Relationship Between Corneal Thickness and Level of Myopia

SABONG SRIVANNABOON, M.D.*

Abstract

A retrospective study of 533 eyes, which underwent complete pre-operative evaluation for refractive surgery, was done. Regression Analysis was performed to find the correlation between corneal thickness and level of myopia and between corneal thickness and corneal curvature. There was statistically significant correlation between corneal thickness and level of myopia ($p = 0.039$) and also in corneal thickness and corneal curvature ($p = 0.04$). No clinical correlation was demonstrated ($R^2 = 0.014$ and $R^2 = 0.0153$, respectively).

There was no clinical correlation between corneal thickness and level of myopia and also between corneal thickness and corneal curvature.

Key word : Corneal Thickness, Level of Myopia, Corneal Curvature

SRIVANNABOON S
J Med Assoc Thai 2002; 85: 162-166

Laser refractive surgery is a worldwide-accepted method used to correct refractive errors. By principle, corneal curvature will be altered by removing the corneal stromal tissue in order to change the focal point of the cornea. Therefore, the remaining cornea will be thinner than usual. One of the limitations in this surgery is limited central corneal thickness. In refractive surgery practice, many surgeons find that the cornea is usually thinner than average thickness in high myopia. This study was performed to find the correlation between corneal thickness and level of myopia.

PATIENTS AND METHOD

A retrospective study of all patients who visited the Excimer Laser Clinic (Siriraj Hospital,

* Department of Ophthalmology, Faculty of Medicine Siriraj Hospital, Mahidol University, Bangkok 10700, Thailand.

Mahidol University) between May 2000 and October 2000 was done. Any patient who had complete pre-operative data was included in this study.

Cycloplegic refraction, pre-operative refractive errors (maximum myopia, not spherical equivalent), central corneal thickness and corneal curvature (evaluated by Orbscan Topography System) were analyzed. Regression analysis was performed to find the correlation between corneal thickness and level of myopia and also between corneal thickness and corneal curvature.

RESULTS

There were 533 eyes (265 right eyes and 268 left eyes) in 280 patients included in this study. The mean age of the study group was 35.8 ± 7.31 years (range 19 to 60 years). The mean refractive errors (maximum myopia) were -6.02 ± 2.41 diopters (range -0.50 to -18.0 diopters). Mean central corneal thickness was 533.12 ± 30.35 microns (range 429 to 670 microns).

There was a statistically significant correlation between corneal thickness and level of myopia and also between corneal thickness and corneal curvature ($p = 0.039$ and $p = 0.04$ respectively). But clinically significant correlation between each values could not be demonstrated ($R^2 = 0.014$ and $R^2 = 0.0153$, respectively) (Fig. 1, 2). The corneal thickness between both eyes in the same patient also showed strong correlation ($R^2 = 0.80$).

DISCUSSION

Corneal thickness is one of the most critical factors in determining the result of laser refractive

