Visual field defects in glaucoma

How the brain fills in the blanks

Glaucoma is referred to as a ‘silent thief’ as symptoms of the early stages of glaucoma are usually not readily noticeable. People with glaucoma often do not realise that there is a problem with their vision until the glaucoma has become advanced. This sometimes causes problems in people who have already been diagnosed with glaucoma. Lack of awareness that there is something wrong, or lack of symptoms, at least in the early stage, may result in less motivation to attend regular eye examinations, or put up with the inconvenience of eye drops. So why is it that people with glaucoma are not aware of a visual field defect? It is thought that their brains are filling in the blanks!

The brain appears to be filling/blending-in small visual defects as best it can by using the signals from any healthy surrounding retinal nerves. Indirect evidence for this comes from detailed accounts of people who have temporary or permanent visual field loss from other conditions such as migraine. You can try this filling-in process out for yourself with a simple test (Figure 1) which simulates the presence of a small visual field defect. A study used this test with healthy volunteers and found that it took on average 5 seconds for this defect to be filled-in. You may assume that movement, either of the eyes or of the background scene, when in a moving vehicle for example, would present more of a challenge to the brain’s ability to perform this filling-in. However, other studies suggest that movement actually helps the brain to fill-in defects more easily.

Continued over page...
So what does this mean for people with glaucoma? You may be familiar with being shown your visual field test results with glaucoma and seeing grey and black areas indicating areas of visual field loss. Many widely available pictures (see Figure 2 a, b) try to simulate the visual field of someone with glaucoma damage by taking these grey and black areas we see on the visual field printout and superimposing it onto a picture. However, as we have now learnt, because of the ability of the brain to fill-in the blanks, this is not exactly how a glaucoma patient would see the world through their eyes!

A more accurate representation comes from a Belgian ophthalmologist who created the following scene from the viewpoint of someone driving along a residential street, and attempts to show how a person with normal vision, early or moderate glaucoma damage would perceive the same scene (Figure 3 a-c).

As the glaucoma damage progresses, it reaches a point at which the brain is unable to fill-in the blanks convincingly. It is at this point that people with glaucoma first notice that they have a problem with their vision. People with defects which are close to the centre of their visual field could have symptoms at an earlier stage. In particular, they may describe missing out words on a page as they are reading because the brain fills these defects in, but without producing sensible text.

This understanding of the nature of visual field defects in glaucoma emphasises the need for regular eye examinations and ongoing use of prescribed eye drops even if glaucoma patients are not aware of a significant problem with their vision.


For New Readers
To those of you who have joined Glaucoma NZ since the last issue of Eyelights, we welcome you!

For your information here are some basic facts about glaucoma:

People of all ages can get glaucoma.

There are different types of glaucoma, but they all involve damage to the optic nerve, the nerve of sight, which is at the back of the eye.

Glaucoma is not curable. If you have glaucoma it must be monitored for the rest of your life.

A family history of glaucoma means you are at much greater risk of developing glaucoma.

Current treatments for glaucoma aim to lower eye pressure.

Medication in eye drops can have side effects on other parts of your body. Tell your eye specialist if you notice any change in your general well-being since you started the eye drops.

If you have glaucoma tell your relatives, especially those close relatives like sisters, brothers and adult children. They have an increased risk of developing glaucoma so advise them to have an eye examination.

Glaucoma NZ is a registered charitable trust which receives no government funding. We rely solely on donations, sponsorship, grants and fundraising. All the information available to you from Glaucoma NZ is free.
The Glaucoma Journey – Part 2

So, you have never heard of glaucoma before and now you have been diagnosed with it. You have many questions you would like answers to. Concerns about your future eyesight raise the fear of blindness.

This article is Part 2 of a series of three where we will look at ‘The Glaucoma Journey’. Part 1 explained what glaucoma is, who is at risk and the importance of early detection. In Part 2 we look at how the diagnosis of glaucoma is made, what tests take place and the different types of glaucoma. Part 3 will look at the treatments available for those with glaucoma, why one treatment may be recommended over another and what decisions may require further consideration.

What is involved in diagnosing glaucoma?

There are a number of tests that will be undertaken when checking for glaucoma including:

Examination of the optic nerve - special instruments are used to look at the back of your eye (where your optic nerve is) – a slit lamp or an ophthalmoscope. This enables an assessment of the health of your optic nerve by looking at the cup, colour and contour of the optic disc.

The size of the optic cup compared to the size of the disc is expressed as a cup-to-disc ratio (C-D ratio). There can be a wide range of “normal” optic cups and the cup shape can vary in appearance from circular to slightly oval.

The colour of the nerve fibres is assessed. They are normally an orange-yellow colour, with the cup appearing more yellow-white.

