

Current Trends in the Diagnosis of Optic Nerve and Retinal Disease in Optometric Practice

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Introduction

This lecture will review some conventional methods for diagnosis of various conditions, most of which are commonly seen in practice by optometrists, and some selected advanced methods of diagnosis which are increasingly being used by optometrists in primary care practice.

We will look at three broad “categories” of ocular fundus conditions:

1. Optic Nerve

- (a) Primary Open Angle Glaucoma (POAG)
- (b) Raised optic nerve head and

2. Macular Disease

3. Other retinal and choroidal conditions

We will review how sophisticated imaging techniques can assist the optometrist and thereby provide patients with an enhanced level of care. Not all practices have or will, in the future, be equipped with some of this technology to be discussed. Nevertheless, this lecture will also offer delegates with some insight of relatively minor changes to their routine to enhance the diagnostic care they provide their patient particularly with regard to assessing the optic nerve with respect to POAG.

1. Optic Nerve

(a) Primary Open Angle Glaucoma

Glaucoma detection

95% of all primary eye care examinations in UK carried out by optometrists. Even with visual field checks, glaucoma detection can be **very** difficult in the early stages. Failure to diagnose glaucoma is reflected by an apparently increasing rate of litigation in the UK against optometrists.

Conventional glaucoma “screening” is carried out by checking one or more of three clinical signs namely intraocular pressures, visual fields and optic nerve head appearance.

These are not listed in order of importance. Indeed, intraocular pressure measures are an extraordinarily insensitive and unspecific measure for detecting glaucoma. Some 20 to 30% of patients with glaucoma have pressures within the “normal distribution”. This realistically means that

if optic nerve assessment is not skilled and visual fields are not assessed, a large minority of the glaucoma population will be missed at the eye examination.

A new method of checking intraocular pressures is the Pascal Dynamic Contour tonometer. This is designed to compensate for corneal thickness, thereby reducing the effect of corneal rigidity on the measurement. Studies suggest that it correlates to true pressure readings taken by measuring through a canula inserted into the eye (animals). The method is easy to use, the technique being akin to Goldmann applanation tonometry. The instrument also gives the “pulse” pressure – the range of IOP that occurs with the diastolic-systolic cardiac cycle.

In terms of assessing the optic nerve head we will see that cup-disc ratio is not the simple indicator of risk or normality that we have possibly previously assumed. Certainly, slit lamp microscopy provides a better assessment than with direct ophthalmoscopy because it provides (for most optometrists) a stereoscopic view of the optic nerve and practitioners switching from direct ophthalmoscopy will often find that they have been underestimating the cup to disc ratio, sometimes significantly so. Dilated pupil enhances the view and helps judgement but mydriasis is not always necessary by any means and with practice a good stereoscopic view may be suitable for screening. Subsequent dilation may be necessary to assist in a diagnostic decision.

Cup disc ratio cannot be used to rule in or out glaucoma.

Some patients with a C/D of 0.2 have glaucoma; others with 0.8 do not have glaucoma.

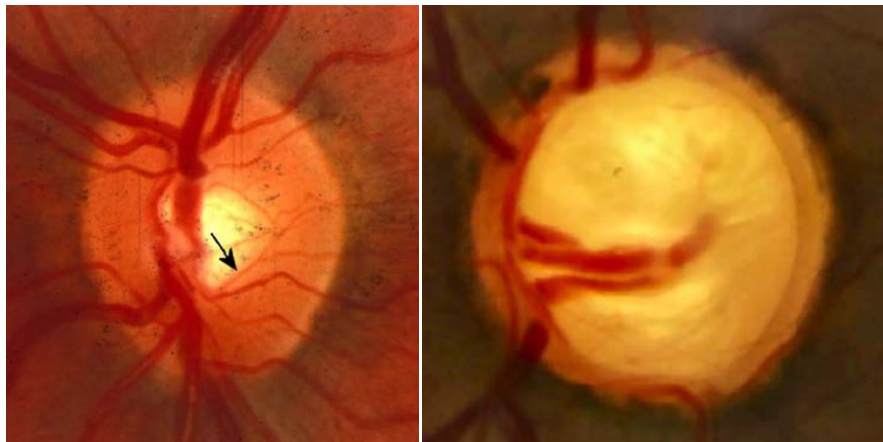


Figure 1. Which is the glaucomatous nerve?

