Synapse

Design and nature

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January 2013 (2)

Dear Colleagues

In January we typically plan for the year ahead. What are your practice goals for 2013? What are your personal aspirations? 'Greener' living is something we should all aspire to, whether you do it to feel virtuous, to save money or to save the planet, forecasters say that the eco trend will be feature strongly this year. The 'reduce, recycle and re-purpose' trend matches the retro or vintage styles that we've seen in fashion, eyewear and decor. With that, there's a return to all things natural.

Wood-look, wood trim and complete wooden frames have been seen in Europe. Closer to home, Hout offers handmade, bespoke wooden frames. See www.hout-online.co.za

Wooden décor solutions are simple, quirky and remind us of a time when things were simpler. Fashions and styles of the 1970s are back in vogue. Children are being encouraged to exchange violent and imaginationless digital games and return to old fashioned toys such as Bolling's wooden ducks and Eames' plywood elephant, both of which have been re-released now, decades after they first hit the market.

See page 5 for a few nature inspired suggestions for your practice. Our CPD article is on evaluating the optic nerve head, with the questions, as always, on the last page.

In the last issue I mentioned that Rieger's anomaly, which carries increased lifetime risk of glaucoma, may look like a pediatric arcus senilis. Here is a website where you can enter signs & symptoms and get a list of possible hereditary conditions responsible.

If you did not receive the January (Back to school) issue, please contact optometry@synapse.org.za

Regards

Nina Kriel

Prism pointers

The ANSI standard for prism tolerance in spectacles is 0.6Δ (prism diopters) horisontally. Our eyes can converge or diverge that amount if necessary but independent vertical movement of the eyes is much more limited, and we almost never see it clinically. The vertical prism tolerance is therefor smaller: 0.3Δ.

Why do we measure PD so accurately on every patient, but mark the optical centres less consistently? For multifocals, bifocals and high Rx lenses, we always mark the optical centres (OCs), but for most single vision lens Rxs it's acceptable that the lab places the OCs at the same height. That way, if there is prism, it's yoked prism which is readily tolerated. In fact, multifocal lenses all have yoked prisms to make them thinner. Always check that OC heights are the same and there is no vertical prism in spectacles before dispensing. It takes very little prism to cause asthenopia.

Analysing the Optic Nerve

Optic nerve disease can affect any portion of the nerve resulting in changes to both the nerve structure and nerve function. Analysing the nerve in terms of structure and function gives us insight into the consequence of disease and the response to treatment. In essence we can better answer the following questions:

1. Is there optic nerve disease present?
2. What impact has that disease had?
3. Is that disease progressive?

When affected by disease, optic nerve structure and function don't necessarily alter in tandem. Function can be lost when axons are reversibly inhibited by disease. This function may later return. Function may be lost permanently when a threshold number of axons are lost. Such loss is irreversible, but the relationship is not linear. Quigley demonstrated that nearly half of the ganglion cells can be lost before corresponding repeatable visual field defects are present in patients with glaucomatous optic neuropathy.

Analysing Structure

Optic nerve structure can be defined many ways – clinically, photographically, using quantitative measurement of retinal nerve fibre layer (RNFL), and radiologically.

Clinically, we can attempt to quantify swelling, cupping, pallor of the nerve and retinal nerve fibre layer defects, but all are subjective. Clinical assessment of structure represents a sensitive method of identifying the presence or absence of disease. However, intra- and inter-observer variability in quantifying disease severity, and detecting progression is poor.

Subjective clinical findings can be made objective by taking high quality disc photos. Serial comparison can then be made to look for change across time and hence detect progression. This, however, fails to quantify that change, and ultimately only documents a poor surrogate marker of axonal damage (i.e. amount of pallor, swelling, or size of cup).

HRT, GDx, and OCT allow for quantitative analysis of intra-ocular optic nerve structure. They provide micron level measurements of excellent surrogates of axonal number – most commonly RNFL thickness. Such measurements are useful not only for optic neuropathy, but also as a marker for severity of more generalised neurological disease. For example, severity of multiple sclerosis in the absence of optic neuritis correlates with both RNFL thickness and macular ganglion cell volume.

Heidelberg Retinal Tomography or HRT (both HRT2 and HRT3) is a confocal scanning laser ophthalmoscope that provides topographic analysis of the optic nerve, and indirect measurement of RNFL thickness. The use of HRT in diagnosis and monitoring of glaucoma is widely published, but much less is published on its use in neuro-ophthalmic disease.

GDx is a scanning laser polarimeter that measures the change in polarisation of light when it interacts with birefringent tissue, such as the retinal nerve fibre layer. Unlike the HRT that only indirectly measures the RNFL, GDx directly measures the RNFL's effect on polarised light, and does not rely on reference planes or tracing the optic nerve margin.

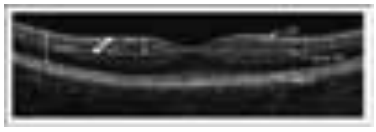
The GDx is a useful tool, but does have drawbacks. Firstly, other ocular tissues are birefringent, most notably the cornea. Variable Corneal Compensation (VCC) GDx includes corneal compensation hardware to overcome this issue. However, compensation for corneal birefringence is based on macula examination for correction – Henle's layer. In patients with macular disease, compensation can be inaccurate. Secondly, the GDx will not measure RNFL swelling.

