Clinical & Refractive Optometry is pleased to present this continuing education (CE) article by Dr. Langis Michaud entitled **Managing a Case of Warped Cornea on a Monocular Patient.** In order to obtain 1-hour of COPE-approved CE credit, please refer to page 450 for complete instructions.

Managing a Case of Warped Cornea on a Monocular Patient

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INTRODUCTION

Corneal warpage secondary to contact lens wear occurs more than we think. In fact, up to 40% of our contact lens patients, soft and rigid wearers combined, show a significant amount of corneal warpage if we perform a screening topographic mapping on them. Are they all symptomatic? Almost all of them are, if we consider the following criteria:

- Reduced wearing time over the past weeks/months
- Increased lens awareness
- Increased end-of-the-day discomfort
- Decreased lens tolerance
- Increased bulbar redness (noticed by the patient)
- Increased secretions and lid deposits

The list would be more extensive in the presence of the following clinical observations:

- Unexpected refraction change (variation of the cylindrical component: power, axis, etc.)
- Change in keratometric values
- Greyish appearance of the peripheral cornea (shadowing of the peripheral cornea)
- Vessel engorgment at the limbus

Are these patients complaining about the issues mentioned above? They almost never will if we don't ask specific questions and if we don't deliberately address this issue. These patients seem to be happy and many of us do not try to investigate further. As the old saying goes, "If it ain't broke, don't fix it." It is, however, broken and no one pays attention to it. Personally, I adopt a different approach when it is time to upgrade the patient's product: My motto is, "If it is not broken, break it!"

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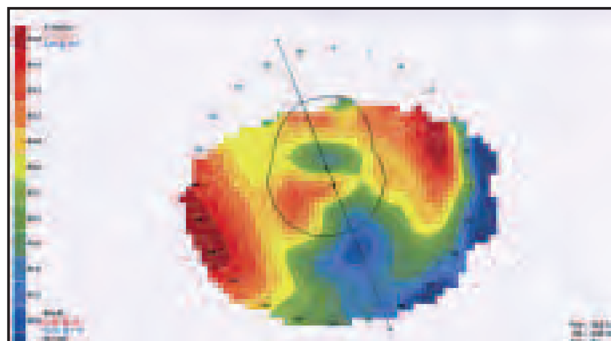

Fig. 1 Initial distorted cornea

SUBJECTIVE

I.C. has been a regular contact lens wearer for more than 20 years. She was referred to the University Clinic by her general practitioner in order to screen for retinopathy since she was recently diagnosed with Type 2 diabetes mellitus.

She is known as a monocular patient. She remained uncorrected for her visual problems until the age of 14 and even then, admitted having a hard time seeing at far. It was not until age 22, when she was first fitted for a contact lens in her right eye, that she was able to consider her visual acuity as acceptable.

A case history revealed that she was happy with her gas permeable contact lenses, which she wore during all her waking hours, every day of the week. When questioned a bit more, she admitted to having some lens awareness after 12 to 14 hours of wear, in addition to some redness. She also complained of itching during allergy season. She does not wear glasses due to a high myopic correction she feels is unacceptable both aesthetically and functionally. She has always been fitted with gas permeable lenses and she has renewed her contact lenses every two years. She has been followed regularly by an ophthalmologist in France, but has never been seen by an eye care practitioner since her arrival in Canada 15 months ago. She is compliant with her care regimen (soap, enzyme and conditioning solution) and denies any kind of side effects due to contact lens wear.

Table I Progression of rehabilitative process					
Follow-up time	**Entering visual acuity (Pinhole)**	**Subjective Rx**	**Topographic maps (Figs. 2, 3, 4)**	**Comments**	**New contact lens power**
Initial	6/12[-2]	–7.50 –5.50 x 100	Reversed + distorted pattern	Temporarily fit with Si-Hy lenses	–10.00
T + 3 weeks	6/21 (6/12)	–8.50 –3.00 x 80	ATR distorted pattern	Refit Acuvue Advance for Astigmatism (AAA)	–9.00 –1.75 x 80
T + 7 weeks	6/18 (6/12)	–8.50 –4.75x 110	Asymmetric ATR	AAA	–9.00 –1.75 x 100
T + 9 weeks	6/18 (6/12)	–9.00 –4.50 x 105	Regular oblique astigmatism pattern	Complete rehabilitation-RGP refit	Back-toric RGP lens
T = initial time					

