Multifocal and aspheric silicone hydrogels under the microscope

Tony Hough explains how power distribution maps of complex contact lens designs can help practitioners select the best lenses for their patients

What level of vision correction should we reasonably expect with current silicone hydrogel multifocals and aspheric optics lenses? Does aberration control have any useful application for rigid lenses? And how can practitioners differentiate between complex contact lens designs?

Belgian company Lambda-X has developed a new power mapping instrument, the Nimo (Figure 1), capable of mapping the power distribution of such lenses. Earlier this year, the company sponsored a seminar in Birmingham to examine these questions and explore the relevance of lens mapping to everyday practice.

Figure 1 The Nimo power mapping instrument for contact lenses

Aberration control: soft and rigid lens applications

There are many current soft lens products which claim to have built-in aberration controlled optics – aspheric optics and aberration neutralising system are just two of the terms used to describe the optics of such lenses.

However, there are very few objective data to indicate that these lenses provide improved vision for wearers. According to optometrist Dr Trusit Dave, the challenge of designing soft lenses to correct the aberrations in normal human eyes has not yet been successfully met by the contact lens industry.

He believes that the natural variability of aberrations in the human eye would result in any standardised lens behaving anomalously when applied to a typical group of patients, especially given the variable draping characteristics of current soft lenses.

It is something of an oddity that aberration management technology, developed primarily for soft lenses, has been applied with some success to rigid contact lenses, notably to lenses designed to correct keratoconus.

Hertfordshire practitioner Don Lydon noted that in a study of keratoconus patients in his clinics a significant majority had reported improved vision when fitted with the Rose K2 aberration-controlled lens by comparison to the original Rose K lens. The higher powers required in keratoconic correction meant that this speciality rigid lens area was in fact the principal beneficiary of aberration-control technology. Figure 2 shows a typical example of a power map for a keratoconus rigid lens.

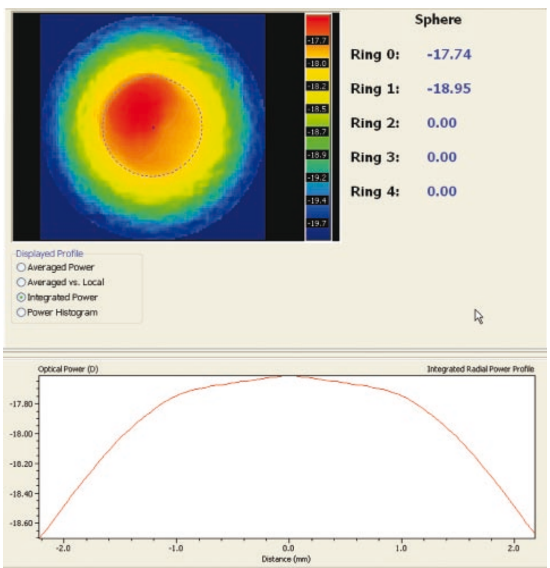

Figure 2 A typical Nimo screen display showing the power map for a small diameter keratoconus rigid lens having a labelled back vertex power of -17.75D

Use of power profiles: varifocal spectacles vs multifocal soft contact lenses

Eyecare practitioners are provided with very detailed power distribution maps of varifocal spectacle lenses, including layout and dimensions of the specific areas on the lens which are dedicated to each power. An example of this is shown in Figure 3. A power mapping device such as the Nimo can be used to confirm the power distribution on such lenses.

According to optometrist Susan Bowers, these power maps are an essential clinical tool which can be used very effectively to select the appropriate varifocal lens based on an understanding of the wearer's lifestyle and day to day visual tasks.

However, there is no comparable information provided by contact lens manufacturing companies. In this case, there is often little or no accurate information on the power distribution of specific lenses so the practitioner has to adopt a trial and error fitting method, trying different lenses in each eye until satisfactory vision is obtained.

Practitioners are frequently in the dark as to the actual power distribution on the lenses being worn. This hit and miss approach highlights the need for education at a much more detailed level than is currently being provided by either academia or the manufacturers, and a much better understanding of how modern 'multifocal' soft lenses work.

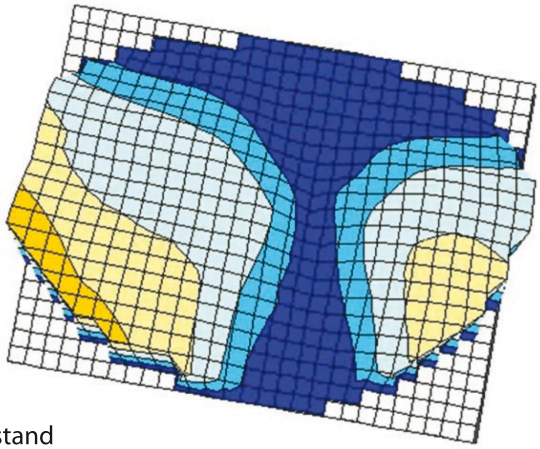

Figure 3 Power map of a Seiko varifocal spectacle lens. This map is for a +2.00 reading add. The actual distribution of power over the lens surface is mapped in detail

