

**David Garway-Heath @ Moorfields Eye
Hospital, UK**



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Professor David Garway-Heath, a specialist in glaucoma, talks with us about the screening devices of the future, low awareness of glaucoma as a chronic disease and collaboration in training and establishing standards of care on a European level.

Professor, can you please introduce yourself and your career path?

I have been a consultant at Moorfields Eye Hospital since 2000. Prior to that, I did my residency and fellowship training in London and my fellowship at Moorfields and at the Jules Stein Institute at UCLA. In 2010, I took on the role of International Glaucoma Association (IGA) Professor of Ophthalmology at UCL and since 2007 I have led the imaging and vision assessment theme at the NIHR's biomedical research centre at Moorfields and UCL Institute of Ophthalmology; I supervise infrastructure funding for translational research from the NIHR for the ophthalmology subspecialist centre in the UK.

I first started working in research in the mid-1990s, focusing on imaging and the optic nerve's importance for diagnostics and monitoring purposes. This corresponded to the time that technology had developed the possibility to make measurements of structures in the eye with imaging devices. In the context of this research activity, I invented a diagnostic algorithm (the Moorfields Regression Analysis) that was incorporated into the device most in use at the time, the Heidelberg Retina Tomograph.

The disease area I am most interested in is glaucoma, a chronic progressive disease damaging the optic nerve in the eye, resulting in vision loss. It is a tricky condition as it often goes unnoticed in early stages of the disease, as one eye fills in the vision deficit of the other. The effort has henceforth long been on finding new methods of diagnosis and developing effective early diagnostic devices.

How does the UK position itself in international comparison in terms of leadership in glaucoma research and treatment?

The Institute of Ophthalmology and Moorfields represent the world's largest single site research centre in terms of productivity. This has come about in part due to the fact that Moorfields is the oldest eye hospital in the world, in existence for over 200 years. We have therefore been able to foster a unique relationship between basic science and clinicians at the joint site. This has long been an object of international recognition and, for many, this close collaboration has been an inspiration. We will further strengthen this collaboration by integrating basic science and clinical science in a single building to maximise the interaction between the clinician and the scientist in order to produce more results.

I think it would be fair to say that the UK leads the world in innovation of glaucoma care. The UK has a large number of highly trained glaucoma experts, many of whom lead internationally-recognized research. We have also been leading the way in clinical trials. We were the first country to undertake a placebo-controlled trial to demonstrate that lowering the intraocular pressure preserved the vision in glaucoma patients. At the moment, Moorfields is undertaking another trial comparing laser treatment with drops.

The UK has a pioneering position in trial design and in diagnostics in glaucoma. The Moorfields safe surgery system, a surgical technique for glaucoma has been taken up in many countries and raised the standards in glaucoma care.

How do you envision the future of diagnostics?

I see technology as the enabler that creates new possibilities. Imaging devices are becoming more and more sophisticated and portable. The structure of the eye is much better represented with these instruments, and the affordable and almost portable character of newer devices allows for diagnostic devices to be more widely available.

However, the diagnostic precision of the devices is not yet good enough that they might be used for large screening efforts. Glaucoma is a disease that becomes much more common with older age but has a relatively low prevalence, affecting only about two percent of a population. The risk with unprecise diagnostic tools is, therefore, a high number of false positives. Overuse of devices that are not precise enough is thus at high risk of flooding the healthcare system with false positives.

So, devices need to have good detection ability but also have to single out patients who do not need treatment. While this stage has not yet been reached, I foresee that in the not too distant future, we will have these devices. They could take various forms, such as a combination test of an imaging and visual function testing device, able to pick up the stage of glaucoma which puts the patients' visual function at risk.

Therefore, I have pursued vision function testing along three different streams within my research activity. The first evolved around a device (Moorfields Motion Displacement Test) my former supervisor Prof Fitzke developed. It is robust against cataract and refractive error, which means it is less susceptible to produce false positives. We are in the process of licensing the technology to a commercial organisation and hope we will be able to use the finalised device for case finding once it is on the market. This device could even work remotely, the test being carried out in front of a computer at home.

The second stream we have been pursuing is optimisation of current devices and have secured a grant from the NIHR to develop more precise tests. This programme has just completed stages, we are currently analysing the resulting data and can already see we have reduced the variability in the test by 50 percent, effectively halving it. This technology is patented as well and in the process of being licensed out.

The final stream we are pursuing is related to intraocular pressure management. It has been found that in glaucoma the major, and only modifiable, risk factor is the level of pressure in the eye. In recent years, new devices have been developed. All methods involve flattening the front of the eye (cornea), and the new devices have been developed which take account of the influence of the biomechanics of the cornea. A bioengineer from the University of Liverpool, Professor Elsheikh, is developing a contact lens for eye pressure measurement, with the technology licensed to a Swiss company. This new technology could solve the problem that for now we can only undertake patient

measurement when the patient comes in to the clinic for a check. Three times a year, at best, the patient gets tested for two minutes, which is a small window on constantly varying eye pressure. A contact lens would make it possible to obtain measurements over longer time periods.

