

The Impatient Innovator

Sitting Down With... Sean Ianchulev, Professor of Ophthalmology at New York Eye and Ear Infirmary of Mount Sinai; Founder and CEO, Eyenovia; and Founder and Chairman of the Board, Iantech Medical.

Sean Ianchulev | 06/06/2017



You're a true innovator – where does that stem from?

I come from an academic background, but I'm very impatient and find the academic approach to product development too slow, which is partly why I work closely with industry. Such collaborative approaches are increasingly necessary, because product development is now so complex. If you want to get even a simple device into patients today, you need to partner with people from many disciplines: engineering, medicinal chemistry, quality, manufacturing, and venture capital. It's no longer as easy as coming up with a Sinsky hook and trying it on patients! For example, even something as safe and non-invasive as intraoperative aberrometry took more than 10 years and millions of dollars of development to get to patients. On the pharmaceutical side even more so – when I was at Genentech and led the clinical development of Lucentis, it needed more than a decade and hundreds of millions of dollars to get it into the clinic. Product development and commercialization are non-trivial parts of the science and innovation process, which is like launching a mission in space – thoughtful, well-planned and disciplined development are required, and this costs real money.



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PRESCRIBING INFORMATION

Which of your innovations do you consider to be the most disruptive?

Intraoperative aberrometry is a good example. When I came up with the idea, I tried it on my patients using a simple auto-refractor during cataract surgery in 2003. It was so powerful and predictive that even 20 patients were enough to get a signal. Getting clinical information early in the process was critical – we published the original series in JCRS. Little did I realize this would break down a 50 year-old paradigm of pre-operative biometry, which had changed only incrementally since the 70s – from the time of Fyodorov’s IOL fundamental models. There have been many permutations and improvements in preoperative formulae since then, but intra-operative aberrometry was based on a categorically different paradigm – in-theater measurement of aphakic autorefractation. And now aberrometry has been used to improve care for more than half a million patients, and counting – the method is almost ubiquitous. Similarly, when I joined Eugene de Juan and Transcend Medical to develop the CyPass Micro-Stent nine years ago, people couldn’t see the point – they were happy with their trabeculectomies and tubes. But today, microstents have revolutionized glaucoma treatment, and MIGS is the fastest growing category in ophthalmology. You simply don’t know where innovation will take you, and building market models is often so treacherous – it is necessary, but often gives investors a false sense of security as they are trained in excel spreadsheets and data analytics. From my experience, all the technologies I have been involved in exceeded estimates by a factor of at least 10. On the venture side, I have seen the flip side of the coin as well – when beautiful and intricate forecasting models come to naught. So, I trust my clinical gut and try to ask one simple question – how can I make patients’ and physicians’ lives better? What is the clinical utility? And then disruption and adoption seem to follow.

What areas remain ripe for disruption?

In technology and telecommunications, major paradigms seem to break down every 20–30 years. In ophthalmology, things are a bit slower and major paradigm shifts can take up to 50 years; therefore, disruption is due where methods have not changed for several decades. For example, trabeculectomy and tubes persisted for almost 50 years before MIGS, and macular degeneration treatment hardly advanced during the 50 years preceding the introduction of intravitreal injections. So it’s interesting that this year is the fiftieth anniversary of Kelman’s introduction of phacoemulsification! That technology was transformative when introduced, but has improved only incrementally since then.

I have come to realize that, after MIGS in glaucoma, cataract surgery will be massively disrupted by translational innovation from cardiovascular surgery and interventional radiology. These fields have amazing minimally-invasive technologies: micro-engineered super-thin filaments, coils, stents and memory-shape devices. Adoption of these systems in ophthalmology will be transformational – not least in cataract surgery and retinal interventions. The explosive uptake of MIGS that we currently see is only the tip of the iceberg – and we’re seeing micro-interventional technology coming to cataract surgery. lantech was founded with this foundational premise – micro-interventional cataract surgery can be even more impactful than MIGS. Actually, most of the CyPass team is now working on this at lantech and we have recruited the CEO of Transcend Medical, Brian Walsh, to lead the company. At ASCRS, lantech revealed the miLOOP – the first in a line of micro-interventional



devices and techniques which can fragment the cataract without any phaco energy – this is a paradigm shift for the field.

