A GENERAL GUIDE TO REFRACTIVE SURGERY CO-MANAGEMENT FOR OPTOMETRISTS

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INTRODUCTION:

This research paper is intended as a general refractive surgery co-management guide for optometrists. Through the course of the paper, various aspects of laser intrastromal keratomileusis (LASIK) and photorefractive keratectomy (PRK) refractive surgery will be discussed including initial patient consultation and evaluation, pre and post-operative care, the steps necessary to perform the procedures and a comparison between LASIK and PRK.

Currently it is estimated that optometrists control 70% of potential refractive surgery patients. Being able to effectively co-manage refractive surgery patients introduces a profitable and satisfying opportunity for professional growth.

DEMOGRAPHICS: WHO WANTS THE PROCEDURE?

Jeffery J. Machat M.D. has performed more than 10, 000 laser refractive surgeries, including 3, 000 LASIK procedures. He states that only 5% to 10% of myopes will ever seriously contemplate refractive surgery, and only 1% to 2% will ever proceed with highly evolved procedures utilizing the excimer laser, even when its' availability increases. All patients who consider refractive surgery are in fear of loosing their sight, and must have sufficient motivation to proceed with an elective surgical procedure.[1]

The mean age of refractive surgery patients is 35 years, with a range from 18 to 60.[1,2] More men than women go through these procedures, although the difference is slight.

Candidates usually fall into three categories. The first is young males age 20 to 25 who are interested in seeking careers in law enforcement or involved in sport activities. The second group are men and women in their thirties who have a primary motivation to reduce their dependence on glasses and contact lenses. The third group consists predominantly of women over age 40 who have increased intolerance to contact lense wear.

In a survey of 500 refractive surgery candidates, those between the age of 31 to 35 showed the most interest at 76%. The next highest were 20 25 year old at 67%.[4]

Patients who are current contact lens wearers, contact lens dropouts or those who have considered contact lenses show more interest in refractive surgery than the average spectacle wearer. There were varying degrees of interest between different types of contact lens wearers. Patients who wore planned replacements showed the greatest interest at 73% vs 59% for RGP patients.

CONSULTATIVE PROCESS:

The purpose of the consultative process is to deal with two issues, patient expectations and patient complications.

Defining the goals and limitations of PRK and LASIK is one of the most important aspects of the pre-operative consultative process. A patient must be educated that successful surgery is not based on 20/20 vision alone. The aim of surgery is to reduce functional dependence on spectacles or contact lenses, with no guarantee that it will eliminate their need entirely. Even with good surgical results patients may need corrective lenses for certain activities including night driving or detailed and visually demanding near work. Patients often have the misconception that a laser will transform their ametropic eyes to emmetropic ones. Successful surgery is based on legal driving requirements (20/40), however most patients typically desire 20/25 vision or better post-operatively.[4]

Patient's expectations must be clearly expressed and written down so a candidate's suitability can be judged. They must also understand the limitations to the surgery. Success rates for PRK with less than 6.00 D of myopia is about 90% - 95% for 20/40 vision. This vision will allow patients to have vision good enough to be functionally independent of glasses.

Optometrists involved in refractive surgery co-management should know the importance of selecting a good surgeon. The confidence that a surgeon instills on you and your patients is a critical factor in the patient's decision making process. Look for a highly experienced surgeon who has excellent outcome analysis and a good working relationship with optometrists. If a patient knows that you will provide the pre- and post-operative care they will be willing to travel some distance for the procedure if the surgeon has an excellent success record.[5]

The referring optometrist should never try to oversell the procedure and offer unrealistic results. The decision to proceed with surgery is entirely up to the patient and the optometrist should only offer an unbiased presentation of information for the patient either to accept or decline. Optometrist can identify possible candidates, refer them to highly skilled surgeons and provide pre- and post-operative care, but they should never guarantee results.[1,6]

Complications after PRK and LASIK surgery will be discussed under post-operative management for each procedure.

PRE-OPERATIVE LASIK & PRK PATIENT EVALUATION

The pre-operative evaluation of the patient is essential, since it will determine if someone will make a suitable candidate for refractive surgery. The patient must meet the correct refractive criteria and lack any systemic or ocular health contraindications. More importantly, they should have reasonable expectations. Patients must understand the limitations of refractive surgery before embarking on an irreversible, elective procedure. Unrealistic expectations can lead to unhappy results both for the patient and the co-managing optometrist.

