Novel Long-acting Ocular Drug Delivery Systems

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RE-VANA
Vision in the Future

The Problem

Visual impairment and blindness is one of the major health challenges facing the UK's National Health Service (NHS). The World Health Organization estimates that globally about 285 million people are visually impaired, of which 39 million are blind and 246 million have low vision.

Eye diseases that originate in the retina lead to permanent loss of vision if left untreated and account for the majority of blindness, such as in patients with age-related macular degeneration (AMD), diabetic retinopathy, uveitis and glaucoma.

Drug delivery to the posterior segment of the eye is notoriously difficult. This is due to a number of distinct biological barriers and clearance mechanisms that hamper the delivery of effective drug concentrations at the target tissues (e.g. retina or choroid) [1]. Currently, direct injection of medicine into the eye (intravitreal injections) is a standard practice. However, due to the chronic nature of these conditions, and the short-acting nature of the medicine available, patients require ***monthly*** injections for indefinite period of time.

Our solution

A controlled release system would be ideal and a solution may lie with *in situ* forming implants (ISFI) or pre-formed implants (PFI) which are composed of biodegradable and FDA approved biocompatible materials.

- ISFI can be administered using **narrow bore hypodermic needles** (e.g. 30/31G)
- Implants are made from **biocompatible & biodegradable** polymers
- Allows **localized** drug delivery
- **Sustained** & **tailored** drug delivery is achievable (2-12 months)
- Ability to deliver **wide range of molecules**, including proteins/peptides or gene therapy

Results

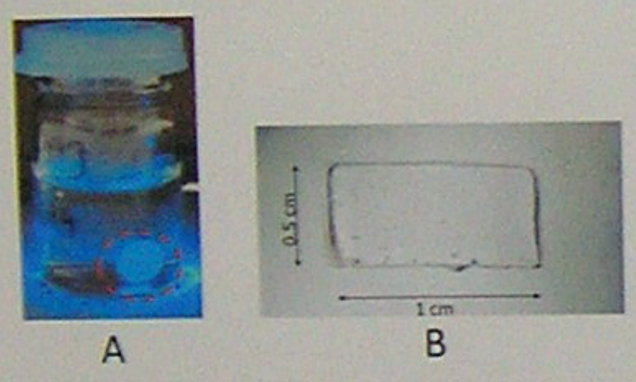


Fig.1 (A) ISFI formed in PBS (B) PFI

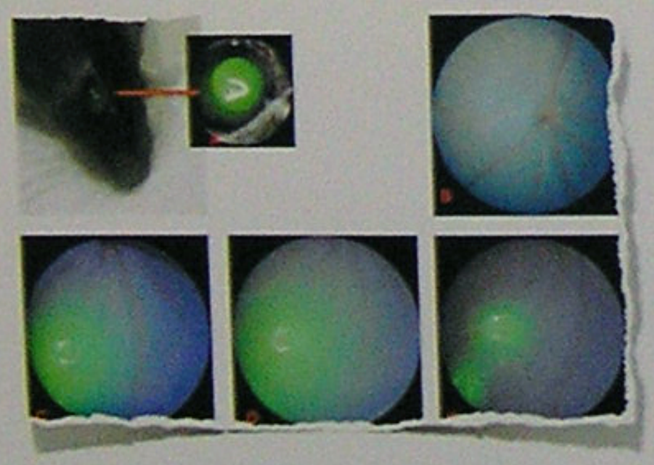
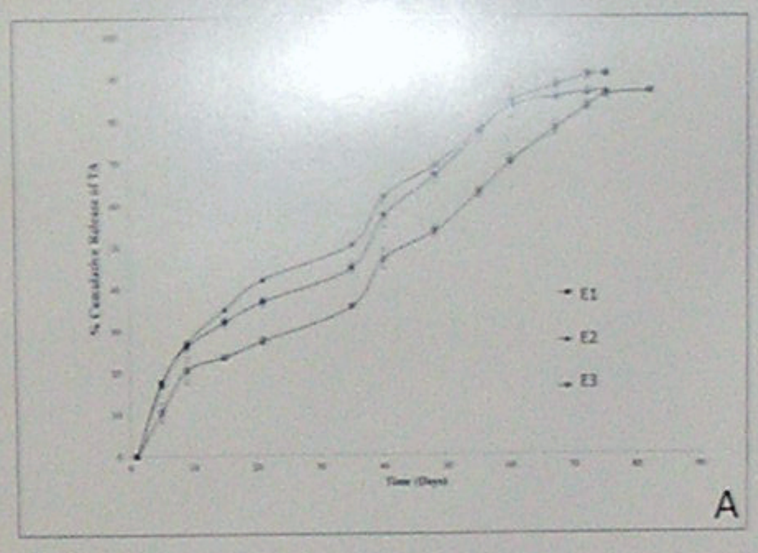
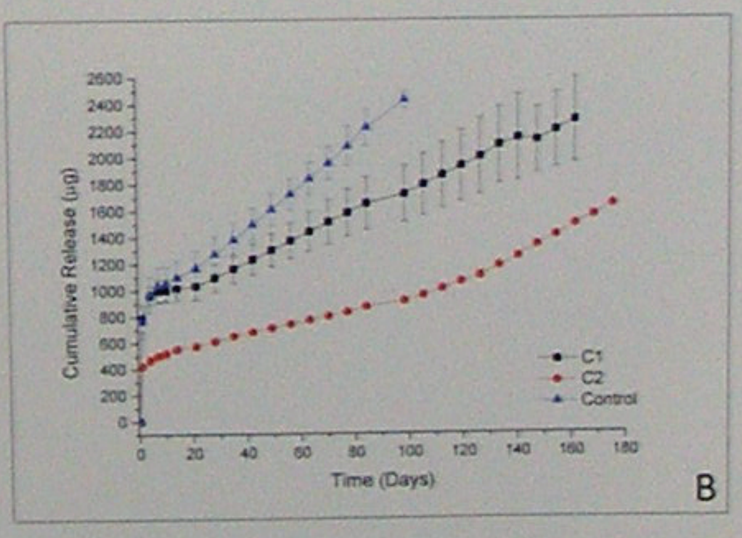


