

Influence of patient race on the outcome of photorefractive keratectomy for myopia correction

Influência racial sobre os resultados da ceratectomia fotorrefrativa para a correção da miopia

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ABSTRACT

Purpose: To examine the effect of patient race on clinical outcomes following excimer laser surgery for myopia and myopic astigmatism. **Methods:** A total of 116 eyes from Caucasian patients, 16 eyes from Asian patients and 16 eyes from Hispanic patients who underwent PRK were evaluated retrospectively. PRK procedures were performed by the same surgeon using a 193 nm argon-fluoride excimer laser (VISX) with 160 mJ/cm² fluence and a 6.5 Hz repetition rate at the Doheny Eye Institute. During 6 months of follow-up, changes in the uncorrected visual acuity (UCVA), refraction and spectacle-corrected visual acuity (SCVA) were evaluated. Pairwise comparisons between races were performed for age, sphere and cylinder using independent sample t tests, while UCVA and SCVA were compared using Fisher's exact tests. The accepted level of significance for all tests was $\alpha=0.05/3=0.0167$. **Results:** The only differences found were between the Asian versus Caucasian groups related to the spectacle-corrected visual acuity of 20/15 (p=0.01) and in the Asian versus Hispanic groups related to the mean cylinder (p=0.04) at 3 months postoperatively. The comparison of the mean cylinder showed a statistically significant difference between the Asian versus Hispanic groups at 6 months postoperatively (p=0.04). After 6 months, 72.7% of the eyes in the Asian group, 85.7% of the eyes in the Hispanic group and 87.1% of the eyes in the Caucasian group had uncorrected visual acuity of 20/40 or better and the mean sphere and cylinder (\pm SD) were: $-0.55 (\pm 0.88)$ and $0.97 (\pm 0.79)$; $-0.75 (\pm 1.24)$ and $0.40 (\pm 0.45)$; $-1.21 (\pm 2.55)$ and $0.75 (\pm 0.89)$, respectively. **Conclusion:** In this study, there were no statistically significant differences between the three race groups related to the final visual outcome following photorefractive keratectomy. These preliminary results suggest that the clinical outcomes of PRK are not significantly affected by patient race. Larger populations and longer-term studies are needed to definitely determine whether racial differences exist.

Keywords: Myopia/surgery; Refraction errors; Keratectomy photorefractive for excimer laser; Racial stocks

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INTRODUCTION

Excimer Photorefractive Keratectomy (PRK) is a safe and predictable modality for the correction of low degrees of myopia and myopic astigmatism since 1996⁽¹⁻²⁾. Studies have shown that the achieved refractive success rates with this procedure range between 71% and 92% for corrections of up to $-6.0 D$ ⁽³⁾.

Although there are many factors influencing its outcomes⁽⁴⁻⁶⁾, there are

few papers about the influence of patient race. This study examines race as a possible variable in the outcome of PRK, since patients of various racial backgrounds may exhibit different wound healing responses that affect PRK outcome. Specifically, Caucasian, Hispanic and Asian races are examined. African Americans were not included in this study due to inadequate sample size. Patient race was defined following criteria like family background and facial characteristics (including eyelid shape and pigmentation of the skin, eye and hair).

The identification of preoperative characteristics influencing PRK outcomes may be important to improve future results either by refining patient selection or by guiding treatment algorithms.

METHODS

A total of 116 eyes from white Caucasian patients, 16 eyes from Asians and 16 eyes from Hispanics who underwent PRK were evaluated retrospectively.

PRK procedures were performed by the same surgeon using a 193 nm argon-fluoride excimer laser (VISX Star S₂, Software Revision 1.14) with 160mJ/cm² fluence and a 6.5 Hz repetition rate at the Doheny Eye Institute, University of Southern California.

The excimer laser was calibrated according to manufacturer's instruction. Laser fluence was tested and standardized automatically by the laser prior to each treatment.

