



Management of late traumatic LASIK flap dislocation related to dog scratch 16 Years postoperatively

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ABSTRACT

Purpose: This report details a case of an unusual late dislocation of a laser in situ keratomileusis (LASIK) flap due to animal-related trauma 16 years after the initial surgery.

Observations: A 59-year-old woman with history of LASIK surgery on both eyes 16 years prior, and uncomplicated cataract surgery on the left eye (oculus sinister; OS) 3 years prior, arrived at our institution with sudden painful visual loss 3 hours after receiving a scratch on OS from her dog. Corneal examination revealed a completely displaced nasally hinged LASIK flap folded irregularly over the hinge, with multiple creases over its entire thickness. The flap was intact but edematous and opaque, with detritus present both on the flap surface and stromal face. Treatment was initiated with topical moxifloxacin and oral clindamycin. The next morning, the flap was refloated, and debris was removed from both sides of the flap while irrigating with preservative-free moxifloxacin. The flap was repositioned and a bandage contact lens placed. Postoperative topical medication included moxifloxacin, prednisolone acetate, and sodium hyaluronate. At the final follow-up visit, the patient was asymptomatic, with a measured uncorrected distance visual acuity (UDVA) of 20/25 OS.

Conclusion and importance: This uncommon case highlights the longest reported interval—16 years— between initial surgery and traumatic LASIK flap displacement, caused by animal-related trauma. Patients experiencing LASIK surgery complications, including contaminated trauma many years after the original ablation, can still recover excellent visual acuity when managed appropriately and in a timely fashion.

1. Introduction

Laser in situ keratomileusis (LASIK) is the most widespread refractive surgery technique used to treat spherocylindrical ametropia because of its safety and predictability; it consists of the creation of a corneal flap and subsequent excimer laser ablation to reshape the corneal stroma, thus correcting the preoperative refractive defect. Flap creation induces additional intraoperative and postoperative risks in comparison to superficial ablation techniques, such as photorefractive keratectomy (PRK). One of the most relevant complications is flap dislocation, which is not confined by any time frame and can happen from weeks up to years after surgery and is mostly related to mechanical injury, either by the patient or an external source.

This case highlights an unusual case of late traumatic flap dislocation occurring 16 years after LASIK surgery. To our knowledge, this case presents the longest reported interval between the initial surgery and

traumatic flap displacement, as well as featuring an uncommon mechanism of dislocation involving an animal-related injury that has been scarcely reported in the literature. Also, the authors detail the specific surgical approach undertaken for this patient that resulted in a favorable visual outcome.

2. Case report

A 59-year-old woman was referred to our hospital approximately 3 hours after receiving an accidental scratch on her left eye (OS) from her pet dog. She noticed a sudden onset of painful visual loss, as well as tearing and redness after the inciting event. Regarding relevant medical records, she reported a history of colon cancer treated with a partial colectomy 2 years before. In terms of her ophthalmological history, she reported LASIK surgery on both eyes 16 years prior, and cataract surgery on OS 3 years prior. At baseline, the uncorrected distance visual acuity

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(UDVA) was 20/25 in the right eye (oculus dexter; OD) and count fingers (CF) OS. The intraocular pressure was 12 mmHg OD, as measured with a Goldmann applanation tonometer (Haag-Streit Verkauf Schweiz, Bern, Switzerland), and 14 mmHg OS, as measured with a Tono-Pen AVIA applanation tonometer (Reichert Inc., Buffalo, NY) over the sclera.

Slit-lamp examination of OD revealed no major abnormalities; OD was found to have an appropriately positioned nasally hinged LASIK flap and mild nuclear sclerosis. OS presented significant superior eyelid edema and discrete hyperemia of the eyelid margins, as well as 2+ conjunctival hyperemia and 1+ chemosis. Corneal examination showed an almost completely displaced nasally hinged LASIK flap, folded irregularly over the hinge and with multiple creases over its entire thickness. The flap was complete but edematous and opaque. Multiple detritus were present, both on the flap surface and the stromal face. Mild stromal edema was also noted centrally.