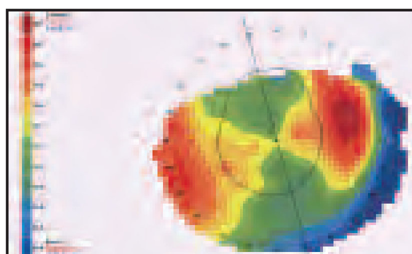
Fig. 2 Follow-up #1: Initial time + 3 weeks

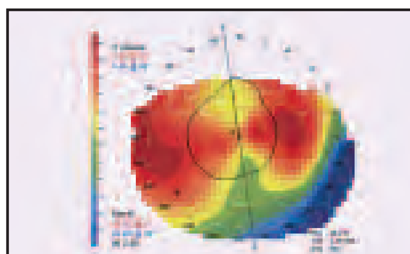
Fig. 3 Follow-up #2: Initial time + 7 weeks

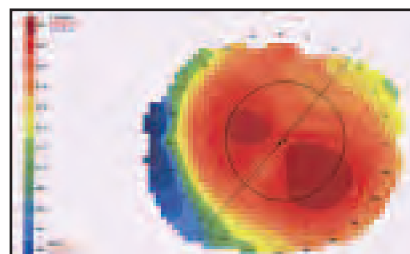
Fig. 4 Final restored cornea (Initial time + 9 weeks)

Objective

Clinical examination provided the following results:

- Visual acuity with lens on: OD 6/12 (20/40) – not improved with pinhole
- Refraction
  Objective: OD –9.00 –4.00 x 90; OS –17.00 –2.50 x 75
  Subjective: OD –7.50 –5.50 x 100 6/12 (20/40); OS N/C – light perception
  Objective Ks: OD 41.75 x 43.50 @ 15; OS 43.25 x 45.00 @ 143
- Biomicroscopy revealed a clear cornea OU with polymegatism OD. Neither corneal edema nor vascularization was seen on either side. Papillae Grade 2– and hyperemia 1+ was seen on the right palpebral conjunctiva and a diffuse bulbar hyperemia (1+) was noticed.
- Dilated fundus exam: No diabetic retinopathy was found OU. A posterior staphyloma was observed on the left eye, without any retinal break, fold, hole or detachment.

The patient was then referred to me in order to evaluate her contact lens wear and in order to improve her visual acuity, if possible.

At the first visit, the right lens was worn for 8 hours. We found the following results:

- Position and movement: Interpalpebral fit; lens riding low
- Fluorescein: Steep fit with against-the-rule (ATR) astigmatic pattern; overly large edge lift leading to poor tear exchange and accumulation of bubbles under the inferior edge
- Surfaces: Scratched, with many lipids and proteins deposits; lens calculi and mascara accumulated on the external mid-periphery
- Analysis: Base curve 7.96 x 8.07 mm (warped); power –8.50 D; diameter 8.90 mm; optic zone diameter 7.5 mm
- Visual acuity: 6/12 (20/40) at far; 0.5 M at near
- Over-refraction: +0.75 –3.25 x 105 6/9+2 (20/30+2)
- Ocular parameters: Corneal diameter 10.5 mm; papillary diameter 3.5 mm (photopic); interpalpebral height 8 mm
- Topographic map (Fig. 1): Distorted and warped cornea OD; irregular astigmatism; reversed pattern (central cornea flatter)

Assessment

I diagnosed a warped cornea secondary to long-term contact lens wear. The contact lenses are also warped. Refractive amblyopia is considered, as well, more pronounced on the left side.

