IGA Open Summer Patient Meeting 2011

The Glaucoma Journey

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I am absolutely delighted to have been asked to speak to you again about glaucoma.

In preparing this talk I thought 'what is it you want to know about glaucoma?' so I wrote down all the questions that people ask me in clinic and decided to try to incorporate them into today's talk – 'The Glaucoma Journey'.

Why have I called it a glaucoma journey?

Well, glaucoma or suspect glaucoma is a journey that will last for the rest of your life. You are not going on that journey alone because your consultant, the other doctors in the clinic, your nurse practitioner, maybe an optometrist in a shared care clinic, your local pharmacist who dispenses your prescriptions and your general practitioner will all be with you all the way.

The journey usually starts at a routine eye test where the optometrist will have found signs that indicate the possibility of glaucoma. It may be that your optic disc looks suspicious (ophthalmoscopy) or you have a raised intraocular pressure (IOP) (tonometry) or, if the optometrist has carried out a perimetry test, it may be that there is a problem area in your visual field, or it may be a combination of all three.

Why do you repeat the optometrist's tests in hospital?

When you get to hospital the three tests (ophthalmoscopy, tonometry and perimetry) will be repeated and other tests may also be carried out to gain more information and help with a diagnosis. We may measure the thickness of the nerve fibre layer where the optic nerve leaves the eye to connect with the brain, which gives us useful information about the health or otherwise of the optic nerve. We may measure the thickness of your cornea (pachymetry) because a thick cornea can give a false high IOP reading when, in fact, your pressure is normal. You may also have the drainage angle of your eye assessed with a technique called gonioscopy and, if you do indeed have a raised IOP, a check will be made to establish if there are any other causes of a raised pressure (secondary glaucoma). However, even after all these tests it may not be possible to

give a confirmed diagnosis there and then because the most important diagnostic criteria for glaucoma is progression and this cannot be shown on one visit. Nevertheless in many people it is possible to be quite sure that glaucoma is present, in which case we may decide to start treatment immediately. Likewise in many other people we can be confident that there is no glaucoma, in which case the person will be discharged. For those where we are still suspicious of glaucoma, but where we cannot be sure, we will usually wait and look for signs of progression at a later date in order to confirm the presence or absence of the condition.

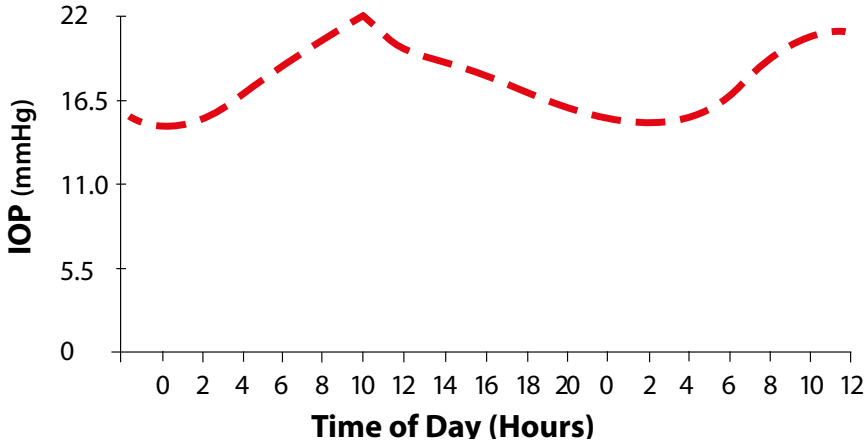
What can change intraocular pressure?

There are lots of things that can change your pressure:

- If you drink a lot of liquid quickly your pressure can go up. Indeed this was once one of the tests for glaucoma.
- Being nervous can also have an effect.
- Lots of blinking or squeezing the eyelids closed can put pressure up.
- The normal pulse causes a regular variation of 2mm Hg – 3mm Hg all the time.
- Posture also affects IOP – laying down raises IOP a little, but being upside down (as in some yoga exercises) can cause a large rise.
- Straining, such as lifting heavy weights, or playing some musical instruments like the trumpet or oboe can raise pressure.
- Even a tight collar can raise the IOP by up to 4mm Hg.
- Gentle aerobic exercise can help lower IOP.

IOP also varies during the day
Fig 1 shows pressure measurements taken over a 24 hour period and how they vary throughout the day.

Fig 1



For the great majority of people IOPs are higher in the morning but there are some people whose pressure is higher at other times which is why we note the time we see you.

Another factor is the slit lamp position, and even the amount of the fluorescein drop (the yellow dye) we put in your eye can affect the accuracy of the measurement, so we accept a variability of 3mm Hg in many people. Tonometry is not an exact measure; it's another piece of the puzzle.

Why is corneal thickness important?

Corneal thickness is important in our interpretation of the initial IOP because a particularly thin or thick cornea can lead to under or over-reading of your pressure. The average corneal thickness is 550microns, and we can apply a correction factor to get a more accurate estimate. We measure the central corneal thickness using pachymetry which uses a little ultrasound probe or a fibreoptic probe to touch the surface of the eye (Fig 2).

