

Clinical & Refractive Optometry is pleased to present this continuing education (CE) article by Dr. John C. Hsiao and Dr. Santos Tseng entitled **Case Report of a Rapidly Progressing Monocular Keratoconus Over Two Years**. In order to obtain a 1-hour Council of Optometric Practitioner Education (COPE) approved CE credit, please refer to page 146 for complete instructions.

Case Report of a Rapidly Progressing Monocular Keratoconus Over Two Years

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ABSTRACT

Keratoconus, the non-inflammatory, progressing, thinning disorder of the cornea, is characterized by diminishing unaided visual acuity and increasing dependence on professional treatment. We report the management of over two years of a 25-year-old monocularly keratoconic male whose disease progression was unusual in that it was remarkably rapid. During the 28 months, the patient's flat-K increased by 3.00 diopters and his steep-K increased by 4.00 diopters. Our lens design and treatment, using the Rose K design rigid gas-permeable lenses, is detailed in this report. Corneal topographies documenting the ectatic progression, as well as a model three-point touch fit, are also shown. Continued monitoring of the patient is still underway as his keratoconus has not yet stabilized.

INTRODUCTION

Keratoconus is a progressive, often asymmetric, non-inflammatory disease characterized by the thinning, protrusion, and scarring of the cornea.^{1,2} Losses in vision can range from mild to profound.

We report a case of a rapidly progressing keratoconic male, from the diagnosis at the initial visit, to the follow-ups at both one and two years later. The patient's condition was remarkable in the speed at which it progressed. The case required responsive rigid lens treatment in order to sustain a minimum level of comfort and acuity for him.

The patient's management remains ongoing and we expect to see him for follow-up in due course. His prognosis at this time, however, is unknown.

CASE REPORT

July 2004

A 25-year-old university-educated Asian male in good general health presented for an eye examination complaining of blur. His ocular history included high myopia and high astigmatism. The examination data was as follows:

- Manifest refraction: OD $-7.25 -2.75 \times 015 \ 6/15-$ (20/50-); OS $-5.75 -1.50 \times 160 \ 6/7.5$ (20/25)
- Keratometry: OD 42.25@035 / 46.25@125; corneal cylinder: $-4.00 \text{ DC} \times 035$; OS 40.25@165 / 42.00@075; corneal cylinder: $-1.75 \text{ DC} \times 165$

Corneal mapping via the Dicon topographer (Paradigm Medical, USA) was performed for both eyes. The maps showed an inferior bulging of the cornea in the right eye (Fig. 1), and an unremarkable with-the-rule astigmatic pattern in the left eye (Fig. 2). Keratoconus was diagnosed OD. After several fittings, the following lens specifications were deemed appropriate:

- OD: 7.45/-7.00/8.90 6/7.5- (20/25-) Rose K rigid gas-permeable lens
- OS: 8.25/-5.75/9.80 6/7.5+ (20/25+) tri-curve lens

The parameters denote the lens' base curve, back-vertex power, and optic zone diameter, respectively. The lenses were dispensed at this visit, and instructions for wear-time and care of the lenses were given.

June 2005

The patient returned to the clinic having lost his right eye contact lens. He reported that prior to losing the lens, the lens was not fitting as well, which ultimately became the cause of the lost lens since it fell out during wear. The examination data was as follows:

- Manifest refraction: OD $-8.25 -4.00 \times 018 \ 6/18-$ (20/60-); OS $-5.75 -1.25 \times 158 \ 6/7.5$ (20/25)

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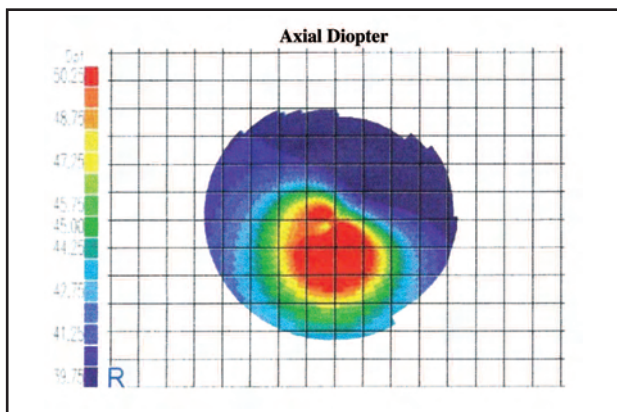


Fig. 1 July 2004: right eye topography at initial presentation, showing keratoconus