Corneal epithelial removal was performed using the laser-scrape technique, whereby 40 µm of epithelium was removed in the PTK mode followed by mechanical removal of residual epithelium down to Bowman's layer using a Paton spatula. The photorefractive keratectomy was then performed on the eye, centered on the pupil entrance. Spherical ablations were

performed with 6 mm diameter, whereas spherocylinder ablations were performed using a combination of cylinder and elliptical ablations, with a minimum width of 4.5 mm and maximum of 6 mm. This was performed according to the manufacturer's PRK software Revision 1.14. Upon completion of the ablation, a bandage contact lens (Accuvue by Johnson & Johnson or Biomedic by American Hydron) was placed on the eye. Postoperative medication consisted of a topical nonsteroidal anti-inflammatory drug (NSAID, either ketorolac or diclofenac) q.i.d for 24 hours and topical ofloxacin q.i.d. until the epithelium was healed. The bandage contact lens was then removed, and topical fluorometholone 0.1% q.i.d. was started, tapering over 2 months.

Preoperative and follow-up visits at 3 and 6 months included a detailed refraction and anterior segment examination.

During 6 months of follow-up, changes in the uncorrected visual acuity (UCVA), refraction and spectacle-corrected visual acuity (SCVA) were evaluated.

Pairwise comparisons between races were performed for age, sphere and cylinder using independent sample t tests, while UCVA and SCVA were compared using Fisher's exact tests. The accepted level of significance for all tests was $\alpha = 0.05/3 = 0.0167$.

RESULTS

The mean age (\pm SD) in the Asian, Hispanic and Caucasian groups were: 39.4 (\pm 7.9); 39.3 (\pm 10.9) and 41.2 (\pm 11.5). The preoperative mean sphere and cylinder (\pm SD) in the Asian, Hispanic and Caucasian groups were: -6.56 (\pm 2.1) and 1.37 (\pm 1.52); -5.54 (\pm 2.06) and 1.06 (\pm 0.69); -5.29 (\pm 2.63) and 1.21 (\pm 1.12), respectively (Table 1).

There were no statistically significant differences between the 3 groups preoperatively.

Table 1. Preoperative data. PRK: Baseline Comparisons Between Asians, Hispanics and Caucasians

	Asians (n=16 eyes)	Hispanics (n=16 eyes)	Caucasians (n=116 eyes)	Asians Versus Hispanics (p)	Asians Versus Caucasians (p)	Hispanics Versus Caucasians (p)
Age	39.4 \pm 7.9	39.3 \pm 10.9	41.2 \pm 11.5	0.99	0.54	0.54
UCVA						
<20/300	2(12.5%)	4(25.0%)	39(33.6%)			
20/400-20/600	5(31.3%)	5(31.3%)	40(34.5%)	0.73	0.12	0.64
CF	9(56.3%)	7(43.8%)	37(31.9%)			
SCVA						
20/15	5(31.3%)	5(31.3%)	48(41.4%)			
20/20	9(56.3%)	11(68.8%)	62(53.5%)			
20/25	2(12.5%)	0	4(3.5%)			
20/30	0	0	1(0.9%)	0.61	0.39	0.74
20/40	0	0	0			
20/50	0	0	1(0.9%)			
Sphere	-6.56 \pm 2.1	-5.54 \pm 2.06	-5.29 \pm 2.63	0.18	0.07	0.72
Cylinder	1.37 \pm 1.52	1.06 \pm 0.69	1.21 \pm 1.12	0.46	0.61	0.60

*Mean \pm SD; UCVA= Uncorrected Visual Acuity; SCVA= Spetacle-Corrected Visual Acuity; CF= Couiting Fingers