Fig 2

This is now a routine part of our examination. However, if we've been following somebody for years, we are looking at comparative pressures: basically, if a person is losing visual field, then the pressure is too high for them; if it is stable, then it is acceptable, so pachymetry is less important in these people.

If we look at risk factors for glaucoma, the thickness of the cornea becomes even more significant. The Ocular Hypertension Treatment Study showed that people with thinner corneas who had higher real pressures (after the correction factor had been applied) were the most likely to progress to open angle glaucoma. Lots of people with high pressure never progress to glaucoma but there was a definite increased risk if you had a thinner cornea, and in fact it wasn't just that a correction factor was important, but that there seemed to be a risk even if that figure was corrected.

The reason for this increased susceptibility is not fully understood, but it is probably because a thin cornea happens in people who have differences in other structures of their eye. In fact, it is considered to be so important that in the National Institute for Health and Clinical Excellence (NICE) guidelines for glaucoma we have a chart to help us decide whether to treat people with high pressure or suspected open angle glaucoma (Fig 3).

Fig 3

Treatment for people with OHT (Ocular Hypertension) or suspected COAG (Chronic Open Angle Glaucoma) From NICE CG85 Glaucoma Guideline

CCT	More than 590 Micrometres		555-590 Micrometres		Less than 555 Micrometres		Any
Untreated IOP (mmHg)	> 21 to 25	> 25 to 32	> 21 to 25	> 25 to 32	> 21 to 25	> 25 to 32	>32
Age (years) a	Any	Any	Any	Treat until 60	Treat until 65	Treat until 80	Any
Treatment	No treatment	No treatment	No treatment	BBb	PGA	PGA	PGA

BB: betablocker • PGA: prostaglandin analogue

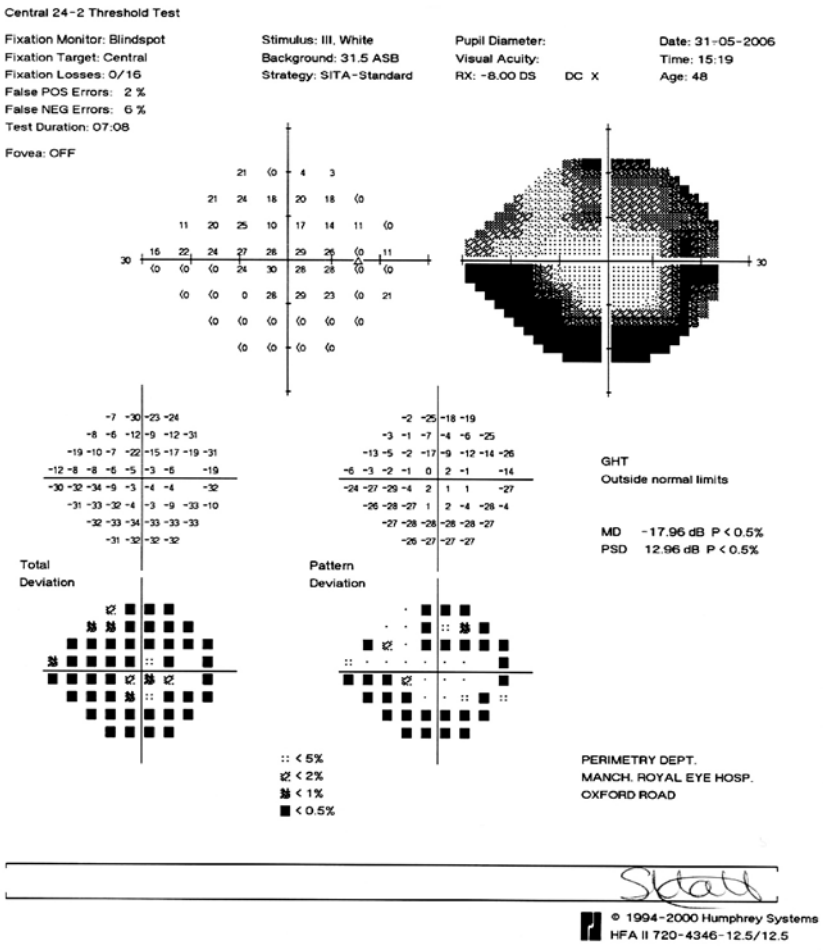
Why do we have to keep on doing visual field (perimetry) tests?

Almost no one likes doing perimetry tests. They are difficult to do because we are looking for something that you can only just see – the threshold – which is the brightness of the bulb that you can see only fifty per cent of the time. This is why, when you are doing the test, there is always the point at which you're not going to see a light and think 'did I see something or did I not?'; don't worry because the computer's going to come back and check that spot again. It won't do it immediately, but it will re-test the point, so by definition it's going to be really quite hard to do the test.

The more you do perimetry, the more information we have, and the more accurate it will be. We can also track changes and trends over time, which is very important when we are looking for progression or stability in your visual field and as this is the only test we have that tells us exactly what you can and can't see, it really is essential for us to be able to control your glaucoma as well as possible.

