Effect of Chalazion on Corneal Astigmatism

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Abstract: A common eyelid disease chalazion causes eye morbidity due to inflammation and cosmetic disfigurement. Important factors in corneal refractive surgery, intraocular lens power calculations for cataract surgery and visual acuity assessments are corneal topographic changes. For better outcome of ocular surgery corneal astigmatism should be corrected earlier. The aim of this study is to evaluate changes in corneal astigmatism according to chalazion size and location.

Methods: This cross-sectional study was conducted in saveetha medical college and hospitals, Thandalam , Department of Ophthalmology Outpatient department. A total of 44 eyes from 33 patients were included in the chalazion group and 70 eyes from 46 patients comprised the control group. Chalazia were classified according to location and size. An autokeratorefractometer and a dual-Scheimpflug analyzer were utilized to evaluate corneal changes.

Result: Oblique astigmatism was greater in the chalazion group compared with the control group ($p < 0.05$). Astigmatism by simulated keratometry (simK), steep K by simK, total root mean square, second order aberration, oblique astigmatism, and vertical astigmatism were significantly greater in the upper eyelid group ($p < 0.05$). Astigmatism by simK, second order aberration, oblique astigmatism, and vertical astigmatism were significantly greater in the large-sized chalazion group ($p < 0.05$). Corneal wavefront aberration was the greatest in the upper eyelid chalazion group, whole area group, and large-sized chalazion group ($p < 0.05$).

Conclusions: Large-sized chalazion in the upper eyelid should be treated in the early phase as great changes in corneal topography were noticed. Corneal topography should be performed preoperatively before chalazion is treated.

Keywords: Chalazia, Astigmatism, Wavefront, Corneal topography.

1. BACKGROUND

A chalazion is a meibomian gland lipogranulomatous condition which presents as swelling on the eyelids [1]. It is a condition that causes eye morbidity due to inflammation and cosmetic disfigurement [2]. This condition is associated with chronic blepharitis, seborrheic dermatitis [1]. Chalazia treatment includes such as warm compression and topical antibiotic eye drops or ointment and surgical incision and curettage, with or without triamcinolone intralesional injection [3] If left untreated amblyopia may develop in children with corneal astigmatism in rare cases [7]. It has been reported that pressure on the upper eyelid bythe chalazion induces hyperopia and astigmatism.7 Chalazia can increase higher-order aberrations (HOAs), as measured by the Hartmann–Shack aberrometer;

Decreased vision due to a chalazion of the upper eyelid has been documented in a patient following laser-assisted in situ keratomileusis (LASIK) [9]. Corneal aberration has been found to affect visual function [10, 11]. Chalazion size and location are to be documented as it is necessary for better outcome of ocular surgery. We have included changes in corneal astigmatism that varies according to chalazion size and location.

44 eyes from 33 patients having eyelid chalazion were assigned to chalazion group. Control group comprised 22 contralateral normal eyes of chalazion patients and 48 eyes from 24 patients without a chalazion were randomly

selected and matched according to age and sex. Patient medical history including diabetes mellitus and hypertension were obtained and local examination of eyes and eyelids were performed . Control group patients had no prior history of ophthalmic surgery nad were not using topical or systemic medications on examination.

Chalazia were classified according to their site (upper, lower, or both eyelid groups) and location (nasal, middle, temporal, or whole area of eyelid), according to their size; small (≤1/5 of eyelid), medium (2/5–3/5), or large (>4/5).

An autokeratorefractometer was utilized to measure keratometric values (K) including mean K, flat and steep K, astigmatism, and axis. Central corneal thickness (CCT), corneal topographic data and wavefront aberration data were obtained using a dual-Scheimpflug analyzer (Ziemer Group; Port, Switzerland). Simulated K (simK) were obtained from the central 3-mm zone of the corneas including flat and steep K, mean K, astigmatism (difference between steep and flat Ks), and the axis of the steep meridian. Corneal wavefront aberrations were analyzed, including total root mean square (RMS, in microns) ,total high order aberration, second order aberration, oblique astigmatism (Z−2 2), defocus (Z0 2), vertical astigmatism (Z2 2), third order aberration, vertical trefoil (Z−3 3), vertical coma (Z−1 3), horizontal coma (Z1 3), oblique trefoil (Z3 3), fourth order aberration, oblique quadrefoil (Z−4 4), secondary oblique astigmatism (Z−2 4), primary spherical aberration (Z0 4), vertical secondary astigmatism (Z2 4), and vertical quadrefoil (Z4 4).

