Laser refractive surgery

A guide for GPs

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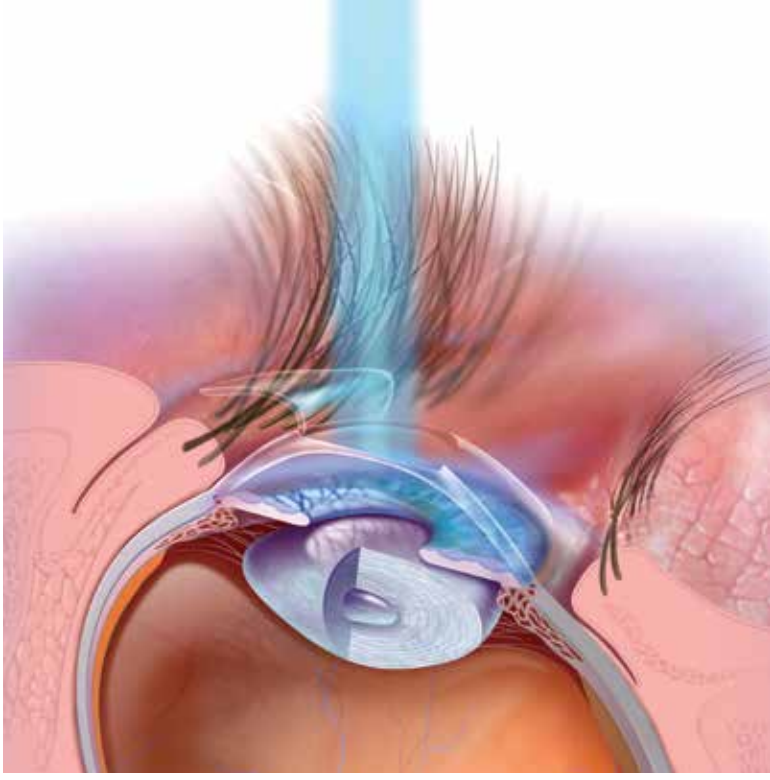

Evolving technology, improved diagnostic criteria and surgeon experience continue to refine the safety profile of laser refractive surgery and enhance refractive outcomes. Despite the availability of information from refractive surgeons and the internet, the GP retains an important role in patient education and ongoing patient care.

Laser refractive surgery is now an established option for patients seeking independence from glasses. With excellent patient satisfaction and millions of procedures previously performed worldwide, refractive surgery is considered to be among the most successful elective procedures;[1] yet achieving an optimal outcome after surgery remains a concern. This is discussed below with reference to the GP as an important source of guidance.

Assessment of suitability

Carefully selecting patients for laser refractive surgery is critical to minimising complications and optimising patient outcomes. The risk of complications may be mitigated through a thorough clinical assessment.[2] The relative and absolute contraindications to surgery are listed in the Table and are briefly discussed below with particular focus on when GP input can be important.

MedicineToday 2016; 17(10): 59-62

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Refractive stability

Refractive stability for a period of 12 months is paramount to obtaining excellent long-term refractive outcomes. The GP remains the central figure in a patient's health assessment and thereby remains in a pivotal position to provide a clear and concise patient history. Recording a patient's use of optical aids and his or her ocular history is essential.

Dry eye

Dry eye syndrome is particularly common in active patients and may lead to a poor healing response after laser surgery. Concurrent medications should be considered, as a range of medications may be contributory.[3] Retinoic acid derivatives such as isotretinoin for acne and vitamin A for psoriasis, antidepressants and antihypertensive agents represent examples of medications that may lead to dry eye syndrome.

Autoimmune disease

Autoimmune diseases such as rheumatoid arthritis, Sjögren's syndrome and Crohn's disease can also have an impact on ocular status. There is evidence that if the disease is systemically well controlled with minimal ocular signs then laser surgery may be appropriate.[4,5] Preoperative assessment and subsequent management of systemic disease is therefore imperative. GPs can play a vital role alongside tertiary assessment in informing, diagnosing and treating patients. Postoperative management of systemic disease is essential in helping to maintain the ocular surface and the patient's comfort.