This is a field test of somebody who has glaucoma (Fig 4). There are some black areas at the top and a much blacker area at the bottom, so this person has got loss visual field damage both superiorly and inferiorly but the centre (looking straight ahead) is quite good, so much so that they are not aware of their loss. It's not a grey area in their field: it's a missing area.

Fig 4



Visual Field - what we look for

- Standardised automated perimetry
- Humphrey used as gold standard
- Typical defects
  - Nasal step
  - Arcuate defect
  - Progresses to altitudinal paracentral loss
  - Gross constriction

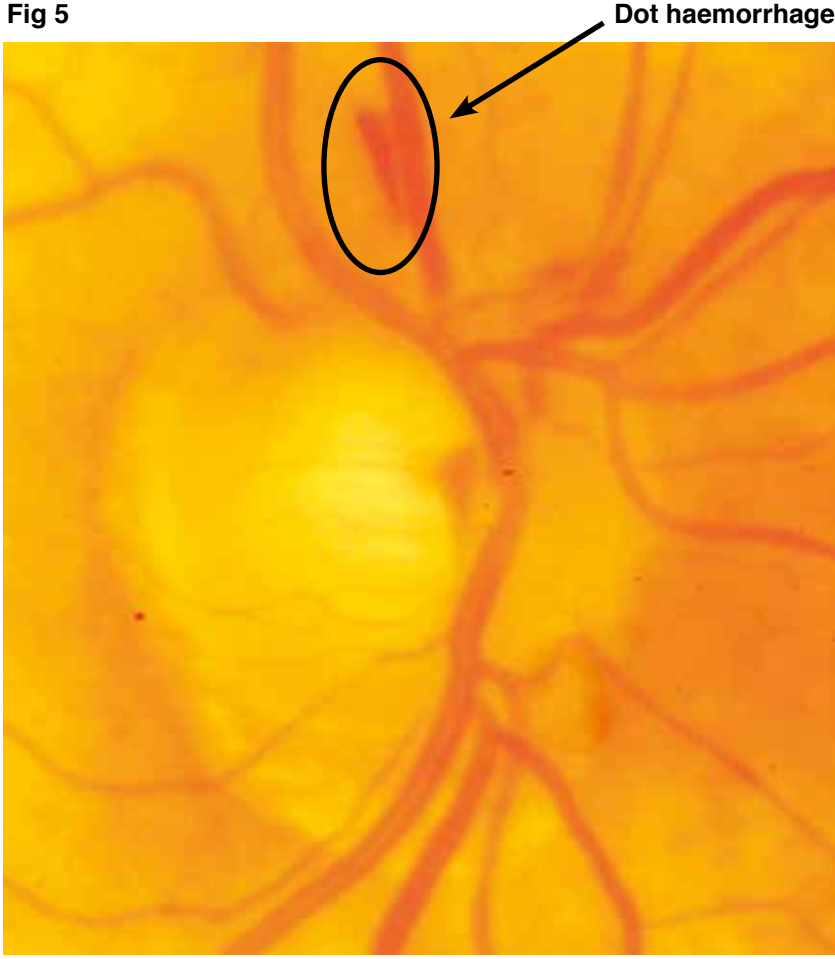
Now, the brain is very very clever, so when we've got missing areas in our visual field, instead of having a blank, it fills in the gap by taking little bit of background from around the area of loss. That is why most people are not aware of their missing vision; it is also why so much glaucoma is detected at a late stage because it is only when there has been a lot of damage that this 'filling in' stops working.

When we're looking at the field chart, we are not just looking at the greyness of the visual field, we're looking at the numbers in the chart on the left and the numbers tell us how bright a light you needed. If it's a very low number, we know you need a very bright light, and 0 means you can't see any light in that bit at all. A high number means you're quite sensitive to light. There are statistical parts of the programme that look at your field and compare them to an age matched population, which tells me how likely that is to be a true glaucomatous loss in the visual field.

However, the most important thing is change over time. If there is virtually no change, then the glaucoma is stable and all we need to do is to continue with the treatment. However, if there is change, especially if it is noticeable over a short period of time, then we need to change the treatment in order to protect your sight.

The next thing that people ask about is the examination of the inside of their eye and in particular your optic disc. We have a lot of things we look at when we're looking at the optic disc, but again, we are looking for evidence of change. (Fig 5) is a picture of an optic disc and the little red exclamation mark indication at the top is a tiny dot haemorrhage next to the blood vessel. Things like this warn us that there could be change happening in the nerve. We also look at the size of the nerve. We look at the rim of nerve tissue travelling down the nerve and we call that the neuro-retinal rim. We look at the nerve fibre layer which is actually all the fibres parting across the retina and going towards the nerve.

Fig 5



We look at the haemorrhages and we look at what we call peri-papillary change (which means changes around the optic nerve) and we look for pale areas because we know that changes like these can indicate glaucoma.

Why does size matter?

