A NOVEL ORTHOKERATOLOGY DESIGN FOR THE TREATMENT OF HYPEROPIA

AUTHORS: **JAGRUT LALLU** MSC SPECIALTY CONTACT LENSES (HONS), BOPTOM (HONS), FIAOMC AND **LACHLAN HOY** BAPPSC (OPTOM) HONS GCOT, FIAOMC, FCCLSA

COMPETITION CATEGORY:
PRACTITIONER/RESEARCHER CATEGORY

ABSTRACT:

INTRODUCTION: This poster outlines the correction of hyperopia and presbyopia using a unique Orthokeratology design. The application for this new design extends to a wide range of ametropia, including myopia, astigmatism and mixed astigmatism. The design is described by two zones. This poster describes an example of a case prior to the commencement of prospective research. The current literature shows a discrepancy between practitioner observation and published evidence on Hyperopia and Orthokeratology. At writing, a literature search demonstrated only 11 original research articles specifically related to Hyperopic Orthokeratology.

METHODS: Lens simulation software was used to design a novel orthokeratology lens for the treatment of hyperopia. A case was presented to describe its application in hyperopia and astigmatism as well as an example showing the design in a hyperope.

RESULTS: A new design was successful in the treatment of hyperopia at a three-month review. Continued work is underway to use this lens design in prospective research and add to the limited base of literature on the topic.

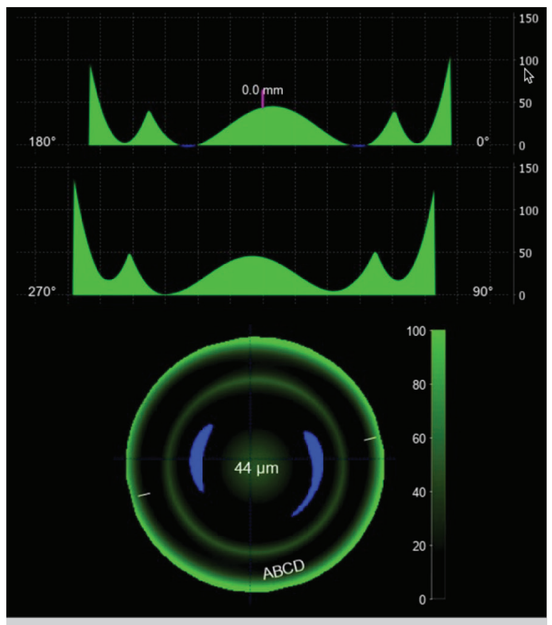
DESIGN INFORMATION:

2 ZONE LENS DESIGN FOR THE TREATMENT OF AMETROPIA IN ORTHOKERATOLOGY

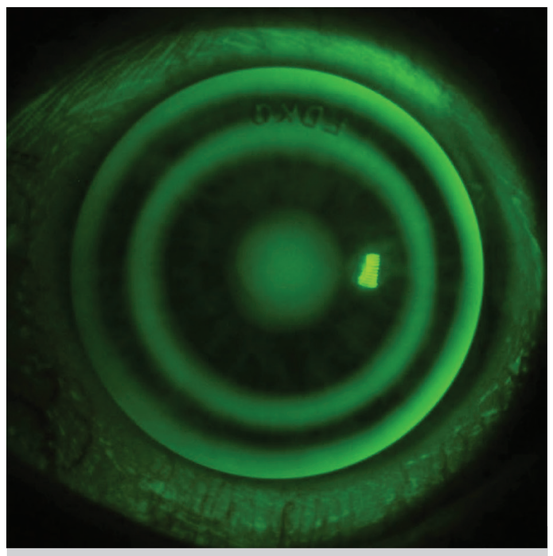
ZONE 1: Elliptic hyperboloid Diameter: 7.6 ctft: 44um	**ZONE 2:** Topography derived monotonically increasing function. Total Diameter: 11.2 Edge lift: 90-120um

This new lens design is useful in the treatment of a wide variety of ametropia correction and in the first example it shows that topography based lens design can generate a lens to a high level of accuracy.

