The Moorfields Motion Displacement Test (MDT)

The Moorfields Motion Displacement Test (MDT) offers a new portable method of testing the field of vision for the detection of glaucoma.

Background information
It is estimated that there are in the region of 65 million sufferers of glaucoma throughout the world. At least 50% are undiagnosed, with this figure rising to 95% undiagnosed in parts of the developing world.

Glaucoma usually develops very slowly and results in a gradual loss of the field of vision. Central vision, which allows us to perform detailed tasks such as reading, writing and sewing, is relatively unaffected until late in the course of the disease. The loss of the surrounding field of vision is so gradual that glaucoma patients are often unaware that there is a problem until the defect is quite large.

Objective
Importantly, visual field loss due to glaucoma can be prevented if it is identified and treated early. The aim of the Moorfields MDT project is to tackle the global challenge of undiagnosed glaucoma by providing an affordable and accessible method of testing for glaucoma in the community.

How does the MDT work?
The Moorfields MDT is a software program and is designed to run on a laptop computer. It has been developed since 1999 and the project is led by Ted Garway-Heath, who is the International Glaucoma Association Professor of Ophthalmology, University College London and Glaucoma Theme Leader to the NIHR Biomedical Research Centre for Ophthalmology, Moorfields Eye Hospital NHS Foundation Trust & UCL Institute of Ophthalmology.
Patients often report that they find visual field tests tiring. The team has worked in collaboration with Professor David Crabb and his PhD student Ciara Bergin at City University to develop fast test strategies which should be less tiring. The current version of the Moorfields MDT for the detection of glaucoma takes less than 2 minutes per eye to complete.

One of the advantages of the Moorfields MDT is that patients find it easy to perform: 32 white lines are presented on a computer screen on a grey background. The patient is asked to look steadily at a central white circle and to press the computer mouse each time a line is seen to move.

The Moorfields MDT can be done without glasses and a patient will be able to see the line movement even if they have cataract. This is important

to ensure that glaucoma is correctly diagnosed.

People of African descent are at risk of developing glaucoma at an earlier age. The Moorfields MDT was found to outperform other instruments of glaucoma detection when it took part in a small 'pilot' study in St Kitts in the Caribbean. This was led by Dr Paul Artes who is associate professor at the department of Ophthalmology and Visual Sciences, Dalhousie University, Halifax, Canada.

Current developments

The performance of the Moorfields MDT is currently being compared against other tests of the field of vision through an international trial with the Bietti Foundation in Rome, The University of Toronto and Dalhousie University in Canada. We anticipate that this study will be completed in March of this year. The results will be used to support the commercial release of the Moorfields MDT, which we hope will take place early in 2012.