In measuring birefringence, it indirectly measures axonal number, rather than actual thickness, so oedematous discs have normal GDx parameters (assuming there is no axonal loss). This second issue could also be viewed as an advantage, as it could in theory allow for documentation of axonal loss in the setting of chronic disc swelling, for example in idiopathic intracranial hypertension (IIH).

OCT or Ocular Coherence Tomography provides accurate and repeatable measurement of the RNFL. It uses the principle of low-coherence interferometry to obtain A-scans through ocular tissues, which, when added together can create both 2-D and 3-D tissue profiles. The original commercially available device used a system known as time-domain OCT (TD-OCT). Details can be found elsewhere, but, in short, the physical movement of the mirror limits the A-scan acquisition rate and scan resolution in TD-OCT.

Newer OCT technology uses a broadband-width light source and a spectrometer to create interference patterns – spectral-domain OCT (SD-OCT). The axial backscatter intensities are calculated using non-proprietary Fourier transformation, allowing for rapid A-scan acquisition (up to 40 000/sec), and much better axial resolution – 2-5µm. This rapid and accurate data has allowed for 3-D assessment. One advantage of the 3-D data is consistent longitudinal scan placement. Several studies have shown improved intra- and inter- visit variability with SD-OCT when compared to TD-OCT. Finally, it should also be remembered that data collected on a SD-OCT cannot currently be compared to data on the same patient collected with TD-OCT. If your practice upgrades – longitudinal follow up starts from a new base line on the SD-OCT.

OCT allows for surrogate measurements of axonal volume – most commonly retinal nerve fibre layer thickness, but also optic nerve cross-section, and more recently with SD-OCT, macular and 'ganglion-cell complex' volume. These measurements allow for progression analysis in chronic optic neuropathy, localised effect of acute pathology, a marker of progression in neurological disease, and as demonstrated by one local study, prediction of reversibility in compressive optic neuropathy.

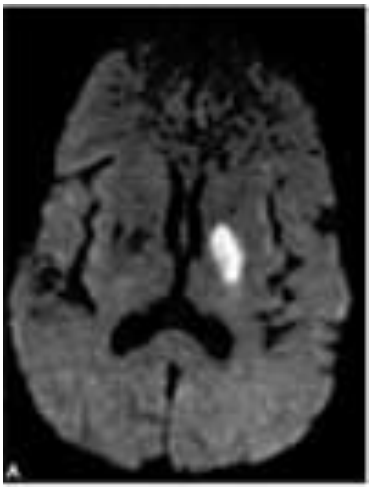


SD-OCT of the macula showing isolated measurement of the inner retinal GCC or ganglion cell complex.

Quantitative RNFL measurement devices come with normative data base software. This software attempts to stretch the utility to include diagnosis – particularly for glaucoma.

The sensitivity of this software remains poor when compared to assessment of other clinical parameters. Further, such normative data-bases will be best at detecting disease in structurally normal discs (i.e. size, tilt, etc.), when in fact such discs are usually the easiest to make a clinical diagnosis in. It is structurally atypical discs where help is needed, but where such normative data is of least value. Overall these databases provide us with a ball-park comparison to 'normal'. Currently, it is repeated measurements that show change, or lack thereof, within a given patient make these machines valuable, rather than comparison of isolated examinations to normative data.

Radiologic imaging in the form of ultrasound, CT scan, and MRI can be used to show structural changes to the intra-orbital and intra-cranial optic nerve. Ultrasound and CT only demonstrate gross structural anomalies of the nerve, but MR holds promise for being able to better define the nature of that change. Consider optic neuritis and NAION (non-arteritic ischaemic optic neuropathy): Both may show gadolinium enhancement on standard MR, but recent advances in diffusion-weighted imaging (DWI) can differentiate overlap cases.



DWI axial MR showing change seen in acute ischaemic stroke involving the internal capsule

DWI measures the relative ease with which water molecules diffuse within a particular tissue – a common use of such imaging is in detecting acute ischaemic stroke. Healthy grey matter allows for relatively free diffusion of water, but acute ischaemic cytotoxic oedema severely restricts diffusion. Such events can now be detected within hours using DWI. A similar finding can be seen following ischaemic optic neuropathy, whereas acute demyelination will usually result in increased diffusion through the loss of diffusion restricting myelin.

Analysing Function

Like structure, the spectrum of testing available is wide and covers clinical subjective methods through to objective testing using electrophysiology.

Clinically, functional analysis includes colour vision, pupil reaction (RAPD) and fields. Congenital dyschromatopsia should be readily distinguished from pathological change based on acuity of onset, symmetry, and axis of colour defect.

Display of Legal Posters

South African legislation requires all employers to display 2 documents where staff can see/ have access to them.

1. Summary of the *Basic Conditions of Employment Act* (BCEA) according to section 30.
2. Summary of the *Employment Equity Act* according to section 25(1).