The contour of the optic disc is determined by the evenness or regularity of nerve fibres around the cup.

The presence of small haemorrhages (bleeds) at the optic nerve may indicate damage from glaucoma.

Eye pressure check – Pressure inside the eye is produced by the circulating fluid known as aqueous. This fluid is necessary because without it the eyeball would shrivel up like a raisin. However, sometimes the pressure is too high inside the eye. This elevated pressure can contribute to the development of glaucoma. Most eye pressure measurements are taken when the eye’s drainage canals resist the outflow of fluid. This results in the pressure in the eye increasing because the fluid cannot drain out of the eye. Every eye has a different pressure it can tolerate. Glaucoma occurs when the pressure rises beyond a critical level for that person. Most people have no symptoms and no early warning signs.

Angle Closure Glaucoma occurs if the path of fluid to the angle becomes blocked. Fluid will continue to be produced at a normal rate but will not be adequately drained, allowing the pressure in the eye to build up to a harmful level. The angle may not be allowing sufficient outflow for a variety of reasons. If a person is born with a narrow angle, it will become even narrower with age. This most commonly presents as sudden onset of pain, nausea and possibly vomiting. The vision usually blurs and the pupil can become slightly bigger. However, there is also a silent form of angle closure glaucoma.

Pseudoexfoliation Syndrome occurs when the trabecular meshwork, (the sponge which drains fluid out of the eye), becomes blocked by flaky, white material. It is estimated that Pseudoexfoliation Syndrome accounts for about 25% of glaucoma worldwide.

Pigment Dispersion Syndrome is another condition in which the trabecular meshwork, (the sponge which drains fluid out of the eye), is unable to function properly. In Pigment Dispersion Syndrome black pigment granules clog the meshwork, which prevents fluid from draining properly. People who are short-sighted (myopic) are at higher risk of this type of glaucoma. This type of glaucoma tends to affect men more often than women.

Paediatric Glaucoma - children can also get glaucoma. In many cases the cause is genetic, but sometimes Paediatric Glaucoma can occur after cataract surgery or following trauma to the eye, or ocular inflammation.

If you have been diagnosed with glaucoma, your eye specialist will tell you which type you have, and prescribe the most appropriate treatment for your particular condition.

Any feedback you have on these articles would be appreciated – it is your stories that help others realise they are not alone in their concerns and fears as they face this lifelong potentially blinding disease and make decisions as to how to manage it.
July is Glaucoma Awareness Month

To help raise awareness of glaucoma and prevent more unnecessary blindness, Glaucoma NZ is once again holding its nationwide Awareness Appeal in July.

The purpose of the Appeal is to highlight the risks associated with glaucoma, importance of early detection, ongoing management and treatment, as well as raising vital funds to enable Glaucoma NZ to continue to extend its free nationwide education and research initiatives.

Be on the look-out for our donation boxes containing specially designed lens cleaning cloths and pens for a donation at participating optometrists, ophthalmologists, pharmacies, ASB Branches and others around the country. To see a list of participants visit www.glaucoma.org.nz or phone 0800 452 826.

As the population ages and people continue to live longer, it’s estimated that 76,000 people in New Zealand will have glaucoma by 2031. 50% of people with glaucoma don’t know they have it, as it slowly steals their vision. Most people experience no symptoms until it is too late to repair the damage that has been progressively getting worse over a long period of time.

Early detection of glaucoma is vital when it comes to preventing blindness and we urge everyone to be vigilant about their eye health and follow the ‘45 plus 5 Rule’. From the age of 45 have an eye examination for glaucoma every 5 years, and then every 3 years from the age of 60.

However, at any age, if you notice changes in your eyesight you should have your eyes examined at that time. For example, if you need hobby glasses, it would be a good idea to have your eyes checked by an eye health professional just in case there is a problem.

It is also really important for people to know if glaucoma runs in their family, because if it does, your risk increases ten-fold.

Glaucoma can’t be cured. Once the vision is gone, you can’t get it back. Modern treatments like eye drops can halt its progression and preserve the sight that is left. That’s where compliance is so important.

Early detection is the first step. 98% of those who comply with their prescribed treatment will not go blind.

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We hope to improve how effectively glaucoma is recognized and treated in both the developing and developed world.

What do you think are the most important advances in glaucoma over the last decade?

The improvement in how we image the inside of the eye promises to bring a more accurate diagnosis and measurement of the effect of treatment. Patients particularly appreciate that the newer imaging techniques are less painful than the bright light flashes of older photography. The prostaglandin eye drops brought once per day treatment, which is much easier for patients to remember, and they are more powerful at lowering eye pressure than older drops, with fewer side effects. Our visual field tests, as bad as they seem to patients, were shortened by half the time each eye takes for testing, without losing any accuracy. A newer method to begin and finish the major operation for glaucoma ( trabeculectomy) has decreased an infrequent but serious complication - late infections of the eye after surgery.

