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The Relationship between Central Corneal Thickness and Degree of Myopia at Lasik Center Bali Mandara Eye Hospital

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Abstract: ***Introduction: This study aimed to determine the relationship between Central Corneal Thickness (CCT) and degree of myopia at Bali Mandara Eye Hospital. Methods: This study was an analytical observational with cross-sectional design. Data taken from 486 eyes from 243 medical records from Bali Mandara Eye Hospital consist of 128 males and 115 females. Variables collected was age, gender, CCT and degree of myopia. The relationships among variables were tested using chi-square analysis with significant value p< 0,05. Results: The mean age of the subject was 23.6 ± 6.1 years (range 18-40 years). Most degree of myopia were severe (57,2 %) and most CCT were thick (52,9%). The mean CCT was 554.6 mm, with a standard deviation (SD) of 38.8 (range 456-709) µm. No correlation was found between CCT and degree of myopia (p=0.175). Conclusions: This study showed no correlation between CCT and degree of myopia.***

Keywords: Central Corneal Thickness, Degree of Myopia, Refractive error

1. Introduction

The leading cause of moderate to severe visual impairment in 2015 was uncorrected refractive errors in 116.3 million out of 216.6 million people in the world [1]. The latest data in 2020 states that around 28.3% of the global population has myopia and 4% has severe myopia. If this condition is not treated appropriately, cases of myopia in the global population are estimated increase to 49.8% and 9.8% will experience severe myopia in 2050 [2]. The prevalence of uncorrected refractive errors in Indonesia is 21.6% in all age groups and is the second leading cause of moderate to severe visual impairment after cataracts [3].

The laser in situ keratomileusis (LASIK) procedure is a corneal laser refractive surgery that is often performed to correct refractive errors, especially in conditions of myopia. LASIK is often chosen because it is relatively safe, produces rapid visual improvement, and has good visual prediction accuracy [4],[5]. Central corneal thickness (CCT) is very important in the pre-operative evaluation of patients undergoing refractive surgery because if the cornea is thin there is a risk of post-operative corneal thinning. Corneal thickness has limitations, especially for LASIK, because the residual stromal bed must have biomechanical stability to prevent corneal ectasia [6], [7].

The cornea is a transparent, avascular tissue consisting of 5 layers: epithelium, bowman's membrane, stroma, descemet's membrane and endothelium [8]. The typical central corneal thickness is 540 – 550 µm. Knowledge of corneal thickness provides context for interpreting the intraocular pressure (IOP). Thicker corneas are associated with artificially high IOP measurement, while thin corneas cause IOP readings to be lower than the actual IOP. Pachymetry is a tool for measuring corneal thicknes. Appropriate corneal thickness is key in reducing the risk of post-operative ectasia [10]. Myopia is a refractive error where the image is focused in front of the retina, when the eye is not in an accommodating condition [11]. Myopia can be classified into axial and refractive myopia [12]. Based on severity, myopia is divided into mild myopia: < -3 D, moderate myopia: -3 D to -6 D, and severe myopia: > -6 D [12], [13].

Several studies conducted to examine the effect of myopia on CCT showed different results. Chang et al in 2001 reported that the corneas were thinner in myopic eyes in 216 young adults [14]. Meanwhile, Fam et al in 2006 found that CCT was not related to the degree of myopia [15]. Study of 652 Singaporean school children also showed that there was no significant relationship between CCT and refractive error [16]. The aim of this study was to determine the relationship between central corneal thickness and the degree of myopia assessed for refractive surgery.

2. Methods

This study is an analytical observational study with a cross-sectional design to determine the relationship between central corneal thickness and degree of myopia. Research data was taken from medical records of myopia patients who underwent LASIK procedures with femtosecond laser (FS-LASIK) and Refractive Lenticule Extraction, Small Incision Lenticule Extraction (ReLEx SMILE) at the Bali Mandara Eye Hospital from February to July 2023. Data collection was carried out from July to August 2023. The inclusion criteria for this study were patients with mild, moderate and severe degree of myopia, had complete data in medical records (gender, age, central corneal thickness and degree of myopia), and aged 18 - 40 years. The exclusion criteria in this study were a history of corneal disease that affects central corneal thickness such as keratoconus, keratitis,

corneal scars and dry eye, a history of glaucoma, and a history of eye surgery. Sample selection was carried out using non-random consecutive sampling who met the inclusion and exclusion criteria. Central corneal thickness was measured by ultrasound pachymetry, in this study grouped into thin<540 µm, normal 540-550 µm, and thick>550 µm. Myopia refractive errors are measured using the Snellen chart and subjective refraction. In this study, they are divided into 3 degrees of myopia, namely mild: < -3 D, moderate: 3-6 D, and severe: > 6 D. Statistical analysis used the IBM SPSS (Statistical product and service solution) version 29 program with the Chi square test and the significant value was p<0.05.

3. Result

This study was conducted on 486 eyes from 243 subjects who underwent corneal refractive surgery procedures at the LASIK Center of the Bali Mandara Eye Hospital from February 2023 to July 2023. The median age of subjects was 22 years (range 18-40 years). The mean age of subjects in this study was 23.6 (SD 6.1) years. Most of the subjects (77%) were aged 18-28 years and 52.7% subjects were male. The characteristics of the subjects are presented in table 1.

