Clinical & Refractive Optometry is pleased to present this continuing education (CE) article by Dr. John C. Hsiao and Dr. Santos S. Tseng entitled **Corneal Iron Ring Induced by Overnight Orthokeratology Lens Wear.** In order to obtain 1-hour of COPE-approved CE credit, please refer to page 438 for complete instructions.

Corneal Iron Ring Induced by Overnight Orthokeratology Lens Wear

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Abstract

Visible iron deposits in the cornea in the form of rings and lines have been observed in patients with corneal pathologies such as keratoconus and pterygium, and other contour-altering procedures such as LASIK and filtering bleb surgery. We report a case of a 14-year-old female overnight orthokeratology patient who was fit with reverse geometry lenses, who after several weeks of lens wear, presented with bilateral shiny brown arcs in the mid-peripheral inferior quadrant of both eyes. Vision was unaffected, and the eyes were otherwise unremarkable. The presumed-to-be iron deposits were deemed the non-pathological orthokeratologic-variant of the keratoconus-associated Fleisher's ring. The location of the deposits, coinciding with the fitting curve of the rigid lens, suggests tear-pooling may have been involved in their development.

Introduction

Iron deposition in the cornea, resulting in brown-colored rings or lines, is thought to be caused by the absorption of the metal into the basal epithelium layer from local stagnant tears.[1] The phenomenon has been observed in several clinical scenarios, most notably keratoconus where the deposition, known as Fleisher's ring, presents as a partial or complete brownish circle residing at the base of the cone.[2] Other manifestations of visible iron depositions in the cornea include conditions marked by the presence of stagnant tear movement, such as the Hudson-Stahli line, which appears at the base of the eyelid, Ferry's line, which appears anterior to a filtering bleb, and Stoker's line, which appears adjacent to a corneal pterygium.[3]

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We report a case of a healthy female undergoing overnight orthokeratology treatment for the reduction of myopia, in whom a Fleisher's-like brown ring developed after several months of lens wear.

Case Report

The patient was a 14-year-old healthy female who presented with an interest in a non-spectacle solution to her myopia. Refractive findings included:

- Refraction: OD –4.75 sph 6/6 (20/20)
  OS –4.75 sph 6/6 (20/20)
- Keratometry: OD 45.50 @ 135 / 45.75 @ 045
  OS 46.00 @ 005 / 46.50 @ 095

The patient was interested in pursuing an orthokeratology regimen to treat her myopia. Pre-treatment topographies (Figs. 1, 2) were performed using the Dicon topographer (Paradigm Medical, USA). Lenses were ordered, and the patient was invited to return in a week's time for lens pick-up.

The Dispensing Visit

The lenses were dispensed at this visit. The lenses were manufactured by Dreimlens (FL, USA), and made of fluorosilicone acrylate (Boston XO). The parameters of the lenses were:

- OD: 8.23/plano/0.22/10.6/6.0
- OS: 8.18/plano/0.22/10.6/6.0

This describes the lens' base curve, back vertex power, center thickness, diameter, and optic zone diameter, respectively. Boston RGP cleaning and conditioning solution were also dispensed, as well as instructions for proper lens care and hygiene. The patient was given the lenses for daily overnight wear.

Follow-Up Visits

Follow-up visits were scheduled at one week, three weeks, seven weeks, and fifteen weeks post-dispensing. The follow-ups, which included measurement of acuity and topography, were otherwise unremarkable. 6/7.5 (20/25) unaided acuity was obtained at the first-week

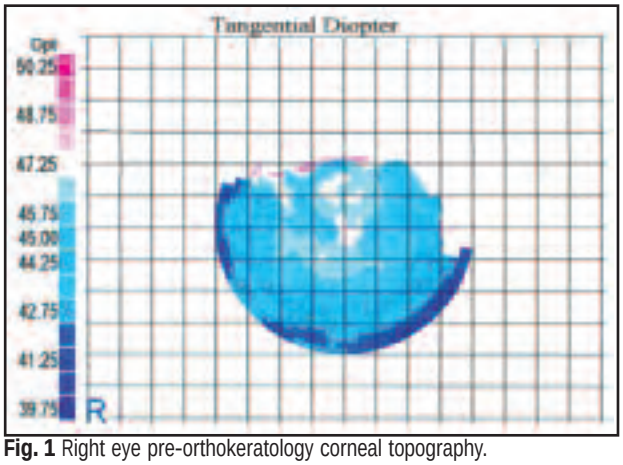

Fig. 1 Right eye pre-orthokeratology corneal topography.

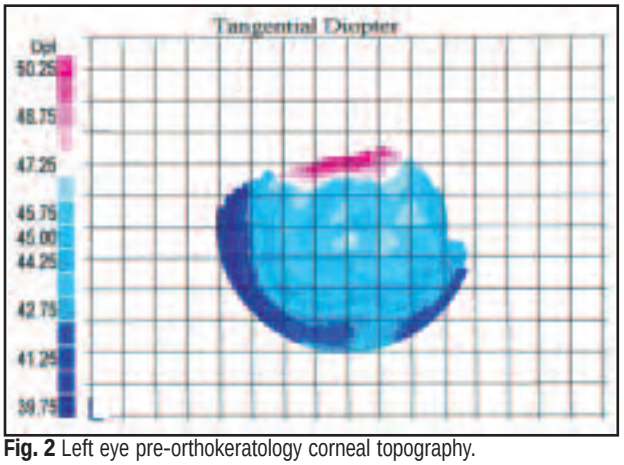

Fig. 2 Left eye pre-orthokeratology corneal topography.