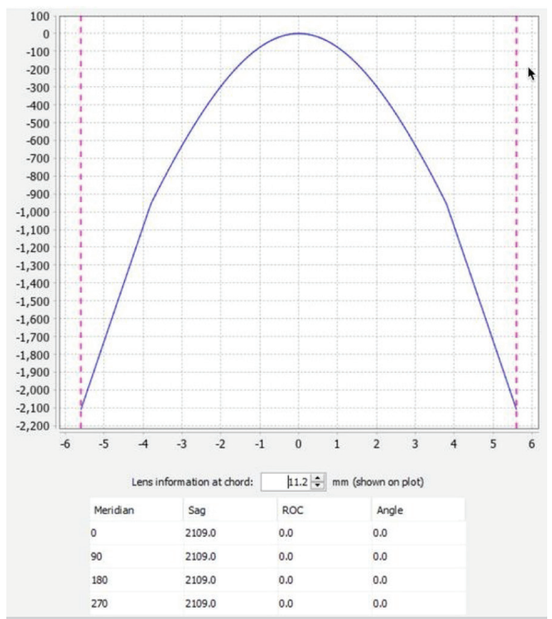
LENS DESIGN SIMULATION



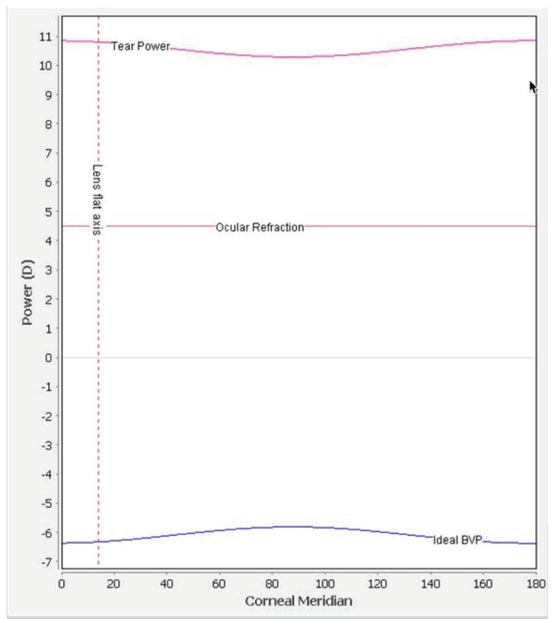
The lens design simulation shows the two zone lens.



Example of the 2-Zone lens for Hyperopia manufactured from the lens design at left demonstrating the accuracy of simulation versus lens in situ.



The lens schematic shows the lens sag and curvature

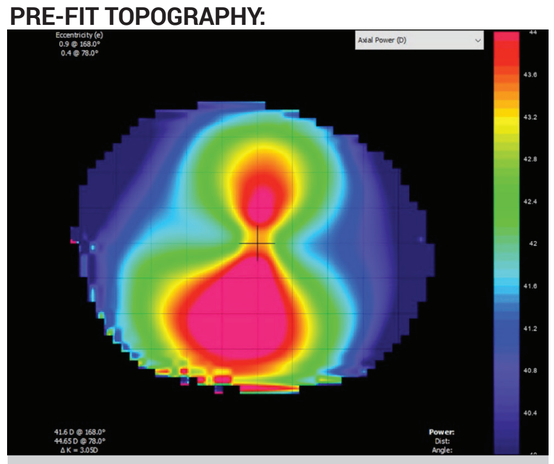


The optical analysis shows the tear power required in order to generate an orthokeratology effect of +4.25D of hyperopia in this new lens design

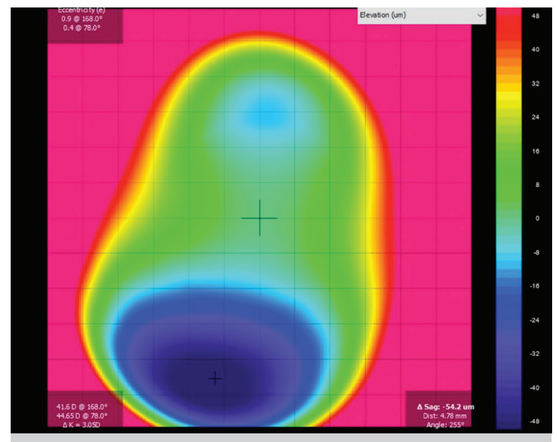
CASE EXAMPLE:

HISTORY: A hyperopic astigmat OS (+3.00/-2.75x173 VA 6/9 or 20/30) attended an assessment for Orthokeratology. Corneal topography data was collected as described.

