Original Article

Agreement between Lenstar and Pentacam in Keratometry and Anterior Chamber Depth Measurements

Maryam Yadgari *[1], MD; Mohammad Reza Agha Mirsalim [1], MD; Mohsen Rezaei Hemami [1], MD, PhD; Anis Alsadat Jazayeri [1], MD; Mina Dargahi [1], MD

1. Eye Research Center, Rassoul Akram Hospital, Iran University of Medical Sciences, Tehran, Iran.

***Corresponding Author:** Maryam Yadgari
E-mail: Maryam.yadgari@yahoo.ie

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Abstract

Purpose: To compare keratometry and anterior chamber depth (ACD) measurements performed using Lenstar LS 900 (Haag-Streit AG, Switzerland) and the Pentacam (Oculus, Weltzar, Germany) devices in healthy eyes.
Method: Sixty eyes of 30 healthy volunteers were included in this prospective study. Keratometry and ACD measurements were obtained using Lenstar, followed by Pentacam on the same day. The readings of the two instruments were compared to evaluate their agreement.
Results: The mean age of participants was 40.01 ± 12.29 years (Range 10 to 65years). The mean ACD was 2.762 ± 0.281 millimeters when measured using Lenstar and 2.801 ± 0.273 millimeters when measured with Pentacam ($P = 0.03$). The average mean keratometry was 44.45 ± 1.65 diopter when measured with Lenstar and 44.16 ± 1.55 diopter when measured using Pentacam ($P < 0.001$). The Bland-Altman plots demonstrated a wide range of inter-device differences in mean keratectomy and also ACD measurements between the two devices.
Conclusion: Our findings suggest that the ACD and keratometry measurements obtained using the Lenstar and Pentacam devices might not be interchangeable.

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Introduction

The examination of the anterior eye segment is important in many areas of ophthalmology such as assessment of glaucoma risk factors [1,2] , planning surgical procedures such as calculation of intraocular lens (IOL) power [3,4] , and implantation of the anterior chamber phakic IOLs [5,6] . The corneal curvature and anterior chamber depth (ACD) measurements are also important in aphakic and phakic IOL surgery. Furthermore, the corneal curvature measurements are crucial in refractive surgery and contact lens fitting.

Currently, several instruments are available for measuring corneal curvature and ACD, such as slit-scanning topography systems, Scheimpflug topography devices, optical coherence tomography, partial coherence interferometry, and optical low-coherence reflectometry.

Pentacam (Oculus, Weltzar, Germany) uses a rotating Scheimpflug camera to produce an image of eye's anterior segment including the lens. This instrument can generate elevation topography and aberration maps of the anterior and posterior corneal surfaces as well as pachymetry maps, and perform chamber angle, ACD, and lens density measurements. The central corneal thickness (CCT) and ACD measurements provided by Pentacam have been reported to have excellent repeatability [7, 8].

The Lenstar LS 900 (Hagg-Streit AG, Koeniz, Switzerland) is a non-contact biometry device that can measure the corneal curvature, corneal diameter, CCT, ACD, lens thickness, and axial length. The system is based on optical low-coherence reflectometry using a broad-band light source. The repeatability of the Lenstar for keratometry, CCT, and ACD measurements has been reported to be excellent [9].

The purpose of the present study was to compare the corneal curvature and ACD measurements performed using the Lenstar LS 900 (Haag-Streit AG, Switzerland) and Pentacam (Oculus, Weltzar, Germany) in healthy eyes.

Methods

Sixty eyes of 30 healthy volunteers were included in this prospective study. The eyes were all healthy except for probable refractive errors. The exclusion criteria were any ocular disease or history of ocular surgery. The participants were informed about the purpose of the study and gave informed consent before inclusion in the study. The present study was approved by the ethics committee of Iran University of Medical Sciences, Tehran, Iran. Keratometry and ACD measurements were obtained with the Lenstar, followed by the Pentacam on the same day according to the manufacturers' recommendations. Both the Lenstar and the Pentacam measure the ACD from the corneal endothelium to the anterior lens capsule, therefore, in the present study; ACD was defined as the distance from the corneal endothelium to the lens.