2. RESULTS

A total 114 eyes from 64 patients were included :

44 eyes in the chalazion group and 70 eyes in the control group .

Mean patient age was 40.0 ± 13.9 years in the chalazion group and 43.4 ± 14.0 years in the control group.

The chalazion group was divided into the various subgroups:

according to site of the chalazion, the upper eyelid (n = 22), lower eyelid (n = 16), and both eyelids (n = 6, 2) according to the location of the chalazion, the nasal eyelid (n = 10), middle eyelid (n = 25), temporal eyelid (n = 4), and whole eyelid (n = 3), and 3) according to the size of the chalazion, small (n = 14), medium (n = 17), and large (n = 11) .

Corneal topographic data for the chalazion and control groups are presented in Fig. 1 and Table 2.

CCT was not different between the two groups. Astigmatism measured by ARK was not different between the chalazion and control groups (p = 0.074; independent t-test). Oblique astigmatism (Z−2 2) was greater in the chalazion group compared with the control group (p = 0.013; independent t-test).

Other topographic data were similar between the chalazion and control groups. Astigmatism by simK, steep K by simK, total RMS, second order aberration, Z−2 2 , and Z2 2 were significantly different between these subgroups (p = 0.001, 0.022, 0.002, <0.001, 0.009, and 0.001, respectively; ANOVA).

Astigmatism by simK was greater in the upper eyelid group compared with the control and lower eyelid groups (p = 0.001 and 0.004, respectively). Steep K by simK significantly differed between upper and lower lids (p = 0.011). Total RMS was greater in the upper eyelid group compared with the control and lower eyelid groups (p = 0.004 and 0.003, respectively). Second order aberration was greater in the upper eyelid group compared with the control, lower eyelid, and whole eyelid groups (p = 0.001, <0.001, and 0.019, respectively). The Z−2 2 was greater in the upper eyelid group compared with the control (p = 0.06). The Z2 2 was greater in the upper eyelid group compared with the control and lower eyelid group, and lower in the upper eyelid group compared with whole eyelid group (p = 0.002, 0.008 and, 0.028, respectively). Corneal topographic changes according to chalazion location are presented in Fig. 3 and Table 4. Astigmatism by ARK, Z−2 2 , Z0 2, and Z−2 were significantly different between groups (p = 0.046, 0.033, 0.003, and 0.015, respectively; ANOVA). Astigmatism by ARK was significantly different between the control and temporal area groups or between middle and temporal area group (p = 0.019 and 0.025). The Z0 2 was greater in the whole area group compared with the control, nasal, middle, and temporal area groups (p = 0.002, 0.021, 0.001, and 0.004, respectively; Tukey post hoc test). There was a significant difference in Z−2 4 between temporal and whole area groups (p = 0.018; Tukey post hoc test). Corneal topographic changes according to chalazion size are presented in Fig. 4 and Table 5. Astigmatism by simK, second order aberration, Z−2 2 , and Z2 2 were greater in the large-sized chalazion group (p = 0.037, 0.036, 0.006, and 0.002, respectively; ANOVA). Astigmatism by simK and second order aberration was greater in the large-sized chalazion group compared with the control (p = 0.049 for both; Tukey post hoc test). There was a significantly greater Z−2 2 in the large-sized chalazion group compared with the control (p = 0.003; Tukey post hoc test). Z2 2 was greater in the large-sized chalazion group compared with the control and small-sized chalazion groups (p = 0.015 and 0.004, respectively; Tukey post hoc test).

Table 1 Demographic data of subjects

	N
Control	70
Chalazion group	44
Site Upper eyelid	22
Lower eyelid	16
Both eyelid	6
Location Nasal	10
Middle	25
Temporal	4
Whole	3
Size Small	14
Medium	17
Large	11