What do you think will be the direction of glaucoma in the next 20 years?

Without question, we will develop treatments for glaucoma that involve something different from lowering the eye pressure. Tests that measure the structures inside the eye will make it easier to tell if the patient is doing well or getting worse. One-time or infrequent deliveries of medicine (like once per year) will replace daily eye drops to lower eye pressure. Better forms of surgery that have higher success rates and fewer problems will be developed.

What do you think is the greatest challenge for glaucoma patients?

Patients have great difficulty remembering to take eye drops for glaucoma. And the scary...
thing is that they don’t know they’re forgetting to take them. We have monitored electronically the eye drop bottles to see how often drops really are taken. Patients who think that they “never forget” are actually missing one out of 3 drops - putting their eyes at risk for damage that should not happen. For this reason, I wrote a book for patients “Glaucoma: What Every Patient Should Know” which gives a lot of information about the disease and how to take, and to remember to take, drops. It also has sections on how to help one’s family avoid glaucoma damage and the roles of surgery, laser, and alternative medicines.

“Glaucoma: What Every Patient Should Know” can be can be ordered through Amazon.com

Macular Degeneration vs Glaucoma

These eye diseases are very different.

Are there any similarities?

Yes. Firstly both diseases get more common with increasing age. Secondly they both are capable of causing blindness.

How about the differences?

The macula refers to the area on the retina that is specialized for seeing fine details. It is 6mm in diameter and lines up with the direction of gaze i.e. it lies on the visual axis. Macula means “spot” and so the macula appears as a dark spot in the centre of the retina of which it is a small part. The eye chart with its letters of decreasing size tests how well the macula is working.

With increasing age the macula can wear out and what used to look like a smooth dark spot in the centre of the retina now has irregularities or blemishes. This is the early evidence of macular degeneration. In the early stages these are visible to the doctor but usually don’t affect the vision at all. As the macular degeneration worsens the vision becomes affected. This is experienced as difficulty with reading or distortion of straight lines or both. The type of vision affected is central vision; the vision required for reading the eye chart, recognizing faces and all fine work. It is usually very obvious. Treatments are available for the some types of macular degeneration once the vision is affected.

Glaucoma affects the optic nerve, the nerve of sight. The optic nerve carries all the electrical impulses from the retina, including those from the macula to the brain to create visual images. In glaucoma the optic nerve wastes away slowly. In all but the advanced stages the sufferer is not aware of this. This is because the vision lost first in glaucoma is side vision (and not central vision as with macular degeneration.) The central vision nerve fibers are usually the last to be damaged in glaucoma. Generally people are not aware of losing side vision. Even though you think your vision is one integrated whole in actual fact it is not. Those with glaucoma who have lost side vision are not necessarily aware of it because the mind paints the world in (see front cover article). Take the blind spot for instance. Every one has a blind spot and if you actively search for it you can find it. But you are otherwise not aware of the blind spot because the brain fills in the gap. Visual field tests are undertaken to determine the extent to which the side vision has been degraded and reference the effectiveness of glaucoma treatments.

Readers Story

‘Suzanne’

I am 74 years old and live in Richmond, Nelson. Our family were farmers, originally in Southland, and we moved to the Nelson area in the 1980’s. I have always enjoyed an active lifestyle, despite having double hip replacements in recent years, and my hobbies in retirement include golf and gardening.

Six years ago, I knew there was something wrong with the vision in my left eye. My optician said there was a problem with my optic nerve, and advised me to see a specialist, which I then did. The specialist diagnosed a ‘small haemorrhage’ around the nerve, and said it may improve with time. After 4 repeat visits every 3 months, I noticed that the ‘banana-shaped’ black zone where I had no vision was getting bigger.

We then moved districts to Richmond. When I saw a specialist at Nelson Hospital a diagnosis of open-angle glaucoma was made. I was 72. My pressures were 29 and 30, and for 3 months I had drops in both eyes, but there was not much improvement. Following further unsuccessful trials with alternative drops, the specialist then advised that I have a trabeculectomy operation, one eye at a time. In 2010 I had the first operation on my left eye – what a steep learning curve! I had the second operation on the right eye in April 2011. What marvellous treatment I received from the hospital staff through all this, as I was sometimes there twice a week.

On my last visit mid April, my pressure was 14 in the left eye, and I use the Timoptol drops in that eye daily. Pressure in my right eye was 10, so no drops at the moment.

