Prevention of pseudophakic cystoid macular edema with drug-eluting hydrogels as therapeutic intraocular lenses

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Background & Objective

Pseudophakic cystoid macular edema (PCME) is the most common cause of visual impairment in the medium term after cataract surgery and, in most severe cases, it can lead to permanent vision loss. Therefore, the prophylactic topical administration of combined steroids and non-steroidal anti-inflammatory drugs is commonly done after surgery. In the last decade, the development of drug-eluting intraocular lenses (DEIL) gained interest as an efficient way to overcome the compliance issues related to the use of topical drops without the need for additional surgical steps. Hence, hydrogels were designed as BS materials able to co-deliver a steroid (desacromethasone sodium, DS) and a non-steroidal drug (Bromfenac sodium, BS), and satisfy an urgent medical need for the prevention of PCME.

Methodology

Two different strategies, namely addition of functional monomers and molecular imprinting, were applied to improve the drug release profile from the hydrogels. A singled-out software was used to select suitable functional monomers. After loading by soaking into a single-drag solution, drug release tests were performed in sink conditions. The best systems were then loaded with the two drugs by soaking into a final-drag solution. A mathematical model was applied to predict the in vivo drug release behavior in the aqueous humour.

Results

Conclusion

The incorporation of APMA as a functional monomer improved the drug uptake of both drugs. Molecular imprinting with BS resulted in a decreased drug release due to the presence of permanent bonding between the drug and the hydrogel, while molecular imprinting with DS improved the subsequent drug release kinetics and increased the amount of drug loaded. The application of a mathematical model to predict the in vivo drug release behavior from the hydrogels functionalized with APMA and imprinted with DS indicates that it shall be possible to achieve therapeutic drug concentrations of BS and DS in the aqueous humour for 5-7 days and 14-19 days, respectively. Those values are compatible with the currently adopted topical prophylaxis after cataract surgery.