

MEDICAL INNOVATION: LASER EYE SURGERY (LASIK) (MEDICAL DEVICE: THERAPEUTIC)

Physician: Dr. Steven Trokel

Engineers: Dr. Samuel Blum, Dr. Rangaswamy Srinivasan and James Wynne

Industry: IBM

Situation

A condition affecting one in two Americans

Refractive errors are the most common eye problems in the world. They are optical defects that result in light not being properly focused on the eye's retina. Nearsightedness (myopia) and farsightedness (hyperopia) are the most common refractive errors. People with myopia see near objects clearly, while distant ones are blurred. People with hyperopia experience just the opposite -- distant objects are clear while near ones are blurred.

Fortunately, almost all refractive errors can be corrected, most often by eyeglasses or contact lenses. It is estimated that more than 150 million Americans – roughly 1 of every 2 citizens – use corrective eyewear to treat their refractive error. Americans are estimated to spend over \$15 billion each year on eyewear, supporting an optical industry in the U.S. worth more than \$30 billion.

However, glasses are cumbersome and difficult to use in outdoor activities and exercise, and contacts are unwieldy and can cause eye irritation and infection. Until the mid-1990s, however, the hundreds of millions of people worldwide who suffer from refractive errors had no alternative means of treating their condition.

Physician-Industry Collaboration

A laser for microchips transforms human vision

The development of ever-more precise laser technology some forty years ago held the promise of a new and better solution. The Excimer laser was originally used for etching silicon computer chips in the 1970s. In the early 1980's, Dr. Samuel Blum, Dr. Rangaswamy Srinivasan and James Wynne of IBM's T.J. Watson Research Center studied the effect of the ultraviolet excimer laser on biologic materials. Srinivasan and the IBM team realized that you could remove tissue with a laser without causing any heat damage to the neighboring material. On further investigation, they determined that the clean precise cuts made by the laser would be ideal for delicate surgical procedures.

A New York City ophthalmologist, Dr. Steven Trokel, made the connection to the cornea and performed the first laser surgery on a patient's eyes in 1987. The next ten years were spent perfecting the equipment and the techniques used in laser eye surgery. In 1996, the first Excimer laser for ophthalmic refractive use was approved in the United States.

The excimer laser uses a process known as photoablation, which allows precise removal of very minute amounts of tissue without the danger of heat damage to the organ. The actual penetration of the ultraviolet beam is less than a nanometer (a billionth of a meter) into the cornea itself. This fine microscopic removal of tissue is what allows the cornea to be sculpted with exact precision.

Innovation Benefits

Restoring vision to millions worldwide

Since it was first approved over fifteen years ago, laser eye surgery has restored sight for over three million Americans and over five million people worldwide with a minimum of complications, offering a convenient and safe alternative to glasses and contacts by way of a minimally invasive, outpatient procedure.

Today, faster lasers, larger spot areas, bladeless flap incisions, intraoperative pachymetry, and wavefront-optimized and -guided techniques have significantly improved the reliability of the procedure compared to that of the mid-1990s.

Patient Benefits

A champion sees clearly for the first time

One of the world's greatest golfers ever, Tiger Woods suffered from serious nearsightedness, with a refractive error of -11, as he [described](#) to TLC's Laser Eye Centers. This put him in the worst one percent of those with nearsightedness. Prior to LASIK surgery, without his glasses or contacts, he would not have even been able to see the ball on the tee.

For years Tiger dealt with what he called the "hassles and frustrations of glasses and contacts." Then, in 1999, he decided to have LASIK and the results were "fantastic."

"As a professional golfer my eyesight was just too important to risk. Some of my main competitors had LASIK and loved the results. So I [decided to do the same]," he said.

"I know what it's like to have poor vision. I also know what it's like to see 20/20. And trust me; life is much better when you see it clearly."

