

## PRK versus LASIK demystified

If you understand the meaning of a series of acronyms such as LASIK, PRK, ASA, Epi-LASIK, LASEK, you are in the minority and should consider a career in ophthalmology. For the remaining 99%, I would like to explain what these procedures are, which ones I prefer, and why.

The use of the excimer laser to modify the shape of the cornea is called laser vision correction (LVC), a generic term that includes all the procedures named above.

### PRK

PRK refers to *photorefractive keratectomy*, or “surface ablation”. During surface ablation procedures, the epithelium, or surface layer of corneal cells, is gently removed allowing the underlying cornea to be exposed to the excimer laser for a brief amount of time. There are a number of methods for removing the epithelium and they all work well. PRK, LASEK and Epi - LASIK are essentially the same procedure, only differing by the method of removing the epithelium. After the laser is applied, the surface of the cornea is covered with a soft contact lens that acts as a bandage and several types of eye drops are given. The surface cells heal back over the eye during the next 4-7 days.

I have been performing surface ablation procedures since 1989, as a participant in the earliest clinical trials of the excimer laser for use in vision correction. As with other types of technology, a great number of improvements have been made over the last two decades, and PRK is currently being regularly performed throughout the world with excellent visual results. The number of PRK procedures performed in the US and elsewhere declined after the introduction of the LASIK procedure in

1996, but in the last several years, due to significant new advances in technology and medications which control the healing process and post-operative discomfort. Surface ablation techniques, sometimes referred to as Advanced Surface Ablation (ASA) are again gaining in popularity.

### LASIK

LASIK is an acronym for *Laser-Assisted in-Situ Keratomileusis*. If this sounds Greek--it is. Iannis Pallikarus MD, an eye surgeon in Crete, described it in 1993. I went to Crete in 1996 to learn about this new procedure from Dr. Pallikarus (and had a wonderful time with great food and wine). LASIK utilizes the excimer cool-beam laser to vaporize a small amount of tissue beneath a surgical flap on the surface of the eye to reshape the cornea.

To perform LASIK, the surgeon uses an instrument called a mechanical microkeratome (or more recently, a specialized laser called a femtosecond laser) to cut a thin layer of corneal tissue (flap), which is then folded back like the pages in a book. As with the PRK procedure, advanced computer technology, including Wavefront technology, is used to program the laser for an individual's particular prescription. Then the laser energy pulses vaporize microscopic amounts of the corneal tissue to reshape the cornea. After the laser pulses, the corneal flap is replaced, as if closing a book. LASIK has the advantage of a quick return of vision, usually within hours, and minimal postoperative discomfort.

### Why I prefer Surface Ablation (PRK):

There are a number of reasons that I will summarize here:

“The PRK procedure is better suited to use Wavefront technology.”

### Office Hours

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### **PRK has Better Results:**

The visual results from both procedures are excellent but recent studies have shown that Wavefront guided PRK has a slight edge over Wavefront-guided LASIK. Wavefront-guided treatments use specialized measurements of the eye, as unique as a fingerprint. These measurements, done in the office before the surgery, utilize complex technology to analyze light coming in and out of the eye. The measurements are fed into an advanced computer program that determines the final shape of the cornea that is required to see clearly without refractive error. The computer instructs the laser on how many pulses, where they are applied and what pattern is utilized.

The PRK procedure is better suited to use Wavefront technology. The reason for this is explained by examining the LASIK procedure. Making a flap of corneal tissue creates a change in the Wavefront pattern of light entering and exiting the eye that cannot be measured again before the laser is applied. This means that the original measurements that are being used are no longer completely accurate. All measurements utilizing the Wavefront analyzer are made in the office before anything is applied to the eye. Measurements are not possible in "real time" during the actual laser procedure. When LASIK is performed, one is making the assumption that the LASIK flap does not alter the Wavefront pattern, which is not the case. The PRK procedure is much like removing the outermost layer of an onion (skin). The shape of the onion is not changed by losing one layer of outer skin; therefore the measurements are still accurate.

