the beginning of a long journey which may be complicated (they won't wake up after the operation with excellent vision!) The patient needs to be motivated for long term follow up and long term immuno suppression (may be on one steroid drop a day for life in the grafted eye). Sutures are removed 8 mths to 2 years after the operation and it can

RSVP

If you've had a corneal transplant at any time in the past, remember that there is always a risk of rejection.

Remember the "**RSVP**" danger signs:

- **R**ed Eye
- **S**ensitivity to light
- **V**ision change
- **P**ain

If you experience these symptoms get to A&E as soon as possible.

take up to 20 mths to read properly or drive. There is a lifelong risk of rejection - it can happen after 20 years. The warning signs are RSVP - Red eye, new Sensitivity to light, new haziness of Vision, Pain. The patient must go to A&E promptly for treatment of threatened rejection.

The question and answer session covered a number of topics including -

The link of allergies with KC

It's important to get allergies under control. Allergic eye disease is one of the risk factors for graft failure.

Can pregnancy trigger the effects of KC again even after crosslinking?

Potentially yes, because of the hormonal effects of pregnancy, it can cause progression. But we need big studies to assess this.

Should a specialist surgeon operate on cataract that has developed 30 years after a graft?

Yes, the cataract operation does put the graft at risk of failure, so it needs a specialist who will take extra precautions during surgery to protect the graft.

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West Midlands

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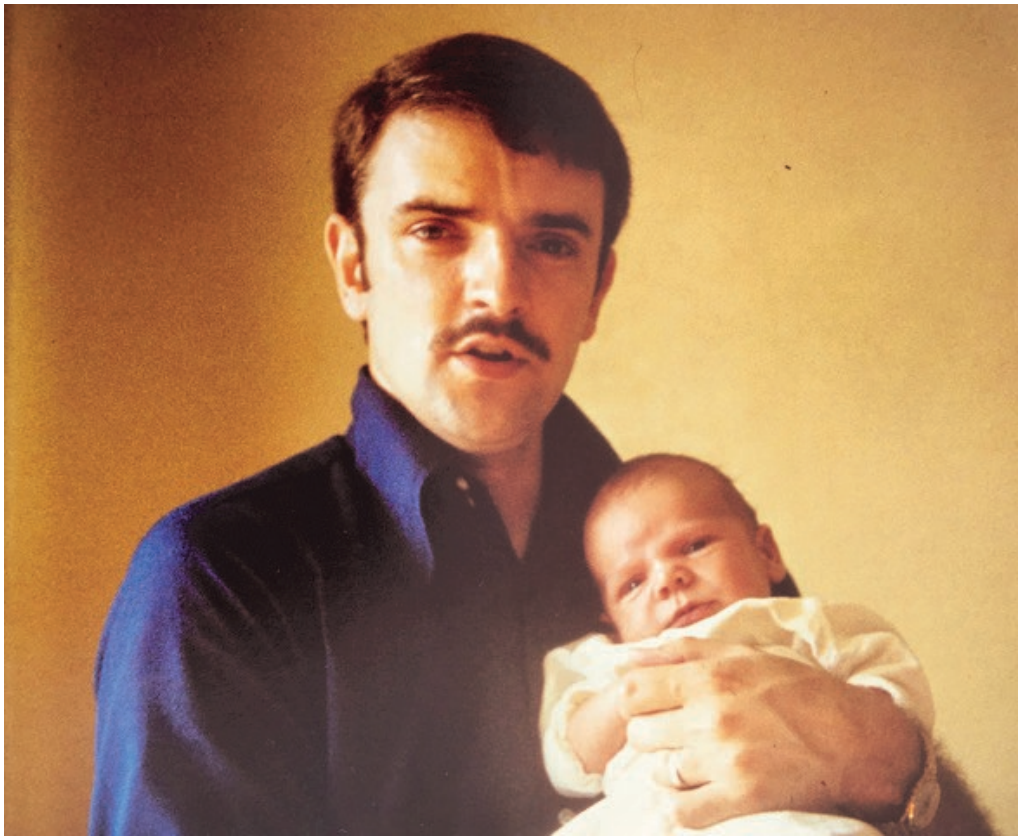
Celebrating the 40th anniversary of his sightsaving surgery

> *The following article, about our West Midlands organiser and committee member,* **John Thatcher**, *appeared recently in the newsletter of the Queen Victoria Hospital, East Grinstead. It is reproduced with kind permission of Queen Victoria Hospital NHS Foundation Trust www.qvh.nhs.uk*

When John was referred from his hometown of Derby to our hospital for surgery to save his sight, little did he think that 40 years later he would be contacting us to say thank you.

