

Treatment strategy for bilateral severe subepithelial fibrosis after photorefractive keratectomy enhancement

Estratégia de tratamento para fibrose subepitelial grave bilateral após aprimoramento com ceratectomia fotorrefrativa

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ABSTRACT

A 27-year-old healthy man with a history of bilateral photorefractive keratectomy (PRK) enhancement after femtosecond laser in situ keratomileusis (LASIK) presented with decreased uncorrected distance visual acuity (UDVA) of 20/125 in the right eye (OD) and 20/300 in the left eye (OS) six months after PRK. Examination revealed bilateral dense subepithelial opacities. Both eyes (OU) were treated with superficial keratectomy combined with phototherapeutic keratectomy (PTK) and adjunctive application of mitomycin C 0.02%. At three months follow up UDVA was 20/30 OD and 20/25 OS. Superficial keratectomy combined with PTK seems to be a safe and efficient technique for treatment of dense subepithelial scar formation following PRK enhancement after LASIK.

Keywords: Photorefractive keratectomy; Laser in situ keratomileusis; Mitomycin; Wound healing; Laser corneal surgery

RESUMO

Um homem saudável de 27 anos de idade com história de aprimoramento com ceratectomia fotorrefrativa (PRK) bilateral, após Ceratomileuse Assistida por Excimer Laser In Situ (LASIK) com laser de femtossegundos, apresentou diminuição da acuidade visual à distância não corrigida (AVNC) de 20/125 no olho direito (OD) e 20/300 no olho esquerdo (OE) seis meses após PRK. O exame revelou opacidades subepiteliais densas bilaterais. Ambos os olhos (AO) foram tratados com queratectomia superficial combinada com ceratectomia fototerapêutica (PTK) e aplicação adjuvante de mitomicina C a 0,02%. Aos três meses de acompanhamento, o AVNC foi de 20/30 OD e 20/25 OE. A ceratectomia superficial combinada com PTK parece ser uma técnica segura e eficiente para o tratamento da formação densa de cicatrizes subepiteliais após o aprimoramento com PRK pós-LASIK.

Descritores: Ceratectomia fotorrefrativa; Ceratomileuse assistida por excimer laser in situ; Mitomicina; Cicatrização de feridas; Cirurgia da córnea a laser

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INTRODUCTION

With more than 16 million surgeries performed worldwide, laser in situ keratomileusis (LASIK) has become the most widely utilized surgical procedure for ametropia correction offering a high index of satisfaction due to its safety and accuracy.⁽¹⁾ More than two decades of refinement and technological advances have significantly reduced the incidence of procedure-related complications; however, potential risks remain.⁽²⁾ Among undesired outcomes, under-correction and post-treatment regression, are the most frequently encountered.⁽³⁾ When enhancement is indicated, photorefractive keratectomy (PRK) is often considered over relifting LASIK flaps when potential complications such as epithelial ingrowth are a concern.⁽⁴⁾ While viewed as a safe and highly successful re-treatment option, PRK enhancement after primary LASIK also carries documented risks including visually significant corneal haze.⁽⁴⁾

Herein we report a case of corneal haze progressing to bilateral subepithelial fibrosis associated with visual impairment following PRK enhancement after LASIK treatment for high myopia.

Case report

A 27-year-old male was referred to our practice with reports of corneal scarring and decreased vision in both eyes. Five years earlier, he had undergone bilateral simultaneous femtosecond LASIK. The preoperative refraction was -7.25 -1.00 \times 10 in the right eye (OD) and -7.25 -1.00 \times 180 in the left eye (OS), with a corneal thickness of 529 μm in each eye. The initial ablation was configured for total tissue removal of 116 μm . The patient remained stable with uncorrected distance visual acuity (UDVA) of 20/20 in both eyes. Four years after the primary procedure, the patient underwent conventional PRK without mitomycin C (MMC) for a myopic regression of -1.25 -0.75 \times 25 OD and -1.50 -0.75 \times 165 OS with settings configured for total tissue removal of 42 and 49 μm , respectively. The patient reported improvement of vision after the procedure and completed a standard post-operative steroid course for two weeks. He returned three months later with complaints of decreased vision in both eyes and a slit lamp examination notable for corneal haze. Topical difluprednate 0.05% was initiated for four weeks with no clinical improvement.

On initial exam in our clinic, six months post-PRK retreatment, the patient's UDVA was 20/125 OD and 20/300 OS. The manifest refraction was -5.25 -2.25 \times 06 , yielding a visual acuity (VA) of 20/60 OD, and -4.25 -1.00 \times 47 , yielding a VA of 20/40 OS. Pachymetries were 478 OD and 460 OS. Slit lamp examination of both corneas revealed central dense opacities with a fibrotic component within the LASIK flap interface (Figure 1).

Anterior segment ocular coherence tomography (AS-OCT) demonstrated hyper-reflective material at the interface, consistent with scar tissue, measuring 164 microns in depth OD and 193 microns in depth OS.

After discussion and review of the risks, benefits and alternatives of surgical management with the patient, the decision made was to proceed with superficial keratectomy combined with phototherapeutic keratectomy (PTK) and adjunctive application of MMC 0.02% for one minute. The right eye was treated first as it was more visually affected (Figure 2).

