A New Approach to Designing Keratoconus Lenses

Marcus P. Soper B.C.O., F.C.L.S.A.

Houston, Texas

BACKGROUND

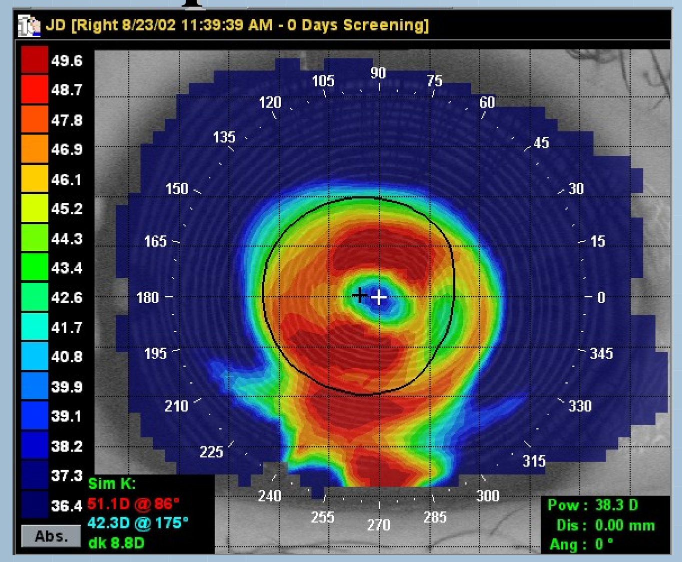
The advent of computer assisted corneal topography has created yet another paradoxical shift within the contact lens industry. Clinicians are now able to better identify true corneal geometry and apply it to contact lens design. Manufacturers are able to partner with the clinician to apply the topographical findings to automated manufacturing equipment and produce the current concept of the "best fit".

PURPOSE AND HYPOTHESIS

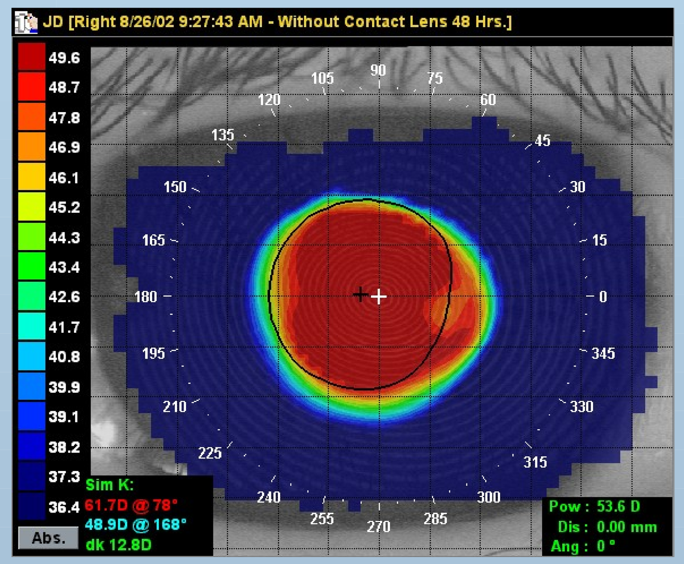
The purpose of this poster is to share an approach to determining the optical zone diameter and base curve radius for keratoconus contact lenses.

Using computerized topographical mapping and advanced analysis of the findings, keratoconus lenses were designed. These lenses were compared to lenses being worn that were empirically designed and determined by the author to be well fitted. This design method can be applied by the clinician for the diagnostic evaluation, design, fitting and follow up of keratoconus.

Wearing lens with Apical touch



Without contact lens 48 hours



MATERIALS AND METHODS

Using the Medmont ES-300 Topographical System corneal topography is performed with analysis of absolute tangential scale maps . *If distortion of the cornea exist due to current contact lens wear it is best to discontinue lens wear for 48 hours and repeat the mapping.*

To determine the optical zone diameter:

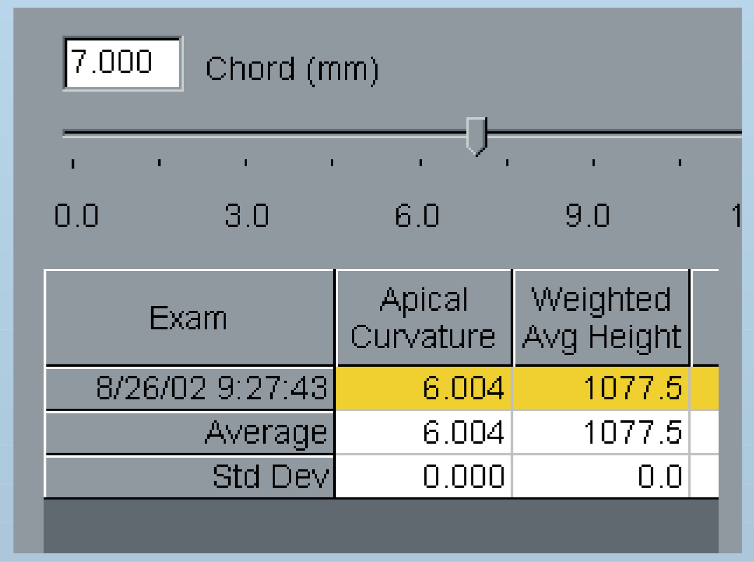
The base of the cone is identified at the point where the cornea returned to a more normal radius of 43:00 diopters (7.85 mm). The diameter of the cone is then measured at the widest point of the base. Two millimeters is added to the diameter of the base to determine the optical zone. One millimeter of the additional two millimeters allows the lens to move without significant compression of the optical zone against the peripheral portion of the conical apex. The second millimeter allows for transitional curves into the peripheral lens design when needed.