Plan

The first step in such a case is to restore the corneal shape. Better visual acuity might be achieved by addressing this issue. Even with the gas permeable lens on, a warped

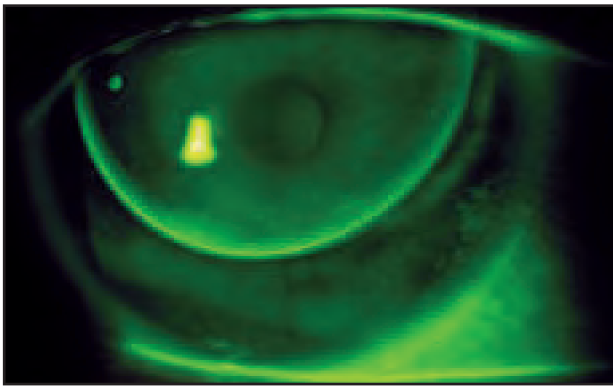

Fig. 5 Final fitting of the right lens

cornea (and warped lenses) cannot provide good visual acuity for most patients, depending on the level of the warpage and the other components of the eye.

We then decided to fit her temporarily with the highest DK soft lens available on the market (Focus Night & Day, 8.4 –10.00). With that lens on, she was able to reach 6/15 (20/50). We explained to the patient that this fitting would be temporary and that her vision would fluctuate as the cornea reshaped itself.

Follow-up Exams

Table I illustrates the progression of the rehabilitative process.

It took 9 weeks to restore the corneal shape. At this time, we were quite confident about refitting the patient with gas permeable lenses. Instead of a spherical lens, as she had been prescribed in Europe, we decided to opt for a back or bi-toric design. It is a well-known fact that any cylindrical cornea over 1.75 D should be fitted with toric lenses. For these patients, fitting a spherical RGP lens can lead to corneal distortion and an increased three to nine o'clock staining due to the altered tear flow under the lens.

Considering that our corneal cylinder (2.50 D) was less than the refractive one (–4.50), we decided to design a back-toric lens in a 5-step approach:

- Step 1: K values OD 42.25 x 44.75
- Step 2: Remba's rule for corneal cylinder: flatten the steepest meridian x 0.50; apply the 2/3 rule (2/3 x –4.50 = 3.00 D); design the back toric: **41.25 x 44.25**
- Step 3: Estimate the tear layer induced power –0.50 –0.50 x 105; if cylinder is over 1.00, consider bi-toric design
- Step 4: Compensate the spherical power (12.0 mm vertex); and consider Step 3 (spherical equivalent) –8.25 – (–0.75) = **–7.50**
- Step 5: Estimate the lens diameter (inside-out procedure)
  - Mean base curves: 42.75 = 7.89 mm
  - 7.89 = optic zone = 7.9 mm
  - +1.4 mm (3 peripheral curves) = 9.3 mm
  - Lenticular design: Add 0.2 mm = **9.5 mm** total

The lens material selected was Boston XO due to its stability (against warpage) and high oxygenation (protection for altered cornea).

The patient reported some difficulty with her visual field on the temporal left side. We then decided to attempt a fitting of the amblyopic eye, on that side, to improve her peripheral perception.

Using the same rationale, we designed the following lens:

- Base curves: 43.87 x 45.00 mm
- Power: -14.50 D
- Diameter: 9.5 mm
- Lenticular
- Boston XO

The lenses were delivered one week later and after 15 minutes of wear, the following results were found (Fig. 5):

- Visual acuity: OD 6/9+1 (20/30+1) – not improved with pinhole; OS 6/24 (20/80) – not improved with pinhole
- Position : Interpalpebral fit with slight lid attachment OU
- Movement: OD N; OS N+
- Fluorescein: Parallel to flat OU
- Edge lift: Optimal OU; no bubbles; good tear exchange

The patient was extremely happy with the results and was instructed to wear her lenses for no more than 14 hours per day. The regular Boston care regimen was prescribed, including cleaning and reconditioning solutions. No enzyme treatment was prescribed initially.

The patient was also strongly encouraged to wear polycarbonate glasses to alleviate any over wear of her contact lenses.

A follow-up exam is planned in several weeks in order to measure all the ocular parameters, the visual field improvement on the left side, and the stability of the topographic maps.

Conclusion

This case illustrates how to handle corneal warpage secondary to RGP contact lens wear. In addition, it illustrates the importance of taking the time necessary and the appropriate steps to improve corneal health and, consequently, visual acuity. ○