DOI: 10.14744/eer.2021.08208
Eur Eye Res 2021;1(1):13–16

EUROPEAN EYE RESEARCH

ORIGINAL ARTICLE

The influence of light condition on anterior segment parameters with Pentacam in healthy subjects

Pelin Ozyol,[1] Irmak Karaca,[2] Melis Palamar[2]

[1]Department of Ophthalmology, SANKO University Faculty of Medicine, Gaziantep, Turkey
[2]Department of Ophthalmology, Ege University Faculty of Medicine, Izmir, Turkey

Abstract

Purpose: The objectives of the study were to determine whether different light conditions influence anterior segment parameters of healthy subjects as measured with Pentacam.

Methods: Anterior segment parameters of 50 healthy subjects were measured with Pentacam under dim light condition and room light condition. Paired t test was used to compare measurements under different light conditions.

Results: Mean age in the study group was 31.7±8.5 (range; 22–43) years. Measurements between 2 sessions were significantly different for the parameters of anterior chamber depth, anterior chamber volume (ACV), and pupilla diameter ($p<0.05$).

Conclusion: Taking Pentacam Scheimpflug measurements in room light causes a significant increase in anterior chamber angle and decrease in ACV as well as pupilla diameter in healthy subjects. When using Pentacam, the effect of light condition on these parameters should be considered and all measurements should be obtained under standard dim light conditions as suggested by the manufacturer.

Keywords: Anterior chamber angle; anterior chamber depth; anterior chamber volume; anterior segment; Pentacam.

The assessment of anterior segment parameters is an important issue when planning ocular refractive and cataract surgery, diagnosing and treating glaucoma, and assessing corneal health.[1–3] Anterior segment imaging technologies, including Pentacam rotating Scheimpflug camera (Oculus Optikgeräte GmbH, Wetzlar, Germany), promise quantitative and qualitative imaging of cornea, anterior chamber, and iridocorneal angle for clinical practice and research settings.[1,4,5]

Reliable anterior segment measurements are important for screening and follow-up of the subjects. Obtaining accurate measurements with Pentacam depends on many properties, including the compliance of the subject, experience of the examiner, and environmental conditions such as room light. Although the manufacturer's guideline suggests taking measurements in a dim light condition, in some clinics, this issue might be underestimated. For reliable and consistent clinical results, it is important to de-

Cite this article as: Ozyol P, Karaca I, Palamar M. The influence of light condition on anterior segment parameters with Pentacam in healthy subjects. Eur Eye Res 2021;1:13-16.

Correspondence: Pelin Ozyol, M.D. Department of Ophthalmology, SANKO University Faculty of Medicine, Gaziantep, Turkey
Phone: +90 342 211 65 00 **E-mail:** pelinozyol@yahoo.com
Submitted Date: 07.03.2021 **Accepted Date:** 05.04.2021

termine how the room light condition influences anterior segment parameters. To the best of our knowledge, alterations in anterior segment parameters, as measured with the Pentacam device under different light conditions, have not been reported previously in the literature. For this reason, we aimed to explore the importance of the room light condition when taking Pentacam measurements in healthy individuals.

Materials and Methods

This prospective study involved randomized 50 healthy adult subjects and was conducted in accordance with the tenets of Declaration of Helsinki. The study was approved by a local ethical committee (02-2019/07). All subjects signed informed consent before they were enrolled in the study.

The inclusion criteria were: A best-corrected visual acuity of 10/10 (on the Snellen scale) for both eyes; a refractive error (in spherical equivalent) within ± 2.00 diopters. The exclusion criteria were: Diseases that could affect measurements in either eye, such as corneal diseases, pterygium, and cataracts; a history of contact lens use or prior ocular surgery.

The Pentacam device is based on a single rotating Scheimpflug camera (180°) that provides a 3-dimensional scan of the anterior segment of the eye. The Scheimpflug camera rotates around the optical axis of the eye and captures 25 slit images of the anterior segment within 2 s. In this study, all measurements were obtained by the same observer who was skilled at using the Pentacam. All subjects were positioned using a headrest and instructed to fixate on an internal target on the center of the camera without blinking during the scans. When using the Pentacam providing automatic measurements, only the scans with an examination quality specification of "OK" were retained for analysis; data from substandard scans were discarded, and the scans were repeated. Subjects were asked to blink once completely just before the scan was initiated to allow an optically smooth tear film to spread over the cornea. After each measurement, the subject was asked to sit back and the system was realigned for the next measurement. The first group measurements were taken under a dim light condition. The second group measurements were taken after the room light was turned on. Flat radius and steep radius (in mm) of anterior and posterior cornea, mean astigmatism, corneal volume (CV), anterior chamber volume (ACV), anterior chamber depth (ACD), anterior chamber angle (ACA), and pupilla diameter measurements that were provided by Pentacam system automatically were recorded. Measurements were taken from both eyes; however, only the right eye of each subject was included for statistical analysis.