### **PRK has Minimal Operative and Postoperative Complications:**

The LASIK procedure is very safe, but there are some potential complications inherent in creating the LASIK flap. Sometimes, there is an imperfect flap: partial, ragged, torn or perforated flaps can occur. Other times, the flap can have microscopic wrinkles, causing distortion or diminution of vision. In a small number of cases, there can be inflammation under the flap which needs to be treated. In a small number of eyes, cells from the surface can

grow under the flap. These cells need to be removed. Almost all of these and other complications can be treated successfully but that involves extra treatment, medications, visits and sometimes, additional surgery.

Most of the significant complications of LASIK involve the flap. The PRK procedure does not have any of these flap-related complications, as there is no flap.

The only serious potential complication of PRK is infection of the cornea. It is seen in about 1 in 400 eyes. As we follow PRK patients very carefully, a PRK infection is almost always superficial. It is usually treated quickly and aggressively and in most cases, does not result in a significant loss of vision. LASIK infections are more uncommon but far more serious, as they are usually deep in the corneal tissue.

### **PRK Does Not Produce Dry Eyes:**

When the LASIK flap is made, most of the nerves to the surface of the cornea are severed. That means that they are no longer sending signals to the brain signaling that the eye is dry. Since the brain isn't getting signals to activate the tear glands, dry eye frequently results. This dry eye condition can range from mild to severe and can last for months. While dry eye for most LASIK patients gets better after six months, as the nerves regenerate, for some people these symptoms can persist for much longer. For people older than 45 or 50, or those with pre-existing dry eye, there is an increased risk of developing more symptoms. The PRK procedure does not affect tear production.

### **Corneal Haze and PRK: No Longer an Issue:**

One of the drawbacks of PRK in its early years of development was corneal haze, which was seen in a small percentage of eyes treated with surface ablation techniques. The haze was from over-aggressive healing and the production of new collagen in the corneas of some patients. The haze usually improved, but could make the procedure less predictable and sometimes caused regression of the visual outcome. In the last five years, the use of diluted mitomycin (an eye-drop), when placed on the cornea once for 10-20 seconds at the time of the laser procedure, has been found to eliminate haze. I have now been using this drop regularly for my

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## PRK versus LASIK demystified (continued)

PRK surgeries without any complications for five years. I have not seen any significant corneal haze in any of my PRK patients since beginning its use. The use of mitomycin has enabled me to retreat prior PRK or LASIK patients using surface ablation techniques and not be concerned about corneal haze, which was more common in eyes that had prior corneal surgery.

### **PRK Does Not Weaken The Cornea:**

The LASIK procedure, by cutting collagen fibers in the cornea, can weaken the cornea. In some patients, a pre-existing condition in which the eye has abnormal collagen fibers can be made much worse and cause the cornea to lose its intended shape. This condition is called ectasia and is difficult to treat. PRK almost never causes these types of problems, and millions of cases of PRK have been performed.

### **PRK is not susceptible to eye injury:**

As explained above, the LASIK flap and cornea never heal back to its original strength. This flap, although sealed, can be dislodged or damaged by certain types of eye injuries. This is the reason that the US military prefers PRK to LASIK for most situations. It has been my privilege to treat many men and women of our armed forces with laser vision correction to give them better vision for their mission. For all of these soldiers, I have chosen surface ablation procedures.

### **PRK has Long Track Record:**

I have been performing PRK since 1990 and now have a small number of patients that I have followed from the original trials in 1991-2. These patients are now out 17 years from surgery and are doing well, with good vision. There has been no regression once healed, and no apparent short or long-term ill effects on the eye.

### **PRK Is Better Than LASIK In Patients Over 40:**

Certain complications of LASIK are more common in patients over age 40. The corneal surface cells of older individuals are not as tightly bound and can slide during a LASIK procedure which can cause problems. With PRK, these cells are deliberately removed and grow back under controlled conditions. There is

no flap for them to grow under. Dry eye is more common in older patients and, as explained above, can be aggravated by LASIK.