Statistical analysis

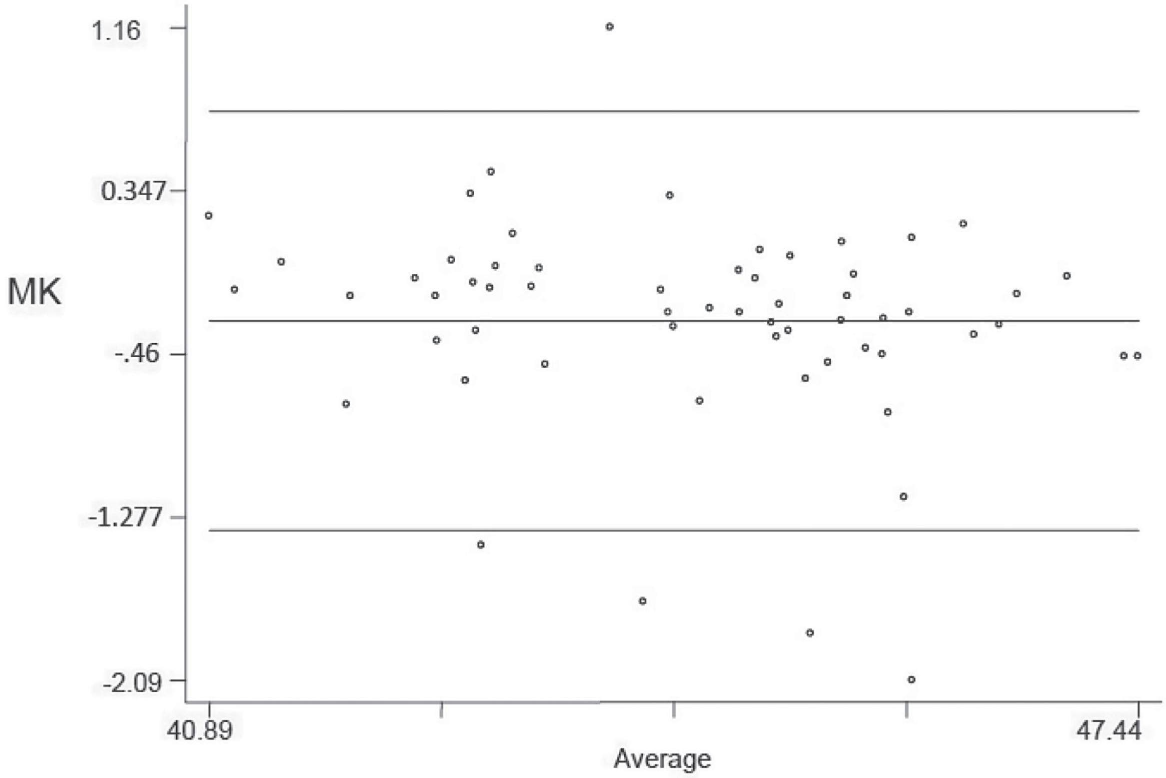
Data were analyzed using SPSS version 20 (Armonk, NY: IBM Corp.). Pearson correlation, intra-cluster correlation coefficients, and Bland-Altman plots were used for reporting contingency.

Results

The mean age of participants was 40.01 ± 12.29 years (range10 to 65 years). The mean ACD was 2.762 ± 0.281 millimeters when measured using Lenstar and 2.801 ± 0.273 millimeters with Pentacam (P = 0.03). The correlation between these two techniques in ACD measurement was good (r = 0.877), and intraclass correlation was moderate (r = 0.275). The mean flat keratometry was 43.93 ± 1.69 diopter when measured using Lenstar and 43.60 ± 1.61 diopter with Pentacam (P = 0.003). The correlation between these two techniques in flat keratometry measurement was good (r = 0.720), and intraclass correlation was excellent (r = 0.931). The mean steep keratometry was 44.99 ± 1.77 diopter with Lenstar and 44.75 ± 1.71 diopter with Pentacam (P < 0.001). The correlation between these two techniques in steep keratometry measurement was excellent (r = 0.972), and intraclass correlation was also excellent (r = 0.986). The mean keratometry was 44.45 ± 1.65 diopter with Lenstar and 44.16 ± 1.55 diopter with Pentacam (P < 0.001). The correlation between these two techniques in mean keratometry measurement was excellent (r = 0.949), and intraclass correlation was also excellent (r = 0.973). The Bland-Altman plots clearly demonstrated a large range of inter-device differences in mean keratectomy (Figure 1) and also ACD (Figure 2) measurements, when comparing the Lenstar and Pentacam readings.

