

## Preparation and Evaluation of Gelatin-Hyaluronic Acid-Polycaprolactone Membrane Containing 0.5 % Atorvastatin Loaded Nanostructured Lipid Carriers as a Nanocomposite Scaffold for Skin Tissue Engineering

**Authors :** Mahsa Ahmadi, Mehdi Mehdikhani-Nahrkhalaji, Jaleh Varshosaz, Shadi Farsaei

**Abstract :** Gelatin and hyaluronic acid are commonly used in skin tissue engineering scaffolds, but because of their low mechanical properties and high biodegradation rate, adding a synthetic polymer such as polycaprolactone could improve the scaffold properties. Therefore, we developed a gelatin-hyaluronic acid-polycaprolactone scaffold, containing 0.5 % atorvastatin loaded nanostructured lipid carriers (NLCs) for skin tissue engineering. The atorvastatin loaded NLCs solution was prepared by solvent evaporation method and freeze drying process. Synthesized atorvastatin loaded NLCs was added to the gelatin and hyaluronic acid solution, and a membrane was fabricated with solvent evaporation method. Thereafter it was coated by a thin layer of polycaprolactone via spine coating set. The resulting scaffolds were characterized by scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FTIR) and X-ray diffraction (XRD) analyses. Moreover, mechanical properties, in vitro degradation in 7 days period, and in vitro drug release of scaffolds were also evaluated. SEM images showed the uniform distributed NLCs with an average size of 100 nm in the scaffold structure. Mechanical test indicated that the scaffold had a 70.08 Mpa tensile modulus which was twofold of tensile modulus of normal human skin. A Franz-cell diffusion test was performed to investigate the scaffold drug release in phosphate buffered saline (pH=7.4) medium. Results showed that 72% of atorvastatin was released during 5 days. In vitro degradation test demonstrated that the membrane was degraded approximately 97%. In conclusion, suitable physicochemical and biological properties of membrane indicated that the developed gelatin-hyaluronic acid-polycaprolactone nanocomposite scaffold containing 0.5 % atorvastatin loaded NLCs could be used as a good candidate for skin tissue engineering applications.

**Keywords :** atorvastatin, gelatin, hyaluronic acid, nano lipid carriers (NLCs), polycaprolactone, skin tissue engineering, solvent casting, solvent evaporation

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