Non adherence of flap following microkeratome-assisted laser-assisted *in situ* keratomileusis: A case report and review of literature

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A 28-year-old male underwent microkeratome assisted Laser-assisted *in situ* keratomileusis (LASIK) for, myopia. On postoperative day 1, patient had a large epithelial defect in OD. The corneal epithelial defect healed within 72 hours, but sub-optimal vision persisted. The patient was referred for further management to us. On evaluation, patient had non-healing of flap margin at 5 o'clock. Fluoroscein stain revealed no corneal epithelial defect, but a large pool of dye beneath the LASIK flap. A clinical diagnosis of non-adherence of LASIK flap was considered. Application of bandage contact lens was done. LASIK flap completely healed in 1 week. Possible etiologies are discussed and literature is reviewed.

Key words: Corneal flap, LASIK flap apposition, LASIK flap non-adherence, LASIK flap, Microkeratome assisted LASIK

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Early post Laser-assisted *in situ* keratomileusis (LASIK) flap related complications, including flap displacement, flap striae and epithelial defects have been reported.[1] Non-adherence of LASIK flap following LASIK has not been reported. We report a case of large epithelial defect with non-adherent LASIK flap. We aim to discuss the possible etiology and review the relevant literature.

Case Report

A 28-year-old male had stable, myopia in OD (–3.50 D) and OS (-3.25 D). According to referring ophthalmologist, pre-operative topography and pachymetry were normal. The patient did not have any systemic (Rheumatoid arthritis) or ocular (severe dry eye) contraindications. Preoperative topical Brimonidine drops were not instilled. The patient underwent uneventful Amadeus 2 Microkeratome (fresh blade) assisted

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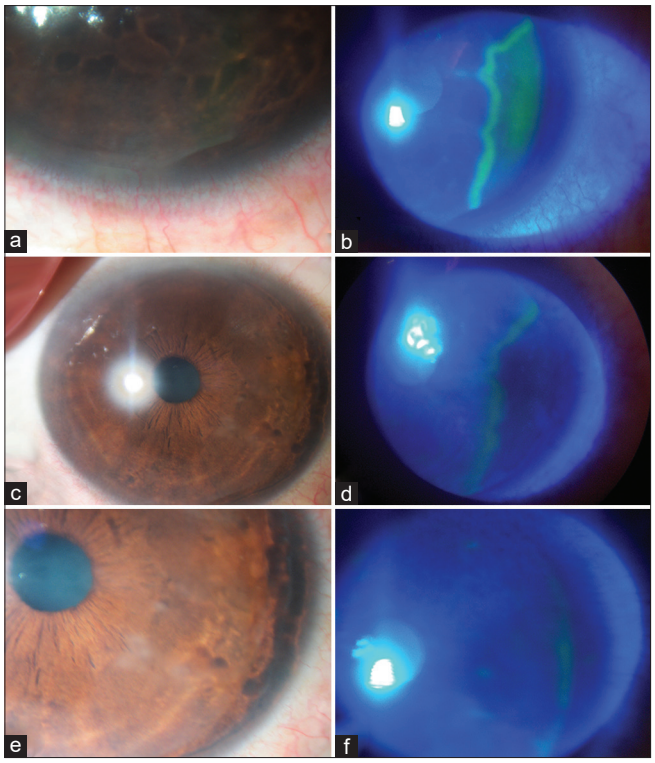

Figure 1: Slit-lamp biomicroscopy images on diffuse illumination and fluorescein dye staining of the right cornea. LASIK flap at 5 o'clock area showing a gap at the margin (absence of epithelial plug), a sign of non-healing (a). Fluoroscein stain shows no epithelial defect, but a pooling of dye under LASIK flap a sign of non-adherence (b). After 48 hours, LASIK flap margin healed (c), marked decrease in the pooling of fluorescein dye under the LASIK flap (d). After 1 week, complete healing of the flap margin (e) and no pooling of dye under the LASIK flap suggestive of completely adhered LASIK flap to underlying stroma (f)

LASIK. On, the first potoperative day, the patient had UAVA 6/24 in OD and 6/9 in OS. Slit-lamp biomicroscopy revealed a corneal epithelial defect (25%) extending up to the inferior flap margin in OD. The patient was put on moxifloxacin 0.5% (Vigamox 5 mg/mL; Alcon Laboratories, USA, Inc.), prednisolone accetate 1% suspension (Pred Forte, 10 mg/mL Allergan USA, Inc.) and carboxymethyl cellulose 0.5% (Optive, 5 mg/mL, Allergan USA, Inc) four times a day. Epithelial defect healed in 72 hours. His visual acuity did not improve. Patient was then referred to us for further evaluation and management.

