

# Late-onset traumatic corneal flap dislocation and secondary epithelial ingrowth 24 years after LASIK

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## ABSTRACT

**Purpose:** To analyze the diagnostic process, treatment, and post-operative outcomes of a unique case involving a late-onset (24 years post) traumatic corneal flap displacement after Laser-assisted in situ keratomileusis (LASIK) surgery due to a plant-related trauma, with an emphasis on the accompanying extensive epithelial ingrowth beneath the flap.

**Observations:** A 59-year-old male patient experienced corneal flap displacement 24 years post-LASIK due to a minor plant-related trauma. This case was complicated by extensive epithelial ingrowth beneath the flap, which was initially misdiagnosed with fungal keratitis. Upon identification of the actual cause, corneal flap repair surgery was performed, leading to partial vision recovery.

**Conclusions and importance:** This case signifies the potential for LASIK flap displacement even decades post-surgery due to minor traumas and highlights the need for vigilance in diagnosing associated complications like epithelial ingrowth. It indicates the importance of ophthalmologists and clinicians being vigilant for such complications and necessitates their familiarity with basic management techniques or quick referral to a corneal refractive surgery specialist. This report of a 24-year interval between LASIK and traumatic flap displacement with epithelial ingrowth is one of the longest known. The case also demonstrates that patients with late flap displacement can regain significant visual acuity with timely and appropriate management.

## 1. Introduction

LASIK is one of the most common refractive surgeries worldwide. While this procedure has demonstrated great efficacy in correcting vision, it is not without post-operative complications, such as traumatic flap dislocation. Early (within one week) post-operative traumatic corneal flap dislocation rates are relatively high compared with the later post-operative period. However, late-onset of this phenomenon, whilst less likely to occur,<sup>1-4</sup> still poses a risk that can persist for several years, even decades.<sup>5,6</sup> Regardless of when this complication manifests, it can significantly affect visual acuity. According to existing literature, the longest delay in onset of traumatic corneal flap dislocation was 16 years post LASIK surgery.<sup>6</sup>

## 2. Case report

### 2.1. Medical history

A 59-year-old male, who had undergone LASIK surgery 24 years

previously, scratched his left eye with a corn stalk while farming. Initially, he visited a local clinic, where his eye was flushed with saline and ofloxacin eye drops were administered. A month later, he consulted the ophthalmology department of a local hospital, not disclosing his prior LASIK surgery. An eye examination revealed both eyes had the same visual acuity (20/40). The corneal examination of the left eye showed partial loss of epithelium with patchy opacities in the central and peripheral areas, along with conjunctival congestion. He was diagnosed with left eye keratitis and prescribed appropriate treatment. Over the subsequent two months, his vision in the left eye progressively worsened. He then consulted a provincial hospital, where tests indicated a further decrease in visual acuity in the left eye. Due to the attending physician's limited experience with refractive surgery complications, the patient was initially diagnosed with fungal keratitis. After two months of ineffective treatment, the patient sought care at our hospital, more than six months after his initial injury.

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## 2.2. LASIK surgery details

The patient had undergone bilateral LASIK surgery at our hospital 24 years ago, where the flap creation was performed using a microkeratome blade. Medical records included the following pre-operative data - i) refractive power: right eye  $-9.50\text{DS}/-2.00\text{DC}180$ ; left eye  $-8.50\text{DS}/-1.00\text{DC}153$ ; ii) intraocular pressure: 17 mmHg right eye; 18 mmHg left eye and iii) corneal thickness: right eye  $564\mu\text{m}$ , left eye  $562\mu\text{m}$ . Other data was not recorded.

