Laser-assisted refractive cataract surgery, utilizing the computer-driven precision of the femtosecond laser as a form of laser scalpel, is this year crossing the translational gap from research and development to a controlled global commercial launch. This is a major event in ophthalmology, as cataract surgery remains the most common procedure performed by the ophthalmic surgeon. In the United States alone >3.2 million cataract operations are performed each year, or approximately 10 per 1000 population, with over 19 million performed worldwide (Market Scope 2011), a number that must increase to meet worldwide demand. Thus, the application of a laser to cataract surgery that has a legitimate chance to successfully commercialize is a seminal event, generating high interest and significant controversy. The incorporation of laser-assisted refractive cataract surgery is in its infancy, and there are more questions than answers. The three articles published in this and a prior issue of the Journal of Refractive Surgery are helpful in evaluating the benefits a femtosecond laser may bring to the cataract surgeon and his or her patients.\textsuperscript{1-3}

In this editorial, I have been requested to present a personal vision of how I see laser-assisted refractive cataract surgery impacting cataract surgery and the cataract surgeon. While humbly admitting this is a daunting task, and realizing many of my predictions may prove to be incorrect, I will do my best to present some constructive thoughts to my fellow ophthalmic surgeons.

I wish to begin with some personal disclosures that may be relevant to the statements that follow. I am a passionate advocate of capitalism and innovation, I consult for four companies engaged in femtosecond-assisted refractive cataract surgery, and I am an optimist. Despite worldwide financial challenges, I remain convinced that new technology will continue to be incorporated into our practices as we strive for the best ways to preserve, restore, and enhance vision. History has repeatedly proven that there is always room for the premium option if it delivers on its value proposition. Throughout 40 years in ophthalmology, I have participated during the time of tremendous advances in cataract extraction techniques, intraocular lens (IOL) technology, and the complete shift in corneal refractive surgery, from crude incisional techniques to our current sophisticated application of computer-driven lasers. In every case, there was controversy, strong and, in several cases, well-organized opposition, and unexpected problems and solutions. None of these disruptive technologies made our surgery technically easier or less expensive. However, all advanced the quality of the surgical outcomes enough to drive surgeon and patient adoption despite the costs in additional training and technology.

My core prediction is this: Laser-assisted refractive cataract surgery will join these major advances in ophthalmic surgery as a mainstream, commonly utilized technology in advanced countries by the year 2020. It will be a disruptive technology, which means it will by definition topple market leaders. If so, those companies and surgeons who embrace it will be richly rewarded and those who ignore it do so at significant risk.

Cataract surgery in its current state is a modern medical miracle. Nonetheless, many meaningful unmet needs remain, including refractive outcome accuracy and reproducibility and improved safety; application of the femtosecond laser may address these issues. The goal in advanced countries remains rehabilitation of the patient following cataract surgery to a visual function that closely resembles that of a 30-year-old emmetropic phakic patient. Our current generation of toric, multifocal, and accommodating IOLs requires a refractive outcome within 0.50 diopters (D) of emmetropia in both residual defocus and astigmatism to perform at their highest level. Today, most surgeons generate this...
outcome in only approximately 50% of their patients. The femtosecond laser, by creating a precise, customized, reproducible capsulorrhexis, may enhance defocus outcomes by making postoperative effective lens position more predictable. Customized, reproducible clear corneal incisions and laser corneal relaxing incisions promise improved efficacy in the treatment of preexisting astigmatism and the reduction of surgically induced astigmatism.

Laser-assisted cataract refractive surgery also shows promise in enhancing the safety of cataract surgery. Precise, reproducible incisions should reduce the occurrence of wound leaks, transient postoperative hypotony, and ideally endophthalmitis. Reproducible capsulorrhexis should reduce anterior and posterior capsular tears, vitreous loss, and IOL decentration and subluxation. Femtosecond laser nucleus softening promises less ultrasound energy, phacoaspiration rather than phacoemulsification, and less endothelial cell damage.

Laser-assisted refractive cataract surgery should also reduce the variability of outcomes from surgery-to-surgery and surgeon-to-surgeon. This is a significant public health issue, as results in regards to critical complications such as capsular tear and vitreous loss vary widely amongst surgeons. Every patient deserves the best opportunity for a predictable and safe outcome.

These surgical improvements will be measured against economics of laser-assisted refractive cataract surgery. How might ophthalmologists successfully incorporate this technology into their practices? The availability and affordability of laser-assisted refractive cataract surgery will vary greatly around the world. In nearly all countries, access to a femtosecond laser to enhance cataract surgery outcomes will require some patient-shared responsibility for the additional cost. In some countries, such as Australia, the femtosecond laser can be routinely offered to patients whether there is a lifestyle-enhancing refractive outcome goal or not, while in many European countries the patient may be required to completely opt out of any insurance reimbursement to access laser-assisted refractive cataract surgery. In the United States, to charge an additional fee in the current patient with third-party reimbursement policy suggests the patient must express a desire for a lifestyle-enhancing refractive outcome, which requires the management of astigmatism and/or presbyopia. It will be prudent for all ophthalmologists who incorporate this technology into their practices to start conservatively in regards to the indications and confer with reimbursement consultants and practice attorneys to be certain their billing practices meet all regulations.

Can we ophthalmologists or our senior patients afford the additional costs inherent in adopting this new offering? I believe patient acceptance and utilization of laser corneal refractive surgery serves as a reasonable indicator for the future of cataract surgery. The same 78 million American baby boomers who drove the LASIK market are now turning 65 years old at a rate of 10000 per day. They are becoming our core cataract surgery patient, are accustomed to sharing in the cost of their care, and are highly motivated to pursue the best of technologies available for themselves and their loved ones than previous generations. I believe the demographics strongly support the expectation that a significant number of these patients will accept the additional cost burden if laser-assisted refractive cataract surgery delivers on its promise of enhanced refractive outcomes, safety, and predictability.

Although not for every surgeon or patient, I believe laser-assisted refractive cataract surgery will attain commercial success everywhere phacoemulsification, advanced technology including intraocular lenses, and LASIK are practiced.

REFERENCES