Please Moon Me!

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Introduction

- Orthokeratology is one of the most clinically significant methods used to slow the progression of myopia.[3] In previous studies, the rate of axial elongation has been reported to be 32-55% slower than in those wearing other forms of correction.[3]
- Toric lenses have been created to meet the needs of myopia control in combined myopic and astigmatic patients. An important development because the incidence of astigmatism in myopic children between the ages 5 and 17 is about 15-28% in the United States.[7]
- This study tests the newly developed toric Moonlens® by Art Optical to determine if it can successfully overcome the past challenges of orthokeratology for patients with refractive astigmatism.
- For current designs being used, they are marketed for the correction of -1.00 D to -5.00 D of spherical power and up to -1.50 D of with-the-rule cylinder power or -0.75 D of against-the- rule cylinder power.[1]
- We are investigating whether the custom designed orthokeratology Moonlenses® can be used for levels of corneal astigmatism greater than or equal to -1.25D of with-the-rule astigmatism, the most common form of astigmatism. If this study is proven to be successful, it is possible that the use of these lenses can be expanded to a wider range of patients in need of the benefits orthokeratology has to offer.

Methods

- To be included in this study the subjects must have:
  - Refractive cylinder power - 1.25D or higher of WTR astigmatism or -1.00D or higher of ATR astigmatism
  - Stimulated K readings must not be lower than 38D
  - Pupils no larger than 5 mm in diameter in bright light
- Subjects may not be current orthokeratology users.
- The fitting included an initial corneal topography using the Medmont Topographer. Measurements of the best corrected visual acuity and subjective refraction were also documented.
- Using Art Optical's Moonlens® fitting guide and calculator, show below in **Figure 1** was used to design each custom toric lens.[6]
- Each patient was taught insertion, removal, and proper care of the lenses.
- The patients returned for periodic visits for a visual acuity check, refraction, slit lamp exam, and corneal topography.

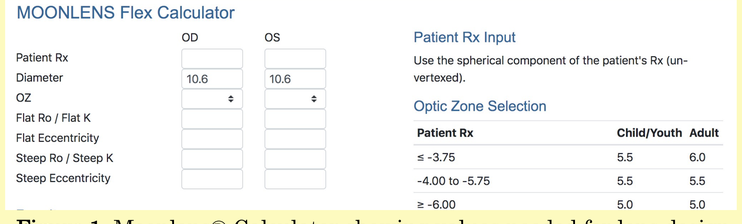

Figure 1. Moonlens® Calculator showing values needed for lens design.

Results

- There were two subjects in the study.
- Topography images showed no vertical or lateral decentration at any point during the study, images shown in **Figures 2 and 3**.
- Using a repeated measures ANOVA, it was determined that there was a significant difference between baseline corneal astigmatism and corneal astigmatism at one-month post-treatment ($F_{Statistic} > F_{critical}$, 7.2033283 > 0.0017325).
- The average decrease in corneal astigmatism was 1.1875 ± 0.16573 D. There were some mild increases during the treatment progress, likely due to decreases in wear time as the study continued

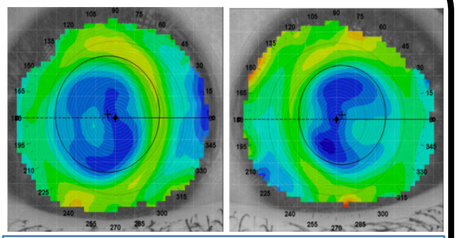

Figure 2 (above). Patinet 1 OD (right) and OS (left) topography images showing central flattening and proper centration.

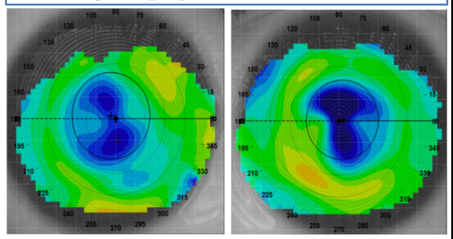

Figure 3 (above). Patinet 2 OD (right) and OS (left) topography images showing central flattening and proper centration.

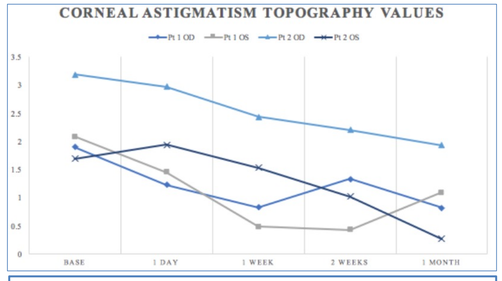

Figure 4 (above). This graph shows the overall decreasing trend of corneal astigmatism over the one month period.

- This same analysis, a repeated measures ANOVA, was done on the amount of astigmatism in the subjective refraction, which was also determined to be statically significant ($F_{Statistic} > F_{critical}$, 1.8330591 > 0.1773618).
- The average decrease in refractive astigmatism was 1.50 ± 0.68465 D. Although the subjective refractions still showed some left-over astigmatism both subjects were able to get 20/30 or better acuity in each eye, unaided by two weeks and 20/20 by one month.
- There were no incidences of patient discomfort, abrasions, microbial infection or other corneal complications aside from mild dryness.

Table 1 (below). Displays the baseline and final subjective refractions for each eye.

Table 1		Subjective Refraction
Pt 1 OD	Baseline	+0.50 -1.75 x 020
	1 Month	+0.50 -0.50 x 015
Pt 1 OS	Baseline	+1.50 -2.50 x 160
	1 Month	+1.25 -0.50 x 140
Pt 2 OD	Baseline	+0.50 -3.25 x 010
	1 Month	+0.25 -1.00 x 175
Pt 2 OS	Baseline	-0.75 -1.50 x 165
	1 Month	+0.75 -1.00 x 010

Conclusions

- In this study we have shown that toric corneas, even those outside the approved parameters for orthokeratology, can successfully be treated with this method of visual correction. All subjects within the study had adequate visual acuity as well as decreased corneal and refractive astigmatism and maintained normal ocular health.
- The Moonlens® design provided proper centrality and successful results.
- The sample size of the study was limited to only two subjects.
- Both subjects were in their mid-twenties, resulting in a bias towards having success of these lenses in a certain age group. Younger patients may have less complaince.
- The study did not monitor the compliance of the patients which may explain why there was such a variance in refraction and keratometry.
- There was a lack of patients with myopic prescription.
- The next step in the research of these lenses would be to fit combined myopic and astigmatic patients with Art Optical's Moonlens® to confirm proper lens centration and corneal flattening.
- In conclusion, this study has found that the Moonlens® is a viable option for the treatment of corneal astigmatism. The initial fitting guide and lens calculator provided all eyes with a lens that had proper centration and corneal flattening.
- These findings can be used to expand the parameters of orthokeratology treatment to combined myopic and astigmatic patients, especially children in need of myopia control.

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