The size of an optic disc nerve can vary by four fold in different people and this means that the optic nerve head can look very different even when it is perfectly healthy. If we imagine we buy a bunch of a dozen daffodils from the shop and put them in a very narrow necked vase, they're going to sit quite bunched together with almost no gap in the middle.

However, if those same 12 daffodils were put in a wide necked vase, they're going to sit right round the edge with this big gap in the middle. It's just the same with the nerve fibres from the retina (except that there are about a million nerve fibres). If you have a very large nerve, you'll have a very large gap in the middle and if you have a very small nerve, you'll have a very small gap. In the old days we believed that if you had a gap that was more than 60 per cent of the vertical measurement of the disc, then it's glaucoma. Now we know that you can have no gap at all and still have glaucoma (if the disc is very small and likewise you can have a gap of 60, 70 or even 80 per cent in a very big nerve and still not have glaucoma).

So, size is very important.

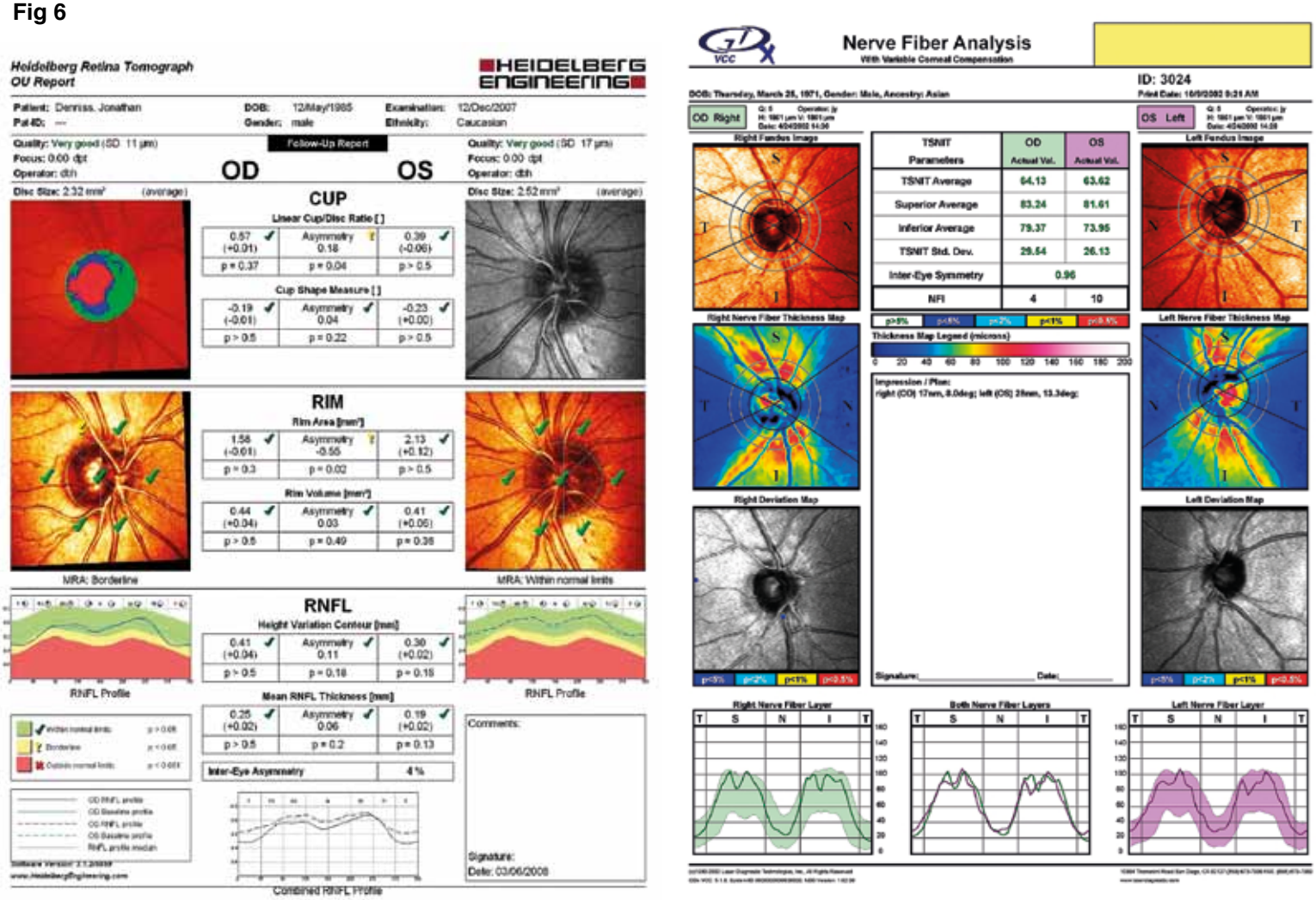
The shape of the rim of the disc is also very important. We know that we should be seeing a thicker rim at the bottom than at the top and then it should be thickest next in the nasal part of the nerve and then temporally.

So, we look for that pattern and if it doesn't fit that pattern, we wonder how some of the nerve tissue had been lost? In other words, has glaucoma damaged the nerve? And we document the pattern. We tend to draw it in the notes or have a photograph taken, so that we can look back the next time we see that disc so see if there has been any change.

