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Evaluation of the effects of pterygium surgery on visual acuity and anterior segment measurements using corneal topography

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Abstract
This study was carried out to evaluate the effects of pterygium surgery on visual acuity, corneal astigmatism, corneal refraction, and corneal topography and the changes of these parameters in the postoperative period. Forty eyes of 34 patients presented with only primary pterygium were included in the present study. Patients with features that could affect corneal topography, such as previous ocular trauma or surgery, corneal scarring, keratoconus, dry eye, and contact lens use, were excluded from the study. After excisional pterygium surgery, primary conjunctival closure was performed. The mean baseline visual acuity measured by the Snellen chart in decimal improved from 0.78±0.19 to 0.97±0.54 in the 3rd month of the postoperative period. The mean values of SimK were 43.33±1.54 diopters (D) and 44.27 ± 1.43 D preoperatively and postoperatively (at 3rd month), respectively. The baseline topographic astigmatism was significantly decreased from 1.85 ± 1.77 (0.50-7.00) D to 0.65 ± 0.40 (0.20-1.75) D at 3rd month of postoperative period (P = 0.000). While 77.5 % of the patients had regular astigmatism at baseline, oblique and irregular astigmatism was observed in the early postoperative period, but 65 % of these patients turned back to regular astigmatism in the late postoperative period. Corneal topographic values were stabilized in the first month of the postoperative period. So, the plan of refractive or cataract surgeries may be appropriate after the stabilization of the corneal refractive components following the first month of pterygium surgery.

Keywords: Pterygium, corneal topography, pterygium surgery, astigmatism

Introduction

Pterygium is the nasal expansion of conjunctiva and fibrovascular tissue to the corneal surface due to several factors such as ultraviolet light, genetic factors, and other environmental factors. Conjunctival epithelium usually has dysplasia, and there is fibrovascular tissue accompanied by elastoid degeneration of collagen tissue under the epithelium [1].

Pterygium before age 20 is rare [2]. The prevalence of pterygium is highest in people over 40 years of age, and the incidence is the highest between the ages of 20-40 [3]. Although pterygium has a worldwide distribution, it is more common in dry climates [4]. There are some conditions such as pseudo-pterygium (pterygoid), and pinguecula that should be considered in the differential diagnosis of pterygium [5]. Medical and surgical treatment of pterygium is possible. Surgical excision indications are; reduced visual acuity, ocular movement disorder, symblepharon, diplopia, chronic inflammation, and cosmetic defect [6-7].

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It is known that pterygium affects corneal topography. The pressure of pterygium on the cornea, more flat appearance of cornea than usual due to tear accumulation around pterygium and corneal distortion by pterygium are of the several hypotheses regarding to the mechanism of pterygium-induced corneal changes [8-9]. So, in this study we aimed to investigate the effects of pterygium surgery on visual acuity, corneal astigmatism, corneal refraction, corneal topography and changes in these parameters after surgery. ¬

Material and Methods

Study Design and Patients

Our study was conducted in patients admitted to the Department of Ophthalmology. The study was adhered with the tenets of the Declaration of Helsinki. The local ethics committee approved the study protocol. Informed consent was obtained from each participant before the enrollment.

Forty eyes of 34 patients with primary pterygium were included in the study. Firstly, ophthalmologic history was taken from the patients, and then the patients had an ocular biomicroscopic examination. Those with features that could affect corneal topography, such as previous ocular trauma or surgery, corneal

scarring, keratoconus, dry eye, contact lens use, were excluded from the study. After the excisional pterygium surgery, only primary conjunctival closure was performed.

Surgical Technique

Eyelid speculum was used in all cases. Local anesthesia was achieved by injecting subconjunctival Lidocaine HCl (Jetokain, Adeka Pharmaceutical Industry Inc.) into the pterygium region. The pterygium body was separated from the conjunctiva with the aid of conjunctival scissors. The pterygium head and body were separated by a parallel incision to the limbus. The pterygium head was removed from the cornea with a peeling technique. Bleeding control was provided with bipolar cautery. The conjunctiva was sutured with 6/0 vicryl sutures, and the operation was terminated. In the postoperative period, topical antibiotic (Tobrased, Bilim Pharmaceutical Industry Inc.), steroid (Predni-Pos, Biem Pharmaceutical Industry Inc.), artificial tears (Refresh, Abdi İbrahim Pharmaceutical Industry Inc.) and analgesics in necessary cases were applied fort the treatment. Postoperative visits were performed at day 1, week 1, month 1, and 3.

Measurement

During the topographic measurements, no medication was used, including artificial tears, and no instruments were used for eyelid retraction. All measurements were taken in the same room, in the same dim light conditions, and by the same masked observer. The measurements were performed by telling the patients to look at the target light in the center of the keratoscopy containing 16 circles by opening their eyes as much as possible. The measurements were repeated when required, and the best images were recorded.