It must be stressed from the initial consultation visit through post-operative management that the goal of refractive surgery is to reduce a patient's dependency on glasses or contact lenses and not to make them completely free from their use.[2]

The pre-operative refractive error will often determine which refractive surgery procedure is more suitable. Ideal PRK candidates are those with mild to moderate amounts of myopia up to -6.00 D. Although approved for higher levels of myopia, its' predictability of long term refractive stability decreases significantly.

For mild myopes the uncorrected visual acuity should be less than 20/40 to justify the risks-benefits ratio from surgery. The rational for this is that legal driving vision in most places is 20/40. Patients must

understand this and have proper motivation (job requirements for law enforcement officers or airline pilots) if they choose to proceed.

Intermediate myopes (-4.00 to -6.00 D) do very well with PRK. Although, LASIK is a suitable choice in this range, patients face less associated procedure risks with PRK.

LASIK is capable of treating as much as -30.00 D. of myopia. The range of myopia that LASIK can be used for can vary on the surgeon, but generally it is the procedure of choice for myopia over -6.00 D.

MILD MYOPIA	**-1.00 TO -3.00 D**	**PRK**
MODERATE MYOPIA	**-3.12 TO -6.00 D**	**PRK/LASIK**
SEVERE MYOPIA	**-6.12 TO -30.00 D**	**LASIK**

Candidates should be over the age of 18 with a stable refractive error over the last year, with variations no greater than 0.50 D.

Presbyopic patients may be candidates for monovision surgery. This option should be explained to them and a trial frame demonstration in office and with soft disposable lenses to take home should be considered. Monovision will have an effect on several visual functions. There is a small decrease in high contrast binocular visual acuity (less than 1 Snellen line). Stereoacuity is reduced with a +2.00 D add in

the range of 80-100 seconds of arc. Near point task performance involving eye-hand coordination/stereopsis shows a 5% decrease after monovision.[4]

Contraindications to monovision include amblyopia or reduced BCVA in one eye and intermittent strabismus, in which monovision may lead to a break down in motor and sensory fusion.

Patients must be in good general health for PRK and LASIK. Systemic conditions that are potentially detrimental to corneal healing should be contraindicated. Relative contraindications include diabetes mellitus (Types I and II), atopy if clinically significant, and pregnancy. solute general contraindications include autoimmune diseases such as rheumatoid arthritis or systemic lupus erythema, conditions causing immunosuppression and systemic illness which may affect wound healing.

Patients with collagen cascular disease have a decreased risk of stromal melt with LASIK procedures versus PRK because the stroma is only exposed intraoperatively and the epithelium remains intact.

Ocular health should be thoroughly evaluated. Best corrected visual acuity should be better than 20/40 in both eyes as a general guideline.[1,4,2]

PRE-OPERATIVE EXAMINATION FOR LASIK AND PRK PATIENTS

Uncorrected visual acuity should be tested on all candidates. This is especially important in patients with mild amounts of myopia. The visual acuity of an uncorrected -1.00 D myope can range from 20/40 to 20/100, and this may determine if a patient meets the vision criteria for surgery.

Best corrected visual acuity is needed so a base line value can be used in comparison with best corrected acuities post-operatively. Many high myopes may only have best corrected visual acuities of 20/25 to 20/30, and this will not improve with refractive surgery. Also, in cases of high myopia and astigmatism, patients often obtain the highest level of vision with RGP lenses. These candidates may be disappointed with post-operative uncorrected acuity and should be properly educated.

Careful patient refraction is critical in order to avoid over and under corrections post-operatively. Both a manifest and cycloplegic refraction should be performed to negate any significant accommodative component.

Keratometry readings and refractive astigmatism should agree. Irregularities in keratometry mires demand further investigation.
Pupil measurement in light and dim conditions is necessary since large pupils pose the greatest risk for night vision complications.
Ocular dominance is determined since surgery is most often performed on the non-dominant eye first.