After the topical application of tetracaine, the flap was repositioned over the stromal bed with a cotton swab and lightly pressed to its previous position with the stem of a blunt cannula. Then, staining with fluorescein dye was performed. An irregular epithelial defect was noted along the superonasal quadrant where the flap was forcefully folded upon itself. Anterior chamber examination revealed no cells and flare, and the Seidel test was negative for anterior chamber leakage. The rest of the ocular examination revealed no perforation or penetration. Fig. 1 shows preoperative slit-lamp photos of OS. Fundusoscopic examination of OD showed nothing abnormal except for mild asteroid hyalosis, while examination of OS was deferred because of considerable media opacity.

Preservative-free 0.5% moxifloxacin eye drops and 300 mg per os (PO) of clindamycin every 6 hours were initiated, and immediately afterwards, a rigid plastic protector was applied over the affected eye. The patient was scheduled for surgery the next day to refloat the flap. The following morning, upon surgical exploration, the flap border was found and marked. The flap was lifted with a spatula and irrigated with

balanced salt solution (BSS) and preservative-free moxifloxacin until all detritus were removed from both sides of the flap and stromal bed. Afterwards, the flap was replaced and the interphase irrigated with BSS. De-epithelization was performed on areas presenting with striae, and ironing of the flap allowed the stromal borders to join appropriately. Further drying was allowed for 3 minutes, and a bandage contact lens was placed. Postoperative topical medications included preservative-free 0.5% moxifloxacin every 4 hours, 1% prednisolone acetate every 6 hours, and 0.2% sodium hyaluronate every 2 hours. At the last follow-up appointment, 15 days later, the patient reported being asymptomatic, with a measured UDVA of 20/25 OD and 20/30 OS. Slit-lamp examination revealed an appropriately positioned LASIK flap with no striae, detritus, or epithelial defects. Fig. 2 shows the postoperative slit-lamp photos of OS.

3. Discussion

Unlike superficial refractive techniques, LASIK surgery creates a corneal flap that represents a plane of weakness that is susceptible to external forces causing its displacement. Flap adhesion in the immediate postoperative period has been hypothesized to be induced by capillarity, collagen fiber interlacing, intracorneal suction, endothelial pumping, intracorneal molecular attraction, and ionic bonding.¹ Corresponding with these relatively weak forces, early flap displacement has been a well-known complication that occurs in 1–2% of cases within 2 days of the initial procedure, mostly caused by eye-rubbing or eyelid motion.²

However, late displacement also appears to be an important cause of morbidity in post-LASIK patients, and the actual mechanisms for the healing and long-term adherence of the flap–stroma interface are unclear.^{3,4} Previous research has shown that a lack of interface scarring between the flap and stromal bed is fundamental for achieving adequate postoperative visual results by keeping the cornea transparent. In other

