بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِيمِ

وَقُلِ اعْمَلُوا فَسَيَرَى اللّٰهُ
عَمَلَكُمْ وَرَسُولُهُ وَالْمُؤْمِنُونَ

Faculty of Medicine
Ophthalmology
Department

New Diagnostic Methods for Prevention of Post Lasik Ectasia

Essay
Submitted for Partial Fulfillment of Master Degree in Ophthalmology

Presented By
Yousra Salama Mahmoud Shehata
M.B., B.Ch. (Ain Shams University)

Supervised by
Prof. Dr. Ali Hassan Saad
Professor of Ophthalmology
Ain Shams Faculty of Medicine

Dr. Ahmed Hassan Samir Assaf
Assistant Professor of Ophthalmology
Ain Shams Faculty of Medicine

Faculty of Medicine
Ain Shams University
Cairo
2012

References

1. **Saad A,Lteif Y, Azan E, Gatinel D.** Biomechanical properties of keratoconus suspect eyes.
   Invest ophthalmology vis sci. 2009 Dec.

2. **Nunez MX,Blanco C.** Efficacy of Orbscan Π and Pentacam topographers by a repeatability analysis when assessing elevation maps in candidates to refractive surgery.
   Biomedica, 2009.

3. **Randleman JB, Woodward M, Lynn MJ, Stulting RD.** Risk Assessment for ectasia after corneal refractive surgery.
   Ophthalmology, 2008 Jan.

4. **Bamashmus M, Saleh MF, Abdelrahman M, Al. Kershy N.** Reasons for not performing LASIK in refractive surgery candidates in Yemen.
   Eur Jophthalmology, 2010 Mars.

5. **Robert SF, Christopher JR.** The preoperative evaluation before LASIK, Corneal topography, management of decentered flap and treatment of Central Island. The LASIK handbook: a case-based approach. (2006); 9-11, 69-72, 96-102 and 110-112.

6. **Ambrosio R, Wilson SE**. Complications of laser in situ keratomileusis: etiology, prevention, and treatment. J Refract Surg (2001); 17:350-379.
7. **Balamurali KA, Carlson AN**. Preventing LASIK buttonholes steep corneas and surface dryness**.** Review of Refractive Surgery.(2002); 03:1-3.
8. **Belville JK, Smith RJ.** Preoperative work-up: Indications and Contraindications for laser in situ keratomileusis. LASIK techniques: pearls and pitfalls. (2003); 36-40.

9. **Chen et al**. Risk factors for keratectasia after lasik. Clin Experiment Ophthalmol. (2007) Jan; 34-44.

10. **JoAnn AG, Simon KL, Joseph C.** The Ocular Response Analyzer. Pearls of Glaucoma Management. (2009); 98-100.

11. **Jorge LA, Dimitri TA.** Bilateral keratectasia after unilateral LASIK, Causes and management of ptosis after lasik. Management of Complications in Refractive Surgery.

كلية الطـــــــــــــب
قســـم طب وجراحة العيون

الطرق التشخيصية الحديثة للوقاية من ترقق القرنية بعد عملية الليزك

رسالة

توطئة للحصول على درجة الماجستير فى طب وجراحة العيون

مقدمة مـــــن

الطبيبة/ يسرا سلامة محمود شحاتة

بكالريوس طب وجراحة
جامعة عين شمس

تحـــــت إشـــــراف

أ.د / علي حسن سعد

أستاذ طب وجراحة العيون

كلية الطب – جامعة عين شمس

د / أحمد حسن سمير عساف

أستاذ مساعد طب وجراحة العيون

كلية الطب – جامعة عين شمس

كلية الطب- جامعة عين شمس
القاهرة
٢٠١٣

الطرق التشخيصية الحديثة لمنع ترقق القرنية بعد عملية الليزك

الليزك هو أكثر عملية تصحيح ابصار شيوعا في العالم حيث يستخدم مبضع دقيق لرفع طبقة رقيقة من القرنية ومن ثم يستخدم الاكسيمر ليزر لنزع كميات دقيقة من النسيج الداخلي للقرنية لتصحيح الابصار.