Anterior segment examination includes assessment of lids and lashes for signs of blepharitis. The cornea must be evaluated for clarity and signs of trauma, contact lens overuse, degenerative disease such as keratoconus and Fuch's endothelial dystrophy. Lens changes must be documented since they may limit post-operative acuity and in cases of cataracts, IOL surgery may be a better refractive option.

IOP should be measured pre-operatively. This can establish a baseline meausrement before topical steroids are used in the healing process.

Corneal pachymetry is measured since corneal thickness will indicate the functional capacity of the endothelium. Patients with compromised endothelial cell functioning should be not undergo refractive surgery.

Pre-operative corneal topography has become the standard of care and helps to distinguish existing corneal pathology. It is helpful in identifying both early keratoconus and forme fruste varieties and also incidence of corneal warpage due to prolonged soft lense use.[1,2,4,5,7]

Highly myopic patients have a higher risk for retinal pathology. A complete retinal examination with scleral indentation should be performed on all candidates to rule out existing pathology. Patients must understand that their risk for myopic degeneration and peripheral retinal pathology will not decrease after surgery and that annual examinations are still necessary.

LASIK PROCEDURE

Prior to surgery the eye is anesthetized with topical proparacaine or tetracaine. Topical pilocarpine 1% is used to constrict the pupil and aid in patient fixation. The lids are draped so they do not obstruct the microkeratome. A speculum is introduced to provide maximum orbital exposure. The cornea is marked in a radial pattern with Rose Bengal stain in order to correctly re-align the corneal flap once the procedure is completed.

A suction ring is then placed into the intra-palpebral fissure which increases intraocular pressure (IOP) between 65 to 80 mmHg, stabilizes the cornea, provides a track for the microkeratome and determines the diameter of the corneal flap.[3,8]

The microkeratome, best described as a small carpenter's plane, is pre-fitted with a plate that determines the thickness of the resected corneal flap. Once engaged the microkeratome advances across 80% of the cornea in a nasal direction creating a hinged flap. The increase in IOP causes the patient's vision to grey out, preventing him or her from visualizing or feeling the procedure. Removal of the suction ring and reflection of the corneal flap introduces a smooth stromal bed for ablation. The corneal flap is periodically hydrated during the excimer procedure.

The programmed amount of stromal ablation based on the patient's level of myopia and astigmatism occurs next with the surgeon observing for corneal centering and an even ablation rate. Once completed the stromal bed is irrigated to reduce potential interface debris with filtered saline solution. The flap is then replaced to its original position using previously placed markings and the surgeon using a cellulose sponge to and tighten its' adherence to the cornea.[9]

topical antibiotic solution is instilled in the eye. Authors have advocated the use of both an eye patch or a clear shield to protect the

flap during the initial postoperative period. Some surgeons believe that a patch is contraindicated since the pressure it creates can displace the flap. The eye shield is used during sleeping hours for the first 7 days.

LASIK POST-OPERATIVE CARE:

It is advisable for patients to rest for the remainder of the day following surgery. A clear eye shield should be used during sleeping hours for the first week after surgery to prevent accidental displacement of the corneal flap.

Immediate post-operative medications include a broad spectrum antibiotic administered four times daily from four to seven days. Fluoroquinolones are recommened because they readily penetrate the corneal stroma.[10] A mild steroid drop can be used for extreme flap or stromal edema up to four days post-operatively. A non-preserved artificial tear supplement can be used every two hours or as needed if there is increased eye discomfort or dryness.

Follow up appointments include day 1 to specifically examine the corneal ap, and at 1 week to determine the refractive and visual performance. Patients return again at 1, 3, 6 and 12 month intervals for monitoring of refractive stability.

Day 1 post-operative testing includes assessment of uncorrected visual acuity and slit lamp exam. Typical visual acuity ranges from 20/40 to 20/60. Moderate myopes may present with acuities better than 20/30.[1] Vision will fluctuate greatly over the fist few post-operative days. The pre-operative level of myopia is a strong determinant in both the final outcome and speed of visual recovery. Patients under -9.00 D of myopia proceed with good results. Above this level results can vary, patients above -15.00 D usually may require enhancement procedures to obtain optimal visual acuities.[9]

Slit lamp examination focuses on the central cornea, the cap and the cap-cornea interface. Lid edema and/or subconjunctival hemorrhages may be present and are secondary to the pneumatic suction apparatus.[8]

The central cornea may reveal signs of edema and superficial punctate keratitis (SPK) caused by the epitheliotoxic effects of the dye used to mark the corneal flap alignment. Examine for signs of epithelial defects.