PRE-FIT TOPOGRAPHY:

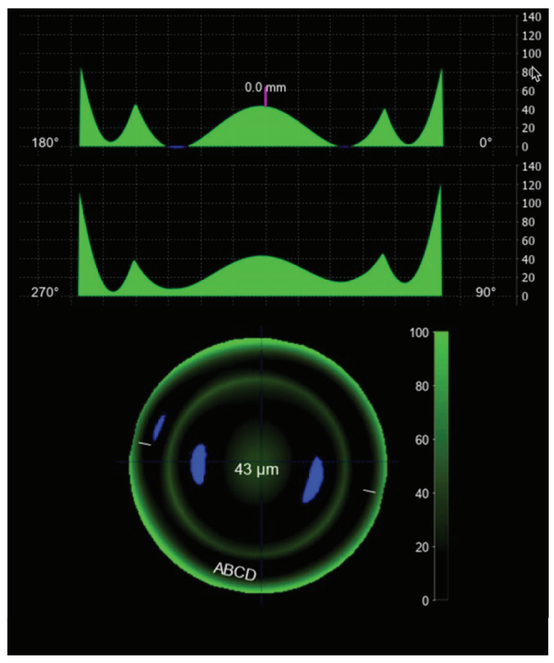


3.05 DC of corneal asymmetric corneal astigmatism. This is approximately equal to the spectacle prescription



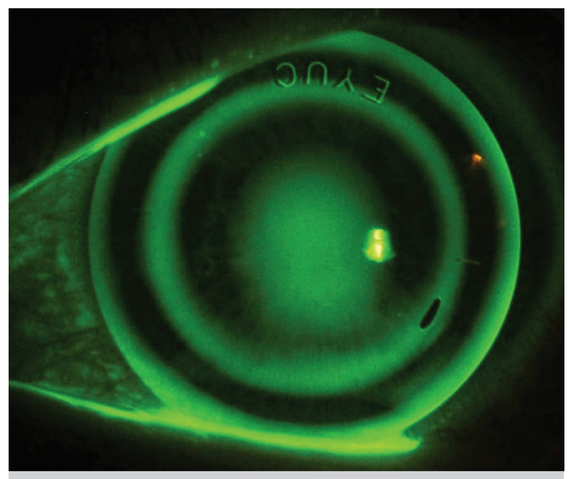
Inferior elevation of 54.2um.

DESIGN: The EyeSpace lens design platform was used. A novel 2-Zone lens was used in this case. The lens design diameter was selected to be 100% of the horizontal visible iris diameter (HVID). To avoid insult to the limbal area an axial edge lift was selected that provided a wide area of clearance. Ideally between 100 to 120um. This design methodology provides excellent centration and avoids inferior decentration which is commonly seen in asymmetric corneae[1].



The simulated fluorescein pattern from the EyeSpace Lens Design Software. The superior tear layer profile is shown through the flat meridian whilst the image below shows the tear layer profile through the steep meridian. The lens design shows an oval treatment zone. The final lens design that was ordered was a bi-toric 2-Zone lens design of the following parameters:

LENS DESIGN ON EYE:

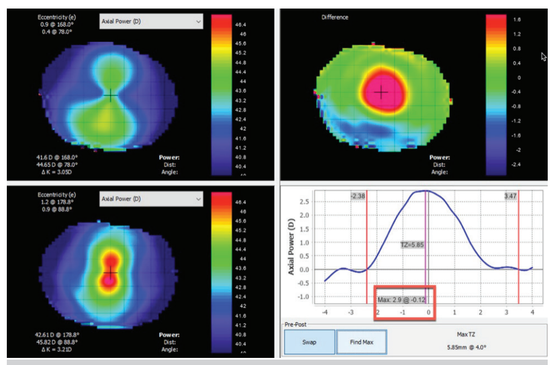


There is an oval treatment zone on both the simulation and lens on eye image which describes an astigmatic eye. The lens design is also 100% of the HVID and there is no impingement at the limbus.