Now, we've also got fantastic imaging techniques to look at the nerve and we can take all sorts of lovely different pictures with these instruments.

On page 12 (Fig 6) we show images of an HRT picture and a GDX picture which allow us to look at the structure of the optic nerve and to make measurements. They give us additional information and they can help us see whether the nerve fibre layer is normal or not. However, they can't completely take over the role of the doctor, because somebody has to interpret that test and still to look for change over time.

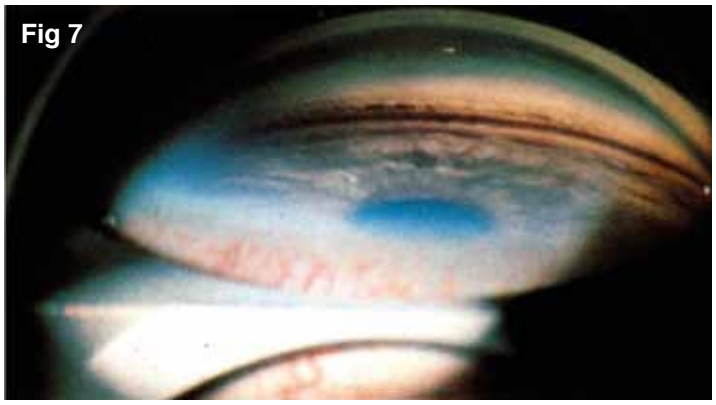
Fig 6



What is gonioscopy?

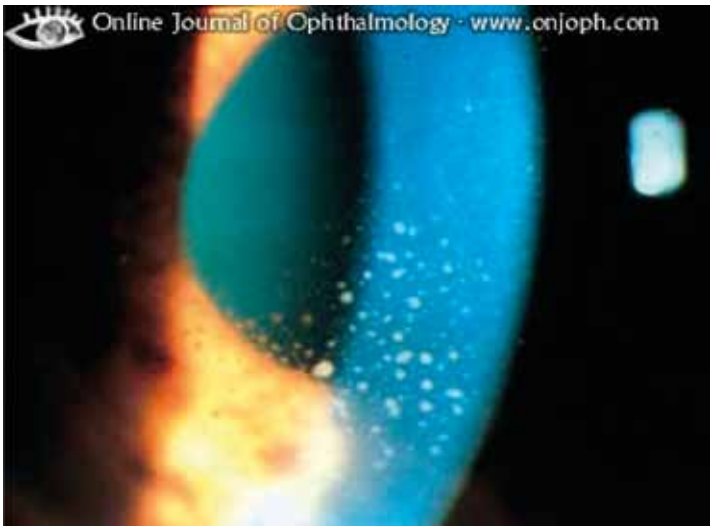
Well, gonioscopy is looking at the drainage angle of the eye. So in this picture you can see the kind of view of the drainage angle we get (Fig 7).

Fig 7



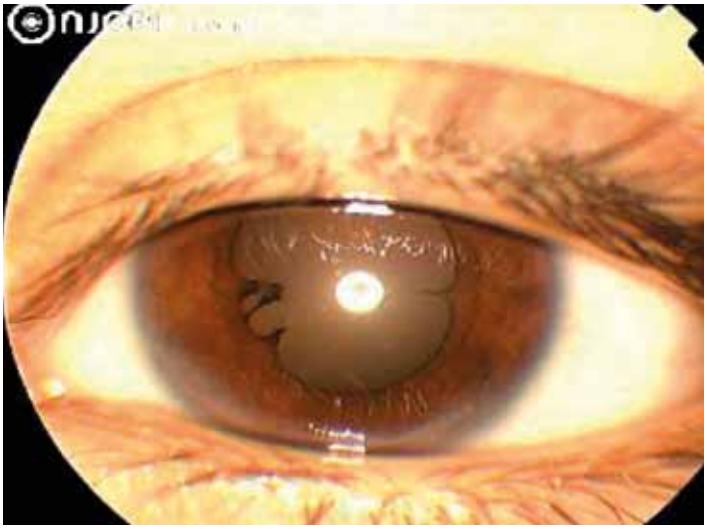
We put a special contact lens with mirrors against the surface of the eye, which overcomes internal reflection and allows us to look backwards and into the drainage angle, so that we can see how open, narrow or closed it may be. OK, so I've said we need to look at your pressure, your nerve and your field. But we also need to look at the front of your eye and these are the kind of pictures and the kind of things we might see if we were looking at the front of your eye on the microscope (Fig 8A-9C). You probably sit there wondering what we're looking at. We can see different changes, so these are some patients who have got different forms of glaucoma. You can see that they've got little dots on the front window of their eye (8A). That shows me that they've got uveitus. They've got inflammation in the eye as the cause of their secondary glaucoma.

Fig 8A



This person has also had inflammation because, you see their pupil doesn't dilate very well. It's stuck down with little strands in places (8B).

Fig 8B



This person has got abnormal blood vessels growing over the iris which can cause a form of secondary glaucoma (8C).

