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Lasik Complications

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No any financial interest to disclose

Intraoperative Complications

- Microkeratome-related flap complications
  1. Flap Buttonhole
  2 .Free Cap
  3 .Incomplete, short, or irregular flaps
  4 .Corneal perforation
- Corneal Epithelial Defect
- Limbal Bleeding
- Interface Debris

Postoperative Complications

1. Overcorrection and Undercorrection
2 .Flap Fold or Striae
3 .Flap Dislocation
4 .Dry Eye and diminished Corneal Sensation
5 .Diffuse Lamellar Keratitis (DLK)
6 .Pressure-induced Stromal Keratitis (PISK)
7 .Central Toxic Keratitis (CTK)
8 .Infectious Kertatitis
9 .Epithelial Ingrowth
10. Ectasia

Azar D. et al. LASIK: Fundamentals, surgical techniques, and complications. New York. Basel, Marcel Dekker, Inc. 2003

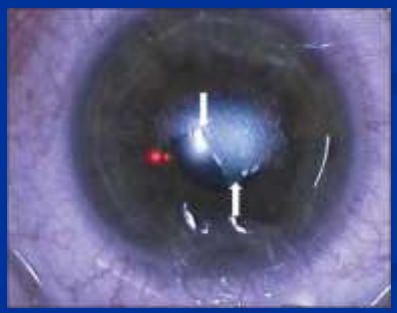
Intraoperative Complications

Flap Buttonhole

Caused by buckling of the cornea during flap creation, occurs predominantly in steep corneas.

Other risk factors include loss of suction, defective blade, abnormal advancement of blade.

Management: Do not perform laser ablation, recut the flap and ablate a minimum of 3 months later.



Free cap

Incidence of free cap is low, from 0.004% to 1.3%

Risk factors are anatomic or mechanical:

Flat cornea (<40D) (Only primary flat corneas carry the risk of free cap)

Deep orbits

Inadequate suction

Decentered ring placement

Faulty microkeratome blades

Stopper set for smaller hinge

When to abort: If stromal bed is irregular, replace the flap without ablation.

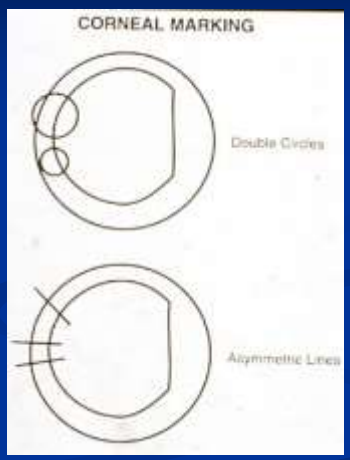
When to continue: If stromal bed and cap of regular thickness, proceed with ablation. Free cap should be placed on a drop of BSS in a chamber or on the conjunctiva to prevent desiccation .

Ascertain that the epithelial side is up and that the reference marks are well aligned.

Use asymmetric markings for best replacement of the cap.

Prevention is the key

prepare for the possibility of free cap by selecting suction rings of larger diameter for flat corneas (do not cut if < 38D), taking care during decentration of the ring, and calibrating the stopper of the microkeratome well.



Complications

- Loss of the disc.
- Astigmatism due to incorrect flap orientation .
- Epithelial ingrowth.
- Flap stria.
- Loss of best corrected vision.

Incomplete or irregular flaps

Caused by inadequate suction or microkeratome malfunction.

Management: Do not manipulate the flap, do not perform laser ablation, place a bandage contact lens, and recut the flap and ablate at least 3 months later.

Corneal perforation

Rare but devastating complication. Reported in older model of microkeratomes when it was not properly assembled.

It can also occur during laser ablation on extremely thin cornea.

Management: Immediately de-activate the suction, remove the microkeratome, and repair the perforation in sterile manner.

Corneal Epithelial Defect

Risk factors: older age, previous corneal trauma, DM, epithelial basement membrane dystrophy.

Predispose to delayed healing, (DLK), epithelial ingrowth, flap striae, and infectious keratitis.

