Editorial: Spatial contrast sensitivity revisited

In 1978 an editorial in the BJO discussing spatial contrast sensitivity coincided with the formal introduction by Arden of a booklet that allowed rapid measurement of contrast sensitivity. At that time it was considered that the measurement of contrast sensitivity would be a useful and rapid method of assessing visual function, applicable to the management of many eye diseases. Since then extensive experience has been gained in the assessment of contrast sensitivity in general and in the use of this booklet in particular. As the experience has not been uniformly encouraging it seems an appropriate time to look at the role of contrast sensitivity in assessing visual function and to reassess the usefulness of Arden’s booklet.

The booklet consists of 7 plates, a screening (no. 1) and six diagnostic plates (2–7). At a testing distance of 57 cm the spatial frequency of the 6 diagnostic plates ranges from 0.4–6.4 cycles per degree in increments of 1 octave. The contrast of each plate changes from top to bottom and covers a range of approximately 1–76 log units. The observer views each plate as the tester slowly uncovers it, noting the first appearance of the grating bars. A score of 1–20 is assigned for each plate according to the amount of the plate uncovered when the bars are first seen. An arbitrary score of 25 was assigned if the bars were not seen. The sum of the scores for the 6 plates was used to quantify contrast sensitivity for each eye. An upper limit of 82 was established for normal subjects together with an interocular difference of less than 12.

Using Arden’s booklet some authors have reported a reduction in contrast sensitivity in diabetics, in patients with optic nerve disease, and in glaucoma. It has also been shown that screening of visual function in both Western and Middle Eastern countries has proved to be a practical proposition.

Additional information has appeared on the response in a normal eye. The result obtained is repeatable, both between tests and between observers. Sensitivity in children is below that of adults, while the score increases with age.

Contrast sensitivity has been extensively studied in patients with glaucoma and with ocular hypertensive and in age-matched normal persons in the hope of detecting glaucoma patients by screening and of identifying ocular hypertensives at risk of developing glaucoma. The initially encouraging results have had to be tempered by later and questioning results, for considerable overlap has been found in the scores obtained in these 3 groups of patients. One complicating factor has been the effects of miosis and lens opacities. Singh and coworkers, in an article reported in this issue of the journal, note the effect of miosis in reducing sensitivity to the high-contrast plates, nos. 6 and 7. This effect, the opposite of optical theory, was caused by the presence of lens opacities. Miosis alone did not, while cataracts did, affect the sensitivity of those high-frequency plates. Indeed the effect of lens opacities in reducing sensitivity to high-frequency plates has been previously noted and suggested as a method of assessing the effect of these opacities on vision.

Raised intraocular pressure alone, without field loss, may not affect contrast sensitivity. Hitchings and coworkers, in an article also reported in this journal, note that in relatives of patients with glaucoma a decrease in contrast sensitivity occurred independently with increasing age, visual field loss, and an increase in C/D ratio. However, there was no decrease in contrast sensitivity associated with increase in intraocular pressure. Damage to the visual system rather than raised intraocular pressure per se would appear to be crucial.

Experience with assessing contrast sensitivity in glaucoma patients has allowed refinements in technique. Arden stressed the importance of equating low-frequency loss with visual field loss and high-frequency loss with reduced acuity. The results obtained by glaucoma screening using high-frequency plates must be interpreted in this light. Atkin and coworkers reported reduced sensitivity in glaucoma patients tested with an oscilloscope using a smaller field size temporally modulated. Vaegan modified Arden’s plates, and by using a 4-alternative forced-choice format could more accurately differentiate between glaucoma patients and age-matched normal persons.

In 1978 Arden alerted clinicians to the possibility of measuring contrast sensitivity and provided a test booklet for this purpose. Experience has shown that contrast sensitivity is reduced in eyes with mild visual defects; many of these eyes can be identified with Arden’s test booklet. However, the test as it stands will not differentiate between every normal patient and those with glaucoma, so that it must be used with caution when screening for glaucoma. Refinements in the measurement of contrast sensitivity would appear to be possible and could well improve differentiation between normal persons and glaucoma patients.
References