STEREOLITHOGRAPHY 3D PRINTED LONG-ACTING INTRAOCULAR IMPLANTS FOR POSTERIOR SEGMENT DISEASE

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Background: Drug delivery to the posterior segment of the eye remains challenging because of the anatomical and physiological barriers of the eye. Sustained release ocular implants can minimize the side effects and improve patient compliance. The development of new drug delivery devices requires reliable, reproducible and efficient technologies. 3D-printing technology can aid in fabrication of micron-sized implants with high precision, desired size/shape, and tailored release profiles. To date, the usage of 3D-printing technology to fabricate ocular implants has not been widely developed. In this study, a long acting intraocular implant of triamcinolone acetonide (TA) was fabricated using stereolithography (SLA) 3D-printing technology. Further, the implants were characterized for chemical/physical characterizing and drug content release.

Methods: Implants were fabricated using SLA-3D printer by loading 5% (w/w) of TA into a non-biodegradable polymer (PlasGRAY®). Implants were made in hollow and non-hollow rod shaped. Subsequently, implants were characterized using Texture Analyzer, Different Scanning Calorimetry (DSC), Size Exclusion Microscope (SEM), and Fourier Transform Infra-Red (FTIR). In vitro drug release studies have been carried out using PBS Buffer pH 7.4. Twenty microliters of samples were injected into HPLC system and the detection was set at 236 nm for TA analysis.

Results: Hollow implants (0.9 OD x 0.3 ID x 7L mm) and non-hollow rod shaped (0.9 OD x 7 L mm) implants were successfully fabricated using SLA-3D printing technology. Hollow and non-hollow implants showed no significant difference in mechanical strength (~ 40 N; $p < 0.05$). DSC, SEM and FTIR results showed that TA is soluble in the PlasGRAY® polymer. Non-hollow implant showed only 2.05 ± 0.32 % of TA released, whereas hollow implant released 8.50 ± 1.32 % of TA in 16 weeks.

Conclusions: Micron-sized of TA-loaded PlasGRAY® implants can be fabricated using SLA-3DP technology. Sustained drug release was achieved from these implants, where modification of degree of polymer crosslinking, drug loading, and implant design will have direct influence upon the release rates.