

## VISUAL FUNCTIONS AFTER PHOTOREFRACTIVE KERATECTOMY

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**Summary:** 1. 45 myopes (-3.0 to -6.0 D) were examined before and 1 and 6 months after photorefractive keratectomy (PRK). Visual acuity (VA) was tested using Snellen and logMAR charts. Contrast sensitivity (CS) was measured using a computerized system. 2. Preoperative best corrected VA (BCVA) in myopes was significantly lower in comparison with a control group using logMAR charts only. A reduction of BCVA by both methods at 1. month and its return after 6 months nearly to original values was noted. 3. Significantly lower values of CS were found in patients before PRK compared to the control group. After 1 and 6 months stayed the values on preoperative level.

**Key words:** Photorefractive keratectomy; Moderate myopia; Contrast sensitivity; Visual acuity; LogMAR charts

## Introduction

Since the original 1983 description by Trokel et al. (10) of the effect of 193 nm laser energy on the corneal stroma, numerous investigators have further defined the clinical usefulness of this modality. An active area of investigation has been the use of the excimer laser in the surgical treatment of refractive errors by modification of the corneal surface contour. This procedure is referred to as photorefractive keratectomy (PRK). By ablating more tissue centrally than peripherally in the treatment zone, a flattening of the contour is achieved, resulting in a reduced corneal dioptric power (Piebenga et al.(5)).

Pallikaris et al. (4), McCarty et al.(3) and other authors agree that PRK is a safe, effective and predictable method for treatment of low and moderate myopia. Most of patients achieve emmetropia, the refraction is stable till 6 months after PRK and complications are very rare and mostly not vision threatening. Optical complications including various degrees of myopic regression call for reoperations, or decrease of best corrected visual acuity in consequence of haze, appearance of central islands after irregular healing of corneal epithelium and other complications grow with the level of myopia (McCarty et al.(3)). A new, more suitable methods for treatment of high and extreme myopia (up -10.0 D) are appearing (Tong et al.(9)).

In our clinic the patients before PRK were given complete ophthalmologic examination including slit lamp, ophthalmoscopy, tonometry, corneal topography and Schirmers test. Uncorrected and best corrected visual acuities were tested using Snellen charts. Refraction was measured using autorefractometer.

Postoperative examinations were scheduled for 4. day or to full reepithelization of the cornea and then for 1,3,6,9 and 12 months. In addition to visual acuity, refraction, tonometry, slit lamp examination and keratotopography were performed on each visit.

Considering that VA is mostly examined only using Snellen charts and CS is not measured at all, we decided to complete this data using logMAR charts with Landolt rings and computerized method for CS.

## Materials and methods

1. PRK was performed on 45 right eyes of 45 patients with myopia -3.0 to -6.0 diopters (D). Median age of the 20 women and 25 men was 27,5 years (range 19 - 46). We examined them before and 1 month after PRK, 40 patients were examined also after 6 months.

As a control group we examined 20 eyes of 20 people with normal intraocular findings and uncorrected VA (UCVA) 6/6 or better using Snellen charts. There were 12 women and 8 men with median age of 26 years (range 20 - 40 years).

2. We examined UCVA and BCVA using Snellen and logMAR optotype charts. CS was tested using computerized Contrast sensitivity 8010 system (Neuroscientific corp., Farmingdale, USA) in spatial frequencies from 0.74 to 29.55 c/deg.

The distance for examination of VA using logMAR charts was 4 meters. The patient determined the position of the gap in Landolt rings that could be in one of four basic directions. Each row contained 10 Landolt rings. Their size in the subsequent rows had a logarithmic progression. We noted the number of the right answers and for the calcula-

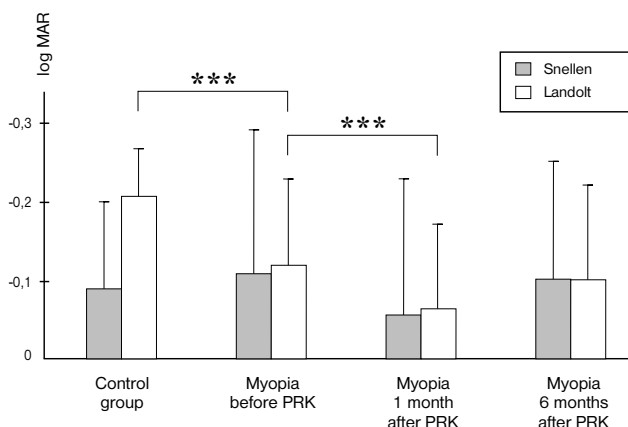
tion of the threshold VA the method of Ferris et al.(1) was used.

The distance for examination of CS was 2.2 meters so that the range of spatial frequencies from 0.74 to 29.55 c/deg was achieved when the size of monitor was 5 x 3.5°. An adjustment method with ascendent and descendent approach of the threshold contrast determination (Langrova (2)) was used.

## Results

### Visual acuity

- In the control group UCVA using Snellen chart was 6/6 or better, in myopes up to 6/12.
- threshold BCVA using logMAR charts in myopes was significantly lower compared to the control group only using logMAR charts.
- 1 month after PRK BCVA decreased significantly by both methods (Snellen charts:  $P < 0.05$ , logMAR charts:  $P < 0.001$ ).
- after 6 months BCVA returned nearly to its preoperative level using both methods (Fig. 1, Tab.1, Tab. 2).