Table 2 Corneal topographic data between chalazion and control group

	Total	Chalazion group	Control group	p-value
N (eyes)	114	44	70	
Gender (M:F)	52:62	19:25	33:37	
Age (year)	41.59 ± 14.08	39.57 ± 13.83	42.86 ± 14.18	0.226
CCT (μm)	547.25 ± 39.90	546.91 ± 43.64	547.46 ± 37.69	0.943
Average keratometry by ARK (D)	42.96 ± 1.86	42.84 ± 2.08	43.03 ± 1.72	0.603
Astigmatism by ARK (D)	-0.85 ± 0.99	−0.94 ± 1.44	−0.79 ± 0.58	0.546
Axis by ARK (°)	104.23 ± 63.36	108.63 ± 60.74	101.48 ± 65.26	0.579
SimK (D)	42.76 ± 3.49	42.43 ± 2.28	42.96 ± 4.08	0.434
Astigmatism by simK (D)	1.31 ± 0.96	1.53 ± 1.16	1.17 ± 0.78	0.074
Axis by simK (°)	84.74 ± 35.24	85.16 ± 28.23	84.47 ± 39.20	0.914
Mean K of posterior surface (D)	−6.28 ± 0.27	−6.25 ± 0.24	−6.29 ± 0.28	0.514
Astigmatism of posterior surface (D)	−0.44 ± 0.29	−0.46 ± 0.26	−0.43 ± 0.32	0.691
Total RMS (μm)	1.81 ± 0.80	1.97 ± 1.05	1.71 ± 0.59	0.127
2nd order aberration (μm)	1.55 ± 0.70	1.68 ± 0.87	1.48 ± 0.55	0.184
Oblique astigmatism ($Z^{-}{}_{2}{}^{2}$; μm)	0.04 ± 0.49	0.18 ± 0.52	−0.05 ± 0.45	0.013*

	Total	Chalazion group	Control group	p-value
Defocus (Z^0_2; μm)	−0.85 ± 0.50	−0.83 ± 0.53	−0.87 ± 0.49	0.693
Vertical astigmatism (Z^2_2; μm)	−0.74 ± 1.06	−0.98 ± 1.16	−0.59 ± 0.98	0.057
3rd order aberration (μm)	0.67 ± 0.42	0.71 ± 0.53	0.64 ± 0.34	0.398
Vertical trefoil ($Z^{-}{}_3{}^3$; μm)	−0.18 ± 0.40	−0.24 ± 0.44	−0.14 ± 0.37	0.216
Vertical Coma ($Z^{-}{}_3{}^1$; μm)	0.34 ± 3.01	0.13 ± 0.37	0.48 ± 3.84	0.555
Horizontal coma (Z^1_3; μm)	−0.04 ± 0.31	−0.04 ± 0.29	−0.04 ± 0.33	0.961
Oblique trefoil (Z^3_3; μm)	−0.02 ± 0.44	−0.06 ± 0.55	−0.01 ± 0.35	0.378
4th order aberration (μm)	0.40 ± 0.30	0.40 ± 0.30	0.40 ± 0.30	0.921
Oblique quadrefoil ($Z^{-}{}_4{}^4$; μm)	0.01 ± 0.09	0.02 ± 0.10	0.00 ± 0.07	0.293
Oblique secondary astigmatism ($Z^{-}{}_4{}^2$; μm)	0.01 ± 0.13	−0.01 ± 0.14	0.01 ± 0.11	0.333
Primary spherical (Z^0_4; μm)	0.17 ± 0.30	0.17 ± 0.32	0.16 ± 0.30	0.922
Vetical secondary astigmatism (Z^2_4; μm)	0.07 ± 0.18	0.05 ± 0.19	0.08 ± 0.18	0.447
Vertical quadrefoil (Z^4_4; μm)	−0.11 ± 0.23	−0.11 ± 0.22	−0.12 ± 0.24	0.888

SimK simulated keratometry, ARK autorefractokeratometry, RMS root mean square, D diopter; *Statistically significant by independent t-test