Evaluation of disc size is essential part of optic disc assessment for the diagnosis of glaucoma (Hoffman et al, 2007). Visualising the optic nerve with a Volk 66D produces an image of 1x magnification. It is relatively easy to use the measuring scale on slit lamp beam to assess the diameter.

Technology for assessing the optic nerve

Examples of current technology include:

- Scanning laser tomography (HRT II)
- Optical coherence tomography (OCT)
- Scanning laser polarimetry (GDx VCC)

- Talia optical coherence tomographer

Scanning laser tomography

The scanning laser ophthalmoscope (SLO) provides a high quality image of the fundus using < 1/1000th of light necessary to illuminate fundus with conventional light ophthalmoscopy.

Only one point on fundus is illuminated at any one time, and the laser sweeps across the fundus in a raster-like fashion building up a piece-by-piece image of the fundus

An example of this technology is the HRT II.

Optical Coherence Tomography

Optical coherence tomography (OCT) is a non-contact technique for high-resolution cross-sectional optical imaging of ocular structures

OCT is analogous to ultrasound, except that OCT measures delay and intensity of back-reflected infrared light, rather than acoustic waves.

The velocity of light is extremely high, so direct measurement of optical 'echoes' cannot be made electronically as in ultrasound. The technique to measure the back reflected light time delay is based on Michelson interferometry.

There are a number of OCTs available. The author is experienced with the Carl Zeiss Meditec Stratus OCT and the Talia RTA. Newer technology still is produced by Topcon and Carl Zeiss Meditec, the Cirrus OCT giving even better resolution.

The Stratus OCT

The Stratus OCT™ (Carl Zeiss Meditec) is a commercially available OCT and is in use in a number of hospitals in the UK. The latest generation, the Cirrus is now available giving enhanced diagnostic capabilities. Partially coherent light of wavelength 820 nm generated by super luminescent diode source. Patient scans are compared to normative dataset. For glaucoma patients, there are two algorithms for optic disc assessment: (a) retinal nerve fibre layer analysis and (b) optic nerve head analysis.

GDx Vcc laser polarimeter

This instrument uses laser scanning polarimetry to measure the amount of reflected polarised light returning from the retinal nerve fibre layer which has birefringent properties. Data is displayed to provide values compared to normative data. A nerve fibre index gives a figure for "risk". Comparisons of repeated tests over time provide invaluable information on change or progression of pathology.

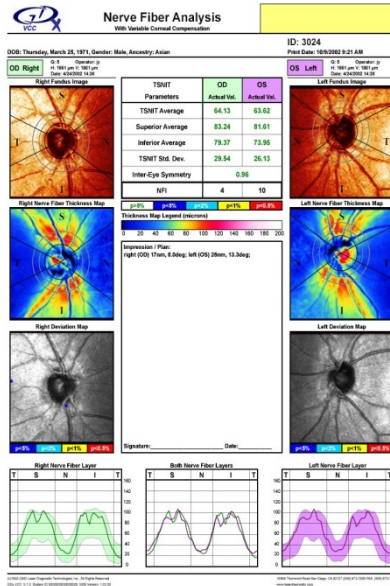


Figure 2. GDx Vcc results

Talia RTA

A combination of fundus camera and green laser scanning ophthalmoscope, this instrument provides the clinician with combined data for analysis of disc topography, retinal nerve fibre thickness analysis for glaucoma, retinal thickness map (macular changes and for diabetes), retinal vessel analyser as a predictor for stroke.