When examining the cap check for areas of overlap between the cap and intact cornea, referred to as corneal shelving.[2] There is a possibility for epithelial in-growth under the cap if proper adherence is not demonstrated here. Assess the cap to make sure there are no signs of wrinkles. Fluorescein dye can be used to detect any epithelial disruptions. Interface clarity is variable, small amounts of debris may be present. The debris is clinically insignificant both visually and physiologically for the patient. Sources of the debris include use of surgical powdered gloves and misused or overused blades which can produce fine metallic particles.[1]

t week 1, IOP can be measured. Acuities are measured and a careful subjective refraction is performed. Autorefraction is not recommended since it tends to over minus patients. Early hyperopia is ideal at this time since regression occurs in the majority of patients. The amount of regression varies with pre-operative refractive status, age and differences in individual healing patterns. Average ranges of +1 to +3 D are common.

Disposable contacts may be needed for under correction or regression. They can be fitted after the first post-operative week. Rigid gas permeable (RGP) lenses should not be used since they may alter corneal topography results, which may be necessary if future enhancement surgery, is needed.

The interface should nearly be imperceptible after the first week. With time, the circular incision line will opacify, revealing a faint white ring along the cap edge.

By one month uncorrected visual acuity has reached its' maximal level and most myopes below -12.00 D have obtained their best visual acuity.[2] Both the healing pattern and visual stabilization occur three to four times faster with LASIK versus PRK.

Subjective complaints of glare or ghost images decrease during this stabilization period. Night vision problems are common after many different types of refractive procedures. One such study by Guell and Muller reported that night vision was effected in 23% of cases six months after LASIK procedure. Night glare is caused by an exaggerated form of spherical aberration, with the pupil diameter in dim light exceeding that of the effective optical zone created.[9]

The three month exam should include a manifest and cycloplegic refraction, corneal topography to check for irregular astigmatism, ocular health assessment of the anterior and posterior segment and IOP measurement. The results of these tests determine the status of a patients vision and if enhancement surgery is necessary.

LASIK: POST-OPERATIVE COMPLICATIONS

Although patients can expect less post-operative complications with LASIK refractive surgery, some serious risks still exist, mainly associated with the use of the microkeratome. The risk of blindness is estimated to be less then 1: 1, 000, 000.[8] The most visually devastating complications occur with ocular perforation due to improper use of the microkeratome during flap formation. The microkeratome must be evaluated pre-operatively to ensure it runs smoothly and has the correct depth plate (160 um) inserted.

Dislodged or completely detached flaps is another complication. The use of the hinge technique has greatly reduced the odds of corneal cap detachment. A dislodged cap is evident clinically with signs of corneal striae, conjunctival injection and epiphora. The patient will often be photophobic and in pain. The vision is blurry and can be reduced to the finger counting level. The patient should be sent back to the surgical center if the flap needs repositioning.[1]

Formation of an inadequate flap that is too thin, thick or uneven is a more likely complication. This may be a result of malfunctioning equipment such as low suction pressure or lid speculum interference. If this occurs surgeons will replace the partial flap and postpone surgery for three to six months.[8]

If the flap is not correctly aligned it can cause significant irregular astigmatism. The incidence of this depends on the experience of the surgeon. Other causes of irregular astigmatism are poor keratectomy and decentered ablation during the excimer procedure.[1,2]

Highly myopic patients are at an increased risk of developing ocular hypertension or glaucoma. Increased IOP during the suction procedure (65 - 80 mmHg) may be contraindicated in patients who show signs of these conditions. Due to central corneal thinning after the LASIK, IOP measurements are lower than pre-operative findings. This should be

considered when deciding to treat a post-LASIK patient with ocular hypertension or glaucoma.[11]