من أهم مضاعفات عملية الليزك **ترقق القرنية** وهو ترقق غير ملتهب و بروز للقرنية ويسبب ضعف في الرؤية.
مرضي ترقق القرنية يعانون من زيادة في قصر النظر والاستجماتزم وفقدان الارتفاع الأمامي والخلفي للقرنية بسبب الانحدار الزائد للقرنية الذي يحدث في منتصفها أو الجزء الأسفل منها.

نسبة حدوث ترقق القرنية بعد عملية الليزك تتراوح بين ٠,٠٤% الي ٠,٦٦%. وهذه التغيرات يمكن أن تحدث في خلال اسبوع من العملية او قد تتأخر لمدة سنوات.

تقييم المرشحين قبل عملية الليزك هو الدعامة الرئيسية لتحقيق نتائج ناجحة.

توجد طرق متعددة لمنع ترقق القرنية بعد عملية الليزك مثل:

جهاز البنتكام و الأورباسكام: الارتفاع الأمامي والخلفي للقرنية هو المقياس المستخدم للكشف عن حالات الاشتباه في القرنية المخروطية.
قياس الارتفاع الأقصي الخلفي بواسطة الأورباسكام ويعتبر أقل دقة بواسطة البنتكام. يمكن تقليل نسبة الخطأ باستخدام متوسط ثلاث قياسات ويمكن ان تكون بمثابة دليل في البحث عن اجهزة التشخيص الخطأ في جميع القياسات.

محلل استجابة العين: قياس خصائص النشاط الحيوي للقرنية قد يساعد في الكشف عن حالات الاشتباه في القرنية المخروطية وتقلل نسبة حدوث ترقق القرنية بعد عملية الليزك.

التبوجراف: لتحديد وتحليل الاسباب التي لا تناسب المرضي المحتاجين الي تصحيح عيوب الابصار جراحيا.

تصنيف راندلمان: لتحديد العوامل البيئية لحدوث ترقق القرنية بعد الليزك ولتقليل نسبة حدوثها.

الهدف من الرسالة: اظهار الطرق الحديثة لمنع ترقق قرنية العين بعد عملية الليزك بواسطة اختيار الاشخاص المناسب لهم عملية الليزك وتجنب الاشخاص الغير مناسبين لعمل الجراحة.

LASIK

LASIK

1.1 Introduction

LASIK (laser in situ keratomileusis) is a surgical procedure designed to correct refractive errors. LASIK involves creating a corneal flap using a microkeratome, reshaping the cornea using an excimer laser to remove tissue from the underlying stromal bed and then replacing the flap. **(Pallikaris, et al., 2003)**

1.2 History of LASIK

LASIK evolved from a variety of techniques in refractive surgery. Keratomileusis, with both freeze and non-freeze techniques was used in the USA in the 1970s. This procedure was followed by automated lamellar keratoplasty (ALK), in which a microkeratome was used to create either a free cap or a hinged corneal flap. Tissue from the corneal bed was removed to alter the refractive error and the flap was replaced. Keratomileusis and ALK were relatively imprecise mechanical techniques. After the ophthalmic excimer laser was developed, it was used to reshape the cornea in a technique called photorefractive keratectomy (PRK). LASIK combines the technique of creating a hinged corneal flap from ALK with excimer laser ablation from PRK Figure (1.1).

Potential advantages of LASIK over PRK include earlier postoperative stabilization and faster improvement of visual acuity; less postoperative patient discomfort; shorter duration of postoperative medication use; and an easier enhancement procedure. **(Hamilton, et al., 2002)**