Patient presented with suboptimal vision at 72 h after surgery. His visual acuity was 6/18 in OD and 6/9 in OS. IOP was 16 and 17 mm hg in OD and OS respectively. Slit-lamp biomicroscopy revealed no epithelial defect, non-apposition of corneal flap margin at 5 o'clock [Fig. 1a]. Fluoroscein staining revealed pooling of dye under the LASIK flap [Fig. 1b]. Clinical diagnosis of non-adherence of LASIK flap was considered. A bandage contact lens was applied. Patient was continued the same topical medication. After 48 hour BCL was removed. His UAVA in OD was 6/18. Slit-lamp biomicroscopy revealed that the LASIK flap margin gap at 5 o'clock has healed completely [Fig. 1c]. Fluoroscein staining revealed that pooling of the dye under the LASIK flap has significantly decreased [Fig. 1d]. The bandage contact lens was reapplied and topical medication was continued. After 1 week he had UAVA 6/12. Slit-lamp biomicroscopy showed flap margin has healed completely [Fig. 1e]. Fluorescein staining revealed no pooling of dye under the LASIK flap, indicating that LASIK flap has completely adhered to the underlying stroma [Fig. 1f]. At 1 month patient achieved 6/9 in OD. During 6 months follow-up patient did not develop interface scarring or epithelial ingrowth.

Discussion

Non-adherence of corneal flap following LASIK, although a rare, but important complication. Non-adherence of flap can predispose to infective keratitis, diffuse lamellar keratitis and epithelial ingrowth. The condition should be suspected if visual acuity after healing of epithelial defect does not improve. LASIK flap non-adherence should be confirmed on fluorescein staining. Anterior segment OCT may also delineate non-adherence and discontinuity of the LASIK flap margin. Non-adherence of corneal flap should be treated at the earliest.

Corneal epithelial defects following LASIK are not always benign. These may lead to DLK, delay in visual rehabilitation and suboptimal final UAVA. Epithelial defects may occur due to pre-existing epithelial basement membrane dystrophy (EBMD), dry eye, microkeratome shearing force or without any obvious cause.[2] In case EBMD is evident pre-operatively surface ablation is preferred over LASIK.[2] No cause for development of corneal epithelial defect could be ascertained in our patient.

It is difficult to speculate the cause of non-adherence of the corneal flap in our patient. Flap displacement could be a possibility. After healing of epithelial defect, flap margin at 5 o'clock did not heal. LASIK flap heals with epithelial plug formation. Due to epithelial defect plug formation may not have occurred. Our patient responded to BCL application. In case patient does not respond to BCL application, flap should be lifted, undersurface of the flap and corneal stroma should be scrapped to remove the epithelial cells. This maneuver may decrease the risk of late epithelial ingrowth. The interface is irrigated and the flap is reposted.

Proper apposition of the corneal flap after laser ablation may prevent non-adherence of corneal flap. Prednisolone 1% suspension has been used to enhance the visibility of gutter width.[3] Femtosecond laser-assisted LASIK flap alignment is assured if the area of dryness exceeds the area of direct touch of the cellulose sponge. This sign of alignment is explained due to micro capillary action.[4] Lid speculum should be removed taking care not to displace the flap.

In a rabit model, flap stability has been attributed to collagen scar tissue formation, epithelial bridging at the cut flap edge and an osmotic gradient across the flap-stromal bed interface.[5] Topical Brimonidine 0.2% instilled, prior to the LASIK procedure, to prevent subconjuntival hemorrhage decreases the Lasik flap adherence.[6] Topical brimonidine tartrate induces a significant decrease in intrastromal corneal pressure and this may be responsible for the decreased corneal flap adherence.[7] Topical Brimonidine was not used in our patient. The recovery of keratan sulfate and chondroitin/dermatan sulfate disaccharides in human postmortem, post-LASIK corneas suggests that laser irradiation alters the composition of the glycosaminoglycans on the modified stroma permanently and renders it unsuitable for normal

wound healing adhesion.[8] Collagen cross-linking with riboflavin has been reported to increase the adhesiveness of the LASIK flap through stromal fibroblasts and the effect of cytokines.[9] In patients undergoing combined LASIK and collagen cross-linking with riboflavin, flap adherence will be enhanced. Stronger flap adhesion with the IntraLase femtosecond laser than with the Amadeus mechanical microkeratome has been reported.[10]

The presence of corneal stromal stem cells at the margin of the flap has been reported to enhance the adherence of LASIK-like flaps.[11] Tissue adhesives have been found effective to secure and seal the margins of the LASIK flap without affecting the clarity of the cornea.[12] Tissue adhesives have the potential to decrease the risk of complications as flap dislocation and epithelial ingrowth.[12] All these modalities have the potential to enhance the adherence of LASIK flap to the underlying stroma.

Conclusion

Non-adherence of LASIK flap is often missed. The surgeon should have a high index of suspicion. In case LASIK flap non-adherence is suspected, it should be confirmed by fluorescein stain and treated promptly to limit ocular morbidity. The BCL should be kept until flap stability is maintained.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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