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Ocular Biometrics of Vietnamese Young Adults with Myopia

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Keywords: Myopia; Axial length; Central cornea thickness; Cornea refraction; Anterior chamber depth; Spherical equivalent refraction

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Abstract

BACKGROUND: Myopia is most prevalent type of refraction error. In some Asian countries, the prevalence of myopia can be 80 – 90% in the population aged 17 – 18.

AIM: To analyze the correlation between ocular biometric indices and refraction status in Vietnamese young myopes.

METHODS: A prospective cross – section study was conducted in young myopes. Data on axial length, central cornea thickness, corneal topography & anterior chamber depth and spherical equivalent were collected. Independent Sample T Test and ANOVA test were used to compare between groups. The correlations between ocular biometry and myopic spherical equivalent refraction were examined by Pearson Correlation with the level of significance $p < 0.05$.

RESULTS: Totally, 418 eyes from 209 patients were recruited. The average axial length, central cornea thickness, cornea refraction & anterior chamber depth were 25.68 ± 1.09 mm, 539.78 ± 32.665 µm, 43.16 ± 1.369 D, 3.30 ± 0.243 mm, respectively. The correlation between axial length and spherical equivalent refraction (SER) was high ($r = - 0.742$, $p < 0.0001$) while those between central cornea thickness and cornea refraction were negligible ($r = - 0.107$, $p = 0.029$; $r = -0.123$, $p = 0.012$; respectively). There was no correlation between anterior chamber depth and spherical equivalent refraction ($r = 0.019$, $p = 0.697$).

CONCLUSION: Among ocular biometric indices, axial length was significantly correlated with spherical equivalent of young adult patients.

Introduction

Refraction error is one among leading preventable blindness causes all over the world [1]. In "VISION 2020: The Right to Sight: A Global Initiative to Eliminate Avoidable Blindness", according to World Health Organization, refraction errors ranks among top five avoidable blindness causes globally [2]. Myopia is most prevalent type of refraction error, and it is anticipated that myopia will account for 50% of the world population by 2050 [3]. In some Asian countries, the prevalence of myopia can be 80 – 90% in the population aged 17 – 18 [4].

Ocular biometric indices including axial length (AL), anterior chamber depth (ACD), central cornea thickness (CCT) and cornea refraction (CR) are crucial in evaluating and treating myopia. There have had some studies concerning the correlation between these indices and the refraction status [5], [6]. However, ocular biometry can vary among ethnic groups [7], [8], [9], which may make an impact on this relation. For understanding of ocular biometry in Asia and around the world, we conducted this study to examine the correlation between ocular biometric indices and the refraction status in a Vietnamese young population with myopia.

Materials and Methods

This was a prospective cross – section study carried out in DND International Eye Hospital from October, 2016 to September, 2017. In the current study, we recruited 418 eyes from 209 participants aged from 18 to 30 and diagnosed with myopia (> 0.5

D). Myopia severity was classified in three stages: low (> 3D), moderate (3D - 6D) and high (> 6D) [10]. Patients with any anterior or posterior segments abnormalities, ocular motility disorders and lid diseases were excluded from the study.

Each patient underwent a through history taking and comprehensive examination process. Auto-refraction measurement (Nidek autorefractor), Cyclogyl 1% retinoscopy and subjective refraction assessment were performed by qualified refractionists. Slit – lamp, fundus examination and B – ultrasound investigation were carried out by registered ophthalmologists to rule out any ocular diseases. IOL master 500 from Zeiss and SCHWIND Sirius - Topography with Scheimpflug camera were employed to evaluate the AL ACD, CCT and CR.

Independent Sample T Test and ANOVA test were used to compare means of groups. Pearson correlation was applied to analyze the correlation between AL, ACD, CCT and CRand myopic spherical equivalent refraction (level of significance, $p < 0.05$). Data was analyzed by SPSS version 20.0.