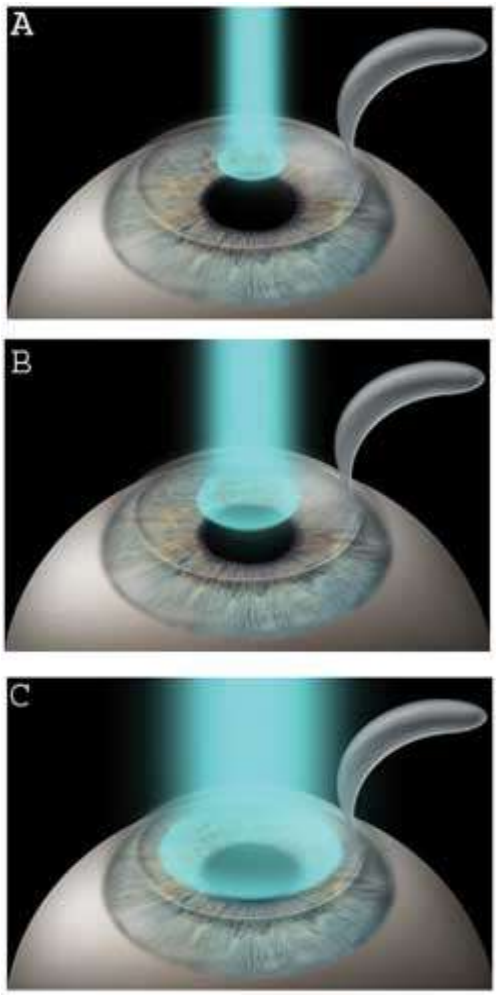

Figure (1.1) Ablation **(Hamilton, 2002)**

1.3 Indications of LASIK

1. Myopia : up to -8 to -12
2. Hypermetropia : up to +5
3. Astigmatism: up to 4.0 of regular astigmatism. **(Belville and Smith., 2003)**

The surgeon and patient should decide whether LASIK is indicated based on a full preoperative evaluation and consideration of goals and alternatives, including spectacles, contact lens, and phakic intraocular lens implantation.

1.4 Contraindication

Unfortunately LASIK cannot rectify all vision impairments - even when they lie inside the correctable refraction values. Other contraindications apply beside the strength of vision impairment. For LASIK there are two forms of contraindications - definite and indefinite. Definite contraindications make the LASIK surgery impossible, indefinite contraindications must be taken into serious consideration before making the decision to undergo LASIK. **(Dimitri and Douglas, 2002)**

1.4.1 Definite contraindications of LASIK

- Diseases of the cornea (e.g. keratoconus, degeneration.)
- Acute eye diseases (e.g. Diabetic retinopathy, developed glaucoma).
- Pregnancy and breastfeeding.
- Patients under 18 years (eye still growing.)
- Instable refraction values (increasing diopter values.)
- Astigmatism > 5 Diopter.
- Corneal thickness < 500 µm. **(Shehzad., 2004)**

1.4.2 Indefinite contraindications of LASIK

- Retinal defects (e.g. Holes, retinal detachment) .
- Eye disease (e.g. High interocular pressure, begin of diabetic alterations, chronic infection).
- System diseases (e.g. Auto immune deficiency, rheumatism) .
- General bad health (e.g. chronic health problems, acute allergies). **(Perry, et al., 2002)**
- Patients under 18 years (eye still growing.)

1.5 Preoperative Evaluation

Preoperative evaluation for refractive surgery follows a structured sequence that includes patient interview followed by a complete ophthalmologic examination. The aim of preoperative evaluation is to answer three broad questions in addition to generating specific refractive data for the actual treatment:

1. Is it possible to safely perform refractive surgery in the patient?
2. What is the risk of possible complications?
3. Is it possible to meet the expectations that the patient has from the surgery? **(Shehzad, 2004)**

1.6 Complete Ophthalmic Examination

It includes UCVA, BCVA, and refraction (after cycloplegia with 1% cyclopentolate eye drops). Cycloplegic refraction is important to uncover pseudomyopia due to spasm of accommodation and latent hyperopia, the extent of myopia and astigmatism determine the choice of excimer laser as well as whether wave front-guided surgery. **(Haw and Manche., 2001)**

If the patient wears contact lenses, he must stop wearing the lenses for a few weeks before the examination, usually:

