

Changes in Corneal and Anterior Chamber Parameters following myopic Transepithelial photorefractive keratectomy

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Abstract

Purpose: To compare changes in the value and location of the corneal thinnest point, anterior chamber depth (ACD), anterior chamber volume (ACV) and iridocorneal angel after myopic transepithelial photorefractive keratectomy (tPRK) by CSO Sirius imaging device.

Materials and Methods: In this prospective comparative case series, 56 myopic eyes scheduled for tPRK in Tishreen University Hospital, underwent CSO SIRIUS imaging before and 6 months after the operation to compare changes in the value and location of the corneal thinnest point, (ACD), (ACV) and iridocorneal angel.

Results: The mean age of the patients was 26.58 ± 6.47 years (range 18-49 years). The spherical equivalent of refraction was -2.23 ± 1.38 diopter (range -0.6, -7.50 diopter). The mean difference in ACV is -3.68 ± 6.25 mm³ (p-value=0.0001). The mean difference in ACD is -0.15 ± 0.13 mm³ (p-value=0.001). The mean difference in the thickness of the corneal thinnest point is -52.88 ± 27.7 microns (p-value=0.0001). The change in the location of the corneal thinnest point according to the center of the cornea = -0.14 mm (p-value=0.001). The iridocorneal angle didn't change.

Conclusion: Thickness of the corneal thinnest point, ACV and ACD decreased and the location of the corneal thinnest point changed after myopic tPRK. The iridocorneal angle didn't change.

Keywords: Cornea, anterior chamber parameters, ACV, ACD, tPRK, SIRIUS.

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1. Background

Trans Epithelial photorefractive keratectomy (tPRK) is the most commonly applied ablative refractive surgery in our hospital. The unique feature of this technique is that it removes the corneal epithelium and stroma in a single step with one ablation profile [1]. All photorefractive keratectomy procedures including tPRK can affect the biomechanical strength of the cornea [2]. However, the corneal biomechanics are less affected in PRK than LASIK [3]. Although most corneal changes occur within the anterior corneal surface, presumed posterior corneal surface changes can occur and as a result changes in the anterior chamber parameters may occur such as changes in anterior chamber depth (ACD) and anterior chamber volume (ACV) [4]. Obtaining pachymetry by scheimpflug topographer can substitute's ultrasound pachymetry [5]. There is lack in

studies that address the change in the value and location of the corneal thinnest point and iridocorneal angle after tPRK. This study was performed to measure these parameters using a CSO Sirius topographer which combines placido disk topography with Scheimpflug tomography of the anterior segment.

2. Materials and Methods

In this prospective comparative case series, we studied 56 eye -29 patients- who underwent transepithelial photorefractive keratectomy at Tishreen University Hospital in Latakia in 2018. Informed consents were obtained from all patients before they were included in the study. The selected patients for the study met the following inclusion criteria: age 18-50 years, documented stable refraction for at least 1 year, corneal thickness > 480 μ m,

spherical equivalent refraction ≤ 8 diopters (D) of myopia, residual stromal bed of 400 μm . Exclusion criteria were: pregnancy, lactation, a history of prior refractive or cataract surgery, keratoconus, collagen vascular disease, and diabetic retinopathy. CSO Sirius imaging - Phoenix software version 2.6.4.44 - was used for imaging preoperatively and after 6 months. The SCHWIND AMARIS 500E excimer laser was used in all of the procedures and mitomycin C was applied for 25-35 seconds in all surgeries. We studied multiple variables of cornea and anterior chamber before and 6 months after surgery. The variables included were: the value and location of the corneal thinnest point -in polar coordinate taking the center of the cornea as a reference point- , anterior chamber depth ACD -the distance between the corneal posterior surface and the anterior surface of crystalline lens- , anterior chamber volume ACV -the volume of the portion limited by the back surface of cornea, the iris and the crystalline lens- and iridocorneal angle - the average of the measured angles for the meridians whose angular position is included in the range $\pm 25^\circ$ from the horizontal meridian.

2.1 Statistical analysis

All data were collected in an Excel database and transferred to SPSS (SPSS for Windows, version 15.0, SPSS Inc, Chicago, IL, USA) for data analysis. The pre and postoperative difference for each variable was analyzed using paired T-test to compare the mean values of the studied variables. The Mann-Whitney U test was used to evaluate the statistical significance of differences between the non-normally distributed data. Spearman correlation

analyses were used to measure the strength and direction of association between two ranked variables. A P-value <0.05 was considered statistically significant. The power of the study = 90%. $\alpha=5\%$.

3. Results

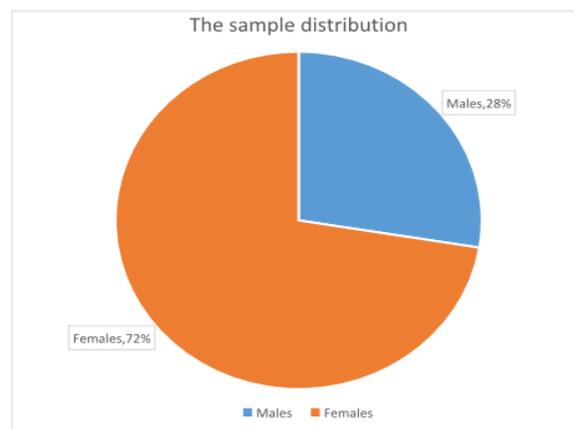


Figure 1: The distribution of the sample between the two sexes

They were 8 males (27.59%) and 21 females (72.41%). The mean age of the patients was 26.58 ± 6.47 years (range 18-49 years). The spherical equivalent of refraction was -2.23 ± 1.38 diopter (range -0.6, -7.50 diopter). (Table 1)