The paired t-test was used for data analysis after the Kolmogorov–Smirnov test confirmed the normality of assumption. $P<0.05$ was considered as statistically significant. A post-hoc power analysis was conducted to assess sufficiency of the sample size.

Results

This study included 28 female and 22 male subjects with a mean age of 31.7±8.5 (range; 22–43) years. Table 1 shows data of analyzed parameters under dim light and room light conditions.

The mean ACA was 34.0±5.6° (range; 22.7°–49.0°) under dim light condition and 36.55±6.07° (range; 23.1°–53.6°) under room light condition (p=0.02). Mean ACV measurement was 163.5±38.6 (range; 95–248) mm^3 under dim light condition and 153.6±37.3 (range; 94–246) mm^3 under room light condition (p<0.0001). The change in mean pupilla diameter was also statistically significant with a mean

Table 1. The measurements under dim light and room light conditions

	Dim light Mean±SD (95% CI)	Room light Mean±SD (95% CI)	p-value*
Rf-ant	7.94±0.27 (7.86–8.01)	7.93±0.27 (7.85–8.01)	0.20
Rs-ant	7.77±0.26 (7.70–7.85)	7.77±0.27 (7.70–7.85)	0.86
Rf-post	6.61±0.26 (6.54–6.69)	6.61±0.25 (6.54–6.68)	0.74
Rs-post	6.19±0.26 (6.11–6.27)	6.21±0.26 (6.13–6.28)	0.14
Mean astigmatism	0.42±0.14 (0.37–0.46)	0.39±0.14 (0.35–0.43)	0.16
Mean CV	60.0±3.94 (58.9–61.1)	60.2±3.83 (59.1–61.3)	0.22
Mean ACA	34.0±5.6 (32.4–35.6)	36.55±6.07 (35.8–37.3)	0.02
Mean ACD	2.93±0.37 (2.82–3.04)	2.93±0.37 (2.82–3.03)	0.76
Mean ACV	163.5±38.6 (160.3–166.7)	153.6±37.3 (148.1–159.1)	<0.0001
Mean PD	3.46±0.66 (3.28–3.64)	3.10±0.58 (2.94–3.26)	<0.0001

*Paired t-test. Rf-ant: Flat radius of anterior cornea; Rs-ant: Steep radius of anterior cornea; Rf-post: Flat radius of posterior cornea; Rs-post: Steep radius of posterior cornea; CV: Corneal volume; ACA: Anterior chamber volume; ACD: Anterior chamber depth; ACV: Anterior chamber volume; PD: Pupil diameter; SD: Standard deviation.