Ocular drug delivery is another major area ripe for disruption. We still deliver topical eye drops with a century-old pipette eyedropper paradigm which overdoses the eye with toxic preservatives and formulations using imprecise, non-targeted delivery of non-physiologic doses of 4–5 times the volume of the entire tear lake. While some companies focus on extended delivery, we founded Eyenovia to focus on high-precision micro-dosing using piezo-print micro-therapeutic delivery – similar to an inkjet printer where piezo-printing can ink beautiful pictures with pixel-sharp accuracy. Eyenovia’s device delivers tiny droplets to the eye’s surface within 70 ms and even beats the blink, which is 100 ms. This product will be undergoing Phase III clinical trial in the next 12 months, and we hope it will provide the first microtherapeutic treatments for glaucoma, as well as enabling improved office diagnostics in dilated eye exams. It is also the first smart technology using mobile connectivity for 100 percent 24/7 compliance monitoring. That’s a few years away, but when it reaches the market it will have far-reaching implications for every front-of-the-eye disease.

Finally, stem cell applications will be another big area for ophthalmology; limbal stem cell replacements for dry eyes and retinal problems could be revolutionary. Stem cell commercialization will, however, require enabling advances, not only in cell scaffold technology but also in surgical micro-intervention and visualization. People have understood that attaching technologies to the microscope dramatically extends its possibilities beyond visualization alone – by 2030, the surgical microscope will look like an airplane cockpit! Then, we can pair this with robotic eye surgery – welcome to another paradigm shift. I have been advising on two very promising breakthrough technologies – one is a robotic surgical system by Preceyes, Inc and the other is personalized IOL refractive modulation by Perfect Lens, Inc. which can dial in any custom mono-focal or multifocal power to an IOL. So, I can see a future where IOL customization will take the cataract IOL paradigm out of the shoe-size stocking and inventory age. Of course, this will take the intraoperative aberrometry invention out of commission –I guess one cannot change that!

You did a Master’s of Public Health – how did that change you?

I was the first student at Harvard to self-design a four-year MD/MPH program; at that time, they didn’t have one, so I was a bit of a guinea pig. As per the rule of unintended consequences, this had a transformative impact on my career. I realized I could do a lot more as a physician by working outside direct patient care than by working within it. The program showed me how disconnected medicine is from public health, and how clinicians can have a completely different scale of impact when they contribute to a public health effort. A great surgeon can only treat one patient at a time. My mother is a professor and retina surgeon in Bulgaria and she helped so many with her hands. She taught me the value of clinical practice and good doctoring! What I learned from my public health studies is that while doctoring is limited to your personal domain, health care and medical innovation transcends the regional and impacts the global. If you develop a new product and bring it to patients, then you can benefit millions.

What’s the biggest challenge in ophthalmology today?

First, we need more bright, entrepreneurial ophthalmologists to get involved and step out of the clinical practice treadmill. Ophthalmology has genericized itself both technologically and practice-wise; it is all about volume and less about differentiation and eminence. There are so



many ideas out there – I get approached every week by a colleague or resident who have had a light bulb go off. But an idea is just the beginning – it needs to be matured into a solution, the solution developed into a product and ultimately into a business which can scale and touch many patients, and that takes a village, or as the Transcend team say, it takes a tribe! I think we need to get more efficient and smarter about how we practice medicine. My team published a study in Ophthalmology 18 months ago, where we analyzed a database of 20,000 office-based cataract surgeries, and found it to be pretty safe – not a single case of endophthalmitis. This gave some people heartburn, but it has tremendous implications: avoiding the OR frees up OR space for other procedures, and aligns cataract surgery with refractive surgery in terms of how it's done. It reduces resource use and improves efficiency – leaving the OR rooms for the more major procedures which need it.

What advice would you give to aspiring innovators?

Follow your passion and trust yourself. Doctors are not always the greatest businessmen, but being able to wear a clinician's hat when judging new technologies – to really understand their clinical utility – is tremendously helpful. But you can't know from the outset which ideas will result in paradigm shifts; you have to persevere – and for that you need passion.

Sean Ianchulev reports the following relevant disclosures: Founder and Chairman of Iantech, Inc; Founder and CEO of EYENOVIA, Inc; Advisor to Alcon-Novartis; and a partner of PME Ventures.

About the Author

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