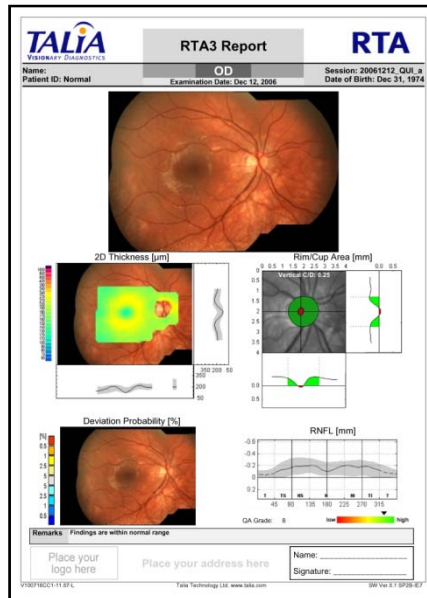


Figure 3. Talia RTA

A major advantage of the Talia RTA is that one instrument provides not only a retinal photograph but screening for glaucomatous damage and macular changes. When suspected anomalies are

detected, this alerts the optometrist to either undertake further investigations or refer the patient. This is an ideal screening instrument for practices that do not have a GDx or OCT.

None of these instruments used on its own is *diagnostic* (e.g., Hsin-Yi et al, 2007).

Each provides measurement information that should be evaluated in the context of other clinical information, such as intraocular pressure level, visual field status and risk factors for disease.

Conclusions

Open angle glaucoma is characterised by retinal nerve fibre loss and changes in optic nerve structure. **25-50% of patients with glaucoma have “normal” IOPs.** By the time a visual defect is present a large amount of damage has occurred. Careful examination of optic nerve head is necessary (preferable stereoscopic with SL).

It is important to measure optic disc diameter and be aware that RNFL assessment will assist in earlier diagnosis.

Because of the difficulties in relying upon IOP and optic nerve head appearance it can be argued that it is advisable to carry out visual fields on all patients over a chosen age.

Swollen nerve

Raised optic nerve heads are common and subtle signs are often visible with slit lamp BIO. It is important to document appearance for future comparison. This is helpful for disease detection and diagnosis.

The dilemma is whether a swollen nerve head – is normal. There are various differential diagnoses:

Congenital crowding of ON – pseudopapilloedema

A relatively common condition reportedly more common in hypermetropes (“small eyes”) but also seen in myopes. Congenitally crowded discs will not cause visual field defects but testing visual fields in children can be a challenge. There will be no haemorrhages present in pseudopapilloedema.



Figure 4. Congenital crowding or pseudopapilloedema

The presence of spontaneous venous pulsation is reassuring.

Drusen

Caused by hyaline deposits, sometimes completely buried and at other cases visible on the surface of the nerve head. These deposits can impinge on nerve fibres thereby giving rise to any manner of visual field defect. Splinter haemorrhages can also occur. The condition can be progressive. Unlike papilloedema or papillitis, the nerve head is often pale due to the hyaline rather than hyperaemic.

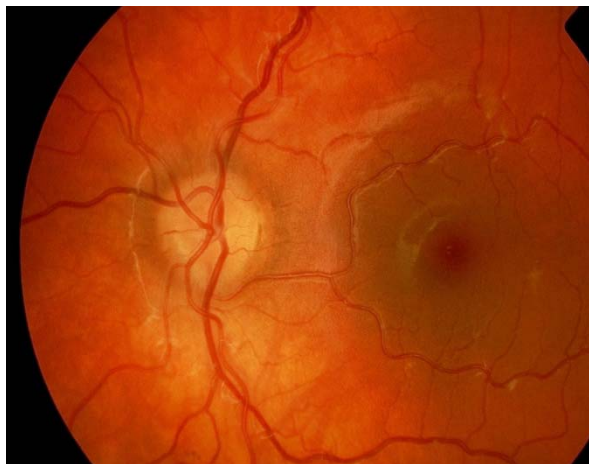


Figure 5. Optic nerve drusen

“Choked disc”

Papilloedema

A passive swelling of the optic nerve head due to either raised intracranial pressure or malignant vascular hypertension (Grade 4 hypertension) caused by untreated hypertension or conditions such as phaeochromocytoma.