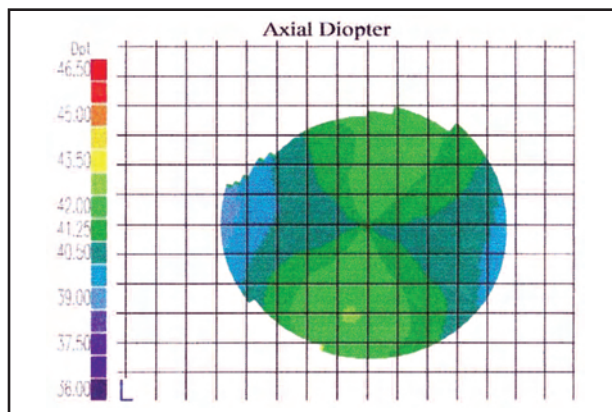


Fig. 2 July 2004: left eye topography at presentation

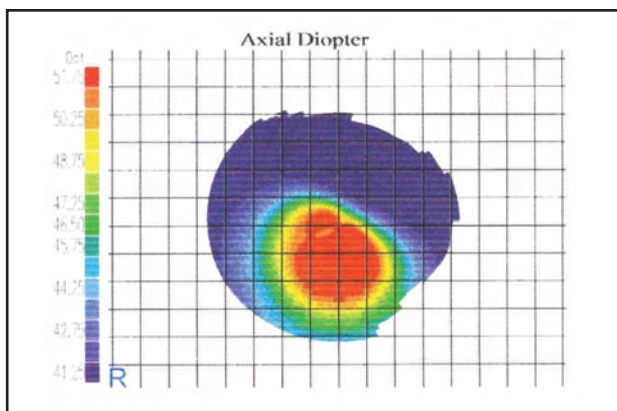


Fig. 3 June 2005: right eye topography showing keratoconus

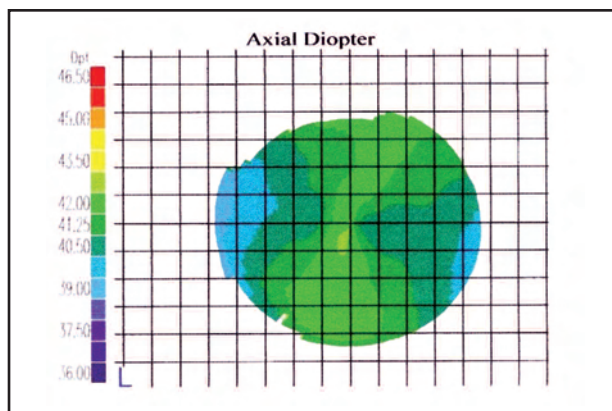


Fig. 4 October 2006: left eye topography

- Keratometry: OD 43.25@032 / 48.75@122; corneal cylinder: -5.50 DC x 032; OS 40.25@162 / 41.75@072; corneal cylinder: -1.50 DC x 162

The examiners were surprised to note that the patient's right eye flat-K was steeper by 1.00 D, and his steep-K was 2.50 D steeper as compared to his last visit. A Dicon topography was performed OD (Fig. 3). The map was consistent with the keratometry findings, and demonstrated a progressing ectasia. The following gas-permeable lens was dispensed for his right eye:

- OD: 7.20/-8.50/8.90 6/7.5- (20/25-) Rose K gas-permeable lens

Both the base curve radius (0.25 mm steeper than the first lens) and the back vertex power (1.25 D more minus) were changed to account for the eye's increasing convexity. The left eye's lens was left unchanged.

October 2006

The patient returned to the clinic complaining of increasing discomfort resulting in decreasing wear-time

of his right lens. The examination data was as follows:

- Manifest refraction: OD -9.50 -3.75 x 013 6/24+ (20/80+); OS -5.75 -1.50 x 160 6/7.5 (20/25)
- Keratometry: OD 45.25@035 / 50.25@125; corneal cylinder: -5.00 DC x 035; OS 40.50@165 / 42.00@075; corneal cylinder: -1.50 DC x 165

Again, the examiners were surprised by the progression of the patient's condition. Compared to the last visit, flat-K was steeper by 2.00 diopters and steep-K was steeper by 1.50 diopters. A Dicon topography was performed OU. The map showed a stable with-the-rule astigmatic left cornea (Fig. 4), but in the right eye, we witnessed yet another increasing protrusion of the cornea (Fig. 5). The eye was thus re-fit with the following lens:

- OD: 7.00/-12.25/8.90 6/7.5- (20/25-) Rose K gas-permeable lens

Both the base curve radius (0.2 mm steeper than the first lens) and the back vertex power (3.75 D more minus)

