High quality retinal image grading and management service by the NetwORC UK

BY RAHILA BASHIR

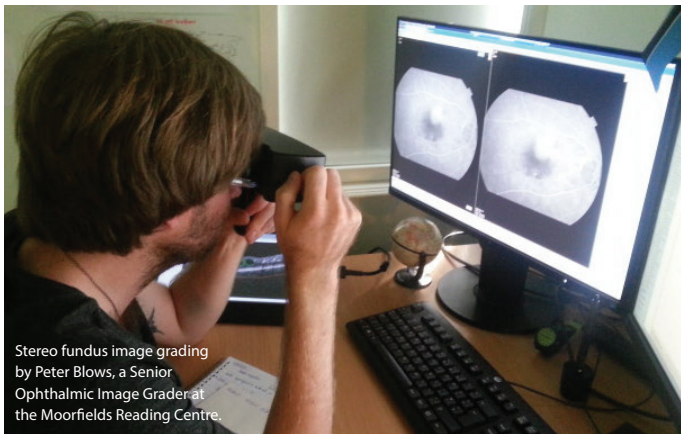
In 2004 a network of three ophthalmic reading centres in Belfast, London and Liverpool (known as NetwORC UK) was established to form the largest reading centre in Europe for the purpose of providing high quality grading of ophthalmic images for clinical research studies. Today, 12 years on, the three reading centres (RCs) have continued collaboration in projects which aim to facilitate grading images in multicentre clinical trials and further epidemiological studies. The involvement of accredited graders and senior clinicians and academics across the three centres gives NetwORC UK significant advantages over other single centre RCs. NetwORC UK is managed centrally by the Central Angiographic Resource Facility (CARF) which is affiliated with the centre for Public Health at Queen's University, Belfast. Sites that take part in clinical research studies submit ophthalmic images to CARF, which is responsible for checking, collating and managing the image repository. CARF costs the studies, generates the contracts once the study is funded, supports the preparation of the electronic grading forms and manuals, prepares the data collection routines, maintains the study logs and monitors grading activity. The studies can be as short as three months or as long as five years or more. CARF engages with the three reading centres located within the UK and distributes electronic imaging data for grading. CARF than collates the results which are recorded using methodologies appropriate to study protocol.

So what is ophthalmic image grading? Why is it important? What is its relevance at the present time? With quality assurance in mind, the CARF director and reading centre clinical advisors supervise ophthalmic grading projects by reviewing various types of high quality photographic images and retinal scans to allow objective evaluation in classifying and creating detailed reports for ophthalmic research studies to confirm clinical diagnosis on various causes of sight loss here in the UK and overseas.

With state of the art digital facilities, NetwORC UK enables automatic image processing from a range of image acquisition systems. Images are evaluated by applying both parametric and non-parametric principles by highly trained grading staff, who also build the structure of NetwORC UK in the fields of ophthalmic imaging, clinical research, information technology and photo grading. There are many image grading studies involving autofluorescence, infrared and colour fundus photographs, optical coherence tomography, fluorescein and indocyanine green angiography. Projects also involve designing grading algorithms and protocols, selecting grading systems from a range of templates, incorporating a large variety of ocular pathologies, customising databases and providing security for file transfers and image submissions. Grader consistency and productivity is monitored by CARF through its quality assurance activities.

All graders participate in intensive training programmes. The grader training plan provides an accredited framework for staff members to help equip them with the relevant knowledge, skills and resources to grade images. NetwORC UK meetings involve workshops for independent and joint grading with structured teachings, clinical representations and training materials. The valuable shared learning sessions combine feedback from each of the reading centres. CARF processes images from the commonly used image acquisition systems, including Topcon ImageNet, Zeiss Visupac, Heidelberg, Canon Eye cap and DHC Oculab. CARF undertakes a series of submission consistency checks and enters all image submissions into a computerised log which enables immediate identification of all images received and their current status in the grading pathway.

Driven by excellence, hard work and determination, the first of these centres is based in Belfast, Northern Ireland, the second in Liverpool in the North West and the third in Central London. Grading results are recorded directly onto study specific databases for transfer to data management centres. The prime objective is to "achieve systematic and comprehensive reading of ocular images to determine clinical characteristics



Stereo fundus image grading by Peter Blows, a Senior Ophthalmic Image Grader at the Moorfields Reading Centre.

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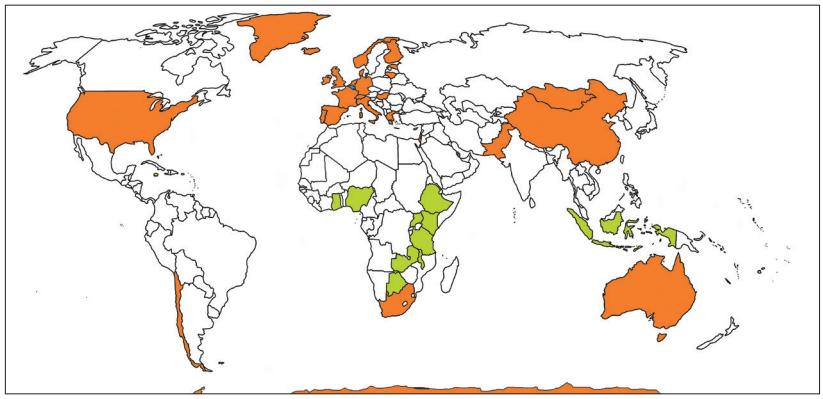

best describing and quantifying morphological biomarkers that reflect ocular tissue damage."

The Belfast Reading Centre is led by Professor Usha Chakravarthy, an expert in age-related macular degeneration (AMD) clinical and pathological studies. The centre was the first to grade AMD on digital acquired images, creating an innovative grading software. It offers comprehensive national and international studies in grading the fundus, angiographic and tomographic images of a variety of eye diseases in the posterior segment.

The Liverpool Ophthalmic Reading Centre is led by Professor Simon Harding and is jointly hosted by the University of Liverpool and St Paul's Eye Unit, Royal Liverpool University Hospital Trust. It is strongly linked with the research activity at the Department of Eye and Vision Science and the Institute of Ageing and Chronic Disease. The centre supports multiple clinical trials on many eye diseases and in addition to grading angiographic and tomographic images for diabetic retinopathy and AMD, it also provides grading for local, national and international programmes with areas of interest including malarial retinopathy.

The Moorfields Reading Centre is led by Professor Tunde Peto. The Moorfields Eye Hospital NHS Foundation Trust in partnership with UCL Institute of Ophthalmology plays an active role in research, as many clinical trials in the field of ophthalmology require accurate and objective phenotyping which is provided by this centre. This unit has also formed part of the NIHR Biomedical Research Centre at the hospital. It is consistent in population based history studies and this allows for a wide range of image modalities to be graded. This centre is focused primarily on diabetic retinopathy and as part of DR-NET (an established network between 17 eye institutions in 10 commonwealth countries). Moorfields Reading Centre has worked with sites across the world in both research and technical support. On the above map, orange marks the sites this centre has engaged with and green marks other sites which are also involved in DR – NET. In 2010, the Moorfields Stars event awarded the centre with the special Trustee's team award for innovation.

New imaging equipment and reading methods offer major improvements and developments in eye care provisions. This is a new era when we are witnessing some amazing work which is proving to show successful and interesting theoretical outcomes combined with beneficial understanding to new knowledge and change in patient eye care.

For further information about clinical studies, work related visits to any of the reading centres, or to read more about the ophthalmic grader's role and image techniques, please visit www.networcuk.com

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