Table 1: the mean age and spherical equivalent of the sample

The variant	Mean \pm SD	Range
Age (year)	26.58 ± 6.47	18 – 49
spherical equivalent (diopter)	-2.23 ± 1.38	-0.6 , -7.50

Table 2: comparing the mean values of the study variants using paired t test

Variant	Mean \pm SD		Difference	t	P - value	
	Before	After				
Iridocorneal angle ($^\circ$)	45.17 ± 4.84	44.94 ± 4.86	-0.23 ± 3.12	0.57	0.5	
Anterior chamber volume (mm^3)	186.96 ± 26.92	183.28 ± 26.63	-3.68 ± 6.25	4.4	0.0001	
Anterior chamber depth (mm)	3.35 ± 0.25	3.20 ± 0.25	-0.15 ± 0.13	4.1	0.001	
Thickness of the corneal thinnest point (μm)	552.80 ± 31.52	499.92 ± 43	-52.88 ± 27.7	14.2	0.0001	
Location of the corneal thinnest point according to the center of the cornea	r (mm)	0.57 ± 0.18	0.43 ± 0.17	-0.14 ± 0.16	6.2	0.001
	Axis ($^\circ$)	242.94 ± 85.14	214 ± 112.94	-28.94 ± 116.5	1.8	0.06

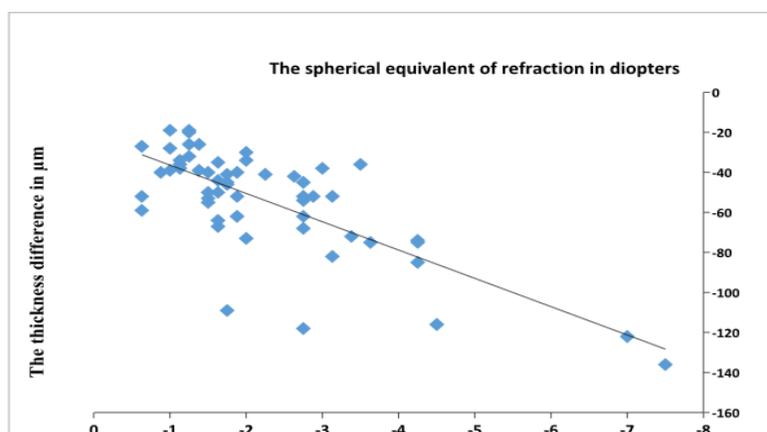


Figure 2: the relation between the difference in thickness of the corneal thinnest point and the spherical equivalent of the corrected refraction

4. Discussion

29 patients -56 eyes - participated in the study, they underwent transepithelial photorefractive keratectomy at Tishreen University Hospital in Latakia in 2018. The corneal and anterior chamber parameters were recorded using CSO-Sirius Topographer. We have compared the mean values of the variants (the value and location of the corneal thinnest point, ACD, ACV and Iridocorneal Angle) before and 6 months after the operation. Using paired T test, we found a decrease in the values of all the variants. The statistical difference was important for: the thickness of the thinnest point (*figure 2*), the distance between the thinnest point and the center of the cornea (r), anterior chamber depth and anterior chamber volume. The difference was statistically insignificant for the iridocorneal angle and the axis of the polar coordination of the thinnest corneal point in relation to the center of the cornea (@) (*Table 2*).

Spearman correlation coefficient stated that the differences in the corneal and anterior chamber parameters were of weak relation to age with no statistical significance.

Spearman correlation analysis showed that the change in the thickness of the thinnest corneal point has a strong correlation with the spherical equivalent of the corrected refraction $r = 0.7$ (p-value=0.0001).

Mann-Whitney U test showed no statistically significant relation between sex and variants change (p-value>0.05).

The anterior corneal surface is reshaped directly by refractive surgery and has been largely studied by corneal topography [6]. The posterior corneal surface may also change, not from direct application of excimer laser but secondary to postoperative corneal thinning and decreased corneal resistance [7].

We found that the average reduction in the thickness of the corneal thinnest point was 8 microns per each -1 diopter of the treated spherical equivalent refraction which seems to be close to the reduction in the central corneal thickness after 1 week of PRK found by Ivarsen, *et al* [8].

We found the reduction in ACD, ACV, is statistically significant in contrary to the results found by Ali Zare, *et al*. This difference may be due to the difference in the topographer devices and software used in each study. However further studies with various topographers should be carried out to fully address this point [4]. The thinnest point of the cornea seems to come closer to the center of the cornea maybe due to the overall reduction in the corneal thickness. The iridocorneal angle change wasn't statistically significant maybe because the minimal effect of the tPRK on the peripheral cornea of the treated myopic patients, and this may be of importance in patients with narrow iridocorneal angles who aims at undergoing tPRK to correct their refractive errors.

4. Conclusion

Imaging by CSO SIRIUS topographer 6 months after myopic tPRK shows statistically significant reduction in the thickness of the corneal thinnest point and changes in its location toward the center of the cornea. The anterior chamber depth (ACD) and volume (ACV) decrease also, however the iridocorneal angle shows no significant change.

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