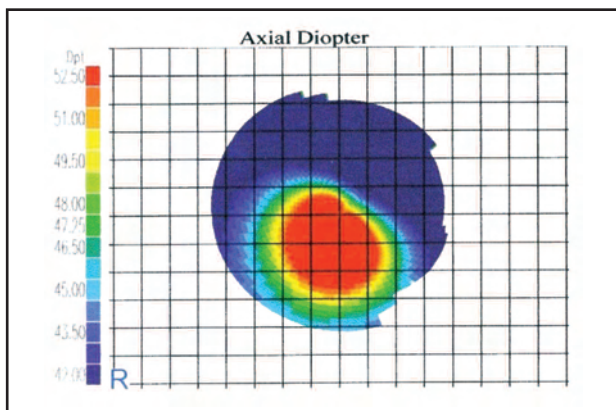


Fig. 5 October 2006: right eye topography showing keratoconus

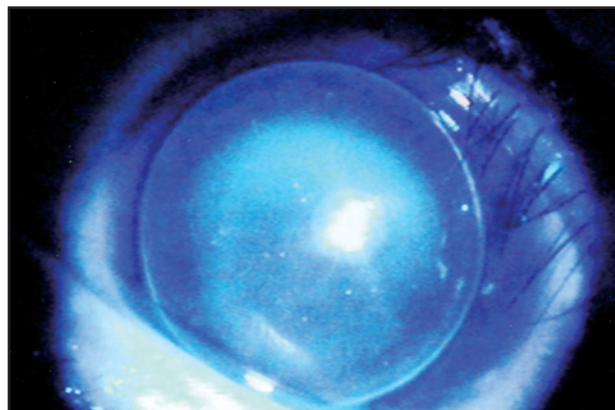


Fig. 6 October 2006: right eye three-point touch rigid lens fit with fluorescein under cobalt blue light

were significantly changed from the last visit. The lens on-eye was photographed (Fig. 6). The left eye lens was left unchanged.

The patient was made aware of his progressing condition, and invited to return for follow-up at his discretion.

DISCUSSION

Disease Progression and Base Curve Selection

In our case, the patient underwent rapid disease progression over the 28 months from the initial visit to the most recent visit. His right eye flat-K increased by 3.00 diopters, from 42.25 D to 45.25 D, while his steep-K increased by 4.00 diopters, from 46.25 D to 50.25 D. The changes in corneal curvature resulted in significant base curve changes from visit to visit. The base curve selection was performed as follows:

The Right Eye. In July 2004, the keratoconic right eye was fitted with a Rose K rigid gas-permeable lens, which is specifically designed to fit keratoconic eyes. The base curve was determined by averaging the corneal Ks then selecting a lens that was 0.2 mm steeper than the average K. In the case of the first lens fitting, the patient's OD Ks were 42.25 D and 46.25 D, giving the eye an average K of 44.25. 44.25 diopters is equivalent to a radius of 7.63 mm. 7.63 mm subtract 0.2 mm gives a radius of 7.43 mm. The base curve of the lens given to the patient was 7.45 mm.

The Left Eye. The left eye, being non-keratoconic, was fitted with a standard tri-curve lens. The base curve of the left eye lens was also determined using the patient's Ks. The patient's OS Ks in the 2004 visit were 40.25 D and 42.00 D, giving a corneal cylinder of 1.75 D. The fitting

philosophy we used was, for corneal cylinders ≥ 1.00 D and ≤ 1.75 D, we would fit the eye with a lens that was 0.50 D steeper than flat K. Since flat K was 40.25 D, we wanted a lens whose base curve was 40.75 D. 40.75 D corresponds to a radius of 8.28 mm. The patient was fitted with a 8.25 mm base curve.

In addition to selecting base curves, the lenses were also fitted on-eye to determine suitability with the use of fluorescein. In the case of the keratoconic lens, the peripheral curves were specifically flattened in order to increase edge lift. This change addressed the insufficient tear exchange present with the trial lenses, whose peripheral curves fit too tight.

The design of the lenses in the follow-up visits was selected using the same methods as described above.

The Three-Point Touch Fit

The right eye rigid gas-permeable lenses were all fitted using the three-point touch method. A photograph of the right fluorescein pattern under cobalt blue light with the lens on-eye is shown in Figure 6. Analysis of the topography (Fig. 5) and the corresponding photograph (Fig. 6) reveals areas of coincident regions. Specifically:

- The blue, flatter regions of the 12 o'clock and 3 o'clock positions in the topography match with the pooling found in the 12 o'clock and 3 o'clock positions found in the photo
- The red, steeper regions at the 6 o'clock and 9 o'clock positions in the topography match with the bearing found in the 6 o'clock and 9 o'clock positions found in the photo
- Centrally, the topography shows rapid curvature change, matching with the light touch found centrally in the photo

The three points of touch in our fitting refer to the positions on the lens found at the 3 o'clock position, the 9 o'clock position, and the central part of the lens.

CONCLUSION

It is believed that management of this patient is still not complete. Though the wear of a rigid lens has been shown in some cases to slow the progression of a growing ectasia,³ if the patient's keratoconus continues to progress at the same rate as in the last two years, we will expect to see him for follow-up some time in 2007 for a new lens fitting. We will also continue to observe his left eye for any signs of incipient keratoconus since the disease affects bilaterally,⁴ although there have been reports of keratoconus presenting monocularly representing extreme cases of asymmetric gene expression.⁵ □

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