I will not regain the sight loss in my left eye, but hopefully now I will retain the sight I still have. My advice is to see a specialist as soon as possible if you have a family history of glaucoma, or notice any abnormal vision problems. Delays can lead to irretrievable loss of sight. I didn’t think there was a family history of glaucoma, but my paternal grandfather was clearly vision-impaired at 50 years old, since he used a white stick. My younger sister, now 69, has also been diagnosed with glaucoma upon my advice to ‘get tested’ and she is on drops that have so far worked for her.

Well done Nelson Hospital for all the excellent treatment I have received from the whole team in the Eye Department, especially your good humour and encouragement.

I hope to get back to gardening and golf with a vengeance soon!

A grateful patient.

Readers Story Contributions

If you would like to share your glaucoma story with readers, we would love to hear from you. Please email, post or fax your story to Glaucoma NZ, attention EyeLights Editor.

Moving House?

Don’t forget to advise Glaucoma NZ of your new address.
What are hobby glasses and how do they work?

Hobby glasses are magnifying spectacles that you can purchase over the counter at various retailers. They all have one feature in common: the same lens magnification power for each eye. If your eyes see best with a +2.00 lens then hobby glasses of +2.00 DS will give you good vision in each eye. However if your eyes require a different lens for each eye, e.g. +2.00 DS for the right eye and +1.00 DS for the left eye then these spectacles are not for you as they will give an imbalance in the focusing between the two eyes. If your eyes have astigmatism hobby glasses cannot correct that for you.

However reliance on hobby glasses for many years may lead to some people not having an eye examination before they are well into their 60s or 70s. When you present for an eye examination before they are well into their 60s or 70s. When you present for an eye examination before they are well into their 60s or 70s. When you present for an eye examination for reading glasses, the routine eye check should also address your risk factors for glaucoma and test whether you have glaucoma. This of course will not occur if you always purchase over-the-counter hobby glasses.

Public Meetings 2011

Glaucoma NZ’s free public meeting programme is well underway with meetings already held in Thames, Nelson, Whangarei, Palmerston North, Havelock North, South Auckland, and Paraparaumu. These meetings are extremely popular and informative so plan to attend when there is one in your area.

Upcoming Meetings:
- 9th July – Auckland Central – 10am
  Alexandra Park Function Centre, Greenlane Rd West, Greenlane
- 16th July – New Plymouth – 10am
  Plymouth International Hotel, Cnr Courtenay & Leach Sts
- 13th August – East Auckland – 10am
  St Columba, 480 Ti Rakau Drive, Botany
- 10th September – Snells Beach – 10am
  Mahurangi East Community Centre, 21 Hamata Rd, Snells Beach
- 1st October – Taupo – 10am
  St Andrews Church Lounge, Titirauenga St, Taupo
- 5th November – Takapuna – 10am
  Channelview Lounge, Mary Thomas Centre
  3 Gibbons Rd, Takapuna, Auckland

To keep up to date with our Public Meeting programme please visit www.glaucoma.org.nz

Glucoma NZ will provide a Certificate of Participation or a Certificate of Achievement depending on whether or not you sit and pass the multiple choice examination posted on the website early September.

For a full explanatory letter and enrolment options please visit www.glaucoma.org.nz

From everyone at Glaucoma NZ – thank you Doug! We will be following your journey.

Photo supplied by
The Daily Post, Rotorua
July Annual Awareness Appeal

PLEASE support us in our mission to eliminate unnecessary blindness from glaucoma in New Zealand. An estimated 68,000 New Zealanders over the age of 40 currently have glaucoma. 50% of these people don’t know they have it.

We have reached thousands of New Zealanders with our programmes but there is still much more to be done:

Public Meetings, Workplace/Community Seminars, Educational Resources, 0800 Advisory Service, Eyelights Publication, Health Professionals Education Programme, Research and Advocacy

It is vital that we continue to maintain and extend our nationwide initiatives but we can’t do it without your help.

Your support is important to us.

THANK YOU for your generosity – every donation counts!

YES! I would like to make a donation to the July Annual Appeal.

☐ $200  ☐ $100  ☐ $50  ☐ $20  ☐ $______ (other)

Name ________________________________

Address ____________________________________________ Postcode______

Phone No _______________ Email ____________________

☐ I enclose my cheque made payable to Glaucoma NZ

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Expiry Date ____ / _____ Signature ______________

Donations of $5.00 or more are tax deductible and will be receipted.

YES! I would like to receive more information about:

☐ Donating on a regular basis by Automatic Payment

☐ Leaving a bequest in my Will to Glaucoma NZ

☐ I have already included Glaucoma NZ in my Will

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