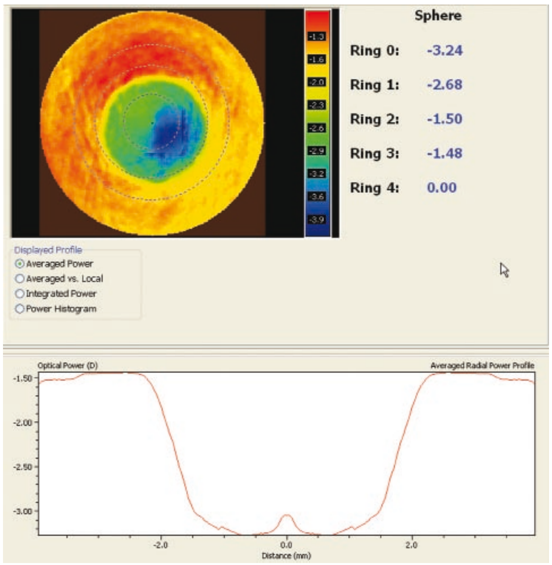

Figure 4 Map and power profile for a Proclear D style multifocal (centre distance). The measured values correspond closely to the label

Technology to help understand multifocal lens designs

The Nimo instrument can provide a useful insight to the power distribution within the optic zone of multifocal and aberration-controlled soft lenses, as shown in the following examples.

The maps will frequently help to explain why practitioners need to use a lens that may not be closely related to the wearer's prescription in order to get best correction. They also help to understand that most of the current silicone hydrogel multifocals rely on modified monovision for their success.

Deciphering power profiles

The following power profiles are all of current soft lenses. Can you identify in each case whether the lens is:

- Single vision?
- Aberration controlled?
- Multifocal (varifocal) and
- What is the labelled power?
- What the prescription of a suitable patient might be for both dominant and non-dominant eyes?

Figure 4 is an easy one. Clearly this is a centre distance multifocal, having an average power of -3.25D in the central distance zone. The lens here is a CooperVision Proclear Multifocal style D (for distance) having labelled powers of -3.00D add +2.00D. The measured power profile here conforms almost exactly to the label and is directly consistent with the manufacturer's description.

What about Figure 5? A clue here is to check the y-axis scale – what is the optic zone size we are looking at? This is a Bausch & Lomb PureVision -3.00D lens. According to the manufacturer, this lens is single vision, aberration controlled and presumably is intended to be worn by a patient requiring a spherical correction close to -3.00D.

In Figure 6 we are looking across an 8mm optic zone. A clue here is to consider what power the wearer would be using if the pupil diameter were 4mm – check with the Nimo ring diameter settings. This is an Air Optix Multifocal labelled -3.00 Hi (Max add +2.50D). The diameter of Nimo ring setting zero ('Ring 0') is 2mm and the average integrated power in this zone is -1.50D.

I would expect a patient having a prescription of -3.00D/+2.50D add to obtain reasonable reading correction (but not perfect) but it is difficult to construct lighting/pupil size combinations where this patient would have reasonable distance vision with this lens. It might be useful in this patient for intermediate vision, for example computer use.

In summary, mapping the power distribution of complex contact lenses leads to better understanding of lens design and can be as useful as power maps for varifocal spectacles in selecting the best lens for a given patient. ●

● Tony Hough is a director of Cambridgeshire-based CLS Software

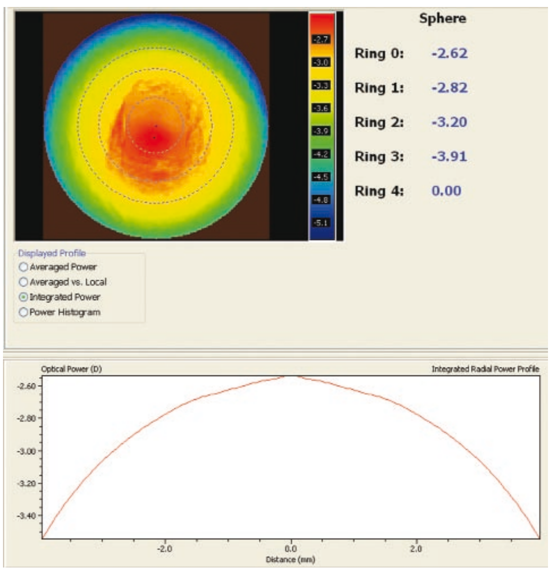

Figure 5 Does this silicone hydrogel lens have aberration controlled optics?

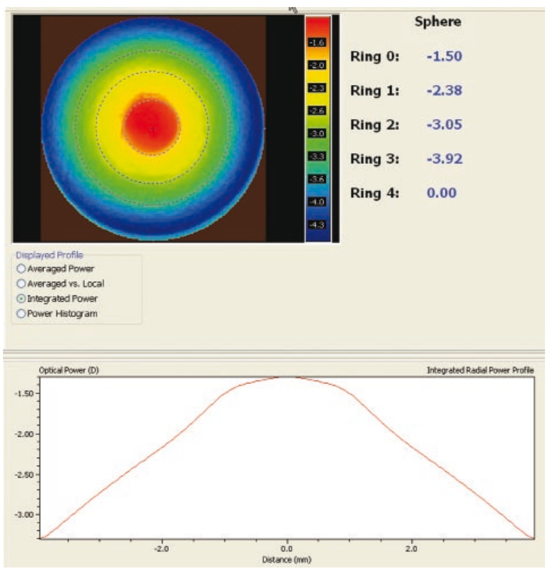

Figure 6 What should the label of this silicone hydrogel multifocal say for the lens power?