- 3 weeks for soft daily wear lenses.
- 6 weeks for gas permeable and extended wear soft lenses.
- 8 weeks for [PMMA] hard plastic lenses. **(Belville and Smith., 2003)**

1.7 Flap Thickness

LASIK flaps are cut with either mechanical microkeratomes or femtosecond lasers. Mechanical microkeratomes are typically labeled for nominal cut depths of between 120 and 180 µm. There is a trend to cut thinner flaps with the newer microkeratome models, which are more precise. Thinner flaps preserve greater stromal bed thickness and reduce the risk of ectasia. Femtosecond lasers tend to create more precise and uniform flap thickness, and settings of 100-120 µm are typically used. A residual posterior stromal thickness of at least 270-300µm is recommended to reduce the risk of post-LASIK ectasia. Some surgeons also believe that the stromal bed should be at least half of the original corneal thickness. To help ensure an acceptable final postoperative residual stromal thickness, stromal bed can be measured by intraoperative ultrasound pachymetry. Anterior segment optical coherence tomography (OCT) can be used to measure flap and stromal bed thicknesses. Flap thicknesses can deviate significantly from the nominal setting and routine measurement can help the surgeon evaluate the range of actual thickness obtained. **(Ambrosio, et al., 2001)**

1.8 Surgical Technique

Before surgery the excimer laser, suction ring, microkeratome and blade (or femtosecond laser settings), are checked by the technician and the surgeon. The surgeon also confirms that the correct treatment data are entered into the laser computer. An eyelid speculum is placed in the operative eye, which has been anesthetized with drops, and the fellow eye is covered. The cornea is marked to aid in postoperative flap alignment.

A suction ring is placed on the eye to achieve fixation.

The microkeratome (or femtosecond laser) is used to create a hinged corneal flap. After the flap has been created, it is reflected away from the cut surface. Excimer laser ablation is performed, centered on the pupil. Eye-tracker and iris registration technology are increasingly used to ensure a well-centered laser treatment. Following the excimer laser, the flap is replaced. **(Ambrosio, et al., 2001)**

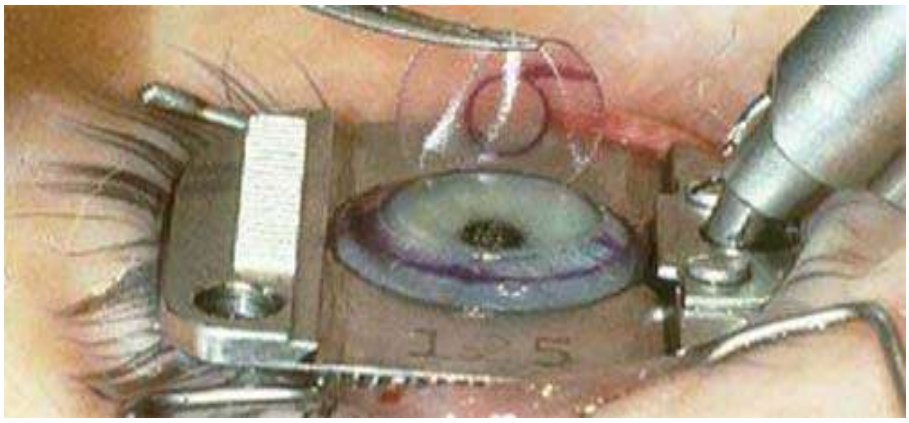

Figure (1.2) Lasik technique **(Dimitri & Douglas, 2002)**

1.9 Postoperative Care

Patients may have mild postoperative discomfort for 4 to 6 hours following LASIK treatment, during which time they should keep their eyes closed and rest or take a nap. Patients should not rub their eyes after surgery. Steroid and antibiotic drops are used for 4 to 10 days after surgery. Preservative-free tears may be used for weeks to months depending on dry eye symptoms and corneal punctate staining. Refractive stabilization for myopes take up to 3 months depending on the amount of treatment performed. Residual refractive error can be corrected after stabilization, typically by relifting the flap and ablating the stromal bed in a retreatment procedure (also called an enhancement). To ensure preservation of at least 250μm of residual bed thickness after laser

retreatment, preoperative OCT or intraoperative ultrasound pachymetry could be performed. **(Rad, et al., 2004)**

1.10 Outcomes of LASIK for Myopia and Astigmatism

For the correction of low to moderate myopia of less than -6D and low to moderate astigmatism of less than 2D, results from studies in the literature have shown that LASIK is effective and predictable in terms of obtaining very good to excellent uncorrected visual acuity and that it is safe in terms of minimal loss of visual acuity. For higher degrees of myopia and astigmatism, the results are more variable.