Fig 8C

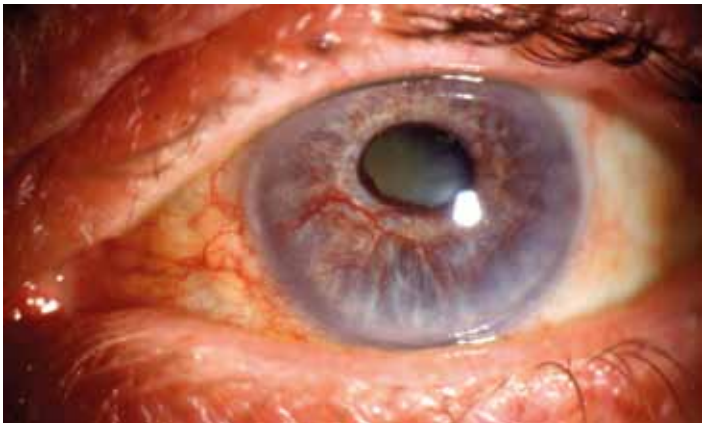
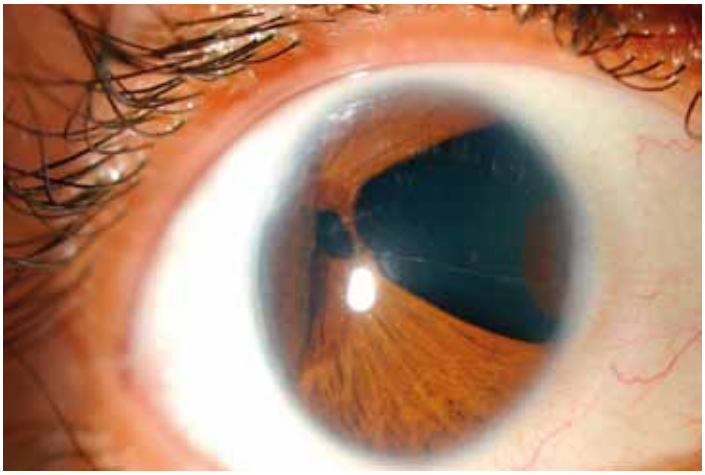


Fig 8D

This is an example of narrow angle glaucoma (8D). By putting a slit beam of light onto the side of the eye, I'd expect there to be a nice little strip of light going through the cornea and then a bit of a gap before the light hits the iris. In this case the iris looks incredibly close to it, so it's extremely narrow.

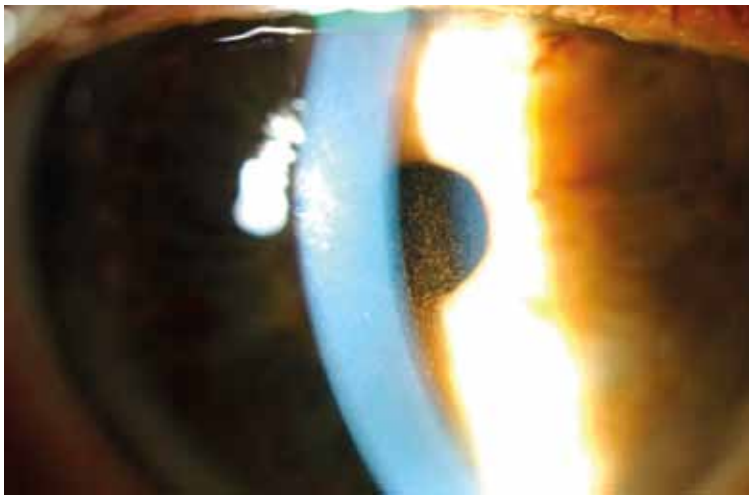
Fig 9A



In this case we have someone whose iris is very abnormal, which is a congenital defect (9A).

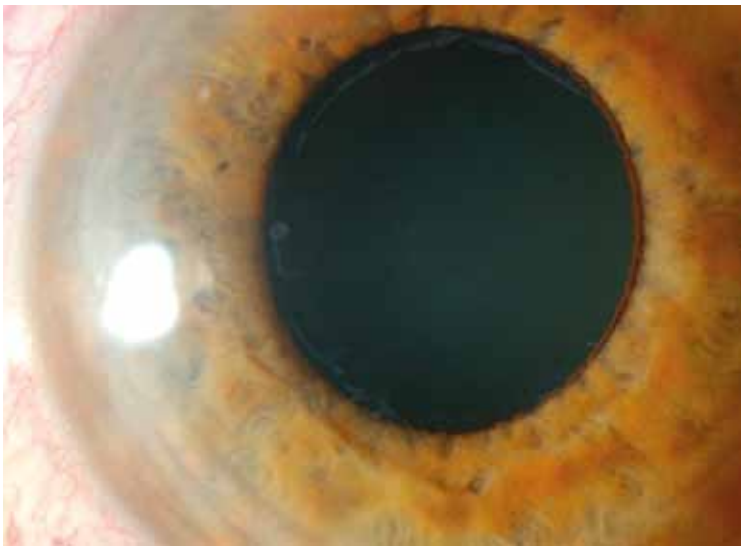
On page 14 (Fig 9B) we have lots of dots, but in this case it is pigment released from the iris in pigment dispersion syndrome.

