Clinical & Refractive Optometry is pleased to present this continuing education (CE) article by Lisa Y. Lin and Dr. Santos S. Tseng entitled **Keratoconus: A Report of a First-Time Rigid Lens Fit.** In order to obtain 1-hour of COPE-approved CE credit, please refer to page 318 for complete instructions.

Keratoconus: A Report of a First-Time Rigid Lens Fit

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Abstract

Keratoconus, a non-inflammatory thinning disorder of the cornea, poses challenges to both patients who have to overcome the visual disorders that accompany the disease, as well as practitioners as correction of keratoconus remains one of the greatest fitting challenges in the art of contact lens fitting. This paper presents a first-time fit of a newly diagnosed bilateral keratoconus patient beginning with the initial visit through to the subsequent follow-ups required to establish an appropriate lens design. The presenting patient was male, in his mid-20s, and complained of recent blur and epiphora. Diagnosis of the disease was confirmed by corneal topography, with the ectasia manifesting as a "lazy-8" pattern of astigmatism, a sign commonly witnessed in incipient cases of the disease. Treatment of the condition involved design of appropriate rigid gas-permeable lenses for both eyes. Contact lens treatment providing acuities of 20/20+ (6/6+) for both the right and left eye is described.

Introduction

Keratoconus is a progressive, often asymmetric, non inflammatory disease characterized by the thinning, protrusion and scaring of the cornea.[1] Visual acuity is affected, and the loss in vision can range from mild to profound.

Management of the condition varies with the severity of the disease. Spectacle correction may be satisfactory in incipient cases, with penetrating keratoplasty being an option in contact lens-untreatable cases. The most common mode of treatment for keratoconus, however, remains non-surgical contact lens correction.

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This report discusses a first-time rigid lens fit for a classic keratoconus case, in which the ectasia developed several months prior to the exam.

Case Report

A 25-year-old university-educated Asian male in good general health presented for an eye examination. He was just recently discharged from a two-year service in the Taiwanese military. His ocular history included high myopia and high astigmatism. He complained of tearing and increasing blur in the last few months. The data from the exam was as follows:

- Current spectacles (2 years old):
  OD -4.75 -1.75 x 159 20/50- (6/15-)
  OS -4.25 -2.00 x 031 20/60 (6/18)
- Pinhole acuity: OD 20/20- (6/6-); OS 20/20- (6/6-)
- Refraction: OD -5.50 -3.25 x 017 20/30+ (6/9+)
  OS -5.50 -3.50 x 170 20/30 (6/9)
- Keratometry:
  OD 44.00 @ 008 / 48.25 @ 098 (distorted)
  Corneal Cylinder: -4.25 DC x 008
  OS 46.25 @ 169 / 52.00 @ 079 (distorted)
  Corneal Cylinder: -5.75 DC x 169
- Intraocular pressure: OD 8 mm Hg; OS 9 mm Hg

A corneal topography (Dicon axial map) was performed OU (Figs. 1, 2). The maps showed inferiorly displaced corneal apices with classic "lazy-8" astigmatism patterns in both eyes. Keratoconus was diagnosed. A tri-curve gas-permeable lens with base parameters 7.30/-4.00/9.20 and an over-refraction of -2.00 DS for OD and OS respectively, was deemed to have a reasonable fit, trialed, and ordered.

First Follow-Up Visit

The first follow-up visit occurred four days after the initial exam. The parameters of the two lenses were verified to be 7.30/-6.00/9.20.

Visual acuity with lenses was: OD 7.30/-6.00/9.20 20/20- (6/6-); OS 7.30/-6.00/9.20 20/25- (6/7.5-).

Both the fit and visual acuity of the OD lens was acceptable. Slight apical clearance was present, and sufficient peripheral support was observed. The OS fit,

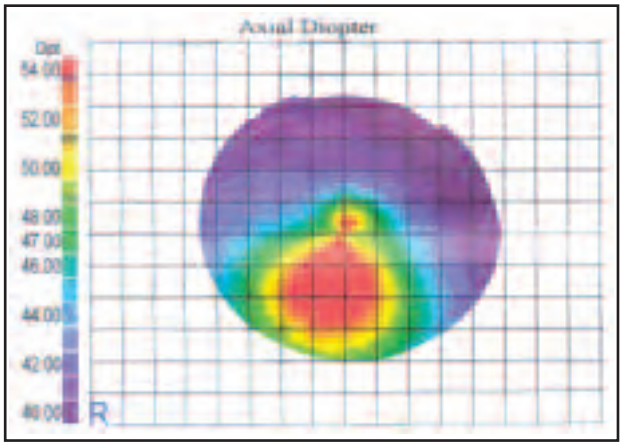

Fig. 1 Corneal topography of the right eye showing astigmatism and an inferiorly displaced apex.