Epithelial defects occur in a small percentage of patients (3%). The causes include poor incision at the initial flap site and the epitheliotoxic effects of topical anesthetic and dye used for marking flap alignment. Patients with epithelial defects will experience variable amounts of pain, epiphora and photophobia. They should be treated like any other epithelial abrasion. Topical antibiotics, mild steroids or NSAIDS are used. A bandage contact lens can be used for large defects and is fit steeply to avoid excessive movement which may cause further irritation. The patient is seen everyday to check for signs of infection and until re-epithelialization occurs. Epithelial defects increase the risk of infection and the incidence of epithelial in-growth.[1,3]

Epithelial in-growth in the interface is a possible complication and can, lead to irregular astigmatism. It can range in size from 20 microns to 2 mm.[8] Its' incidence is 2 % and increases with patient's age (45 years or greater), presence of epithelial defects, and weak interface adherence. They appear under the flap and grow away from the interface junction. If the epithelial in-growth is greater than 2 mm from the flap edge refer the patient for interface cleaning. If less than 2 mm, assess weekly until stabilization is noted.

The incidence of stromal haze is 10 to 20 times less with LASIK versus PRK. However, it has been observed in patients with higher levels of pre-operative myopia. If visually significant, mild topical steroids can be used for up to one month. If this does not work, the flap can be lifted and the stroma re-ablated.

Regression occurs more frequently in highly myopic individuals. Patients with very little hyperopia at day 1 post-operative often will regress to myopia. LASIK regression occurs more quickly than in PRK and is less responsive to topical steroid intervention. Temporary contact

lenses or glasses may be prescribed after one week to correct any significant residual refractive error. Criteria for enhancement include uncorrected visual acuity (UCVA) less than 20/40 and/or manifest refraction of greater than -1.00 D. Enhancement should not be attempted until the third to sixth month post-operative period. In cases of higher myopia the cornea requires up to 6 months to fully stabilize.[4] The management of over correction poses more difficulties. Initial overcorrection is ideal and allow for predictable regression. Younger patients may be able to cope with small amounts of hyperopia, however pre-presbyopic and presbyopic patients are immediately bothered with the additional strain during near and distance tasks. Again temporary glasses or contact lenses may be dispensed after one week post-operative. Over the counter readers may also meet short term visual requirements.

Hyperopia in LASIK patients is more noticeable and is not improved with tration of steroids as with PRK patients. If significant hyperopia exists after six months, enhancement procedures are performed.

Currently there are several methods of hyperopic enhancement offered. These include photo-therapeutic keratectomy (PTK) on the surface epithelium or stromal bed to produce central islands. Clinical trials are being conducted on the use of hyperopic LASIK procedure three months post-operatively to decrease initial overcorrection.[1,9,11]

The effects of LASIK on corneal endothelium have been studied. The phototoxic effects of the excimer laser on the corneal endothelium have not yet been established. Human corneal endothelium cannot regenerate, therefore any loss of endothelial cells after LASIK would lessen its' acceptance as a refractive procedure. One such study by Perez-Santonja showed that LASIK does not cause significant observable damage to the central corneal endothelium up to 6 months after surgery.[12,13]

THE PHOTOREFRACTIVE KERATECTOMY PROCEDURE

Prior to the surgery the laser must be recalibrated to ensure proper functioning. The patient's vertex distance corrected prescription is programmed. The majority of patients, including presbyopes prefer to be plano.

Preoperative medications include topical anesthetics, NSAIDS and antibiotics. Topical proparacaine is used in large amounts, 15-20 drops, prior to epithelial debridement. The pre-operative use of antibiotics is advocated by some surgeons and can include broad spectrum fluroquinolones (Ciloxin, Occuflox) or aminoglycosides (Tobrex).[4] Topical NSAIDS such as Keterolac (Acular) or Diclofenac (Voltaren) are used to ease postoperative pain.