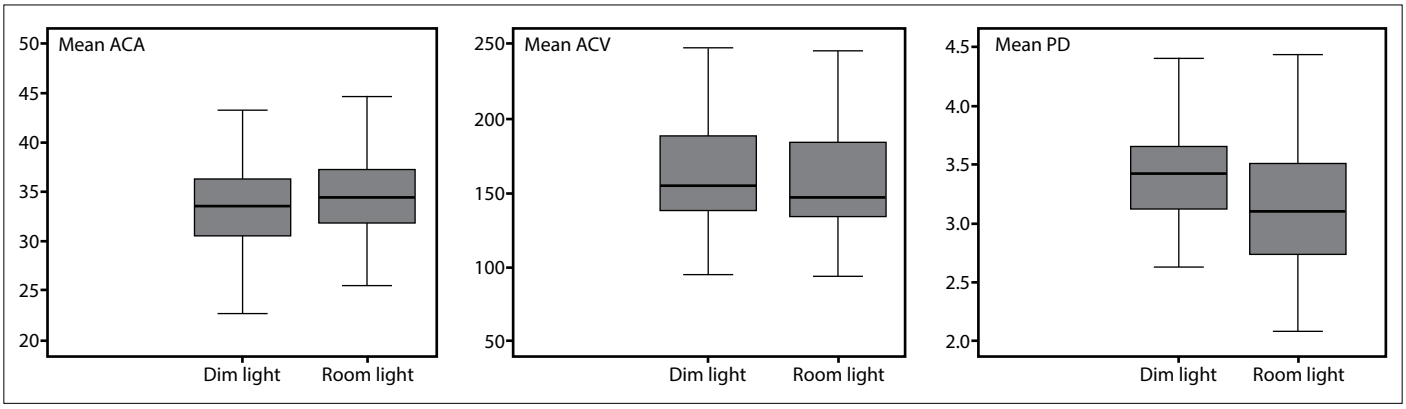

Fig. 1. The changes in statistically significant parameters as box - plots under dim light and room light conditions.

of 3.46±0.66 (range; 2.17–5.01) and 3.10±0.58 mm (range; 2.08–4.44) under dim light and room light conditions, respectively (p<0.0001). Figure 1 demonstrates the changes in statistically significant parameters as box-plots under dim light and room light conditions.

No significant difference in flat or steep radius of anterior and posterior cornea, mean astigmatism, mean CV, and mean ACD measurements was found between dim light and room light conditions. The mean radius value of anterior cornea was 7.94±0.27 (range; 7.31–8.42) mm under dim light condition and 7.93±0.27 (range; 7.29–8.43) mm under room light condition for flat radius (p=0.20) and 7.77±0.26 (range; 7.21–8.24) mm under dim light condition and 7.77±0.27 (range; 7.21–8.24) mm under room light condition for steep radius (p=0.86). The mean flat radius value of posterior cornea for dim light and room light conditions was 6.61±0.26 (range; 5.90–7.11) mm and 6.61±0.25 (range; 5.97–7.09) mm, respectively (p=0.74). The mean steep radius value of posterior cornea was 6.19±0.26 (range; 5.40–6.65) mm under dim light condition and 6.21±0.26 (range; 5.40–6.70) mm under room light condition (p=0.14).

Mean astigmatism was 0.42±0.14 (range; 0.1–0.8) D under dim light condition and 0.39±0.14 (range; 0.1–0.7) D under room light condition (p=0.16). Mean CV was 60.0±3.94 (range; 54.1–73.3) mm^3 under dim light condition and 60.21±3.83 (range; 54.2–73.4) mm3 under room light condition (p=0.22). Mean ACD was 2.93±0.37 (range; 2.25–3.80) mm under dim light condition and 2.93±0.37 (range; 2.17–3.79) mm under room light condition (p=0.76).

Considering the mean ACV in post-hoc analysis, the power for the sample size used was found to be 90%.

Discussion

Developments in imaging techniques allow the clinician to quantitatively calculate the anterior segment parameters.[5,6] Among these devices, the Pentacam is a rotating Scheimpflug system that allows noninvasive assessment of the anterior chamber structures. In various studies, it has been reported that Pentacam provides repeatable and reliable measurements.[1,7] To take accurate measurements, the compliance of the subject, the experience of the examiner, and environmental properties, including the room light condition, are important. In different light conditions, the pupil reacts to the light that enters through pupilla. Therefore, in increased light conditions, the pupillary light reflex is activated. The pupillary light reflex is a reflex that controls the diameter of the pupil in response to the intensity of light that falls on the retina, thereby assisting in adaptation of vision to various levels of lightness/darkness. The control of the diameter of the pupil is also under parasympathetic and sympathetic axons. In the current study, we sought to determine whether the different light conditions modify anterior segment parameters of healthy subjects.

The ACA, ACV, and ACD are important anterior segment parameters in ocular pharmacokinetics and primary angle-closure glaucoma development.[8,9] In our study, the mean ACA, ACV, and pupilla diameter were significantly different between dim light and room light conditions; however, the ACD was not. It has been reported that the iris bowing is an important biometric parameter that determines the ACA from dark to room light conditions.[10] The decrease in iris bowing from dim light to room light condition could contribute to the decreased narrowing of the angle due to the pupillary miosis in the room light. The probability of primary angle-closure glaucoma formation increases with smaller iridocorneal angle width values. For this reason, it is important to examine the angle under dim light, especially for evaluation of angle closure. The increasing pupil diameter leads to higher ACV measurements.[11] When the pupil is dilated, iris volume also reduces, thus

creating space in the anterior chamber. Thus, decreased iris volume and increased pupilla diameter could influence the higher ACV measurements under dim light condition. Obtaining a correct ACD measurement is very important for precise biometric evaluation and phakic anterior chamber intraocular lens implantation. We did not observe an effect of light condition on ACD measurements different from other studies that focused on influences of pharmacological dilatation on anterior segment parameters. With these agents, the increase in ACD is associated with the lens thickness decrease and the backward moving of the lens.[12–14]

In summary, to take Pentacam measurements under room light causes a significant increase in ACA and decrease in the ACV readings in healthy subjects. For this reason, to obtain reliable and consistent results with Pentacam all measurements should be obtained under standard dim light conditions as suggested by the manufacturer.