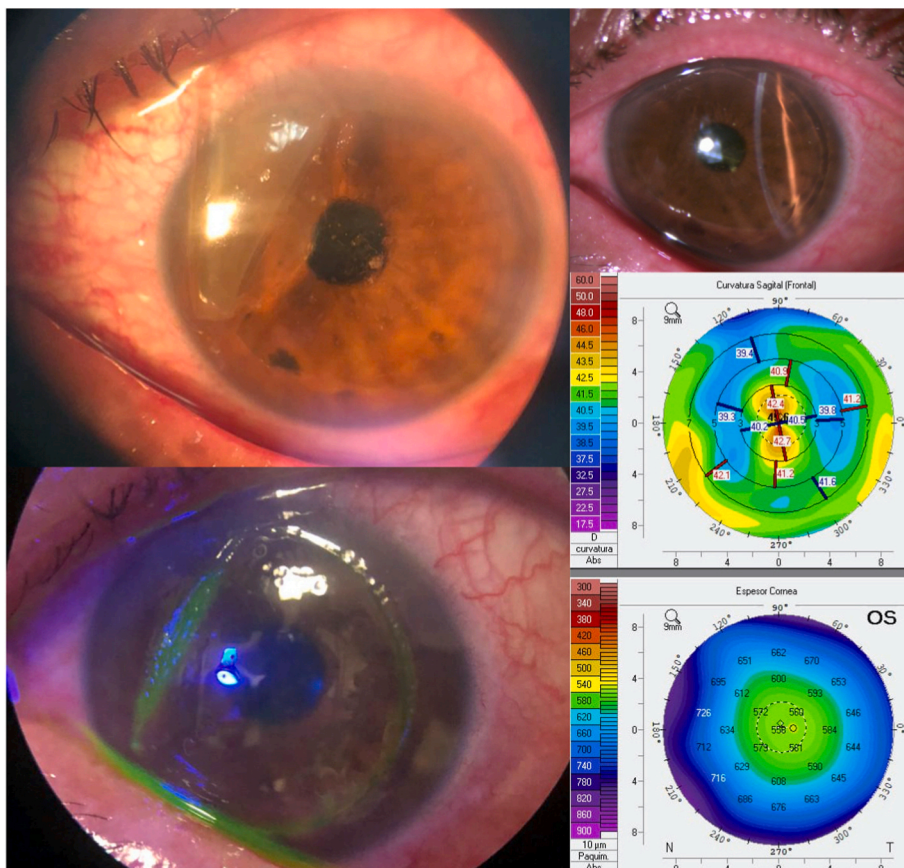


Fig. 1. *Top left:* Displaced, nasally hinged laser-assisted in situ keratomileusis (LASIK) flap folded irregularly over the hinge. Detritus are visible over the stromal face. *Bottom left:* After fluorescein staining, an epithelial defect was noted along the superonasal quadrant where the flap was folded upon itself. *Top right:* After the initial replacement of the flap, topical moxifloxacin is administered. *Bottom right:* Scheimpflug-based topography done before the formal refloat and irrigation shows an irregular profile and corneal edema.

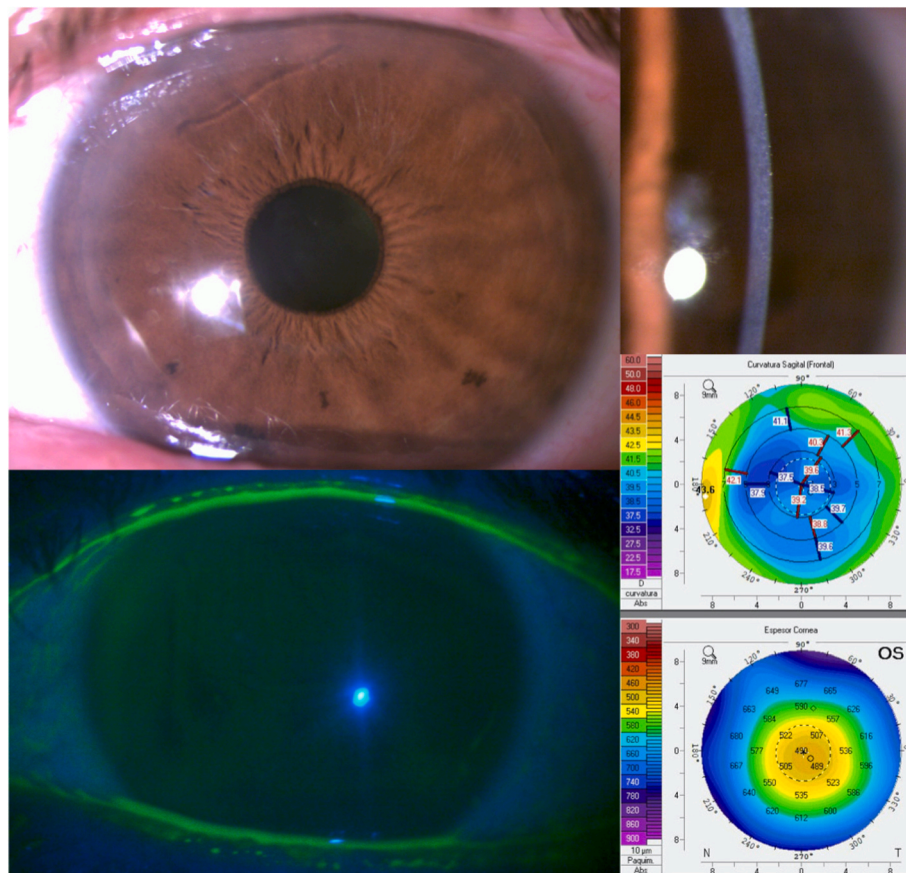


Fig. 2. *Top left:* Slit-lamp photograph taken five days after the flap replacement. *Bottom left:* After fluorescein staining, the epithelial defect is no longer evident. *Top right:* The flap is clear and in an adequate position, with no evidence of detritus. *Bottom right:* Postoperative Scheimpflug-based topography shows the flattening and resolution of corneal edema.