Preoperative expectations

Patient satisfaction after laser refractive surgery is high overall; however, the patient's perception of the success of the surgery is significantly related to his or her preoperative expectations and psychological characteristics.[6] Patients with unrealistic expectations should be identified and alternative treatments, if

TABLE. RELATIVE AND ABSOLUTE CONTRAINDICATIONS FOR LASER REFRACTIVE SURGERY

Relative contraindications	Absolute contraindications
• Dry eye symptoms (moderate symptoms may be managed perioperatively and postoperatively with lubricants, punctual plugs or anti-inflammatory treatment) • Recurrent corneal erosions (these patients may be more suitable for photorefractive keratectomy procedures although mild cases may be managed at the time of surgery) • History of herpes simplex keratitis or herpes zoster ophthalmicus • Atopic disease • Autoimmune disorders • Thin corneas (dependent on patient preoperative refraction) • Glaucoma • Pregnancy	• Unstable refraction (> 0.5 dioptres change over past 12 months) • Inadequate central corneal thickness (dependant on ablation depth) • Keratoconus • Abnormal or irregular corneal topography • Significant corneal scarring • Visually significant cataract • Uncontrolled ocular or systemic disease • Unrealistic patient expectations

appropriate, should be explored. Inappropriate expectations may include expectations of improved visual quality in the case of extreme refractive errors or concurrent eye conditions.

Presbyopia is not a contraindication to surgery, however it is an essential component of the surgeon–patient discussion if it is relevant because of the patient's age. Additionally, occupational requirements should be considered. Leaving one eye slightly myopic (monovision) remains an excellent option for some patients with presbyopia; however, this may rule a patient ineligible for a heavy vehicle licence. Similarly, laser refractive surgery may not be acceptable for patients who hold some military positions.

Avoiding suboptimal outcomes

Preoperative assessment and counselling is essential to help patients avoid postoperative anxiety. Up to a quarter of patients may not be suitable for laser refractive surgery, which is consistent with the authors' experience.[7,8] The surgeon must be prepared to suggest that the correct option may be to not proceed to surgery. A detailed discussion of potential complications and suboptimal outcomes is essential. The GP is encouraged to participate in managing patient expectations and care.

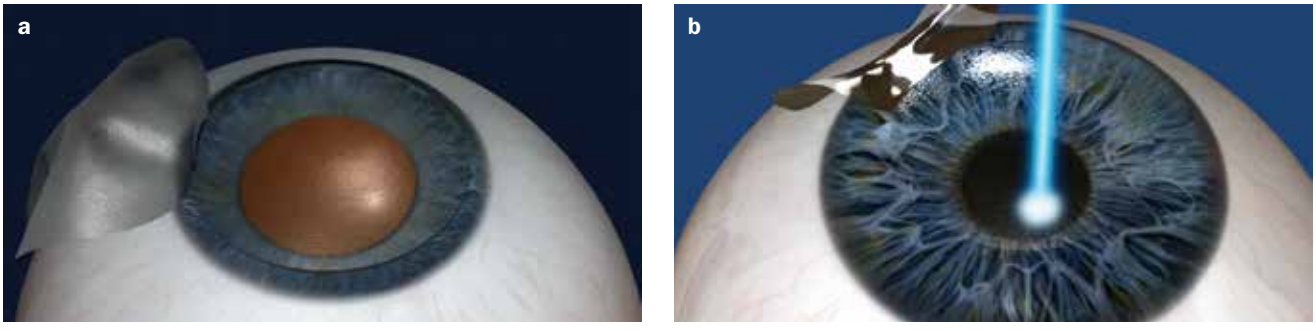
Refractive surgery options

Change is created by altering the shape of the cornea. This is achieved by altering the stroma, the middle corneal layer. In broad terms, laser refractive techniques differ by how the stromal layer is accessed and the tissue modified.

Laser in situ keratomileusis (LASIK) remains the mainstay of refractive surgery. In this procedure, a corneal flap is created using a femtosecond laser or manually using a microkeratome. The surgeon lifts this flap back to allow the excimer laser to reshape the exposed corneal bed. The flap is then replaced. No sutures are required to maintain flap position (Figures 1a and b).

Photorefractive keratectomy (PRK) was the initial laser refractive procedure developed. Unlike LASIK, with this technique the surgeon exposes the stromal bed by manual removal of the corneal epithelium. After surgery, a bandage contact lens is placed on the eye for comfort and protection while the epithelium regenerates, which occurs during the next two to three days (Figures 2a to c).