Table 2. Postoperative Data: 3 months

	Asians (n=16 eyes)	Hispanics (n=16 eyes)	Caucasians (n=116 eyes)	Asians Versus Hispanics (p)	Asians Versus Caucasians (p)	Hispanics Versus Caucasians (p)
UCVA						
20/15	1(6.3%)	4(25.0%)	31(26.7%)	0.33	0.12	1.00
20/20 or Better	7(43.8%)	10(62.5%)	65(56.0%)	0.48	0.43	0.79
20/25 or Better	10(62.5%)	12(75.0%)	82(70.7%)	0.70	0.56	1.00
20/30 or Better	11(68.8%)	14(87.5%)	92(79.3%)	0.39	0.34	0.74
20/40 or Better	13(81.3%)	15(93.8%)	103(88.8%)	0.60	0.41	1.00
20/50 or Worse	3(18.8%)	1(6.3%)	13(11.2%)	-	-	-
SCVA						
20/15	3(18.8%)	7(43.8%)	61(52.6%)	0.25	0.01	0.60
20/20 or Better	12(75.0%)	14(87.5%)	100(86.2%)	0.65	0.27	1.00
20/25 or Better	15(93.8%)	15(93.8%)	110(94.8%)	1.00	1.00	1.00
20/30 or Better	15(93.8%)	16(100%)	112(96.6%)	1.00	0.48	1.00
20/40 or Better	15(93.8%)	16(100%)	112(96.6%)	1.00	0.68	1.00
20/50 or Worse	1(6.3%)	0	4(3.5%)	-	-	-
Sphere	-0.16±0.89	-0.08±0.89	-0.80±1.97	0.8	0.20	0.15
Cylinder	0.68±0.60	0.29±0.44	0.64±0.83	0.04	0.85	0.10

*Mean±SD; UCVA= Uncorrected Visual Acuity; SCVA= Spectacle-Corrected Visual Acuity; CF= Counting Fingers

Table 3. Postoperative Data: 6 months

	Asians (n=11 eyes)	Hispanics (n=7 eyes)	Caucasians (n=70 eyes)	Asians Versus Hispanics (p)	Asians Versus Caucasians (p)	Hispanics Versus Caucasians (p)
UCVA						
20/15	1(9.1%)	3(42.9%)	14(20.0%)	0.25	0.68	0.18
20/20 or Better	3(27.3%)	4(57.1%)	35(50.0%)	0.33	0.20	1.00
20/25 or Better	6(54.6%)	5(71.4%)	49(70.0%)	0.64	0.32	1.00
20/30 or Better	6(54.6%)	5(71.4%)	57(81.4%)	0.64	0.06	0.62
20/40 or Better	8(72.7%)	6(85.7%)	61(87.1%)	1.00	0.36	1.00
20/50 or Worse	3(27.3%)	1(14.3%)	9(12.9%)	-	-	-
SCVA						
20/15	2(18.2%)	3(42.9%)	30(42.9%)	0.33	0.19	1.00
20/20 or Better	8(72.7%)	5(71.4%)	65(92.9%)	1.00	0.07	0.12
20/25 or Better	9(81.8%)	7(100%)	68(97.1%)	0.50	0.09	1.00
20/30 or Better	10(90.9%)	7(100%)	68(97.1%)	1.00	0.36	1.00
20/40 or Better	10(90.9%)	7(100%)	69(98.6%)	1.00	0.26	1.00
20/50 or Worse	1(9.1%)	0	1(1.4%)	-	-	-
Sphere	-0.55±0.88	-0.75±1.24	-1.21±2.55	0.69	0.40	0.64
Cylinder	0.97±0.79	0.40±0.45	0.75±0.89	0.04	0.44	0.31

*Mean±SD; UCVA= Uncorrected Visual Acuity; SCVA= Spectacle-Corrected Visual Acuity; CF= Counting Fingers

The follow-up data at 3 and 6 months are shown in Tables 2 and 3.

At 3 months postoperatively, the only differences found were between the Asian versus Caucasian groups related to the spectacle-corrected visual acuity of 20/15 ($p=0.01$) and in the Asian versus Hispanic groups related to the mean cylinder ($p=0.04$).

The comparison of the mean cylinder showed a statistically significant difference between the Asian versus Hispanic groups at 6 months postoperatively ($p=0.04$).

After 6 months, 72.7% of the eyes in the Asian group, 85.7% of eyes in the Hispanic group and 87.1% of the eyes in the Caucasian group had uncorrected visual acuity of 20/40 or

better and the mean sphere and cylinder (\pm SD) were: $-0.55(\pm 0.88)$ and $0.97(\pm 0.79)$; $-0.75(\pm 1.24)$ and $0.40(\pm 0.45)$; $-1.21(\pm 2.55)$ and $0.75(\pm 0.89)$, respectively.