words, the amount of wound healing between the flap and stromal bed is intended to be diminished centrally to maintain corneal transparency; however, this allows relatively easy flap displacement because healing occurs mostly at the edges of the flap and minimally on the central cornea.⁵ Animal and in vitro studies have confirmed this lamellar healing occurring mainly on the corneal periphery, leaving a transparent but inadequately supported central zone.⁶ Schmack et al. found that the wound margin of a LASIK flap heals by producing peripheral hypercellular fibrotic stromal scar, which is about 28.1% as strong as normal corneal stroma. In contrast, the central and paracentral hypocellular primitive stromal scar is only 2.4% as strong as normal corneal stroma, which means it is 10 times weaker than the peripheral margin scar.⁷

Mechanical injury creates shearing forces, causing a break in the weak scar tissue at the flap edges; thus, this late complication is shown to be mostly associated with external trauma. Several previous case reports have been published on trauma causing flap dislocation, ranging from 10 days up to 14 years after surgery. This is evidence that the common ophthalmological belief that the corneal structure will slowly regain its integrity entirely is erroneous.⁸ The case being reported here shows that as long as 16 years after the procedure, the cornea is still vulnerable to traumatic displacement, reinforcing the idea that LASIK flaps never heal completely. This should be reason enough to recommend the regular use of eye protection before participating in most sporting activities in patients with previous LASIK surgery, even decades after the procedure.

Many different mechanisms for late traumatic flap complications have been reported, including but not limited to sporting injuries with different types of balls, finger-in-the-eye injury, automobile airbag deployment, blunt object trauma, and animal-related injuries.^{3,4} This last mechanism is rarely encountered and must be highlighted for its

possible association with wound and flap contamination by distinct microbiological entities that are normally found only in animals. The current case involved a dog's paw directly injuring and displacing the patient's corneal flap, but appropriate treatment achieved a remarkably positive outcome. Our results demonstrate that even when the mechanism of trauma is complex or causes contamination, the final outcome need not be affected if the management of the case is appropriate and timely, and the removal of debris and the irrigation of the flap is thorough.

Hence, the treatment of flap dislocation should be managed as an emergency, with immediate repositioning to avoid complications such as fixed folds, infection, epithelial ingrowth, flap striae, flap loss, and optical aberrations.⁸ As the flap is lifted, a meticulous examination is critical to detect and remove any foreign body or debris by irrigating with preservative-free antibiotic solution. In the presence of epithelial ingrowth, aggressive scraping is paramount before the repositioning of the flap. As for flap striae, the stretching and additional denudation of the epithelium are favorable before the re-approximation of the flap margin. Excessive manipulation must be avoided to prevent post-operative corneal edema or irregular healing. Severe cases with complete flap detachment may involve the risk of irregular astigmatism or significant optical aberrations after erroneous orientation; this requires suturing with 10-0 nylon to stabilize the flap. The adhesion between the flap and stromal bed is best achieved by removing excess interface fluid by stroking the flap with a cyclodialysis spatula or sterile surgical sponge and allowing it to deturgess and dry under the influence of the corneal endothelial pump for at least 5 minutes. A lack of independent flap movement when depressing the adjacent cornea confirms optimal adherence.

4. Conclusions

Due to LASIK being an increasingly prevalent refractive procedure in recent decades, cases of late traumatic flap dislocations are expected to become commonplace. Accordingly, all ophthalmologists should be adept at the general management of these complications. There should be awareness of the fact that even minor trauma experienced decades after the procedure can displace LASIK flaps. To the best of our knowledge, the 16-year interval reported in this case is the longest reported interval between initial surgery and traumatic flap dislocation, caused by animal-related injury or any other mechanism. Patients who have undergone LASIK surgery and experienced the complication of late-onset flap displacement can still recover excellent visual acuity when the flap displacement is managed appropriately and in a timely fashion.

List of abbreviations

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| 1. LASIK | laser-assisted in situ keratomileusis |
| 2. PRK | photorefractive keratectomy |
| 3. OD | oculus dexter (right eye) |
| 4. OS | oculus sinister (left eye) |
| 5. UDVA | uncorrected distance visual acuity |
| 6. CF | count fingers |
| 7. PO | per os |
| 8. BSS | balanced salt solution |

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