OFTALMOLOGIE

Electronics

Electronic Glasses That Treat "Lazy Eye"

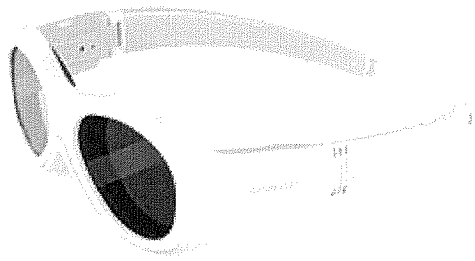
Charles Heschmeyer

19 January 2016

One of the most common vision problems in children is lazy eye, or amblyopia, a condition in which the vision in one eye does not develop normally during early childhood. Common treatments are eyepatches or medicated eye drops. Both treatments can be challenging for ophthalmologists and parents because children tend to show strong resistance to them. Failure to follow these treatments is the number one cause of children going blind in one eye.

Now, the U.S. Food and Drug Administration (FDA) has approved a new type of treatment: electronic glasses that combine both vision correction and occlusion therapy in one device.

Trademarked Amblyz, the glasses are the creation of XMD, a spinoff of the European company XPAND, a leader in active shutter 3D eyewear for movie theaters, gaming and home entertainment. The colorful lightweight plastic frames are designed to appeal to kids and the glasses themselves look like a mix of everyday prescription eyewear and sunglasses.



The electronics glasses have won approval from the U.S. Food and Drug Administration. Image source: xpand.meBecause lazy eye is mostly a condition of de-activated or neglected neural pathways between one eye and the brain, the treatment of lazy eye is based on the occlusion principle: by blocking the vision in the stronger eye, the brain is stimulated to use the weak eye to see, which ultimately improves vision in the weak eye.

How They Work

The Amblyz liquid crystal display, or LCD, lenses are made of shatter-proof laminated glass that features an electronic shutter controlled by a pre-programmed microchip embedded in the frame. Powered by a rechargeable Li-ion battery, the microprocessor controls the shutter, allowing it to turn opaque and intermittently occlude the stronger eye to treat the weaker one.

For XPAND, the biggest engineering challenge wasn't the shutter technology, which has been applied in entertainment markets for more than a decade, but coming up with a kid-friendly product.

"Designing a product that was exclusively targeted at young children in the age range of 3-10 years was new for us," says Karel van Gorp, XMD co-founder and product development director.

Unexpected requirements came up, for example the absence of buttons. Van Gorp says that small children love to push buttons so including them on a device could compromise the treatment. Eventually, however, the main challenge was finding the optimum among robustness, light weight and comfort. "Choosing the right medical grade materials was key," he says

Shutter Technology

Active shutter technology is based on two properties of liquid crystals, or LCs. They align in a specific direction under the application of an electric field, and they influence the polarization of the light passing through them. The LCs are placed between two glass layers covered by a polarizer to form a shutter lens. Without an electric field, the lenses are transparent, but with a slight tint. When the electric field is applied over the LCs they align in such a way that they polarize the light in the direction opposite to the polarizer, thereby blocking all the light from passing through. This results in the eye being occluded behind the lens.

By modulating the electric field, the occlusion can be controlled up to very high frequencies. At XPAND, engineers manipulate the open and closing of the shutters in the realm of 10 microseconds, allowing virtually any desired occlusion frequency and pattern.

Breakthrough Treatment

Creating a viable, FDA-approved alternative to the adhesive eyepatch was itself an advancement in treating amblyopia, says Daniel Neely, MD, Professor of Ophthalmology at the Glick Eye Institute at the Indiana University School of Medicine. "This form of standard therapy has not changed in the last 50 years, so the new treatment with the LCD glasses is definitely a breakthrough."

The eyepatch can be a source of embarrassment, discomfort and even trauma in children, preventing it from being an effective therapy for many patients. "When we talk to adults who were patched as children, they always describe what a horrible experience it was," Neely says. "It is traumatic for children and families."

Not only are the new glasses as effective as the patch for correcting moderate amblyopia (vision of 20/40 to 20/100), but it even may be superior for more severe amblyopia and noncompliant patients. "The reason is that the glasses are more enjoyable and permit normal vision every 30 seconds from the good eye whereas adhesive patches require covering the good eye continuously for two to six hours or more straight," Neely says. Children who cannot see well do not tolerate this very easily, he says. Neely is a specialist in pediatric ophthalmology involved in the Amblyz study presented at a November 2015 meeting of the American Academy of Ophthalmology.

Typically, the treatment course for amblyopia runs six to nine months, but in some cases significant improvement in vision can be noted in as little as three months. "The glasses have been amazingly effective at treating amblyopia," Neely says. "So far we have found them to be 100% equal to the traditional form of treatment."

In fact, the programmable LCD glasses have proven so effective in treating moderate amblyopia that research is underway to apply the technology to treat more severe vision impairments including strabismus (misalignment of the eye, either inward or outward), myopia, hyperopia and astigmatism.

Market

About 4% of all children suffer from lazy eye and another 4% from strabismus. Because of some overlap in the conditions, this means that the conditions are present in around 7% of all births

annually, resulting in about 300,000 new patients each year in the U.S. "We're determined to help improve the quality of life and saving the eyesight of as many children as possible," says XMD's van Gorp. "We have an extensive pipeline of new applications of our wearable medical technology lined up, both in vision care and in other fields of neurostimulation."