

Correlation between Lens Thickness and Central Anterior Chamber Depth

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Abstract

Purpose: To investigate gender differences in lens thickness (LT) and central anterior chamber depth (ACD) in normal subjects, and to assess age associated changes in these measures.

Methods: The anterior chamber depth (ACD), and lens thickness (LT), of 150 normal subjects (150 eyes) was measured by anterior segment optical coherence tomography (AS-OCT). Gender differences were assessed by independent t-test, and correlation analysis was used to examine the effect of age.

Results: The mean values of ACD and LT were 2.69 ± 0.32 mm and 4.85 ± 0.43 mm, respectively. Women had a significantly lower Mean ACD as compared to men (2.56 ± 0.33 mm vs 2.85 ± 0.29 mm; $P < 0.05$). No statistically significant difference was found in LT between male and female subjects ($P > 0.05$). Correlation analysis findings suggest that LT increases with age ($r = 0.83, P < 0.05$), and that ACD decreases with age ($r = -0.57, P < 0.05$). After controlling for LT, no significant correlation was observed between age and ACD ($P > 0.05$).

Conclusion: The ACD of female subjects was, on average, shallower than that of their male counterparts. Aging was associated with increasing LT, and the observed narrowing of ACD with age, might be partially mediated by the increasing LT. (*Eye Science* 2012; 27:124–126)

Keywords: anterior chamber; lens; age; primary angle-closure glaucoma

The anatomical structures of eyeballs are significantly correlated with multiple ocular diseases. Certain biological data including anterior chamber

depth (ACD) and lens thickness (LT) are of significance in the diagnosis and treatment of primary angle closure glaucoma (PACG), etc. Previous studies revealed that LT of PACG patients was thicker than that of healthy individuals, indicating that thicker lens may be one of the risk factors of PACG. It is known that the thickness and size of lens gradually increased over age, making the structures of anterior segment narrow (chamber angle and ACD). Thus, aged-related lens changes may act as a vital factor causing chamber angle narrowing and closure. But the association between LT and anterior segment structure remains elusive. Anterior segment optical coherence tomography (AS-OCT) is a non-contact, non-traumatic system applied in measuring the parameters of anterior segment structures³⁻⁵. In this study, AS-OCT system was applied to measure the ACD and LT of normal individuals to identify the relationship between LT and ACD, understand the association between LT and anterior segment structures and explore the underlying pathogenesis of PACG.

Materials and methods

Study subjects

A total of 150 healthy subjects (150 eyes) undergoing eye examination in Zhongshan Ophthalmic Center, Sun Yat-sen University between May 2008 and May 2011 were recruited in this clinical trial. Inclusion criteria: 1. refractive $-1.00 \sim +1.00$ D; 2. intraocular pressure (IOP) ≤ 21 mmHg (1 mmHg = 0.133 kPa); 3. optic cup/optic disk (C/D) ≤ 0.6 , C/D difference between both eyes ≤ 0.2 ; 4. those without retinal nerve fiber layer or signs or symptoms related to acute onset of PACG or chronic peripheral anterior synechia; 5. those had no history of trauma,

DOI: 10.3969/j.issn.1000-4432.2012.03.003

Funding: This study was supported by Fund for Medical Sciences and Technology of Guangdong Province (B2009085)

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cataract, eyeball surgery or familial glaucoma.

AS-OCT and imaging evaluation

ZEISS Visante™ AS-OCT (Visante 1000, Carl Zeiss, Germany) was used to measure ACD and LT. Anterior segment single scan mode were used for the measurement of ACD and LT³⁻⁵. Caliper program was utilized to analyze the horizontal scan images of ACD and LT.

Statistical analysis

Age, ACD, LT and sex were compared using independent *t*-test; the relationship between age and ACD/LT was statistically studied by linear correlation analysis.

Results

General materials

The enrolled subjects aged from 35 to 81 years, 62±18 years on average; 68 male, 63±19 years average; 82 female, 62±18 years on average, and there was no statistical significance in age between both genders ($P < 0.05$).

ACD and LT

The mean values of ACD and LT were 2.69±0.32 mm and 4.85±0.43 mm. Mean ACD of female subjects was 2.56±0.33 mm, significantly shallower than 2.85±0.29 mm of male counterparts ($P < 0.05$). No statistical significance was noted in LT between both genders ($P > 0.05$).

Correlation analysis between age and LT/ACD

Correlation analysis revealed that age was closely correlated with LT ($r = 0.83, P < 0.05$) and age is significantly related to ACD measurement ($r = -0.57, P < 0.05$). Age and ACD were subject to partial correlation analysis and no significant correlation was found ($P > 0.05$).

Discussion

ACD and LT measurement

In clinic, ACD and LT measurements are commonly performed by A-scan. However, A-scan is not conducted under direct vision, thus, pupil size, operators' experience and potential off-axis operation may influence the accuracy of A-scan measurement⁴. Besides, ACD and LT measurements are correlated with refractive regulation, which varies according to refractive status and object distance. Therefore, A-

scan fails to objectively reflect the ACD and LT under normal conditions. AS-OCT system yields images with high resolution and penetrates anterior segment tissues, which is suitable for the measurement of anterior chamber, chamber angle and lens. Meantime, anterior/posterior poles of lens can be precisely measured under monitoring screen and reduce the incidence of off-axis measurement as possible. Due to these advantages, AS-OCT system can be employed to measure ACD and LT accurately and objectively³⁻⁵. Previous clinical trials confirmed that the incidence of PACG in female subjects was higher compared with that in male ones. In addition, the ACD of female individuals was shallower than that of male counterparts⁶⁻⁸. In this study, average ACT and LT were 2.69 mm and 4.85 mm. ACD in female subjects was 0.29 mm shallower than that of male ones, which is consistent with previous findings. No statistical significance was noted in LT between both genders, hinting that the anterior segment structures of female individuals are smaller than those of male ones, which is a potential factor of higher incidence of PACG in female individuals.

Effect of LT on anterior segment structures

Lens epithelia consistently differentiate and proliferate during the whole life time. Lens gradually becomes thicker over age. A study¹ demonstrated that the thickness and size of lens keep increasing over lifetime, which may induce lens zonular laxity and even lens subluxation. The changes in lens position make ACD become shallower, leading to the narrowing of anterior segment structures^{8,9}. Current study suggested that both ACD and LT are correlated with age, that is, LT increases while ACD become shallower over age. Partial correlation analysis confirmed that there is no significant correlation between age and ACD when LT is controlled, hinting that the narrowing of ACD over age is caused by increasing LT. Except certain pathological myopic cases, the eyeball axis remains stable after maturation. The shallowing of central ACD directly leads to the incidence of chamber angle closure in PACG patients. The findings in this study suggested that the thickening of lens directly contributes to the shallowing of ACD. Thus, we assume that the thickening of LT may serve as a factor stimulating the inci-

dence of angle closure in PACG cases. These changes possibly not only involve the increase in LT, but the changes in lens position. Since this is a cross-sectional trial, axial lens was not included. So, the lens position can not be determined. But the data alone strongly support that lens plays a pivot role in the incidence of PACG. More studies related to anatomical and physiological changes in lens over time should be performed to investigate the underlying pathogenesis of PACG.

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