



SCIENTIFIC LETTER

Bowman strip complications during routine LASIK: Two cases demonstrating the clinical advantage of using Mitomycin C in such cases



Complicaciones a nivel de una porción de la membrana de Bowman durante la rutina del procedimiento LASIK: dos casos que demuestran la ventaja clínica del uso de Mitomicina C en tales casos

Introduction

Bowman strip is the term used to describe a portion of Bowman's layer that remains exposed at the posterior surface of the flap. The incidence of intraoperative complications related to flap creation during LASIK is between 0.19%¹ and 21.2%.² Several explanations have been proposed to account for Bowman strip or "buttonhole" complications such as: steep corneas, partially opened eyes, microkeratome deficits such as blade defect and, insufficient synchronization between the movement of the blade and microkeratome translational movement. High astigmatism, or conjunctival entrapment may also lead to Bowman strip or buttonhole flap.^{4,5}

Treatment options for Bowman strip appear to depend on the severity of the complications encountered. Some authors recommend waiting three months, relifting the flap, bathing the bed with Mitomycin C (MMC) followed by surface ablation.^{6,7} In more severe profound cases it is recommended to wait six months, relift the flap, apply of topical MMC, close the flap and re-cutting a new flap.⁸

We report our experience of two cases where, the same type of microkeratome and laser platform were used for routine LASIK surgery. In both cases, Bowman strip was encountered with thin strip of epithelium and photo ablation was completed during the two individual surgical events. The only difference was that in one case we applied topical 0.02% Mitomycin C, while in the other the procedure was completed without any additional medications or intervention.

Scientific letter

A 42-year old male patient with myopic astigmatism and a 36-year old hyperopic female patient were referred to our clinic for laser vision correction. First patient's CDVA was 1.0 (Snellen) with $-1.25DS/-1.00DC \times 85$ in the right eye and with $-1.50DS/-0.75DC \times 150$ in his left eye, while second patient's CDVA was also 1.0 (Snellen) with $+3.50DS$ in the right eye and with $+3.75DS$ in her left eye. Preoperative examination was identical for both patients and we found no contraindications for the surgery. Steepest keratometry readings were 43.2D/42.8D for the first and 43.8D/43.5D for the second patient. Both patients underwent routine LASIK procedure with 90 μm microkeratome flap (Moria SA, Antony, France) and photoablation with the Allegretto Wave-Light 400 Hz excimer laser (Alcon Laboratories, Inc. Forth Worth, TX, USA) with wavefront-guided optimization. During the lifting of the flaps, a significant central Bowman strip was observed in the left eye of the first patient and both eyes of the second. In spite of these findings, we continued with the planned photoablation treatments in all cases. Prior to flap repositioning, the first patient did not receive any modified additional treatment. However, for the second patient we applied topical 0.02% Mitomycin C (MMC) on both stromal beds for 20s just before closing the flaps. A bandage contact lens (SofLens 59, Bausch & Lomb, Rochester, NY, USA) was placed over each eye and kept in situ for 7 days followed by standard postoperative topical therapy consisting of antibiotic/corticosteroid 5 times/day and lubricant eye drops 8 times/day. On the first day post-op, the left eye of the first patient had developed significant central corneal haze grade 3 and the flap was well positioned. The second patient had developed very slight bilateral central corneal haze with clear strip edges and stable fixed flaps. For the first patient, we decided to extend corticosteroid treatment by recommending another topical corticosteroid drops (Maxidex®), because the patient refused to take any oral corticosteroids. For the second patient, we continued with a standard unchanged postoperative regimen. One week post-op, in the first patient's left eye CDVA dropped to 0.5 (Snellen), corneal haze had reduced slightly but, epithelial ingrowths became manifest at the flap's edges. In the second patient UCDVA was right 0.7 and left 0.8 after removing the bandage lenses. One month post-op, the left eye of the first patient had lost another line of CDVA and the

residual refraction was $\text{pl}/-1.25\text{DCx60}$. The haze was unchanged and the ingrowths had resolved. The biggest problem we faced, other than the unsatisfied patient, was the likelihood of secondary glaucoma due to prolonged topical corticosteroid treatment. We decided to discontinue corticosteroids replacing with non-steroid anti-inflammatory drops (NSAID). The second patient had bilateral UCDVA of 1.0, there was no observable corneal haze and no ingrowths, but the boundary edges of the Bowman strip were still visible. Two months postoperatively, we decided to perform surface ablation in the left eye of the first patient in order to correct the residual refractive error and try to minimize the persistent haze. One year after the second procedure, the first patient presented with no significant residual refraction, UCDVA was 0.7, slight central corneal haze was still present but without any epithelial ingrowths. Unfortunately, at this point the patient had lost three lines of his CDVA and was very unsatisfied with the outcome in his left eye.

Discussion

Real buttonholes or Bowman strips rarely occur with all types of microkeratomes. Nevertheless, Gimbel et al.⁹ suggested that the Bowman strip complication occurs as a result of excess tissue being compressed beyond appplanation by the keratome footplate causing the apical cornea to buckle inward. Our hypothesis is that, for the two cases presented, the strips occurred because of inadequate and uneven suction on the ring occurred during the keratome motion as a consequence of patient anxiety and subsequent hard squeezing of the eye during surgery.

Mitomycin C (MMC) is a well known prophylactic agent used to prevent haze formation in PTK and PRK¹¹ and for reduction of postoperative complications after LASIK buttonhole.⁶ In our study, a methylcellulose sponge soaked with 0.02% MMC was applied for 20s and not for 60s as recommended by others.¹² We believe that a 20s period is sufficient to achieve the desired result without any impact on surrounding tissue.

There is a major difference in the surgical outcome and recovery when comparing cases with and those without MMC treatment. Lane et al.⁵ in their case report found no haze, no epithelial in growth and excellent visual acuity outcomes 10 days after the surgery with Bowman strip and MMC topical application. In contrast to this, Taneri et al.¹¹ reported marked corneal haze and progressive epithelial in growth eight weeks postoperatively when the MMC was not used. Our results support both of these findings. Mitomycin C is an antineoplastic drug which crosslinks the DNA and prevents its replication and transcription. Therefore, it is very useful in arresting the proliferation of active fibroblasts, release of inflammatory factors and prevention of epithelial ingrowths. Kymionis et al.¹³ were probably the first to continue with photoablation when Bowman strip or buttonhole formation was encountered at a time when the general recommendation was to cease the surgical procedure. We decided to continue with the photoablation of corneal stroma because the Bowman strip was very thin and the corneal flaps were sufficiently adequate in size, position and overall integrity. The patient with MMC topical application showed excellent results after the ablation, comparing to the patient who did

not have MMC before flap repositioning. The reason for the challenged refractive outcome in the non-MMC case could be associated with the intrinsic postoperative tissue inflammation and healing process.

In conclusion, based on all said above, topical application of MMC for 20s during LASIK seems to be a safe and effective course of action when Bowman strip is encountered.

Financial statement

We hereby certify that we have no financial or any other interest in devices, equipment and drugs mentioned in this study.

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