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Kertas Asli/*Original Article*

Ocular Dimensions of Young Malays in Malaysia

(Dimensi Okular Remaja Melayu di Malaysia)

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ABSTRAK

Kajian terdahulu banyak menunjukkan perbezaan dalam dimensi okular mengikut kaum. Walau bagaimanapun hanya terdapat sedikit data mengenai dimensi okular bangsa Melayu di Malaysia yang dilaporkan. Kajian ini bertujuan untuk menetapkan nilai normal dimensi okular bangsa Melayu muda di Malaysia. Seramai 584 orang telah diundang untuk menjadi subjek untuk kajian secara sukarela. Pengukuran yang dilakukan meliputi kelengkungan dan ketebalan tengah kornea, nilai esentrisiti kornea (e), diameter iris horizontal dan vertikal yang kelihatan, saiz pupil dan bukaan palpebral. Subjek dibahagikan kepada 3 kumpulan berikut mengikut umur dan dipadankan mengikut jantina dan umur: Kumpulan 1 (7-12 tahun, n = 188), Kumpulan 2 (13 to 18 tahun, n = 196) and Kumpulan 3 (19 to 24 tahun, n = 200). Pengukuran dilakukan menggunakan topografer kornea (CTK 922 dari Haag Streit, Jerman), pakometer ultrasonik (Corneo-Gage Plus 2 dari Sonogage Incorporated) dan auto refraktometer (Auto-Ref R1 dari Canon, Jepun). Dimensi okular bangsa Melayu yang diukur didapati lebih kecil dari bangsa lain di seluruh dunia. Perbezaan yang signifikan juga didapati untuk semua pengukuran dengan peningkatan umur ($p < 0.05$). Keputusan kajian ini boleh dijadikan rujukan untuk nilai dimensi okular populasi Melayu muda Malaysia di masa hadapan.

Kata kunci: Melayu, Dimensi okular, Kelengkungan kornea, Bukaan palpebral, Ketebalan kornea

ABSTRACT

It is well documented that ocular dimensions vary with race. However few data on the Malay population was available in the literature. The purpose of this study is to establish normal values of ocular dimensions among one sample of young Malay population in Malaysia. A total of 584 healthy subjects from around Kuala Lumpur volunteered for the study. Measurements include corneal curvature and central thickness, corneal eccentricity value (e), horizontal and vertical visible iris diameter, pupil size and size of palpebral aperture. Subjects were divided into 3 different groups and were age and gender matched: Group 1 (7-12 years old, n = 188), Group 2 (13 to 18 years old, n = 196) and Group 3 (19 to 24 years old, n = 200). Parameters were measured using corneal topographer (CTK 922 from Haag Streit, Germany), ultrasonic pachometer (Corneo-Gage Plus 2 from Sonogage Incorporated) and auto refractometer (Auto-Ref R1 from Canon, Japan). Ocular dimensions measured found to be smaller and different from other ethnics groups from around the world. Significant differences in all measurements were also observed with age increment ($p < 0.05$). The results found from this study can be used as future reference for ocular dimensions in young Malaysians.

Keywords: Malay, Ocular dimension, Corneal curvature, Palpebral aperture, Corneal thickness

INTRODUCTION

Certain anatomical differences have been noted between Asian and Caucasian eyes. These include epicanthal folds in adults, narrower palpebral fissures, a larger index of Broca and a greater magnitude in the rate of change toward against-the-rule (or decreased with-the-rule) corneal astigmatism with age. It was postulated that the differences of ocular dimension between races were attributed to the difference genetic traits (DNA), differences in climates and environmental surroundings and also the differences in physical stature of each race (Dain et al. 2004; Doughty & Zaman 2000; Shimmyo et al. 2003). Due to these anatomical differences, it is reasonable to anticipate additional differences might be found during clinical examination.

