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Competing interests: None declared.

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All in the timing

All in the timing

Bryan J Winn

mfVEP as a measure of perimetry

In this issue of the *BJO*, the paper by Semela *et al*¹ (see page 445) reports on the characteristics of the multifocal visual evoked potential (mfVEP) in six cases of compressive optic neuropathy (CON) secondary to optic nerve meningiomas. The mfVEP can be thought of as an objective measure of perimetry. With the display used by Semela's group, the 60 sectors tested comprise about the same area of visual field as the Humphrey 24–2 standard automated perimetry (SAP) test. Unlike SAP, the mfVEP does not require the subject to consciously register and respond to stimuli but rather is generated by the electrical potentials evoked by the individual pattern-reversal stimuli at the primary visual cortex.² The amplitudes of mfVEPs have been shown to correlate well with SAP in several optic neuropathies including ischaemic optic neuropathy (ION) and glaucoma.^{2–8} It is not surprising that the mfVEP amplitudes in optic nerve meningiomas follow suit. This is in agreement with work by Danesh-Meyer *et al*⁹ using the AccuMap system of mfVEP, demonstrating good amplitude correlation with SAP in CON due to pituitary lesions.

However, unlike the mfVEPs seen in ION and glaucoma, Semela *et al* demonstrate that CON mfVEPs have significant latency delays.^{10–11} This is consistent with conventional VEP studies showing prolonged latencies in compressive neuropathies including those caused by chiasmal gliomas, orbital tumours and thyroid orbitopathy.^{12–17} Prolongations in latency have been attributed to disruptions of the saltatory conduction along the myelinated portion of ganglion cell axons and are the hallmark of demyelinating entities such as optic neuritis.^{7–18} Both mechanical and vascular mechanisms for CON have been proposed, and an experimental model of compressive peripheral neuropathy induced by a pneumatic tourniquet demonstrating anatomical disruption of the nodes of Ranvier and subsequent demyelination supports Semela *et al*'s findings.^{17–19}

Semela *et al* found that the latency delays occurred topographically at the interface between normal and abnormal regions of the visual field and could be seen in areas of visual field that test normal on SAP, as is shown in their cases 1 and 4. Delays may not be seen inside the scotoma

owing to the fact that the mfVEP amplitudes are typically so diminished in areas of significant field loss that information on timing in these sectors is lost. However, the delays seen outside the areas of field loss are perhaps more interesting. Do these delays represent early signs of compressive optic nerve dysfunction? Although potentially interesting, this is clinically irrelevant in cases of optic nerve meningiomas as most of the cases are diagnosed only after presenting with visual loss. However, if true, it could prove a useful method for diagnosing early compressive neuropathy in thyroid orbitopathy and pituitary adenomas.

Unlike ION and glaucoma, which typically are not associated with any recovery of visual field, CONs frequently will improve when the compression is relieved. What happens to the latency changes after surgery or radiation? Are the latency changes somehow linked to the ability of nerves for recovery? Studies documenting visual outcomes after either surgical or radiation decompression of CONs show that 40–47% improved, 33–40% remain stable and about 20% worsen.^{20–21} Does the presence or absence of latency delays correlate with prognosis? It would be interesting to see how the mfVEPs and SAPs of Semela *et al*'s six cases change after intervention.

Semela *et al* suggest monitoring changes in amplitude for evidence of progression or recovery of CON. This is good for modest visual field defects. We know, though, that mfVEP amplitudes can be completely wiped out when Humphrey visual field thresholds drop below –6 dB.²² Theoretically, a recovery from –20 to –10 dB in a localised area

could go unnoticed since the mfVEP might not have a detectable amplitude in either case. However, since the latency changes frequently occur at the perimeter of the field deficit, and if we posit that in the presence of normal amplitudes they may represent the earliest detectable damage, changes in latency could signal the subtlest progression or recovery of disease.

As with all theory and conjecture, validation or rejection by experimentation is required. Semela *et al.*'s findings invite several interesting questions on the significance and relevance of latency shifts in compressive neuropathies. It is easy to hypothesise about them, but only further experimentation will provide real answers.

Br J Ophthalmol 2007;**91**:406–407.
doi: 10.1136/bjo.2006.108332

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Competing interests: None declared.

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Combined triamcinolone acetonide injection and grid laser photocoagulation

Combined triamcinolone acetonide injection and grid laser photocoagulation: a promising treatment for diffuse diabetic macular oedema?

Tomohiro Iida

Diabetic macular oedema is a major cause of visual loss in patients with diabetes. The Early Treatment of Diabetic Retinopathy Study showed that focal laser photocoagulation reduced moderate visual loss in eyes with clinically significant macular oedema.^{1–3} The efficacy of grid photocoagulation for treatment of diffuse diabetic macular oedema was reported in the 1980s.^{4–6} Those studies reported resolution of macular oedema and stabilisation or improvement of visual acuity (VA). Eyes treated with conventional grid photocoagulation for diffuse macular oedema, however, developed progressively expanding laser scars that resulted in decreased vision,⁷ subretinal

fibrosis⁸ and visual field loss.^{6–9} Lee and Olk¹⁰ reported that VA improved in 14.5% and was unchanged in 60.9% of eyes with diffuse macular oedema treated with grid laser photocoagulation. However, the VA decreased by three lines or more in 24.6% of eyes. The limited efficacy of grid laser photocoagulation for treatment of diffuse macular oedema prompted interest in modified methods of grid photocoagulation and other treatments such as steroid injections and pars plana vitrectomy.

In eyes with diffuse diabetic macular oedema, retinal opacification, macular swelling and fluid accumulation prevent the transmission of laser energy to the outer retina and the retinal pigment

epithelium. Conventional grid laser photocoagulation, in which grey–white spots are applied around the fovea, causes intense retinal damage in the macular area. Innovations in photocoagulation technology have focused on improved laser instruments and laser techniques. Laser damage can be decreased by reducing the duration of laser exposure and by using subvisible clinical endpoint laser photocoagulation.^{11–13} Luttrull *et al.*¹³ studied the visual and clinical outcomes of subthreshold diode micropulse laser photocoagulation in eyes with diabetic macular oedema. This method minimised retinal and choroidal damage and had a beneficial effect on VA and resolution of macular oedema.

Intravitreal injection of triamcinolone acetonide has been reported to improve VA and to reduce the macular thickness in eyes with diffuse diabetic macular oedema.^{14–18} However, the beneficial effect on vision and macular thickness does not persist in long term. Massin *et al.*¹⁸ reported the results of a prospective controlled study of intravitreal triamcinolone acetonide, which showed that one intravitreal injection of triamcinolone acetonide reduced the macular thickening due to refractory diffuse diabetic macular oedema in the short term. All eyes that were injected with triamcinolone acetonide had a dramatic