John explains: “When I was in my late teens I started having problems reading at school but my optician wasn’t sure what the problem was. I tried glasses but my vision was changing fast and I was fortunate an optician recognised this as Keratoconus. I was fitted with micro RGP contact lenses but as



my condition got worse I was getting regular corneal abrasions and sometimes I'd blink and the lens in the worst eye would just flick out. After being seen by a few different opticians and consultants I was eventually referred to QVH who confirmed I had Keratoconus.

I'd never heard of it before, neither had anyone in the family or friends; there wasn't the same amount of information available as there is now - this was way before the internet!"

Keratoconus is a condition where the normally round dome-shaped clear window of the eye (cornea) progressively thins causing a cone-like bulge to develop. Left untreated, it affects the eye's ability to focus properly and causes poor and blurred vision. It is something that affects more than 1 in every 2,000 people. At QVH John was treated by internationally renowned expert consultant on corneal grafting, the late Tom Casey. In October 1980, he had a corneal transplant to remove the abnormal part of his cornea and replace it with a donated cornea. John continues: "I remember being in hospital for two weeks and when the bandages were removed several days after the operation,

Moorfields Eye-to-Eye walk 2022

The next Eye to Eye walk will be on **20 March 2022.** There will be a hybrid approach, the London walk will be happening but people can also choose to do their walk locally over the weekend of 19-20 March if they can't get to London. There's brand new walking routes in London that explore the East End, starting and ending at Moorfields Eye Hopsital

Every 15 minutes someone starts to lose their sight so participants can walk 15 or 5 miles

There is an Early Bird half-price entry for those signing up between 13th September to 11th October 2021.

www.moorfieldseyecharity.org.uk/eyetoeye2022 will be live from 13th September 2021 for people to register.

realising I had good vision straight away. The registrar had done such neat stitches the nurse said he should do embroidery!"

In February 1982 John went back to QVH to have the stitches removed. Since then John says he has "never looked back". "I'm now in my 70s and have been retired several years, but that graft allowed me to have a very full family life and active career, both of which would otherwise have been greatly diminished. I worked in the space industry on several satellite programmes including a lot of time working with NASA, so good sight has been crucial.

"Over 40 years later it [the graft] is still giving me 6/5 vision [6/6 being classed as perfect vision] with a mini-scleral contact lens over it. I wear lenses all day long and, when I put them in, I have the daily miracle of sight and I can't thank you enough for that."

Samer Hamada, consultant ophthalmic surgeon and clinical lead of our corneoplastic unit said: "QVH continues to be at the forefront of cornea and eye surface diseases, a legacy that started more than 60 years ago. We are referred and treat patients from across the UK and Europe, and thanks to the refinement of corneal surgeries it is now safer and more effective than ever before.

"John's eye condition (Keratoconus) is now treated using cornea cross -linking which is a minimally invasive procedure to stop or slow its progression. If the condition is very advanced then a partial thickness corneal transplantation can be performed. Recovery is much quicker and in most cases the procedure is carried out as a day case. We are also proud to be one of the very few eye units around the country

and the world to perform suture-less corneal transplantation.

“40 years ago, transplanting cornea cells or thin layer of the cornea as thin as 20 microns was a dream! Now it is a reality thanks to the skilled team, advanced technology, and the amazing work at the QVH Eye Bank which was established as the first eye bank in the UK in 1952.”

Keratoconus - Progression and Detection

This is a summary of a Zoom presentation given to the KC Group in July by **Howard Maile** on the subject of his PhD, which he is currently doing at Moorfields BRC. You can watch a recording of the full talk on our website.