1.11 LASIK Risks

- **Over/under correction**

With LASIK eye surgery, overcorrection and under correction are both possible. These and other potential laser eye surgery complications can usually be attributed to the fact that corneas can vary greatly from patient to patient, in terms of water content, healing ability, and other variables that are beyond the control of the surgeon. While extreme cases of over- or under correction may necessitate further treatment, mild cases can be effectively addressed by wearing glasses when necessary. **(Kohnen, et al., 2000)**

- **Infection**

As with any surgery, a risk of infection is possible with LASIK. If left untreated, eye infections can result in scarring on the cornea or significant and permanent loss of vision. However, eye infections from LASIK surgery are very rare. Antibiotic eye drops are normally prescribed after surgery to prevent infections, and patients should schedule regular post-

operative visits to make sure eyes heal properly treatment. **(Sekundo, et al., 2003)**

- **Flap Wrinkles**

Small folds in the corneal flap are among the most common complications of LASIK surgery, but the surgeon can easily identify and remove them. Also, within the first few hours following surgery, wrinkles can form in the corneal flap if the patient tightly shuts the eye. The surgeon can fix this by re-laying the corneal flap to smooth out any wrinkles. However, flap wrinkles are a rare laser eye surgery complication and occur in less than 1 percent of cases. **(Wiegand, et al., 2003)**

- **Central Corneal Islands**

Central corneal islands are small areas of raised tissue that show up on the cornea when the laser used during surgery does not remove tissue uniformly. This type of complication occurs in less than 1 percent of LASIK cases, and can usually resolve itself after a few months. If central islands persist, the surgeon may prescribe contact lenses to smooth out the cornea surface or a laser touchup if necessary. **(Mattausch, et al., 2003)**

- **Epithelial Ingrowths**

Another LASIK risk occurs when cells from the corneal epithelium start growing under the corneal flap. In some cases, these epithelial ingrowths will stop growing, die, and be absorbed into the cornea. But if the epithelial cells continue to grow, they can significantly affect vision. To treat this, the surgeon must lift the LASIK flap and remove the ingrown

cells. However, this eye complication happens in less than 1 percent of LASIK cases. **(Pallikaris, et al., 2001)**

- ## Corneal Ectasia

Corneal ectasia refers to a weakened cornea that may bulge out months after LASIK surgery. This occurs when the surgeon makes too deep an incision during the flap creation process or removes too much corneal tissue during surgery. Ectasia can only be treated with a corneal transplant. If left untreated, the patient may have a recurrence of nearsightedness or astigmatism. This LASIK complication is rare and can be prevented if the thickness of a patient's cornea is measured prior to surgery. **(Kymionis, et al., 2001)**

- ## Diffuse Lamellar Keratitis (DLK)

Diffuse lamellar keratitis (DLK) is a post-operative LASIK risk that occurs when foreign bodies become trapped behind the corneal flap. Patients with DLK may experience pain, sensitivity to light, blurred vision, or the sensation that there is something trapped in their eye. Some patients experience no symptoms at all, but DLK can be detected during follow-up examinations after surgery. Symptoms typically present themselves within a week of LASIK surgery, but DLK complications have been known to occur even years after surgery if patients experience corneal trauma. Patients who experience any sort of eye trauma should be evaluated by an eye care professional. Though DLK is one of the more dangerous post- LASIK risks, it is easily treatable with topical and oral medication when caught in its earlier stages. **(Rad, et al., 2004)**