An alternative diabetic retinopathy therapy: a laser triggered microsystem for controlled release of resveratrol

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Diabetic retinopathy (DR) is one of the most severe ocular complication that causes visual impairment and blinding due to retina and optic neuronal path damage. During recent years, there was expressed a general interest in using resveratrol (RV) (3,5,4’-trihydroxystilbene) for prevention or complementary therapy for eye diseases. However current challenges in RV delivery and bioavailability require a targeted delivery strategy. Our current approach is to load RV as a cargo molecule, into polyelectrolyte multilayer microcapsules (PEM), with RV’s controlled release by a laser triggered procedure into retina pigmented epithelial cells (RPE cells). Mimicking the hyperglycemia physiology which occurs in DR patients by using D407 cells as a platform for an in vitro experimental model for this eye disease, we assessed the therapeutic potential of RV-loaded PEM. The synthesis process of the RV-PEM complex is based on a simple layer by layer assembly approach. During this procedure the capsules walls are decorated with gold nanoparticles for laser controlled release facilitation. The RV-loaded PEM obtained by this procedure were characterized using spectroscopic and microscopic methods. Next, the laser triggered release process of RV was optimized. Quantification of the RV released from microcapsule was assessed by HPLC-ESI-MS. The RV entrapment efficiency and the yield of production were determined in order to determine the amount of therapeutic agent who reaches the target site. Moreover, confocal and transmission electron microscopy proved that RV-loaded PEM were internalized in RPE cells. Raman/SERS spectroscopy, a rapid and non-invasive biochemical analysis of cells, has been used for detection and imaging applications of RV-loaded PEM inside RPE living cells. The results obtained show a promising strategy to enhance the bioavailability of RV and to increase its solubility, stability and release, by developing an efficient controlled-release delivery system for RV specifically targeted toward retina.

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