**Fig. 1:** Visual acuity values (in logMAR units) using Snellen (Sn) and logMAR charts with Landolt rings (L). The control group consisted of 20 subjects, patients group of 45 persons. n.s. nonsignificant differences, \*\*\*  $p < 0.001$ .

Visual acuity	After 1 month (%)	After 6 months (%)
6/6 or better	51	54
6/12 or better	100	93
Refraction		
± 1 D	88	74
± 2 D	100	98

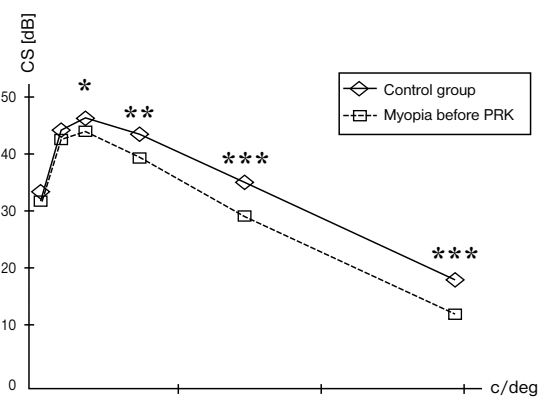
**Table 1:** The percentage of eyes 1 and 6 months after PRK which achieve BCVA 6/6 or better and 6/12 or better using Snellen charts and refraction (1 D and 2 D from emmetropia).

Lines of BCVA	Gained (Nr. of eyes)		Lost (Nr. of eyes)	
	1 month	6 months	1 month	6 months
1	6	7	12	9
2	1	2	6	0
3	1	1	1	0

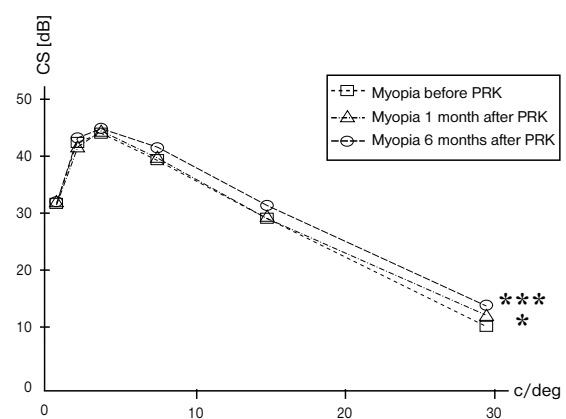
**Table 2:** The number of eyes 1 and 6 months after PRK which gain or loose 1,2 and 3 lines of BCVA using Snellen charts.

### Contrast sensitivity

- CS in myopes was significantly lower compared to the control group, especially in moderate and higher spatial frequencies (Fig. 2).
- Nonsignificant changes in CS after PRK were noted except the value in frequency of 29.55 c/deg which increased significantly in both terms after PRK (Fig. 3).



**Fig. 2:** Contrast sensitivity (CS) values in decibels (dB) for spatial frequencies of 0.74, 0.97, 3.69, 7.39, 14.77 and 29.55 c/deg. The differences in CS between the control group [black ring] and myopic patients [white rectangle] before PRK are statistically significant: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$  at spatial frequencies from 3.69 to 29.55 c/deg.



**Fig. 3:** The changes of CS in decibels (dB) after PRK were nonsignificant except significant increase of the CS in spatial frequency of 29.55 c/deg ( $p < 0.05$  after 1 month,  $p < 0.001$  after 6 months).

## Discussion

The changes of VA after PRK using logMAR charts are similar to those of McCarty (3). She described a significant loss of VA 1 month after PRK and its return to preoperative level after 3 months. Our results are better than those of Tong et al (9) who used Snellen charts for testing of VA in myopes up -5 D and Salz et al (6) who tested myopes up -7.5 D (Tab. 3).

Visual acuity	After 1 month (%)			After 6 months (%)		
	This paper	McCarty (3)	Tong (9)	This paper	McCarty (3)	Tong (9)
6/6 or better	51	40	23	54	52	28
6/12 or better	100	84	55	93	89	61
Refraction						
± 1 D	88	82		74	86	
± 2 D	100	97		98	97	

**Table 3:** Comparison of the results of three studies concerning the changes of visual acuity and refraction.

In contrast to Pallikaris et al.(4), who noted the loss of BCVA of 1 - 1,5 lines using logMAR charts, we described the loss of VA of 2 - 3 lines after PRK.

Contrary to Pallikaris et al.(4) who describe the decrease of CS using CSV-1000 (Vector Vision) in spatial frequencies 3, 12 and 18 c/deg without glare 1 month after PRK and the return to preoperative level in 3 months, we noted non-significant changes in all but one frequencies tested. Also Piebenga et al.(5) noted lower values in all frequencies 6 months after PRK, significantly only in frequency of 18 c/deg. Identically with us saw Sher et al.(7) nonsignificant changes of CS using Vistech charts 3 months after PRK and Shimizu et al.(8) in CS without glare 6 months after PRK.

## Conclusions

Our results indicate that PRK is a suitable method for the treatment of moderate myopia from the functional point of view.

## Acknowledgement

This work was supported by the Grant Agency of Charles University (Grant No 59/97).

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*Submitted May 1997.*

*Accepted June 1997.*

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