

Original Article

Eyestrain and Dry Eye after Photorefractive Keratectomy in a Sample of Iranian Patients

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Abstract

Purpose: To evaluate the medium-term postsurgical effects of photorefractive keratectomy (PRK) on patients' subjective perception of dry eye and eyestrain.

Patients and Methods: This prospective comparative pre-post study was performed at Vanak Eye Surgery Center, Tehran, Iran, from May 2020 to September 2021. The inclusion criteria were patients with mild to moderate myopia (less than -6 diopters) undergoing PRK. To evaluate the indirect subjective signs of eyestrain and its severity, we used a questionnaire including six questions regarding itching, foreign body sensation, excessive tearing, eye tiredness, blurring, and photophobia. We administered this questionnaire to each patient in face-to-face interviews pre-surgery as well as 1 and 6 months post-surgery. To evaluate post-surgical dry eye, we asked patients if their dry eye symptoms had increased or decreased compared to the pre-surgical period.

Results: A total of 40 patients were assessed in this study. The mean age of patients was 26 ± 8 years, with 16 (40 %) male patients and 24 (60 %) female patients. There was no statistically significant difference in mean eyestrain scores one month ($P = 0.371$) and six months ($P = 0.939$) post-surgery compared to pre-surgery. There was a significant increase in dry eye symptoms at both 1 month ($P = 0.010$) and 6 months ($P = 0.004$) post-surgical follow-ups.

Conclusion: Our results indicate that PRK significantly increases dry eye symptoms compared to the pre-surgical period, up to six months post-operatively. There was no statistically significant difference in eyestrain symptoms among patients compared to the pre-surgical period.

Keywords: Photorefractive; Surgery; Dry Eye; Eyestrain.

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Introduction

Refractive errors are among the most common types of vision impairments worldwide ¹. Traditionally, refractive errors have been corrected using glasses or contact lenses, but in recent decades the use of laser-assisted refractive surgery to correct refractive errors has been rapidly gaining popularity ². The most common type of laser-assisted refractive surgery is Laser-assisted in situ keratomileusis (LASIK) ³. In this method, a corneal flap is created before applying the laser beam to correct the corneal curvature ⁴. In an alternative method called photorefractive keratectomy (PRK), instead of creating a flap, the surgeon removes the epithelial layer of the cornea to facilitate the application of the laser to the corneal stroma for correction of the refractive error ⁵. In recent years, PRK has received renewed popularity compared to LASIK due to concerns regarding flap-related complications and postoperative ectasia caused by the LASIK procedure ^{6,7}. However, PRK is associated with greater pain and slower visual recovery than LASIK, and there is an increased risk of superficial corneal haze ⁸.

The most common side effect of all corneal laser refractive surgeries is the possibility of postoperative dry eye syndrome ⁸. Dysfunction in the ocular surface-lacrimal gland functional unit and damage to the corneal afferent nerves, disrupting sensory input into the ocular surface-lacrimal gland feedback system, might cause dry eye following corneal refractive surgeries ⁹. Although it seems that PRK is associated with a lower chance of postoperative dry eye syndrome compared to LASIK, postoperative dry eye is still a challenge for patients undergoing PRK ¹⁰⁻¹².

Another less studied complication of laser corneal refractive surgeries is postoperative eyestrain ¹³. Eyestrain is a combination of

symptoms including eye itching, foreign body sensation, eye watering, eye tiredness, blurring of vision, and light sensitivity ¹⁴.

The aim of the present study was to evaluate the medium-term (3 and 6 months) postsurgical effects of PRK on patients' subjective perception of dry eye and eyestrain.

Patients and Methods

This prospective comparative pre-post study was performed at Vanak Eye Surgery Center, Tehran, Iran, from May 2020 to September 2021. The study adhered to the tenets of the Declaration of Helsinki and was approved by the institutional Ethics Committee. Informed consent was obtained from all patients prior to inclusion in the study. The inclusion criteria were patients with mild to moderate myopia (less than -6 diopters) undergoing PRK. The exclusion criteria included eye inflammation, eyelid or ocular surface disease, history of previous eye surgery, contact lens wear within two months before the refractive surgery, as well as any systemic or eye disease that could cause dry eye other than the refractive error.

To evaluate the subjective signs of eyestrain and its severity, we used a questionnaire including six questions regarding itching, foreign body sensation, excessive tearing, eye tiredness, blurring of vision, and photophobia. The patients were asked to categorize the severity of these symptoms from 0 to 6, with 0 implying no symptom and 6 implying a severe symptom. We then calculated the mean value of these six questions for each patient, with 0 implying no eyestrain and 6 implying severe eyestrain. We administered this questionnaire to each patient in face-to-face interviews pre-surgery as well as 1 and 6 months post-surgery. To evaluate post-surgical dry eye, we asked patients if their dry eye symptoms

had increased or decreased compared to the pre-surgical period. We also recorded the demographic characteristics of each patient. To present the data, we used mean, standard deviation, and percentage. To evaluate the changes during the follow-up periods, we used repeated measures ANOVA. P-values less than 0.05 were considered statistically significant. All statistical analyses were performed using SPSS Version 25 (Armonk, NY: IBM Corp.).