Topcon KR-8800 Auto-Kerato-Refractometer and i-Trace Corneal Topography devices with a wide form of Placido EyeSys 2000 systems were used to measure refractive, keratometric, and topographic measurements of the patients.

The refraction power is measured from a 3 mm central zone like the measurement of 'K' values. The difference between the keratometric values in the horizontal and vertical axes were defined as keratometric astigmatism. The values of the simulated keratometry (Sim K) and topographic astigmatism were expressed as diopter (D). Astigmatism was considered to be regular, irregular and oblique if the axis was between 90±20 degrees, between 180±20 degrees and out of 70-110 and/or 160-20 degrees, respectively [10].

All patients underwent a detailed ophthalmic examination including visual acuity (VA) measured in Snellen chart, topographic astigmatism, keratometric astigmatism, astigmatism axis, and mean corneal refraction power (Sim K) before the surgery and at the 1st day, 1st week, 1st and 3rd month of the postoperative period.

Statistics

Statistical analysis was performed using SPSS version 11.5 (SPSS Inc. Chicago, IL) for Windows. Descriptive statistics (mean ± standard deviation) were used to present the data. The T-Test (Paired Samples t-Test) was used to compare the means of the two dependent groups. Analysis of variance (ANOVA) for repeated measurements was used for the comparison of the mean values in case of more than two dependent groups. Pearson correlation analysis was used to assess the relationship between the two variables. A P value less than 0.05 was considered to indicate statistical significance.

Results

No serious complication was observed in the postoperative period. There was no recurrence during the three months follow-up. A complete cosmetic improvement was achieved for all patients after surgery. The numbers of male and female patients were similar (P>0.05). The ages of patients were ranged in a small area (40-50 years).

All pterygiums were located nasally. Demographics of the patients and the properties of the eyes were noted in Table 1. The changes in the mean of VA, keratometric astigmatism, topographic astigmatism, and simulation keratometry values at baseline and during the follow-up are shown in Table 2.

Table 1. Distributions of CNP and creatinine levels according to groups

Variables	Values
Patient Number	34
Age (Mean± SD, years)	44.80±12.92
Age Range (years)	(40-50)
Gender (M/F)	16 / 18
Eye Side (R/L)	23 / 17
Eye (U/B)	20/ 20
Pterygium (P/R)	40/ 0

SD: Standard deviation, M/F: Male/Female, R/L: Right/Left, U/B: Unilateral/ Bilateral, P/R: Primary/Recurrent

Table 2. Changes in the parameters of corneal topography before the surgery and after the surgery

	Group					
Parameters	**Preop. Mean±SD**	**Postop. Day 1 Mean±SD**	**Postop. Week 1 Mean±SD**	**Postop. Month 1 Mean±SD**	**Postop. Month 3 Mean±SD**	**p**
VA	0.78±0.19	0.84±0.17	0.89±0.14	0.93±0.11	0.97±0.54	0.000*
Keratometric Astigmatism(D)	1.85±1.77	1.42±0.77	1.14±0.67	0.67±0.38	0.66±0.38	0.000*
Topographic Astigmatism(D)	1.85±1.77	1.42±0.77	1.14±0.67	0.66±0.38	0.65±0.40	0.000*
Sim K(D)	43.33±1.54	43.63±1.48	43.96±1.57	44.19±1.50	44.27±1.43	0.000*

SD: Standard deviation, VA: Visual acuity, Sim K: Simulation keratometry, D: Diopter, *: Statistically significant

The mean postoperative VA was found to be higher than the preoperative level (P=0.000). Postoperative keratometric astigmatism was found to be decreased significantly compared to baseline (P=0.000). There was a significant difference in the mean of keratometric astigmatism between baseline and postoperative 1st month (p=0.000). A statistically significant difference was also found between the baseline and postoperative 3rd month (P=0.000). However, no statistically significant difference was found between the postoperative 1st month and 3rd month (P=0.06). The preoperative keratometric astigmatism axis was regular in 23 (57.5%) eyes, irregular in 13 (32.5%) eyes, and oblique in 4 (%10) eyes. These values were 16 (40%), 8 (20%) and 16 (40%) at first postoperative day; 19 (47.5%), 7 (17.5%) and 14 (35%) at first postoperative week; 23 (57.5%), 9 (22.5%) and 8 (20%) at first postoperative month; 25 (62.5%), 7 (17.5%) and 8 (20%) at third postoperative month, respectively.