Prevention: limiting toxic topical medications, minimizing use of topical anesthetics, frequent use of lubricating drops, preoperative inspection of blade and meticulous microkeratome maintenance.

Management: Use bandage soft contact lens for larger defect (>1 mm), topical lubricants until re-epithelialization.

Limbal Bleeding

Presence of corneal pannus ,contact lens wearers, using inappropriate size or position of the suction ring.

Management:

gentle pressure on oozing vessels with dry sponge directly or pushing a fold of conjunctiva over limbal feeders with dry sponge.

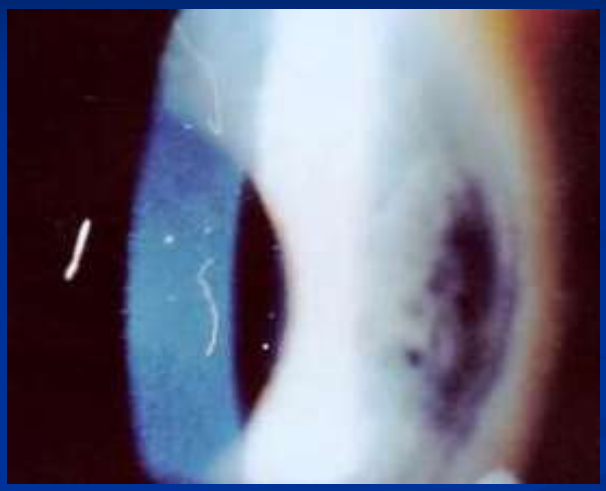
Remove any blood in the ablation zone. After replacing the flap, phenylephrine 2.5% may be used.

Interface Debris

Sources include meibomian gland secretions, particles from sponge, talk from gloves, metallic fragment from blade, RBCs, epithelial cells, and debris from tear film.

Prevention: Use aspirating speculum, operate in a lint-free environment, drape the lashes and eyelids.

Management: Only if inflammatory reaction elicited by debris, lift the flap, irrigate and remove the debris manually. Otherwise they are well tolerated.



Postoperative Complications

Overcorrection & Undercorrection

Undercorrection is the most common complication after primary LASIK. Overcorrection is mostly seen after retreatment.

Both are related to the ablation algorithm, nomogram, age, and the amount of refractive error.

Flap Fold or Striae

Risk factors:

Excessive irrigation of flap during LASIK.

Poor repositioning of the flap.

Thin flaps.

Deep and highly myopic ablation with flap-bed mismatch.

Eye squeeze or trauma.

Macrostriae

Full thickness rolling stromal folds.

Management:

Perform immediate refloating and repositioning.

After 24 hours, de-epithelialization, refloating and may be suturing.

Microstriae

Fine folds in Bowman's layer, mismatch of flap to new bed.

Management: Observation with aggressive lubrication, if visually significant , manage as macrostriae.

Flap Dislocation

The risk factors:

Excessive lid squeezing.

Eye rubbing.

Excessive dry eye.

Presence of epithelial abrasion.

Poor intraoperative repositioning.

Excessive irrigation of flap.

Trauma.

Prevention: Check adhesion of flap at the end of procedure, Remind the patient not to squeeze or rub the eyes.

Management: Flap reposition, Suture the flap in the event of persistent fold, and use lubricants.

Dry Eye

One of the most common side effects of LASIK , 60-70% of all patients with varying degrees due to corneal denervation.

Prevention: Perform a thorough preoperative exam to discover dry eye syndrome and treat .

Management:

mild dry eye syndrome: frequent use of non-preserved artificial tears.

Severe dry eye syndrome: topical cyclosporine A, topical corticosteroid, oral tetracyclines, oral omega-3 fatty acids, and punctual occlusion.

Diffuse lamellar keratitis

. Also known as 'Sand of Sahara'

- Non infectious complication.
- Infiltration of inflammatory cells in the interface.

Possible causes:

- Retained meibomian secretions.
- Metallic debris.
- Talc from gloves.
- Lubricants on the microkeratome or blades.
- Topical medications such as anesthetics.
- Endotoxins.
- IL 1 released from injured or degenerated corneal epithelial cells.

