Using Smaller Optic Zone (OZ) Diameter Design to Enhance Visual Quality in OrthoK Treatment

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Introduction

The global prevalence of myopia is steadily increasing each year with an estimated 50% of the population projected to be affected by myopia by the year 2050.[1] Orthokeratology (OrthoK) lenses have been shown to slow myopic progression in children compared to single vision spectacles. OrthoK utilizes specialty gas permeable lenses that work by temporarily reshaping corneal curvature through overnight wear. This case illustrates that reduced vision due to uneven central flattening can be improved with a smaller back optic zone diameter design without changing the width of the return zone.

Case Report

- A 15-year-old Asian male presented for his quarterly myopia control follow-up examination
- POHx
  - Has been seen in myopia control clinic since 01/2017
  - Pre-treatment refractive error
    - OD -3.50 -0.50 x 079
    - OS -3.50 -0.50 x 162

Treatment Timeline

- **1/2017 - 10/2020:** Initially fit in Paragon CRT Dual Axis lenses OU with the standard 6mm OZ (6OZ)
  - Good initial fit, but consistently showed a pseudocentral island of undertreatment OD>OS and noticeable decreased vision
- **11/2020**: Switched into a 5OZ CRT lens OD due to complaint of increased halo and glare in the morning and when playing basketball. Vision was reported to be significantly better after the 1st night of wearing 5OZ lens.
- **04/2021**: Switched into a 5OZ CRT lens OS since he was now noticing reduced vision OS compared to OD, which again improved his vision after the first night of 5OZ lens wear.
- **11/2021**: At the most recent visit, he achieved good visual performance OU and the lens showed a good fit with topography mapping. Axial length was stable and no myopic progression was noted

Lens Parameters:	Topography Interpretation	VA
October 2020 (6OZ lenses) OD 88-500/600-33/34 (10.5 DIA) OS 86-550-33/34 (10.5 DIA)	Pseudocentral island causing slight decreased vision OD>OS (see Fig 1)	OD: 20/20-3 OS: 20/20-1
November 2021 (5OZ lenses) OD 88-400/425-33/34 (10.5 DIA) OS 86-400/425-33 (10.5 DIA)	Improved pseudocentral island, decreased treatment zone size and enhanced midpheriphal steepening (see Fig 2)	OD: 20/20- OS: 20/20-

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Clinical Findings

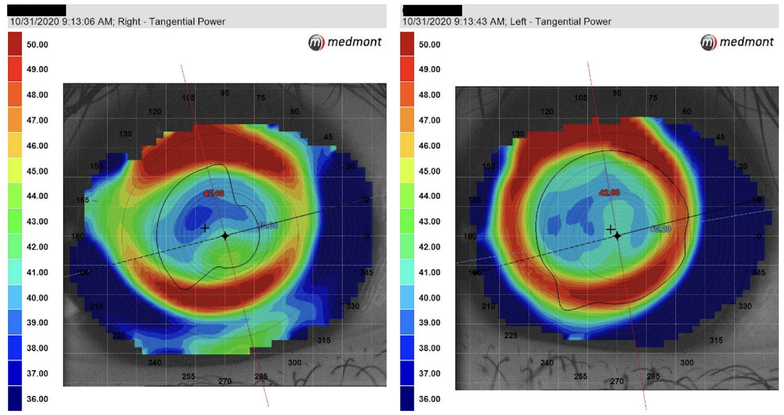

Fig 1: Topographical map of previous 6OZ lenses showing slight undertreatment and unevening central flattening causing a pseudocentral island OU

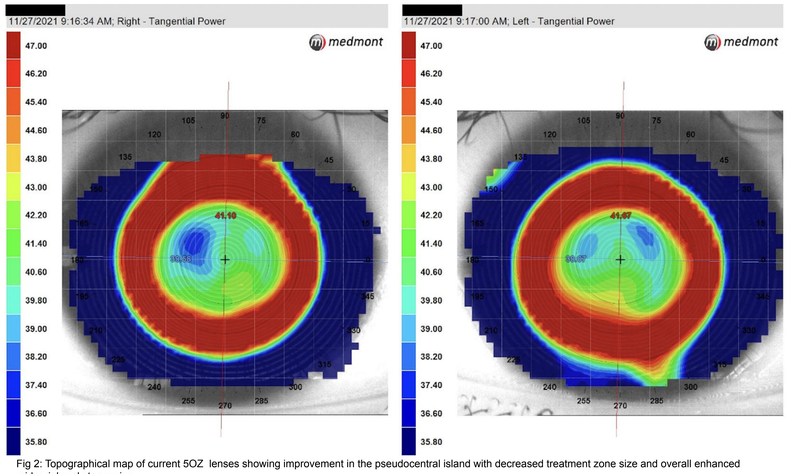

Fig 2: Topographical map of current 5OZ lenses showing improvement in the pseudocentral island with decreased treatment zone size and overall enhanced midperipheral steepening

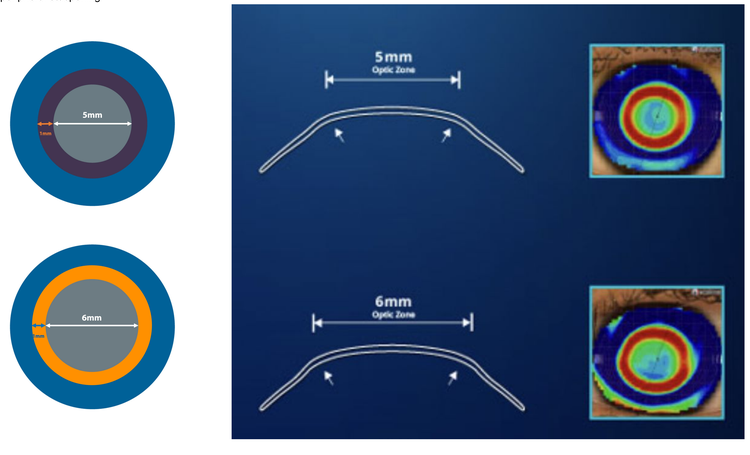

Fig 3: Topographical map and profile comparison of 5OZ lens (top) vs 6OZ lens (bottom)[3]

Discussion

- Factors to consider in CRT evaluation[3]:
  - Lens centration
  - Adequate treatment effect
    - Overcorrection or undercorrection
    - **Pseudocentral island**
      - Typically addressed by decreasing sagittal depth through changing the landing zone or return zone width
  - Appropriate edge lift & movement upon awakening
  - Induced or residual astigmatism

Conclusion

OrthoK lenses utilize a reverse geometry design to create a negative hydraulic pressure gradient that redistributes the tear film under the lens. The lens applies a positive push pressure over the central cornea and a negative pull pressure in the midperiphery. As a result, the central corneal epithelium is flattened and the midperiphery is steepened. The conventional design of CRT lenses utilizes an OZ of 6 mm. By utilizing a smaller 5OZ design, the distance from the peak of negative pressure to corneal apex is reduced, which allows for a **more efficient distribution of the hydraulic pressure gradient and eliminates the uneven central flattening**. A smaller treatment area can also help address complaints of halo and glare, as a larger treatment area combined with an uneven treatment zone runs the risk of more pronounced symptoms as compared to a smaller treatment area with more uniform central flattening. In summary, the 5OZ design can be utilized to achieve better treatment effect and improved outcomes in cases of challenging fits that do not respond well to the conventional 6OZ design.

References

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