Two companies develop new approaches to vision correction


Perry S Binder


Guoqiang Li

by Devon Schuyler

THE humble pair of eyeglasses is getting a high-tech makeover, thanks to two companies in the US.

The first, California-based Ophthonix, has successfully introduced "high-definition" glasses that correct high-order as well as low-order vision abnormalities and is already experiencing a significant positive in market response. The second, Virginia-based PixelOptics, is developing glasses with dynamic lenses that can switch between various corrections as needed.

High-definition glasses

The iZon™ glasses employ the same wavefront technology that has been used since 2002 in some LASIK machines, according to Perry S Binder MD, an ophthalmologist in San Diego and Ophthonix's medical director. They are designed to provide excellent acuity, improved contrast, minimal glare and distortion, and high colour perception.

Physicians and optometrists who want to prescribe the glasses must first purchase a special wavefront aberrometer from the company, called the Z-View™. The device automatically records high-order aberrations (trefoil, coma, and spherical aberrations) – know as the optical fingerprint, or iPrint™ – as well as low-order measures. The Z-View is as accurate as surgical aberrometers but is priced at about half of what a practitioner would pay for the surgical instruments. So, it is affordable for practitioners who dispense spectacle lenses.

"Significant higher-order aberrations exist in more than 90% of myopic and 70% of emmetropic patients," says Dr Binder. "And, higher-order aberrations represent about 20% of refractive error, which is why patients don't see clearly or experience problems in low contrast conditions," he continued.

Because the type and degree of aberration affect whether the glasses will help a particular person, a built-in software program analyses how likely they are to make a difference.

After a patient has decided to go ahead with the glasses, the prescription and the patient's frames are sent to Ophthonix. There, the company manufactures the lenses and returns the finished product within three weeks.

The iZon lenses were first introduced in April 2005 in a regional launch in the US. According to Dennis Jarvis, the company's vice-president of marketing, the company also introduced a progressive-lens version in March of this year. "Patient feedback has been very positive, with better than eight out of 10 preferring the iZon Lens," noted Jarvis. The iZon Lens is the only eyeglass product that is fully customised, because it incorporates the patient's iPrint. As a result, patients see in high definition.

"I just got the iZon Progressives a week ago, and I'm very happy with them. I'm going to test them out this weekend on my golf game," said Dr Binder.

David I Geffen OD, who prescribes the lenses as part of a group practice with Dr Binder, said he screens all his patients with the wavefront aberrometer. The machine rates about 80% of people without previous corneal surgeries as being good candidates for the glasses; the rate is lower for people with previous surgeries because the machine may have difficulty obtaining an accurate reading. He said he recommends the iZon lenses to about 10% of his patients who need single-focus lenses and half of those who need multifocal lenses.

Some people have expressed concern that the glasses might not work if they slip down the face. However, with its proprietary design and process, Ophthonix is able to optimise the entire lens, so patients will see in high definition whether they are looking through the centre or peripherally, when their gaze angle shifts.

Dr Binder said that the company is currently studying the lenses in people with optical complaints from LASIK surgery or the implantation of multifocal lenses. The lenses also might be especially useful for competitive athletes.

The company has distributors in Switzerland, the UK, Italy, and Germany in preparation for an official European launch in 2007.

Dynamic-lens glasses

An intriguing pair of glasses that switches between two focusing powers is in the prototype stage. A team led by Nasser Peyghambarian PhD, a professor of optical sciences at the University of Arizona, is developing the technology for PixelOptics. The technique was recently described in The Proceedings of the National Academy of Sciences (April 2006; 103:6100-6104).

"We sandwich liquid crystal between two pieces of glass, one of which is covered with tiny ring electrodes," said Guoqiang Li PhD, an assistant research professor of optical sciences at the University of Arizona, and the study's lead author. When an electrical charge is applied to the electrodes, the orientation of the crystals changes and the lenses change their focus.

Dr Li said that his goal is to overcome the limited field of view that exists with current bifocal and progressive lenses.