Luckily, we are able to access comprehensive funding in the UK. Not only did the NHS reform its funding system 12 years ago, establishing the NIHR (National Institute for Health Research) so that clinical and translational research can now access funding better, Moorfields and the Institute of Ophthalmology also benefit from funding from the Medical Research Council, the Wellcome Trust and various charities, especially from the IGA, as well as industry funding. Because we have such a well-developed biomedical research centre, it is easy for industry to tap in and research can be carried out collaboratively.

You are also president of the European Glaucoma Society (EGS). Can you tell us more about your role and the activity of the EGS?

I became president of the EGS at the beginning of 2018. When I took over, it became apparent to me that patient support organisations are not as well developed in all countries across Europe as they are in the UK. In fact, only half the countries in Europe have a patient support organisation for glaucoma. This means that patients cannot access support outside the clinical environment. Our idea at the EGS was to identify best practice where it exists, to provide a network within which best practices and literature could be shared. This involves doctor engagement in those countries that do not currently have patient organisations. Developing the network requires the initiation and facilitation of interactions between the established support organizations and the local professional glaucoma associations and doctors in the various countries. We would like patient views to influence care provision and research priorities across Europe. In the UK, the James Lind Alliance brought together patients, doctors and scientists to identify the key research questions that matter in order to help direct research effort in the right direction. We are looking to generalise such a model in our role as EGS.

On a personal dimension, I was interested in this position because I saw potential to achieve something, raising the standard of care for glaucoma across Europe. There is much we can achieve through education and training because the EGS is a very dynamic and collaborative organisation. We all have the same vision, which is to reduce the glaucoma-induced visual disability across Europe, and I am very excited about the upcoming 40th anniversary of the EGS we will celebrate in 2020 (symbolically “perfect vision”) in Brussels, the European capital.

Today, the reach of the EGS far extends Europe as our literature, forming a manual for patient care, has been translated into many languages. This helps to bring the standard of glaucoma care up to a consistently high level across Europe and beyond. In Europe, we still observe important differences in training in the different countries, some include surgery training, others not; we strive to harmonise standards. The EGS also collaborates with the American Glaucoma Association across the Atlantic and we will further our collaboration in the coming years.

When comparing the UK to other European countries such as Germany or France, it seems characterised by a very low number of ophthalmologists in comparison. What should be the standard of care across Europe?

What is interesting is that in Europe, the systems are all very different. The setup in the UK is unusual in there are very few ophthalmologists per capita; indeed there are almost as many

ophthalmologists in Los Angeles as in the whole of the UK. However, the UK has 14,000 optometrists, academic eye care specialists. Some take the opportunity to go through subspecialist training taking them to the level of practitioners in glaucoma care. In the UK, they act as a partner in care, whereas in most European countries they are seen as competition to the ophthalmologists. Thus, the patient care pathway in the UK is different from, say, France. In France your first step as a patient is to go to the ophthalmologist; in the UK you would only be referred in some cases. As glaucoma is an asymptomatic disease in its earlier stages, we rely on optometrists to identify it. They need diagnostic devices to help them do that, but not all have the higher level of training available to them and hence are often not experts in reading the devices' reports, which leads to many false positive referrals.

It is difficult to compare the various care pathways across Europe. In the end, it comes down to the issue that there are little or no metrics across Europe to quantify the standard of care. We can establish a standard of training, but we have few metrics to establish the end result in terms of patient outcomes. Last year, the EGS held a meeting to agree on metrics that answer to the question 'how do we know if we are doing any good?' • Systematic recording of these metrics will enable us to establish which health care systems work best for patients.

How would you assess awareness of glaucoma in the UK?

Awareness is relatively low and confusion between glaucoma and cataract persist. This is due to the fact that people do not talk about their health problems much; this is particularly important as glaucoma is an hereditary disease. And, because glaucoma is asymptomatic until an advanced stage, the only way to pick it up is through detection by healthcare professionals. People often do not go for an eye check if they do not know they are at risk. The ideal would be a screening programme, but the cost effectiveness of such a programme is not proven yet.

In Scotland for instance, eye tests are free, but it is not clear if this leads to better outcomes. The cost effectiveness of screening remains a major factor. One idea for the UK would be to make an eye health check mandatory when people come in for their driving license renewal at the age of 70. It would be the perfect moment for a 'screening test' and could be cost effective if drivers were to pay for it. After all, having a driving license is a privilege and people could be asked to pay for the test. I think many cases of previously undetected glaucoma would be picked up and it would be a very effective solution.

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