Patient positioning and preparation includes occluding the fellow eye with a solid eye shield so it can remain open during the procedure, thus avoiding a Bell's phenomenon. A speculum is introduced, firmly securing the lids while the eyelashes are taped down.[1]

Removal of the corneal epithelium is accomplished with blunt or sharp debridement with chemical assistance or through a transepithelial method. Blunt debridement is recommended since it induces less trauma on Bowman's layer. Transepithelial approaches using the excimer laser to ablate the overlying epithelium are better tolerated by patients but end point determination is more difficult due to lack of epithelial uniformity. Although alcohol is an efficient method of debridement it can alter stromal hydration patterns. Alcohol may increase the incidence of haze and regression but reduces the frequency of central islands.[4]

Postoperative medications and therapy are variable and depend on the surgeon's preference. Topical proparacaine may help with the insertion of the bandaged contact lens. Topical NSAIDS, 1-2 drops, given immediately help to retard the prostaglandin mediated inflammatory

process. Topical antibiotics, 1-2 drops, are given immediately to prevent any secondary bacterial infections. Some surgeons choose to soak the bandaged contact lens with NSAIDS and/or antibiotics prior to insertion.[1,2]

PRK: POST-OPERATIVE CARE

The risks and possible complications of PRK surgery must be reviewed with the patient prior to the procedure. These risks include:

*Infection: Greatest risk in the first 72 hours during epithelial healing
*Night glare: Common post-operative complication seen more with large diameter pupils and excimer laser utilizing small optic zones
*Healing Haze: Collagen protein produced during the stromal healing process
*Regression: Seen more commonly in higher myopic patients and may need repeat surgery or the use of contacts or spectacles to correct
*Steroid-induced complications: Includes increased intra ocular pressure, posterior subcapsular cataracts, lid ptosis which should nearly resolve after discontinuation of steroids, herpes simplex virus reactivation
*Overcorrection: Difficult complication to manage and occurs in 3% of patients
*Loss of Best Corrected Visual Acuity: Considered the most significant complication and should be well explained to interested candidates.
*Lid ptosis: Lid speculum complication
*Loss of stereopsis: Will occur during the period between treatment of the two eyes. May cause patients to feel unbalanced

PRK post-operative care can be divided into pre- and post-epithelial healing phases.

The first symptoms of pain occur 1 hour after surgery as the anesthetic drops begin to wear off. Pain and sleep medication may be prescribed by the surgeon and the patient is instructed to sleep as much as possible over the next few days to increase the healing rate. Patients may resume regular activities but rest is encouraged. Showers and baths are permitted, but the eyes should be closed. Patients should avoid working in dirty environments or gardening for one week.

Common immediate post-operative symptoms include photophobia, epiphora, eye irritation, redness and swelling, increased night glare, unbalanced feeling, loss of depth perception, difficulty reading and blurred vision.[1,2,4] Patients should be advised that their vision will be blurry during the first week.

During epithelial healing the patient is placed on a broad-spectrum topical antibiotic (Ocuflox) 2 drops qid until healed, topical NSAIDS (Voltaren, Accular) 2 drops bid to qid up to three days, a mild topical steroid such as 0.1% fluorometholone 2 drops qid until healed. A bandaged contact lens, fit steeply (8.4 B.C.) is used during re-epithelialization.

The risk of a corneal infiltrate is 1/500 and a infectious corneal ulcer 1/1000. Proper lid hygiene and the use of prophylactic antibiotics reduce these figures by half.

Topical NSAIDS are used for pain relief, however toxicity can produce keratitis and impair epithelial healing. Their use can also lead to sterile paracentral infiltrates that must be differentiated from infectious causes.

Topical steroids are used initially to reduce inflammation, corneal edema and possibly prophylactically against sterile infiltrate formation.

The patient is seen daily until the epithelium is healed. The contact lense should not be removed during the exam. Slit lamp examination at these visits should be focused on the rate of healing, contact lense complications and corneal infiltrates.

Ideally the rate of epithelial healing should be 30%-60% at day 1, 60%-% day 2 and 100% by day 3.

Signs of contact lense related corneal hypoxia (SLACH) or peri-limbal injection may indicate that the contact lense needs to be fit more loosely. A snug fit, however, will insure patient comfort and reduce epithelial disturbances during healing. Ideally 0.5 mm of contact lense movement should be seen with each blink.

The cornea should be assessed for signs of infiltrates. Infiltrates may be sterile and caused by corneal hypoxia related to contact lens use. They are usually smaller than 1.00 mm, round, peripherally located, with well defined margins. More importantly they usually have an intact epithelium overlying them. Conservative treatment includes removal of the bandage contact lense and use of a broad spectrum antibiotic, 1 drop every hour while awake.

