Reading refractions

UNLESS YOU WEAR GLASSES, you are probably unfamiliar with the prescriptions provided by ophthalmologists or optometrists. These prescriptions are equations that describe the lens strength necessary to correct vision. The equations usually describe the sphere, cylinder and axis. The sphere and cylinder describe the optical power of the lens in dioptres: the "spherical" component corrects for long- or short-sightedness, and the "cylindrical" component corrects for astigmatism.

A magnifying glass is a positive spherical lens. Such lenses are used to correct for hypermetropia (long-sightedness) or as a reading correction in presbyopia (loss of reading vision with age). Myopic or short-sighted people need negative lenses. The lenses change in 0.25 dioptre steps, and a very rough rule of thumb is that there is a loss of about one line on an eye chart for each additional 0.25–0.50 dioptres of refractive error.

Cylindrical lenses refract light in only one meridian (known as the axis). Astigmatism is caused by the optical surfaces of the eye (such as the cornea or lens of the eye) being elliptical, not spherical. To correct this problem requires a lens that has power in only one axis — a cylindrical lens.

The axis specification on a prescription gives the orientation of the meridian of the cylindrical correction, and can vary from 1° to 180°. The total power of a cylindrical lens varies from 0 along its main axis to its maximal value along the axis 90° away. The total power of a lens with both spherical and cylindrical correction changes accordingly: along the specified axis it is equal to the "spherical" value, and it reaches the sum of "spherical" and "cylindrical" along the axis perpendicular to the specified one.

Australian Defence Force entry standards for vision are contained in *ADFP 1.2.1.1 Health standards and procedures for entry and transfer.* This document specifies the allowable myopia, myopic astigmatism, hypermetropia and hypermetropic astigmatism. The vision standards are divided into Minimum Visual Requirement 1 (MVR1), MVR2 and MVR3. The maximum acceptable refractive error (MVR3) is 5.00 dioptres in either axis in either eye. If the two eyes differ, the eye with the greatest refractive error determines the visual standard.

Many applicants' reports do not indicate these parameters explicitly, and prescriptions can be presented in various ways. For some applicants, the prescription equation may be the only report provided. Even if not involved directly in recruiting, many ADF health professionals are asked to interpret these equations. The following examples are provided to assist in interpreting refractive prescriptions.

Example 1

What does $\frac{-4.50}{-1.25\times110^{\circ}}$ or - 4.50/- 1.25 × 110° mean?

The top number is the measurement of the sphere (positive for hypermetropia and negative for myopia). The bottom numbers are the measurement of the cylinder (the sign and magnitude of the astigmatism) and the axis.

The axis is not relevant in assigning a visual standard, so we can remove the axis value to give –4.50/–1.25.

To work out the visual standard for ADF purposes, the myopic or hypermetropic axis is simply calculated by adding the top and bottom numbers.

In Example 1, the sphere is –4.50 and the myopic axis is –5.75 (–4.50 plus –1.25). This means that in one axis the vision is more blurred than the other. For the purposes of the visual standard, the vision in the worse axis is taken (in this case –5.75). Hence, this applicant does not meet MVR3 because the magnitude of the myopia is greater than 5.00 dioptres. The magnitude of astigmatism (1.25) is irrelevant here, as the applicant has already failed MVR3.

Example 2: + 3.00/+ 1.75

In this case, one axis (the sphere) is + 3.00 and the other axis is + 4.75 (+ 3.00 plus + 1.75). This is within the MVR3 limits. The magnitude of the hypermetropic astigmatism is 1.75, also within the MVR3 limits.

Example 3: + 9.00/–3.00

In this case, one axis is + 9.00 and the other axis is + 6.00 (+ 9.00 plus –3.00). The worse axis (+ 9.00) is used for the visual standard, and this person does not meet MVR3. The astigmatism is irrelevant here.

Example 4: + 0.75/–3.50

One axis is + 0.75 and the other axis is –2.75 (+ 0.75 plus –3.75): mixed astigmatism. The worse axis, –2.75, meets the MVR3 standard. The magnitude of the astigmatism is 3.50, which also meets MVR3 requirements.

Example 5: + 2.00/–3.00

One axis is + 2.00 and the other is –1.00 (+ 2.00 plus –3.00): mixed astigmatism. This means one axis is hypermetropic and the other is myopic. The hypermetropia is less than + 2.50 and the myopia is no greater than –1.00 dioptre. The magnitude of the astigmatism is 3.00. This applicant meets the MVR3 standard.

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