Table 3 Corneal topographic data according to site of chalazion

	Control	Upper eyelid	Lower eyelid	Both eyelids	p-value
n	70	22	16	6	
Gender (M:F)	33:37	10:12	3:13	6:0	
Age (year)	42.86 ± 14.18	41.27 ± 12.41	38.63 ± 16.74	35.83 ± 11.16	0.519
CCT (μm)	547.46 ± 37.69	5583.27 ± 42.50	528.25 ± 45.57	555.00 ± 28.33	0.136
Average keratometry by ARK (D)	43.03 ± 1.72	43.38 ± 1.69	42.18 ± 2.58	42.82 ± 1.44	0.269
Astigmatism by ARK (D)	-0.79 ± 0.58	−1.12 ± 1.93	−0.88 ± 0.85	−0.50 ± 0.45	0.490
Axis by ARK (°)	101.48 ± 65.26	118.16 ± 67.99	102.50 ± 53.94	92.00 ± 57.73	0.750
SimK (D)	42.96 ± 4.08	43.11 ± 1.69	41.51 ± 2.99	42.42 ± 1.21	0.470
Astigmatism by simK (D)	1.17 ± 0.78	2.01 ± 1.27	0.98 ± 0.59	1.23 ± 1.26	0.001*
Axis by simK (°)	84.47 ± 39.20	83.05 ± 25.31	88.31 ± 27.04	84.50 ± 43.78	0.470
Mean K of posterior surface (D)	−6.29 ± 0.28	−6.29 ± 0.29	−6.24 ± 0.15	−6.16 ± 0.25	0.653
Astigmatism of posterior surface (D)	−0.43 ± 0.32	−0.53 ± 0.32	−0.36 ± 0.13	−0.42 ± 0.16	0.336
Total RMS (μm)	1.71 ± 0.59	2.35 ± 1.13	1.46 ± 0.39	1.96 ± 1.47	0.002*
2nd order aberration (μm)	1.48 ± 0.55	2.11 ± 1.04	1.23 ± 0.31	1.24 ± 0.20	<0.001*

	Control	Upper eyelid	Lower eyelid	Both eyelids	p-value
Oblique astigmatism (Z^{-2}_{2}; μm)	−0.05 ± 0.45	0.33 ± 0.57	−0.03 ± 0.40	0.21 ± 0.43	0.009*
Defocus (Z^{0}_{2}; μm)	−0.87 ± 0.49	−0.79 ± 0.72	−0.82 ± 0.25	−0.99 ± 0.10	0.820
Vertical astigmatism (Z^{2}_{2}; μm)	−0.59 ± 0.98	−1.55 ± 1.28	−0.48 ± 0.69	−0.25 ± 0.62	0.001*
3rd order aberration (μm)	0.64 ± 0.34	0.85 ± 0.68	0.55 ± 0.17	0.62 ± 0.43	0.129
Vertical trefoil (Z^{-3}_{3}; μm)	−0.14 ± 0.37	−0.28 ± 0.54	−0.16 ± 0.21	−0.31 ± 0.50	0.470
Vertical Coma (Z^{-1}_{3}; μm)	0.48 ± 3.84	0.23 ± 0.41	−0.02 ± 0.31	0.18 ± 0.30	0.939
Horizontal coma (Z^{1}_{3}; μm)	−0.04 ± 0.33	−0.025 ± 0.29	−0.13 ± 0.31	0.13 ± 0.15	0.398
Oblique trefoil (Z^{3}_{3}; μm)	−0.01 ± 0.35	−0.16 ± 0.72	−0.01 ± 0.28	0.14 ± 0.30	0.332
4th order aberration (μm)	0.40 ± 0.30	0.44 ± 0.21	0.39 ± 0.40	0.30 ± 0.27	0.802
Oblique quadrefoil (Z^{-4}_{4}; μm)	0.00 ± 0.07	0.03 ± 0.14	0.02 ± 0.05	−0.02 ± 0.03	0.422
Oblique secondary astigmatism (Z^{-2}_{4}; μm)	0.01 ± 0.11	−0.02 ± 0.16	−0.00 ± 0.11	0.03 ± 0.15	0.618
Primary spherical (Z^{0}_{4}; μm)	0.16 ± 0.30	0.10 ± 0.23	0.29 ± 0.43	0.11 ± 0.09	0.243
Vetical secondary astigmatism (Z^{2}_{4}; μm)	0.08 ± 0.18	0.10 ± 0.21	−0.01 ± 0.16	0.02 ± 0.06	0.230
Vertical quadrefoil (Z^{4}_{4}; μm)	−0.12 ± 0.24	−0.13 ± 0.25	−0.07 ± 0.11	−0.15 ± 0.33	0.876

SimK simulated keratometry, ARK autorefractokeratometry, RMS root mean square, D diopter; Results were presented as mean ± standard deviation.*Statistically significant by ANOVA