Table 1: Subject Characteristics

Characteristic	*Frequency (N)*	*Percentage (%)*
Age		
18-28	187	77
29-40	56	23
Sex		
Male	128	52.7
Female	115	47.3

Table 2: Distribution of cases in each eye according to degree of myopia and CCT

Variables	*Right eye*		*Left eye*		*Total*	
	N	*%*	*N*	*%*	*N*	*%*
Degree of myopia						
Mild	43	17.7	46	18.9	89	18.3
Moderate	57	23.5	62	25.5	119	24.5
Severe	143	58.8	135	55.6	278	57.2
CCT						
Thin	95	39.1	81	33.3	176	36.2
Normal	24	9.9	29	11.9	53	10.9
Thick	124	51	133	54.7	257	52.9

Of a total 486 eyes, most of the subjects had severe degree of myopia on right eye (58,8%), left eye (55,6%), and both eyes (77,2%). Moreover, this study discovered that most of the subjects had thick CCT on right eye (51%), left eye (54,7%), and both eyes (52,9%). The distribution of cases in each eye according to degree of myopia and CCT presented in table 2. The mean CCT in the study subjects was 554.6 (SD 38.8).

Table 3: CCT according to degree of myopia

Variables	*CCT*							
	Thin		*Normal*		*Thick*		*Total*	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*
Mild	32	36	11	12.3	46	51.7	89	18.3
Moderate	52	43.7	15	12.6	52	43.7	119	24.5
Severe	92	33.1	27	9.7	159	57.2	278	57.2

Of a total of 89 eyes with mild myopia, 32 (36%) eyes had thin CCT, 11 (12.3%) eyes had normal CCT, and 46 (51.7%) eyes had thick CCT. Of the total 119 eyes with moderate myopia, 52 (43.7%) eyes had thin CCT, 15 (12.6%) eyes had normal CCT, and 52 (43.7%) eyes had thick CCT. Of a total of 278 eyes with severe myopia, 92 (33.1%) eyes had thin CCT, 27 (9.7%) eyes had normal CCT, and 159 (57.2%) eyes had thick CCT as seen in table 3. The results of statistical tests using the chi-square test showed that there was no significant relationship between central corneal thickness and the degree of myopia (p=0.175).

4. Discussion

This study shows that patients aged 18-28 years suffer more from myopia, 52.7% consist of men and are dominated by severe myopia. The average CCT of this study was 554.6 µm. It is 4.4 µm thinner than the average CCT of Chen et al study in Chinese adults in Taiwan (560 µm) and thicker 12.6 µm from average CCT found in Foster et al study with subjects of Chinese Singaporeans (542 µm) [17], [18]. The average CCT in this study is very close (different 0.6 µm) to the average CCT of female subjects in a study conducted by Chen et al in Taiwanese Chinese adults (554 µm) [19].

This study showed that there was no significant relationship between central corneal thickness and the degree of myopia in the research subjects (p=0.175). This is similar to the study of Chen et al showing that CCT is not associated with the degree of myopia in Chinese adults in Taiwan. The mean age of the 528 subjects was 34.8 ± 7.3 years and 79.9% were female. The mean refractive error was -7.27 ±2.96 diopters and the mean CCT was 560 ± 35 µm measured with Orbscan [17].

Study by Fam et al in 714 Chinese adults in Singapore with an age range of 15-59 years. The research subjects were mostly women (66.7%) and the average age was 32.9 years. Overall, 20 (2.8%) patients were below 2 standard deviations (SD) from the mean of 458.3 µm and 13 (1.8%) were above 2 SD from the mean of 610.7 mm. The mean SD spherical equivalent was –5.30 (2.74) D, range 217.5 to 20.625 D. Researchers found no correlation between CCT and spherical equivalent (r =20.13, p = 0.72) [15].

Chen et al studied 500 people consisting of 54.8% women with an average age of 60.9 ± 11.2 years (range 40-80 years). The mean refractive error was 0 ± 2.1 D, and the mean CCT was 554 ± 29 µm. They found no significant relationship between CCT and refractive error (r = -0.034, p = 0.445) or axial length (r = - 0.053, p= 0.223). CCT was measured using a pachymeter [19].

Ortiz et al study in 175 Spain adults also did not found a significant relationship between CCT and SE (spherical equivalent) in patients with mild (<6 D), moderate (- 6-12 D) or severe (> -12 D) myopia. SE (spherical equivalent) was -3.31 ± 1.40 D, -8.32 ± 1.64 D and -16.44 ± 4.48 D for groups #1, #2, and #3 respectively [20].

Study by Tong et al in 2006 also showed there was no significant relationship between CCT and refraction in a study of 652 school children in Singapore. Mean CCT was 543.6 ± 32.0 µm. Ethnic Chinese children had thicker corneas than Malaysians and Indians (P = 0.002) [16].

Different with the study by Chang et al in 216 Chinese adults (31.5% women) with an average age of 22.2 ± 4.2 years. The mean refractive error was -4.17 ± 5.03 diopters and the mean CCT was 533 ± 29 µm. They proved that the cornea was thinner in eyes with more severe degrees of myopia. (r = 0.16, p =0.021). The cornea also tended to be thinner in eyes with a long axial length, but this relationship was not statistically significant (r = 0.11, p = 0.14). CCT was measured using a pachymeter [14].

Mimouni et al. also found that there was a correlation between central corneal thickness and the degree of myopia (r = 0.94, p < 0.001). The mean refractive error was 4.02 ± 2.17 D (range 0.25-19.5), and the mean CCT was 533.5 ± 35.5 µm (range 404-794). There was no relationship between CCT and age (p = 0.226). Subjects over 40 years had higher CCT (p < 0.001). No significant relationship was found between CCT and cylinder (p > 0.05) [21].

The limitation of this study is the axial lengths of the subjects were not assessed to differentiate axial myopia and index myopia. However, the subjects were patients with myopia who were assessed for LASIK, the patients are not expected to have index myopia.

5. Conclusions

There was no significant relationship between central corneal thickness and the degree of myopia. Most of the subjects had severe myopia (57.2%) and thick central corneal thickness (52.9%).

Conflict of Interest

The author has no conflict of interest in this research.

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