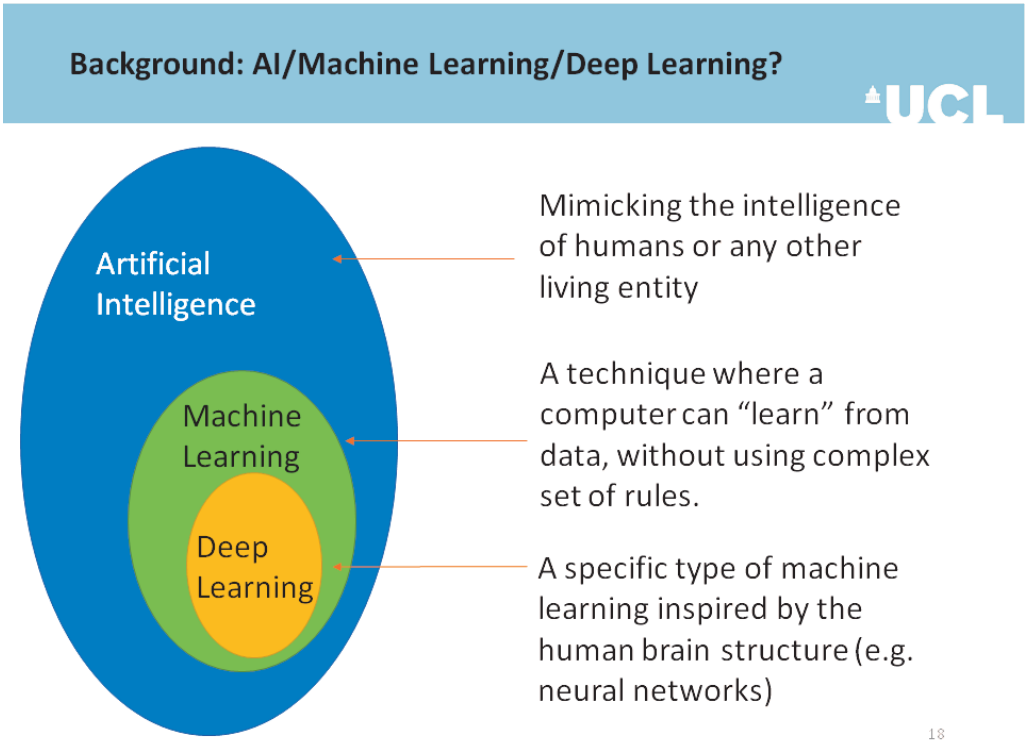
Howard Maile

The aim of the first part of Howard's research was to model KC progression, establishing the trajectory of KC from the patient's first appointment to progression to corneal crosslinking (or not). As well as plotting the time taken for progression, the aim was to examine the effects of clinical data (corneal thickness and steepness), patient data (gender, age, ethnicity, smoking) and genetic data on the likelihood of progression to CXL. Creating a model to predict an individual's risk of progression would enable clinicians to plan CXL appointments and enable patients to understand how their condition was likely to develop.

Howard used a dataset of 8,590 patients seen between 2011 and 2020 at Moorfields early KC clinic. The most important variables proved to be age at first appointment, with each extra year decreasing likely need for CXL by 10%, and corneal steepness, with each extra unit of steepness found at first appointment increasing risk of progression by 8%. The model still needs to be validated using data from another clinic.

In the next part of his talk, Howard described doing a systematic review of the academic literature of the work done on machine learning in the detection of KC. Machine

Remember that you can watch videos of coffee morning and conference talks on our website or YouTube channel.



learning is where a computer is given a dataset and uses it to learn to make decisions itself without needing to be given a complex set of rules. Deep learning is a specific type of machine learning inspired by the structure of the human brain and neural networks. Machine learning is already being used in ophthalmology. It has been introduced into screening programmes for diabetic retinopathy and an algorithm to detect AMD (age related macular degeneration) developed by **Pearse Keane** of Moorfields working with Google's Deepmind is currently being validated. No such algorithm yet exists for detection of KC. Papers on the topic looked at imaging data (scans from Pentacam or OCT) but did not use the raw imaging data, only the numeric data and heatmaps from the scans. Some used data from refraction, and a few used biomechanical data (the response of the cornea to a puff of air). A small number of articles used demographic data and none looked at genetic data or data on associated diseases.