In 1992, Matsuda et al compared corneal curvature and horizontal visible iris diameter (HVID) between 125 Asian and 81 Caucasian eyes and found significant difference in the HVID between both groups. Horizontal visible iris diameter of Asian eyes was found to be smaller than Caucasians. In another study, corneal curvature of Caucasians, Hispanic, Asians and African Americans were compared and the authors found no significant difference between all the races studied (Shimmyo et al. 2003). However, the number of subjects in each group varies, with the highest number of subjects being Caucasians. Thus the results reported may not reflect the actual situation. In Hong Kong, Lam and Loran (1991) found that the corneal curvature of Chinese subjects was significantly steeper compared to British of the same age, gender and

refractive errors. Female subjects were excluded from this study due to the fact that female may experience changes in corneal curvature due to menstruation. The differences in ocular dimensions such as corneal curvature could contribute to the differences in the prevalence of refractive errors (Grosvernor 1994; Wojciechowski 2003). This has been suggested as one of the possible explanation of higher prevalence of myopia among Asians (Benjamin&Borish 1998; Kleinstein et al. 2003).

The Malays is one the many races in South East Asia. They exist mainly in Malaysia, Indonesia, Brunei, Singapore and in some parts of Philippines. Physically, Malays have smaller physical stature than Caucasians which result in differences in anatomical dimensions and hence ocular dimensions. Information about ocular dimension of the Malays is important for eye care practitioners practicing in South East Asian region especially in the field of contact lenses. However, limited data is available in the literature. Garner et al (1991) compared the corneal curvature and refractive error between Malay and Melanesian school children and found little variation in corneal power within their age range (6 to 17 years). Young Malay adults were also found to have slightly thicker central cornel thickness (CCT) compared to the Chinese of similar refractive error (Mohd-Ali et al 2009). In the Singapore Malay Eye study, CCT of 3239 Malay subjects aged between 40 to 80 years old were measured using ultrasound pachymeter (Su et al. 2008) and the results found no significant differences compared to other ethnic groups (Foster et al. 2003; Foster et al. 1998). However, compared to other ethnic groups in Asia such as Mongolians and Japanese, mean CCT of the Malays in Singapore was greater.

This study proposed to establish normal values of ocular dimensions of young Malays living in Kuala Lumpur and to investigate the changes of ocular dimensions with age. The results from this study will serve as future reference on ocular dimensions of Malay population in South East Asia.

MATERIALS AND METHODS

SUBJECTS

A total number of 584 Malay subjects (age range 7 to 24 years old) were recruited for this study. Subjects were recruited using convenient sampling method. To ensure that the sample size meet at least 80% power of study, number of subjects was calculated for every parameter using software CCSTAT (version 3.1) and it was found that 144 subjects were required for each group. However, 180 subjects were chosen for each group to increase the power and validity of this research.

Advertisements were put up at strategic places around Kuala Lumpur to attract volunteers for this study. Malay is defined as having both parents of Malaysian Malay descendants. The inclusion criteria include refractive error of not more than ±4.00 DS and astigmatism of not more than -2.00 DC, good ocular and general health, and not a contact lens wearer. Those who fulfilled the inclusion criteria were given appointment for eye examination at the Optometry Clinic, Faculty of Allied Health Sciences, Universiti Kebangsaan Malaysia, Kuala Lumpur.

Informed consent was obtained from subjects or parents/guardians (for subjects who was less than 18 years old) prior to data collection. The informed consent was approved by the Medical Ethics Committee of Universiti Kebangsaan Malaysia and follows the tenets of Declaration of Helsinki. Subjects were later divided into 3 groups: Group 1 (7-12 years old), Group 2 (13 to 18 years old) and Group 3 (19 to 24 years old) with age and gender matched.

MEASUREMENT

Measurements of the ocular dimensions include corneal curvature, corneal thickness, corneal eccentricity value (e), horizontal (HVID) and vertical iris diameter (VVID), size of pupil and palpebral aperture. The corneal topographer (CTK 922 from Haag-Streit, Germany) was used to measure the corneal curvature and eccentricity value (e). Central corneal thickness was measured using ultrasonic pachometer (Corneo-Gage Plus 2 from Sonogage Incorporated). The HVID, VVID and pupil diameter were measured using autorefractometer (Canon Autoref R-1 from Canon, Japan). Mean of three readings were recorded for all the measurements.

