

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



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Introduction

As the scleral gas-permeable contact lens (SCL) 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 its evaluation.^{1,2} Due to the importance of assessing the post-fit lens thickness, or the amount of central corneal clearance (CCC), and the inferior issues 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 measurements in the measurement of scleral lens thickness *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 bilateral pachymetry maps on each eye of nine of our investigators were obtained with three different instruments: two AS-OCT and one Scheimpflug system.

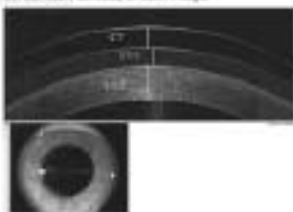
1. Visante Anterior Segment Optical Coherence Tomographer (Carl Zeiss Meditec, Dublin, California, USA)
2. Cirrus HD-OCT (Carl Zeiss Meditec, Dublin, California, USA) with the cornea AS lens
3. Pentacam HR (OcuLus, Wetzlar, Germany)

High definition images 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 seconds of lens application.

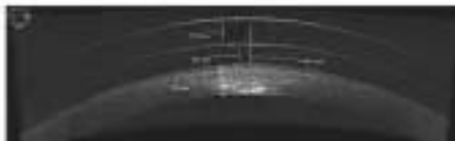
Lens	Manufacturer	Material	Prevalent thickness	Minimum value
Sprinkle VS "900 16-42"	Sprinkle Optics, CA	Conformal Optimum Extreme	543.500 mm IC 8.40 mm Per 5.00 mm SA 14.0 mm T 0.35 mm	5.011
Baylor "21"	Biological Services, NY	Polymer Shell, Nylon NY	543.500 mm IC 7.10 mm Per 4.00 mm SA 14.0 mm T 0.35 mm	5.011

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 OcuLus HR.



Methods

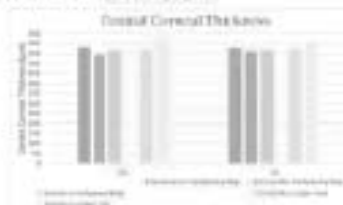
A handheld center thickness gauge and a digital thickness gauge were used as reference, both of which measured thickness to the nearest 0.01 mm, or 10-micron increments.



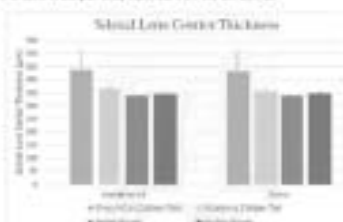
Results

It is agreed with literature, all 3 instruments provided consistently repeatable measurements of the CCT of the naked eye when no contact lens was in place.^{5,6}

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

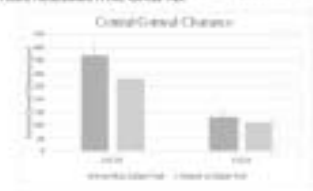


There was considerable variation in the measurement of the CT of the scleral lens by the built-in caliper tool, none so with the Cirrus HD.



Results

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



Discussion

Conclusions

Although this study confirmed the repeatability of current AS-OCT and Scheimpflug systems in measuring CCT in naked eyes, it showed lower repeatability of the same with SGP in vivo. Measurements of the CT of the SGP and CCC between the contact lens and the cornea also proved less 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 SGP.

References

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