Table 4 topographic changes according to chalazion location

	Control	Nasal	Middle	Temporal	Whole	p-value
n	70	10	25	4	3	
Gender (M:F)	33:37	5:5	9:16	2:2	2:1	
Age (year)	42.86 ± 14.18	42.20 ± 16.29	38.12 ± 13.66	43.75 ± 14.48	45.67 ± 4.51	0.679
CCT (μm)	547.46 ± 37.69	550.50 ± 19.60	542.16 ± 50.65	542.25 ± 32.40	552.33 ± 14.05	0.952
Average keratometry by ARK (D)	43.03 ± 1.72	42.44 ± 1.71	42.83 ± 2.35	44.79 ± 1.51	42.51 ± 0.88	0.411
Astigmatism by ARK (D)	-0.79 ± 0.58	−0.93 ± 1.01	−0.79 ± 58.50	−2.58 ± 3.19	−0.75 ± 0.35	0.046*
Axis by ARK (°)	101.48 ± 65.26	108.89 ± 61.53	115.00 ± 58.50	126.67 ± 70.77	105.00 ± 49.50	0.851
SimK (D)	42.96 ± 4.08	41.96 ± 1.91	42.33 ± 2.59	43.47 ± 1.62	43.86 ± 2.15	0.823
Astigmatism by simK (D)	1.17 ± 0.78	1.16 ± 1.14	1.54 ± 1.13	1.61 ± 1.79	2.30 ± 0.56	0.143
Axis by simK (°)	84.47 ± 39.20	80.00 ± 33.72	82.92 ± 27.77	103.00 ± 29.06	92.00 ± 22.54	0.843
Mean K of posterior surface (D)	−6.29 ± 0.28	−6.19 ± 0.20	−6.24 ± 0.24	−6.40 ± 0.34	−6.42 ± 0.37	0.543

Astigmatism of posterior surface (D)	−0.43 ± 0.32	−0.43 ± 0.13	−0.45 ± 0.32	−0.46 ± 0.19	−0.58 ± 0.13	0.942
Total RMS (μm)	1.71 ± 0.59	1.64 ± 0.76	2.03 ± 1.14	2.09 ± 1.48	2.37 ± 1.05	0.243
2nd order aberration (μm)	1.48 ± 0.55	1.35 ± 0.78	1.69 ± 0.82	1.90 ± 1.53	2.14 ± 0.93	0.219
Oblique astigmatism (Z_2^{-2}; μm)	−0.05 ± 0.45	0.06 ± 0.48	0.17 ± 0.49	0.44 ± 0.82	0.58 ± 0.47	0.033*
Defocus (Z_2^0; μm)	−0.87 ± 0.49	−0.75 ± 0.34	−0.94 ± 0.15	−1.09 ± 0.06	0.22 ± 1.80	0.003*
Vertical astigmatism (Z_2^2; μm)	−0.59 ± 0.98	−0.56 ± 1.11	−1.00 ± 1.19	−1.18 ± 1.68	−1.51 ± 0.54	0.269
3rd order aberration (μm)	0.64 ± 0.34	0.65 ± 0.36	0.75 ± 0.66	0.67 ± 0.19	0.71 ± 0.30	0.877
Vertical trefoil (Z_3^{-3}; μm)	−0.14 ± 0.37	−0.27 ± 0.40	−0.31 ± 0.47	−0.01 ± 0.24	0.11 ± 0.51	0.212
Vertical Coma (Z_3^{-1}; μm)	0.48 ± 3.84	0.18 ± 0.24	0.16 ± 0.41	−0.12 ± 0.39	0.10 ± 0.46	0.986
Horizontal coma (Z_3^1; μm)	−0.04 ± 0.33	−0.07 ± 0.26	−0.05 ± 0.28	0.15 ± 0.47	0.00 ± 0.24	0.820
Oblique trefoil (Z_3^3; μm)	−0.01 ± 0.35	−0.12 ± 0.42	−0.13 ± 0.64	0.29 ± 0.19	0.10 ± 0.24	0.349
4th order aberration (μm)	0.40 ± 0.30	0.43 ± 0.20	0.38 ± 0.34	0.36 ± 0.07	0.56 ± 0.50	0.885
Oblique quadrefoil (Z_4^{-4}; μm)	0.00 ± 0.07	0.03 ± 0.14	0.03 ± 0.10	0.01 ± 0.01	−0.05 ± 0.06	0.380
Oblique secondary astigmatism (Z_4^{-2}; μm)	0.01 ± 0.11	−0.03 ± 0.12	−0.02 ± 0.12	0.15 ± 0.12	−0.14 ± 0.16	0.015*
Primary spherical (Z_4^0; μm)	0.16 ± 0.30	−0.03 ± 0.12	−0.02 ± 0.12	0.20 ± 0.14	−0.11 ± 0.50	0.590
Vetical secondary astigmatism (Z_4^2; μm)	0.08 ± 0.18	0.17 ± 0.26	0.20 ± 0.34	−0.03 ± 0.15	0.12 ± 0.41	0.754
Vertical quadrefoil (Z_4^4; μm)	−0.12 ± 0.24	0.03 ± 0.25	0.05 ± 0.12	0.01 ± 0.20	−0.18 ± 0.39	0.710