Fig.2 *In vivo* implant formation in rat eye





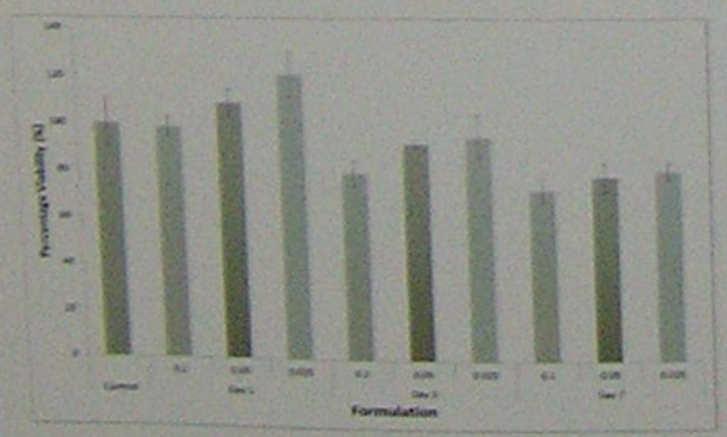


Fig.3 Percentage cell viability after ARPE-19 cells were exposed to various sized implants.

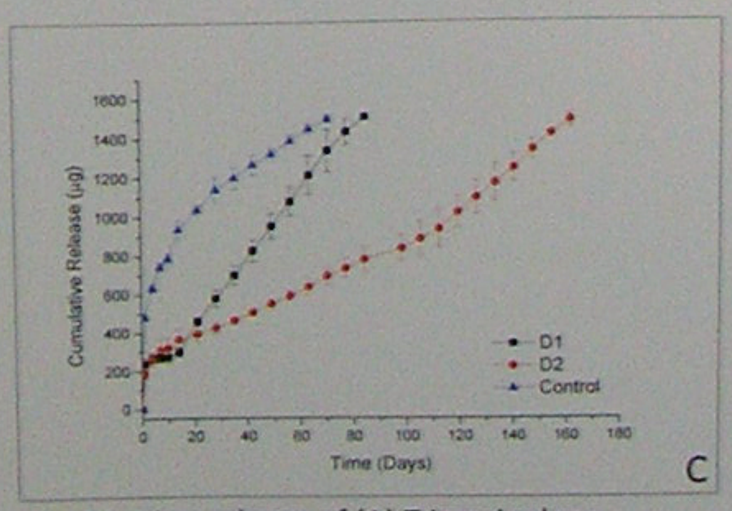


Fig.4 *In vitro* release of (A) Triamcinolone acetonide (B) Ovalbumin, and (C) Avastin®