Small incision lenticule extraction (SMILE) is a more recently developed laser refractive surgical technique. The surgeon creates a small disk within the corneal stroma using the femtosecond laser and then manually removes this through the



Figures 1a and 1b. Laser in situ keratomileusis (LASIK). a (left). A corneal flap is produced using a femtosecond laser. b (right). Once the flap is opened, the excimer laser proceeds to reshape the exposed corneal stroma. Once complete, the flap is put back in place.

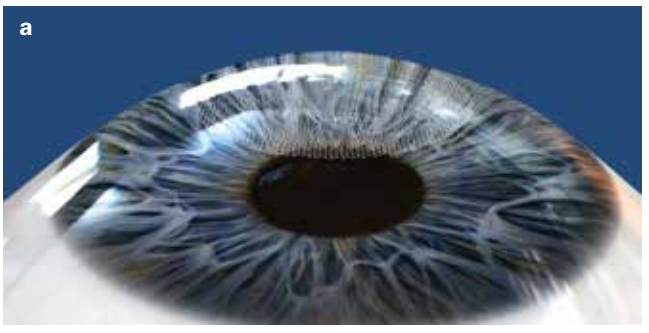
Figures 2a to 2c. Photorefractive keratectomy (PRK). a (top left). Surface ablation requires the removal of the epithelial layer. b (top right). The excimer laser is then applied directly to the corneal stroma. c (left). Once complete, a bandage contact lens is placed over the exposed corneal bed until re-epithelialisation occurs (by 72 hours).

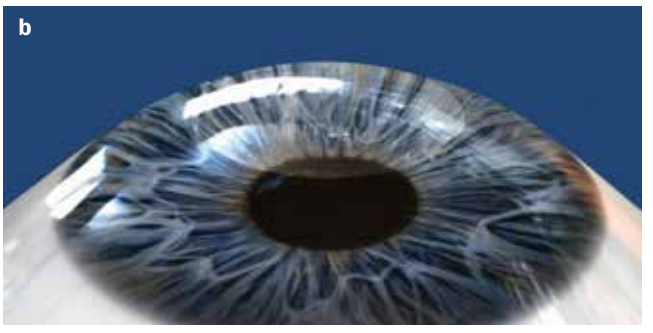
laser-created incision in the corneal epithelium (Figures 3a to d).

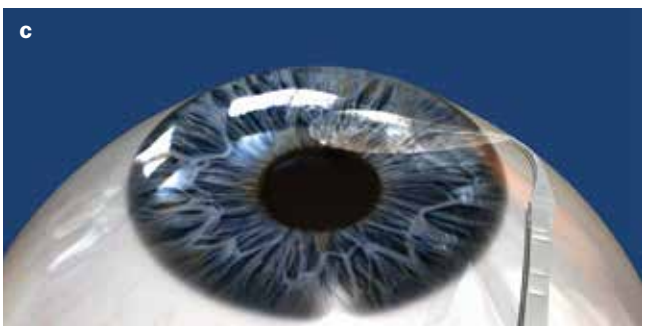
Patient suitability

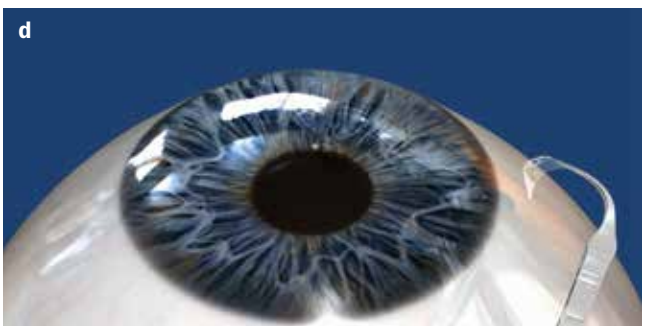
Most patients are suitable for LASIK surgery. Patients with thinner corneas or subtle corneal irregularities, including dry eye, may benefit from PRK or SMILE.

Patients with refractive errors falling outside the effective range of laser refractive surgery may benefit from an intraocular approach such as an implantable collamer lens (phakic intraocular lens). This lens is placed immediately behind the iris and in front of the natural lens. Intraocular surgery carries additional risks that should be discussed with the patient if this type of surgery is contemplated.