Ethics Committee Approval: This study was approved by SANKO University Faculty of Medicine Ethics Committee (02-2019/07).

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: P.O., I.K., M.P.; Design: P.O., I.K., M.P.; Resource: P.O., I.K., M.P.; Data Collection and/or Processing: P.O., I.K., M.P.; Analysis and/or Interpretation: P.O., I.K., M.P.; Literature Search: P.O., I.K., M.P.; Writing: P.O., I.K., M.P.; Critical Reviews: M.P.

Conflict of Interest: None declared.

Financial Disclosure: The authors declared that this study received no financial support.

References

1. Ceylan OM, Turk A, Erdurman C, et al. Comparison of oculus pentacam and stratus optical coherence tomography for measurement of central corneal thickness. Cornea 2011;30:670–4.
2. Ambrósio R Jr., Valbon BF, Faria-Correia F, Ramos I, Luz A. Scheimpflug imaging for laser refractive surgery. Curr Opin Ophthalmol 2013;24:310–20. [CrossRef]
3. Zhao Q, Li NY, Zhong XW. Determination of anterior segment changes with pentacam after phacoemulsification in eyes with primary angle-closure glaucoma. Clin Exp Ophthalmol 2012;40:786–91. [CrossRef]
4. Konstantopoulos A, Hossain P, Anderson DF. Recent advances in ophthalmic anterior segment imaging: A new era for ophthalmic diagnosis? Br J Ophthalmol 2007;91:551–7. [CrossRef]
5. Oliveira CM, Ribeiro C, Franco S. Corneal imaging with slit-scanning and scheimpflug imaging techniques. Clin Exp Optom 2011;94:33–42. [CrossRef]
6. Park SH, Choi SK, Lee D, Jun EJ, Kim JH. Corneal thickness measurement using orbscan, pentacam, galilei, and ultrasound in normal and post-femtosecond laser in situ keratomileusis eyes. Cornea 2012;31:978–82. [CrossRef]
7. Shankar H, Taranath D, Santhirathelagan CT, Pesudovs K. Anterior segment biometry with the pentacam: Comprehensive assessment of repeatability of automated measurements. J Cataract Refract Surg 2008;34:103–13. [CrossRef]
8. Fu J, Wang X, Li S, Wu G, Wang N. Comparative study of anterior segment measurement with pentacam and anterior segment optical coherence tomography. Can J Ophthalmol 2010;45:627–31. [CrossRef]
9. Rossi GC, Scudeller L, Delfino A, et al. Pentacam sensitivity and specificity in detecting occludable angles. Eur J Ophthalmol 2012;22:701–8. [CrossRef]
10. Cheung CY, Liu S, Weinreb RN, et al. Dynamic analysis of iris configuration with anterior segment optical coherence tomography. Invest Ophthalmol Vis Sci 2010;51:4040–6. [CrossRef]
11. Wendt M, Croft MA, McDonald J, Kaufman PL, Glasser A. Lens diameter and thickness as a function of age and pharmacologically stimulated accommodation in rhesus monkeys. Exp Eye Res 2008;86:746–52. [CrossRef]
12. Palamar M, Egrilmez S, Uretmen O, Yagci A, Kose S. Influences of cyclopentolate hydrochloride on anterior segment parameters with pentacam in children. Acta Ophthalmol 2011;89:e461–5. [CrossRef]
13. Palamar M, Alkan Z, Egrilmez S, Yagcı A. Influences of tropicamide on anterior segment parameters with pentacam in healthy individuals. J Ocul Pharmacol Ther 2013;29:349–52.
14. Tsai IL, Tsai CY, Kuo LL, Liou SW, Lin S, Wang IJ. Transient changes of intraocular pressure and anterior segment configuration after diagnostic mydriasis with 1% tropicamide in children. Clin Exp Optom 2012;95:166–72. [CrossRef]