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# More Than Meets the Eye:

## The Next Generation of Refractive Diagnostics



Bradley Barnett, MD, PhD

Only secondary to the dermatologist, the ophthalmologist is offered direct visualization. For this reason, we lag behind interventional radiology and other minimally invasive surgical fields in imaging guidance. Ophthalmologists have

learned that with advanced imaging we can see more than meets the eye. In addition to OCT, two areas of imaging in the refractive space that are underutilized and poised for adoption are adaptive optics utilized by the WaveDyn Vision Analyzer, and robotic ultrasound with the ArcScan Insight 100.

We are fortunate in ophthalmology to attract the interest of premier optical scientists who have changed our view of the universe through adaptive optics for imaging our solar system. Giants such as Dan Neal PhD, the CEO of WaveFront Dynamics, have begun to apply similar principles of adaptive optics to assess the eye. Dr. Neal and his team are using the WaveDyn Vision Analyzer to generate ray-trace wavefront optimized scleral lenses, but this is just the beginning. It is foreseeable that we will be able to not only achieve excellent results for laser vision correction but also ray-traced modifications in lens-based surgery such as ray-traced light adjustment to the RxSight Light Adjustable lens (LAL).

The WaveDyn provides optimized objective refraction with subjective refinement. Numerous clinical studies are underway demonstrating the power of WaveDyn to provide accurate refraction without subjective input. It is foreseeable that a closed-loop system could be developed in which the WaveDyn directs Laser Vision Correction (LVC) or adjustment of the LAL. With more subjective input from



the patient, we not only introduce error at times but certainly slow things down. This is one of the largest criticisms of the adoption of the LAL. The ability for iterative advancement with real-time nomogram adjustments with Ray-traced treatments and outcomes being assessed by the same machine will enable the neutralization of irregular astigmatism and higher-order aberrations. Such an approach will undoubtedly eventually be adopted for optical tuning of IOLs, Phakic IOLs, and LVC.

The ArcScan Insight 100 provides the highest-resolution images of the entire anterior segment to date. The ArcScan, through its contact-free robotically driven 50MHz ultrasound probe, utilizes a water bath to achieve the



highest resolution scan of the entire anterior segment. The use of immersion eliminates variability induced by tear film instability. With this data, we may be able to more precisely recognize persons who are not LVC candidates as well as monitor outcomes from LVC including arguably the best visualization of LASIK flaps, etc. to date. The imaging behind the iris has applications for monitoring depot drug delivery and ICL surgery, including sizing and verifying correct footplate positioning.

While traditional ultrasound can also visualize this space, the ArcScan resolution and repeatability enable precise determination of effective lens position as well as assessment of vault changes over the life of the patient. The ArcScan elevates ultrasound by incorporating iris registration and robotic control, which enables

us to obtain repeatable imaging of the entire anterior segment. This repeatability provides a yet unavailable effective lens position and ICL vault serially. Together with the adaptive optics of the WaveDyn and the ArcScan, the refractive surgeon will be able to enable real-time analysis of the anatomy of the optical system and how the various refractive interventions change the overall ray-traced optics of the eye.