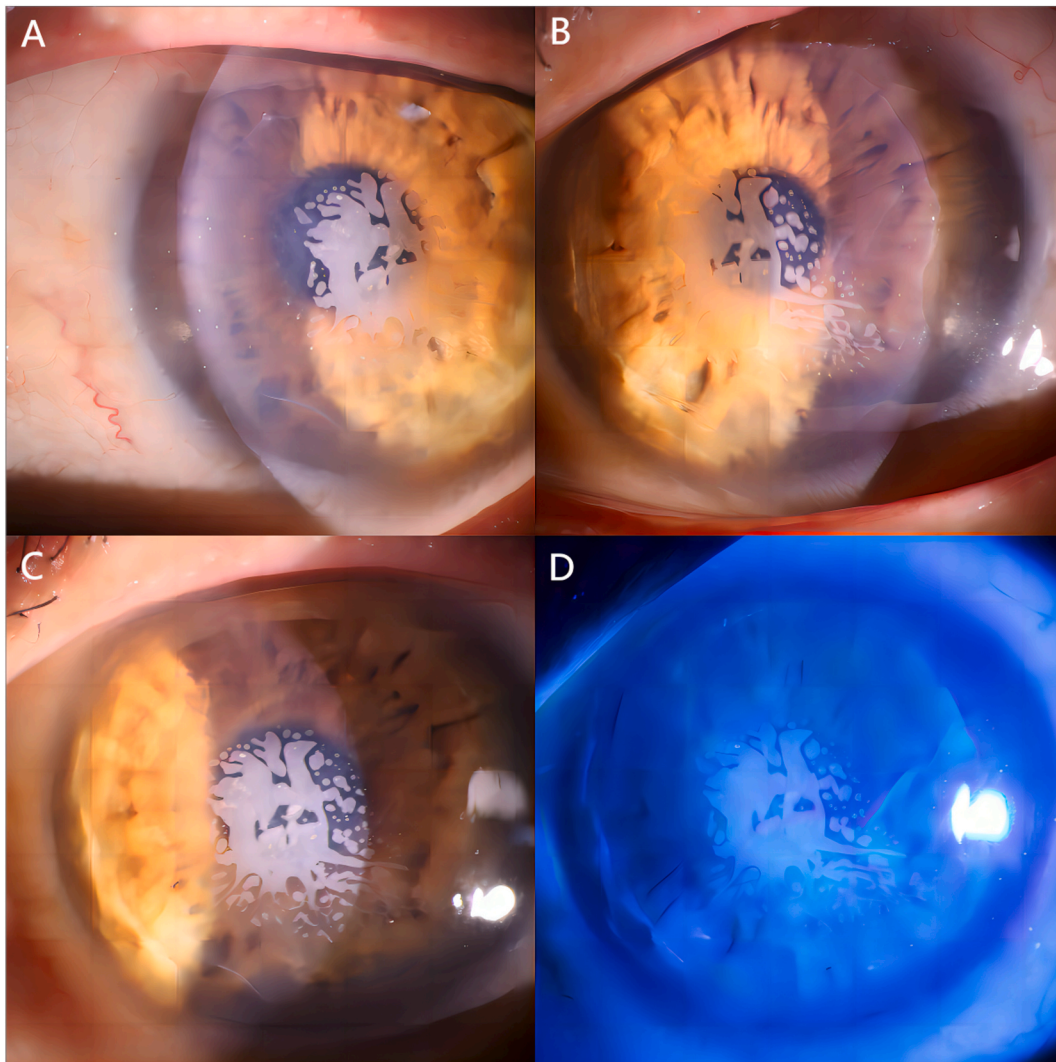
## 2.3. Pre-operative examination

The patient's uncorrected distance visual acuity (UDVA) was 20/40 in the right eye and "counting fingers" (CF) in the left eye. Slit-lamp examination revealed no conjunctival congestion in either eye. Both eyes exhibited a corneal flap with its base at the nasal side. In the left eye, severe epithelial ingrowth beneath the corneal flap was noted, with irregular and potentially defective flap edges at the 7 and 3 o'clock positions. Visible wrinkle striations were present on the temporal corneal flap, and the corneal mid-periphery showed net-like scars and irregular creamy turbidity. The lens capsules in both eyes displayed mild cortical clouding, consistent with early age-related cataracts. The fundus of the left eye was not visible (Fig. 1A–C). Fluorescein sodium was used