For purpose of analysis, subjects were divided into 3 groups according to age that is Group 1 (7 to 12 years), Group 2 (13 to 18 years) and Group 3 (19 to 24 years). Data were analysed using statistical analysis software (SPSS 15.0; SPSS Inc). Data normality was tested using Komogorov Smirnov test and the alpha level (p) of < 0.05 was used to define statistical significance.

RESULTS

A total of 584 subjects participated in this study and only the results of the right eye are reported here. Distribution of subjects according to age and gender is shown in Table 1. Visual acuity (VA) was measured using Snellen chart to determine that all subjects have good vision prior to data collection. Results showed that all subjects have VA of 6/6 and no significant differences between groups measured.

Mean and standard deviation (SD) of the ocular dimensions measured is shown in Table 2.0. Statistical analysis using two-way ANOVA was performed to demonstrate the effect of age and gender on the measured parameters. Significant difference ($p < 0.001$) was found in mean corneal curvature ($F = 8.14$, $p < 0.001$, eta squared = 0.031), eccentricity value ($F = 25.37$, $p < 0.001$, eta squared = 0.09), corneal diameter ($F = 8.44$, $p < 0.001$, eta squared =

0.03) and corneal thickness ($F = 9.44$, $p < 0.001$, eta squared = 0.04) with age. Significant differences ($p < 0.001$) were also noted between gender in some of the parameters measured that is mean corneal curvature ($F = 25.79$, $p < 0.001$, eta squared = 0.03), corneal diameter ($F = 18.67$, $p < 0.001$, eta squared = 0.024) and size of palpebral aperture ($F = 20.89$, $p < 0.001$, eta squared = 0.03). Females were found to have steeper corneas, smaller corneal diameter, thicker cornea at nasal area and smaller palpebral aperture than male subjects.

curvature of the Malays was found to be flatter than the ones observed in young Chinese population (Syimmyo et al. 2003). Besides that, the corneal diameter and palpebral aperture size of the Malays were also found to be smaller than Caucasians as measured by Lam & Loran (1991). The differences observed could be attributed to the difference in physical structure. Generally, the Malays have smaller physical stature than Caucasians. Nevertheless this could not explain the disparity observed between Malays and

TABLE 1. Demographic data of subjects

Characteristic of Each Group	Group 1 (Mean ± SD)			Group 2 (Mean ± SD)			Group 3 (Mean ± SD)		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Number of Subjects (n)	98	90	188	100	96	196	95	105	200
Age range (years)	7 - 12	7 - 12	7 - 12	13 - 18	13 - 18	13 - 18	19 - 24	19 - 24	19 - 24
Mean age (years)	9.25 ± 1.71	9.50 ± 1.72	9.50 ± 1.71	15.34 ± 1.72	15.45 ± 1.69	15.39 ± 1.70	21.53 ± 1.70	21.35 ± 1.75	21.43 ± 1.72
Vision (LogMAR)	0.12 ± 0.19	0.12 ± 0.17	0.12 ± 0.18	0.13 ± 0.25	0.32 ± 0.38	0.22 ± 0.34	0.40 ± 0.46	0.33 ± 0.42	0.36 ± 0.44
Habitual RX (D)	-0.09 ± 0.52	-0.02 ± 0.16	-0.06 ± 0.39	-0.15 ± 0.71	-0.52 ± 1.13	-0.33 ± 0.96	-01.29 ± 1.47	-1.01 ± 1.37	-1.14 ± 1.42
VA with habitual RX (LogMAR)	0.11 ± 0.17	0.10 ± ± 0.15	0.11 ± ± 0.16	0.08 ± ± 0.18	0.17 ± ± 0.24	0.13 ± ± 0.02	0.02 ± ± 0.13	0.04 ± ± 0.15	0.03 ± ± 0.14
Subjective RX (D)	-0.24 ± 0.77	-0.17 ± 0.59	-0.21 ± 0.69	-0.42 ± 0.95	-1.08 ± 1.42	-0.74 ± 1.25	-1.47 ± 1.59	-1.16 ± 1.52	-1.31 ± 1.56
VA with Subjective RX (LogMAR)	-0.03 ± 0.03	-0.03 ± 0.04	-0.03 ± 0.04	-0.04 ± 0.04	-0.03 ± 0.04	-0.03 ± 0.04	-0.06 ± 0.05	-0.05 0.07	-0.05 ± 0.06