Postoperative topographic astigmatism was found to be decreased significantly compared to baseline (P=0.000). There was a significant difference in the mean of topographic astigmatism between baseline and postoperative 1st month (p = 0.000). A statistically significant difference was also found between the baseline and postoperative 3rd month (P = 0.000). However, no statistically significant difference was found between the postoperative 1st month and 3rd month (P = 0.453). The preoperative topographic astigmatism axis was regular in 31 (77.5%) eyes, irregular in 9 (22.5%) eyes, and oblique in no (%0) eyes. These values were 12 (30%), 14 (35%) and 14 (35%) at first postoperative day; 16 (40%), 11 (27.5%) and 13 (32.5%) at first postoperative week; 18 (45%), 11 (27.5%) and 11 (27.5%) at first postoperative month; 26 (65%), 10 (25%) and 4 (10%) at third postoperative month, respectively.

Postoperative corneal refraction was found to be significantly higher than the preoperative level (P = 0.000). There was a significant difference in the mean of corneal refraction between baseline and postoperative 1st month (p = 0.000). A statistically significant difference was also found between the baseline and postoperative 3rd month (P = 0.000). However, no statistically significant difference was found between the postoperative 1st month and 3rd month (P = 0.342).

There was a strong positive correlation between mean topographic astigmatism and mean keratometric astigmatism in the postoperative period (P = 0.000, r = 1.000). We did not find any significant correlation between other parameters.

Discussion

Vision loss is associated with high asymmetric corneal astigmatism besides the covered visual axis due to pterygium [11]. There is a close relationship between the size of the pterygium and astigmatism it produces [12]. Similar to some studies in the literature, in our study, postoperative VA increased significantly compared to the preoperative level. This increase in VA was observed from the postoperative 1st day up to postoperative 1st and 3rd month [13-14].

Adıgüzel et al. [15] showed a significant reduction in post-operative regular and irregular astigmatism in the 3 mm and 6 mm areas by using the Fourier analysis method.

Yılmaz et al. [16] performed pterygium surgery in 115 patients using four methods; conjunctival autograft, limbal-conjunctival autograft, bare-sclera, and mitomycin C plus bare sclera. Postoperative astigmatism decreased statistically in all four surgical techniques.

Oltulu et al. [17] studied 21 eyes of 21 patients with primary pterygium, both before and two months after the pterygium excision using conjunctival autograft technique. Parallel to our study; they found that corneal topographic changes induced by pterygium are almost reversible after surgical treatment of the pterygium. There was a significant decrease in the mean keratometric astigmatism after the pterygium surgery in some other studies [18-19].

Corneal astigmatism induced by pterygium is reduced after the pterygium excision. Nevertheless, the changes and stabilization in astigmatism after the surgery have not been clearly demonstrated. In our study; preoperative, postoperative 1st day, 1st week, 1st, and 3rd-month measurements were performed, and the changes in astigmatism could be observed. Similar to previous studies, postoperative astigmatism was significantly reduced in our study compared to the preoperative period. This reduction started at postoperative day 1, and the reduction reached the highest value in postoperative 1st and 3rd month. The fact that there was no significant difference in astigmatism between postoperative 1st and 3rd months suggests that astigmatism may be stabilized after 1st postoperative month. However, Özdemir et al. [20] found stabilized topographic appearance at a later period (third month).

In our study, although the preoperative regular astigmatism was turned to irregular and oblique astigmatism in the early postoperative period, returning to regular astigmatism was observed in the late postoperative period. This result is coherent with the literature, and it is thought to be associated with the nature of pterygium surgery.

Sim K values are one of the most important and most commonly used corneal topography parameters. Sim K values reflect the refractive power of the most straight and flat axis of the corneal surface in keratometer. These parameters show values on both spheroclyndiric and non- spheroclyndiric (on irregular surfaces) corneal surface. Sim K values are parallel with keratometer values but provide more detailed and reliable information [21].

In a study, mean Sim K values after the pterygium excision were increased statistically [22]. In our study, the mean values of Sim K were also increased postoperatively, and a significant decrease was detected in the corneal flattening (P = 0.000). However, the absence of a statistically significant difference between postoperative 1st and 3rd month in the mean corneal refractive power leads us to believe that the topographic values of the cornea are stabilized at 1st month.

Conclusion

In conclusion, corneal topography is one of the best methods for diagnosing and following the changes in the cornea due to pterygium. In our study, the mean visual acuity increased, the mean keratometric and topographic astigmatism decreased, and the mean corneal refraction increased after successful pterygium surgery. We observed that the preoperative regular

astigmatism turned to irregular and oblique astigmatism in the early postoperative period and then again returned to regular astigmatism in the late postoperative period. The similar values of the mean topographic astigmatism and mean corneal refractive power in the postoperative 1st and 3rd month suggests that the topographic values of the cornea are stabilized at postoperative 1st month. For this reason, it may be appropriate to wait for the first postoperative month if the patient needs glasses.