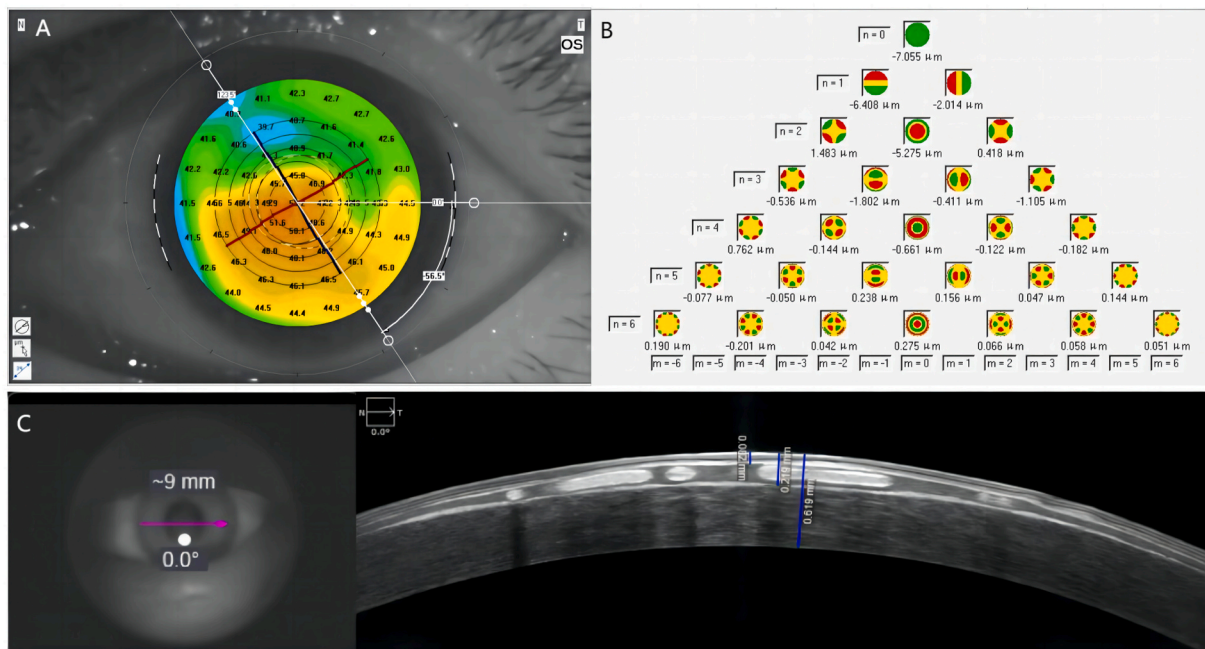
for staining. No significant epithelial defects were observed, but irregularities and folds at the flap edge were apparent (Fig. 1D). Corneal topography (Pentacam, OCULUS, Germany) indicated increased curvature and anterior surface astigmatism, and aberrations included RMS HOAs, coma, and trefoil (Fig. 2B). Corneal OCT (CIRRUS HD-OCT 400, ZEISS, Germany) revealed a corneal flap depth, a high reflection area under the flap, and central corneal thickness (Fig. 2C).

## 2.4. Surgical treatment

After preoperative disinfection, the flap of the left eye was lifted from the temporal inferior area using a corneal flap separator. The flap was relatively easy to separate. The connection at the base of the epithelial flap was observed to be intact, but partial defects were noted at the temporal and inferior nasal edges of the epithelial flap, with the edges curling inward. Epithelium was then carefully scraped off the stromal bed and the inner stromal side of the corneal flap using a golf knife. The debris was washed with a balanced salt solution (BSS). Depithelialization was meticulously performed on areas with striae and pits. The curled edges were repositioned after inducing corneal edema with injectable water to facilitate repositioning and reduce wrinkles. The interface was thoroughly cleaned, and the corneal flap was repositioned using a cotton swab, followed by placing a corneal bandage lens.



**Fig. 1.** Preoperative slit-lamp examination and corneal fluorescein staining in the left eye. (A–C)The flap edge in the 7 and 3 o'clock positions of left eye was irregular, suspected to be defective, the temporal corneal flap had visible wrinkle striations, the corneal meso-periphery had net-like scars and irregular creamy turbidity. (D)No significant epithelial defects were observed, but irregularities and folds at the flap edge were appar.



**Fig. 2.** Preoperative Pentacam and corneal OCT examination. (A) The central and lower curvature was increased, the anterior surface astigmatism was 1.7D (123.5°). (B) Aberrations: RMS HOAs (2.508 $\mu\text{m}$ ), coma (2.213 $\mu\text{m}$ ), trefoil (1.641 $\mu\text{m}$ ). (C) corneal flap depth about 82 $\mu\text{m}$ , sheet-like high reflection area under the corneal flap, CCT about 614 $\mu\text{m}$ .

Post-operative topical medications included tobramycin dexamethasone eye drops every 4 hours and sodium hyaluronate eye drops every 2 hours.

### 2.5. Post-operative

Follow-up on the first day after surgery, the UDVA in the left (operated) eye was 20/60. Slit-lamp examination: There was slight stromal edema of the cornea involving the central and temporal inferior quadrants. One week later, the corneal bandage lens was removed, the UDVA of the operated eye improved to 20/50. The slit-lamp showed that the corneal edema was less than before, scars and temporal fine lines were still present, and no obvious epithelium was seen between the layers. The corneal bandage lens was removed.

