

Increase post-lens central tear film thickness to resolve central corneal staining in OK lens wear

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Background

In contrast to RGP in daytime wear, Ortho-K lens is worn overnight with eye closed in which lens movement is almost absent. Close of eyelid also exerts additional pressure on the cornea through the lens. In Ortho-K lens wear, lens binding has been reported as the most frequent problem (Cho et al. 2003). Around 40% of the Ortho-K lens wearers showed various grade of corneal staining in day 1 post-lens wear (Chan et al. 2008). Among patients with corneal staining, majority of them were in central cornea (Chan et al. 2008). It has been reported that the incidence rate of central corneal staining at day 1 post overnight lens wear was 22% and at day 7 was 17% among 51 pediatric wearers (Chan et al. 2012). Central corneal staining was believed to relate to poor lens fitting which may cause lens binding to the cornea (Lui and Xie 2016). The reduction in sag height was estimated up to 20um due to "settling down" of Ortho-K lens during overnight wear, thus pushing the lens closer to the corneal surface (Chui and Cho 2003). Use of lubricant before and after lens insertion (Chui and Cho 2003) as well as before lens removal (Chui and Cho 2003, Chan et al. 2008) were proposed by some practitioners to alleviate the possible lens binding and central corneal staining. The aim of this case report is to demonstrate how computerised contact lens fitting simulation can be used to increase the post-lens central tear film thickness (cTFT) to resolve the central corneal staining in an Ortho-K wearer.

Case description

A 49-year-old Caucasian female came for an Orthokeratology consultation in 2010. She had been using soft disposable contact lenses in a monovision correction and wanted to explore the option of Ortho-K lens wear. With subjective refraction of R: -3.25/-1.00x80 (6/6) and L: -2.75/-0.25x70 (6/6), she was fitted with a Forge Ortho-K lens designed by corneal topography based computerised simulation software, EyeSpace. The right eye was corrected for distance and the left eye remained unaided for near. Lens fitting was optimal with a typical bull's eye sodium fluorescein pattern observed at lens delivery. Lens care with hydrogen peroxide and non-preserved lubricant in the back on the lens on insertion was prescribed. After 2 weeks of overnight lens wear unaided vision was 6/6. In the subsequent reviews, no specific issues with lens wear were noted. She returned for regular lens replacement and aftercare in the following years with the most recent lenses being prescribed on 14-Aug-15. During the aftercare visit on 06-Feb-18, Superficial central corneal staining was found in the Right eye. Centrally distorted mire was also shown in the corneal topography map.

A new lens was designed with increased cTFT was ordered, with the cTFT increased from 2.9um to 10.2um based on the simulated fluorescein pattern. She started to wear the new lens on 20-Mar-18. With the new lens, no central corneal staining was found in the subsequent follow-up visits. Corneal topography showed no distortion in the corneal mire with unaided visual acuity of 6/6 for distance.

	Before lens re-fit	4 weeks after lens re-fit
Unaided VA	R: 6/6	R: 6/6
Central corneal mire distortion	Present	Resolved
Central corneal staining	Present	Resolved

