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Predictable refractive outcomes: The future of keratoconus treatment

Experts say PiXL procedure is promising but still has “a long way to go”

By Liz Hillman, Eyeworld Staff Writer

We are in an era of rapid innovation in corneal refractive surgery, and the last 12 months have given us a wide range of technologies that provide more options to improve the outcomes for our patients. One particularly exciting technology is corneal crosslinking, and specifically its use in therapeutic cases. According to the 2016 ASCRS Clinical Survey, almost 20% of ASCRS members plan on performing crosslinking procedures in the next 12 months.

In this month’s “Refractive editor’s corner of the world,” Roberto Pinelli, MD, Anders Behndig, MD, and A. John Kanellopoulos, MD, provide an excellent overview of how this new technology may fit into our practices, in terms of patient selection, protocols, and potential combination treatments. Corneal crosslinking, though available outside of the U.S. for many years now, is a new option for many surgeons. As with any new product, we should continue to review studies and the literature, as well as seek out additional educational resources to ensure we are well versed and equipped to provide the best options for our patients.

Steven Schallhorn, MD, Refractive editor

This topography-guided crosslinking, which has been available internationally for the last few years, is marketed by Avedro as the “next revolution in refractive correction” in low myopic or post-cataract patients. Dr. Behndig spoke at the ASCRS•ASOA Symposium & Congress about PiXL in the context of providing customized, refractive keratoconus treatment.

PiXL offers a new indication of the availability of PiXL, it automatically becomes the treatment of choice because not only can it stabilize ectasia through its efficacy and safety and introduction of higher corneal rigidity, but it can also through its variable pattern help improve the refractive effect,” he said, noting that correction of irregular myopic astigmatism, which is especially linked to keratoconus and post-LASIK ectasia, would be an extreme benefit to patients.

PiXL is not the only procedure that seeks to address refractive error while ensuring a stable cornea. Conventional crosslinking has also been combined with topography-guided PRK, intrastromal rings, and LASIK.

Dr. Kanellopoulos said that while traditional crosslinking in and of itself can result in a 1.5–2 D correction of irregular astigmatism and flattening, when performed after PRK—the Athens protocol—physicians can achieve up to 15 D of correction.

Dr. Pinelli said that when refractive error of up to 2 D remains after transepithelial crosslinking (also known as epi-on crosslinking where the epithelium is not removed prior to soaking the cornea with riboflavin as it would be in epi-off procedures), he usually corrects it with an advanced surface ablation technique. For higher diopters of refractive error, Dr. Pinelli said he usually performs intraocular surgery, such as a lensectomy or phakic IOL implant, 3 months post-crosslinking.

Dr. Behndig told Eyeworld that the fact that PiXL doesn’t remove any tissue might be an advantage, but he acknowledged that PRK may have better refractive precision.

“We don’t know which factors make one treatment—PiXL or crosslinking and PRK—better than...
the other in the individual case," he said.

Dr. Kanellopoulos said PiXL could be combined with topography-guided PRK as well for even better refractive outcomes.

"In my mind, any patient with a refractive error resulting from corneal ectasia and keratoconus is a good candidate for the Athens protocol [topography-guided PRK followed by crosslinking]; having PiXL in our hands, we can employ [it] in combination with the partial topography-guided PRK in order to achieve a better refractive correction of the cornea and also being able to remove less tissue and/or being able to apply this even in corneas where no tissue can be removed due to limitations from cornea thinning that go along with ectasia," he said.

Where to go from here

Dr. Kanellopoulos said PiXL is his treatment of choice for patients with corneas too thin to consider an excimer or femtosecond laser procedure and for post-cataract surgery patients left with only a small amount of ametropia. Still, he said more needs to be learned about cornea biomechanics and variability among patients. He also said a dose effect nomogram needs to be developed.

Dr. Pinelli thinks PiXL should be improved when it comes to the time and energy currently required in the procedure.

"Sometimes the treatment is too long; we should stay within the accelerated crosslinking parameters," he said.

Dr. Behndig said more research is needed to optimize treatment parameters of PiXL for both keratoconus and myopia patients. EW

Editors’ note: Drs. Behndig and Pinelli have no financial interests related to their comments. Dr. Kanellopoulos has financial interests with Alcon (Fort Worth, Texas), Allergan (Dublin), A.R.C. Laser (Nuremberg, Germany), Avedro, KeraMed (Orange, California), Optovue (Fremont, California), and Carl Zeiss Meditec (Jena, Germany).

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