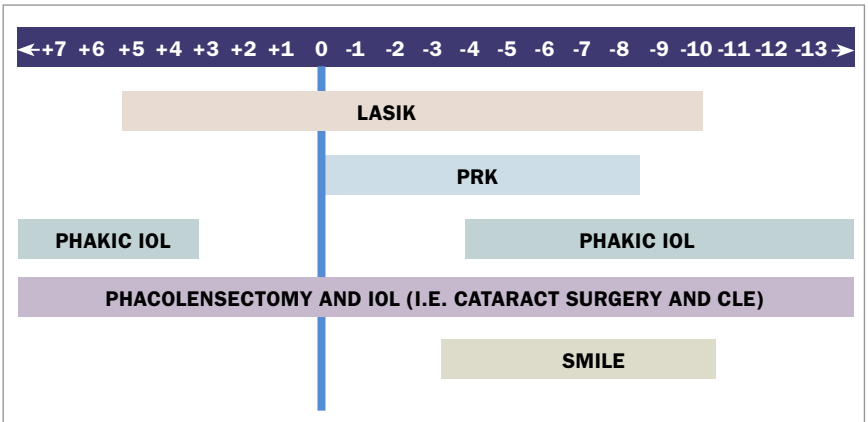








Figures 3a to 3d. Small incision lenticule extraction (SMILE). a and b (top). The femtosecond laser creates an intrastromal disk within the corneal stroma. c and d (bottom). The corneal disk is removed and discarded, and no sutures are required to close the pocket.



Abbreviations: LASIK = laser in situ keratomileusis; PRK = photorefractive keratectomy; IOL = intraocular lens; CLE = clear lens extraction; SMILE = small incision lenticule extraction.

Figure 4. Advised refractive ranges, in dioptres, for refractive surgery techniques.

A diagnosis of cataract suggests a contraindication for primary corneal laser surgery; however, residual refractive error after lens replacement may be treated effectively with a laser procedure if the patient remains motivated to achieve optical independence. Figure 4 shows the suitable ranges for each surgical procedure.

How the lasers work

The most common laser employed for refractive laser surgery is the excimer laser, which provides a tightly focused beam of ultraviolet light to the cornea. Excimer lasers are considered 'cool' lasers in that they do not generate heat which may then be passed on to the surrounding air or unintended surfaces. The laser works by directing light to the targeted area. The energy created at the surface results in the local breakdown of intermolecular bonds, which leads to tissue removal. Lasers are guided by computer algorithms to optimise the efficiency of ablation and to ensure adequate tissue is removed to achieve the required refractive effect.

Figure 5. Infection of the eye after laser in situ keratomileusis (LASIK); note the acute redness, corneal haze and hypopyon (pus in the anterior chamber).

In the LASIK and SMILE procedures, a femtosecond laser is used to separate the corneal layers through a process that is broadly similar for both. A pulse of laser energy is focused to a precise location within the cornea. The local response generates a microplasma bubble at the point of laser which, when connected with subsequent laser pulses, expands to create the resection plane. This is then manually separated by the surgeon before laser reshaping (if required).

Postoperative management

LASIK intraoperative complications are rare, with a reported incidence of between 0.16 to 0.31%.[9,10] These values have remained relatively consistent over the past decade and reflect stability of technique, gradual refinement of technology, and surgeon awareness and experience. Patients remain under the care of the primary surgeon until discharge, however the GP should remain aware of potential complications.

Infection remains a serious complication and may lead to severe discomfort, photophobia and vision loss (Figure 5). Infection is most likely to occur in the initial one to two weeks after surgery, if at all. Immediate referral to the ophthalmologist or emergency department is essential for optimal management.

Dry eye is a significant problem after laser refractive surgery. Up to 95% of patients will report at least one dry-eye related symptom immediately after LASIK surgery, although significantly fewer patients will require treatment.[11,12] Dry eye symptoms peak during the first months after surgery before gradually decreasing over the first year. Typical symptoms include mild irritation, discomfort, photophobia and visual fluctuations. Ongoing use of ocular lubricants may be necessary for some patients.

Posterior ocular complications such as retinal detachment, macular hole and macular haemorrhage have been reported after LASIK, although without conclusive evidence for LASIK being a direct cause in most cases.[13,14] Patients may report the appearance of continuing flashes or floaters and/or a corresponding decrease in vision. Once again, immediate referral is paramount.

Conclusion

Corneal laser surgery has been available to Australian surgeons for approximately 25 years and represents a safe and effective alternative to glasses or contact lenses in suitable patients. As a primary source of health care, the GP is in a central position to influence preoperative counselling and management of conditions that may impact on surgical outcomes. MT

References

A list of references is included in the website version of this article (www.medicinetoday.com.au).

COMPETING INTERESTS: None.

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