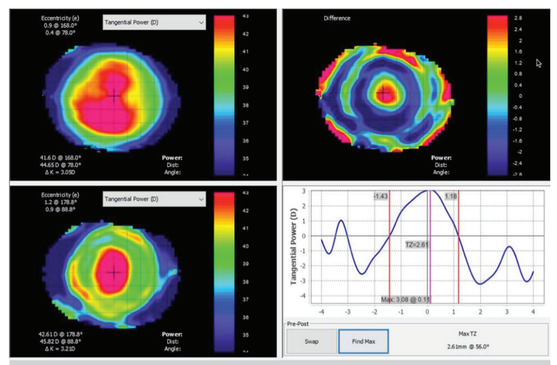
Zone 1:
Elliptic hyperboloid
Diameter: 7.7
ctft: 44um

Zone 2:
Topography derived monotonically increasing function, comprising two orthogonal meridians with sagittal height difference of 114 microns.
Total Diameter: 11.2
Edge lift: 90-120um

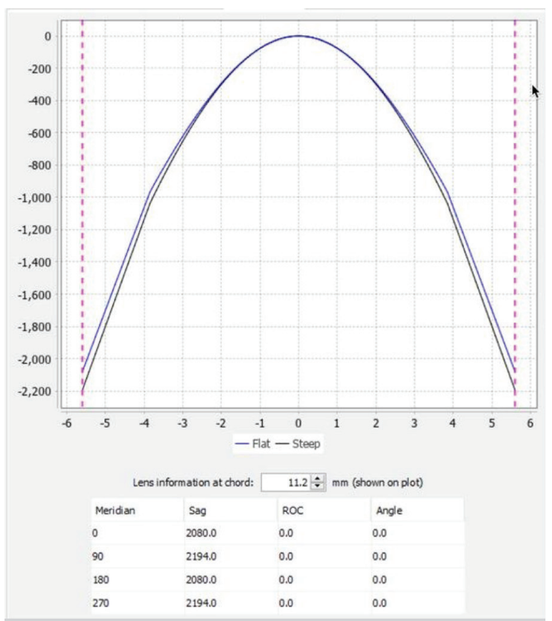
POST-WEAR TOPOGRAPHY



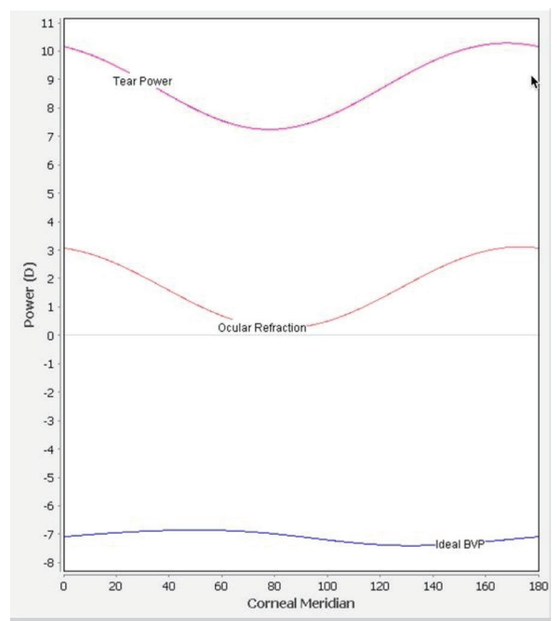
The post-wear axial difference map shows a large treatment zone diameter and a maximum correction of +2.90 D or Hyperopia.



The post-wear tangential difference map shows a well centred treatment zone.



The lens schematic describes the curvature of the lens in both the flat and steep meridian.



The optical analysis shows the tear power and Jessen Factor required in this design to achieve the final outcome.

Unaided vision following three months of wear was recorded as 6/7.5 (20/25).

CONCLUSION:

A new design for the treatment of hyperopia and other ametropias appears to be effective in its treatment. The authors plan to continue and carry out prospective research that will add to the global research on this promising niche within the modality.

References:
1. *Chen Z, Xue F, Zhou J, Qu X, Zhou X, Orthokeratology FTS, et al. Prediction of Orthokeratology Lens Decentration with Corneal Elevation. Optom Vis Sci. 2017 Sep 1;94(9):903–7.*