Results

We recruited 418 eyes from 209 patients for the current study. Table 1 gives information on some main features of the study population. The majority of participants were female (56%). 77% of patients were in the 18 – 23 age group (undergraduated). The number of patients with moderate myopia accounted for 58.1 % of the study population (58.1%). Nearly 95% of participants had used spectacles before whereas approximately 15% of them worn soft contact lens.

Table 1: Demographic characteristics of study population

Charateristics	Mean ± Standard deviation
No. Gender (men/women)	92 / 117
Age	21.33 ± 3.196
No. Age group (18 – 23 / 24 – 30)	161 / 48
SER	- 4.85 ± 1.99
No. Myopia severity (low / moderate / high)	82 / 243 / 93
No. Treatment (spectacle / soft contact lens / none)	198 / 32 / 11

Table 2 shows the calculation of different ocular biometric indices by myopia classification. The average AL, CCT, CR and ACD were 25.68 ± 1.09 mm, 539.78 ± 32.665 µm, 43.16 ± 1.369D and 3.30 ± 0.243 mm, respectively. The AL of low myopia group was significantly shorter than that of moderate group ($p < 0.0001$), and the AL of high group was significantly higher than that of moderate group ($p < 0.0001$). Central cornea of low myopia group was significantly thinner than that of the moderate group ($p < 0.05$). CR of the group with low myopia was significantly higher than that of the high myopia group ($p < 0.05$). There was no difference among three groups in terms of ACD ($p > 0.05$).

Table 2: Ocular biometric indices and myopia classification

Index	Myopia severity		
	Low n = 82	Moderate n = 243	High n = 93
AL	24,61 ± 0,85 mm	25,63 ± 0.78 mm	26,79 ± 0,93 mm
CCT	530,24 ± 35,56 µm	541,76 ± 32,30 µm	539,78 ± 32,67 µm
CR	43.46 ± 1.51 D	43.15 ± 1.38 D	42,93 ± 1.15 D
ACD	3.34 ± 0.27 mm	3.29 ± 0.22 mm	3.31 ± 0.28 mm

The correlation between myopic SER and a variety of ocular biometric indices was studied (Figure 1). There was a significant correlation between the refraction status and AL ($r = - 0.742$, $p < 0.001$), which implies the equation $SER = - 1.358 * AL + 30.042$. The correlation between the refraction status and CCT & CR was negligible ($r = -0.107$, $p < 0.05$; $r = 0.123$, $p < 0.05$; respectively) while there was no correlation between the refraction status and ACD ($r = 0.019$, $p > 0.05$) (Figure 1).

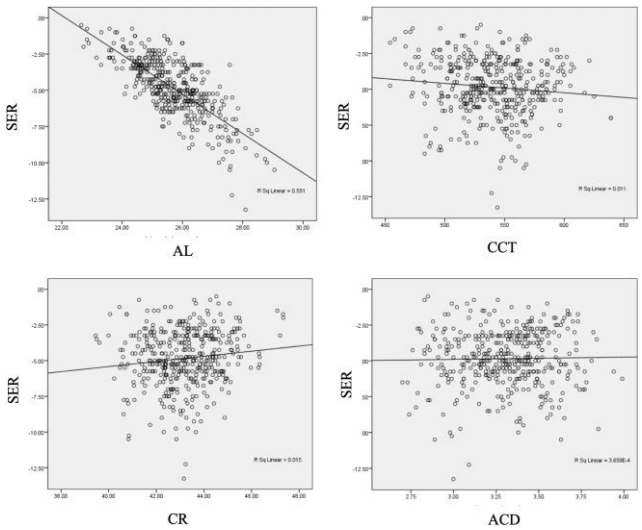

Figure 1: The correlation between ocular biometric indices and refraction status

Table 3 gives information about the correlation between myopic SER and the ocular biometry by myopia classification. AL significantly correlated with the refraction status across all stages of myopia. CCT only significantly correlated with the refraction status in the group with low myopia. There was no significant correlation between the refraction status and remains.