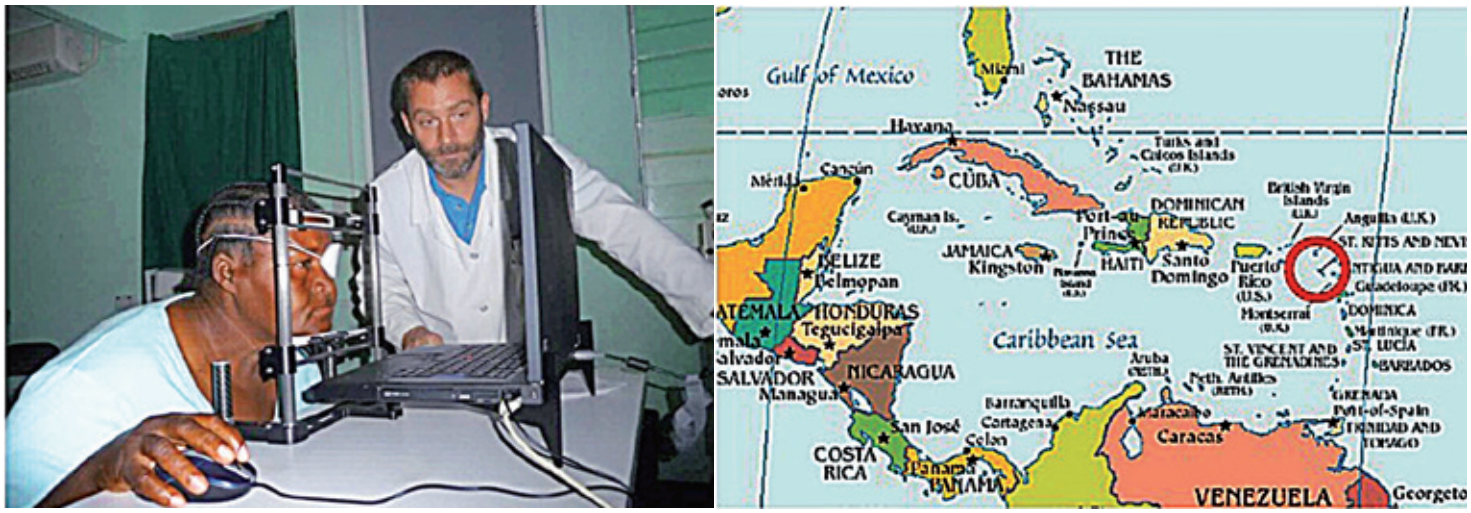
We have recently started a new study which will explore whether the role of the Moorfields MDT may be extended to monitoring patients who are known to have glaucoma, as well as diagnosing new patients with the condition. One of the current difficulties is that tests used for detecting glaucoma in the community are often different to those used for monitoring in the hospital. It would be beneficial to use the same platform of testing for easy comparison.

Much collaboration

We are privileged to be working in collaboration with the following international professionals:
Dr Alfonso Antón, Hospital de la Esperanza y el Mar, Instituto Municipal de Investigaciones Médicas (IMIM, IMAS) and the Universidad Autónoma de Barcelona. The Moorfields MDT is participating in a community study in Barcelona.

The study objective is to assess the cost effectiveness of screening for glaucoma through "telemedicine". The glaucoma testing is conducted locally in the community by trained nurses and technicians. The results are sent electronically via the internet to a "reading" centre, where they are reviewed by specialist ophthalmologists. Patients who are suspected to have glaucoma are called to the hospital for further investigation.

Professor Roger Anderson and Dr James Loughman. We hope that the Moorfields MDT will take part in the Mozambique Eye Care project which is an Irish Aid/Higher Education Authority (HEA) initiative. This will be the first time that the Moorfields MDT has had the opportunity to be tested in Africa.



The Moorfields MDT taking part in a community study in St Kitts.
Courtesy of Paul Artes and Glen Sharpe, Dalhousie University.

Professor Tin Aung and Dr Alicia How, Singapore National Eye Centre. Their work includes investigation of the Moorfields MDT in closed angle glaucoma. This type of glaucoma is more common in people of Asian descent.

Dr Paul Healey, Centre of Vision Research, University of Sydney. Dr Healey will investigate how the Moorfields MDT performs in optometry practice with Mr Ankur Mehta, Optometrist.

Professor Fotis Topouzis, Aristotle and University of Thessaloniki, Greece. This study will explore the potential role of the Moorfields MDT in GP practice in rural northern Greece where the population has limited access to eye care.

Dr Jugnoo Rahi, Great Ormond Street Hospital for Children NHS Trust and The UCL Institute of Child Health, London. We plan to develop a paediatric version of the MDT. We think that the test will be suitable for children as it is quick to perform and very easily understood.

Dr Eamon Sharkawi, Hôpital Ophtalmique Jules-Gonin. Université de Lausanne, Switzerland. The Moorfields MDT is participating in several studies, including comparison with Octopus perimetry, which is widely used in Europe. The MDT will also take part in an innovative screening session which has been organised by Dr Sharkawi in response to the World Glaucoma Week initiative by the World Glaucoma Association (6 -12 March 2011).

Conclusion

The Moorfields MDT project was overall winner of the Medical Research Council (MRC) award for translational innovative research in 2008 as a simple solution to a global problem. We are getting closer to making our vision become a reality and we hope that the Moorfields MDT will make a substantial contribution to

the prevention of world blindness due to glaucoma in the future.