Moreover, pterygium surgery should be performed first, then cataract or refractive surgery can be planned after the postoperative 1st month when the corneal refractive components are stabilized. Retrospective nature, lack of control or comparison group, and the small sample size are the limitations of the study. Considering these disadvantages, new studies are warranted.

Competing interests
The authors declare that they have no competing interest.

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Ethical approval
The local ethics committee approved the study protocol.

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References

1. Bengisu Ü. Göz hastalıkları, 4. Baskı: Kornea Anatomisi ve Fizyolojisi. Ankara, Palme yayıncılık. 1998;69-72.
2. Perra MT, Maxia C, Corbu A, et al. Oxidative stress in pterygium: relationship between p53 and 8-hydroxydeoxyguanosin. Mol Vis. 2006;30:1136-42.
3. Varma R, Vajaranant TS, Burkemper B, et al. Visual impairment and blindness in adults in the United States: demographic and geographic variations from 2015 to 2050. JAMA Ophthalmol. 2016;134:802–9.
4. Kanski JJ. Konjonktiva Hastalıkları, Klinik Oftalmoloji, Orağlı KM. 3. Baskı, İstanbul; Nobel Tıp Kitabevleri. 2001;56.
5. Sowka JW, Gurwood AS, Kabat AG. Pterygium, Handbook of Ocular Disease Management, Jobson Publishing, USA. 2001:1-2.
6. Yaycıoğlu RA, Aydın Akova Y. Amnion membran transplantasyonunun oftalmolojide yeri. T Klin Oftalmoloji. 2003;12:227-36.
7. Prabhasawat P, Barton K, Burket G, et al. Comparison of conjunctival autografts, amniotic membrane grafts, and primary closure for pterygium excision. Ophthalmology. 1997;104:974-85.
8. Walland MJ, Stevens JD, Steele AD. The effect of recurrent pterygium on corneal topography. Cornea. 1994;13:463-4.
9. Maden A. Oküloplastik Cerrahi. İzmir, Punto Yayıncılık. 1995;301
10. Güler C, Aydın P, Akova YA. Gözün Refraktif Durumu, Temel Göz Hastalıkları. 1. Baskı, Güneş Kitabevi, Ankara. 2001;99-100.
11. Ma DH, See LC, Liau SB, et al. Amniotic membrane graft for primary pterygium: comparison with conjunctival autograft and topical mitomycin C treatment. Br J Ophthalmol. 2000;84:973-8.
12. Duman F, Kösker M. Demographics of Patients with Double-headed Pterygium and Surgical Outcomes. Turk J Ophthalmol. 2015;45:249-53.
13. Errais K, Bouden J, Mılı- Boussen, et al. Effect of pterygium surgery on corneal topography. Eur J Ophthalmol. 2008;18:177-81.
14. PL Wu, CN Kuo, HL Hsu, et al. Effect of pterygium surgery on refractive spherocylinder power and corneal topography. Ophthalmic Surg Lasers Imaging. 2009;40:32-7.
15. Adıgüzel U, Yeşilli M, Sarı A, et al. Effect of Pterygium surgery on corneal regular and irregular astigmatism: Evaluation with Fourier analysis. Turk J Ophthalmol. 2008;38:4-8.
16. Yılmaz S, Yüksel T, Maden A. Corneal topographic changes after four types of pterygium surgery. J Refract Surg. 2008;24:160-6.
17. Oltulu R, Demirel S, Sarac O, et al. Evaluation of corneal and anterior chamber changes following pterygium surgery using a Pentacam Scheimplug system: a prospective study. Semin Ophthalmol. 2013;28:206-9.
18. Bahar I, Loya N, Weinberger D, et al. Effect of pterygium surgery on corneal topography: a prospective study. Cornea. 2004;23:113-7.
19. Yagmur M, Altan A, S Sarı, et al. Visual Acuity and Corneal Topographic Changes Related with Pterygium Surgery. J Refract Surg. 2005;21:166-70.
20. Özdemir M, Cinal A. Early and late effect of pterygium surgery on corneal topography. Ophthalmic Surg Lasers Imaging. 2005;36:451-6.
21. Tomidokoro A, Miyata K, Sakaguchi Y, et al. Effect of pterygium on corneal spherical power and astigmatism. Ophthalmology. 2000;107:1568-71.
22. PL Wu, CN Kuo, HL Hsu, et al. Effect of pterygium surgery on refractive spherocylinder power and corneal topography. Ophthalmic Surg Lasers Imaging. 2009;40:32-7.