Figure 6. Papilloedema

Apart from a raised, hyperaemic nerve head, haemorrhages and exudates will often develop. However, these changes may not be sudden but due to a slow, progressive pathology. Therefore, papilloedema may be present in the absence of haemorrhages.

An enlarged blind spot may be present to visual field testing but VA may not be affected until late stage.

Optical coherence tomography is invaluable in differentiating papilloedema from congenitally crowded disc. Not only will the optic nerve head be observably raised but the RNFL may be thickened due to peripapillary oedema.

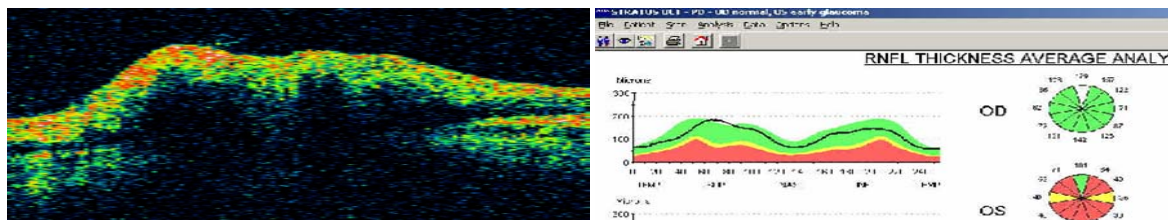


Figure 7. The use of OCT for differential diagnosis

Papillitis

Papillitis is a true inflammatory swelling of the optic nerve had appearing ophthalmoscopically as very similar to papilloedema. Indeed, until a diagnosis is confirmed, the term “choked disc” is better employed. Helpful for differential diagnosis is that even in the early stages, visual acuity, colour vision and central visual fields will be affected. This compares to papilloedema where visual acuity, colour vision and central visual fields (apart from a large “blind spot”) may remain normal until the condition is advanced.

2. Macular disease

A number of case histories are presented to show a variety of macular conditions seen by the author in practice. These include pseudo holes, full thickness holes, vitreoretinal traction and post cataract surgery macular oedema.

The author finds the use of optical coherence tomography invaluable for those patients with slightly reduced visual acuity and early cataract. Tomography can be used to rule out major macular conditions. Referral for cataract surgery can then be made with an enhanced prognostic prediction.

The prevalence of post cataract surgery macular cystic (o)edema (CME) is just under 2% of cataract procedures (Schmier et al, 2007). The author has had referred to him by ophthalmologists a number of post cataract CME.

Early detection of macular pseudo-holes (or lamellar holes) in the early stages using optical coherence tomography can prove critical in terms of preserving sight. Early surgical intervention can prove beneficial but fast tracking patients without clear evidence of the diagnosis can be problematical. Referring a patient along with scans can help the ophthalmologist decide on urgency.

3. Other retinal and choroidal conditions

Case examples are presented to illustrate choroidal naevus, epiretinal membrane and choroidal detachment.

Not all sudden loss of central vision from a macular lesion is due to wet macular degeneration. A case example presented here shows an acute choroidal detachment at the macula.

Take home messages

1. Measure optic nerve head **size** and not just CD ratio
2. Be aware that 30% of glaucoma patients have “normal” IOPs
3. Understand that this is a reason for very careful optic nerve head evaluation using slit lamp microscopy
4. Be aware that a large amount of nerve damage has occurred before the earliest visual field defects show up on full threshold visual field testing
5. Understand that retinal analysis techniques are available for early diagnosis and investigation of retinal disease
6. Equipment such as the Talia RTA is designed to incorporate as a screening tool in primary care optometric practice.

References & Further Reading

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