



ORIGINAL ARTICLE

Single session, intrauser repeatability of anterior chamber biometric and corneal pachy-volumetric parameters using a new Scheimpflug + Placido device



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KEYWORDS

Scheimpflug imaging;
Anterior chamber;
Cornea;
Repeatability

Abstract

Purpose: To analyze single session, intrauser reliability of a Scheimpflug device for anterior chamber (AC) and corneal parameters.

Methods: In this observational study, 100 normal candidates underwent Scheimpflug analysis with Sirius 3D Rotating Scheimpflug Camera and Topography System (Costruzione Strumenti Oftalmici, Italy). Two scans in dark room conditions were performed by the same experienced user. The candidates were asked to keep both eyes closed for 5 min before the scans. Exclusion criteria were previous ocular surgery, corneal scarring and anterior segment/posterior segment anomalies. Only the right eyes were used for the analysis. Both corneal (central, minimum, and apical thickness, volume, horizontal visible iris diameter, and apical curvature) and anterior chamber (volume, depth, angle, horizontal diameter) measurements were evaluated.

Results: There was no difference in the means of repeated measurements ($p > 0.05$, ANOVA). Intraclass correlations between the measures were high and ranged from 0.995–0.997 for corneal to 0.964–0.997 for anterior chamber (AC) parameters. The precision of repeatability measures ($1.96 \times Sw$) was approximately 5μ for the central and minimum corneal thickness, 8μ for the apical corneal thickness, 0.06 mm for AC (anterior chamber) depth and less than 2° for the AC angle.

Conclusions: Sirius Scheimpflug system has high repeatability for both corneal and AC parameters in normal eyes.

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PALABRAS CLAVE

Adquisición de imágenes
Scheimpflug;
Cámara anterior;
Córnea;
Capacidad de repetición

Repetibilidad intra-usuario en una única sesión de las medidas de parámetros biométricos de la cámara anterior y volumétricos de la córnea utilizando un nuevo dispositivo Scheimpflug + Placido

Resumen

Objetivo: Analizar la repetibilidad intra-usuario en una única sesión del dispositivo basado en cámara Scheimpflug, en la medición de diversos parámetros para caracterizar la cámara anterior (CA) y la córnea.

Métodos: En este estudio observacional, se realizó a cien sujetos normales un análisis con cámara rotatoria de Scheimpflug utilizando el sistema Sirius 3D (Costruzione Strumenti Oftalmici, Italia). Se realizaron dos escaneos en condiciones de oscuridad por parte del mismo usuario experimentado. Se solicitó a los sujetos que mantuvieran ambos ojos cerrados durante los cinco minutos previos al escaneo. Los criterios de exclusión fueron: cirugía ocular previa, cicatrices en la córnea y anomalías de los segmentos anterior/posterior. Únicamente se utilizaron los ojos derechos en el análisis. Se evaluaron las mediciones tanto de la córnea (espesor central, mínimo y apical, volumen, diámetro horizontal del iris visible, y curvatura apical) como de la cámara anterior (volumen, profundidad, ángulo, diámetro horizontal).

Resultados: No se produjo diferencia en las medias de las mediciones repetidas ($p > 0,05$, ANOVA). Las correlaciones intra-clase entre las mediciones fueron elevadas, oscilando entre 0,995-0,997 para los parámetros de la córnea y 0,964-0,997 para los de la cámara anterior (CA). La precisión de las mediciones de repetición ($1,96 \times Sw$) fue de aproximadamente 5 micrones para el espesor central y mínimo de la córnea, 8 micrones para el espesor apical de la córnea, 0,06 mm para la profundidad de la CA (cámara anterior), e inferior a 2 grados para el ángulo de la CA.

Conclusiones: El Sistema Sirius, basado en el uso de una cámara Scheimpflug, tiene una elevada capacidad de repetición para las mediciones de los parámetros de la córnea y la CA en ojos normales.

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Introduction

Comprehensive anterior segment analysis units have been developed recently. In contrast to stand-alone cornea or anterior chamber units, these devices incorporate multiple functions including corneal topography, pachymetry, anterior chamber depth and volume in a single capture.¹⁻⁵ This has made these devices useful for the anterior segment practitioner.

One such group of devices is based on the principle of Scheimpflug imaging.⁶⁻⁸ There are multiple studies evaluating the repeatability of corneal parameters of Scheimpflug based instruments and their comparison with other devices such as ultrasound pachymetry and optical coherence tomography.⁹⁻¹⁵ However, there is less information on the repeatability of these devices for anterior segment anatomical and volumetric parameters such as the white to white diameter, anterior chamber diameter, depth, AC angle, corneal volume and AC volume.

In this current study, we evaluate the single user repeatability of a Scheimpflug device, Sirius 3D Rotating Scheimpflug Camera & Topography System [Costruzione Strumenti Oftalmici (CSO), Italy], for anterior chamber biometric and corneal parameters.

Methods

In this study, 100 consecutive candidates presenting for anterior segment analysis were assessed. The study had

the approval of the institutional review board and followed the tenets of declaration of Helsinki. The population pool consisted of patients for pre-refractive surgery workup, those for keratoconus screening, healthy volunteers and medical staff. Informed consent was obtained from all the candidates. Slit lamp assessment and clinical evaluation were done to rule out any anterior segment, and pupillary or retinal abnormalities. Cases having corneal scarring and anterior segment/posterior segment anomalies or a history of ocular surgery were excluded.

Sample size estimation

The a priori sample size was estimated by using expected difference in intraclass correlation (ICC), as has been proposed by Walter et al.¹⁶ We expected the ICC to be high based on the results of previous studies in the same field.^{9,10} For a power of 0.8 and an alpha (α) of 0.05, with 2 measurements per eye, the minimum sample size required to pick up difference of 0.1 between ICC of 0.9 and 0.8 was estimated.¹⁶ This number was a minimum of 46 eyes. The corneal parameters with Sirius have been studied in detail. However, there is less information available on the expected reliability of AC angle measurement and volume with the Sirius device. Thus, we wanted to keep adequate margin in the final sample size.¹⁶ Therefore, the final sample size was decided to be 100 eyes (approximately twice of the minimum required sample size). Depending on the stringency for accuracy, the confidence

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