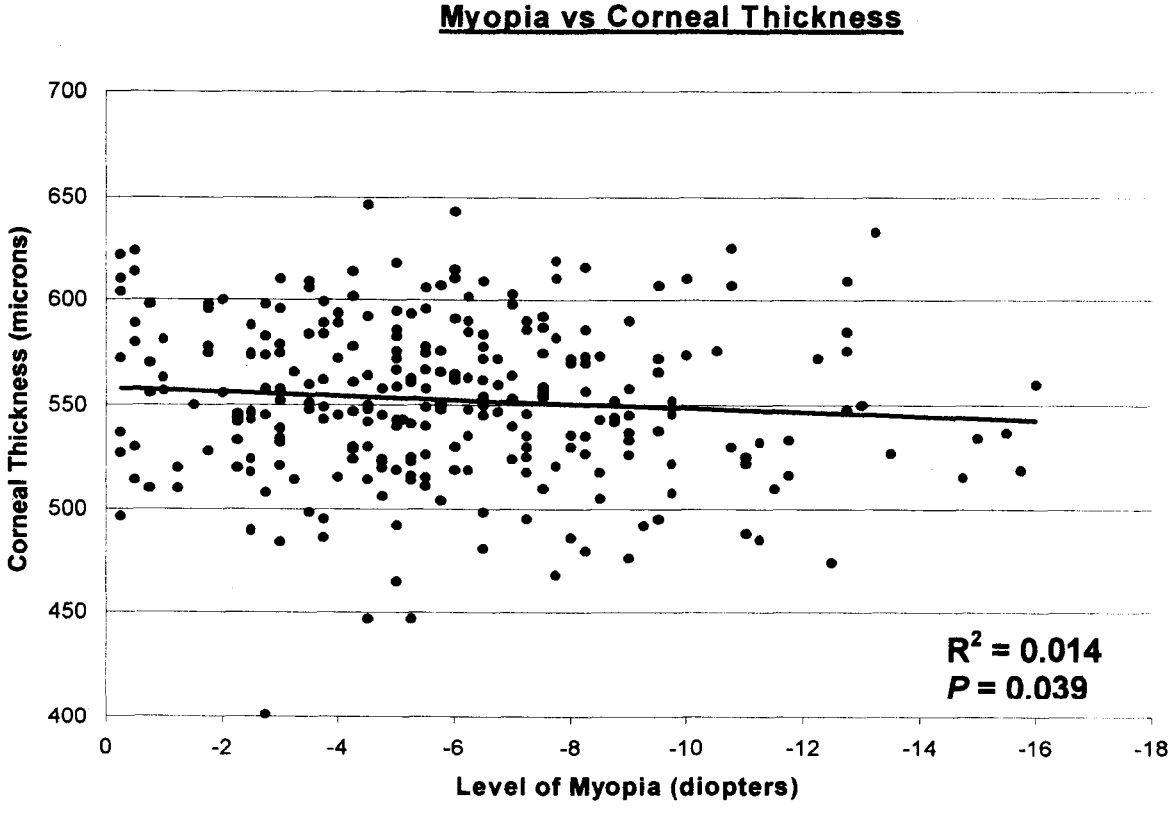

Fig. 1. Demonstrates the correlation between level of myopia and corneal thickness in micron. Note that the p value is statistically significant (0.039) but no clinically correlation (low R^2, 0.014) is shown. Trend line also demonstrates a slight decrease of corneal thickness in the higher level of myopia.