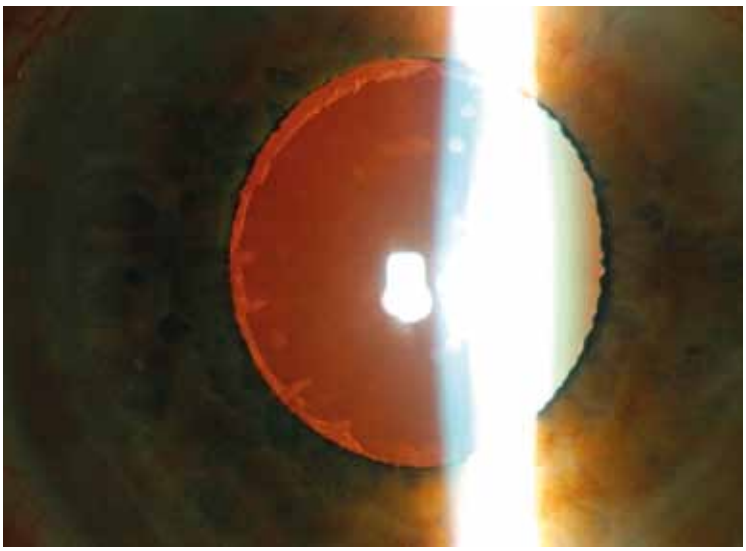
Fig 9B



In these two photographs we have the same eye with the light coming through, so you can see a ring just inside the pupil. This is a condition called pseudo-exfoliation (9C).

Fig 9C





All of these conditions are associated with glaucoma. So when you come to the clinic, we have to look for them and exclude them in order to be able to say that you have primary open angle glaucoma (chronic open angle glaucoma).

So, at the end of putting all that together, the person in front of me generally says “Well, do I have glaucoma?” and I might decide well actually, no, you’ve just got raised pressure in the eye, so we call that ocular hypertension. I might say “Yes, you’ve got primary open angle glaucoma. There’s no other cause for it that I can see, and the angles are open”. I might say “Well, actually within that, you’ve only got normal pressure, so you’ve probably got normal tension glaucoma”. I might say “We’ve found a secondary cause for the glaucoma” or I might say “Actually, we’re a bit suspicious that you’re nerve’s glaucomatous, but I can’t say you have or haven’t got glaucoma, so I’m going to recommend a review and follow you up and look for change”. And then I have to decide whether any of these people need treating? So I have to make a plan.

With a plan we’re deciding about whether we are going to start treatment, or whether we’re going to watch somebody over time, and then decide. We also need to think about when we want to see them again?

Whether we need other investigations?

We might want to set a target pressure. People often say to me "Well, I've got a pressure of x, and this is what happened to me and is that OK?" and the answer is, without seeing all the evidence of fields and discs and understanding if they changed over time no one can say, but we generally have an idea of a target. It may not be an exact number, but a target range that we're aiming for.

So that's the sort of plan we make and we also have some guidance from NICE, which had a working party on glaucoma, which had patient representation from the IGA provided by David Wright (IGA CEO). The group looked at all the evidence and put together guidelines, advising on the tests required, when to treat, which treatment to use and the appropriate monitoring intervals for people at different levels of risk of losing parts of their visual field.

Now the most important time in a person's glaucoma journey could be starting treatment because you've got to learn to put drops in your eyes properly. The time interval is very important, so I tend to say to people they should aim for a one hour time window only.

We need to tell people to remember to get their repeat prescriptions; every week somebody will pop up to the clinic who has run out of drops and not realised they were going to need to continue.

We also need to realise that, for some people, putting drops in can be very difficult. Who puts the drops in? Is it the person with the glaucoma or high pressure? Is it a member of their family? Is it a carer? Is it a friend? Is it a neighbour? There can be quite a variety for lots of people I look after. Maybe people need something to help them with their drops, in which case there are all sorts of aids that can be prescribed or purchased from the IGA or from other places.

So what happens if when you're at home you have a problem with your drops? You have a side effect that's very unpleasant, which means you can't tolerate them? Or you actually have an allergy to them? What happens if when you come back to the clinic they're not working very well? Well we have a number of different classes of drops that work in different ways, so that they may work together to lower your pressure. And we also have different drops within a class. So we may be able to find another one that suits you within that type of drop, or we might be able to find the different type of drop that suits you.

Sometimes, people have allergies to preservatives in drops, or very dry eyes and eyes become very uncomfortable with drops. So we may need to look for preservative-free drops. And some people just can't tolerate the drops. They give them all sorts of problems, and obviously all the side effects on the leaflets we see are experienced by somebody. Luckily, most people don't get them or we wouldn't be using all these drops. But they can be a problem and so we might not use drops, even quite early on in somebody's management and offer laser or surgical treatment instead.