Further information can be found at the following web-links:

www.moorfieldsmdt.co.uk

www.moorfields.nhs.uk

http://www.staff.city.ac.uk/d.crabb

http://www.dit.ie/mozambique-eyecare

http://www.wgweek.net/

http://www.worldglaucoma.org/

The views expressed in the publication are those of the author and not necessarily those of the Department of health.

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Senior Research Fellow to The Moorfields MDT project

The genetics of pigment dispersion syndrome

Background information

Pigment dispersion syndrome (PDS) is an eye condition, which in a proportion of patients, can lead to a potentially blinding condition known as pigmentary glaucoma. A study from the United States of America has estimated that PDS is present in around 1 in 40 of the white population and the vast majority of those affected have a myopic (short sighted) spectacle prescription. It is likely that only a small proportion of these are identified and referred to the Hospital Eye Service. In patients with PDS, the iris (coloured part of the eye) has a tendency to curve backwards. This causes it to rub on the lens, which sits just behind it, with the result that iris pigment is released into the front of the eye. As pigment is released from the iris, characteristic 'transillumination defects' (figure 1) can be detected on slit lamp examination. Some of this pigment collects on the trabecular meshwork (drainage tissue of the eye), shown in figure 2, and in a proportion of patients this causes a build up of pressure within the eye. Usually the patient is unaware of this, although sometimes, in particular after exercise, an acute pressure rise may cause transient blurring of the vision or the appearance of haloes around lights. This pressure, in the long

Figure 1.
Characteristic iris transillumination defects

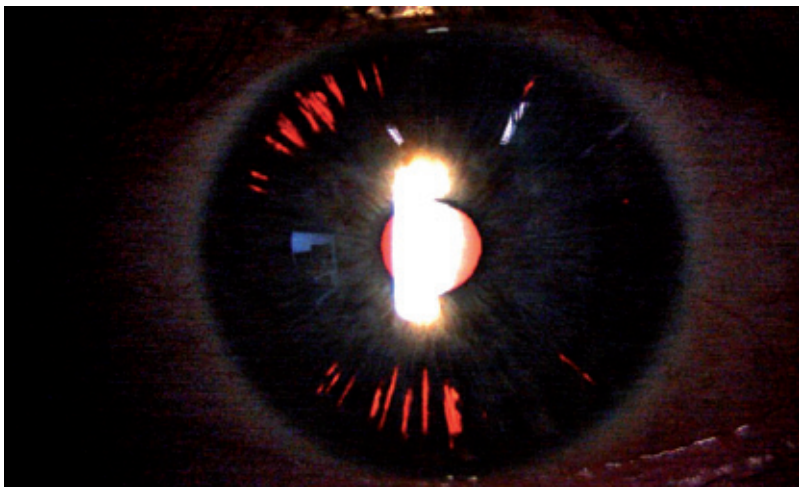
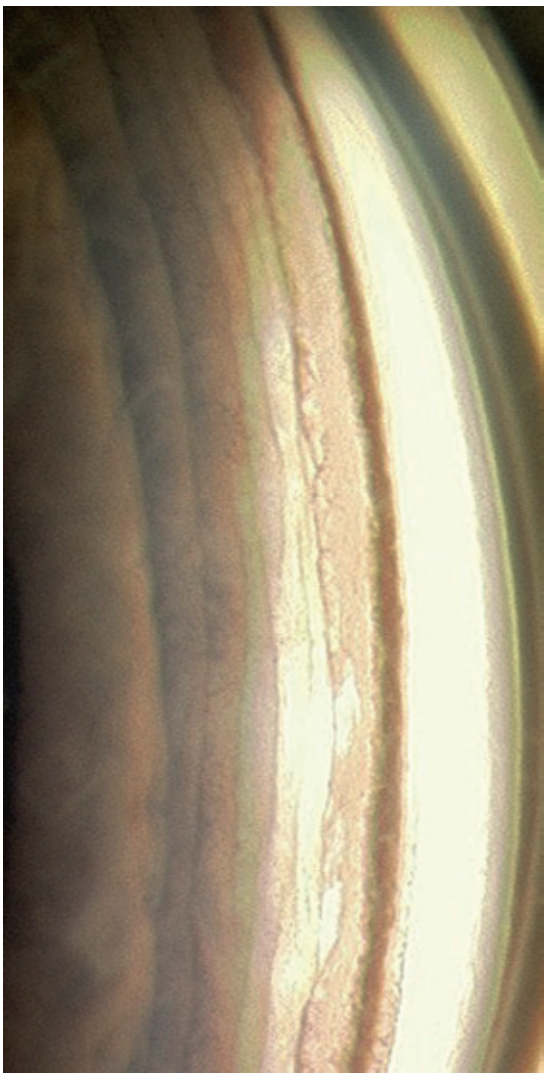


