Vector Planning: An overdue paradigm shift

This balanced approach achieves the maximal reduction of both corneal and refractive astigmatism.

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The word “innovation” connotes an element of time. An innovation is a leap forward, reaching a place that perhaps might have been ultimately reached but becomes reality more quickly than by evolutionary trial and error. As one credited with a few innovations, however, let me say that innovation is not for the impatient. Established paradigms are not easily shifted no matter how unsubstantiated the basis for their adoption may be.

Ophthalmology has had decades of technological advances. *Ocular Surgery News* itself, founded in 1982, is an excellent example of how intuitive journalists and new developments can accelerate changes in practice. From the outset it enjoyed widespread industry and physician support, which is ongoing.

OSN provided coverage from the source of the advances, and its launch was well timed. The 1980s saw the last gasp of intracapsular cataract extraction, the widespread use of extracapsular cataract extraction and the ascendency of phacoemulsification toward the end of that decade. IOLs made the transition from anterior chamber and iris clip designs to the posterior chamber and from the inpatient to the outpatient setting, with new leaders emerging to make impressive contributions in surgical approaches, devices and equipment. These occurred in close collaboration with companies that valued these experts’ guidance.

A similar revolution occurred in refractive surgery. Incisional refractive procedures — with concomitant advances also during the 1980s with radial and astigmatic keratotomy — were joined, and then diamond blades were largely replaced by ablative lasers, microkeratomes and femtosecond incisional devices.

The largest, most renowned changes all required two decades before they became generally accepted and popularized. The two most notable technological leaps in cataract surgery were implantation of an IOL after cataract removal in 1949 by Harold Ridley and small-incision cataract surgery enabled by phacoemulsification after its introduction in 1967 by Charles Kelman.

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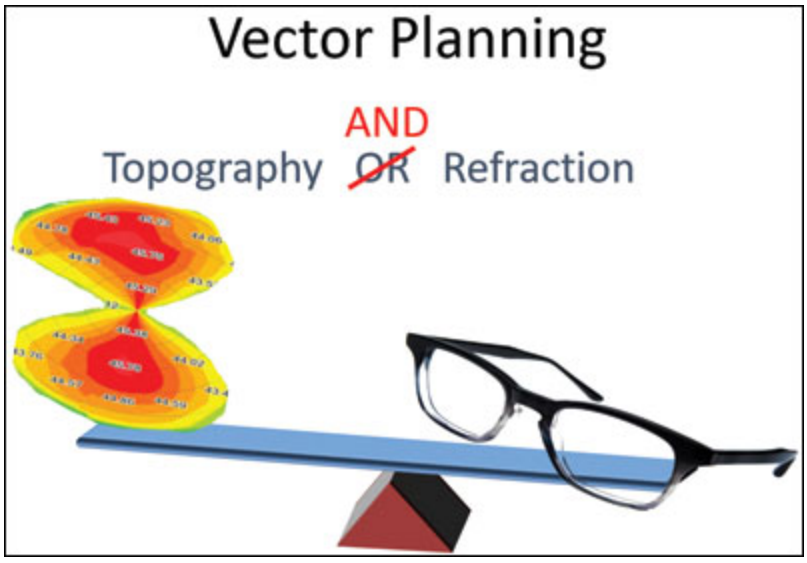
Clear, unequivocal industry support is an indispensable element of technological development and dissemination for such universally accepted shifts as these. Refractive surgery has made large advances, some incremental and others by leaps and bounds. My initial publication of the Alpins method for astigmatism planning and analysis was in 1993. I more fully developed the methodology over the next 20 years, as described in my book, *Practical Astigmatism: Planning and Analysis*. It took that long for the major peer-reviewed ophthalmic journals to adopt my approach as the basis for reporting astigmatism results, beginning with an October 2014 *Journal of Refractive Surgery* editorial. However, a central element of my work — perhaps the most significant and beneficial application of the Alpins method — remains a relatively uncommon practice: Vector Planning.

The technical aspects of Vector Planning can be found in peer-reviewed journals; this article relates to the relative lack of awareness of the visual benefits achieved using Vector Planning to treat all astigmatic errors.

A discrepancy between the two primary means of measuring astigmatism — corneal and refractive — in magnitude, axis or both is termed ocular residual astigmatism (ORA) and should be calculated preoperatively as a prognostic indicator. Using ORA, Vector Planning allows the calculation of laser treatment that maximally treats astigmatism to reduce the amount remaining on the cornea postoperatively compared with treating based solely on refractive cylinder parameters. It does this without compromising the refractive cylinder outcomes at all — what I have often termed as “getting something for nothing,” in itself enough evidence for its adoption as standard practice.

The question commonly asked when Vector Planning is presented is: Why not just enter the spectacle refraction into the laser to eliminate the need for glasses? This simplistic approach, currently utilized by the vast majority of refractive surgeons, is the conventional paradigm, which is advocated at the time of training.