To determine the base curve:

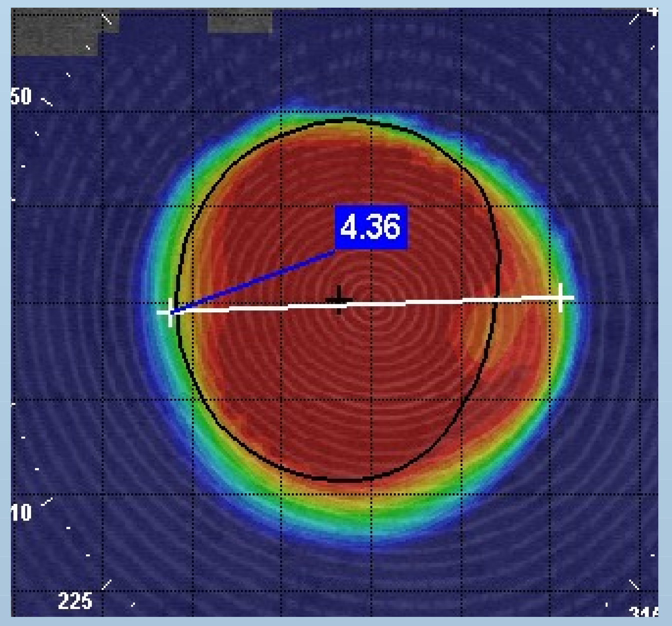
The sagittal height of the cone is measured along the steepest meridian at a chord length of 7.0 millimeters. The sagittal height is transposed into millimeters/diopters using Creighton's Tables[1] derived from:

Sag = Radius – (√ Radius² - Chord Radius²).

EXAMPLE



Base Curve Selection
Sagittal Height = Base Curve
1077 @ 7.0mm = 54:25D



Optical Zone Diameter
Apical Base + 2 mm
4.36 + 2.0 = 6.36 mm

RESULTS / DISCUSSION

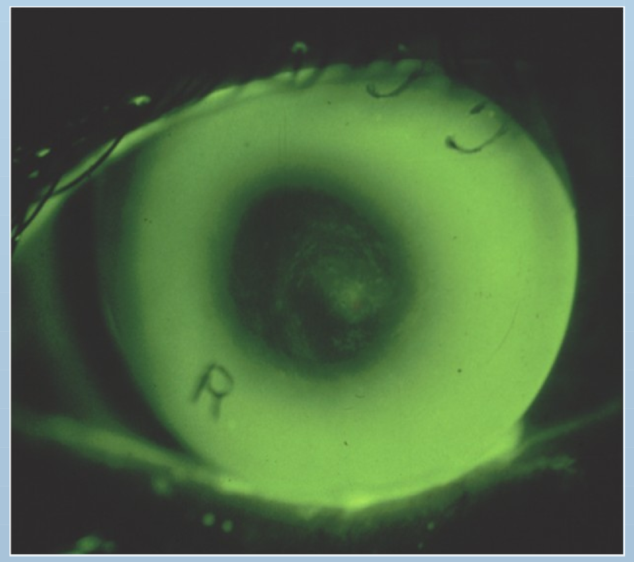
Four hundred eleven eyes were fitted using this method Resultant lens sagittal depths were found to mirror the empirically designed lenses on previously well fitted eyes. In addition, application of the base curve and optical zone findings simplified and enhanced the initial fitting, refitting and follow up of keratoconus lens. A limitation of the topographer used is that the chord determining the sagittal height is aligned with the geometric center of the cornea. This requires the use of a chord larger than the base of the cone to insure the complete encompassing of the cone. A larger offset chord length creates the potential for skewing the sagittal height of the cone. The ability to relocate the central point of the chord length over the absolute apex of the cornea and allow the sagittal height to be measured from the true base of the cone would yield absolute values. The 7.0mm offset chord used in this example works well but should be recognized as a variable.

CONCLUSIONS

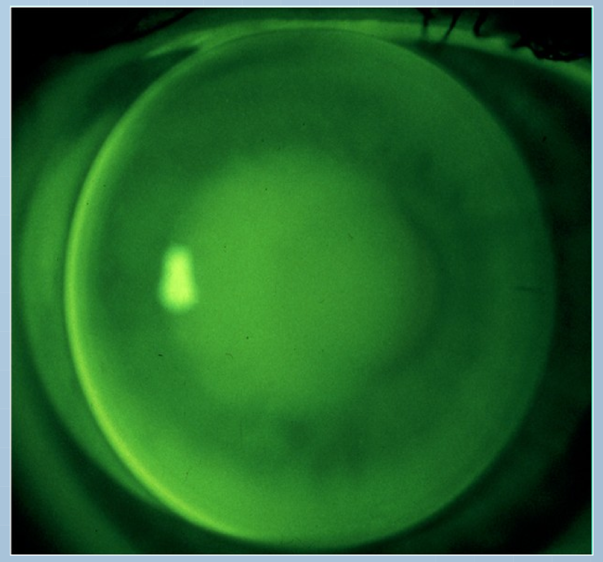
The author concludes that in his hands this method of designing keratoconus lenses is a valuable and viable tool for the ophthalmic industry.

Further multi-center studies are planned in order to confirm these initial findings.

Apical Touch



Improved Design



1. Creighton, C.P.: Contact lens fabrication tables, Creighton Publishers, Towanda, New York, 1964