TABLE 2. Measurements of ocular dimensions in different age groups

Ocular Dimensions	Group 1 (Mean ± SD)	Group 2 (Mean ± SD)	Group 3 (Mean ± SD)
Mean K (D)	42.95 ± 1.45	42.94 ± 1.45	42.93 ± 1.21
Eccentricity (e value)	0.46 ± 0.07	0.43 ± 0.08	0.42 ± 0.09
Horizontal corneal diameter (HVID, mm)	11.89 ± 0.36	11.92 ± 0.29	11.80 ± 0.43
Vertical corneal diameter (VVID, mm)	11.29 ± 0.27	11.23 ± 0.34	11.20 ± 0.43
Pupil diameter (mm)	4.69 ± 0.32	4.77 ± 0.26	4.79 ± 0.76
Central corneal thickness, CCT (μm)	646 ± 42	636 ± 36	633 ± 40
Palpebral aperture size, PAS (μm)	9.04 ± 0.56	8.94 ± 0.63	9.21 ± 0.78

DISCUSSION

The objective of this study was to establish the normal values of ocular dimensions namely corneal curvature, corneal thickness, corneal eccentricity value (e), horizontal (HVID) and vertical iris diameter (VVID), size of pupil and palpebral aperture among young Malays living in Malaysia. The values obtained showed that the Malays have different size of ocular dimensions compared to other races in Asia (Shimmyo et al. 2003; Grosvernor 1994). The corneal

other ethnics in Asia. Another possible factor to be considered is the difference in the anatomical structure. The Chinese are known to have epicanthal folds and narrower palpebral fissures than Caucasians. Lui and Hsu (1986) reported that the average of palpebral aperture size of the Chinese was 8.5 ± 0.9 mm. It is impossible to compare our result with their value due to the difference in the study population size. However, suffice to say that the Malays have larger palpebral aperture compared to the Chinese.

Gender wise, the results of this study showed significant difference of corneal curvature, diameter and palpebral aperture between males and females. The discrepancies may be due to the difference in refractive error between the two groups. In this study, female subjects in Group 2 have significantly higher degree of myopia than male subjects, which resulted in steeper cornea. Female subjects may also experience some physiological changes due to menstruation which could affect their ocular dimensions at the time of the study (Lam & Loran 1991).

The effect of age on ocular dimensions was also observed in this study. Corneal thickness, curvature, eccentricity were found to change with age. Corneal thickness measured in this study fall within the range of 0.503 and 0.565 mm, which is considered as normal by earlier authors (Doughty & Zaman 2000). The thickness was found to reduce with age, which was consistent with earlier works (Doughty & Zaman 2000; Lam & Loran 1991). It was postulated that the change was probably due to decline in the keratocyte density and breakdown in the collagen fibers in the aging cornea (Faragher et al. 1997). Our results also showed that the corneal curvature of the Malays becomes steeper while e value decreases with age. However, the differences were less than 0.5D between groups. The trend was also observed among school children in the United States (Zadnik et al. 2004). Corneal growth takes place mainly during the first two years of life and hardly after that (Gordon et al. 1985). The changes could be due to some physiological changes that alter the elasticity of the cornea and causing it to become steeper with age (Malik et al 1992; Hayashi et al. 1995).

CONCLUSION

Normal values of ocular dimensions for Malays in Malaysia were established at the end of this study. The differences in ocular dimension between races could be attributed to the difference in gender and age. The results will serve as future reference for eye care practitioners in making clinical decisions and management of patients particularly in East Asia.

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