NSAID-related sterile infiltrates pose a more difficult clinical differential diagnosis. They are usually located paracentrally, between 00 to 3.00 mm in size, round with well-defined margins. The overlying epithelium may be intact or denuded. The incidence of these infiltrates is 0.5%.

Corneal infiltrates may also be infectious. Management includes contact lense removal and culturing if the overlying epithelium is denuded. If uncertain as to the etiology of the infiltrate it must be treated as infectious.

If the epithelium is healed by day 3 the bandage contact lens is removed. Large amounts of artificial tears or topical anesthetics are instilled to ease in lense removal. If the epithelium is not healed after 72 hours patch the eye with a antibiotic-steroid ointment daily until healed.

Once the epithelium is healed patients should be seen back at 1, 2, 3, 4, 8 and 12 months. Procedures to be done at these visits include corrected and best corrected acuities, refraction, corneal clarity determination and IOP assessment.

After the epithelium is healed patients are put on a standard topical steroid regimen. Some surgeons choose intensive 6 month or longer regimens while other may choose no steroids. Topical steroids are helpful in decreasing the amount of post-operative stromal haze and improving refractive stability. A conservative approach is taken using milder forms such as FML 0.1%, for a 4 month period during the time that the greatest healing activity takes place. Suppression of wound healing is essential in preserving corneal clarity and obtaining maximum refractive results. The use of more powerful topical steroids may cause irreversible complications such as glaucomatous visual field loss and posterior sub-capsular cataract formation. A typical standard topical steroid regimen is as follows:

FML .1%
1 gtt q.i.d. for 4 weeks
1 gtt t.i.d. for 4 weeks
1 gtt b.i.d. for 4 weeks
1 gtt q. am for 4 weeks

Topical steroids should be gradually tapered to help stabilize refractive results. They should never be withdrawn abruptly.

Wound healing during the PRK post-operative period involves both the epithelium and stroma. Hence, regression can occur at either of these levels. The interaction between these corneal layers determines the healing response.[1,5,7]

Remodeling of the stroma occurs as an extracellular matrix forms along with vacuoles between intersected lamellae. An increase in hyaluronic acid production occurs which in turn helps to bind large amounts of water, effectively changing corneal curvature and thus altering refractive power.

ree types of healing responses have been identified, each requiring a specific treatment regimen. The majority of patients (95%) or Type I

are normal healers showing signs of trace reticular haze and mild regression. Usually at one month these patients are slightly hyperopic and will often regress to plano by month six. This healing group should have their steroids tapered according to the previous example.

Type II healers are more aggressive and have a higher tendency toward myopic regression. This small subset of patients (2%) display clinically significant confluent haze formation. This healing pattern is more often seen in young patients, especially those with higher myopic refractive error. These patients must be maintained on a higher dosage of steroids an often needed to be re-treated.

Type III healers make up the other small subset (3%) and are considered non-healers. They are usually over the age of 40 and do not display significant haze and show little regression. Minimal stromal remodelling leads to abnormal amounts of corneal flattening and peropia. A general treatment guideline for patients with over +2.00 D of hyperopia includes discontinuing the steroid until +1.00 D and then re-initiating.

It is important to classify the amount of corneal haze as insignificant or significant. The hallmark of clinically significant haze is confluence. Confluent haze can be diffuse or focal and is associated with a higher risk of regression and loss of BCVA related to compromised vision, abnormal corneal topography and irregular astigmatism.[1,2,4,5]

CORNEAL CLARITY GRADING

Clinically Insignificant Haze:

Clear:	0.0	Clear cornea, no discernable haze
Trace:	+0.5	Barely visible, fine reticular nature
Mild:	+1.0	Easily visible, most common form, reticular

Clinically significant Haze:

Moderate:	+2.0	Area of confluence, focal
	+3.0	Diffuse area of confluent haze
Severe	+4.0	Extensive confluent haze, iris is still visible
	+5.0	Opaque cornea, no visible iris detail

Most mild to moderate myopes will have 20/40 vision or better within the first 2 weeks post-operatively, and their best uncorrected visual acuity occurs within 1 to 3 months. Type III healers over age 40 have a slower recovery but will eventually achieve the same results. The majority of patients who have obtained good vision and refractive results remain stable after month 6.