Pallikaris I et al . Excimer laser in situ keratomileusis and photorefractive keratectomy for correction of high myopia. J refract Corneal surg 1994;10:498-510

Linebarger staging of DLK

Stage 1

- Fine white cells of granular appearance distributed in wave like fashion in periphery of flap
- Frequently occurs on day 1
- No decrease in BCVA

Ttt:

- Frequent administration of topical steroids

Stage 2

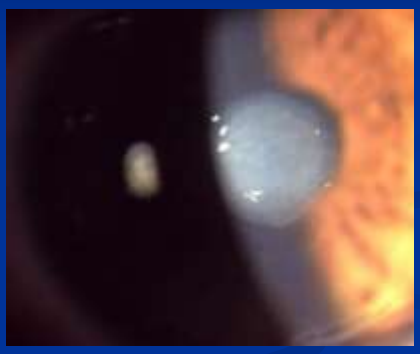
- Whitish cells of granular or wave like appearance in visual axis and possibly at the periphery
- Typically seen 2 or 3 days post Lasik
- No decrease in BCVA

Ttt:

- Frequent administration of topical steroids

Stage 3

- Increased density of cells in visual axis, more clumped than wave like
- Transparent peripheral cornea
- Seen on day 3 or 4
- Patient may describe fogginess of vision

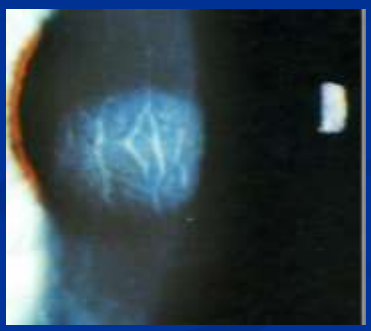


Ttt:

- Raise the flap and thoroughly irrigate with BSS
- Frequent administration of topical steroids

Stage 4

- Central corneal melting at interface by release of collagenase by aggregated inflammatory cells
- Scarring and folds in visual axis
- VA is decreased, hyperopic shift
- Irregular astigmatism



Ttt:

- When repair process has concluded, consider anterior lamellar keratoplasty

Pressure-induced Stromal Keratitis (PISK)

Late-onset interface opacity similar to DLK with visible fluid cleft in the interface as a result of elevated IOP because of prolonged corticosteroid treatment.

Management: rapid tapering or cessation of the corticosteroids and use of anti-glaucoma medication to lower IOP.

Central Toxic Keratitis (CTK)

Rare, acute, non-inflammatory complication of LASIK.

Fraenkel and colleagues first described CTK in 1989 as being inflammatory in nature but the condition has subsequently been recognized as a non-inflammatory process.

Etiology

Exact cause of CTK is ambiguous,

Among the most prominent suggestions in the literature are: Photoactivation of povidone-iodine by the excimer laser,

Laser-induced keratocyte apoptosis of corneal matrix , Intraoperative exposure to meibomian gland secretions,

Marking pen ink ,

Talc from latex surgical gloves ,

Post-surgical debris from the microkeratome blade.

Sonmez B et al. Central toxic keratopathy: description of a syndrome in laser refractive surgery. Am. J. Ophthalmol. 143, 420–427 (2007).

Symptoms

photophobia, pain, floaters, redness, halos, and reduced BCVA.

Signs

Dense central corneal opacification, stromal tissue loss, striae, and significant hyperopic refractive shift .

These signs typically begin on post-operative day 2-6.

This corneal opacity and hyperopic shift characteristically persists for 2-18 months before spontaneously resolving.

Management and Follow up

CTK spontaneously resolves within 18 months, close monitoring and regularly-scheduled follow-up .

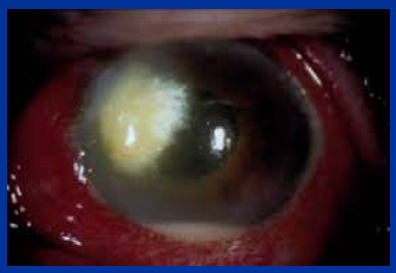
Although corticosteroids were used in the past, the recent discovery that CTK is non-inflammatory in nature with the fact that CTK is unresponsive to steroid therapy have discouraged the use of these medications in the management of CTK.

