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Case report

Discontinuation of long term orthokeratology lens wear and subsequent refractive surgery outcome

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ABSTRACT

Purpose: To report a case of lens discontinuation in a long term orthokeratology (OK) lens wearer and describe regression in refraction, corneal topography, and corneal thickness over 408 days after lens discontinuation. Furthermore, the outcome of subsequent LASIK treatment is also reported.

Case report: A 41 year old Caucasian female who had been previously wearing OK lenses for 13 years discontinued lens wear in the left eye to consider refractive surgery in that eye. The greatest changes in subjective and objective refractions, corneal topography and thickness occurred during the first 28 days after lens discontinuation. Subjective refraction did not reach baseline values, but corneal topography parameters returned to pre-OK values after 408 days of no lens wear. The patient then received successful refractive surgery treatment in that eye, achieving uncorrected visual acuity of 0.00 LogMAR units, and residual refractive error within ± 0.50 D of emmetropia.

Conclusion: The period of lens discontinuation required for long term OK lens wearers before refractive surgery is likely to vary between individuals and the patient described in this case report required a significant period of lens discontinuation of at least one year before being considered suitable for refractive surgery.

Myopic orthokeratology (OK) is a clinical technique involving the overnight wear of reverse geometry rigid contact lenses. The lenses reshape the anterior corneal curvature to temporarily correct mild to moderate degrees of myopia [1]. OK lenses are increasingly prescribed in progressive myopic children following numerous studies which have repeatedly demonstrated significant myopia control effects with OK compared to conventional single vision corrections [2,3]. Furthermore, OK is currently the most effective optical strategy for myopia control [4]. Although OK is claimed to be a completely reversible procedure, there have only been a handful of studies which have described the time course of regression effects after OK discontinuation [5–11]. Three studies to date have reported complete recovery of visual, refractive and corneal topography parameters to baseline values after ceasing OK lens wear, although recovery periods varied significantly. Hiraoka et al. [8] demonstrated recovery of refraction, uncorrected visual acuity, and higher order aberrations to baseline values after 1 week of OK discontinuation in a group of young adult myopes who had previously worn OK lenses for 1 year. On the other hand, Kobayashi et al. [9] reported 8 weeks of lens discontinuation was required for visual acuity, contrast sensitivity and corneal topography indices to return to baseline values after 1 year of OK. Lorente-Velazquez et al. [11] discovered a month of lens discontinuation was needed for the recovery of high

contrast distance visual acuity, refractive error and induced higher order aberration changes to pre-OK values after 1 year of OK lens wear in a group of 34 myopic young adults.

To the authors' knowledge, there are currently no publications which have monitored OK regression over a period greater than 2 months of lens discontinuation. Furthermore, there is no report of the regression effects in any long term (greater than 10 years) OK lens wearer or the success of refractive surgery subsequent to lens discontinuation, a clinically significant question for all children undergoing OK treatment for myopia control. In the current case report, we describe a myopic adult who discontinued OK lens wear in the left eye for approximately 13 months, after which she proceeded with laser in situ keratomileusis (LASIK) surgery in that eye.

1. Case report

A 41 year old Caucasian female was seen at our research clinic in January 2015. She had been fitted with BE OK lenses (Capricornia Contact Lens) at the Cornea and Contact Lens Research Unit (CCLRU; Sydney, Australia) and had continuously worn OK lenses since her initial lens fit in January 2002. Although she achieved successful OK treatment, the patient wished to cease lens wear to consider refractive

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surgery options in the left eye only while she continued to wear an OK lens in the right eye. The patient decided to cease lens wear as she was finding it difficult to achieve continuous 7–8 h of sleep each night. OK was discontinued from one eye only in order to assess the outcome of refractive surgery, before discontinuing lens wear and potentially proceeding to refractive surgical correction in the other eye. Details of the patient's subjective refraction and corneal topography parameters before commencing OK were retrieved from the CCLRU. After discontinuation of OK lens wear, we monitored regression in the left eye for 408 days, after which she proceeded with LASIK surgery. We continued to monitor her after the LASIK procedure for another 83 days. During the period of lens discontinuation, the patient was prescribed with daily disposable soft contact lenses to provide clear distance vision.

1.1. Refraction

The patient's subjective and objective refraction (Shin-Nippon NVision-K 5001 autorefractor; average of 5 measurements), described as power vectors M , J_{180} and J_{45} [12], and best corrected visual acuity (BCVA) before any OK lens wear and during lens discontinuation are presented in Table 1. Refraction throughout the regression period and after LASIK surgery are described in spherical equivalent (M) values in Fig. 1. The greatest change in refraction occurred during the first 28 days after lens discontinuation, and after 255 days her refraction remained stable and subjective refraction during the last 3 visits before surgery measured to within ± 0.25 D (Fig. 1). Interestingly, her subjective refraction never returned back to pre-OK values. The last follow-up visit during lens discontinuation was scheduled 2 days before surgery and twelve weeks after LASIK surgery, the patient's entering uncorrected VA in the left eye was 0.00 LogMAR units and spherical equivalent subjective refraction was within ± 0.50 D of emmetropia.