It is very important to get good communication about what's happening with your eye drops, and how easy it is to for you to put them in. Now, I try to not think of myself as scary in clinic, but I know that my patients want to please me, so they don't really want to say to me "Well, actually I don't put the drops in very much; I have a lot of trouble with them". They often feel more comfortable telling perhaps the nurse practitioner in the clinic or somebody less intimidating. Jane (one of our nurses) did a recent questionnaire in our clinic that showed this up very clearly, even though I think I'm relatively approachable, that there were quite a lot of people who found it quite nerve wracking to confess to how often they don't put their drops in, but were able to tell Jane, which is great news because then she can help us look for a drop that's going to work better for that person, or she can look at their technique of putting the drops in or alert us that we might need to think of another treatment.

So, we have to try and find solutions for different people. And the more drops you're on, and the more complex the regime is, then the harder it is to remember them all.

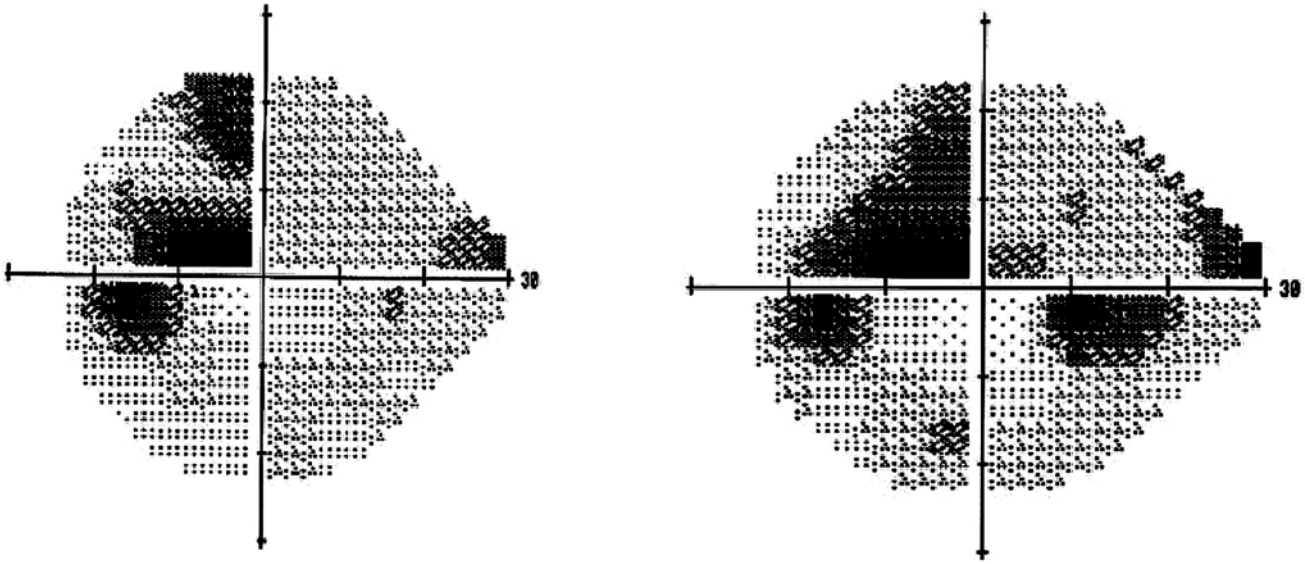
OK, we talked earlier about visualising the drainage angle (gonioscopy) and about open angles during diagnosis, but what about narrow angles? One of the problems with narrow angles is that you may not be able to have your pupil dilated successfully, so we can't get as good an image as we would like when we examine the back of the eye. You're also at greater risk of an acute angle closure glaucoma, so we often suggest laser iridotomy for such patients. This is making a tiny hole in the iris so that we can prevent angle closure and allow us to be able to examine the eye safely and once that's been done, then any raised pressure that's still present in the eye, we can treat just as we would a primary open angle glaucoma.

So now I've said to you, in your journey, you might have been diagnosed with high pressure or glaucoma, you might have been started on treatment and we've checked that you're getting on with

that treatment OK, and it's working for you. But what next? Are you going to have the tests repeated again? Well we need to look for change, so when you come back we will repeat some or all of the tests, so we can see if the treatment is fully effective.

These two visual fields (Fig 10) are from the same eye of the same patient, some time apart and you can see that the area of loss is a bit bigger.

Fig 10



This is somebody whose field has progressed, so it gives us evidence of change and we need to get a lower pressure than we had before. So we then try to achieve that with drops or with other treatment and then once we have achieved it, we then go back and monitor again to make sure no more change happens. So that's what we're trying to do in the clinic. When we look at the nerve in the eye, we might see changes in the nerve fibre layer, we might see a pin point haemorrhage or something else that shows us that the pressure is too high for this individual patient.

There are, of course, further options for treatment. If drops are not enough to control pressure, then we can use laser treatment and surgical treatments and there are other newer treatments 'in the pipeline' using ultrasound, but those will have to wait for another lecture – I only mention them because it is important to know that there are always options to help protect your field of vision.