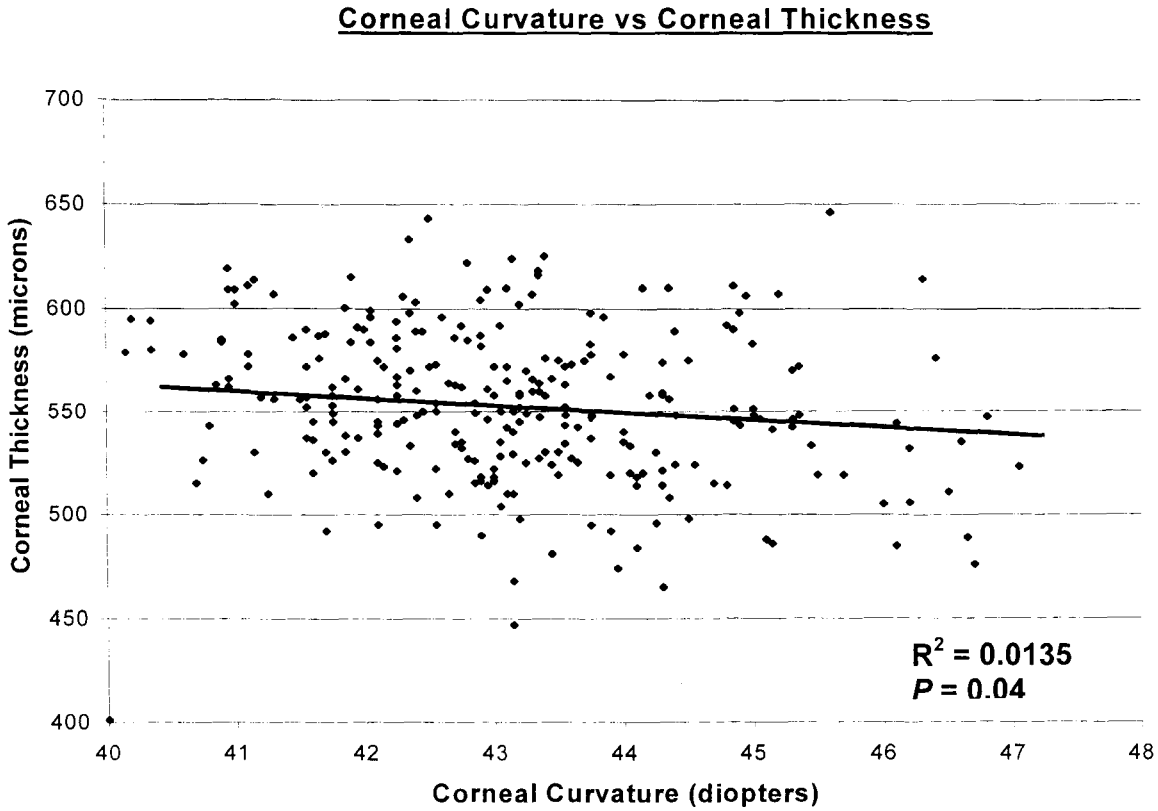

Fig. 2. **Demonstrates the correlation between level of myopia and corneal curvature in diopter. Note that the p value is statistically significant (0.04) but no clinical correlation (low R^2, 0.0153) is shown. Trend line also demonstrates a slight decrease of corneal thickness in the higher degree of corneal curvature.**

surgery[1,2]. The more refractive errors, the more corneal tissue required. Most surgeons encounter the problem of limited corneal tissue in a high level of refractive errors. Reduced zone of treatment, which is usually 6.0 mm, can sometimes solve the problem because of less tissue removal being required[3].

In this study, the Orbscan Topography System was used to evaluate the thickness of the cornea. Orbscan Topography System is one of the most powerful instruments used to evaluate the cornea prior the surgery. With its scanning slit mechanism, Orbscan Topography System can measure the thickness at any point of the cornea. Prior study showed the result of higher corneal thickness measured by Orbscan Topography System compared to ultrasonic pachymetry[4]. We could not find the clinically significant correlation (low R^2) between interested parameters (level of myopia and corneal curvature) and corneal thickness even though it was statistically significant. The trend line somehow showed relatively less thickness in higher levels of myopia and also less thickness in a higher degree of corneal curvature. This finding demonstrated the same phenomenon occurring to the retina in high levels of myopia (thin retina caused by the stretching effect from elongation of the eyeball). The stretching force could transmit both posteriorly to the retina and anteriorly to the cornea. More effect occurs to the retina due to a thinner structure. The more the stretching force, the more the curvature of the cornea. This could explain why the same trend line in level

Fig. 3. Demonstrates the strong correlation of corneal thickness between both eyes (high R^2, 0.80).

of myopia and corneal curvature to the corneal thickness was found. No evidence has been published to support this theory. The corneal thickness between both eyes also showed strong correlation as expected. Maximum myopia was used instead of spherical equivalent because it represents the actual total value of myopia, not the average.

Further study between level of myopia and scleral thickness is recommended to support the stretching force theory.

(Received for publication on January 25, 2000)

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ความสัมพันธ์ระหว่างความหนาของกระจกตา กับระดับสายตาสั้น

*สบง ศรีวรรณบูรณ์, พ.บ.**

การศึกษาฉบับนี้ทำขึ้นเพื่อหาความสัมพันธ์ระหว่างความหนาของกระจกตากับระดับสายตาสั้นและระหว่างความหนาของกระจกตากับความโค้งของกระจกตา โดยทำการศึกษาข้อมูลย้อนหลังของผู้ที่มารับการทำผ่าตัดแก้ไขสายตาสั้น จำนวน 533 ตา โดยทุกตาจะได้รับการตรวจตาอย่างละเอียด ค่าความหนาของกระจกตา, ความโค้งของกระจกตาและระดับสายตาสั้น ได้ถูกนำมาหาความสัมพันธ์กันโดยวิธีการวิเคราะห์เชิงถดถอย (Regression Analysis) พบว่าความสัมพันธ์ระหว่างความหนาของกระจกตากับระดับสายตาสั้นและความหนาของกระจกตากับความโค้งของกระจกตา มีนัยสำคัญทางสถิติ ($p = 0.039$ และ $p = 0.04$ ตามลำดับ) แต่ไม่พบว่ามีนัยสำคัญทางคลินิก ($R^2 = 0.014$ และ $R^2 = 0.0153$ ตามลำดับ) การศึกษานี้ไม่พบว่ามีความสัมพันธ์ระหว่าง ความหนาของกระจกตากับระดับสายตาสั้นและระหว่างความหนาของกระจกตากับความโค้งของกระจกตา

คำสำคัญ : ความหนาของกระจกตา, ระดับสายตาสั้น, ความโค้งของกระจกตา

สบง ศรีวรรณบูรณ์
จดหมายเหตุทางแพทย์ ฯ 2545; 85: 162-166

* ภาควิชาจักษุวิทยา, คณะแพทยศาสตร์ศิริราชพยาบาล, มหาวิทยาลัยมหิดล, กรุงเทพ ฯ 10700