SimK simulated keratometry, ARK autorefractokeratometry, RMS root mean square, D diopter; Results were presented as mean ± standard deviation.; *Statistically significant by ANOVA

Table 5 Corneal topographic changes according to chalazion size

	Control	Small	Medium	Large	p-value
n	70	14	17	11	
Gender (M:F)	33:37	5:9	6:11	7:4	
Age (year)	42.86 ± 14.18	43.64 ± 19.08	38.47 ± 10.72	38.36 ± 10.00	0.543
CCT (μm)	547.46 ± 37.69	539.29 ± 27.84	555.29 ± 34.43	535.91 ± 60.86	0.526
Average keratometry by ARK (D)	43.03 ± 1.72	43.66 ± 1.01	42.71 ± 2.11	42.09 ± 2.96	0.224
Astigmatism by ARK (D)	-0.79 ± 0.58	−0.85 ± 0.88	−0.89 ± 1.67	−1.20 ± 1.82	0.688
Axis by ARK (°)	101.48 ± 65.26	108.33 ± 50.24	113.75 ± 66.37	121.00 ± 55.42	0.714
SimK (D)	42.96 ± 4.08	43.07 ± 1.11	42.23 ± 2.30	42.05 ± 3.41	0.767
Astigmatism by simK (D)	1.17 ± 0.78	1.05 ± 0.67	1.69 ± 1.43	1.82 ± 1.13	0.037*
Axis by simK (°)	84.47 ± 39.20	89.93 ± 39.47	80.76 ± 26.52	84.45 ± 13.91	0.917

	Control	Small	Medium	Large	p-value
Mean K of posterior surface (D)	−6.29 ± 0.28	−6.23 ± 0.19	−6.25 ± 0.27	−6.30 ± 0.29	0.858
Astigmatism of posterior surface (D)	−0.43 ± 0.32	−0.34 ± 0.12	−0.54 ± 0.36	−0.48 ± 0.14	0.322
Total RMS (μm)	1.71 ± 0.59	1.77 ± 0.96	1.90 ± 1.05	2.33 ± 1.24	0.113
2nd order aberration (μm)	1.48 ± 0.55	1.34 ± 0.37	1.68 ± 1.04	2.06 ± 1.00	0.036*
Oblique astigmatism (Z^{-2}_{2}; μm)	−0.05 ± 0.45	0.09 ± 0.48	0.09 ± 0.50	0.49 ± 0.55	0.006*
Defocus (Z^{0}_{2}; μm)	−0.87 ± 0.49	−0.89 ± 0.31	−0.94 ± 0.15	−0.56 ± 0.96	0.222
Vertical astigmatism (Z^{2}_{2}; μm)	−0.59 ± 0.98	−0.20 ± 0.87	−1.15 ± 1.21	−1.60 ± 1.01	0.002*
3rd order aberration (μm)	0.64 ± 0.34	0.63 ± 0.30	0.64 ± 0.44	0.94 ± 0.84	0.169
Vertical trefoil (Z^{-3}_{3}; μm)	−0.14 ± 0.37	−0.24 ± 0.34	−0.23 ± 0.43	−0.26 ± 0.60	0.691
Vertical Coma (Z^{-1}_{3}; μm)	0.48 ± 3.84	0.01 ± 0.37	0.18 ± 0.42	0.22 ± 0.30	0.947
Horizontal coma (Z^{1}_{3}; μm)	−0.04 ± 0.33	−0.11 ± 0.32	0.03 ± 0.24	−0.01 ± 0.33	0.632
Oblique trefoil (Z^{3}_{3}; μm)	−0.01 ± 0.35	−0.04 ± 0.28	−0.02 ± 0.35	−0.19 ± 0.98	0.619
4th order aberration (μm)	0.40 ± 0.30	0.29 ± 0.18	0.38 ± 0.21	0.58 ± 0.45	0.094
Oblique quadrefoil (Z^{-4}_{4}; μm)	0.00 ± 0.07	0.04 ± 0.12	−0.00 ± 0.05	0.05 ± 0.14	0.296
Oblique secondary astigmatism (Z^{-2}_{4}; μm)	0.01 ± 0.11	0.01 ± 0.13	−0.02 ± 0.11	−0.06 ± 0.17	0.264
Primary spherical (Z^{0}_{4}; μm)	0.16 ± 0.30	0.10 ± 0.09	0.20 ± 0.26	0.22 ± 0.54	0.739
Vetical secondary astigmatism (Z^{2}_{4}; μm)	0.08 ± 0.18	0.05 ± 0.16	0.03 ± 0.19	0.06 ± 0.22	0.840
Vertical quadrefoil (Z^{4}_{4}; μm)	−0.12 ± 0.24	−0.09 ± 0.18	−0.09 ± 0.21	−0.15 ± 0.31	0.903