In my opinion, as physicians we are obliged to continuously investigate and utilize methods that offer better outcomes — in this case, improved visual and astigmatic outcomes — and not settle for conventional approaches simply because it is traditional and others do it that way. In actuality, for some 7% of patients, ablating the refractive correction onto the cornea actually increases their corneal astigmatism. These patients typically have high amounts of ORA and end up with suboptimal visual results at best, and at worst have outcomes associated with halos and ghosting of images. Several researchers have demonstrated these results in patients with high ORA, and as a result, there is a growing body of work that supports the use of Vector Planning. Surgeons familiar with Vector Planning will better manage the expectations of such



The treatment of astigmatism using Vector Planning.

Source: Noel A. Alpins, AM, FRANZCO, FRCOphth, FACS

patients by avoiding this excess corneal astigmatism and its negative undesirable consequences.

I have one of the busiest refractive practices in my part of the world and believe that patient satisfaction — attributable principally to Vector Planning as a point of difference — underlies that success. Happy patients refer others. Unhappy patients with adverse visual symptoms will discourage many others, and if their complaints are ignored or trivialized, they can become more active in their opposition to LASIK.

Vector Planning has a sound rationale based on prudent principles, has been extensively published and supported in the scientific literature, and has demonstrated beneficial effects verified by independent researchers. So why is refractive surgeon access to this technology not being facilitated?

First, some ophthalmic device companies can be held accountable; as a paradigm, combining corneal and refractive astigmatism may compete with their own technologies, which may employ just one or the other mode of treatment. Typically, the Vector Planning innovation was “NIH” (not invented here), in their own proprietary R&D facilities, and it does not require an expensive additional piece of hardware to apply it. In fact, the merging of operating software may be seen as a hurdle, creating more effort than it is worth economically for only a limited return, as their development teams might see it.

On the surgeon’s part, the challenge of a new method can be ignored by sidestepping it in favor of the common, more familiar technique. There is also the inherent reluctance to follow a colleague’s innovation without approval or integration by the manufacturer of the laser that they already use, as this step might be perceived as too bold or “off label.” Although most refractive surgeons would consider themselves also

to be corneal experts, paradoxically there does not seem to be sufficient recognition of the benefits of reduced corneal astigmatism that is gained. This seems to be a contradiction to conventional refractive goals of corneal surgery.

On the other end of the scale, optical scientists see the therapeutic world in terms of spectacle and wavefront error and give little priority to the corneal shape except in a secondary sense.

In fact, the cornea is the primary source of the astigmatic error, and what has not been considered are the repercussions resulting from the omission of its shape parameters from the treatment plan.

So, what does it take to get a new paradigm introduced in the refractive laser studio? For a start, there needs to be an acknowledgement by some or all three of these groups that a problem actually exists and a change in approach is required. This is the principal challenge as change is best generated willingly from within the industry. As a parameter, ORA needs to be utilized at the time of patient counseling, and if not used for planning surgery for all astigmatic treatments, then certainly those that are above 1 D should raise concern.

At present, the Alpins method (including Vector Planning paradigm) requires specifically designed software (ASSORT Pty Ltd) that incorporates all the nuances of the method to simplify the surgeon’s approach. It would not be difficult for any interested laser company to make those benefits available to its user base of refractive surgeons and their patients.

Even with the best technology now available based on refractive parameters alone, there is a small percentage of patients, around 5%, who are unhappy with their results. Some may be simply ambivalent about their outcome, but some may become increasingly vocal and visible, as evidenced by the rowdy street demonstration at the 2018 meeting of the American Society of Cataract and Refractive Surgery in Washington, with signboards containing confronting information. This infrequent phenomenon of dissatisfaction until now may have been a silent minority, but it may underlie the languishing popularity of LASIK over the past decade and undermine its widespread success.

The explanations given for this flat LASIK market have been many and varied: the economic downturn, fear and cost of surgery, advances in contact lens technology and the nature of millennials. But even though these detractors are a minority, they can make their views known on a continuous basis both in social media and in the popular press. Although astigmatism was a common complaint in the 140 communications to

the FDA before 2008, the issue of excess astigmatism remaining on the cornea from totally refraction-driven treatments has not been sufficiently highlighted at any time as a cause for unsatisfactory outcomes. Although not generally recognized as a predisposing factor in patient dissatisfaction, this situation of excess remaining astigmatism can cause increasing aberrations even with successful refractive correction and adequate unaided visual acuity.

The rationale for the widespread adoption of Vector Planning is compelling, and the evidence for its benefits over conventional refraction-based treatment is undeniable. The introduction of Vector Planning is a relatively straightforward step. Other more expensive technologies have been introduced on less evidence of improved outcomes. Excimer laser manufacturers need to look at the scientific data available and incorporate this utility for the planning calculated by their system, so that surgeons would have it readily available as an option, in addition to current modes employing only refractive or topographic measurements.

Vector Planning is the balanced approach for treatment to being more mindful of the cornea and achieving the maximal reduction of both corneal and refractive astigmatism. We should give greater consideration to the predicted corneal astigmatism that will remain and how we can minimize its adverse effects to provide maximum visual benefits. We must never forget that, after laser vision correction, patients may no longer require spectacles but must wear their cornea for the remainder of their lives.

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Disclosure: Alpins reports he has a financial interest in ASSORT Surgical Management System, which holds trademarks and patents in Vector Planning.