Low Energy Blue pulsed Light-activated Peptide Injectable Materials for Restoring Thinning Corneas

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Abstract

Many alternatives to human donor corneas are being developed to meet the global shortage of donated tissues. However, corneal transplantation remains the gold standard for diseases resulting in thinning corneas. In this work, transparent low-energy photoactivated extracellular matrix peptide-mimicking materials are developed for intrastromal injection to restore stromal thickness. The injectable biomaterials are comprised of short peptides and glycosaminoglycans (chondroitin, hyaluronic acid) that assemble into a hydrogel when pulsed with low-energy blue light. The dosage of pulsed-blue light needed for material activation is minimal at 8.5 mW cm^{-2}, thus circumventing any blue light cytotoxicity. Intrastromal injection of these light-activated biomaterials in rat corneas show that two iterations of the formulations remain stable in situ without stimulating significant inflammation or neovascularization. The use of low light intensities and the ability of the developed materials to stably rebuild and change the curvature of the cornea tissue make these formulations attractive for clinical translation.