Results

A total of 40 patients were assessed in this study. The mean age of the patients was 26 ± 8 years, with 16 patients (40 %) being male and 24 patients (60 %) being female. Table 1 shows the demographic characteristics of the patients included in the study.

Table 2 shows the mean score of eyestrain pre-surgery as well as 1 and 6 months post-surgery. As can be observed, there was no statistically significant difference in the mean eyestrain score at one month ($P = 0.371$) and six months ($P = 0.939$) post-surgery compared to pre-surgery.

Table 3 shows the number of patients indicating either an increase or decrease in dry eye symptoms compared to the pre-surgical period. As observed in this table, there was a significant increase in dry eye symptoms

Table 1: Demographic characteristics of patients entering the study

Variable		Values
Age (Years)		26 ± 8 (mean)
Sex	M	16 (40.0 %)
	F	24 (60.0 %)
Smoking	No	34 (85.0 %)
	Yes	6 (15.0 %)
Alcohol	No	30 (75.0 %)
	Yes	10 (25.0 %)

at both 1 month ($P = 0.010$) and 6 months ($P = 0.004$) post-surgical follow-ups.

Discussion

In the present study, we observed no statistically significant difference in the mean eyestrain score at one and six months postoperatively compared to the preoperative period. Previous studies have reported symptoms such as itchiness, tearing, photophobia, foreign body sensation, eye tiredness, and excessive tearing, which contribute to eyestrain after PRK (photorefractive keratectomy)¹⁵⁻¹⁹. However,

Table 2: The mean score of eyestrain pre-surgery and at 1 and 6 months post-surgery

Variable	Time	Values		Change from Baseline			P*
		Mean ± SD	Range	Mean ± SD	95 % CI		
					Lower	Upper	
Mean eyestrain score	Pre	1.18 ± 0.75	0 to 3.25	-			
	Month 1	1.45 ± 1.15	0 to 3.92	0.27 ± 1.16	- 0.1	0.64	0.371
	Month 6	1.27 ± 0.95	0 to 3.42	0.09 ± 1.09	- 0.26	0.44	0.939

* Based on repeated measure ANOVA.

Table 3: Changes in dry eye condition after surgery

Time	Status	Number of patients	%	95 % CI		P*
				Lower	Upper	
Month 1	No dry eye	7	17.5 %	6.9 %	29.7 %	0.010
	Increased	22	55.0 %	39.6 %	70.2 %	
	Decreased	11	27.5 %	16.5 %	44.5 %	
Month 6	No dry eye	10	25.0 %	13.6 %	39.8 %	0.004
	Increased	23	57.5 %	42.1 %	71.9 %	
	Decreased	7	17.5 %	8.2 %	31.3 %	

* Based on Chi-Square test for equality percentage of the levels.

there is a consensus that these symptoms are short-lived and typically subside within several days to months after surgery. Our study aimed to evaluate these symptoms at one and six months postoperatively to determine if they persist during longer follow-up periods. The results corroborate previous findings, indicating no statistically significant difference in eyestrain severity at one and six months postoperatively compared to preoperative levels, thus reinforcing the short-lived nature of surgically induced eyestrain in PRK patients.

Despite dry eye being the most common post-surgical complication of refractive surgeries, including PRK, limited studies exist regarding its prevalence and duration ⁸. In this study, we observed a significant increase in dry eye symptoms at both one month ($P = 0.010$) and six months ($P = 0.004$) postoperatively. These findings are consistent with a study by Murakami et al, ²⁰, which reported a significant increase in self-reported postoperative dry eye at one, three, and six months after PRK compared to preoperative levels. Additionally, Hovanesian et al., ²¹ found that 43 % of patients still experienced dry eye symptoms six months post-PRK. In contrast, a study by

Beheshtnejad et al, ²² reported abnormal dry eye test results (Schirmer, TBUT, and tear osmolarity) two months after PRK, which returned to preoperative values after four months.

This study had several limitations, including a relatively low number of participants and reliance on self-reported dry eye severity without clinical tests like Schirmer, TBUT, and tear osmolarity to confirm these findings. Furthermore, we did not follow patients for more than six months, preventing us from determining the rate of chronic post-surgical dry eye. Future studies with larger sample sizes, longer follow-up periods, and incorporating both self-reported and clinical test results are recommended to better understand the nature of post-PRK dry eye and eyestrain syndromes.

Conclusion

Our results indicate that PRK significantly increases dry eye symptoms compared to the pre-surgical period, up to six months post-operatively. There was no statistically significant difference in eyestrain symptoms among patients compared to the pre-surgical period.

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Footnotes and Financial Disclosures

Conflict of interest:

The authors have no conflict of interest with the subject matter of the present manuscript.