COMPARING LASIK & PRK:

Clinical results show the main difference between the two procedures are in refractive predictability. A substantial decrease begins to occur around -6.00 D for PRK and -12.00 for LASIK. The LASIK refractive range is also greater extending from -1.00 to -30.00 D.

Overall visual results between -1.00 and -6.00 D for the two are equal, with 95% obtaining functional uncorrected vision of 20/40 after one surgery.[1] Between -6.00 and -9.00 D, 78% achieve 20/40 vision with LASIK. The percentage falls to 65 for myopès between -9.00 and -15.00 and to 23% for those between -15.00 and -30.00 D.

Only 1 in 5000 patients has corneal infections after LASIK compared to 1 in 1000 with PRK. There is also a lower associated risk of scarring with LASIK.

PRK has lower overall risk during surgery and higher risks during the healing process due to the longer use of topical steroids. Conversely, LASIK can have some very serious associated surgical risks, but much fewer post-operatively.

Visual recovery is quicker with LASIK, 1 to 4 days, compared to 1 to 4 weeks with PRK.

There is much less reported pain with LASIK. Only 1 in 50 experience pain compared to 1 in 10 with PRK.

Due to the quick visual recovery with LASIK it can be done bilaterally, which makes it more convenient than PRK. A shorter medication regimen is needed with LASIK (4-7 days) than PRK (4 months), making it more convenient.

Patients have equal night glare complaints with the two procedures, with 50% of patients suffering in the early period and 2% in the later stages.[14]

CONCLUSION:

It is estimated that over 300, 000 excimer laser procedures will be performed in America through 1998. Optometrist must be able to counsel their patients regarding all their refractive options, including LASIK and PRK surgery. Hostile and negative attitudes toward refractivfe procedures will drive patients away and an opportunity to expand your patient base will be lost. A satisfied laser surgery patient will be an excellent source of new primary care and contact lens patients. A large percentage of the refractive surgery is unrelated to the actual surgery. Instead, it deals with counselling, educating and providing pre- and post-operative management. Optometrists are in a perfect position to succeed in these areas. When patients ask about laser vision correction, you should be ready to answer questions in an informed, intelligent and unbiased manor. Potential candidates will be happy to know that you will be able to guide them through the surgery process.

A COMPARISON OF PRK & LASIK [4]

	PRK	LASIK
OVERALL VISUAL RESULTS	Equal	Equal Better for severe degrees of myopia >6.00 D Better for certain eye and medical conditions
OVERALL RISKS	Lower risks during surgery. Higher risks after surgery.	Higher risks during surgery. Lower risks after surgery.
RECOVERY TIME	Slow 80% vision at 7 days	Very fast 80% vision typically 1-2 days
SECOND EYE TREATMENT	2-6 weeks Average 1 month	Within 1 week Average 2 days
RETREATMENT IF NOT FULLY CORRECTED	3 months	3 months
MEDICATION	3-4 months	1-2 weeks
INFECTION	1/500	1/3500
PAIN	1/10	1/50
NIGHT GLARE	Equal Early – 50% Late – 2%	Equal Early –50% Late – 2%
HAZE /SCARRING	Mild myopia 0.5% Moderate Myopia 1% Severe myopia 2-3% Extreme myopia 4-5%	1/1000
OVER/UNDER CORRECTIONS	Overcorrections 1-2% Undercorrections Severe- 10% Extreme 25%	Overcorrections 1-2% Undercorrections Severe-10% Extreme 20%
REGRESSION	10%	5%
LOSS OF BEST CORRECTED VISUAL ACUITY	1 % overall Most sharpness returns over 6-12 months	1% overall
TIME FOR SURGERY	4-5 Minutes	10-15 minutes
PAIN DURING SURGERY	No	No Patient will feel pressure during the initial steps of the procedure.
TYPE OF SURGERY	Out patient Topical anesthetic only	Out patient Topical anesthetic only
SUMMARY	PRK is the procedure of choice for lower degrees of myopia,	LASIK is the procedure of choice for higher degrees of myopia, with better stability and lower risk of scarring.

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