

# New eyedropper delivers medication more precisely with less waste and reduced side effects

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A new kind of eyedropper can deliver tiny droplets of medication, treating the eye more precisely than traditional eyedroppers, while reducing waste and avoiding dangerous side effects. According to research presented today at AAO 2017, the 121st Annual Meeting of the American Academy of Ophthalmology, this technology may prove to be especially advantageous in the treatment of dry eye and glaucoma, for which patients require daily use of medicated eye drops that can cost hundreds of dollars for a bottle that lasts only a month.

Researchers at New York Eye and Ear Infirmary of Mount Sinai showed that a microdose delivery system achieved a treatment effect comparable to a conventional eyedropper, while delivering less than four times the amount of drug. Microdosing also reduced the eye's exposure to the drug and preservative by 75 to 80 percent. Patients experienced reduced side effects, leading to a gentler treatment.

While glaucoma treatment preserves sight by reducing pressure inside the eye, it can also cause painful, irritating side effects for patients.

A conventional eyedropper's opening creates a drop that's four to five times larger in volume than the human eye can actually hold. When drops are too big, the overflow runs down the face or drains into the body through the ducts in the corner of the eye. Oversized eye drops don't just waste medication, they

overdoses the eye with medication and toxic preservatives that cause side effects, such as redness, itching, irritation, and dry eye. Some topical medications can cause the heart to beat too fast, too slow or irregularly when too much is absorbed into the body.

Delivering drugs in very small, precise dosage volumes not only avoids spillage, it can also decrease tearing and blinking, thereby limiting dilution of the medication. The hand-held system evaluated in the study could deliver precise, single-digit microliter doses of medication to the eye's surface within 80 milliseconds, quicker than the blink of an eye.

To test the safety and effectiveness of microdosing, the researchers delivered a common drug ophthalmologists use to dilate the pupil and examine the back of the eye. Microdosing was used to treat one group of patients, while a conventional eye dropper was used to deliver the drug to another group.

They found that high-precision microdosing dilated the pupil as well as the conventional eye dropper method. At the same time, microdosed patients showed lower levels of the drug in their bloodstream. They also experienced a significantly lower rate of side effects – 8 percent compared with 66 percent for patients treated with conventional eyedrops.

“We believe that we have developed a viable 21st-century microdosing technology to transform the 100-year old eyedropper paradigm with modern, high-precision smart technology,” said lead researcher, Tsoncho Ianchulev, M.D. MPH, professor of ophthalmology at the Icahn School of Medicine at Mount Sinai. He is also the director of the Ophthalmic Innovation Technology Program at New York Eye and Ear Infirmary of Mount Sinai Hospital.

Dr. Ianchulev expects additional clinical trials to begin within the next 12 months to further evaluate the technology

for treating patients with glaucoma, as well as for pupil dilation. He believes the first micro-therapeutic formulations could be available for consumers by 2020.

Dr. Ianchulev noted that the microdosing approach could eventually be used to treat a wide variety of eye diseases and conditions, such as dry eye, allergic eye disease, and infections. He also believes that the smart electronics of the platform will be used for digital health applications, such as compliance monitoring by both patients and physicians.