Figure 2. Pigment accumulated on the trabecular meshwork (internal drainage tissue of the eye)



term, can cause damage to the optic nerve and permanent damage to the patient's sight (pigmentary glaucoma).

The treatment of pigmentary glaucoma is broadly similar to that of primary open angle glaucoma i.e. drops to lower the eye pressure and surgery in advanced cases or those resistant to eye drops although there is some evidence for the use of a procedure known as laser peripheral iridotomy, which may reduce or eliminate the backwards curvature of the iris.

Objective of the project

PDS is more common in relatives of people with the disease than in the general population which suggests there are likely to be specific genes responsible for causing the condition. These genes may influence the tendency of the iris to curve backwards and possibly make the iris tissue more likely to disperse its pigment. The characteristic features of pigment dispersion usually do not appear until the 3rd decade of life or later. As the age of onset is variable, it is presently difficult to assess the risk to a patient's siblings or children of developing PDS or pigmentary glaucoma. Identifying the genes involved in this condition would potentially allow for more accurate risk assessment of these relatives. Those found to have the 'high risk genes' could then be closely monitored, whilst those at 'low genetic risk' could be reassured accordingly and avoid unnecessarily frequent follow-up.

Method

We have selected 2 different strategies in order to identify our genes of interest. Firstly, families affected by PDS through multiple generations may be recruited for a type of study known as a 'linkage analysis'. DNA contains a huge number of naturally occurring variations known as 'single nucleotide polymorphisms' (SNPs). Linkage analysis works by comparing the

distribution and the inheritance of these SNP's between different family members. Computer programs are required to analyse this information as usually hundreds of thousands of SNPs will be compared. By specifying the relationships within the family as well as which members have the condition, the program is able to provide information on which regions of the DNA are likely to harbour the genes of interest. We are presently working on 2 large families as well as a number of smaller families, in whom we are conducting a linkage analysis. So called 'candidate' genes identified through this work, as well as those identified by other researchers in the area are being looked at to find out whether they may be involved in causing PDS.

The second, alternative, approach to gene-finding involves recruiting a large number of (unrelated) patients with the condition and comparing the distribution of SNPs between these patients and a group of 'control' healthy volunteers, who don't suffer with the condition. We currently have samples from over 150 patients with pigment dispersion and have recently been awarded funding in order to conduct the genetic analysis. This type of study is known as a 'genome-wide association study' (GWAS).

Conclusion

As well as conducting our own GWAS, we are trying to collaborate with other UK sites to conduct an even larger GWAS (400 patients in total). The hope is that this project would serve as an example of how large numbers of patients can be recruited to facilitate genetic studies into relatively uncommon diseases more efficiently than any one institution working in isolation.

The search for the genetic basis to PDS is a challenging one: there are likely to be several genes involved in the development of the condition. Furthermore, the disease process is likely to involve a complex interaction between genes and acquired factors leading to short-sightedness. Advances in laboratory techniques for genetic analysis, as well as an increasing sophistication in the computer software used to analyse the genetic information, means that we can be hopeful of exciting new findings in this field over the coming years.

Acknowledgements
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