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# Ophthalmic formulations for treatment of scarring following glaucoma surgery

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**Statement of the Problem:** Glaucoma is the greatest cause of irreversible blindness in the world. This condition can be treated by glaucoma filtration surgery (GFS) which is conducted in the subconjunctiva. GFS is currently a complex surgical procedure that requires considerable post-surgical treatment to stop fibrosis and to promote healing. Fibrosis can be inhibited in 30% of patients using cytotoxic antiscarring agents (e.g. mitomycin-c, 5- fluorouracil), which are the only clinically used medicines to control fibrosis after GFS. There is no licensed treatment to treat ocular fibrosis. Ilomastat is a matrix metalloproteinase inhibitor that has been shown to inhibit fibrosis after GFS in a rabbit model of ocular fibrosis. To reduce scarring and fibrosis following GFS, an effective formulation of ilomastat is required that allows a prolonged local concentration of ilomastat to be maintained within the subconjunctival space. In this study, we describe the development of ophthalmic formulations of ilomastat in form of topical eye drop and self-gelling implants.

**Methodology & Theoretical Orientation:** Ilomastat eye drop was prepared using hydroxypropyl-β-cyclodextrin in aqueous solution. Permeation of ilomastat-cyclodextrin (ilomastat-CD) eye drop through pig eye conjunctiva was studied using Franz diffusion cells. In vitro activity of ilomastat-CD was assessed using fibroblasts seeded in collagen. Ilomastat-CD eye drop was applied to rabbit eyes in vivo, and the distribution of ilomastat in ocular tissues and fluids was determined by liquid chromatography-mass spectro-scopy. Subconjunctival implant of ilomastat was prepared using cross linked hyaluronic acid (HA) matrix. The release of ilomastat from the implant was measured using high performance liquid chromatography.

**Conclusion & Significance:** Administration of topical ilomastat-CD in vivo to rabbit eyes resulted in presence of ilomastat at therapeutic concentration in the conjunctiva and within the aqueous humor. Ilomastat was slowly released from the HA matrix implant up to 28 days. Ilomastat in form of topical eye drop and self-gelling implant can be used for prevention of scarring following GFS.

**Recent Publications:**

1. Mohamed-Ahmed A, Lockwood A, Li H, Bailly M, Khaw P and Brocchini S (2017) An ilomastat-CD eye drop formulation to treat ocular scarring. Investigative Ophthalmology & Visual Science 58(9):3425-3431.
2. Mohamed-Ahmed A, Awwad S, Sharma G, Heng J, Brocchini S and Lockwood A (2017) Principles of pharmacology in the eye. British Journal of Pharmacology DOI: 10.1111/bph. 14024.
3. Gibson D J and Schultz G S (2013) Molecular wound assessments: matrix metalloproteinases. Advance Wound Care (New Rochelle) 2:18-23.
4. Ru Q, Fadda H M, Li C, et al. (2013) Molecular dynamic simulations of ocular tablet dissolution. Journal of Chemical Information and Modeling 53:3000-3008.
5. Parkinson G, Gaisford S, Ru Q, et al. (2012) Characterization of ilomastat for prolonged ocular drug release. AAPS PharmSci-Tech. 13:1063–1072.

## Biography

Abeer H A Mohamed Ahmed has her expertise in pharmaceutical formulations development. Her main interest is in the translation of pharmaceutical laboratory research into the clinic. Her research passion is focused on addressing unmet clinical needs. She has been working as Research Fellow and main Formulation Scientist in several projects funded by Medical Research Council and Welcome trust at UCL School of Pharmacy. Her passion is developing novel ophthalmic formulations to treat scarring following ocular surgeries. She is also interested in tropical eye diseases. She has been working in close collaborations with clinicians, academia and pharmaceutical companies to develop anti-scarring ocular formulations.

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