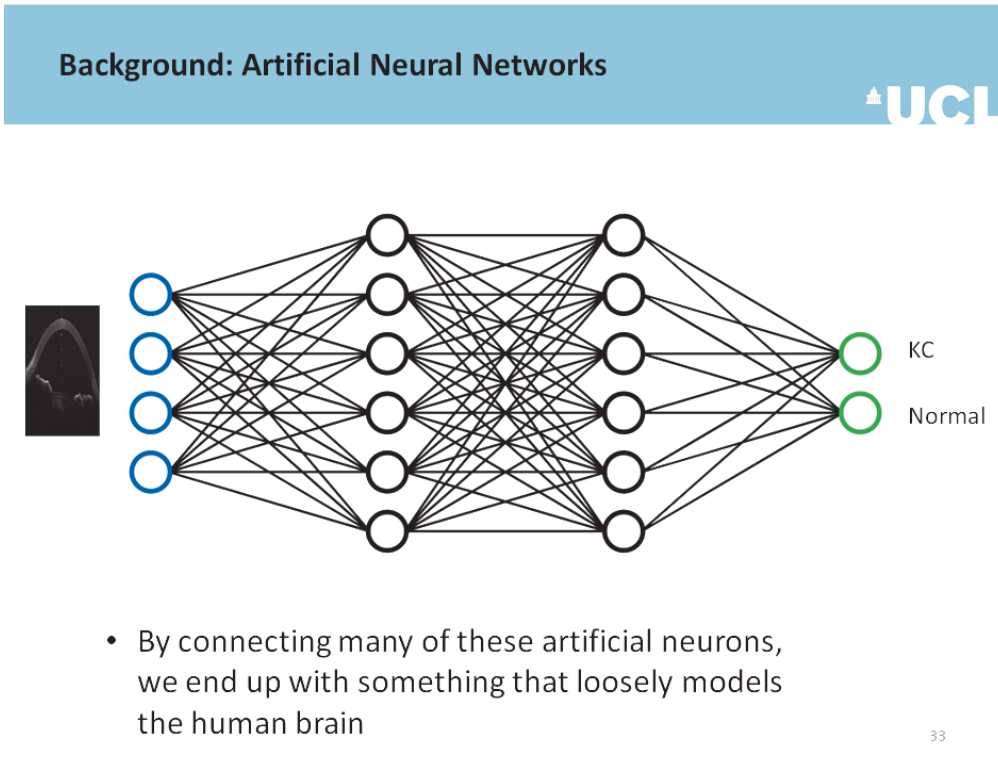
Howard then went on to talk about his current research, in which the aim is to classify grades of KC from the raw images of scans and to identify subclinical KC.
He explained how the brain uses neurons to process information and how the same process can be used in machine learning, with the network eventually able to classify the raw images with a high accuracy. He has been working with 31,000 scans from a high resolution optical tomography device with 25 slices from different angles for each eye. The results are still a work in progress, with differentiating between each of the various stages of KC proving more challenging (78.3% accuracy) than distinguishing between stage 1 and stage 4 (97.4% accuracy). However, it is already clear that machine learning can be used effectively to classify KC from raw images. The next aim is to classify a normal eye against one

with subclinical KC, though this dataset is hard to obtain as it requires clinicians manually classifying the images. In addition, Howard aims to include other types of data into the model such as demographic, genetic and biomechanical data.

Topics covered in the Q&A session that followed included:-

- the potential for making better decisions about whether to crosslink the 'good' eye
- earlier studies had found ethnicity was significant in predicting progression, but was only recorded in about 50% of cases in the dataset studied for this research so limited the effect
- the contact lens clinic sees a number of patients whose KC continues to progress over the age of 40, often with corneas that are too thin for CXL
- one member quoted CXL being unavailable on the NHS for her granddaughter (living in Cornwall and studying in Wales) so having it done privately
- the importance of getting diagnostic tools to High St opticians who often don't have Pentacam or OCT devices for scanning the eye, or having them for retina only, and needing to buy an additional attachment to do corneal scanning
- raising the profile of KC generally with High Street opticians, including risk factors such as family history and allergies.

"the aim is to classify grades of KC from the raw images of scans and to identify subclinical KC"



Setting the priorities for KC research - your feedback needed

Our West Midlands organiser, **John Thatcher**, is the lay representative on a panel setting the future clinical research strategy in ophthalmology, specifically in the area of cataract, optometry, refractive and cornea. Priorities were last set nine years ago, with efficacy of CXL high on list. Now CXL has become standard treatment for early KC, what should research concentrate on? Work continues on developing stem cell treatments, but what other research would make a real difference to you and the effects KC has on your vision? We would love to hear from you and feed the views of patients into this exercise. Please e-mail your ideas to info@keratoconus-group.org.uk or ring **020-8993 4759** by the end of October.

KC Coffee Mornings

At the start of the lockdown our Chairman **David Gable** decided to host a Zoom event titled **Coffee with David**. He had 12 participants and it proved to be an interesting project. From there our Saturday morning Coffee mornings have grown and attracted guest speakers who have been mentioned in this and the previous newsletter.

Whilst we are keen to get back to face to face meetings, zoom has proved a useful tool for engaging with our national and occasionally international members. Now that lockdown has ended we must consider how we continue these zoom events. Whilst the recent more popular speaker events attract a larger participation we have lost the personal relationship we had with the first very small meetings where everyone attending could tell their story and get feedback and encouragement from their fellow travellers.

Unlike other charities, we are purely a self-help group. David would welcome any views you may have on how we continue the Coffee Mornings. You can contact him at chair@kcgroup.org.uk.

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