### **More Patients Qualify For PRK Than LASIK:**

There are a number of factors that can exclude some patients from having LASIK, but do not affect PRK being a good option. These include thinner corneas and corneas that are too flat or too steep. Patients with dry eye can have PRK.

### **Why Is LASIK Advertised By The "Chain" Surgery Centers When There Is Little Mention Of PRK?**

Most of these centers perform LASIK on both eyes at the same session, saving them some time and money. LASIK is cheaper to perform, requires fewer eye drops and does not need as much follow-up with the surgeon. The "chains" do not usually have the manpower to personally take care of PRK patients and discourage or do not offer the procedure. The swift return of better vision in LASIK patients (the "wow" factor) helps the laser chains with their marketing.

### **PRK and Discomfort or Pain:**

I have helped develop a regimen that is very successful in controlling postoperative discomfort or pain. Most patients describe a foreign body sensation and watering in the operative eye, which usually comes and goes for a few days. Most people describe it as feeling like a "bad contact lens day". There is rarely any significant pain. When it is encountered, the discomfort is almost always due to the soft bandage lens that is placed on the eye at the time of surgery becoming dislodged or fitting poorly. Normally, this discomfort goes away when the lens is replaced.

### **Conclusion:**

LASIK is a widely used form of laser vision correction with very good outcomes, but in my opinion, has been surpassed by surface ablation techniques such as Wavefront-guided PRK. The advantages of PRK include greater safety; slightly better visual outcomes, less dry eye, less susceptibility to injury and better utilization of Wavefront technology. The disadvantages include a longer time to return to optimal vision and slightly more discomfort. PRK has a long track record of safety and efficacy.



**"PRK is currently being regularly performed throughout the world, with excellent visual results."**





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**Neal A. Sher M.D.** is an internationally recognized expert in laser vision correction and has focused his practice on refractive surgery for almost two decades. He has performed thousands of procedures. He was one of the first surgeons in the world to perform laser vision correction and one of the initial researchers to participate in those clinical trials. Dr. Sher was one of the founding members of the renowned Phillips Eye Institute, where he also served as Chief of Ophthalmology. As an author and lecturer who has written numerous scientific articles and textbook chapters on refractive surgery, Dr. Sher is frequently asked to lecture in the U.S. and abroad. He is an Adjunct Clinical Professor of Ophthalmology at the University of Minnesota Medical School and a Fellow of the American College of Surgeons and the American Academy of Ophthalmology.



## Eye Safety Tips for Skiing and Snowboarding

One of our two seasons is rapidly approaching (hint: road construction is the other) Eye protection is just as important in winter sports as it is in summer activities, perhaps even more. There is a reason why you see Olympic and other competitive skiers and snowboarders wearing goggles or high-impact sunglasses: better vision and fewer injuries.

Beautiful white snow slopes create serious glare, reflecting the sun directly into the eyes. This makes it difficult to see where you're going, which can be a real hazard, especially if you're not on the "bunny slope". Poor vision and glare cut down your reaction time, masking hazards until you're right on top of them. Tinted ski goggles or wraparound-style high-impact sports sunglasses with UV protection cut down on these problems. Polarized lenses help even more to give you clear vision.

Ultraviolet protection for the eyes is essential to block the strong UV rays that can cause inflammation of the cornea and "snow blindness". Long term UV exposure can accelerate aging of the eye as well as increase the risk of cataract, skin cancer and possibly macular degeneration.. Tinted and polarized lenses also let your eyes and facial muscles relax, so that you aren't constantly squinting, which can cause deep, permanent wrinkles at an early age.

Ice crystals can be razor-sharp and hard-packed snow can act just like sandpaper. Goggles can save you from painful cuts and scrapes on the eyes incurred in a fall. High-impact eye protection is also a barrier to injuries from tree branches, ski poles and flying objects. Constant wind on the eyes when snow-boarding or skiing can be drying and painful, especially if you wear contact lenses; goggles or sunglasses act as a barrier.