DISCUSSION

The Summit Photorefractive Keratectomy Phase III Study Group using a specific laser system, configuration and optical zone diameter concluded that PRK algorithms need to be modified according to factors such as age, attempted corrections and zone diameter⁽⁷⁾. They found that older patients not only had a decreased chance of achieving 20/40 or better

uncorrected visual acuity compared to the younger patients but were also less likely to achieve a target refraction within 1.00 D of attempted correction. Patients with higher attempted corrections were also less likely to achieve 20/40 or better visual acuity⁽⁷⁾. Such patients also tended to become undercorrected as were patients who received smaller ablation diameters during treatment.

Seiler and Wollensak also reported greater overcorrection in older patients in the first six months after surgery⁽⁸⁾.

Tanzer et al., studying PRK in African American patients, including those known to be keloid formers, found no increased risk for haze or regression⁽⁹⁾. They also found that African Americans may have an excellent visual outcome following PRK and history of keloid formation does not appear to have an adverse effect on the outcome.

Amano et al, studying Asian (Japanese) patients found no difference in clinical outcomes for low to moderate myopia⁽¹⁰⁾. On the other hand, this population had a higher frequency of haze (37%) compared to the Caucasian patients. Neither of these studies, however, performed a comparative analysis of one race versus another regarding PRK outcome.

In this paper, there were no statistically significant differences between the three race groups related to the final visual outcome following photorefractive keratectomy.

These preliminary results suggest that the clinical outcomes of PRK are not significantly affected by patient race. Larger populations and longer-term studies are needed to definitely determine whether racial differences exist.

RESUMO

Objetivo: Avaliar o efeito do fator racial nos resultados clínicos após cirurgia de excimer laser para correção da miopia e astigmatismo miópico. **Métodos:** Um total de 116 olhos de pacientes caucasianos, 16 olhos de pacientes asiáticos e 16 olhos de pacientes hispânicos submetidos a PRK foram avaliados retrospectivamente. Os procedimentos foram realizados pelo mesmo cirurgião usando um excimer laser (VISX) de 193 nm com 160 mJ/cm² de fluência e 6,5 Hz de taxa de repetição no Doheny Eye Institute. Durante 6 meses de pós-operatório, mudanças na acuidade visual sem correção (AVSC), refração e acuidade visual com correção (AVCC) foram avaliadas. Comparações pareadas entre as raças foram realizadas segundo a idade, grau esférico e cilíndrico usando testes t (amostras independentes), ao passo que AVSC e AVCC foram comparadas usando o teste exato de Fisher. O nível aceitável de significância para todos os testes foi de $\alpha = 0,05/3 = 0,0167$.

Resultados: As únicas diferenças encontradas foram no grupo asiático versus caucasiano com relação a acuidade visual corrigida de 20/15 ($p=0,01$) e no grupo asiático versus hispânico com relação a média do cilindro ($p=0,04$) no 3º mês pós-operatório. A comparação da média dos cilindros mostrou diferença estatisticamente significativa no grupo asiático versus hispânico no 6º mês de pós-operatório ($p=0,04$). Após 6 meses do procedimento, 72,7% dos olhos dos pacientes asiáticos, 85,7% dos olhos dos pacientes hispânicos e 87,1% dos olhos dos pacientes caucasianos apresentaram acuidade visual sem correção de 20/40 ou melhor e a média do grau esférico e cilíndrico foi de (\pm SD): $-0,55 (\pm 0,88)$ e $0,97 (\pm 0,79)$; $-0,75 (\pm 1,24)$ e $0,40 (\pm 0,45)$; $-1,21 (\pm 2,55)$ e $0,75 (\pm 0,89)$, respectivamente. **Conclusão:** Neste estudo não houve diferenças estatisticamente significativas entre os 3 grupos raciais relacionadas ao resultado visual final após ceratectomia fotorrefrativa. Estes resultados preliminares sugerem que os resultados clínicos do PRK não são significativamente afetados pela raça dos pacientes. Populações maiores e estudos com um acompanhamento mais prolongado são necessários para se determinar definitivamente se diferenças raciais existem.

Descritores: Miopia/cirurgia; Erros de refração; Ceratectomia fotorrefrativa por excimer laser; Raças

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