One week after treatment, corrected distance visual acuity (CDVA) was 20/20 with $+1.75$ -1.50 \times 75 OD. Three weeks later, the left eye was treated using the same protocol. At three months

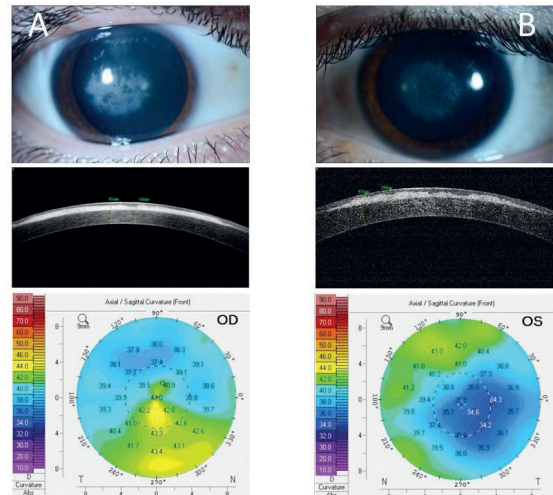


Figure 1. Slit-lamp photograph, AS-OCT and Pentacam Sagittal Curvature map of OD(A) and OS (B) preoperative

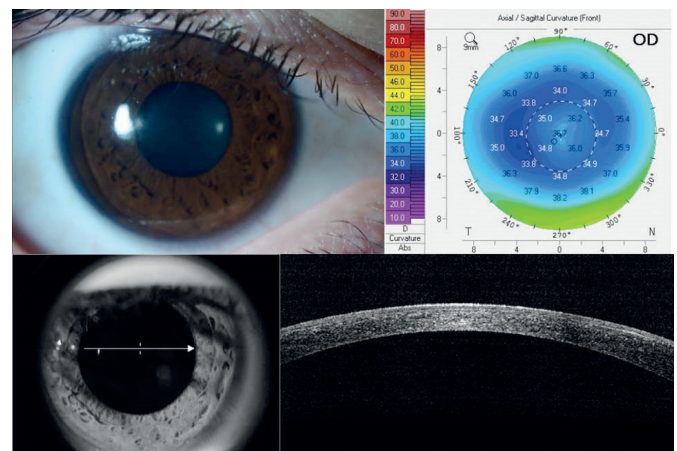


Figure 2. Postoperative third week slit-lamp photograph, Pentacam Sagittal Curvature map and AS-OCT of OD showing markedly improvement of cornea transparency

follow up CDVA was 20/20 OD with $+1.50$ -0.75 \times 60 and 20/20 OS with $+0.25$ -0.75 \times 180 and no signs of recurrent recurrence OU although a stable faint haze remained in each eye. The patient was very satisfied with his visual outcome. Informed consent was obtained from the patient for reporting this case and all work was Health Insurance Portability and Accountability Act-compliant, adhered to the tenets of the Declaration of Helsinki.

DISCUSSION

Residual refractive errors are a common indication for retreatment after LASIK, and, among the available alternatives, PRK is appealing as it circumvents potential complications related to re-lifting the flap.⁽⁴⁾ PRK, however, carries the risk of visually significant haze.⁽⁵⁾ A series of 17 patients reported by Carones et al.⁽⁶⁾ indicated that approximately 82% of 17 eyes treated with PRK after regressed myopic LASIK developed grade three or four haze. Beerthuis et al.⁽³⁾ subsequently described a higher safety profile in which two of 18 treated eyes (11%) developed visually significant haze. Importantly, in both studies, MMC was not utilized.

The use of MMC in corneal refractive procedures – although considered off-label – has become widespread over the past few decades. Its effectiveness in modulating corneal wound healing was first demonstrated by Talamo et al.⁽⁷⁾ in an animal model of PRK in 1991. Insofar as regressed corneas requiring retreatments may represent a higher risk group compared with naïve corneas for post-operative haze, the use of MMC during retreatment procedures seems desirable. Indeed, Srinivasan et al.⁽⁸⁾ performed PRK with MMC in 30 eyes for retreatment of post myopic LASIK regression and reported no incidents of haze postoperatively. Furthermore, in a prospective study comparing PRK with MMC against PRK alone, Carones et al.⁽⁹⁾ reported an incidence of 0% of significant haze in the MMC groups versus 63% in the control group, highlighting the essential role of MMC in maximizing the success rate of this procedure. Mitomycin-C used in the above setting at a concentration of 0.02% or lower carries a favorable safety profile.⁽⁹⁾ Gambato et al.⁽¹⁰⁾ evaluated the effects of intraoperative use of MMC in PRK five years after surgery and concluded there was no endothelial cell density reduction or any other corneal changes at the end of follow up.

In a retrospective study PRK with MMC was also considered a safe and effective alternative for high-myopic patients.⁽¹¹⁾ Another one concluded that PRK with MMC could be safely used as retreatment for residual myopia less than 3D after LASIK.⁽¹²⁾ Wilson et al.⁽¹³⁾ even considered application of MMC as the final step of any PTK procedure.

In this case, we achieved favorable results using a method similar to that described by Majmudar et al., modified with an additional PTK step.⁽¹⁴⁾ After mechanical removal of the epithelium the maximum amount possible of fibrotic tissue was removed with a #57 Beaver blade followed by five to 10 microns of PTK to complement removal and optimize the surface of the stromal bed. A sterile sponge soaked with MMC (0.02%) was applied for one minute, followed by copious irrigation with balanced salt solution and placement of a bandage contact lens for one week.

To our knowledge, this is the first report of the use of PTK in conjunction with mechanical debridement and MMC application for treatment of haze after PRK enhancement of myopic LASIK regression.

A limitation of this case report is lack of long-term follow-up which is required to ascertain stability of the postoperative results.

Further studies are needed to establish the optimal application time of MMC and the role of PTK as an adjunct to mechanical debridement in this setting.

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