* PLGA/NMP/No hydrophilic additive

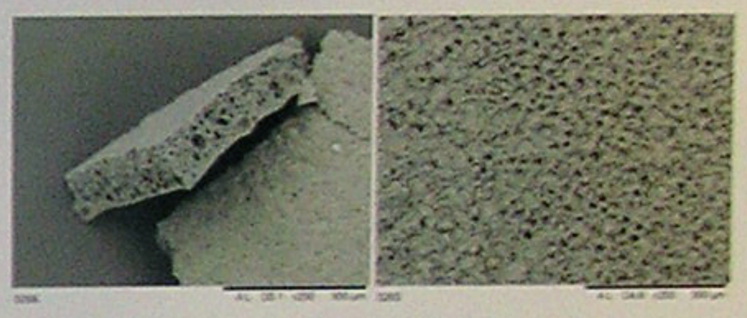
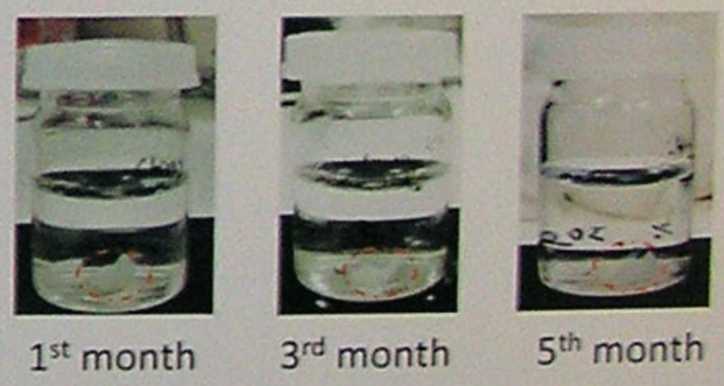


Fig.5 SEM figures of ISFI showing outer shell (left)and inner structure (right).



1st month 3rd month 5th month

Fig.6 *In vitro* biodegradation of ISFI in PBS

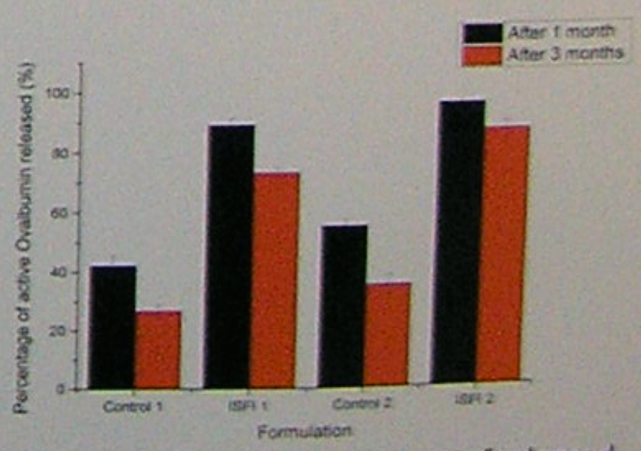
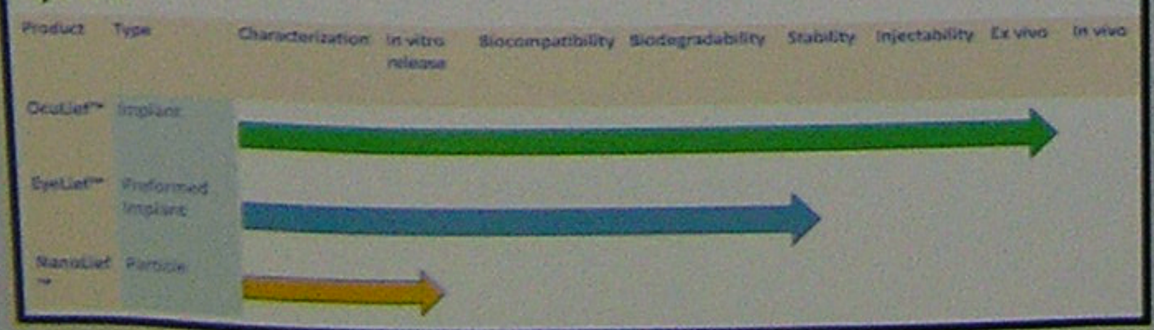


Fig.7 Release bio-stability: Percentage of released Ovalbumin that retained activity as analysed by ELISA (Mean ± SD, n=3).

Pipeline



References

[1] Gaudana, R., Jwala, J., Boddu, S., & Mitra, A. Pharm. Res. 2009;26(5):1197-1216
[2] Thakur, R. R. S., McMillan, H. L., & Jones, D. S. J. Control. Rel. 2014;176:8–23

Acknowledgments

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