At the one-month follow-up, the patient's vision improved to 20/40. No epithelial ingrowth was observed. At the six-month follow-up, the patient's vision remained at 20/40. The slit-lamp examination revealed increased corneal clarity compared to previous observations, with persistent scars but no significant epithelial ingrowth (Fig. 3A–B). Corneal topography showed improved corneal regularity and reduced curvature, with anterior surface astigmatism now at 0.9D (Fig. 3C). Eye imaging indicated lower corneal higher-order aberrations (HOAs) and coma (Fig. 3D). Corneal OCT demonstrated mild scarring under the flap (Fig. 3E). Given the ongoing risk of epithelial re-ingrowth, further follow-up is required.

### 3. Discussion

There is a high risk of flap displacement after LASIK surgery, particularly when external forces are applied. Approximately 1–2% of cases exhibit early flap displacement (within two days post-surgery), mainly due to eyelid movement or eye rubbing,<sup>7,8</sup> whereas late (occurring more than a week post-surgery) traumatic flap displacement is relatively rare.<sup>9</sup> Studies have shown that late stromal healing after LASIK surgery primarily occurs at the flap edges, with patient's only recovering ~28% of the normal corneal strength. Healing at the lamellar interface between the flap and stromal bed is weaker, typically restoring

only about 2.4% of the normal corneal strength. This weak adhesion may result in a lifetime risk of flap displacement even under mild shear forces.<sup>3,10</sup>

Late displacement can be a significant factor in morbidity following LASIK surgery, with risk factors including sports injuries with different types of balls, finger-in-the-eye injury, car airbag deployment, blunt trauma, animal or plant-related injuries, etc.<sup>4–6,11–14</sup> As illustrated, delayed complications are usually related to external trauma, rather than being spontaneous. Previous case reports have confirmed that trauma can cause flap displacement up to 16 years post-surgery, refuting the common ophthalmological notion that corneal structure gradually restores its integrity over time.<sup>15,16</sup>

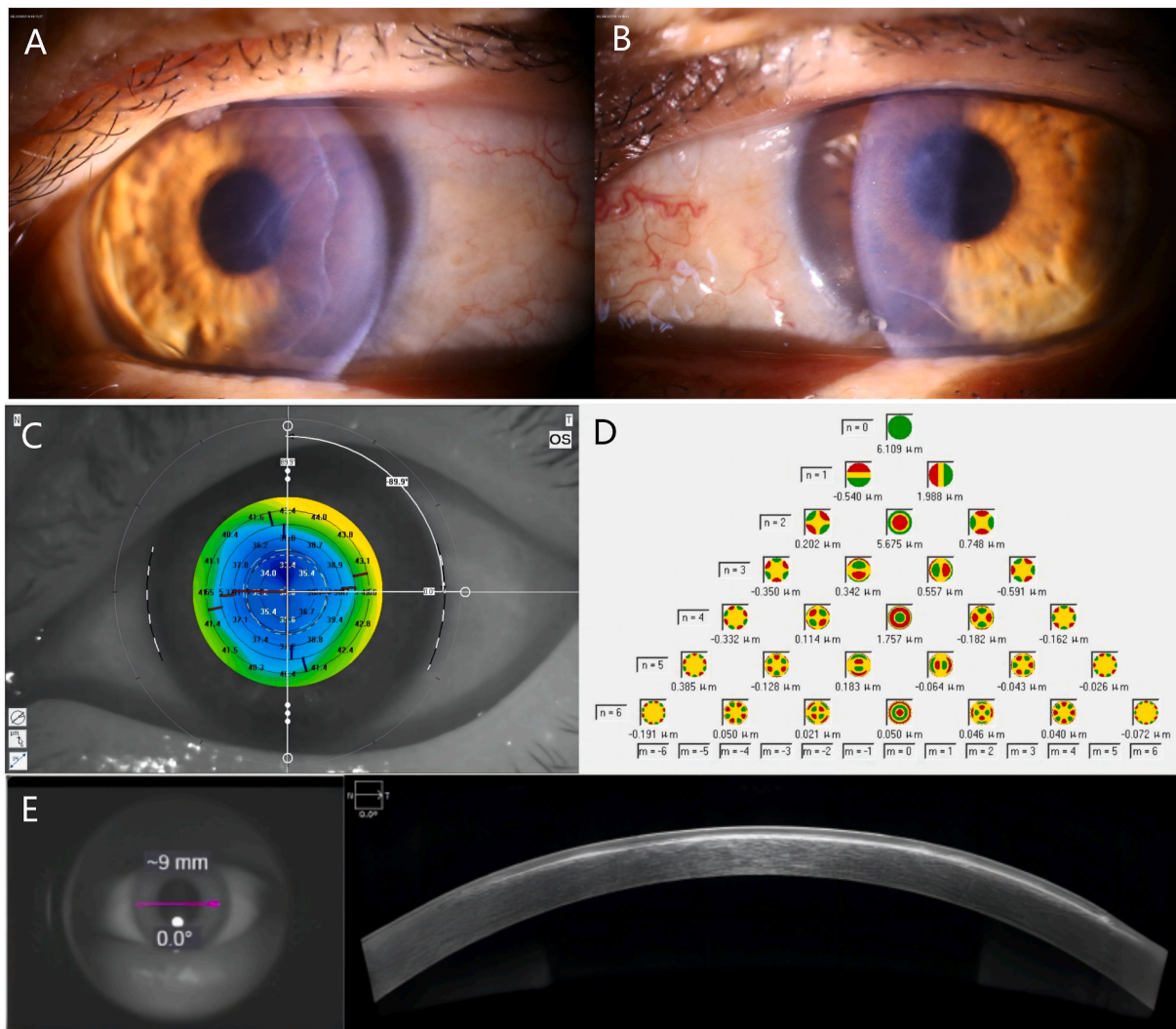
In this exceptional case, the patient exhibited traumatic flap displacement 24 years after LASIK, a rarity that underscores the long-term vulnerability of the cornea post-surgery. This emphasizes the need for ongoing eye protection, particularly in activities with higher risk, highlighting the unique and prolonged risks associated with LASIK surgery.