1.2. Topography

Corneal topography was measured with the Medmont E-300 corneal topographer (Medmont; Melbourne, Australia). Apical radius of curvature (r_0 ; mm), and Flat and Steep K values (D) were averaged from 4 maps at each visit (Fig. 2a and b). Pre-OK r_0 , and Flat and Steep K values in the left eye were 7.75 mm, 43.10 D and 43.55 D, respectively. Similar to refraction, the greatest change in corneal topography occurred during the first month after OK lens discontinuation after which corneal topography remained relatively stable (Fig. 2a and b). After 408 days (approximately 58 weeks) of lens discontinuation, all corneal topography parameters reached pre-OK values (r_0 within 0.1 mm, and Flat and Steep K values within 0.25 D).

Table 1

Subjective and objective refraction (D), and best corrected visual acuity (BCVA; LogMAR units) at various study visits.

Study visits	Subjective refraction				Objective refraction		
	M	J_{180}	J_{45}	BCVA	M	J_{180}	J_{45}
Baseline (before OK lens wear)	-3.88	-0.12	0.04	-0.04	N/A		
OK lens wear (before lens discontinuation)	-0.63	0.29	0.24	-0.10	-0.73	0.30	0.21
28 days after lens discontinuation	-3.00	0.19	0.16	-0.10	-2.70	0.16	0.19
408 days after lens discontinuation	-3.50	0.17	0.18	-0.10	-3.33	0.24	0.22
83 days after LASIK	-0.38	0.12	-0.02	-0.10	-0.25	0.25	0.00

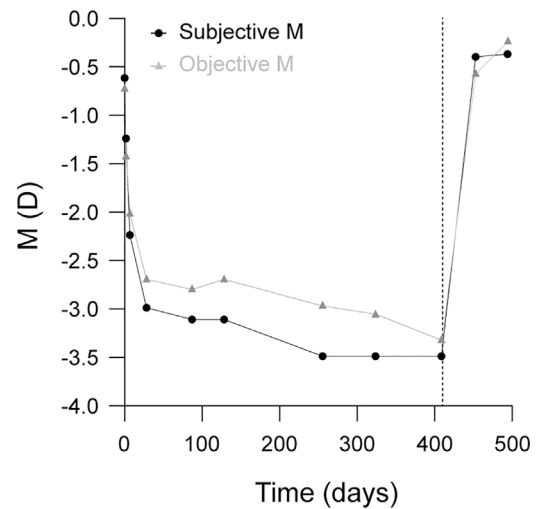


Fig. 1. Subjective and objective spherical equivalent (M) over 493 days of lens discontinuation. The dotted vertical line indicates time of LASIK surgery.

1.3. Corneal thickness

Changes in corneal epithelial, stromal and total thicknesses over the regression period were measured across the horizontal corneal meridian using the Tomey CASIA OCT (average of 3 scans at each visit). Similar to refraction and corneal topography, the greatest changes in epithelial, stromal and total corneal thicknesses occurred during the first 28 days after OK lens discontinuation after which they stabilized. Measurements were taken at various points across the central 8 mm horizontal corneal meridian as shown in Figs. 3 and 4. Interestingly central epithelial thickness increased after LASIK surgery (Fig. 3).

Although there appears to be an increase in central stromal and total corneal thicknesses during the first 28 days of lens discontinuation (Fig. 4a and b), there is no consistent trend in changes in thicknesses. After LASIK surgery, there is a definite decrease in both central stromal and total corneal thickness, as would be expected.

2. Discussion

Orthokeratology lenses are increasingly prescribed in clinical practice for myopia control as this is currently the most effective optical form of myopia control [4]. Children who are fitted with OK for myopia control are often advised to wear OK lenses until late teenage or early adult years, when it is assumed that refractive error development will stabilize. With the increasing number of long term OK lens wearers, it is important to understand the regression effects experienced after lens discontinuation, particularly after long-term lens wear, and whether refractive surgery is a viable and safe option for these patients in the future.

In this paper we report the recovery after OK lens discontinuation of a single eye in a long-term OK lens wearer, and the outcomes of subsequent refractive surgery. In agreement with previous studies, the most significant changes in refraction and corneal parameters occurred during the first month after lens discontinuation [8,9,11]. Interestingly, although the patient was out of lens wear for over a year, subjective refraction did not reach pre-OK values; this suggests the possibility that the patient's refractive error may have changed during the period of OK treatment. As we did not measure objective refraction pre-OK, we are unable to report if the same effect was apparent with objective measures of refraction. However, the mild residual hyperopic shift in subjective refraction did not affect the success of the refractive surgery with the patient achieving unaided VA of 0.00 LogMAR units and refractive correction within ± 0.50 D of emmetropia after the LASIK procedure.

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