Table 3: The correlation between the ocular biometry and myopia severity

Myopia severity	Low n = 82	Moderate n = 243	High n = 93
SER & AL	r = - 0.380 p = 0.000	r = - 0.428 p = 0.000	r = - 0.595 p = 0.000
SER & CCT	r = -0.240 p = 0.030	r = 0.019 p = 0.770	r = 0.116 p = 0.226
SER & CR	r = 0.006 p = 0.960	r = 0.001 p = 0.987	r = 0.129 p = 0.218
SER & ACD	r = - 0.189 p = 0.090	r = - 0.063 p = 0.329	r = 0.120 p = 0.250

Discussion

The current study examined the correlation between ocular biometric indices and the refraction status. To the best of our knowledge, the present study provides the first comprehensive assessment of the ocular biometry in Vietnamese young patients with myopia.

In this study, we found that the average AL was 25.68 ± 1.09 mm, which was similar to other studies in myopic population. [11], [12], [13]. There was the significant difference in AL among stages of myopia, and this was consistent with previous researches [12], [13], [14]. AL strongly affects the refraction status because its elongation leads to the progression of myopia. CCT in our study was 539 ± 36.74 µm, which was higher than that of Chang et al., (533 ± 29 µm) [15] and tied with those of Kadhim and Farhood [16] (543.95 ± 32.58 µm) and Kawesch (548 ± 33 µm) [17]. CCT plays a key role in the surgical plan or refractive surgeons. Any candidate without enough residual stromal bed will be eligible for other approaches such as Ortho – keratology or Phakic ICL. In the current study, CR was 43.16 ± 1.369 D, which was consistent with other authors [16, 18]. Cornea holds two – third of the refraction power of the whole eye globe; hence appropriate interventions on CR can be supportive to myopia treatment. ACD is very critical in Phakic ICL surgery for patients with high myopia or thin cornea. Phakic ICL is contraindicated in any candidates with shallow anterior chamber (ACD < 3 mm). In the present study, ACD was shorter than findings of other studies [5], [12], [19], [20].

Not surprisingly, there was the significance correlation between the refraction status and AL in general ($r = -0.742$, $p < 0.001$) and in each stage of myopia progression. This means that the higher AL is, the worse myopia gets and is consistent with other studies [6], [11], [12], [15], [21], [22]. Some researches indicated that AL ≥ 26.5 mm was a risk factor of pathological changes in myopia such as lattice degeneration, retinal detachment, choroidal neovascularization, and retinal atrophy [23], [24]. Hence, because of the predictive value, identifying AL in examining myopic patients is very important to the prevention of high myopia complications.

Our result that the correlation between CCT and the refraction status was negligible ($r = - 0.107$, $p < 0.05$) was similar to that of male patients in the study of Suzuki et al., (right eye: $r = - 0.080$, $p < 0.001$; left eye: $r = -0.039$, $p = 0.036$; no correlation in female participants) [25]. This can be inferred that CCT is an independent factor and not correlated with myopic status [6], [26], [27].

Our analysis demonstrated that the correlation between CR and the refraction status was negligible ($r = 0.123$, $p < 0.05$). This was consistent with studies of Chen in 2009 [6] and Zeng in 2015 [28]. We also found no correlation between ACD and the refraction status ($r = 0.019$, $p > 0.05$) while other studies [5], [6], [21] revealed that this correlation was significant.

There are certain strong and weak points of our study. The time for data collection was limited, so we could not increase the sample size. However, we used modern equipment with cutting – edge technologies; hence, our findings were reliable.

In conclusion, among 4 ocular biometric indices examined, AL significantly correlated with myopia status. This factor plays a vital role in the diagnosis, management and prediction of myopia.

Ethics Approval

This prospective study strictly obeys the tenets of Declaration of Helsinki and was approved by Hanoi Medical University Ethics Committee.

Informed Consent

Informed consents were collected from participating patient(s) for their anonymized information to be reported in the study.

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