



ORIGINAL ARTICLE

Customized photorefractive keratectomy to correct high ametropia after penetrating keratoplasty: A pilot study



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KEYWORDS

Astigmatism;
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Abstract

Purpose: To evaluate preliminarily the safety and efficacy of customized photorefractive keratectomy (PRK) to correct ametropia and irregular astigmatism after penetrating keratoplasty (PK).

Methods: This pilot study included five eyes of five patients with a mean spherical equivalent of -5.1 ± 1.46 D (range from -2.75 to -6.50 D). In all cases, ametropia and irregular astigmatism was corrected with topography-guided customized PRK. Ocular examinations with topographic analysis were performed preoperatively as well as at 1, 3 and 6 months after surgery.

Results: All eyes gained postoperatively at least three Snellen lines of uncorrected visual acuity. Mean refractive spherical equivalent was 0.62 ± 0.63 D (range from -0.25 to -1.75 D) at 6 months postoperatively.

Conclusion: Our pilot study suggests that customized PRK can be a safe and effective method for treating ametropia and irregular astigmatism after PK. Future studies with larger samples and longer follow-ups should be performed to confirm these results.

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PALABRAS CLAVE

Ametropía;
 Astigmatismo;
 PRK personalizada;
 Queratocono;
 Queratoplastia
 perforante;
 Agudeza visual

Queratectomía fotorrefractiva personalizada para corregir altas ametropías tras queratoplastia penetrante: estudio piloto

Resumen

Objetivo: Evaluar preliminarmente la seguridad y eficacia de la queratectomía fotorrefractiva personalizada (PRK) para corregir la ametropía y astigmatismo irregular tras queratoplastia penetrante (PK).

Métodos: Este estudio piloto incluía un total de 5 ojos de 5 pacientes con un equivalente esférico medio de $-5,1 \pm 1,46$ D (rango entre $-2,75$ y $-6,50$ D). En todos los casos, la ametropía y astigmatismo irregular se corrigió mediante PRK personalizada guiada por topografía. Se realizaron exámenes oculares con análisis topográfico preoperatoriamente, así como a los 1, 3 y 6 meses tras la cirugía.

Resultados: Todos los ojos ganaron al menos 3 líneas de agudeza visual Snellen no corregida. El equivalente esférico medio fue de $0,62 \pm 0,63$ D (rango entre $-0,25$ y $-1,75$ D) a los 6 meses tras la cirugía.

Conclusión: Nuestro estudio piloto sugiere que la PRK personalizada puede ser un método seguro y eficaz para el tratamiento de la ametropía y el astigmatismo irregular tras PK. Deben realizarse futuros estudios con muestras de pacientes mayores y seguimientos más largos que confirmen estos resultados.

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Introduction

Keratoconus (KC) is characterized by progressive corneal protrusion and thinning, leading to irregular astigmatism and impairment of visual function. KC is among the best indications for doing a penetrating keratoplasty (PKP), with long-term graft survival rates surpassing those for any other indication.^{1,2} Generally accepted indications for PKP in KC are poor visual acuity with contact lenses, contact lens intolerance or inability to fit/wear contact lenses, and non-resolving corneal hydrops. The percentage of patients with KC eventually requiring PKP varies widely in different reports.³⁻⁷ Residual refractive error and corneal irregularity following PKP can be managed with spectacles or contact lenses. However, although advances in techniques and instrumentations for PKP, especially the introduction of femtosecond lasers, have greatly improved PKP results, high refractive errors, especially high astigmatism, associated to high levels of corneal irregularity, may appear postoperatively in spite of an uneventful surgical procedure. These optical errors are hardly correctable and very disturbing for the patient.⁸⁻¹⁰ In order to reduce residual astigmatism after PKP, some options have been described: surgical approaches such as relaxing incisions,^{11,12} wedge resection as well as selective removal of sutures, which is a less predictable and stable method.¹³⁻¹⁶ Some of the most common related complications to this last method are the risk for wound dehiscence, transplant rejection, and unsolvable topographic and refractive fluctuations.¹⁷ Crystalline lens extraction with IOL implantation can correct ametropia but not corneal aberrations and some risks are associated to this procedures, such as endophthalmitis, secondary glaucoma, retinal detachment, or endothelial cell loss.¹⁸⁻²⁰

The use of the excimer laser is a safe and effective technique to correct post-keratoplasty ametropia.²¹⁻²⁴ How-

ever, conventional LASIK and PRK have limitations because they are unable to correct the irregularity of the post-transplantation corneal surface. Furthermore, some risks of the LASIK technique due to the creation of the flap should be considered, such as the creation of incomplete, irregular or even damaged flaps.²⁵⁻²⁷ PRK is a safe and reliable technique but the risks of corneal haze and refractive regression should be also considered.²⁸⁻³¹

Customized topography-guided corneal ablation with excimer laser is a procedure that can be used to correct not only ametropia after penetrating keratoplasty (PKP), but also irregular astigmatism.³² We have used this technique to treat ametropia and irregular astigmatism after PKP in five of our patients in the attempt of verifying its efficacy, predictability, and safety. Therefore, the purpose of the current study was to evaluate preliminarily the safety and efficacy of topography-guided customized PRK for the correction of irregular astigmatism after PKP.

Methods

This study comprised of five eyes of five patients with significant residual ametropia (mean spherical equivalent -5.1 ± 1.46 D, range -2.75 D to -6.50 D) and irregular astigmatism after PKP that was treated by customized PRK. Patient age ranged from 49 years to 61 years. The sample included one male and four female patients.

All patients had undergone PKP at least 18 months before PRK, with removal of sutures at least 6 months before PRK. In all cases, PKP has been performed due to the presence of keratoconus of grade 3 or 4 according to the Amsler-Krumeich classification. After suture removal, no large changes in manifest refraction were observed. As a significant ametropia was present in the eye with previous PKP, a significant level of aniseikonia was present in all patients,

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