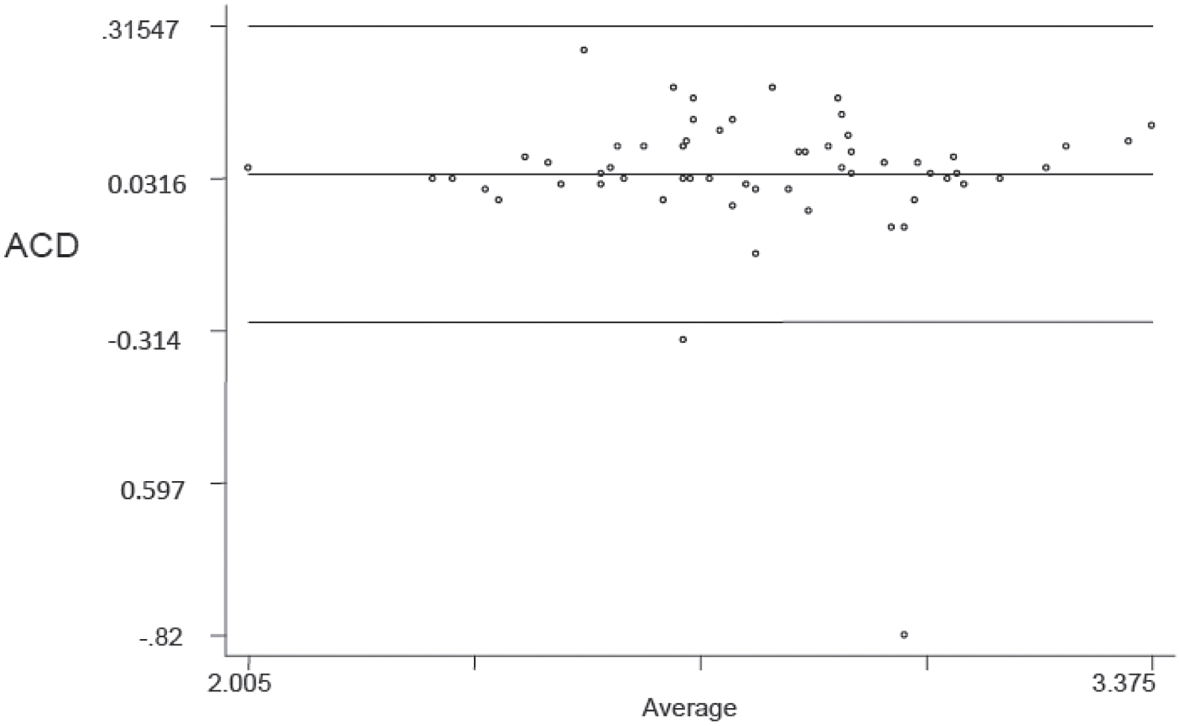
Discussion

In the present study, we compared keratometry and anterior chamber depth measurements of healthy eyes between the Lenstar LS 900 (Haag-Streit AG, Switzerland) and the Pentacam (Oculus, Weltzar, Germany). In this study, the keratometry measurements obtained using Lenstar were significantly steeper than those from Pentacam (P = 0.03 for flat meridian, P < 0.001 for steep meridian, and P < 0.001 for the mean keratometry). This result is supported by the results of previous studies



MK: Mean keratometry

Figure 1: Bland-Altman plot of agreement between the mean keratectomies measured using Lenstar and Pentacam. The solid line indicates the mean difference (Bias). The upper and lower lines represent the 95 % limits of agreement



ACD: Anterior Chamber Depth.

Figure 2: Bland-Altman plot of agreement between the mean ACD measured using Lenstar and Pentacam. The solid line indicates the mean difference (Bias). The upper and lower lines represent the 95 % limits of agreement

performed by Uçakhan et al., [10] and Huang et al., [11] which found significant differences in keratometry readings using Lenstar in comparison with Pentacam. In our study, the Bland-Altman plots clearly demonstrated a wide range of inter-device difference in mean keratometry measurements between the two devices. This difference was even more than those reported by Uçakhan et al., [10] and Huang et al., [11].

In our study, the difference in ACD measurements between the Lenstar and the Pentacam was statistically significant (P = 0.03) and Pentacam showed deeper ACD values compared to the Lenstar. The Bland-Altman plots showed a moderate range of inter-device differences. This difference was relatively more than those reported by Uçakhan et al., [10] and Huang et al., [11] studies. Uçakhan et al., [10] and Huang et al., [11] concluded that the keratometry readings of the two devices should not be used interchangeably whereas the ACD measurements are interchangeable. However, according to our study findings both the keratometry and ACD measurements obtained using the Lenstar and Pentacam are not interchangeable in clinical setting. Although our sample size seems to be acceptable, a potential limitation of our study was including only healthy persons with normal corneas. Further studies are necessary to determine interchangeability of anterior segment measurements using Pentacam and Lenstar systems in eyes with different pathologies.

Conclusion

Our findings suggest that the ACD and keratometry measurements obtained using the Lenstar and Pentacam might not be interchangeable.

Authors ORCIDs

Maryam Yadgari:
https://orcid.org/0000-0003-0829-1861

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Footnotes and Financial Disclosures

Conflict of interest:

The authors have no conflict of interest with the subject matter of the present study.