If you have more than 5 employees, a copy of the *Occupational Health & Safety Act* (OHSA) should be available. Smaller companies should supply a copy if an employee requests it. It's not clear, but Schedule D of the *General Machinery Regulations* (GMR) of OHSA is best displayed if you have an on-site lab.

Non-compliance may result in penalties from the Department of Labour. My current labour inspector is a patient, and she does regular inspections. Her predecessor, however, came only once. In theory all registered employers are assessed periodically by the Department of Labour.

Download the documents at **www.labour.gov.za**.

Similar to the structure discussion above, these clinical assessments of function are very useful for deciding whether disease is present, but are less useful in grading severity and documenting progression.

Standard automated perimetry (SAP) has largely replaced Goldmann perimetry as the gold standard assessment of field sensitivity. However, other field technologies may offer some advantages. Frequency Doubling Technology (FDT) tests the integrity of the magnocellular visual pathway. Because glaucoma affects peripheral magnocellular ganglion cells early in disease, FDT can detect glaucoma at an earlier stage than SAP. This means that FDT is useful in answering the question: 'Is disease present?' However, little data exists on the use of FDT for monitoring glaucoma – probably because it is not as repeatable, and does not have the required high dynamic range required for progression monitoring. The data on FDT in neuro-ophthalmic disease is sparser. The technique seems to be good for picking the presence of defects, but again has no track record in demonstrating progression. The greatest advantage of this technology is test speed.

Micro-perimetry: macula region

Micro-perimetry allows for exact projection of threshold stimuli onto a real time retinal image. It has the advantage of allowing for tracking of ocular movement, so is useful in disease that affects fixation. However the test is too cumbersome for most real world environments.

Electrophysiology provides an objective measure of visual function from the retina through to the visual cortex. Through specific tests, the site of dysfunction can be isolated. ERG and multifocal ERG do not specifically analyse the optic nerve, but are very useful for detecting occult retinopathies and maculopathies that are commonly confused for optic neuropathy. Pattern ERG, like multifocal ERG can isolate macular retinal dysfunction – further isolating this dysfunction as being outer retinal (P50) or ganglion cell (N95) in origin. Pattern ERG has been shown to have diagnostic accuracy similar to SAP in glaucoma.

Visual-evoked potential (VEP) is the measured gross electric potential of the visual cortex in response to a visual stimulus. It measures the central 5 or so degrees of field. It provides an amplitude and a latency of response measurement. The latency measurement can be compared to population data, whereas amplitude measurements are better compared from one eye or hemisphere to the other.

Top Tips for 2013

Take a critical look at your practice: Do you need...

A bigger space?

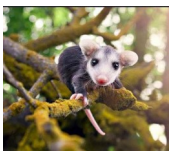
Better marketing?

Updated uniforms?

More focus on children?

Or families?

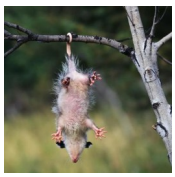
It's never too early for eye health.



Try to listen more.

Bring fresh flowers into the practice.

And a water fountain for patients.



Hang in there!

Plan a break.

Conclusion

Accurate analysis of optic nerve structure and function adds significantly to our understanding of optic neuropathy. A combination of tests allows for accurate and repeatable information that aids in establishing disease effect, treatment response, and provides prognostic information. An understanding of the relative utility of each test is essential when considering incorporating a new test into clinical practice.

Source:

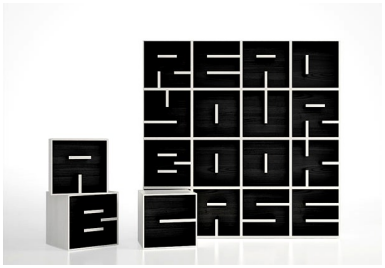
Analysing the optic nerve
Gaskin B
Clinical Desktop (NZ Optics)
December 2011

CPD questions

1. You order multifocal spectacles that arrive with yoked prisms of 0.5Δ base down. This is outside the ANSI prism tolerance standards and should be returned to the lab.
2. Functional loss due to optic nerve disease is always permanent and predictably correlated with axon loss.
3. RNFL thickness is related to axon numbers.
4. HRT (Heidelberg Retinal Tomography) maps the retina, showing its thicker and thinner parts.
5. Resolution and repeatability are better with spectral domain OCT than time domain OCT.
6. OCT can map physical progression of neuropathy in chronic and acute conditions.
7. Comparison of a patient's RNFL OCT with a normative database is the most sensitive measure of glaucomatous damage.
8. Colour vision is a valuable functional assessment of optic nerve head health in patients with congenital dyschromatopsia.
9. Standard automated perimetry (SAP) tests the integrity of the magnocellular visual pathway and may identify glaucoma earlier than Frequency Doubling Technology (FDT) does.
10. Visual-evoked potential (VEP) measures the central 30° of visual field by comparing the amplitude of the response to population data.

Read your book case

The cubes in this bookshelf can be arranged to spell the words
'READ
YOUR
BOOK
CASE.'
It's easier to see when the shelves are empty.



Do you see it?

Submitting your CPD responses

Please send your answers to optometry@synapse.org.za and include your name, surname and HPCSA registration number.

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