SimK simulated keratometry, ARK autorefractokeratometry, RMS root mean square, D diopter; Results were presented as mean ± standard deviation.; *Statistically

3. DISCUSSION

A chalazion is a very common eyelid disorder affecting individuals of all ages, which caused by pluggingof meibomian glands and chronic lipogranulomatous inflammation of the glands[12]. Chalazia have been reported to increase corneal astigmatism and HOAs [7, 8, 13, 14]. In this study, we have evaluated effects of chalazia on the cornea accordin to chalazia site, location, and size using corneal topography and wavefront analysis. This study revelas mechanical effects of chalazia on corneal astigmatism. Corneal topographical and wavefront assessments have been noted in patients having large sized chalazion have been noted. These changes might be due to following mechanisms. Compressive pressure of chalazia in excessive of these levels can induce the corneal astigmatism. Cornea under reduced strain by corneal refractive surgery (such as LASIK) may be more affected by lower pressure [9]. Lamellar orientation in human corneas has been related to mechanical properties [16, 17]. The mechanical effects increase in the meridian direction as they become closer to the center of the cornea [17]. The pressure-induced meridional strains were smallest at the corneal paracenter and periphery, with the largest recorded at the limbus [18].

The circumferential strains varied less between regions with the para-centre straining to the greatest extent. In the meridional direction, Young's modulus of elasticity was greatest at the central and para-central corneal regions, while the greatest circumferential elastic modulus was found at the limbus [17, 18]. The para-central region of the human cornea was found to be stiffer in the meridional direction compared with the circumferential direction, suggesting a meridionally-orientated reinforcement of the para-central parts of the human cornea [18]. The human corneal stroma exhibit a preferred collagen orientation in the inferior-superior and nasaltemporal directions. At the limbus, the preferred orientation is tangential to the cornea [19]. Therefore, it is difficult for the pressure on the sclera to have an effect on the cornea in the meridian direction. Chalazia in the middle eyelid can induce corneal astigmatism easily in the meridian direction because it is located superior to the cornea and close to the center of the cornea. Chalazia generally affected $Z-2$, an aberration of off-axis rays. HOAs influence sensitivity to contrast to varying degrees at different orientations [20]. These findings may have implications in pediatric patients at risk of amblyopia [13]. Transient chalazion-induced astigmatism can disturb the visual acuity, mislead intraocular lens calculation before cataract surgery, and result in serious error during refractive surgery. Therefore, in these cases, chalazia should be treated in the early phase. Chalazia on long term may induce the remodeling of corneal stroma through the secretion of inflammatory mediators including matrix metalloproteinases. Chalazia excision can decrease corneal astigmatism and irregularity which is more prominent in single, firm, and central upper eyelid lesions [14]. Treatment modality includes incision and curettage, intralesional triamcinolone injection, and intralesional botulinum injection.

4. CONCLUSIONS

Large-sized chalazia in the upper eyelid should be treated in the early phase because they induce great changes in corneal topography. Before corneal topography is performed Chalazion should be treated preoperatively .

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