In this case, delayed recognition of flap displacement led to complications like epithelial ingrowth. Misdiagnosis as fungal keratitis, due to insufficient experience in corneal refractive surgery, hindered proper treatment. Prompt and accurate diagnosis after eye injuries, especially for patients with LASIK history, is crucial.

Mismanagement and prolonged medication use adversely affected vision recovery, though later meticulous treatment improved vision partially. Ongoing follow-up is essential to manage potential recurrences and complications. Therefore, flap displacement should be treated as an emergency and the flap should be promptly repositioned to avoid complications such as fixed folds, infection, epithelial ingrowth, flap striae, flap loss, and optical aberrations, to achieve a favorable prognosis.<sup>7,17</sup>

### 4. Conclusion

Due to the growing popularity of LASIK surgery in recent decades, the incidence of late traumatic flap displacement may increase. Therefore, all ophthalmologists and physicians, likely to encounter eye



**Fig. 3.** Six-month postoperative follow-up examination images. (A-B) Slit-lamp examination revealed reduced corneal edema and persistent scars, with dot-like opacities at the 4 o'clock position of the left corneal flap, indicative of re-emergent epithelial ingrowth. (C) Corneal topography showed the anterior surface of the cornea was more regular, the central and lower curvature significantly decreased compared to before the surgery, and the anterior surface astigmatism was 0.9D (80.1°). (D) Eye imaging showed corneal HOAs (1.942 $\mu$ m), coma (0.951 $\mu$ m), trefoil (0.691 $\mu$ m). (E) Corneal OCT showed mild scar formation under the corneal flap.

injuries, should learn to recognize this complication, learn basic management, or promptly refer patients to a corneal refractive surgery specialist. It should be recognized that, even decades post-surgery, minor trauma can cause LASIK flap displacement. To our knowledge, the 24-year interval reported in this case represents the longest reported interval between initial surgery and traumatic flap displacement caused by plant-related injuries or anything else. Patients who have undergone LASIK surgery and present with late flap displacement complications can still regain good visual acuity with appropriate, timely management of flap displacement.

**Patient consent**

The patient has provided written consent for the publication of the case details. Copies of the signed consent forms have been retained for reference if needed. This report does not contain any personal information that could lead to the identification of the patient.

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**Authorship**

All authors attest that they meet the current ICMJE criteria for Authorship.

**CRediT authorship contribution statement**

**Xu Zhang:** Writing – original draft, Project administration, Methodology, Conceptualization. **Huixian Wang:** Writing – review & editing, Validation, Formal analysis, Data curation. **Xiaowei Gao:** Visualization, Supervision, Resources, Investigation. **Wenjing Li:** Writing – review & editing, Software, Funding acquisition.

**Declaration of competing interest**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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