

Refractive Surgery Today (Part I)

The field of refractive surgery is dynamic, having seen incredible advances over the last decade that have benefited thousands affected with visual disorders [ie. myopia (nearsightedness), hyperopia (farsightedness) and for astigmatism.] Laser-driven refractive surgical procedures like laser-assisted in situ keratomileusis (LASIK) involve reshaping the cornea (i.e. for myopes, flattening of the steep central cornea or steepening the flat central cornea for hyperopes) by removal of a precise amount of corneal tissue determined by the magnitude of the eye's preoperative refractive error. Astigmatism can be corrected simultaneously.

LASIK is accomplished under topical anesthesia in a few minutes with minimal discomfort. A corneal flap is created with a microkeratome and then is retracted back to allow for application of a computer-guided excimer laser beam that reshapes the cornea. The flap is then replaced, allowing the patient to return to normal activities the next day in most cases. LASIK is best suited for refractive errors in the range of ≤ 3.50 diopters (D) of hyperopia, ≤ 10.0 D of myopia and ≤ 5.0 D of astigmatism.

Not all eyes qualify for LASIK because of extreme refractive errors, excessively thin corneas and/or large pupils. These special cases are reserved for laser-assisted in situ epithelial keratomileusis (LASEK) in which no corneal flap is created thus preserving corneal tissue. Instead the outer corneal epithelium is chemically loosened and lifted back to allow laser treatment. The epithelium is replaced and a bandage contact lens is applied for comfort. This removed in 48-72 hours and recovery of functional vision may take 3-5 days. LASIK offers a quicker return of vision with less discomfort than LASEK but at 6 months follow up, the visual results are comparable.

Numerous technological advancements have occurred in excimer laser refractive procedures. The University of Kentucky Refractive Surgery Service utilizes the Bausch & Lomb (B&L) excimer laser for use in both conventional and customized treatments. Its small scanning-spot platform offers greater accuracy, its large blended treatment zones

minimize nighttime vision problems, and its mechanical eyetracker ensures more precise feature by the treated eye. These advancements have made the B&L laser one of the most widely used in the world.

In fact, its FDA study approval data in conventional or customized LASIK treatment is unmatched by other excimer laser systems. Wavefront-guided or customized laser ablation represents a major step towards achieving “super” or perfect vision. A conventional laser treatment corrects a patient’s refractive error but can induce higher order aberrations (HOAs) which can reduce the quality of post-operative vision. Customized laser surgery treats not only the refractive error but at the same time inherent HOAs to further fine-tune the patient’s quality of vision. This means improved night driving and enhanced contrast under low-light conditions especially in those with larger pupils. However, vision will not necessarily be perfect after a customized treatment as technology has not created the ideal laser platform to reduce all HOAs.

Still, customized LASIK performed with the B&L Zyoptix laser system has yielded postoperative uncorrected visual acuity (UCVA) of 20/20 or better in 94% and 20/15 or better in 74% of treated eyes compared with conventional LASIK results of 87.3% and 30.1% respectively. Overall, no patients were dissatisfied with their visual outcome following their Zyoptix treatment. A thorough pre-operative screening is necessary as not all eyes are eligible for a customized treatment meaning a conventional approach may be in order.

Refractive Surgery Today (Part II)

For those patients who do not qualify for excimer laser refractive surgery alone because of extreme refractive error, corneas that are structurally inappropriate, or are wary of the permanence of the procedure, there is still hope for independence from eyewear in the form of the phakic intraocular lens (PIOL). Two types of PIOLs are

FDA-approved: the Verisyse® (AMO) and the Visian® implantable contact lens [ICL (STAAR)].

The Verisyse® PIOL is a one-piece hard non-foldable plastic lens that must be inserted through a large incision of 6.0 mm necessitating placement of sutures. It's placement within the eye is technologically difficult and it must attach to the midperipheral iris. This can result in disadvantageous and/or chronic inflammation. Its use is limited to pupil sizes of ≤ 6.0 mm because of glare and halos. It is approved for -3.0 to 23.5 D myopia.

The Visian® ICL (STAAR) is a foldable one-piece Collamer lens that can be inserted through a self healing sutureless wound of 3 to 3.7 mm. This reduces the risk of wound leakage, infection, induced astigmatism and susceptibility to trauma when compared to the Verisyse® PIOL. Furthermore, there is less risk of intraoperative ocular damage as the Visian® ICL is not iris-fixated, and implantation is simpler. Its use is not limited by pupil size. The Collamer in the Visian® ICL also reduces HOAs unlike the Verisyse® PIOL, thus enhancing the patient's visual outcome. It is approved for myopia of -3.0 to -23.0 D. The Visian® ICL also fared better than the Verisyse® PIOL in FDA approval study data as 94% and 59% of Visian with eyes had postoperative vision of 20/40 or better and 20/20 or better respectively compared to 92% and 50% of Verisyse eyes respectively.

Interestingly, the Visian ICL® compared favorably with LASIK in the treatment of moderate to high myopia (-8.0 to 12.0 D). At 6 months, both the loss of 2 or more lenses of best spectacle corrected visual acuity (BSCVA) (Visian 0%, LASIK 2%) and gain of 2 or more lines of BSCVA (Visian 7%, LASIK 3%) were better with the ICL®. The predictability of outcome at 6 months was better with the Visian ($90\% \pm 1$ D of goal, $65\% \pm 0.5$ D) than with LASIK ($76\% \pm 1$ D, $53\% \pm 0.5$ D). The Visian ICL® also scored higher in 1 year UCVA and BSCVA of 20/20 or better outcomes [Visian® 52% and 90% respectively; LASIK (36% and 82% respectively)]. It also provided a more rapid return to functional vision than LASIK.

Visian the ICL is versatile; it can be used in combination with LASIK in a procedure called bioptics to treat excessively high refractive errors. This involves a two-step process in which the ICL® is implanted several weeks later; LASIK is performed to correct any residual refractive error.

In summary, PIOLs specifically the Visian ICL® offer a viable alternative to LASIK with greater predictability of outcome, more rapid recovery of vision, and the bonus of reversibility. However, not all patients are appropriate candidates for the Visian ICL and a thorough preoperative screening exam is necessary to assure the desired result.