**Commercial Ophthalmic Products with Advanced Drug Delivery System (DDS) and Formulations**

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**Background and aims.** Ocular drug delivery poses significant challenges due to the complex anatomy of the eye and physiological barriers such as tear drainage and the corneal epithelial barrier. Conventional eye drops, while convenient, have low bioavailability due to rapid loss from tear production and eyelid movements, resulting in short retention times on the ocular surface. To solve these problems, new drug delivery systems (DDS) have been developed to increase the residence time, penetration, and bioavailability of drugs. Advanced DDS aims to provide controlled and sustained drug release, target disease sites directly, reduce dosing frequency, and minimize systemic absorption and side effects.

**Methods.** This study selected major ophthalmic products approved by the FDA from 2021 to 2024, categorized by topical application and drug-device combination. We focused on seven commercial products that use a variety of advanced technologies, including proprietary buffer systems, low- viscosity gels, surfactants (SFAs), microdose array printing, and intraocular implants.

**Results.** By applying advanced DDS to ophthalmology, it overcomes the unique anatomical and physiological barriers of the eye. The pHast™ system allows rapid pH adaptation upon administration, increasing the limited ocular bioavailability of pilocarpine (1-3%) to high levels. The iDose TR® implant sustained intraocular delivery of travoprost for up to 3 years, reducing intraocular pressure without daily drops. Other innovations—such as low-viscosity gels, microdose array printing, SFA-based tear stabilization, nanomilling, and water-free formulations—further enhanced drug penetration, minimized visual disturbance, and improved formulation stability. These advances collectively enhance bioavailability, targeted delivery, and sustained release, improving therapeutic outcomes and patient compliance.

**Conclusion/Discussion.** Recent developments in DDS have introduced concrete technologies that enhance drug delivery to the eye, leading to effective treatment of ocular diseases. Ongoing development in DDS is expected to lead to new therapies that can improve the effectiveness and convenience of eye care.

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**References**

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