Before lens re-fit

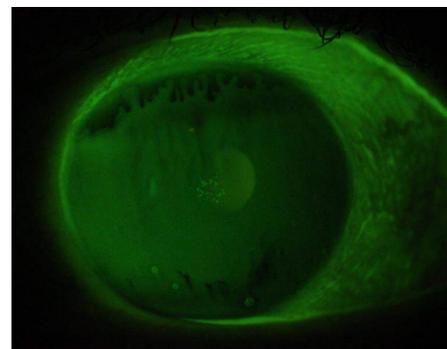


Figure 1: Superficial central corneal staining on the Right eye

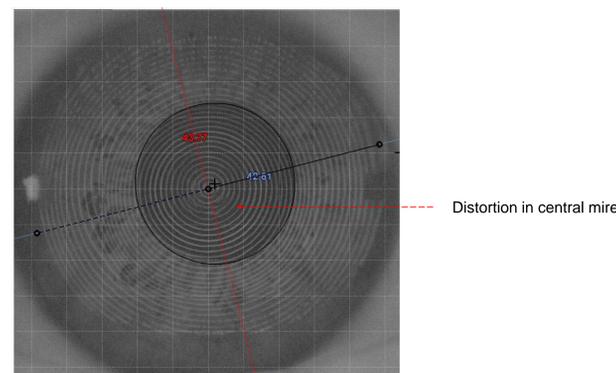


Figure 2: Corneal mire of the Right eye

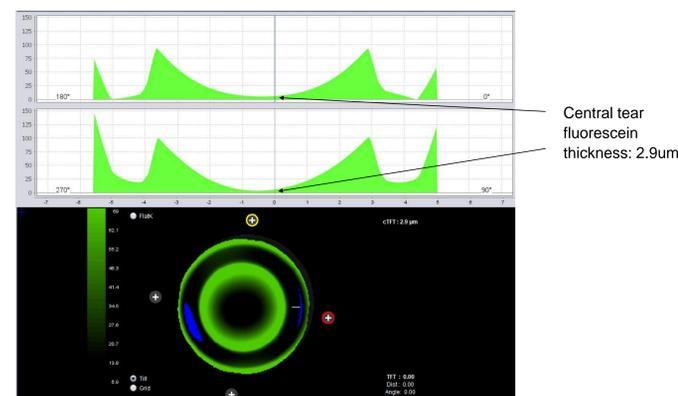
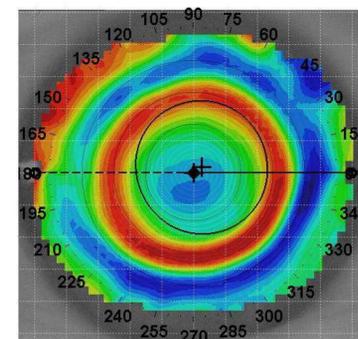


Figure 3: The simulated fit of the old lens on the Right eye

4 weeks after lens re-fit



Standard Power Diff: 0.00 mm Angle: 0° Power: -3.46 D

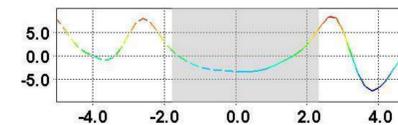


Figure 4: Tangential difference map of the Right eye on 17-Apr-18

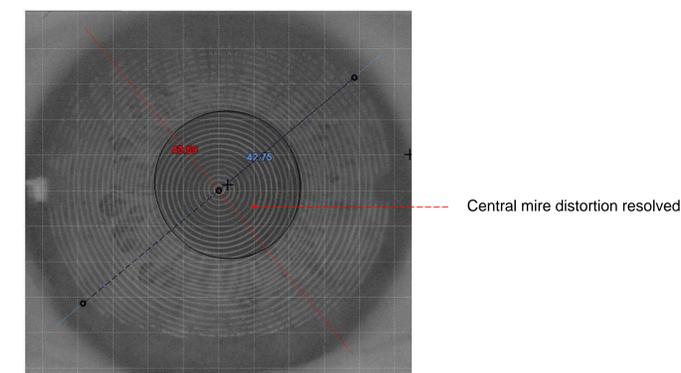


Figure 5: Corneal mire of the Right eye

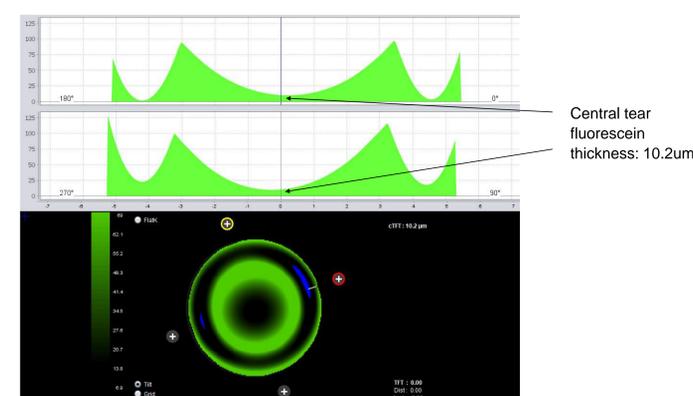


Figure 6: The simulated fit of the new lens on the Right eye

Discussion

- This case describes central corneal staining in orthokeratology lens wear.
- Using corneal topography based fluorescein simulation, a lens designed with cTFT of 2.9um resulted in corneal staining following overnight lens wear and corneal reshaping.
- While the lens was designed with central corneal lens clearance, as the lens reshapes the peripheral cornea, then lens will move towards the cornea, resulting in reduced central clearance, and eventually central lens corneal bearing.
- Excessive lens cornea bearing results in central corneal staining.
- To reduced the lens corneal bearing the lens was redesigned with increased central corneal clearance. This can be achieved by increasing the sagittal height of the lens, and is aided by computerized lens design software.
- As fluorescein is not visible when its thickness is below 15um (Young 1988 cited in Efron 2017), an increase of cTFT from 2.9um to 10.2um is very difficult to assess with biomicroscopy.
- Use of simulated cTFT to predict the actual cTFT on the eye provided valuable information to refine the lens fit.
- Central corneal staining is a common finding in ortho-K lens wear and results in a compromised cornea and increases risk for microbial keratitis. Computerised simulated contact lens fitting may enable more accurate lens fitting, and potentially reduce central corneal staining.

Conclusion

- Central corneal staining was resolved by an increase of post-lens cTFT. As fluorescein is not visible when its thickness is below 15um, this case demonstrated the usefulness of using simulated fluorescein pattern in refining the lens fit in Ortho-K wear.

References

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