Reliability of *in vivo* scleral contact lens evaluation using various high-definition anterior segment optical coherence tomography instrumentation

Western University

Dorcas K. Tsang[1], Jie Shen[1], Frank Spors[1] Lance E. McNaughton[2], Donald J. Egan[3]

[1]Western University of Health Sciences, College of Optometry, [2]New England College of Optometry, [3]University of Pikeville, Kentucky College of Optometry

College of Optometry

Introduction

As the scleral gas-permeable contact lens (SGP) becomes more widely prescribed for both irregular and regular corneas, more practitioners have integrated the technology of anterior segment optical coherence tomography (AS OCT) in its design and fit evaluation.[1-3] Due to the importance of assessing the post-lens tear thickness, or the amount of central corneal clearance (CCC), and the inherent biases from viewing angle limitations in the existing biomicroscopes, the utilization of the built-in caliper tools of these instruments have become common practice.[3,4] This study compared the agreement among high-definition AS OCT instruments in the measurement of scleral lens thicknesses *in vivo* against the measurements of central corneal thickness (CCT) by the same instruments, and against SGP center thickness (CT) measurements by digital and handheld thickness gauges.

Methods

Ten baseline pachymetry maps on each eye of one of our investigators were obtained with three different instruments: two AS OCT and one Scheimpflug system.

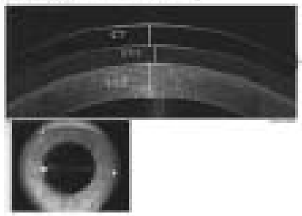
1. Visante Anterior Segment Optical Coherence Tomographer (Carl Zeiss Meditec, Dublin, California, USA)
2. Cirrus 5000 HD-OCT (Carl Zeiss Meditec, Dublin, California, USA) with the cornea AS lens
3. Pentacam HR (Oculus, Wetzlar, Germany)

High definition imaging of the corneas were also obtained as baseline, after which 10 consecutive images of the anterior segment in two different scleral lenses were captured within 30 minutes of lens application.

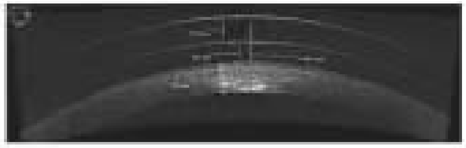
Lens	Manufacturer	Material	Ordered Parameters	Refractive Index
SynergEyes VS "3600 16-42"	SynergEyes Carlsbad, CA	Contamac Optimum Extreme	SAG 3.500 mm BC 8.40 mm Pwr 0.00 D Dia 16.0 mm CT 0.35 mm	[illegible]
Zenlens "33"	Alden Optical Lancaster, NY	Polymer Tech. Boston XO	SAG 4.500 mm BC 7.50 mm Pwr -4.00 D Dia 16.0 mm CT 0.36 mm	[illegible]

Methods

The built-in caliper tool of each of the AS OCT was used to measure the CT (center thickness of the contact lens), the CCC (central corneal clearance), and the CCT (central corneal thickness) of each image.



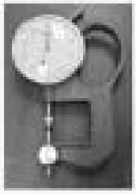
The CT, CCC, and CCT values were read to the 0.001 mm, or in 1-micron increments, with the caliper tool of the Cirrus HD.

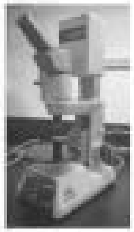


The CT, CCC, and CCT values were read to the 0.01 mm, or in 10-micron increments, with the caliper tool of the Visante.

Methods

A handheld analog thickness gauge and a digital thickness gauge were used as reference, both of which measured thicknesses to the nearest 0.01 mm, or 10-micron increments.

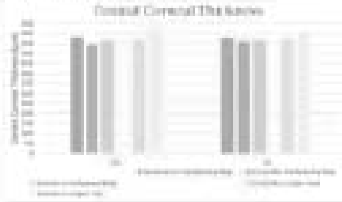




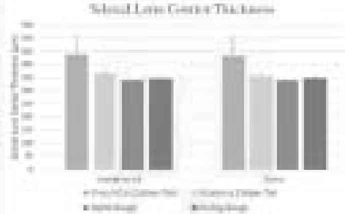
Results

In agreement with literature, all 3 instruments provided consistently repeatable measurements of the CCT of the naked eye when no contact lens was in place.[5-8]

When CCT was remeasured within 30 minutes of the application of a scleral lens, however, the results were considerably higher.

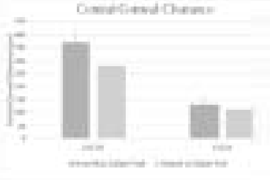


There was considerable variation in the measurements of the CT of the scleral lens by the built-in caliper tool, more so with the Cirrus HD.



Results

In addition, there was poor agreement of CCC measurements between the two AS OCT using their built-in caliper tools. Weak reproducibility was also found, which was more noticeable in the Cirrus HD.



Discussion

Conclusions

Although this study confirmed the reproducibility of current AS OCT and Scheimpflug system in measuring CCT in naked eyes, it showed lower reproducibility of the same with SGP *in vivo*. Measurements of the CT of the SGP and CCC between the contact lens and the cornea also yielded low accuracy with the AS OCT.

Further studies are needed to determine the need for refinement of the AS OCT in the application of *in vivo* evaluation of SGPs.

References

[illegible]

Contact Information: dtsang@westernu.edu