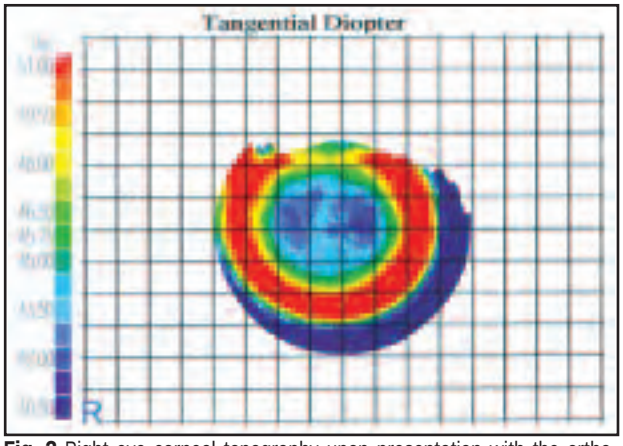

Fig. 3 Right eye corneal topography upon presentation with the orthokeratology-associated iron ring.

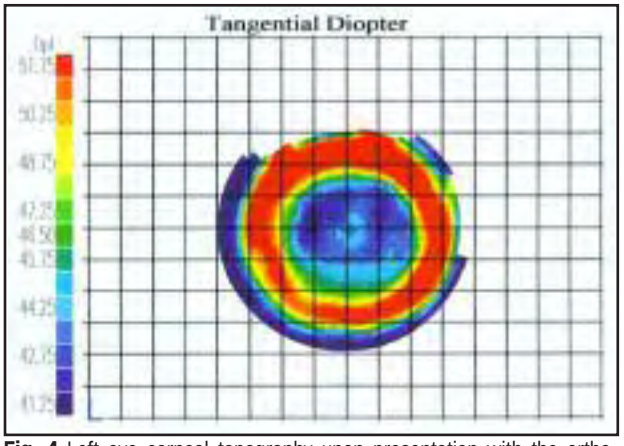

Fig. 4 Left eye corneal topography upon presentation with the orthokeratology-associated iron ring.

follow-up, with 6/6 (20/20) unaided acuity attained at the three-week follow-up. The patient was invited to continue lens wear.

The Iron Ring Deposition

At the 24-week post-dispensing follow-up visit, the patient presented with 6/6 (20/20) unaided acuity in each eye. Topography was unremarkable (Figs. 3, 4), and consistent with previous visits. Slit-lamp examination revealed a shiny, brownish Fleischer's-like ring present at the mid-peripheral inferior quadrant of both corneas (Figs. 5, 6). The location of the deposition coincided with the fitting curve of the orthokeratology lens, suggesting a stagnant-tear mechanism for its development. The non-pathologic orthokeratologic variant of the keratoconic Fleischer's ring was diagnosed.

The patient reported no adverse symptoms and desired continuation of lens wear. Given that her corneas were otherwise unremarkable and her vision clear, the patient was permitted to continue lens wear and instructed to continue with her routine maintenance follow-up visits.

Discussion

Iron deposition in the cornea has been associated with normal aging (Hudson-Stahli) eyes, as well as several pathologies and procedures leading to an abrupt change in corneal contour. Keratoconus, pterygium, Salzmann's nodular degeneration, filtering bleb surgery, radial keratotomy, intrastromal corneal ring implantation, myopic photorefractive keratectomy, hyperopic laser in situ keratomileusis (LASIK), and iatrogenic keratectasia after LASIK, have all been associated with the development of iron rings and lines.[3,4]

According to the tear-pooling hypothesis, iron found present in localized stagnant tears is absorbed into the basal epithelial layer of the cornea, giving rise to the brownish color.[1] The shape of the reverse geometry contact lens, characteristic of those used in orthokeratology, allows for tears to pool beneath the second (fitting) curve

Fig. 5 Right eye showing an iron-ring in the inferior mid-peripheral cornea of a 14-year-old female overnight orthokeratology lens wearer.

Fig. 6 The left eye of the same patient, demonstrating a similar orthokeratology-associated iron-ring as in the right eye.

of the lens, giving a tear reservoir from which the iron line/ring can form.

In the case of our patient, an otherwise healthy myopic female, the iron depositions witnessed were not a sign of corneal pathology, and must be differentiated as such. Unlike the keratoconus Fleisher's ring, or other pathologies/procedures that give rise to a stagnant tear reservoir on the eye, the iron ring associated with orthokeratology is simply a result of reverse geometry lens wear. In conclusion, the rings are considered benign, and when encountered clinically, must be distinguished from similar rings resulting from pathologic conditions. ❑

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