"With the switchable glasses, you can use the full aperture of the lens."

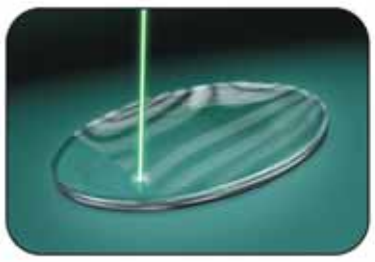
The lenses presently provide no vision correction when uncharged, shifting to reading glasses only when a charge is applied. Dr Li explained that this is an important advance over previous versions, which worked as reading glasses when uncharged – meaning that a sudden power failure could pose a hazard for someone driving a car. Future commercial versions of the glasses will be able to shift between correction of myopia/hyperopia (distance correction) and presbyopia (reading correction).

The prototype glasses are relatively large and heavy, but eventually will be pared down. Although a manual switch is currently used to activate the glasses, Dr Li said that his group was working on an automatically adjusting lens that would have a sensor to detect the distance of an object, just like a camera lens. The group is also working on lenses that have triple focusing power to replace trifocals.

Dwight Duston PhD, executive vice-president of research and development for PixelOptics, said that the company hopes to begin selling the glasses in the US within the next few years. He said that the commercial version will be no larger or heavier than regular glasses, with tiny chips and batteries hidden in the nosepads or earpieces. At night, the user would place the glasses in a stand that would recharge the battery overnight – much like a cell phone. He predicted that a larger company might eventually acquire PixelOptics and bring the glasses to a worldwide market.

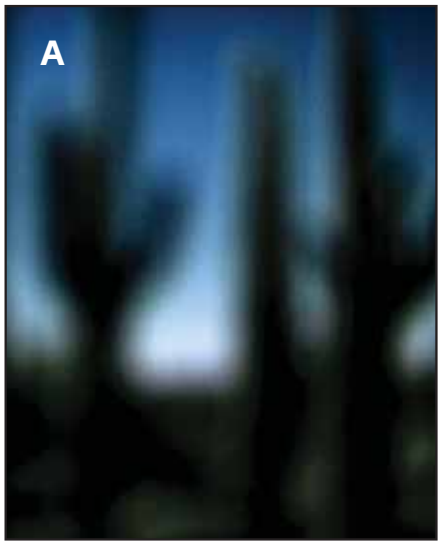
garrett23@aol.com
Dig2020@aol.com
gli@optics.arizona.edu
dduston@pixeloptics.com

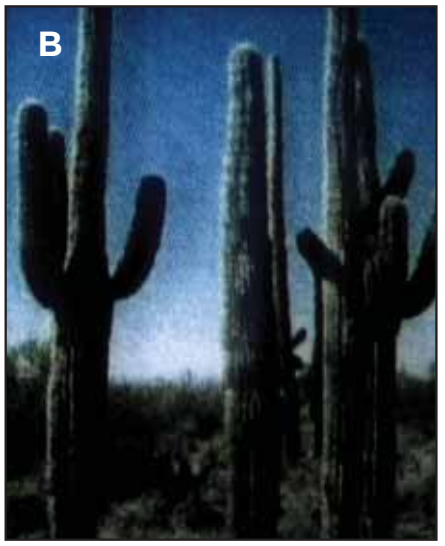
This proprietary composition allows Ophthonix to incorporate the wavefront measurements from the Z-View Aberrometer onto the lens.



Patented iZonik programmable and photo-refractive polymer is sandwiched between front and back surface blanks. This creates a multiple composition layer of the lens.

Courtesy of Perry S Binder MD





Courtesy of Guoqiang Li PhD

Hybrid imaging using the 1-diopter electro-active diffractive lens with the model eye. The function of the diffractive lens is to provide near vision correction to the model eye. (a) The object is placed at a reading distance (~30 cm). The image is severely out of focus in the model eye when the diffractive lens is OFF. (b) When the diffractive lens is activated, the object is imaged clearly. Guoqiang Li et al, PNAS USA, V103, 6100-6104 (2006).