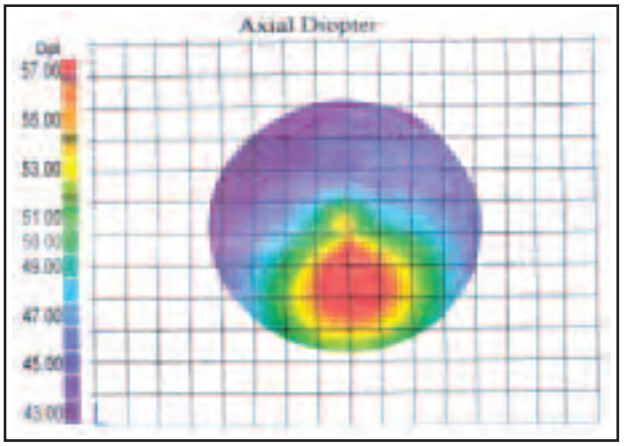

Fig. 2 Topography of the left eye demonstrating similar forme fruste keratoconus characteristics as the right eye.

however, was deemed to be too flat (bubbles underneath the lens, significant movement, poor centration), and unacceptable to both the examiner and patient. A steeper lens, with parameters 7.20/-4.00/9.20 and an over-refraction of -2.25 DS, providing an acuity of 20/20 (6/6) was trialed and ordered for the left eye. No lenses were dispensed at this visit.

Second Follow-Up Visit

The second follow-up visit occurred three days after the first follow-up. The parameters of the new OS lens were verified to be 7.20/-6.25/9.20.

Visual acuity with lenses was: OD 7.30/-6.00/9.20 20/20- (6/6-); OS 7.20/-6.25/9.20 20/25+ (6/7.5+)

The fit of the two lenses was deemed acceptable at this visit. Slight apical clearance was present in both eyes, sufficient peripheral support was evident, movement was acceptable, and the patient was willing to attempt wear of the new lenses, although he reported considerable foreign body sensation. The lenses were dispensed at this visit, and instructions for wear time and care of the lenses were given.

Third Follow-Up Visit

The third follow-up visit occurred seven days after the second follow-up visit. The patient wore his rigid lenses into the exam.

Visual acuity with lenses was: OD 7.30/-6.00/9.20 20/20+ (6/6+); OS 7.20/-6.25/9.20 20/20+ (6/6+).

Slit-lamp examination revealed acceptable fit, centration, and movement of the lens in both eyes. The patient still noted considerable foreign body sensation, but felt the amount to be tolerable and would work on adaptation. He reported satisfaction with his acuity. Follow-ups were scheduled at one month, and planned for every two months thereafter.

Discussion

Keratoconus is a non-inflammatory, asymmetric, and progressive ectasia of the central or paracentral cornea. It is characterized by the thinning and subsequent steepening of the apical cornea, resulting in a localized protrusion at the corneal apex. Visual acuity is reduced, often due to the increasing presence of irregular astigmatism, at a rate consistent with disease severity.

Vision is typically correctable by spectacles in the early stages of the disease, with most cases managed through the use of rigid contact lenses thereafter.[2] Approximately 10% to 15% of patients will eventually undergo penetrating keratoplasty (corneal transplantation) when non-surgical treatment options become no longer viable or effective.

Disease Characteristics

Incipient keratoconus often presents as an initial decrease in visual acuity. Refractive findings typically include increasing irregular astigmatism, and a decrease in best-corrected spectacle acuity. The retinoscopy reflex, as well as keratometry mires, are often distorted. Other findings[3] include:

Fleischer's Ring: A yellow-brown ring that encircles the base of the cone. The phenomenon, caused by the absorption of iron by the basal epithelium layer from stagnant tears, is best viewed under cobalt blue light.

Vogt's Striae: Vertical stress lines that occur in the posterior stroma. The striae are typically a sign of more advanced keratoconus, and disappear upon induced pressure such as from an examiner's finger pressing on the patient's eyelid.

Munson's Sign: The V-shape form that the lower eyelid acquires when a patient with a moderate to severe corneal ectasia looks in downward gaze.

In general, the severity, and hence detectability of keratoconic signs increase with disease progression. In developing cases, known as forme fruste keratoconus,[4] diagnosis of the disease relies more heavily on refractive findings and topography.

Unique Challenges to Lens Practitioners

The fitter of a keratoconic patient must deal with several issues above the routine gas-permeable lens fit. Given the ectatic profile of a keratoconic cornea, specific challenges include the heightened difficulty in controlling lens centration, providing enough edge lift to prevent disruption of the corneal epithelium, creating enough tear exchange to allow for adequate oxygen transmission, and preventing sealing of the lens to the cornea that can lead to scarring and loss of best-corrected vision.[5] Unlike routine gas-permeable lens fits, keratoconus is a progressive disease, and hence fits must be modified over time as the profile of the cornea changes.

Another challenge facing a gas-permeable lens fitter is finding a balance between the opposing merits of apical support versus apical clearance fittings.[6] Some case study evidence has led to the hypothesis that apical clearance fittings accelerate ectatic progression. However, management by the opposing method, via apical support, is viewed as the primary cause of corneal scarring, which is the first significant step towards penetrating keratoplasty. Currently, fitting philosophies that balance the two above hypotheses, while placing particular importance on the reduction of excessive mechanical pressure on the cone, are recommended. Two fitting philosophies that attempt to balance the above conditions include the three-point touch method, and the "first definite apical clearance" fitting pattern.

Conclusion

The impact of keratoconus on a patient's quality of life can be significant. Typically, the disease is identified in patients during their late teens. Due to its average age of onset, the disease has been known to force students from pursuing educational goals because of an inability to perform necessary visual tasks. In working individuals, the disorder has caused the loss of, and inability to acquire employment. For those who are scheduled to undergo penetrating keratoplasty, wait times for the surgery are often measured in years.

For many patients suffering from keratoconus, the disease will present profound challenges. Research into the disease remains ongoing, and attempts to identify risk and protective factors are underway by groups worldwide.[7] ❑

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