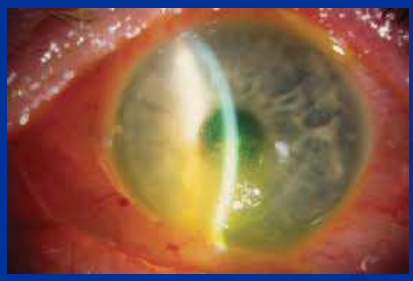
Infectious Kertatitis

One of the most vision threatening complications. The most common organisms are gram-positive bacteria followed by atypical mycobacteria and fungi.

Symptoms: decreased vision, pain, photophobia, and redness.

Prevention: Adequate sterilization of the instruments, preoperative treatment of blepharitis, use of sterile surgical technique, postoperative antibiotic prophylaxis.





Management:

Lift the flap, culture the interface, and irrigate with antibiotics.

Start empirical fortified treatment including vancomycin (50 mg/ml), tobramycin (14 mg/ml), or gatifloxacin, moxifloxacin.

Atypical mycobacteria: topical clarithromycin (10 mg/ml), oral clarithromycin (500 mg bid), and topical amikacin (8 mg/ml).

Fungal keratitis: Natamycin (50 mg/ml), amphotricin (1.5 mg/ml)

Epithelial Ingrowth

Risk factors :

poor adhesion of the flap edges, epithelial abrasions at the flap margin, buttonhole, free cap, ablation at edge of stromal bed, epithelial irregularity at flap edge, introduction of epithelial cells during the cut, inadequate irrigation, previous RK, reoperation.

Two types recognized:

Isolated epithelial pearls in the interface,

Epithelial sheet growing into the interface from the periphery.

Narvaez J, et al. Treatment of epithelial ingrowth after LASIK enhancement with a combined technique of mechanical debridement, flap suturing, and fibrin glue application. Cornea 25(9), 1115–1117 (2006).

Symptoms: reduced vision, irregular astigmatism, and risk of stromal melting.

Prevention: Avoid epithelial abrasion, remove epithelial cells and debris from the interface, and avoid wide ablation zone.

Management: No treatment for asymptomatic isolated nests, otherwise lift the flap and scrape both the underside and the stromal bed then reposit the flap.

Ectasia

One of the most devastating complications after LASIK.

Ectasia is suspected in patients who developed increasing myopia, with or without increasing astigmatism,

loss of UCVA with keratometric steepening, with or without central and paracentral corneal thinning,

topographic evidence of asymmetric inferior corneal steepening after LASIK.

Randleman JB et al. Risk assessment for ectasia after corneal refractive surgery. Ophthalmology 115(1), 37–50 (2008).

Ectatic changes can occur as early as 1 week or can be delayed up to several years after LASIK. The actual incidence of ectasia is undetermined, although the incidence rate of 0.04% to 0.2% to 0.6% has been reported.

Risk factors

Table 3.2: The ectasia risk score system for identifying eyes at high risk of developing ectasia after Lasik

Pattern	Points				
	4	3	2	1	0
Topography	Abnormal topography	Inferior steepening/ skewed radial axis		Asymmetrical bow tie	Normal/ symmetrical bow tie
RSB	< 240 µm	240 – 259 µm	260 – 279 µm	280 – 299 µm	≥ 300 µm
Age		18 – 21 yrs	22 – 25 yrs	26 – 29 yrs	≥ 30 yrs
CT	< 450 µm	451 – 480 µm	481 – 510 µm		≥ 510 µm
MRSE	> -14.00	> -12.00 to -14.00	> -10.00 to -12.00	> -8.00 to -10.00	-8.00 or less

Other risk factors include eye rubbing, family history of keratoconus, refractive instability, BCVA less than 20/20 preoperatively, and male gender.

Management:

CL, CXL, ICRs, keratoplasty

THANK YOU

See you next year

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